**Emergent threats: Lessons learnt from Ebola**

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**Abstract**

Recent disease outbreaks have demonstrated the severe health, economic, and political crises that epidemics can trigger. The rate of emergence of infectious diseases is accelerating and with deepening globalisation, pathogens are increasingly mobile. Yet the 2014-15 West African Ebola epidemic exposed major gaps in the world’s capacity to prevent and respond to epidemics. In the midst of the world’s second largest-ever recorded Ebola outbreak in the Democratic Republic of the Congo, we reflect on six of the many lessons learned from the epidemic in West Africa, focusing on progress made and challenges ahead in preparing for future threats. While Ebola and other emerging infections will remain a challenge for the years to come, by working in partnership with affected communities and across sectors, and investing in robust health systems, it is within our power to be better prepared when they strike.

**Keywords**

Ebola; epidemic preparedness; emerging infections

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Recent disease outbreaks have disrupted global health on an unprecedented scale, demonstrating the severe costs epidemics pose to human health and the economic and security crises they can trigger (1). Today, a confluence of socioeconomic, political, and environmental factors is accelerating the rate of emergence of infectious diseases. With deepening globalisation, these pathogens are increasingly mobile and the threats they pose are global in nature. Indeed, we have recently faced numerous era-defining epidemics such as the 2002-2003 outbreak of severe acute respiratory syndrome, the global spread of Zika virus, and the West African outbreak of Ebola Virus Disease (EVD)

The 2014-15 Ebola epidemic in particular exposed how a ‘perfect storm’ of weak health systems, poverty, and political and economic fragilities can fuel outbreaks (2). In the aftermath, numerous analyses (3) have shown that better preparedness and a faster response could have prevented some of the 28 000 infections of EVD and 11 000 deaths (4). At the time of writing, the second largest-ever recorded Ebola outbreak is unfolding in the North Kivu and Ituri provinces of the Democratic Republic of the Congo (DRC), with 1 945 cases and 1 302 deaths as of 28 May 2019 (5). Amidst prolonged humanitarian crisis, armed conflict, attacks on health care facilities, political instability, and community resistance and mistrust, the outbreak continues to spread with a worrying rise in cases in recent months (6). It is within this context that we briefly reflect on six of the many critical lessons learned from the West African Ebola outbreak, focusing on progress made and challenges ahead in preventing and preparing for future epidemics.

**First, countries must strengthen their core capacities to prevent, detect, and respond to outbreaks, with commensurate domestic and, where needed, international investments** (4)**.** Strengthened health systems must be responsive to peoples’ rights and needs, addressing both the everyday health problems they experience as well as emerging threats. A strong and supported health workforce is central to a robust health system. At the onset of the Ebola outbreak in West Africa, many frontline staff lacked appropriate training in emergency preparedness and response. Several health workers operated in unsafe environments with inappropriate equipment and without adequate pay, which affected their readiness, safety, motivation, and the quality of care they could provide. Within this context, more than eight hundred health worker infections were reported (7).

Encouragingly, many initiatives have since mobilised to improve national preparedness (8). For instance, WHO launched the Joint External Evaluation tool to independently assess national capacities to address public health threats, in line with country commitments to implement the International Health Regulations . As of March 28 2019, 96 countries have already completed the assessment (9). Another important step was the establishment of the Africa Centres for Disease Control and Prevention, which supports countries throughout the African region to strengthen surveillance, prevention, and response to infectious diseases and wider health issues (10).

However, efforts to strengthen countries’ core capacities are also challenged by inadequate funding, with few national action plans developed or implemented (8). Limited investment in health workforce strengthening, for example, has meant that four years after the West African epidemic, health workers in the affected countries are still underprepared to address existing and emerging health threats. In Liberia, for instance, limited funding and fiscal space challenge the Ministry of Health’s capacity to absorb, distribute, and retain newly trained health workers to address identified gaps, which minimizes the impact of well-designed evidence-based interventions.

