

EBOLA VIRUS DISEASE OUTBREAK IN WEST AFRICA: ONE YEAR DOWN THE LINE AND THE NICD RESPONSE

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Background

Ebola virus disease (EVD) is caused by zoonotic RNA viruses belonging to the family Filoviridae. Five diverse species of Ebola virus have been described to date but only the *Zaire* and *Sudan ebolaviruses* have been associated with sizeable and highly fatal human outbreaks.¹ Natural outbreaks caused by *Zaire ebolavirus* (ZEBOV) have been described mostly from equatorial Africa, but the current outbreak in West Africa suggests that the geographic distribution of the virus may be more widespread than anticipated.² The Ebola viruses in Africa are thought to be maintained in specific species of arboreal bats, but exact mechanisms of spill-over into other susceptible animal and human populations are not fully understood.³⁻⁵ Various outbreaks have been traced back to index patients that had contact with bushmeat, for example chimpanzees during the Gabon outbreak in 1996, and bats during the 2014 Democratic Republic of Congo outbreak.⁶⁻⁷ The likely index case of the ongoing West Africa outbreak was a two-year-old patient that died in December 2013, who supposedly had contact with bats while playing in a hollow tree near his home.⁸⁻⁹ Once the virus has spilled over to humans, outbreaks are perpetuated by direct contact with infected bodily fluids, secretions and excreta. This mode of transmission predisposes healthcare workers, relatives and friends caring for the sick.¹⁰⁻¹² Burial ceremonies have been recognized as a major risk factor for transmission.¹⁰⁻¹²

A more comprehensive overview of EVD was provided in the previous NICD Communicable Disease Surveillance Bulletin (2014, Volume 12 number 4, pages

109-116). Here we give an update on the outbreak developments in West Africa and summarize the response launched by the South African National Institute for Communicable Diseases (NICD) to this event.

EVD in West Africa

On 29 March 2015, one year since the outbreak was first reported, a cumulative total of 25 178 EVD cases (laboratory-confirmed, probable and suspected), including 10 445 deaths with an overall case fatality rate (CFR) of 41% has been reported by the World Health Organization (WHO) in the three countries currently affected with intense transmission, i.e. Guinea, Liberia and Sierra Leone.¹³

The outbreak started in Guinea's southern district, Guéckédou in December 2013, with subsequent spread to other districts (including the capital Conakry), as well as neighbouring countries Liberia and Sierra Leone. A marked increase in the number of EVD cases was noted from July 2014 onward with a peak occurring in September/October 2014 in Liberia and November/December in Sierra Leone, before gradually declining to lower levels in 2015. Rates of disease incidence have differed by country, with Sierra Leone and Liberia being the most affected. As of 29 March 2015, the total number of EVD cases reported per country was 3 492 EVD cases in Guinea, despite the fact that the epidemic started there, and totals of 9 712 and 11 974 EVD cases in Liberia and Sierra Leone, respectively.¹³ Over the past 21 days, one new confirmed case was reported from Liberia on 20 March (who later died on 27 March),

while Guinea and Sierra Leone continued reporting relatively many new cases (197 and 113 respectively) and deaths over the same period (8–29 March).¹³

Sustained transmission of infection occurred at community level for a prolonged time in numerous regions and towns across all three affected countries. However, the numbers of cases differ within regions with certain districts accounting for a higher proportion of total cases than others, while other areas remain unaffected. In Guinea, transmission remains centred in

the west of the country, in and around the capital Conakry and nearby prefectures (Boffa, Coyah, Dubreka and Forecariah). Two additional prefectures, Fria in the west and Siguiiri, to the north on the border with Mali, reported cases for the first time in over 50 days. In Sierra Leone confirmed cases are still being reported from the northern and western districts as well as in and around the capital Freetown (Bombali, Kambia, Port Loko, and Western Rural) in the week leading to 29 March 2015 (figure 1).

