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# The Ebola epidemic in Liberia and managing the dead—A future role for Humanitarian Forensic Action?

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ABSTRACT

With some of their economies, communities and health systems weakened by decades of war and poor governance, it was no accident that an epidemic of Ebola virus disease broke out in west Africa. Being spread in part by contact with body fluids of those who had died from the disease, funerary rites and the way dead bodies were managed were important modes of transmission. The Liberian Red Cross, supported by the International Federation of Red Cross and Red Crescent Societies and the International Committee of the Red Cross, undertook the challenging task of managing the dead bodies in Monrovia during the epidemic. The work was undertaken by volunteers, not health care workers, who were trained and equipped for this task. The authors observed their work and were impressed. Valuable lessons were learned for mortuaries generally, and for Humanitarian Forensic Action involving the management of highly infectious human remains.



## 1. Introduction to Liberia

> "The Ebola virus disease outbreak in west Africa affected impoverished post-conflict countries with weak health systems and no experience with Ebola" [1]

It is very difficult for those who have not been exposed to resource constrained contexts to understand the challenges. Table 1 sets some of these out, the comparators being averaged out over the three countries in west Africa and the three high income countries for data from 2012.

A proper appreciation of the epidemic requires some understanding of the context within which it erupted (see Box 1).

## 2. Ebola virus disease (EVD)

Ebola is a member of the Filovirus family and causes a severe, often fatal, illness in humans and non-human primates. The virus is 800–1000 nm long with a lipid envelope and it persists at room temperature. The illness is highly infectious, the virus spreading by direct contact with the body fluids of infected patients, including soiled surfaces, equipment and linen. The virus has been found in the blood, saliva, faeces, breast milk, tears and semen. It is quite easily eliminated with heat, alcohol based cleaners and sodium or calcium based hypochlorite bleaches [3].

Current evidence suggests that the reservoir hosts are probably bats, while other animals and people are incidental hosts [4]. Humans seem to become infected with the virus after handling, or otherwise coming into direct contact with, tissues from infected non-human primates and other species, for example in the wild. It is not thought that Ebola virus can be spread by mosquitos. Once a virus has entered human populations, it can rapidly spread from person to person, especially within families, hospitals, and during funerary rites where contact with the bodily fluids of infected individuals becomes more likely. Before outbreaks are confirmed in areas of weak surveillance, Ebola is often mistaken for malaria or one of a myriad of other infections endemic to the region: typhoid fever, yellow fever, Lassa haemorrhagic fever, varicella, measles, dengue, staphylococcal or streptococcal infection, gram-negative sepsis, toxic shock syndrome, meningococcaemia, leptospirosis or dysentery [5].

The onset of symptoms following infection with the Ebola virus varies, the incubation period being from 2 to 21 days. Infection causes significant immune suppression and a systemic inflammatory response, leading to multi-organ failure and shock. Patients may develop vomiting and diarrhoea; kidney and liver function

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**Table 1**
Population indicators: West Africa (Liberia, Guinea and Sierra Leone) and three high income countries (US, UK and Australia) compared [2].

| Comparator | West Africa | High income countries |
|---|---|---|
| Gross national income per head ($US) | 1110 | 43,270 |
| Malaria: confirmed cases (average/country) | 970,000 | 0 |
| Maternal mortality (per 100,000 live births) | 915 | 10 |
| Neonatal mortality (per 1000 live births) | 30.1 | 3.0 |
| % population living in an urban area (%) | 41 | 84 |
| Fertility rate per female (live births per female) | 4.8 | 1.9 |
| Median age of the population (years) | 18.7 | 37.9 |

