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Ebola response in Sierra Leone: The impact on children

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Summary The West African Ebola virus disease (EVD) outbreak is the largest ever seen, with over 28,000 cases and 11,300 deaths since early 2014. The magnitude of the outbreak has tested fragile governmental health systems and non-governmental organizations (NGOs) to their limit. Here we discuss the outbreak in the Western Area of Sierra Leone, the shape of the local response and the impact the response had on caring for children suspected of having contracted EVD. Challenges encountered in providing clinical care to children whilst working in the "Red Zone" where risk of EVD is considered to be highest, wearing full personal protective equipment are detailed. Suggestions and recommendations both for further research and for operational improvement in the future are made, with particular reference as to how a response could be more child-focused.

Introduction

The West African Ebola virus disease (EVD) outbreak is the largest ever seen, with over 28,000 cases and 11,300 deaths since early 2014.[1] The magnitude of the outbreak has tested fragile governmental health systems and non-governmental organizations (NGOs) to their limit. Spread from a rural outbreak source in the Guéckédou district of Guinea to the crowded urban environments of Monrovia, Conakry and Freetown allowed viral transmission on an unprecedented scale.[2] Over a year after the EVD transmission was established in Freetown, Sierra Leone, it is time to take stock. At the peak of the outbreak, pragmatic decisions were taken about how to respond to the novel situation

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of EVD transmission in impoverished urban settings. Without understanding those decisions and the shape of the response in Sierra Leone, it is difficult to interpret data emerging from the outbreak.

Here we describe the setting of the outbreak and the emergency response in the densely populated Western Area of Sierra Leone including the capital Freetown, to demonstrate features of the response which particularly impacted on children. Issues affecting data collection will be described, followed by an urgent call for granular and contextual research into the current outbreak in order to plan better for the future.

Ebola in the Western Area of Sierra Leone

The Western Area of Sierra Leone is the most densely populated area of Sierra Leone, with ~1 million inhabitants at the last published census (2004), over 25% of whom live in informal housing, and only 26% of whom have a private toilet.[3] In certain areas of Freetown, the population density reaches 40,000 persons/km^2.[3] In 2013, Sierra Leone had 0.2 doctors and 1.7 nurses/midwives per 10,000 population.[4] For context, corresponding figures in South Africa were 7.8 and 49, and 27.9 and 88.3 in the United Kingdom.[4] In this environment of overcrowding, poor sanitation and an overstretched health system, transmission of EVD was the most intense out of all areas affected in this outbreak.[5]

Ebola virus is an enveloped filovirus thought to have a natural host in bats.[6] It has previously caused isolated outbreaks in Uganda and the Democratic Republic of Congo with a mortality rate of up to 81%.[7,8] Transmission is via contact with bodily fluids particularly in later stages of the disease, with corpses being highly contagious. The incubation period is 2–21 days (mean 11.4).[9] Pooled adult and paediatric data as well as clinical experience suggest that clinical manifestations of the disease in this outbreak differ from previous ones. Along with fever and fatigue, gastrointestinal features are much more prominent, occurring in 50–68% of cases with diarrhoea being significantly associated with a fatal outcome.[10–12] Gastrointestinal fluid loss and resultant electrolyte imbalance can be dramatic with up to 10 L of diarrhoea a day and resultant hyponatraemia and hypokalaemia.[13,14] Spontaneous bleeding is uncommon in this outbreak, seen in 2–18% of patients.[9,10,15] Overall, the mortality rate for this outbreak is ~56%.[16]

The Ebola holding unit model

One of the most insidious and destructive features of EVD is its proclivity for infecting health care workers (HCWs). To date, over 880 HCWs have been infected in this outbreak with a mortality rate of 58%.[1] Coupled with the non-specificity of symptoms, this breeds distrust within hospitals and other health care facilities whereby doctors and nurses view their patients with fear and in turn patients fear health facilities. Without a robust system for triaging and testing potential EVD patients, hospitals closed as staff were too afraid to come to work. Such a situation was seen in the John F Kennedy hospital in Monrovia, Liberia in July 2014.[17] The impact this closure had on nationwide mortality rates from other conditions is not fully defined. In Sierra Leone, inpatient admissions dropped by 70% from May to October, leaving a predicted 35,000 patients without essential inpatient care,[18] and additional deaths from malaria alone exceeding those from EVD.[19,20] A reduction in vaccine coverage led to a prediction of 12,000 additional deaths from measles.[21] In order to avoid a catastrophic cessation of any health care provision in the Western Area, a novel Ebola Holding Unit (EHU) model was developed.[22]

In the EHU model, the most frequented health care facilities – hospitals and community health centres – all have an associated EHU on site for safe isolation and testing of potential EVD patients. All those seeking health care are screened at the gate using a questionnaire asking about potential EVD contacts and symptoms (Fig. 1). Potential Ebola suspect cases are also referred by district surveillance officers (DSOs) in the community, or from observational interim care centres (OICCs). OICCs care for, and observe, asymptomatic children who have had close contact with an EVD patient and have no other caregiver for the 21-day incubation period of EVD.

Those with a positive contact, or a fever and 3 or more symptoms consistent with EVD (Fig. 1), are admitted as a suspected case to the EHU for EVD testing (Fig. 2). A venous blood sample is sent to specialist laboratories with category 4 facilities where a quantitative polymerase chain reaction (PCR) for Ebola is performed. Depending on the test result, patients are transferred on to an Ebola treatment centre (ETC: these tended to be large specially built and designed units set up and run by NGOs in response to the outbreak), admitted to the general ward if still needing inpatient treatment for a non-EVD condition, or discharged home if recovered. In Freetown, patient movement was coordinated by the Western Area emergency response centre (WAERC), which was in daily contact with each EHU and ETC, community DSOs and the laboratories processing samples for EVD testing.

The principal features of EHUs were that they were rapidly built (with a lead time of as little as 48 h); co-located at existing hospitals and functioned in partnership between an NGO and the Sierra Leonean Ministry of Health.[22] Their primary functions were threefold: isolation of suspected cases to minimize community transmission, maintenance of non-EVD-related healthcare provision, and the creation of an EVD-free environment within the adjoining hospital through gate and ward daily screening combined with immediate on site isolation for protection of healthcare workers and other patients.[23] In our experience, the provision of care across EHUs was heterogeneous, dependent on staffing numbers, skillsets and the space available within the facility. Care varied between a "no needle" policy with provision of oral medications only, to more sophisticated therapy with intraosseous infusions and blood transfusions.

At the peak of the Sierra Leone outbreak in late 2014, there were bottlenecks at each stage of this system. Patients could wait for 48 h to be admitted to an EHU, up to 8 days in an EHU (the mean duration of admission in late November 2014 was 2.3 days) waiting for test results or bed availability in an ETC, and then face long transfer distances to the nearest available ETC bed. During the peak of the outbreak laboratories were not co-located at EHUs and laboratory capacity did not meet demand, so the