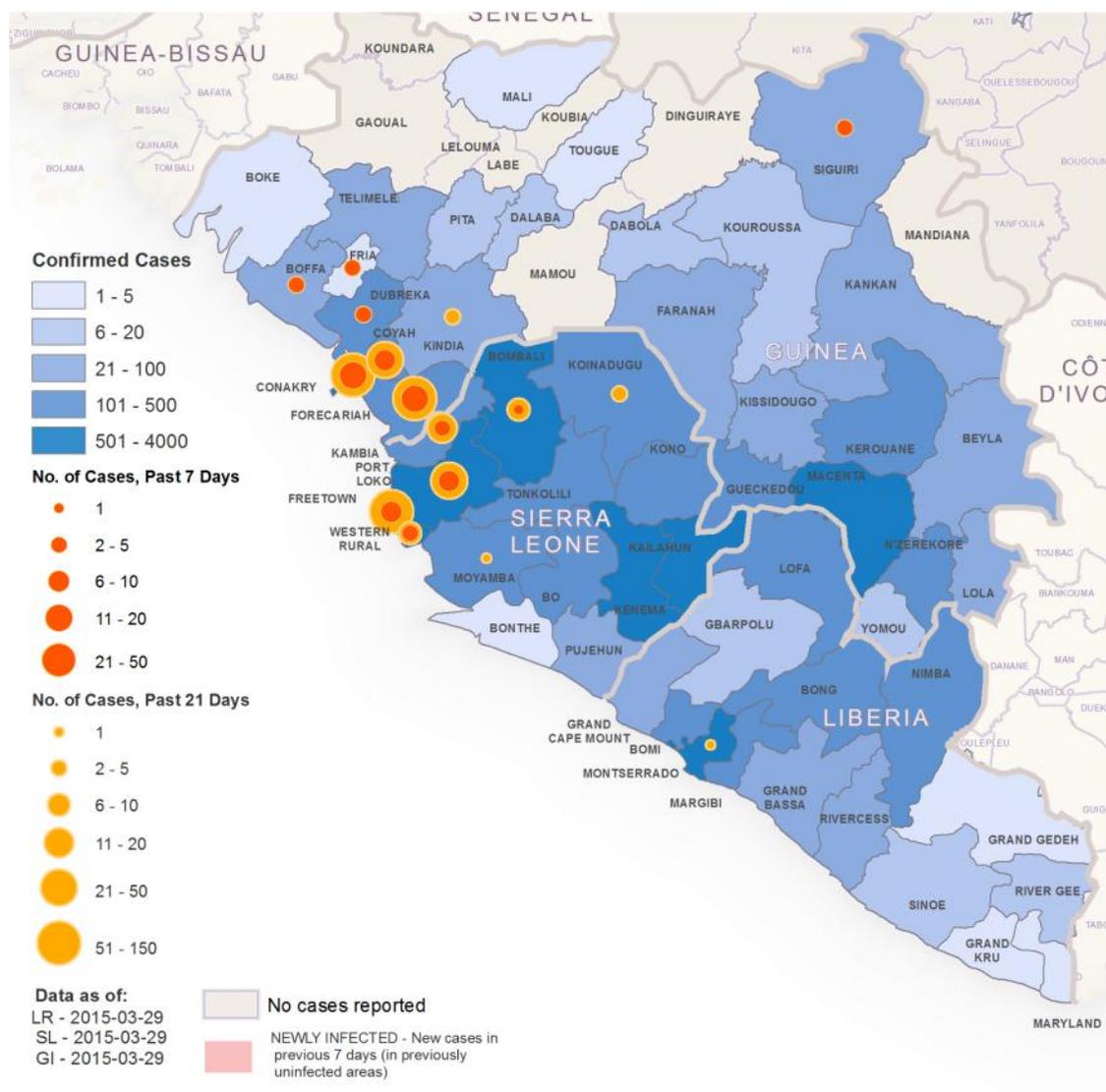


Figure 1: Geographical distribution of Ebola virus disease (EVD) cases in Guinea, Liberia and Sierra Leone as at 29 March 2015. Source: World Health Organization: Ebola situation report of 1 April 2015 (<http://apps.who.int/ebola/current-situation/ebola-situation-report-1-april-2015-0>).

