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An outbreak of Ebola in Uganda

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Summary An outbreak of Ebola disease was reported from Gulu district, Uganda, on 8 October 2000. The outbreak was characterized by fever and haemorrhagic manifestations, and affected health workers and the general population of Rwot-Obillo, a village 14 km north of Gulu town. Later, the outbreak spread to other parts of the country including Mbarara and Masindi districts. Response measures included surveillance, community mobilization, case and logistics management. Three coordination committees were formed: National Task Force (NTF), a District Task Force (DTF) and an Interministerial Task Force (IMTF). The NTF and DTF were responsible for coordination and follow-up of implementation of activities at the national and district levels, respectively, while the IMTF provided political direction and handled sensitive issues related to stigma, trade, tourism and international relations. The international response was coordinated by the World Health Organization (WHO) under the umbrella organization of the Global Outbreak and Alert Response Network. A WHO/CDC case definition for Ebola was adapted and used to capture four categories of cases, namely, the 'alert', 'suspected', 'probable' and 'confirmed cases'. Guidelines for identification and management of cases were developed and disseminated to all persons responsible for surveillance, case management, contact tracing and Information Education Communication (IEC). For the duration of the epidemic that lasted up to 16 January 2001, a total of 425 cases with 224 deaths were reported countrywide. The case fatality rate was 53%. The attack rate (AR) was highest in women. The average AR for Gulu district was 12.6 cases/10 000 inhabitants when the contacts of all cases were considered and was 4.5 cases/10 000 if limited only to contacts of laboratory confirmed cases. The secondary AR was 2.5% when nearly 5000 contacts were followed up for 21 days. Uganda was finally declared Ebola free on 27 February 2001, 42 days after the last case was reported. The Government's role in coordination of both local and international support was vital. The NTF and the corresponding district committees harmonized implementation of a mutually agreed programme. Community mobilization using community-based resource persons and political organs, such as Members of Parliament was effective in getting information to the public. This was critical in controlling the epidemic. Past experience in epidemic management has shown that in the absence of regular provision of information to the public, there are bound to be deleterious rumours. Consequently rumour was managed by frank and open discussion of the epidemic, providing daily updates, fact sheets and press releases. Information was regularly disseminated to communities through mass media and press conferences. Thus all levels of the community spontaneously demonstrated solidarity and response to public health interventions. Even in areas of relative insecurity, rebel abductions diminished considerably.

keywords Ebola, outbreak, Uganda, surveillance, case management, community mobilization

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Introduction

Background

On 8 October 2000, the Ministry of Health (MOH) received reports from the District Director of Health Services of Gulu District of an outbreak of an unusual and highly fatal disease that was characterized by fever and haemorrhagic manifestations. In response, technical teams were immediately dispatched by the MOH to investigate the outbreak. On October 12 2000, specimens collected from suspected cases were sent to the National Institute of Virology (NIV) in South Africa. Examination of the

specimens confirmed that Ebola Sudan serotype was responsible for the outbreak.

Gulu is one of Uganda's northern districts. It borders Sudan. Its population is approximately 404 000 of a national total population of nearly 22 million. Because of persistent insecurity, approximately 60% of its residents live in camps in 'protected villages'. The district has 23 subcounties. Health services in the district are based on two regional referral hospitals: Gulu and Lacor, which also double as a training schools for nurses. A network of health facilities serve each of the subcounties, but the services at the time of the epidemic had deteriorated greatly because of prolonged insecurity in the area. The District Director of Health Services who is based in Gulu town coordinates the services.

Most of the cases reported on October 8 2000 originated from Rwot-Obillo, a remote village 14 km north of Gulu town. At the time of the reporting, 12 people had died, including a health care worker and two student nurses. Most cases were linked to attendance of burial ceremonies.

Historical outbreaks of Ebola

The disease is caused by the Ebola virus. Three subtypes of this virus are pathogenic to humans: *Ebola Zaire, Ebola Sudan and Ebola Tai forest*. These subtypes have accounted for previous outbreaks. A forth subtype, *Ebola Reston*, caused disease outbreaks in non-human primates in 1989. The Ebola virus was first recognized in 1976 when two parallel epidemics occurred in Zaire near Ebola River and in the Sudan. More than 550 cases with 430 deaths were recorded (Anonymous 1978a,b). In 1995, another epidemic was confirmed in Kikwit, Zaire which infected 315 people, 242 of whom died. In 1994, a single non-fatal case of Ebola occurred in Ivory Coast after post-mortem of a chimpanzee.

