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### CONTAINMENT OF EBOLA - STEPS TO PREVENT SPREAD OF EMERGING INFECTIOUS DISEASES, THE NIGERIA EXAMPLE

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#### ABSTRACT

Emerging infectious diseases are diseases whose incidence in humans have increased in the past decades or threaten to increase in the near future. The epidemiological and Laboratory techniques needed to detect, investigate and contain a deliberate outbreak are the same as those used for natural outbreaks. The threat to Nigeria posed by the arrival in Lagos of a patient acutely ill with Ebola was potentially enormous. Six response teams were deployed within the Emergency Operations Centre; 1) Epidemiology/ Surveillance, 2) Case Management/ Infection Control, 3) Social mobilization, 4) Laboratory Services, 5) Point of Entry and 6) Management / Coordination. The strategy group reviewed and approved all of the teams work and needed resources. Eleven patients with laboratory confirmed Ebola were admitted and discharged, an additional patient was diagnosed at convalescent stage while eight patients died. Several issues were observed by the response team during Nigeria Ebola outbreak that could in retrospect have been mitigated through additional preparedness planning for public health emergencies:- 1) Financial resources were slow to arrive, 2) Political leadership did not appreciate the enormous consequences that even a small Ebola outbreak could have on civil institutions, 3) Lack of Nigerian health workers willing to care for Ebola because of a lack of information and training on how to care for Ebola patients, 4) Inappropriate coordination of private sector engagement and 5) Partners and parts of government were unfamiliar with EOC/IMS system and its use as a means of streamlining coordination and response elements into one unified approach.

### LE CONFINEMENT DE L'EBOLA - MESURES POUR PRÉVENIR LA PROPAGATION DES MALADIES INFECTIEUSES ÉMERGENTES, LE NIGERIA PAR EXEMPLE

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#### Résumé

Les maladies infectieuses émergentes sont des maladies dont l'incidence chez les humains ont augmenté au cours des dernières décennies ou menacer d'augmenter dans un avenir proche. Les techniques de laboratoire et épidémiologiques nécessaires pour détecter, enquêter et contenir une épidémie délibérée sont les mêmes que celles utilisées pour les éclosions. La menace pour le Nigéria posés par l'arrivée à Lagos d'un patient gravement malade avec le virus Ebola est potentiellement énorme. Six équipes d'intervention ont été déployés dans le centre des opérations d'urgence ; 1) de l'épidémiologie et de surveillance, 2) La gestion de cas/ Contrôle de l'infection, 3) la mobilisation sociale, 4) Les Services de laboratoire, 5) le point d'entrée et 6) Gestion / Coordination. La stratégie groupe a examiné et approuvé l'ensemble des équipes de travail et les ressources nécessaires. Onze patients atteints d'Ebola confirmé en laboratoire ont été admis et déchargée, un autre patient a été diagnostiqué au stade de convalescence alors que 8 patients sont morts. Plusieurs questions ont été observés par l'équipe d'intervention pendant le Nigeria l'éclosion d'Ebola qui pourrait rétrospectivement ont été atténuées par la planification des mesures supplémentaires pour les urgences en santé publique :- 1) ressources financières ont été lentes à arriver, 2) Le leadership politique n'a pas apprécié les conséquences énormes que même une petite épidémie d'Ebola pourrait avoir sur les institutions civiles,

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3) le manque de travailleurs de santé nigériens prêts à s'occuper de l'Ebola en raison d'un manque d'information et de formation sur la façon de soigner les patients d'Ebola, 4) Pas de la coordination de l'engagement du secteur privé et 5) Partenaires et parties du gouvernement n'étaient pas familiers avec l'EOC/IMS système et son utilisation comme moyen de rationaliser la coordination et des éléments de réponse dans l'une approche unifiée.

## INTRODUCTION

Emerging infectious diseases are diseases that: -

1. Ebola cases have not occurred in humans before (this type of emergence is difficult to establish and is probably rare (1), or
2. Have occurred previously but affected only small numbers of people in isolated places (AIDs and Ebola hemorrhagic fever are examples (2);
3. Have occurred throughout human history but have only recently been recognized as distinct diseases due to an infectious agent (3).

Many specialists in infectious diseases include re-emerging diseases as a subcategory of emerging disease (4). An infectious disease emerging in a single country is a threat to all countries (5).

Despite the challenges of emerging and re-emerging infectious diseases, the results of basic research, show that there is a reason for hope (6). Acquired immune deficiency syndrome (AIDs was first described in 1981, and it took two years to identify the retrovirus that causes it, which named Human Immunodeficiency Virus (HIV) (7). The development of polymerase chain reaction (PCR), a powerful new research technique allows rapid identification of causative agents of infections (8). Recommendations for avoiding and/or treating of new infectious diseases become possible when new techniques, developed through basic research are applied to the problem of disease emergence (9).

