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Recurrent Ebola outbreaks in the eastern Democratic Republic of the Congo: A wake-up call to scale up the integrated disease surveillance and response strategy

Olivier Kambere Kavulikirwa [a,*], Franck Katembo Sikakulya [b,c]

[a] Faculty of Veterinary Medicine, Université Catholique du Graben de Butembo, Democratic Republic of the Congo
[b] Faculty of Clinical Medicine and Dentistry, Department of Surgery, Kampala International University Western Campus, Ishaka-Bushenyi, Uganda
[c] Faculty of Medicine, Université Catholique du Graben de Butembo, Democratic Republic of the Congo.

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ABSTRACT

Ebola virus disease (EVD) is a dangerous viral zoonotic hemorrhagic fever caused by a deadly pathogenic filovirus. Frugivorous bats are recognized as being the natural reservoir, playing a pivotal role in the epidemiological dynamics. Since its discovery in 1976, the disease has been shown to be endemic in the Democratic Republic of the Congo (DRC). So far, thirteen outbreaks have occurred, and EVD has been prioritized in the national surveillance system. Additionally, EVD is targeted by the Integrated Disease Surveillance and Response (IDSR) strategy in DRC. The IDSR strategy is a collaborative, comprehensive and innovative surveillance approach developed and adopted by WHO's African region member states (WHO/Afro) to strengthen their surveillance capacity at all levels for early detection, response and recovery from priority diseases and public health events.

We provide an overview of the IDSR strategy and the issues that can prevent its expected outcome (early detection for timely response) in eastern DRC where there are still delays in EVD outbreaks detection and weaknesses in response capacity and health crisis recovery. Therefore, this paper highlights the advantages linked to the implementation of the IDSR and calls for an urgent need to scale up its materialization against the recurrent Ebola outbreaks in eastern DRC. Consequently, the paper advocates for rapidly addressing the obstacles hindering its operationalization and adapting the approach to the local context using implementation science.

1. Introduction

Infection caused by Ebola Virus is a fatal disease in both human and non-human primates populations [1]. Belonging to the genus *Filovirus*, the species of this group have different virulence and the *Zaire Ebola virus* is known to be the most fatal [2]. So far, bats (*Suborder Microchiroptera*) are known to be putative reservoir hosts of the filovirus, playing a crucial role in the epidemiology of the Ebola Virus Disease (EVD) [3,4]. An Ebola outbreak often starts from a single case of zoonotic transmission which is followed by a human-to-human transmission through either direct contact with a patient or deceased or contact with body fluids from an Ebola-infected person [5–7].

The disease is a huge threat to both public health as well as wildlife conservation, suggesting a need for effective control efforts for better health security for humans and nonhuman primates [8]. Also, Ebola Virus epidemics cause tremendous social and economic consequences to affected communities. For instance, it has been reported that huge mental health challenges result from the Ebola Virus Disease, the emotional reaction of communities fearing the virus, and the loss of revenue and high cost of preventive measures and patient care [5,6,9,10].

Likewise, Ebola Virus Disease crises have negative consequences on the health systems of affected countries with fragile health systems [11]. During outbreaks, there are challenges on the supply chain, poor provision, and utilization of health services, and many other issues reducing the availability and accessibility of health services [12]. Due to its epidemiological patterns, the huge burden on public health systems and the need for a huge amount of resources for sanitary responses, EVD is a

Abbreviations: IDSR, Integrated Disease Surveillance end Response; EVD, Ebola Virus Disease; IHR (2005), International Health regulations (2005); CBS, Community-based surveillance; HMIS, Health Management and Information System.

* Corresponding author.
E-mail address: olivierkavulikirwa@ucraben.ac.cd (O.K. Kavulikirwa).

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global health emergency paradigm requiring both national and supranational responses [13].