Source of Ebola

The source of infection for Ebola outbreak is still unknown. However, there is speculation that unidentified vector or reservoir could be responsible (Swanepoel *et al.* 1996; Leirs *et al.* 1999; Reiter *et al.* 1999; Formenty *et al.* 1999). Several probable reservoirs have been proposed to be responsible for the propagation of the outbreak. For example, non-human primates are susceptible to Ebola infection and disease. Rodents are also known reservoirs for common viruses. Several small mammals such as the shrew have been in contact with Ebola virus; its nucleic acid has been detected in some of their organs, which suggests that they may act as intermediate hosts (Gonzalez *et al.* 2000; Morvan *et al.* 2000). Although arthropods are vectors to several viruses including yellow fever, they have not been shown to harbour Ebola virus (Reiter *et al.* 1999). Studies (Swanepoel *et al.* 1996) have shown that Ebola virus can replicate in bats without causing the disease. In 1999, 400 bats were tested in Zaire and found free of infection (Breman *et al.* 1999). Although plant viruses have been proposed to be responsible for maintaining the virus, the hypothesis has not been confirmed (Swanepoel *et al.* 1996).

The role of humans during an outbreak is well known. Body fluids from Ebola patients are vehicles for the spread of further infection. However, the role of humans as reservoir is yet to be substantiated. All large outbreaks so far are limited to sub-Saharan Africa, where the virus periodically emerges from an unknown reservoir.

Response strategies

Due to the many players that were involved in the outbreak, the MOH immediately constituted a National Task Force (NTF) to coordinate the national response. International efforts to contain the epidemic were coordinated by World Health Organization (WHO) under the Global Outbreak Alert and Response Network. Response strategies consisted of active surveillance and contact tracing, public education and community mobilization, isolation of cases, infection control through universal precaution and safe burial of the dead using properly trained burial teams. Laboratory confirmation was by on-site field laboratory set up by the CDC team.

Coordination

The government assumed overall responsibility for coordinating expertise, manpower, supplies, funding and communication, which streamlined all support to the programme. Coordination of the national response to the epidemic was achieved through three task forces, namely, the Interministerial Task Force (IMTF) (Anonymous 1978a), NTF and the District Task Force (DTF), each with specific roles.

The NTF was set up in the MOH and consisted of a multisectoral team of technical experts from health, local government, the Prime Minister's Office, security agencies, donor agencies and non-governmental organizations (NGOs) with experience in grassroot mobilization and provision of public health information and education.

A corresponding DTF was formed in each district of Uganda. This committee was responsible for coordination and implementation of tasks and the response at the

district level. The largest scope of activities was concentrated in Gulu district. However, a similar programme was conducted in all 56 districts. To oversee the national response to the Ebola outbreak, a high level IMTF was formed.

The IMTF consisted of the Minister of State Office of the Prime Minister (Chairman), Minister of Health, Minister of Information, Minister of State for Defence, Minister of State for Internal Affairs, Minister of State for Foreign Affairs, Minister of State for Tourism and Minister of State for Trade, and provided policy direction.

Efforts from the international community were coordinated and harmonized by the NTF assisted by the WHO. Donors were requested to contribute towards a mutually agreed strategy and work plan. The contributions were in various forms such as financial assistance, provision of logistics and supplies, technical assistance and advocacy.

Technical expertise was received from many organizations, which included the WHO, Centers for Disease Control, Atlanta, Georgia, Médecins Sans Frontières, Public Health Laboratory Services (London), International Committee of the Red Cross and Istituto Superiore di Sanità (Rome). The South Africa Institute of Virus Research provided tertiary laboratory support. The international team worked with the local teams right from the time the outbreak was confirmed. Materials, supplies and financial support were sent regularly to the affected districts every week.

Surveillance and community mobilization

Programmes for public education were made at national and district levels. Various channels were used to disseminate information to the public, including person-to-person communication, print and electronic media such as the 20 FM radio stations whose national coverage is more than 60% of the population. Communities were mobilized by political leaders at all levels including local councillors, volunteers and mobile teams. The volunteers and mobile teams in particular helped in the safe referral of suspected cases.

At district level training was given to all health care workers and selected village volunteers to enable them provide door-to-door information to households at community level. Two scouts from each village of the 23 subcounties were recruited for an active case search, contact tracing and surveillance. The scouts reported daily to the mobile teams, who in turn reported to the DTFs through the technical committees.

Case definition algorithms were provided to all health care workers and volunteers. Case definitions were adapted from the WHO/CDC guidelines and included four categories of cases, namely, the 'alert', 'suspected', 'probable' and 'confirmed cases'(Oyok *et al.* 2001; Anonymous 2001).

Timely dissemination of appropriate information was crucial. Speedy communication mechanisms were instituted from village to district to the centre through radio communication and mobile phones. Motorized and foot patrols at the community level urgently disseminated information. Dissemination and management of information was centralized and announced daily to the media by the NTF through interviews, update reports, fact sheets and press releases. At lower levels, people were mandated to convey information through the media to the public. This was a significant action, which reduced rumour mongering drastically and helped to instil confidence in the public.