It is also noted that case fatality rates (CFR) vary from country to country and per location within each country: the highest overall CFR is recorded for Guinea (66%; 2314/3492), followed by Liberia with a CFR of 45% (4332/9712) and the lowest death rate (32%; 3799/11974) amongst all cases is documented for Sierra Leone.

Healthcare workers (HCWs) have frequently been infected while treating patients with suspected or confirmed EVD and their case numbers and deaths

continue to be reported up until present. To date, 861 cases amongst HCWs have been reported, with 495 deaths (CFR: 57%); the highest HCWs CFR is being reported from Sierra Leone (73%).¹³

Where information on age and gender is available, people aged 15-44 are three times more likely to be affected than children (<15 years), and those 45 and over, three to five times more likely. Rates of disease incidence are similar between males and females within all three affected countries (figure 2.)¹³

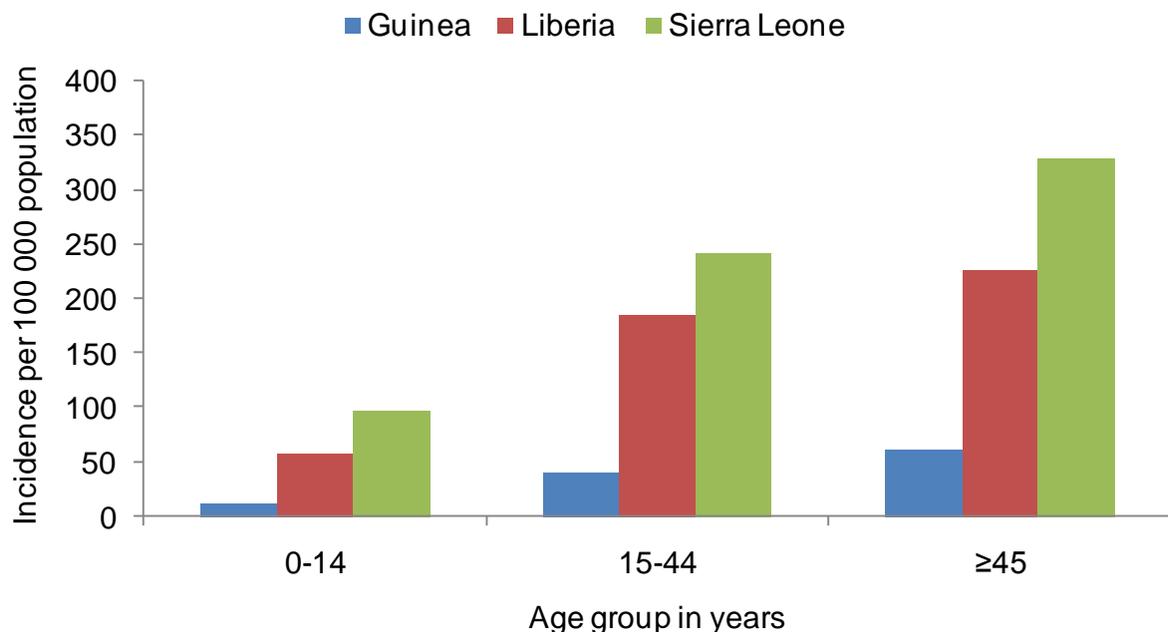


Figure 2: Age-specific incidence of Ebola virus disease cases in Guinea, Liberia and Sierra Leone as at 29 March 2015 (created from data in WHO Ebola situation report of 1 April 2015).

Several interventions to contain spread have been instituted with the primary goal of breaking the chains of transmission, and include: early identification of cases and contacts, isolating and treating patients, infection prevention and control, laboratory diagnosis, contact tracing and safe burials. However, unsafe burials and unknown chains of transmission (those who were not known to be contacts of a previous case) continue to be reported, especially in Guinea.

EVD status in South Africa, SADC region and other countries

Even though the outbreak has been largely confined to Guinea, Liberia and Sierra Leone, there is a concern about importing EVD cases into other countries.

No EVD cases have been confirmed in South Africa since the West African outbreak was announced. Close monitoring and testing is being carried out on returned

travellers from the affected countries that present with features suggestive of EVD. No EVD cases have been documented from other SADC countries to date.

