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COMMENTARY

Ebola outbreak in the Democratic Republic of the Congo: Lessons from Kasai (2025) and emerging challenges from the Bundibugyo resurgence

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Abstract

On December 1, 2025, the Democratic Republic of the Congo declared the end of its 16th Ebola virus disease outbreak in Kasai Province after 42 days without new cases. The outbreak involved 64 cases (53 confirmed, 11 probable) and 45 deaths. Response measures included enhanced surveillance, rapid isolation, ring vaccination with Ebola Zaire Vaccine, Live (ERVEBO), and strengthened infection prevention and control. More than 44,000 individuals were vaccinated, while monoclonal antibody therapies and early referral contributed to reduced mortality. This commentary synthesizes epidemiological, immunological, and operational lessons from the Kasai outbreak, emphasizing surveillance, vaccination strategies, and community engagement for future preparedness. Recent developments highlight the evolving threat of Ebola, with the ongoing 17th outbreak caused by the Bundibugyo virus in the Democratic Republic of the Congo. As of July 2026, over 1,560 cases and more than 506 deaths have been reported, with cross-border transmission and no licensed vaccines, underscoring the need for strengthened regional response strategies.

Keywords: Ebola virus disease; Filovirus ecology; Kasai Province; Democratic Republic of the Congo; ERVEBO

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1. Background and latest status

On September 4, 2025, Democratic Republic of the Congo (DRC) health authorities declared an Ebola virus disease (EVD) outbreak in Kasai Province, initially affecting Bulape and Mweka health zones, after confirmation of Zaire ebolavirus at the National Institute for Biomedical Research in Kinshasa. The declaration cited 28 suspected cases and 15 deaths (including four health workers), with the World Health Organization (WHO) rapidly deploying experts and supplies to support surveillance, infection prevention and control (IPC), laboratory, and case management in a hardtoreach area with minimal transport links.[1] On December 1, 2025, after two incubation periods without new confirmed cases, the outbreak was declared over. The final epidemiologic tally was 64 cases (53 confirmed, 11 probable) and 45 deaths (case fatality rate [CFR] 70.3%), with all confirmed cases originating from Bulape Health Zone. The last patient

was discharged on October 19, 2025, initiating the 42day countdown to outbreak closure.[2,3]

This commentary arises from the need to better understand the evolving dynamics of Ebola outbreaks in the DRC, particularly amid changing epidemiological patterns, emerging viral species, and operational challenges in outbreak response. The recurrence of Ebola outbreaks, coupled with increasing complexity in transmission patterns and the emergence of non-Zaire Ebola species, highlights the importance of synthesizing lessons from recent outbreaks to improve preparedness and response strategies.

We connect detailed operational and epidemiological lessons from the 2025 Kasai outbreak with the evolving dynamics of the ongoing 17th Ebola outbreak (2026) caused by the Bundibugyo virus. By contrasting these outbreaks, it highlights critical differences in viral species, availability of medical countermeasures, and the emergence of cross-border transmission. This integrated perspective, combining epidemiological data, immunological and genomic insights, and operational response lessons, provides timely and policy-relevant insights to inform future filovirus preparedness, surveillance strategies, and outbreak response interventions.

2. Epidemiology and operational response in Kasai

Given early nosocomial amplification and a funeral super-spreader event, response teams prioritized ring vaccination, rapid isolation, and incident management system (IMS)-coordinated risk communication and community engagement (RCCE) to compress transmission chains. These early transmission dynamics included infections among health workers and community spread linked to unsafe burial practices.[2] Despite substantial terrain and access challenges, an integrated response combining contact tracing (572 contacts by mid-October), rapid isolation, strengthened IPC, and risk communication successfully contained transmission within Bulape.[2] Recent studies have emphasized that understanding infectious disease transmission requires integrated approaches combining epidemiological modeling, environmental context, and public health interventions. Such frameworks have been shown to improve outbreak prediction and response strategies across diverse settings.[4] These perspectives are relevant to Ebola outbreaks, where complex transmission dynamics necessitate coordinated surveillance and response systems.

