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# Global lessons from Nigeria's ebolavirus control strategy

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The current Ebola virus disease outbreak challenged medical and public health systems in West Africa. In Nigeria, the existing infrastructure of the polio surveillance system was leveraged rapidly to contain the spread of Ebola virus. We highlight important lessons learnt from the successful implementation of Ebola virus disease surveillance strategies, which should be amplified further to prepare the ground for successful vaccination programs. Close collaboration between national and international stakeholders as well as public/private partnerships will be instrumental in future Ebola virus immunization strategies.

Ebolavirus, a filovirus, remained restricted to Africa for 35 years and was considered a neglected disease confined to isolated regions. In early 2014, it became an important cause of concern for international public health, as it suddenly emerged in Guinea, spreading rapidly to Liberia, Sierra Leone, Nigeria, Senegal, Mali and the USA. The epidemic was characterized by rapid dissemination, large case fatality numbers including among health-care workers and difficulties in controlling the spread of ebolavirus [1]. The WHO soon declared the ebolavirus outbreak a public health emergency.

Ebolavirus disease (EVD) presents as a severe, frequently fatal hemorrhagic syndrome in humans. Symptoms typically appear after an incubation period of approximately 6–12 days [2]. A flu-like syndrome can progress to hemorrhagic fever with multi-organ failure and frequently to death. Diagnosis is confirmed by detection of viral RNA or antigens in blood or other bodily fluids. Ebolavirus transmission requires direct contact with infected individuals or objects contaminated with infected bodily fluids, or with the corpse of a person who died from EVD. EVD mortality has been >80% in the past. Modern treatment modalities have been able to lower this dramatic figure. Treatment

currently consists of early supportive care and rehydration.

### The index case

In July 2014, an adult patient under observation in a hospital for patients with suspected EVD in Monrovia, Liberia, decided to leave against medical advice. Three days later, he took a commercial flight via Accra, Ghana and Lomé, Togo to Lagos, Nigeria. Upon arrival in Lagos, he was found acutely ill with fever, vomiting and diarrhea and was subsequently transferred to a private hospital. When queried about EVD, he initially denied any known exposures and was treated for presumed malaria, without success. The patient was then isolated and tested for EVD. Local public health authorities were alerted and Lagos University Teaching Hospital confirmed ebolavirus positivity by Real-Time-PCR. The patient died on day 5 after arrival in Lagos. Port Harcourt Health Services conducted early contact tracing at the airport and worked with airlines and partners to ensure notification of the outbreak through International Health Regulation mechanisms.

### The ebolavirus response in Nigeria

The Nigerian health authorities successfully utilized the existing poliomyelitis surveillance infrastructure to establish

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Emergency Operation Centers (EOC) for the ebolavirus outbreak in the country.

There was a strong focus on preparedness with dissemination of self-assessment tools, stringent surveillance at points of entry and adequate logistic support for field activities, ensuring adequate supplies of protective equipment, supportive medicines and consumables. Patients from endemic areas, who showed any symptoms, were immediately isolated for 21 days. Centralized monitoring of case numbers was provided by the National Ebola EOC.

The National Ebola EOC was in charge of responding to queries from the general public. A toll-free EVD Hotline (0800EBOLAHHELP) was circulated through all relevant stakeholders in the country.

A specific case-management team took care of any laboratory-confirmed or suspected cases, triaged potential patients and decontaminated areas inhabited by them [3]. Patients with suspected infection were isolated in 'Suspected EVD Case Wards'. A Contact Tracing Team, staffed and supervised by dedicated epidemiologists, was established to investigate all primary contacts and alert the case management team of symptomatic contacts for assessment and possible reclassification.

The National Primary Health Development Agency, the Federal Ministry of Health and Development Partners instituted coordinated wide-scale preventive measures to control the outbreak and reduce EVD mortality. National Sensitization Workshops and Emergency National Council on Health Meetings led to the rapid implementation of standard operating procedures and designated treatment centers in all 36 federal states and the Federal Capital Territory [4].

The existing National Polio EOC structures were utilized to support the newly formed Ebolavirus EOC with experienced staff members. The National Public Health Institute (NCDC), the National Primary Health Development Agency EOC and an Incident Management System had all been created in 2012, when Nigeria declared polio a public health emergency and restructured its national polio program. The overall responsibility rested with a senior strategic team made up of the local and international key stakeholders, including the WHO, the US CDC, Doctors Without Borders and the United Nations Children's Fund.

Community and traditional leaders were actively involved in the development of communication and social mobilization activities and materials. Local leaders were encouraged to inform the community through regular dialog and announcements, through group discussions as well as during traditional festivals, naming and marriage ceremonies. Key messages were provided in separate communication packages including:

- Social mobilization and supportive messaging: key facts about EVD severity, transmission and importance of early prevention.
- Treatment: information for those seeking treatment for a person with symptoms of EVD; information for those treating

sick family members at home; and information for those who have fully recovered from EVD.

- Contacts: information for those who have had close contact with a person with EVD.
- Safe burial practices: information for those handling a person with EVD who has died.
- Practical steps to prevent EVD in the community and effective community mobilization.