**Box 1.** Liberia—some history

The first immigrants were freed North American slaves which gave Liberia its name. They arrived in 1820 in what is now the capital Monrovia named after US President Monroe. In 1847 these settlers declared their independence from the American Colonization Society, which had bought and governed the land. The new Republic, Africa's first, established trade links, and although punctuated by violent disputes with the indigenous population and colonial competitors, its history was largely peaceful until 1980. The country was dominated by the True Whig Party with oppression and exclusion of non-American Liberians from institutions and the economy, especially land, until 12 April 1980. Then, Master Sergeant Samuel Doe seized power, executed President Tolbert, and 133 years of American Liberian political and economic domination was replaced by the Peoples Redemption Council. One closed political system was replaced by another. By the mid 1980's, the standard of living was declining drastically, aggravated by human rights abuses, corruption and ethnic tension. In 1989, Charles Taylor, formerly Doe's procurement officer, challenged him and the country plunged into civil war. This came to be regarded as one of Africa's bloodiest conflicts. Complicated events involving the Economic Community of West African States, the UN, US and the Organization of African Unity (now the African Union) over the next 6-8 years led to Taylor clearly winning elections in 1997. Over 6 years of Taylor's rule, unemployment and illiteracy remained over 75% and infrastructure – electricity, schools, hospitals – remained unavailable. Taylor's political style was reminiscent of his predecessor.
Liberia, Sierra Leone and Guinea squabbled and fought, accusing each other of supporting their rebels. In 2003 the UN Special Court for Sierra Leone indicted Taylor for "bearing the greatest responsibility" for atrocities in Sierra Leone since November 1996. Taylor resigned under great pressure from the US and went into exile in Nigeria. Elections in 2005 resulted in Ellen Johnson-Sirleaf being elected President, Africa's first female head of state. Things in Liberia subsequently were pursuing a generally positive trajectory. Successful elections were held in 2011 with the re-election of President Johnson-Sirleaf. Post electoral violence in Ivory Coast in 2010/11 resulted in 200,000 refugees fleeing to Liberia adding further strain to the country's decimated economy.

may be affected; and some patients may experience bleeding, both internal and external. EVD has a case fatality rate in different outbreaks ranging from 25% to 90% [6].

## 3. A brief history of Ebola, including the 2014/15 outbreak

The disease was first identified in 1976 in two simultaneous outbreaks, one in Nzara in South Sudan (formerly Sudan), and the other in Yambuku, a village in the Democratic Republic of Congo (formerly Zaire) near the Ebola River, from which the disease takes its name. Since then there have been several outbreaks, mainly confined to Equatorial Africa (Table 2).

In west Africa, the disease first appeared in a two year old child in Guinea (as distinct from Guinea Bissau, or Equatorial Guinea) in December 2013 but was misdiagnosed [7]. It was not until March 21, 2014 that Ebola was confirmed with the report of 49 cases in Guinea, and two days later in Liberia. The diagnosis of Ebola was delayed in Sierra Leone until late May [8]. Briefly, it was felt that the threat was easing and in Liberia the outbreak appeared to halt. But it re-emerged in the capital Monrovia in June and within 2–3 weeks it had overwhelmed local capacity to respond.

Guinea, Sierra Leone and Liberia all have weak health systems. There are only 150 doctors for Liberia's 4 million population. The symptoms and signs of Ebola virus disease, particularly in its early stages, are not much different to those of other endemic diseases such as malaria and other conditions listed in the previous section. The point is that early in an epidemic, especially in the absence of a surveillance system, Ebola does not stand out, and the opportunity for early intervention is lost. In contrast, later in the epidemic every acute fever is attributed to Ebola, and all of the non-Ebola conditions are not treated when the health system collapses, as it did in Liberia. Being unprepared, health care workers became infected. Lack of knowledge of the disease was aggravated by lack of basic personal protective equipment (gloves, masks, aprons and goggles). Not surprisingly, many health workers decided to stay at home, not so much because of fear but because of lack of

**Table 2**
Ebola virus disease Outbreaks 2000–2014 [5].

| Year | Place | Infections/deaths[a] |
|---|---|---|
| 2000–2001 | Uganda | 425/224 |
| 2001–2003 | Gabon, Republic of Congo (multiple outbreaks) | 313/264 |
| 2004 | South Sudan | 20/5 |
| 2007 | Republic of Congo | 249/183 |
| 2007 | Uganda | 149/37 |
| 2011 | Uganda | 1/1 |
| 2012 | Uganda | 24/17 |
| 2012 | Republic of Congo | 77/36 |
| 2012 | Uganda | 7/4 |
| 2014 | Republic of Congo | 66/49 |
| 2014/15 | West Africa: Guinea, Sierra Leone and Liberia. | 28,610/11,308 |

[a] The number of infections in each outbreak may be based on different definitions: suspected, probable and/or confirmed cases. Likewise, all deaths may not be laboratory confirmed cases.