The response in Bulape was structured under the IMS with seven coordinated strategies: (i) thorough retrospective and prospective investigation, (ii) community-level IPC, (iii) holistic case management by experienced staff (including sub-pillars for blood transfusion and animal care), (iv) strengthened RCCE, (v) ring vaccination, (vi) operational research, and (vii) anchoring interventions in the existing health system. This model reduced delays, improved alignment with local authorities, and minimized duplication of efforts across partners. A notable RCCE innovation was a community pact negotiated with traditional clan leaders to accelerate alert generation, contact identification, safe burial acceptance, and vaccine demand, which coincided with the rapid discharge of the last patient and containment within a single health district.[5]

Ring vaccination with Ebola Zaire Vaccine, Live (ERVEBO; recombinant vesicular stomatitis virus–Zaire Ebola virus vaccine) was implemented for contacts and frontline health workers; more than 48,000 doses were deployed, and over 44,400 individuals were vaccinated during the response, reflecting strong multi-partner coordination (Ministry of Health, Africa Centers for Disease Control and Prevention, WHO, United Nations International Children's Emergency Fund, International Organization for Migration, Doctors Without Borders, World Food Programme, Alliance for International Medical Action).[3,6]

Key factors influencing Ebola transmission include the intensity of direct contact with infected individuals, healthcare-associated transmission due to inadequate IPC measures, and high-risk funeral practices involving exposure to bodily fluids. Additional determinants include delays in case detection, population mobility, and the strength of local health systems. Human-to-human transmission primarily occurs through direct contact with blood or other bodily fluids of symptomatic individuals, with caregiving and traditional burial practices representing high-risk exposures.[1–3] From an epidemiological perspective, these factors influence key parameters governing outbreak dynamics, including the transmission rate, the effective reproduction number, and the duration of infectiousness. Variations in these parameters can substantially alter outbreak trajectories: increased contact intensity or delayed case detection can amplify transmission, whereas timely isolation, vaccination, and effective infection prevention measures can reduce spread and interrupt transmission chains.[5] Typical epidemiological estimates for EVD include an incubation period of 2–21 days, a basic reproduction number generally ranging between 1.5 and 2.5 in most outbreaks, and a relatively high CFR depending on the outbreak context. These parameter ranges provide a useful framework for understanding how changes in transmission conditions influence outbreak magnitude

and duration. Overall, rapid case detection and isolation are critical for reducing the effective reproduction number, while prolonged delays may allow undetected spread, underscoring the importance of timely and targeted interventions in outbreak control.

3. Vaccines, therapeutics, and clinical outcomes

With transmission localized, vaccination and monoclonal antibody therapies became decisive drivers of survival, contingent on early referral. ERVEBO received Food and Drug Administration approval in December 2019 and an indication expansion in August 2023 to individuals ≥ 12 months of age, enabling broader use, such as during outbreaks in Kasai.[7]

Demand generation for ERVEBO was RCCE-led and coupled to real-time data in the national health information system, enabling a shift from frontline worker-only vaccination to geographic ring vaccination of contacts and contacts-of-contacts, and pre-emptive coverage of at-risk actors such as traditional healers, pastors, and motorcyclists in neighboring areas. These practices were associated with improved uptake and outbreak containment in Bulape. During the Kasai response, approximately 48,000 doses were deployed, and between 44,400 and 47,600 individuals were vaccinated, reflecting strong logistics and community acceptance.[3,5,6]

These operational choices complement trial evidence showing that early vaccination and monoclonal antibodies (mAb114/Ebanga, Regeneron Ebola antibody cocktail [REGN-EB3]/Inmazeb) reduce mortality when delivered promptly. Evidence from the tenth DRC outbreak indicates that vaccination reduces mortality by 1.7-fold among hospitalized patients, and that treatment with mAb114 or REGN-EB3 is associated with significantly lower adjusted mortality compared to standard care.[8] These findings are concordant with the PALM trial, in which mAb114 and REGN-EB3 outperformed ZMapp and remdesivir (overall mortality 29–34% vs. 49–53%; even lower among early presenters).[9,10] Early diagnosis and referral remain decisive determinants of outcome.