Case management

Ebola infection is principally transmitted by close contact with body fluids from Ebola cases. Therefore a system for isolation and barrier nursing, contact tracing and safe burial of the deceased was established to minimize further spreading of the infection.

Isolation wards were established in all districts that reported suspected or confirmed cases. In Gulu District, two isolation wards were created, equipped and manned by selected trained volunteer staff from Lacor and Gulu hospitals for barrier nursing and management of cases. All suspected cases from all health units were referred to and transferred to these isolation units for assessment and possible isolation. Special ambulances, properly equipped with trained staff and drivers, were provided. In all health units we reduced to a minimum invasive medical interventions such as surgery and blood transfusion. Protective supplies were provided to all units to ensure universal infection control. Security agencies handling suspected cases were also trained and given essential supplies.

The availability of a temporary field laboratory at Gulu helped with confirmation of cases within 24 h. The laboratory was able to detect immunoglobulin G (IgG) Ebola antibodies, elevated liver enzymes, antigenaemia, and Ebola genome using reverse transcription–polymerase chain reaction (RT–PCR). This facilitated the early isolation of non-cases from true cases and thus reduced the risks for nosocomial infection. It also helped to identify patients who had become non-infectious and those correctly eligible for discharge.

Burial teams were established for safe burial of the dead in a designated cemetery created for this purpose. This was

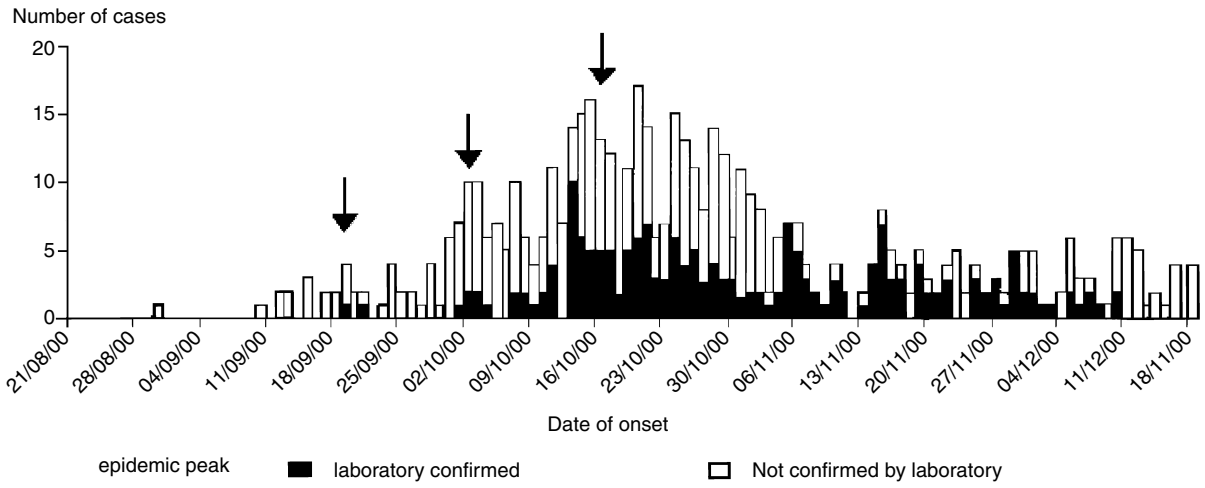

Figure 1 Number of Ebola cases per day according to their laboratory confirmation, Uganda, August–December 2000.

Table 1 Summary of cases and deaths by district

	Cumulative totals			
District	Cases	Deaths	Survivors	Remarks
Gulu	393	203	190	The last confirmed case occurred on 14 January 2001. This was the grandmother to the 5-month-old baby who died of Ebola on 4 January 2001
Mbarara	5	4	1	Mbarara district had been declared Ebola-free earlier
Masindi	27	17	10	The last death was on 21 December 2000. No cases were admitted after this
Other parts of the country	0	0	0	Of 56 districts only Gulu, Mbarara and Masindi have confirmed cases of Ebola
Country total	425	224	201	Overall case fatality rate was 53%

necessary to avoid hazardous traditional practices such as cleansing the bodies of the deceased.

Results and discussion

Case description

The commonest symptom in this outbreak was fever, which occurred in 85% of cases. This was accompanied by severe headache, weakness and muscle aches. Diarrhoea and inflammation of the mucous membranes, especially of the eye, followed. Bleeding from body orifices was less frequent and occurred in only 30% of cases. It was associated with high mortality. The onset of symptoms was sudden and the disease rapidly progressed to multiple organ failure within a week. The incubation period was less than 2 weeks for the majority of cases with a mean of 12 days and range of 2–21 days. Neurological disturbances and deterioration of liver and kidney functions were swift. Deaths were mainly caused by dehydration and massive organ failure and often occurred within 10 days of onset of symptoms.