### Ebola Virus Disease

*Ebola virus* disease (EVD) is a severe, potentially life threatening illness caused by *Ebola virus* (10). *Ebola virus* is an enveloped RNA virus about 80x800-1400 nm in size whose survival is dependent on an animal reservoir (11). An international team of researchers have sequenced 99 *Ebola virus* genomes and also observed a rapid increase in its genetic variation (9). However, more recent molecular data obtained from the outbreaks in Kikwit and Gabon did not find any molecular evidence for adaptation during human to

human transmission (12). Infection results in severe disease with high mortality rate among infected humans and other primates (13). It has no known cure or vaccine; treatment is only supportive (8). Ebola virus is considered a potential biological weapon candidate (11).

On the 23<sup>rd</sup> of March 2014, the World Health Organization (WHO) issued its first communiqué on a new outbreak of EVD, which began in December 2013 in the republic of Guinea (14). Located on the Atlantic coast of West Africa, Guinea became the first country in this geographical region to report an EVD outbreak with more than one case reported. The 2014 Ebola epidemic is the largest in history, affecting multiple countries in West Africa (15).

### The Nigeria Ebola Outbreak

On July 20<sup>th</sup> 2014, an acutely ill traveler from Liberia arrived at the Murtala Mohammed International airport in Lagos, Nigeria and was admitted to a private hospital (16). Based on the patient's failure to respond to malaria treatment and his travel from an Ebola affected country in the region, treating Physicians suspected EVD. The patient was isolated and tested for *Ebola virus* infection while local public health authorities were alerted about a suspected case of EVD (16). He was later confirmed to have EVD. This index patient potentially exposed 72 persons at the airport and the hospital (14). The Federal Ministry of Health with guidance from the Nigeria Centre for Disease Control (NCDC) thereafter, declared an Ebola emergency. On July 23<sup>rd</sup>, the Federal Ministry of Health with the Lagos State government and International partners activated an Ebola Incident Management Centre (IMC) as a precursor to the current Emergency Operations Centre (EOC) to rapidly respond to this outbreak. On August 8<sup>th</sup>, the WHO declared the epidemic to be a public health emergency of International concern (17).

Port Health Services conducted early contact tracing at the airport and worked with airline and partners to ensure notification of the outbreak through the International Health Regulations mechanisms (18).

The EOC case-management team took over the management of each laboratory confirmed or suspected case, triaged potential patients, and decontaminated areas inhabited by them. Patients with suspected infection were isolated in suspected case ward at the Ebola treatment facilities(9), initially in Lagos, Western Nigeria and subsequently in Port Harcourt, South east Nigeria. A contact tracing team staffed and supervised by skilled, dedicated epidemiologists was established to investigate all primary contacts and alert the case management team of symptomatic contacts for assessments and possible reclassification. A suspected case was reclassified as a confirmed case if reverse transcription polymerase chain reaction (RT-PCR) detected *Ebola virus* in a blood specimen, and was ruled out if RT-PCR testing of two blood specimens collected at least 48 hours apart was negative.<sup>16</sup> Additionally, testing for anti-*Ebola virus* immunoglobulin G, indicating an immune response to *Ebola virus*, was added to the testing protocol for PCR-negative suspected cases in persons with some symptoms who were epidemiologically linked to subsequent confirmed cases (19). When a contact became ill with suspected case, the contact tracing team gathered data on persons exposed to that contact from the date of symptom onset in the event the suspected case should become laboratory confirmed (20). Having the capacity to conduct Ebola laboratory diagnosis in-country facilitated rapid identification of confirmed cases and quick discharge of persons with suspected EVD who tested *Ebola virus* negative.

### **The Nigeria Response**

The threat to Nigeria posed by the arrival in Lagos of a patient acutely ill with Ebola virus infection was potentially enormous (21). The implementation of a rapid response that made use of the available public health assets was the highest priority at the onset of the outbreak, as was organizing the response using proven structures for the delivery of public health in Nigeria.<sup>22</sup> Initially, NCDC and the Lagos State Ministry of Health established an IMC which served as the overall implementing arm of the national response. The initial IMC was subsequently recast as the national EOC, in line with Incident Management Systems (IMS) nomenclature and national structures aimed at emergency response. The EOC expanded its operations to Rivers state when cases emerged there,

and oversaw the monitoring of contacts in Enugu state with state health officials as part of the early outbreak response.<sup>22</sup> There was a stated expectation that all partner organizations, donors and response teams would work through the EOC structure, reporting to an Incident Manager (IM). In turn, the IM would be responsible to deliver accountable and transparent results to the NCDC and the Federal Ministry of Health. The IM responsible for oversight of the response was selected based on IMS experience and competency rather than rank in government or public service.