4. Immunology, survivor sequelae, and implications

The pathogenesis of EVD features a dysregulated innate response, lymphocyte apoptosis, endothelial activation, and coagulopathy. Viral persistence in immune-privileged sites underlies post-EVD sequelae such as uveitis (reported in 13–34% of survivors in West African cohorts), cataract, and prolonged convalescence; both clinical and experimental work support ocular compartmentalization and inflammation as a substrate for vision-threatening disease.[11,12] Formal survivor care pathways, including ophthalmology, musculoskeletal, and psychosocial support, should be integrated early in response planning.

While the Ebola virus shows strong purifying selection over decades, recent genomic analyses reveal variant-specific virulence and lineages linked to latent persistence (e.g., Makona variant; Guinea 2021 resurgence), suggesting that re-emergence may follow long-term persistence rather than new spillover events. These findings underscore the need to integrate sequence-based surveillance into outbreak operations to monitor changes relevant to pathogenesis, immunity, and vaccine performance.[5] Such genomic insights complement immunologic data and inform vaccine strategies, particularly for ERVEBO and other candidates targeting Zaire ebolavirus glycoprotein.

Ecology and genomics must be read together; reservoir dynamics frame spillover risk, while genomic surveillance informs clinical and vaccine performance. This integrated approach strengthens predictive models for future outbreaks and supports One Health strategies discussed in Section 5. These relationships are further illustrated in Figure 1 and Table 1: Figure 1 depicts the spatial distribution and relative burden of Ebola outbreaks across the DRC, highlighting marked heterogeneity in geographic concentration and outbreak magnitude, while Table 1 provides a chronological summary of all reported outbreaks, enabling comparison of case counts, mortality, and CFRs over time.[1,2,13]

5. Reservoir ecology and zoonotic risk context

Multiple lines of evidence implicate fruit bats, notably *Epomops franqueti*, *Hypsignathus monstrosus*, and *Myonycteris torquata*, as likely reservoirs or maintenance hosts for *Zaire ebolavirus*, while acknowledging ecological complexity and potential roles for other taxa; spatial niche modeling supports alignment between bat habitats and historical spillovers.[14,15]

6. Updated chronology based on final World Health Organization/Centers for Disease Control and Prevention data

To contextualize Kasai-2025, Table 1 presents an updated chronology of 17 EVD outbreaks in the DRC (1976–2026), with revised totals for the North Kivu/Ituri epidemic (2018–2020): 3,481 cases and 2,299 deaths, making it the second-largest EVD outbreak on record.[16] Figure 1 illustrates the distribution of cases and deaths across outbreaks, emphasizing the disproportionate impact of

Table 1. Ebola outbreaks (n = 17) in the Democratic Republic of the Congo (1976–2026), including cross-border spread in the 2026 Bundibugyo outbreak

Year(s)	Major location(s)	Cases (confirmed and probable)	Deaths	CFR (%)
1976	Yambuku, Mongala	318	280	88.1
1977	Tandala, Sud-Ubangi	1	1	100.0
1995	Kikwit, Kwilu	315	254	80.6
2007	Luebo and Mweka, Kasai/Kasai-Central	264	187	70.8
2008	Mweka and Luebo, Kasai/Kasai-Central	32	15	46.9
2012	Bas-Uele, Haut-Uele, Ituri	38	13	34.2
2014	Boende, Équateur	69	49	71.0
2017	Likati, Bas-Uele	8	4	50.0
2018	Bikoro, Équateur (May)	54	33	61.1
2018–2020	North Kivu/Ituri (Aug 2018–Jun 2020)	3,481	2,299	66.0
2020	Mbandaka, Équateur	130	55	42.3
2021	Biena, North Kivu (Feb)	12	6	50.0
2021	Beni, North Kivu (Oct)	11	9	81.8
2022	Mbandaka/Wangata, Équateur (Apr)	5	5	100.0
2022	Beni, North Kivu (Aug)	1	1	100.0
2025	Bulape Health Zone, Kasai	64	45	70.3
2026 (till , July 4, 2026)	Ituri, North Kivu, South Kivu	1,561	506	32.4

Note: CFR = deaths/cases × 100.
Abbreviation: CFR: Case fatality rate.