Since the first discovery of the Ebola virus in the Democratic Republic of the Congo (DRC) in 1976, Africa has experienced several Ebola outbreaks with a high number of confirmed cases and deaths. So far, the western African Ebola epidemic of 2013 to 2016 remains the most fatal of the history of Ebola Virus Disease, with around 11.000 deaths [14]. To date, DRC has experienced 13 Ebola Virus Diseases outbreaks, the 10th and 12th of which occurred in the eastern part of the country with a total of 3317 confirmed cases and 2287 deaths (68,9% lethality rate) and 12 confirmed cases and 6 deaths (50% lethality rate) for the 10th and 12th outbreaks respectively [15–18]. The 13th Ebola outbreak started in the same province on October 8th 2021 and ended on December 16th 2021. The outbreak ended with a cumulative of 11 cases (eight confirmed and three probable), nine deaths (six confirmed and three probable cases), and two recoveries, which led to a cumulative case fatality ratio of 82% [19].

From the above, it is possible to notice that the frequency of Ebola Virus Disease outbreaks is steeply increasing, with the occurrence of two epidemics in the same year. Particular attention should be put on promoting early detection for the sake of global health security given that the outbreaks continue being notified with a delay and after registering a community death with probably some contacts difficult to track as may be seen from the last ongoing outbreak [20].

This paper highlights the importance of materializing the Integrated Disease Surveillance and Response (IDSR) strategy, an important approach to strengthen the capacity of the health system to quickly detect, respond and recover from public health crises like Ebola epidemics. Likewise, it deals with the foundations of the IDSR strategy, advocating how the approach may constitute an important asset in the fragile health system settings of eastern DRC where pre-existing socio-economic conditions due to a long history of armed insecurity have increased the vulnerability of the community to health crises and underlying consequences.

Also, the paper reflects on possible challenges that may hinder the operationalization of the IDSR strategy and stresses the need for capitalizing on the opportunity provided in the IDSR strategy in the capitalization of the experience acquired during different Ebola responses for a resilient health system. The insights provided may serve not only as a reminder for a need to use IDSR for Ebola surveillance in DRC but also they may be relevant as a wakeup call to all countries in the World Health Organization's African region (WHO/Afro) which are still delaying the true prioritization of the strategy several years after its adoption.

2. Integrated disease surveillance and response strategy to tackle Ebola virus outbreak as a priority disease

Containing the notion of “watching over”, surveillance in public health is a continuous and systematic process through which information regarding diseases and public health events are collected, gathered, analyzed and interpreted to take adapted decisions at the right time [21–23]. For appropriate actions and evidence-based decision making, high-quality information from diseases and events surveillance is important as a tool for an evidence base. This positively affects the planning, implementation of programmes and interventions aiming to improve population health [24,25].

With the continuously increasing need for effective and efficient surveillance tools in the era of complex public health challenges, web-based surveillance systems have been developed to ensure real-time operability, low cost, adaptability and intuition [26]. Information from these web-based surveillance systems is useful to support appropriate resources allocation for efficient management [27].

The data used by the surveillance system are generated in two ways – gathered from the health facilities without any active search of cases, or active search of cases by continuous and regular contacts with reporting sources. These constitute the two types of surveillance referred to as passive and active diseases and event surveillance, respectively. Thus, the health management and information system (HMIS) and routine-based indicators are of greater importance as a source of data generation in passive surveillance, whereas in active surveillance, the investigation to find cases is the core [28].

In the 1990s, many African countries were heated by outbreaks of emerging and reemerging diseases, causing several cases and deaths with a risk of transboundary spread. These diseases included meningococcal meningitis, yellow fever, hemorrhagic fevers and cholera [29,30]. As a result, this situation revealed the need to develop a strategy for timely detection and confirmation of diseases in WHO's African region(WHO/Afro) [31].

In 1998, the WHO/Afro member states adopted a surveillance strategy entitled “Integrated Disease Surveillance in Africa: A Regional Strategy (1999–2003)”. This surveillance strategy is what was later named “Integrated Disease Surveillance and Response” (IDSR) [32]. The main characteristic of the IDSR strategy is that the approach is comprehensive and evidence-based, aiming at strengthening national public health surveillance and response systems at all levels for improved health security as per the International Health Regulations (IHR) [33]. For this purpose, the strategy was designed so that WHO Afro member states effectively prevent, promptly detect and respond to disease outbreaks as well as other events of public health concern [34].

Once properly implemented and operationalized, the strategy was to provide sufficient laboratory capacity at the national and supranational levels to confirm priority diseases and public health events; ensuring an acceptable level of public health emergency preparedness and response at all levels in all member states.