**Second, outbreaks are not only a major cause of societal disruption in the nation that they occur in, they can spread across borders and can surpass national capacities; coordinated global action across sectors is therefore critical.** After the collective failure to respond early and effectively in West Africa, consensus emerged that both WHO and the broader humanitarian system required strengthening (4). WHO was heavily criticised for its performance and substantial reforms were recommended to address longstanding operational and institutional shortcomings (4). In particular, concern was raised that the then WHO Director-General was too late to convene the Emergency Committee and to declare a public health emergency of international concern (11), which highlighted the need for a more nuanced and accountable global procedure to declare an outbreak instead of an all-or-nothing system. Humanitarian and other nongovernmental organisations beginning with Médecins Sans Frontières worked to fill this gap in the response (11).

The good news is that we have since seen some improvements. WHO has created a new Health Emergencies Programme, which is working to strengthen its operational capabilities and to support countries’ preparedness for health emergencies (12). Health emergencies have also featured prominently on WHO’s agenda under the new leadership of Director-General Dr Tedros, with a central position in WHO’s thirteenth general programme of work 2019-2023 (13) and Dr Tedros’ personal engagement with health emergencies in DRC and elsewhere. Another important step is the establishment of the World Bank’s Pandemic Emergency Financing Facility (PEF), which provides surge funding to prevent rare, high-severity disease outbreaks from becoming largescale pandemics (14). The PEF is currently supporting up to US$80 million of the cost of the ongoing Ebola response in DRC (15). Despite a swift and better coordinated response in many ways to the current outbreak from actors within DRC and internationally, the number of cases continues to rise and it is clear that redoubled efforts, increased funding, and a consideration of new strategies are needed to bring the outbreak under control.

**Third, we must remain vigilant and forward-looking, implementing well-accepted control measures when an outbreak hits but also expanding these strategies to areas at high risk of infection.** Since the first-known outbreak of Ebola in 1976, and refined over subsequent outbreaks since, the basic control strategy has focused on rapid case identification for isolation, treatment, and care; contact tracing; community engagement and mobilisation; safe and dignified burials; effective infection control; laboratory testing; and, recently, ring vaccination (16). From a purely reactive response to primary prevention through vaccination, expanding efforts to find and reach high-risk areas and groups is critical for stopping small, localised epidemics from spiralling into global emergencies.

**Fourth, early investment is critical to incentivise research and development (R&D) on pathogens that are likely to cause epidemics**.Despite early studies into EVD in the 1970s, there were no approved drugs, vaccines, or rapid diagnostic tests when the outbreak began in West Africa (17). The scarcity of available health technologies signalled a wider failure in the R&D system to respond to diseases that predominantly affect relatively small populations in poorer countries (18). Equitable access to these technologies lies at the heart of the right to health and research agendas must be set with scientists and communities from affected countries.

Promising efforts to rethink how health technologies for emerging infections are developed are now underway. WHO convened a broad coalition of experts to contribute to a new R&D Blueprint, which identifies a list of priority diseases and acts as a source of global guidance on R&D during outbreaks (19). Complementing the normative functions of WHO, a global multisector partnership also launched in 2017 called the Coalition for Epidemic Preparedness Innovations (CEPI) to fast-track the development of vaccines against emerging pathogens and to ensure affected populations have equitable access to them during outbreaks (20).