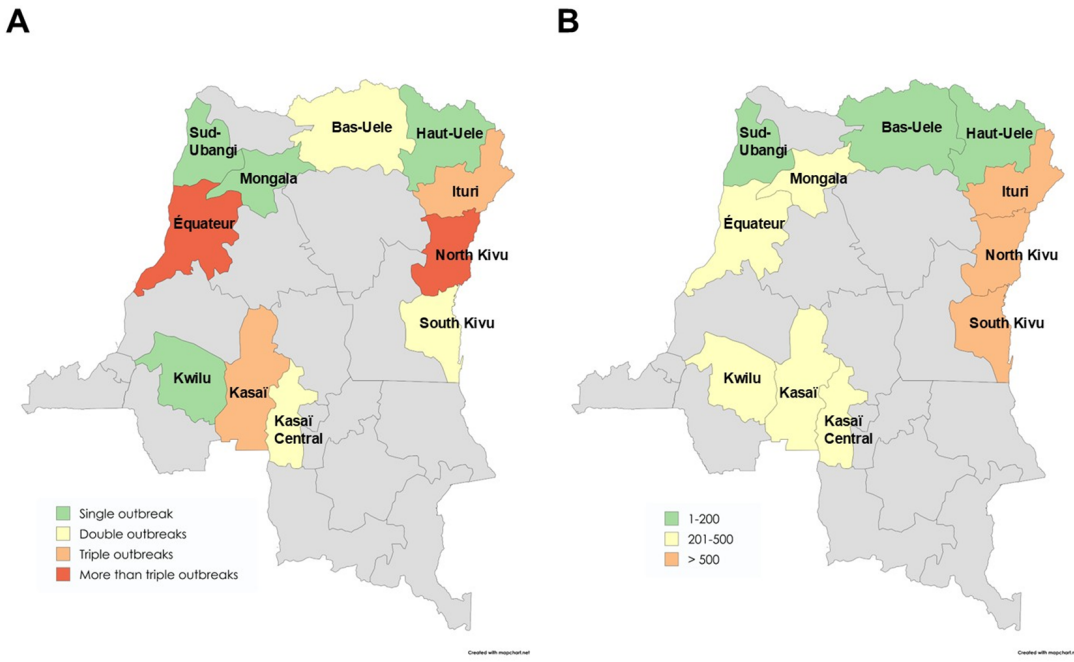

Figure 1. Spatial distribution and burden of Ebola virus disease outbreaks in the Democratic Republic of the Congo (1976–2026). (A) Outbreak frequency by province: single, double, triple, or ≥4 events. (B) Confirmed cases and fatalities grouped by magnitude: 1–200, 201–500, and >500 cases. Data compiled from the World Health Organization and the Centers for Disease Control and Prevention reports.[1–3,6,17]

the 1995 Kikwit and 2018–2020 North Kivu/Ituri events compared to smaller outbreaks.

7. Emerging insights from the ongoing 17th outbreak (2026)

Unlike Zaire ebolavirus, Bundibugyo virus currently lacks licensed vaccines or specific therapeutics, emphasizing reliance on traditional outbreak control strategies. The ongoing 17th Ebola outbreak in 2026, caused by Bundibugyo virus, represents a distinct epidemiological and operational challenge compared to the 2025 Kasai outbreak. As of July 2026, more than 1,560 confirmed cases and over 506 deaths have been reported across the DRC, with clear evidence of cross-border transmission.[18] The outbreak is largely concentrated in Ituri Province but has extended into North and South Kivu through imported and secondary cases.

