Ebola Virus Epidemic in West Africa: Global Health Economic Challenges, Lessons Learned, and Policy Recommendations

Mahmoud Elmahdawy, PharmD1*, Gihan H. Elsisi, MSc, PhD2, Joao Carapinha, PhD, MM-P&DM3, Mohamed Lamorde, PhD4, Abdulrazak Habib, MBBS, MSc, MRCP, FAMS, FRCP, Peter Aggyie-Baffour, PhD5, Redouane Soualmi, MBA6, Samah Ragab, MPA7, Anthony W. Udezi, PhD8, Cyril Usifoh, PhD9

1ISPOR Africa Network, Cairo, Egypt; 2Pharmacoeconomic Unit, Central Administration for Pharmaceutical Affairs, Cairo, Egypt; 3Carapinha & Company, Boston, MA, USA; 4Infectious Diseases Institute, Makerere University College of Health Sciences, Kampala, Uganda; 5Infectious and Tropical Diseases Unit, Bayero University, Kano, Nigeria; 6School of Public Health, College of Health Sciences, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana; 7Boehringer Ingelheim, Ouled Fayet, Algeria; 8MSD, Cairo, Egypt; 9Faculty of Pharmacy, University of Benin, Benin City, Nigeria

A B S T R A C T

The Ebola virus has spread across several Western Africa countries, adding a significant financial burden to their health systems and economies. In this article the experience with Ebola is reviewed, and economic challenges and policy recommendations are discussed to help curb the impact of other diseases in the future. The West African Ebola virus disease epidemic started in resource-constrained settings and caused thousands of fatalities during the last epidemic. Nevertheless, given population mobility, international travel, and an increasingly globalized economy, it has the potential to re-occur and evolve into a global pandemic. Struggling health systems in West African countries hinder the ability to reduce the causes and effects of the Ebola epidemic. The lessons learned include the need for strengthening health systems, mainly primary care systems, expedited access to treatments and vaccines to treat the Ebola virus disease, guidance on safety, efficacy, and regulatory standards for such treatments, and ensuring that research and development efforts are directed toward existing needs. Other lessons include adopting policies that allow for better flow of relief, averting the adverse impact of strong quarantine policy that includes exaggerating the aversion behavior by alarming trade and business partners providing financial support to strengthen growth in the affected fragile economies by the Ebola outbreak. Curbing the impact of future Ebola epidemics, or comparable diseases, requires increased long-term investments in health system strengthening, better collaboration between different international organizations, more funding for research and development efforts aimed at developing vaccines and treatments, and tools to detect, treat, and prevent future epidemics.

Keywords: Ebola, health economic challenges, lessons learned, policy, recommendations.

© 2017 Published by Elsevier Inc. on behalf of International Society for Pharmacoeconomics and Outcomes Research (ISPOR).

Introduction

The Ebola virus disease (EVD) has spread across several West African countries, adding a significant medical and financial burden to their health systems and economies. The virus has the potential to spread, and efforts to halt its progression are challenged by already struggling economies and health care systems. The EVD epidemic started in resource-constrained settings and caused thousands of fatalities. Nevertheless, given population mobility, international travel, and an increasingly globalized economy, the recent EVD epidemic has the potential to re-occur and evolve into a global pandemic [1]. Struggling health systems in West African countries pose a significant challenge to contain future EVD epidemics and to reduce their causes and effects.

Human outbreaks are usually initiated through direct human contact with an infected animal, and subsequent human-human transmission is then triggered by direct contact with bodily fluids of infected patients. During the recent EVD epidemic there were more than 20,000 confirmed, probable, and suspected cases of EVD in Guinea, Liberia and Sierra Leone (Table 1), with at least more than 8,000 deaths (deaths are under-reported) [2]. Keeping track of Ebola in West Africa is particularly challenging, given that so many patients either never visit a health facility or are turned away because of overcrowding. Stigmatization also prevents many patients from coming forward when they experience symptoms [3].

The clinical management of EVD encompasses the identification and isolation of suspected cases, laboratory confirmation of EVD, supportive management of presenting signs and symptoms,
Table 1 – The number of cases per country during the period March 2014–November 2014 [2,4].

<table>
<thead>
<tr>
<th>Country</th>
<th>Cases</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guinea</td>
<td>2164</td>
<td>1327</td>
</tr>
<tr>
<td>Liberia</td>
<td>7635</td>
<td>3145</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>7312</td>
<td>1583</td>
</tr>
<tr>
<td>Nigeria</td>
<td>20</td>
<td>8</td>
</tr>
<tr>
<td>Spain</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>United States</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Senegal</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Mali</td>
<td>8</td>
<td>6</td>
</tr>
</tbody>
</table>

psychosocial support for patients who recover, and safe burial for those who succumb to the disease [4]. We examine the response to the latest EVD outbreak in West Africa, identify direct and indirect treatment costs to treat the patient from a public health system perspective, present key economic challenges and lessons learned, and highlight policy recommendations to further assist an already stretched health system in Africa. There were institutional failures of some international organizations that had grave consequences for global health in Sri Lanka in 2009, Haiti in 2010, South Sudan in 2013, and the multidrug-resistant tuberculosis response in Papua New Guinea at present [5,6]. It is important to reconsider how the global health architecture should be reshaped to allow for greater assurance of global health and to prevent future health crises.