Thus far there are six countries i.e. Nigeria (20 cases, 8 deaths), Mali (8 cases, 6 deaths), Senegal (1 case), United States of America (4 cases, 1 death), Spain (1 case) and the United Kingdom (1 case) that have reported localised transmission or imported a case or cases from Guinea/Liberia/Sierra Leone. Nonetheless, the EVD outbreaks in these countries have been declared over. The latest imported EVD case-patient, a healthcare worker who returned from volunteering at an Ebola treatment centre in Sierra Leone, was confirmed EVD positive on 29 December 2014 in Scotland in the United Kingdom, but has recovered and gained EVD-negative status on 24 January 2015.¹⁴

NICD response to the EVD outbreak

EVD testing of returned travellers to South Africa or SADC, and other national activities

The Centre for Emerging and Zoonotic Diseases (CEZD) of the NICD operates the only maximum biosafety laboratory (biosafety level 4) in Africa. With more than 30 years history in the laboratory diagnosis and investigation of viral haemorrhagic fevers (VHFs) including EVD, the NICD represents a critical national and international resource during the current EVD outbreak in West Africa. The CEZD is recognized by the WHO as one of nine laboratories worldwide for expertise in diagnosis of filoviruses, and has a status of World Health Organization Collaborating Centre for Reference and Research of VHFs and Arboviruses. From February 2014 to date, samples from a total of 37 suspected cases were subjected to testing at the CEZD at the NICD in Johannesburg. Eight of these cases were referred from other African countries including Zimbabwe (n=2), Namibia (n=4), Angola and Ethiopia (not SADC). The remainder were patients presenting to

South African health-care facilities, who required follow-up for suspected EVD. All of these cases tested negative for EVD. The differential diagnosis of these cases revealed infectious and non-infectious causes of disease. A total of ten cases was diagnosed with malaria, but laboratory testing also supported trypanosomiasis (n=1), dengue (n=1) and parvovirus infection (n=1). Two cases involving Nigerian patients were related to complications of sickle-cell anaemia, a common hereditary condition in the Nigerian population. One patient was diagnosed with severe complications of autoimmune disease, whilst another died from a possible drug reaction.

In addition to follow up of suspected cases, the NICD also contributed to drafting of guidelines, EVD risk communication to the general public and other stakeholders, and various training activities to support responses to EVD in other countries. With the outbreak of Ebola virus disease in West Africa, the NICD has also initiated an Emergency Operations Centre (EOC) in South Africa to prepare and respond better to high-risk outbreaks such as Ebola in the country, in line with its mandate by the National Department of Health.

Ebola molecular diagnostic facility in Sierra Leone

With the momentum of the EVD outbreak in Liberia and Sierra Leone building after June 2014, and in response to international calls for assistance, the NICD of South Africa has been actively involved in the "hot zone". In mid-August 2014, the NICD deployed its field Ebola Molecular Diagnostic Facility (EMDF) to Freetown, Sierra Leone. Under Professor Janusz Paweska's leadership, volunteers from the NICD and from the University of Pretoria were deployed under the management of the Global Outbreak Response Network of the World Health Organization. The EMDF established by CEZD-NICD in Freetown-Lakka, Sierra Leone, is a significant collaborative effort of the Sierra

Leone Ministry of Health and Sanitation, the South African Department of Health and the World Health Organization, in response to the public health crisis caused by the unprecedented outbreak of EVD. The full

operationalisation of the EMDF in August 2014 has been critically important in supporting the response to the EVD outbreak in Sierra Leone.



Clockwise from top left: Dr Jacqueline Weyer setting up a polymerase chain reaction (PCR) for testing a suspected EVD case in South Africa; the team from the Ethiopian Public Health Institute (including Director Ahmed Kebede, left front) received training in EVD diagnosis at CEZD in October 2014; Alan Kemp and Professor Janusz Paweska working in the only biosafety level 4, maximum containment facility in Africa, which is housed at the NICD.

Up to March 2015 the NICD had deployed eight teams to operate the EMDF in Freetown-Lakka, each comprising of 2-5 members, rotating every 4-6 weeks. Since the second week of the NICD EMDF operation, the NICD staff undertook intensive training of Sierra Leonean scientists and technical personnel in facility operational logistics, biosafety and Ebola diagnostic procedures. The national staff became fully integrated into all aspects of functions and operation of the EMDF.