The evolving outbreak highlights several critical challenges, including delayed diagnosis due to non-specific early symptoms, limited laboratory capacity, security-related disruptions affecting surveillance, and high population mobility across borders. These transmission dynamics are further influenced by key factors, such as cross-border population movement, healthcare-associated infections, and delays in diagnosis, all of which increase transmission potential in complex settings. From a parameter-based perspective, increased cross-border movement and delayed diagnosis can elevate effective transmission rates, while strengthened surveillance and rapid isolation can reduce the effective reproduction number and limit outbreak expansion. In the context of the current outbreak, variability in these parameters, particularly those related to mobility and delayed detection, plays a critical role in shaping transmission dynamics and the potential for cross-border spread. In addition, a substantial proportion of cases have been linked to healthcare settings and cross-border care-seeking behavior. These findings reinforce the importance of strengthening cross-border coordination, improving IPC in healthcare facilities, and sustaining community trust and engagement.

The current outbreak further underscores persistent preparedness gaps and the need for equitable investment in vaccines and therapeutics for non-Zaire Ebola species. Notably, the ongoing 17th outbreak is caused by the Bundibugyo virus, in contrast to the Zaire ebolavirus responsible for most historical outbreaks in the DRC. This distinction has important implications, as the Bundibugyo virus is associated with different epidemiological characteristics and currently lacks licensed vaccines or specific therapeutics. Interpretation of the apparent lower CFR (~32%) in the ongoing outbreak should be approached with caution. Compared to earlier outbreaks, this may reflect improved surveillance, expanded diagnostic capacity, and the detection of a higher proportion of milder or earlier-stage cases, rather than a true reduction in virulence. Data for the ongoing outbreak are based on WHO Disease Outbreak News reports (July 2026) and remain subject to revision as the outbreak evolves.

8. Lessons for future filovirus control

The Kasai outbreak underscores that rapid containment requires both biomedical tools and systemic coordination anchored in community trust. Building on operational experience and recent evidence, several priorities emerge for future filovirus control. First, integrated IMS coordination should be institutionalized. Deploying a standardized IMS with clearly defined pillars and accreditation of responders ensures alignment with national systems and minimizes duplication. Daily coordination meetings and real-time dashboards for vaccination and case management improve resource efficiency and accountability. Second, community engagement through RCCE must be treated as a core pillar rather than a support function. The Bulape experience demonstrated that negotiated community pacts with traditional leaders, school-based peer education, and structured infodemic management can transform resistance into cooperation, improving alert generation, acceptance of safe burials, and vaccine uptake. Third, vaccination strategies require precision and flexibility. Maintaining ERVEBO stockpiles and implementing geographic ring vaccination for contacts and contacts-of-contacts remain essential. Pre-emptive vaccination of high-exposure groups—such as traditional healers, pastors, and motorcyclists in adjacent areas—proved effective in Bulape and should be considered in future responses. Uptake should be monitored through national health information systems to guide adaptive deployment. Fourth, diagnostics and genomic surveillance must advance in tandem. Co-deploying point-of-care polymerase chain reaction platforms with targeted sequencing enables lineage tracking, detection of viral persistence, and assessment of vaccine performance, thereby supporting more responsive, evidence-informed interventions. Finally, One Health integration and survivor care should be embedded within preparedness frameworks. Incorporating animal health and veterinary coordination addresses human-animal-environment interfaces, while structured survivor clinics for ophthalmologic, musculoskeletal, and psychosocial follow-up mitigate long-term sequelae and strengthen post-outbreak resilience.

The ongoing 17th Ebola outbreak caused by the Bundibugyo virus highlights both the relevance and the

limitations of these lessons. In contrast to Zaire ebolavirus outbreaks, the absence of widely available species-specific vaccines and therapeutics for Bundibugyo virus places greater reliance on early detection, infection prevention, and coordinated response systems. The observed cross-border transmission between the DRC and Uganda further underscores the importance of regional preparedness, harmonized surveillance, and coordinated response strategies.