Health Economic Challenges with Treatment Aspects

The clinical management of EVD consists of supportive treatment and includes oral rehydration salts and intravenous fluids for dehydration, potassium, anti-emetics, and parenteral antibiotics for bacterial infections or co-morbidities such as malaria [7–9]. Managing EVD requires a multidisciplinary team including doctors, nurses, hygienists, laboratory technologists, psychologists, and other support staff, many of whom are exposed to EVD through clinical or laboratory handling of patient fluids, blood, vomitus, urine, and stool. Prevention and control elements must be integrated into a system with facilities for barrier nursing and infection and death [10].

In the United States, treatment costs have been reported to be as high as $500,000 per patient treated [8]. These estimates include staff costs, ward isolation costs, and the opportunity costs from emptying other beds in the unit. Ebola treatment units (ETUs) in West Africa are very different in terms of access to resources and health worker staffing per patient. A 92-bed ETU in Sierra Leone was reported to have cost the UK government £2 million. There are no published data on the costs of treatment in the West African countries in which the toll of the outbreak was the greatest. Nevertheless, there are various costs that need to be considered, such as 1) infrastructure costs for establishing ETUs as well as smaller community care centers for isolation and management of patients, 2) ambulance costs for identifying patients within the community and taking them to hospital, 3) costs of training health workers, 4) costs of personal protective equipment, 5) costs of laboratory tests to diagnose EVD as well as other supportive laboratory tests, 6) costs of administering treatments and meals in the ETU, 7) costs of disinfectants and sanitation and the costs of facilities for burials, 8) costs of social, psychological, and economic support that may be required after discharge of the patient, and 9) personnel costs.

Personnel costs are challenging to estimate. ETU teams often comprise a mix of local and international health workers funded by nonprofit organizations, international organizations, and national agencies that use different allowance rates, insurance plans, and compensation scales. A shortage of health workers and the use of occlusive personal protective equipment suits in tropical settings combine to limit the amount of time health workers can interact with an individual patient. In one report, patients may have less than 5 minutes of contact with physicians per day for assessment of needs to establish a care plan [11].

Several factors have a role in the deterioration of the affected countries’ economies, high costs of treatment and virus control measures, loss of productivity of those infected, and behaviors related to concerns about infection that may result in the prevention of labor movement and supply of goods. A study estimated that the future productivity loss due to EVD-related mortality was $156 million, with 27.86% attributable to Guinea, 34.84% to Liberia, and 36.96% to Sierra Leone [12]. A World Bank study analyzed the economic impact of the EVD outbreak in the three worst-affected countries—Guinea, Liberia, and Sierra Leone. The analysis shows that the short-term impact on gross domestic product will reduce growth in Guinea from 4.5% to 2.4%, in Liberia from 5.9% to 2.5%, and in Sierra Leone from 11.3% to 8% [13]. This reduction in growth represents approximately $359 million in 2014 prices [13].

The World Bank analysis also estimated the medium-term impact of EVD—a “low Ebola” scenario that assumed a rapid containment in Guinea, Liberia, and Sierra Leone and a “high Ebola” scenario based on the upper ranges of epidemiological estimates. The low Ebola scenario estimated a medium-term impact on gross domestic product of 1% in Guinea, 4.2% in Liberia, and 1.2% in Sierra Leone, corresponding to $97 million, whereas the high Ebola scenario estimated growth reduction of approximately $809 million in the three countries alone (Table 2) [14]. The outbreak had less significant economic impact in Nigeria and Senegal, which may be related to their stronger health systems and ability to contain EVD or to the ability of larger economies to withstand economic shocks [15].

Lessons Learned

There are five lessons that have been learned from the EBOV outbreak. The first is the critical need to strengthen health systems overall, with a particular focus on low-income countries where infectious diseases spread easily. Weak health systems, health worker shortages, lack of appropriate equipment, limited knowledge and training, and inadequate information-sharing systems facilitated the EVD epidemic. Health systems and regional economies are interdependent, and models suggest significant future risk of mortality at a country level and among neighboring countries [16]. Second, mobilization and capacity strengthening toward control and prevention efforts against EVD should be developed at state, regional, and international levels. In the World Health Organization (WHO) Strategic Action Plan, collaborative mechanisms relating to communication, public relations, social mobilization, field, and cross-border coordination are being strengthened in the affected countries. Similar steps are being extended to countries at risk [17,18]. Such support takes the form of activating and testing preparedness plans, active surveillance, and strengthening laboratory diagnostic capacity, case management, infection prevention, and control capabilities.