During the 69th regional committee in 2019, the Ministers of Health of WHO's African region adopted the IDSR(2020−2030) in Brazzaville, Congo. At the end of the meeting, all member states were asked to implement the strategy based on the third edition of the IDSR Technical Guidelines. This revised version of the IDSR technical guide was launched in 2019 with a training of trainers(TOT) from all member states [35].

The innovation in the revised version of the strategy is that its stresses guidance on strengthening the approach in alignment with each member states' broad national plans and policies with integrated supervision, monitoring and evaluation system; and a clear emphasis on milestones, targets and interventions that should be prioritized [36].

With thorough implementation of the revised IDSR guidelines in DRC, the country would acquire a good surveillance system and include innovations such as the operationalization of community-based surveillance (CBS) [37], an asset for the early detection of Ebola outbreaks and other public health events. Also, the country would be able to improve the triangulation and use of information to prevent, detect, prepare and respond to EVD emergency as well as any public health emergency or threat in a timely, well-coordinated and resources-effective manner, like in countries where the strategy is relatively more grounded [38,39].

This has been observed in Uganda, where the IDSR revitalization program in 2012 resulted in notable progress in key surveillance performance indicators including timeliness and data completeness, highlighting the importance of rooting the IDSR in each country's context [40]. Likewise, it was demonstrated that early detection and response resulting from enhanced surveillance at the peripheral, intermediate and central levels of the health system provided Uganda with a good opportunity to limit the damages of viral hemorrhagic fever outbreaks, which has served as a model for the country in the management of public health events of international concern [41].

Thanks to the interoperability across countries in the IDSR, easier and swift information sharing will improve health security across borders: an outbreak in the eastern DRC present a high risk to neighbouring countries due to intense cross-border movement with eastern African countries [15]. Indeed, when an Ebola outbreak occurs in the eastern

part of DRC, Uganda, Rwanda, Kenya, Tanzania and to some extent South Sudan, are directly exposed. So, an Ebola Epidemic in eastern DRC would present a threat to the entire sub-region of the African great lakes, requiring highly rigorous and interconnected surveillance for improved health security.

3. Limitations to the IDSR strategy in the DRC health system and future outlook

During its ongoing implementation and operationalization in the WHO/Afro member states, the IDSR strategy encounters some challenges undermining its optimal functioning and there are notable differences in the implementation status across countries, sub-Saharan countries being the less advanced [36,42,43]. A high-level meeting entitled "Building Health Security Beyond Ebola" conducted in 2015 in South Africa involved the WHO, the most Ebola-affected countries and many other stakeholders. This meeting, aimed to mobilize all actors to build a more robust system against Ebola outbreaks, was a huge opportunity for all participating countries to scale up the implementation of the IDSR strategy [44].

Unfortunately, even though DRC is highly prone to EVD and many other diseases with high epidemic potential [45], the country is not one of the best examples in the implementation of the IDSR. The 2017 country status assessment revealed that even if DRC had already adapted the second edition IDSR technical guidelines and the bulletin had been produced and disseminated, a lot was still to be done on the key progress indicators such as capacity building and reporting. At that time, there had never been any training of trainers (TOT) nor existing information on the cascade of training until the peripheral level. Likewise, the same assessment showed that only 50–89% of districts had training between 2015 and 2017 and the degree of reporting timeliness and completeness was 80% and 95% respectively [36].

Since its early implementation in 2000 in DRC the challenges that the IDSR has been facing to meet its optimal functioning may be explained by the fragile health system linked with the political instability the country has been undergoing for decades [46].

Like many other countries in the Sub-Saharan region, IDSR in DRC is still highly reliant on routine data capturing from the HMIS, which doesn't foster Event-Based Surveillance and CBS because informal sources of surveillance information are under-used in such context [43]. Otherwise, the health system in DRC has not yet well embraced the opportunity of current technological advancements and big data analytics techniques needed for good epidemic intelligence [33].

Also, as a multi-level and multi-stakeholder surveillance strategy, the IDSR is deeply linked with the One Health approach and the IHR(2005) (International Health Regulations(2005)) [47,48]. Consequently, good implementation of the IDSR strategy is an opportunity for the alignment of the abovementioned Global Health Security frameworks, given that IDSR serves as a vehicle for the IHR(2005), the latter serving as a booster for IDSR [31]; while the One Health approach is intrinsic to the IDSR as per the Global Health Security Agenda [49,50].