The Nigeria response benefited from the rapid use of its national public institution (i.e. NCDC), previous outbreak responses such as a major lead poisoning response in 2010, and its recent experience with polio eradication. In October 2012, responding to the declaration by the World Health Organization of polio eradication as a global public health emergency and to improve its national response, the Government of Nigeria used the IMS to establish a national EOC as part of a new national emergency plan for the global polio eradication initiative. The use of IMS through the EOC changed the operational tempo, accountability measures and success of the polio eradication program. Indicators and dashboard (electronic displays of high level indicators for each response team monitored at the EOC) were developed to increase accountability of the program staff and spending. Through the EOC and the Nigeria Field Epidemiology and Laboratory Training Program (NFELTP) polio activities, State health systems strengthening and preparedness was prioritized.<sup>16</sup>

Six response teams were developed within the EOC specific to an Ebola response including; 1) Epidemiology/Surveillance, 2) Case Management / Infection Control, 3) Social Mobilization, 4) Laboratory Services, 5) Point of Entry, and 6) Management / Coordination (23). Terms of reference and priority activities were developed by the strategy team to guide each operational team's work; operational teams develop their own staffing list, list of materials and financial needs and a goal oriented operational plan (23,24). The strategy group reviewed and approved all of the teams work and needed resources. Technical partners assigned staff throughout the operational teams in technical

advisory roles aimed at building the capacity of the local teams and ensuring quality work (21).

### **The Impact of the Nigeria Response**

The index patient died on July, 25<sup>th</sup>; as of September 24<sup>th</sup>, there were 19 Laboratory confirmed Ebola cases and one probable case in two states, with 894 contacts identified and followed during the response (25). No new cases had occurred since August 31, suggesting that the Ebola outbreak in Nigeria might be contained.<sup>25</sup> The EOC established quickly and using an IMS to coordinate the response and consolidate decision making, is largely credited with helping contain the Nigeria outbreak early. National public health emergency preparedness agencies in the region, including those involved in Ebola responses, should consider including the development of an EOC to improve the ability to rapidly respond to urgent public health threats (26).

### **The Lessons Learnt**

Several issues were observed by the response team during the Nigeria EVD outbreak that could in retrospect, have been mitigated through additional preparedness planning for public health emergencies (27).

First, financial resources were slow to arrive at the EOC, a delay that threatened to impede the rapid expansion of containing activities across the response (24). National preparedness efforts should consider how resources can be quickly made accessible to fund the early stage of the response.

Second, there were discrepancies among the levels of political leadership in fully appreciating the enormous consequences that even a small Ebola outbreak could have on civil institutions such as hospitals, airports and public gatherings.<sup>16</sup> Targeted education about the urgent need to fund, staff and supply a response effort was provided to political leadership and should be considered for preparedness efforts elsewhere (27). Similarly, the Nigerian public did not have specific information

about *Ebola virus* infection and early information provided by the press, in advance of official information from the health authorities was sometimes inaccurate and created a nationwide scare.<sup>10,26</sup> This scare resulted in some persons resorting to extreme and sometimes harmful and ineffective measures to avoid infection such as consuming large quantities of salt water, even in places distant from the outbreak. Both issues could have been addressed through preparedness activities that focused on education and planning, as well as explaining *Ebola virus* infection to the public and describing how to respond should *Ebola virus* arrived in Nigeria (28).

The case management team indicated that early efforts to establish an isolation ward were delayed due to a lack of Nigerian health care workers willing to care for patients with Ebola because of a lack of information and training about how to care for Ebola virus infected patients without getting infected and because care providers had been disproportionately impacted by EVD in other affected countries (29). Preparedness activities should include orientation and training of physicians, nurses and attendants to safely provide services with attention to infection control procedures and quality EVD treatment at an appropriately designed facility.

Another challenge was ensuring appropriate coordination of private sector engagement. The EOC system facilitated improved coordination through the designation of the Management and Coordination Team Lead as the private sector point of contact.

Finally, some partners and parts of government were unfamiliar with the EOC/IMS and its use as a means of streamlining coordination and response elements into a unified approach. The government led EOC process could define opportunities for partners to place staff strategically in the national and local response efforts and could encourage this through the EOC response teams and management system. Further, EOC mechanisms should be tested through strategic exercises and use in other emerging infection response (17).

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