Third, international collaboration should be led by several organizations and at different levels to facilitate policy
formulation, humanitarian aid in cash, emergency medical supplies, field teams, and other containment efforts. The international community’s response to EVD was initially slow because of the lack of capacity and expertise to respond to epidemics; nevertheless, experience from Nigeria underscores the importance of coordination and collaboration in successful control efforts. Governance and prioritization of political considerations are the structural barriers that dictate the pace of response. Three main bodies collaborated and implemented EVD containment efforts—the Federal Government of Nigeria, United Nations Children’s Fund, and WHO. The Federal Government of Nigeria set up the National Ebola Emergency Operations Centre that supported two Ebola emergency operations centers in the states of Lagos and Rivers. The United Nations Children’s Fund team led the social mobilization group and the management and coordination group while the WHO team led the epidemiology/surveillance group for the states [17].

The fourth lesson is the need to scale up financial resources mobilization. In the first half of 2014, WHO issued funding appeals that totaled $4.8 million and received $7.0 million from several organizations (African Development Bank, Department for International Development, Societe des Mines de fer de Guinée, and United States Agency for International Development) and several countries (Brazil, Canada, Estonia, Germany, Italy, Japan, South Korea, and the United States). These funds supported WHO’s activities from only March to June 2014 [18,19], and three countries were left with significant funding gaps exacerbated by additional funds needed for regional and global control. There is a need for concerted coordination for scaling up financial resources mobilization.

The fifth lesson is the need for more efficient, prompt, and harmonized implementation aligned with country-level needs to curtail duplications. For example, more investment in countries such as Liberia in medical infrastructure will help prevent future EVD outbreaks and other diseases [20]. Priority should be given to collaborations leveraging relative strengths of countries (e.g., capacity from Nigeria) to complement government interventions in capacity strengthening. Evidence-based approaches should be implemented to prevent further spread, whereas ethical approaches for experimenting with different interventions should be hastened. To this end, more efficient allocation of resources between development partners and country-level agencies is needed, particularly decisions aligned to the long-term requirements of the health system [21].

1. Directing funding is needed for humanitarian efforts estimated at $600 million by the United Nations [22] to finance protective equipment for health teams, salaries, and health system strengthening. Funding is required to contain direct and indirect costs from sickness and mortality in the hardest hit countries and provide financial support to enhance growth in fragile economies affected by the outbreak. All activities by international and local organizations should be reviewed to ensure cost-effective implementation of programs.

2. Adoption of policies communicated by leading international organizations that allow for the free flow of relief and trade in the affected countries is needed. Such policies will avert the adverse impact of a strong quarantine policy that may prevent a state from receiving help or exaggerate the aversion behavior by alarming trade and business partners.

3. Weak health systems not only pose a threat to their citizens, but also have spillover effects on other health care systems and global trading partners [23]. Better policies from prominent governmental organizations are needed to strengthen the epidemiological surveillance systems in developing countries by investing in primary care systems, referral networks, and diagnostic reporting and treatment capacity. These organizations have the credibility to commit experts to mobilize a quick response [24].

4. Policies are needed from regulatory bodies on fast-tracking access to EVD treatment and vaccine options. Such policies will provide guidance on safety, efficacy, quality, regulatory standards, and ethical use of therapies in the research and development pipeline and ensure that these efforts are oriented toward current needs [25].

Conclusions
The EVD poses a challenge to weak health systems in Africa, with significant medical and economic implications. Control of the infectious disease outbreaks requires better collaboration between international organizations, nongovernmental organizations, WHO, and ministries of health across the region to ensure a more efficient response, especially at a time when many countries and organizations are revising their policies regarding the outbreaks. There is a need for clear global leadership, addressing challenges that cross borders, and responding to health crises, such as the Ebola epidemic, that require the mobilization of unique skill sets, capacities, and resources.

Directing funding for humanitarian efforts, adopting policies to combat the negative consequences of strong quarantine policies, strengthening epidemiological surveillance across lower income countries, and encouraging research and development for treatment and vaccine options are key policy areas that need international support. These activities will improve the effectiveness of international organizations, secure global health by preventing future health crises, and lead to a reformed era of global health collaboration. To combat the world’s next global health

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Guinea</td>
<td>$130 million (2.1 pp)</td>
<td>$43 million (1.0 pp)</td>
<td>$142 million (2.3 pp)</td>
</tr>
<tr>
<td>Liberia</td>
<td>$66 million (3.4 pp)</td>
<td>$82 million (4.2 pp)</td>
<td>$228 million (11.7 pp)</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>$163 million (3.3 pp)</td>
<td>$59 million (1.2 pp)</td>
<td>$439 million (8.9 pp)</td>
</tr>
<tr>
<td>Core three countries</td>
<td>$359 million</td>
<td>$97 million</td>
<td>$809 million</td>
</tr>
</tbody>
</table>

pp, percentage points.
emergency, we need forward-thinking investments in research and health system strengthening.

Acknowledgments

We thank Melissa Mugambi, Assistant Professor, Department of Global Health, University of Washington (Seattle, WA), and Miloud Kaddar, Former Senior Adviser, WHO (Geneva, Switzerland), for reviewing the manuscript.

REFERENCES