So far, even after the adaptation of the third edition of the IDSR technical guideline, DRC has not yet sufficiently deployed interconnected and interoperable surveillance platforms, which is a barrier to real-time information sharing among stakeholders across sectors for effective integration in surveillance [37]. As a result, operationalizing the One Health approach in the IDSR and optimal alignment of different global health security frameworks are still difficult in the context of DRC.

Owing to the limitations above, the DRC's surveillance system is still vulnerable to challenges such as least timeliness, incompleteness and limited accuracy [51]. This situation is likely to lead to delays in diseases and outbreaks detection and response, underlining the dire need to be addressed as soon as possible for better health security.

Therefore, to foster the materialization process, implementation science is important to systematically identify and address the bottlenecks to its operationalization as well as economic evaluation of implementation [51,52]. This way of systematically addressing the challenges hampering the IDSR in DRC is of paramount importance and will play a crucial role as an enabler in breaking the silo and filling the gap between scientific knowledge, policy, and practice on the ground. Likewise, among neighbouring countries, some have better implementation status of the IDSR [51]. As some elements of the great lakes regional context may be close, learning from each other's experience is important for DRC to overcome its challenges in the operationalization of the strategy.

4. Potential obstacles to the IDSR in the context of eastern DRC and ways forward

The eastern DRC has been a war-torn area for decades [53]. A long history of armed conflicts and political instability has harmed the institutional capabilities, forming a bottleneck to the implementation of many policies and approaches mostly when it comes to collaborative works. For instance, in such an environment, the flow of information will not be smooth and monitoring and supervision may not be easy within the system.

It is known that CBS captures the data from the whole community and involves them in the data collection regarding diseases and public health events, putting the community in the primary position of the diseases alert [54]. Due to the long history of conflicts and instability described above, the region is one of the places with the highest number of Internally Displaced People (IDP) in the world [55]. In such settings, community-based data capturing would be hindered by war-driven permanent population movements that would lead to incomplete and irregular reporting as well as delayed alerts and warnings.

The eastern DRC is a large geographical region with poor quality of roads in some areas, poor network coverage, tough livelihood and mistrust in government-led initiatives resulting from chronic insecurity. This may decrease accessibility and hinder the involvement and access to a large part of the community and negatively impact surveillance at the peripheral level, which is detrimental to early diseases and events detection [56].

Furthermore, it may be difficult to operationalize IDSR in a region where numerous members of the community have experienced psychologically traumatizing situations such as sexual abuse or any other kind of gender-based violence, forced displacement or have previously served in armed services(ex-combatants) [53,57], especially in CBS, where community engagement is highly needed but not easy to achieve.

Therefore, in the eastern DRC, operationalizing the IDSR requires very strong strategic planning and foresight; high-level leadership; interdisciplinarity; alignment to existing coordinating mechanisms and social structures; creativity and innovation in stakeholders mobilization and integration. Thus, community involvement requires some strategies like engagement with youth lobbying and pressure groups as well as negative armed groups in these exceptionally sensitive settings of the conflict-torn eastern DRC; where even healthcare facilities have been prone to many deadly armed attacks during the 10th Ebola outbreak due to misinformation [58].

5. Conclusion

The frequency of Ebola outbreaks in Eastern DRC has dangerously increased over the past four years. Using a One Health thinking, this situation should drive investigations on a probable change in the human, environment and natural virus reservoir interactions in the area. Additionally, it is crucial to correct possible weaknesses in the follow-up of Ebola survivors. For better management of EVD in DRC, there is a need for the country to speed up the effective implementation of the Integrated Disease Surveillance and Response strategy, which will foster the advancement of Global Health security in the EVD-prone DRC. It is highly important to systematically investigate and address the

bottlenecks to a successful implementation of the IDSR and consider the exceptional context of eastern DRC using a high level of creativity and innovation.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and material

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Authors' contributions

OKK: Conceptualization, search of accurate literature and manuscript drafting. FKS: Search of literature and draft review for coherence. All authors read and approved the manuscript before submission.

Author statement

None.

Declaration of Competing Interest

None.

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