The Western Urban Area of Sierra Leone, where the NICD EMDF operates, remained a hotspot of the EVD epidemic for months. Consequently, this facility played a major role in providing Ebola diagnostic services for Sierra Leone, especially during the first months of the epidemic, when it was the only Ebola diagnostic facility in Freetown. As of 31 March 2015, the NICD EMDF has tested 7 261 clinical specimens from suspected EVD cases, of which 32.67% were positive by RT-PCR. The

NICD contributes to the following aspects of EVD outbreak response in Sierra Leone:

- Provides assistance to the Sierra Leonean national laboratory counterparts, the WHO Country Office, and international response teams in the diagnosis of EVD.
- Provides adequate bio-hazard protection of staff working in the EMDF.
- Contributes to the improvement of the national Ebola diagnostic capacity.
- Provides technical assistance to the Government of Sierra Leone in controlling the EVD outbreak.



Clockwise from top left: Professor Janusz Paweska and the first team deployed to Sierra Leone; Dr Petrus Jansen van Vuren setting up a PCR run at the Lakka Laboratory; Günther Meier assists Cardia Fourie in donning of personal protective equipment before entering the containment area; staff performing inactivation of specimens from suspected EVD cases. Note the containment infrastructure associated with this procedure.¹⁵

Epidemiology support to the West African outbreak

In addition to laboratory expertise, two medical epidemiologists were deployed to Liberia for epidemiology and surveillance of EVD cases. Dr

Ngormbu Ballah, a Liberian medical doctor who is completing a Field Epidemiology Training Programme (FETP) in SA, returned to his country during July-August 2014. Dr Chikwe Ihekweazu was deployed in

Montserrado County (including the capital city of Liberia, Monrovia) during January-February 2015. Both experts worked with the World Health Organization team while in Liberia.

Dr Ihekweazu fed back on the challenges of contact tracing during the response. Contact tracing is the process of finding everyone who has come in direct contact with a sick Ebola patient. Contacts are monitored for signs of illness for 21 days from the last day they came in contact with the Ebola patient. If the contact develops a fever or other Ebola symptoms, they are immediately isolated, tested, provided care, and the cycle starts again – all of the new patient's contacts are found and watched for 21 days. In January 2015, 22 cases in the St. Paul Bridge cluster in Liberia led to about five hundred contacts who were followed every day for 21 days by the team. Contacts were urged to stay at home for 21 days. Ensuring the comfort of contacts during the 21-day follow-up period was essential in achieving the isolation objectives. A major challenge was ensuring that all contacts received food

and other essential commodities while at home. A complicating factor at this stage of the outbreak was the increasing number of suspected cases that turned out to be negative, but all of whom required isolation until testing was completed. During this period, the full public health response, including contact tracing, had to be instituted. The large number of contacts that required monitoring made paper-based questionnaires burdensome and impracticable. Making use of personal mobile phones for collection of data may be a more efficient solution for future contact tracing and outbreak control. Finally, while carrying out contact tracing and monitoring, a compassionate approach is required. It is important to remember that these "contacts" are indeed people that most likely suffered loss due to Ebola, and it would be unfair to expect them to behave in a completely rational way in such circumstances. Coordination of the numerous resources, in particular human capacity and the technical skills from different organisations with same mission and expertise, was a major task in itself.



Dr. Chikwe Ihekweazu visiting a treatment centre (left); at the Ministry of Health in Liberia (right).

Concluding remarks

The ongoing and unprecedented Ebola outbreak in West Africa has resulted in one of the largest public health responses to an outbreak to date. These efforts far exceeded the borders of the countries reporting EVD

cases, and have not only seen governments around the world putting measures in place to prevent introduction of EVD into their countries, but also to be prepared to handle EVD cases if they should occur. As numbers of EVD cases are declining in the three most-affected

countries, the experts are calling the “end game” for the EVD outbreak. Nonetheless, efforts are required in the coming weeks and months to ensure that the final case of EVD during this outbreak can be concluded.

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