Applying lessons from successful polio EOCs, Nigeria established an effective National Ebolavirus EOC immediately after importation of the disease on 20 July 2014. The early use of the EOC/Incident Management System enabled the country to streamline a coordinated and effective response in Lagos (pop. 21 million), and to expand that response to Port Harcourt, another large city.

As of 24 September 2014, a total of 894 contacts in three states had been monitored, and 20 confirmed or probable EVD cases were identified, of whom 8 had died [5]. No new cases had occurred since 31 August 2014, and WHO has declared Nigeria EVD-free on 20 October 2014 [6].

### Lessons learnt

Nations need to rapidly assess their readiness to manage the importation of EVD into their countries. Given the widespread use of modern transportation and global travel, EVD and other infectious diseases may pose a significant global risk, with transmission only a plane flight away.

Preparedness activities should include EOC to guide a coordinated and effective response to EVD outbreaks or similar public health threats. Where EOC already exists for other diseases such as poliomyelitis [7], this infrastructure should be strengthened and utilized to mount effective responses. Nigeria's recent experience provides important clues for a public health model to be emulated and documented for future referencing.

Similar measures for the coordination of ebolavirus responses have proven successful in other African countries that have experienced ebolavirus outbreaks in the past. EVD was not restricted to Central Africa. Tai Forest ebolavirus had emerged as early as in 1994 in Côte d'Ivoire causing a non-fatal infection in a Swiss national. Other African countries were affected by Zaire ebolavirus, including Sudan and Zaire in the 1970s, and Gabon and the Democratic Republic of Congo in the mid-1990s, with additional outbreaks in Zaire and Sudan in the early 2000s.

When Uganda experienced its first ebolavirus outbreak in 2000, a National Ebolavirus Task Force was established comprising of various ministries and departments, development partners, bilateral agencies and NGOs under the stewardship of the Ugandan Director General of Health Sciences [8]. Any time a case of ebolavirus or Marburg virus is suspected, this National task force can now be reactivated to prevent the spread of potentially fatal infectious diseases. This was also the case during EVD outbreaks in Uganda in 2007, 2011 and 2012.

### Ebolavirus success strategy – a proposal

In conclusion, a success strategy for effective EVD public health responses should consist of the following key parameters.

- EOC based on existing Polio EOC, including experts from WHO and CDC.
- One hundred percent contact tracing and isolation of contacts; involvement of social scientists from the very beginning [9].
- Rapid-turnaround PCR and antibody testing; timely dissemination of results to relevant institutions as well as patients and their families.
- Community social mobilization via print (handbills, posters, fliers) and social media [10], including educational materials and self-care instructions for EVD contacts.
- Rapid development of standard operating procedures and dissemination of protective equipment to healthcare workers.
- Interventions including preventive initiatives, active disease surveillance, effective quarantine, point-of-care diagnostics, public health education and timely response to queries [1].
- Routine surveillance systems to detect early signs of an EVD outbreak extending beyond sentinel sites to be scaled up rapidly; surveillance linked with national public health laboratories to enable robust monitoring and response; anonymized data derived from signal tracing available in real-time for Geographic Information System (GIS) mapping.
- Digital databases with information on numbers and location of cases as well as survivors, shared safely to allow rapid (re)allocation of resources to areas most in need.
- Positive messaging such as 'you can survive EVD', including distribution in local languages; effective public health communication, coordination of messages conveyed by different authorities as well as news channels and social media.
- High-level political commitment, national coordination and leadership.
- Prioritization of ebolavirus vaccine development.

### Integrating ebolavirus vaccines into the strategy

A safe and effective ebolavirus vaccine is probably the only efficient approach to avoid future re-emergence of EVD with its associated large-scale morbidity and mortality.

The recent outbreak of EVD in West Africa highlighted the need for a protective vaccine and to design – ahead of time – effective implementation programs [11]. The first large-scale trials of two experimental vaccines to protect against EVD have begun in Liberia [12]. Both vaccines have been shown to be safe and efficacious in animals. However, it will take some time to determine whether the experimental vaccines will offer protection in humans.

Even if a vaccine is found to be efficacious, the question will remain whether the countries affected by EVD, in particular considering scarcity of resources, can afford the vaccine. The good news is that the Global Alliance for Vaccines and Immunization (GAVI) Board has planned to raise US\$ 300 million to procure the vaccines and use it in countries at risk for the disease. An additional US\$90 million has been planned to support introduction of the vaccines, rebuild health systems and restore immunization services in EVD-affected countries [13]. There is reason for hope that this concerted effort to produce and disseminate ebolavirus vaccine and introduce the vaccine with GAVI support will help to minimize the threat from this deadly virus disease.

Before an ebolavirus vaccination campaign is launched, proper communication of the expected benefits and risks of the vaccine should be provided to the public. People may also want to know the cost of the vaccine and how much they may have to pay out of pocket. Throughout the immunization campaign, authorities should actively monitor and confirm the effectiveness and necessity of vaccination, considering any potential side effects of the vaccine. Any safety concerns, real or perceived, should be addressed in a timely manner using concise and objective public health messages explaining the decision-making processes underlying the ebolavirus immunization program. This information should be accessible, accurate, consistent and, most importantly, easy to understand in order to launch a national ebolavirus vaccination program successfully.

### Financial & competing interests disclosure

*The authors have no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript. This includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties.*

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