During the 2014-2015 crisis, a cause for optimism was that social science and biomedical research efforts were mobilised during the epidemic. This research has translated into application on the ground with the deployment of health technologies in DRC to help manage the current outbreak.. In particular, vaccination with Merck’s rVSV-ZEBOV-GP has been rolled out in DRC through a ring vaccination strategy after a trial carried out in Guinea found that the vaccine offered maximal impact against the spread of the virus among contacts of patients (21). As of 6 April 2019, over 96 000 contacts and contacts of contacts have been vaccinated with rVSV-ZEBOV-GP(22). While the addition of the rVSV-ZEBOV-GP vaccine has been a critical new tool in the current response, protection of larger populations through vaccination with the Janssen Vaccines and Prevention B.V. candidate preventive vaccine regimen (Ad26.ZEBOV, MVA-BN-Filo) against EVD may also be required to stop the epidemic and prevent further transmission of EVD to high-risk areas. The Ministry of Health of DRC also announced in November 2018 the launch of the first-ever multidrug randomized control trial to evaluate the effectiveness and safety of Ebola therapeutics, which is currently well coordinated with all patients with confirmed EVD at treatment centres in Katwa, Beni, and Butembo receiving novel therapeutics alongside life-saving supportive care (22,23).

**Fifth, affected communities must be engaged and empowered as primary partners in preparedness and response activities.** Innovative medical technologies alone are not enough to prevent and contain epidemics without serious efforts to gain the trust of affected communities and to understand their perceptions of control measures in order to better meet their needs (24). And for this, social science and community engagement activities must be included as central components of decision-making and resource prioritisation during the conceptualisation, planning, and implementation phases of public health initiatives (25). The deployment of new health technologies in DRC is certainly a marked improvement from West Africa; however, in a time of political instability and controversial national elections, community resistance and distrust are stopping people from seeking care, accepting health interventions, and adopting preventative behaviours (26). It is clear that an urgent and careful reset is needed to mobilise effective community engagement activities that build trust and better work together with people from affected communities as the epidemic continues to worsen.

**Sixth and finally, the health care needs surrounding Ebola do not end when the outbreak does- we must take a long-term view, placing affected communities and their needs at the centre of our efforts during epidemic recovery and relief.** Increasing clinical and research observations have shown that the medical complications experienced by Ebola survivors linger on for many years after an outbreak(27–32). Yet, this accumulating evidence has had little impact on health services for survivors. Local health institutions were not prepared to care for survivors and international humanitarian organisations funded or implemented short-term interventions in few affected areas. Ministries of Health battled with whether and how to integrate survivor care needs within existing public health services due to the lack of resource capacity and expertise to provide clinical care for the specialised medical and psychological sequelae of Ebola.

Moreover, the very slow clearance of Ebola virus fragments from immunologically-protected body tissues and fluids prolongs the potential risk of infection of close contacts and relapse of acute EVD (33–37). Thus, even where capacity exists for treatment, health workers are reluctant to provide critically needed care considering their risk of infection. The 2017 death of Salome Karwah, a Liberian Ebola survivor, caused by eclampsia highlighted this fear (38). International recommendation to delay surgical procedures amidst uncertain level of risk of transmission caused delay in provision of ophthalmologic surgery and progression to irreversible blindness resulting from ongoing post-infectious inflammatory uveitis.

As countries with weak health systems continue to experience Ebola outbreaks, the population of survivors is growing and the need for and right to access care must not be ignored. Countries need to enhance baseline capabilities for integrated research and long-term specialised care for Ebola survivors. Improving Ebola survivors’ interaction with quality health services is associated with regression or arrest of progress of the physical and psychological post Ebola sequelae, and can have a lasting positive impact on the quality of life of survivors.

To conclude, the West African Ebola epidemic was a profound tragedy for all of the affected individuals, communities, and countries. It was also a wakeup call that hoisted global health security onto the world’s agenda. While important lessons have been learnt in the aftermath of the crisis and efforts are already underway to strengthen epidemic preparedness at all levels, concerning gaps remain. The world remains vulnerable to the threat of emerging infections. Looking ahead, further investment is needed to strengthen core capacities in countries, including to create enabling work environments with training and fair pay for health workers. Progress delivering medical innovations must be matched by scaled-up efforts to meaningfully engage and empower affected communities, including supporting the needs and promoting the rights of Ebola survivors. While Ebola and other emerging infections will remain a challenge for the years to come, by working in partnership across sectors and with communities, and investing in robust health systems, it is within our power to be better prepared when they strike.

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