Together, these observations indicate that while integrated response frameworks have improved outbreak control capacity, important gaps remain, particularly for non-Zaire ebolavirus species. Strengthening surveillance systems, expanding rapid diagnostic capacity, and investing in research on vaccines and therapeutics for diverse filoviruses are therefore critical priorities. Enhancing cross-border coordination and embedding culturally adapted RCCE strategies will further support timely detection and effective containment. These priorities collectively support a more resilient and coordinated regional approach to Ebola prevention and control, particularly in settings characterized by recurrent outbreaks and evolving epidemiological risks.

Figure 2 summarizes key operational challenges and corresponding response strategies, emphasizing the importance of coordinated interventions such as surveillance, infection prevention, and community engagement. Together, these priorities reinforce the need for integrated and context-specific approaches to effectively control Ebola outbreaks.

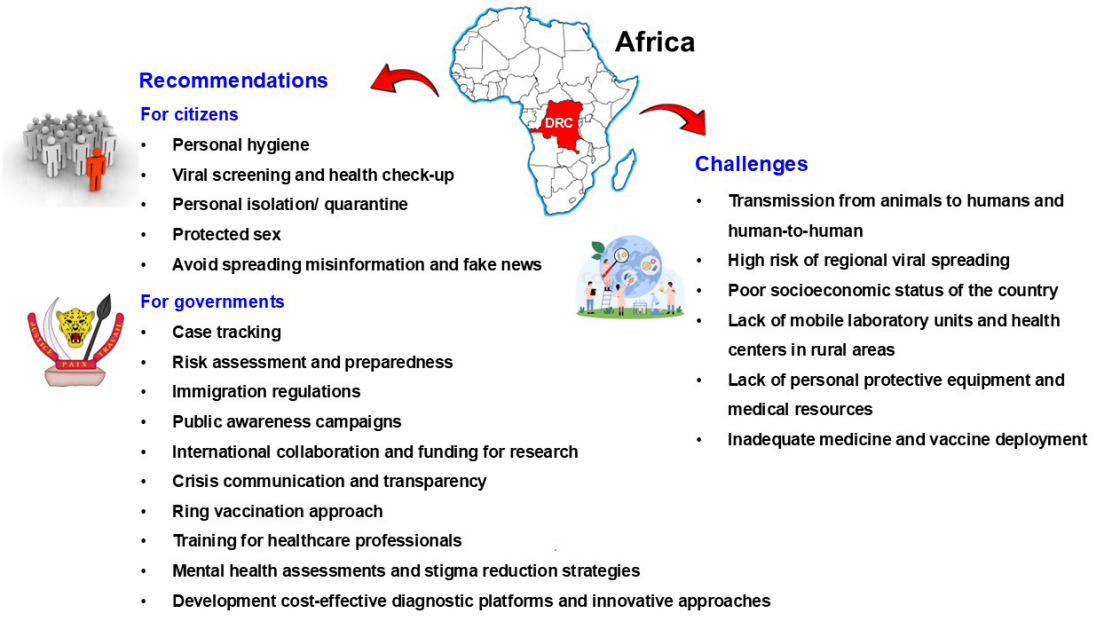

Figure 2. Key operational challenges and recommended strategies for Ebola virus disease control in the Democratic Republic of the Congo. Data synthesized from the World Health Organization, the Africa Centers for Disease Control and Prevention, and the United Nations International Children's Emergency Fund reports.

9. Conclusion

The successful containment of the 2025 Ebola virus disease outbreak in Kasai Province highlights the effectiveness of integrating rapid surveillance, ring vaccination, early case management, genomic monitoring, and strong community engagement within a coordinated Incident Management System. Despite a high case fatality rate, the timely deployment of ERVEBO vaccination and evidence-based therapeutics contributed to outbreak control. The Kasai experience reinforces the importance of combining biomedical interventions with community trust, genomic surveillance, and One Health approaches to strengthen preparedness and response to future Ebola and other filovirus outbreaks.

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