Of the 425 cases 195 were laboratory-confirmed. There were a few asymptomatic cases positive for IgG antibody. The sensitivity of the tests was not exactly known, as there were some false positives and negatives. Only 56.5% of cases had contact with primary cases, which raises concern over the possibility of indirect contact for the remaining cases. This area requires further research.

Most cases (393; 93%) were from Gulu district, 27 (6%) from Masindi, and five (1%) from Mbarara district (Table 1). Twice as many women (63%) as men (37%) were affected. Thirty-one medical workers were infected, of whom 17 died. The median age of cases was 27 years (range 3 months to 81 years). Children under five constituted 14.6% of cases. The mean period between onset of

symptoms and recovery was 12 days (range 2–35 days), the median 13 days (Figure 1). The mean length of admission among hospitalized cases who recovered was 10 days (range 1–29 days). Convalescence among survivors was slow and took several weeks. It was associated with several residual problems such as weight loss, dehydration, difficulty in hearing, mental disturbances and general weakness.

Attack rate

The Attack rate (AR) among nearly 5000 contacts was 12.6 cases/10 000 inhabitants for suspected, probable and confirmed cases. The lowest AR occurred in children 5–14 years of age, the highest among women 40–45 and 60–61 years of age. We identified approximately 1000 contacts of laboratory-confirmed cases of whom 24 developed Ebola, thereby corresponding to a secondary AR of 2.5%.

Time trends

Although the earliest presumed case is suspected to have occurred at end of August 2000, the first confirmed case was reported on 8 October 2001. The last case was reported on 9 January 2001. Uganda was declared Ebola free on 27 February 2001, which was 42 days after the last reported case. The epidemic curve showed three epidemic successive peaks, separated by 13 days, which may correspond to the incubation period. The graph below shows evolution of the epidemic during the period August 2000 to January 2001.

Lessons learnt

A number of strategies were used to control this epidemic (Oyok *et al.* 2001; Anonymous xxxx). The backbone of the response was a strong national multisectoral mobilization, which provided essential coordination and mobilized resources. Implementation relied heavily on a decentralized but harmonized system at community level. The major interventions were epidemiological surveillance, case management, and infection control, public information and effective communication.

Leadership and commitment from government

The government from the very beginning assumed full leadership to coordinate international and national efforts. This measure coordinated and harmonized all inputs into the programme including expertise, supplies, funding and essential communication and information. Against all odds – a surprise attack from Ebola, compounded by inadequacies and insecurity in the area – both national and international response were mounted within a week of suspicious reports. Government commitment mobilized the essential critical additional resources locally and from abroad. It was not business as usual; special task forces were assembled at all levels. The NTF took the lead in coordination and harmonization of international, national and local inputs and efforts into the campaign to control Ebola. A special appeal was made for a jointly agreed work plan for specific support in various areas. This immediately generated essential funding, expertise and supplies. Local partners, NGOs and the private business community showed spontaneous generosity and support.

Community-based disease surveillance

The community members and their enthusiasm were a big resource. Non-medical workers were extensively used in a network of surveillance and public information. Suspected cases were rapidly assessed using the simplest tools available – namely, history of contact and or clinical assessment. A community-based surveillance system used a network of hastily trained community members to identify any suspected cases with their contacts. Meticulous reporting of cases from households, villages and communities was streamlined into the DTF and NTF. Thus, while money was important, organized community effort contributed significantly to containment measures. Community-based surveillance plays an important role in disease control and prevention in many developing countries and should be encouraged and strengthened.

Research and laboratory reference centres

Laboratory testing provided special problems as there was no tertiary unit established in the country. A field laboratory provided on the spot screening. The equipment was appropriate and avoided the risk of transferring infection to tertiary laboratories inland. Regional and subregional reference laboratories should be established to provide quality and timely screening and supervision. The South African Institute of Virus Research was a reference laboratory for us. Further research work is required to develop more universally available and appropriate tools for simpler screening. Future long-term surveillance programmes in tropical Africa would then be greatly facilitated.

Operational social research identified cultural aspects which contributed to escalation of the infection. Harmful practices of cleansing the dead and the key role of women in providing care in communities were significant factors. Gender-sensitive messages and programmes were therefore designed to respond to this observation.

Infection control and hospital waste management

Inadequacies in emergency preparedness for similar complex and unexpected diseases were noted at various levels of health care system. The districts had working committees and mechanisms to cope with routine diseases, but required additional supplies and logistics for these new challenges. Information on rare diseases was scanty at district level, and guidelines are required at all levels. Poor attention to infection control was a common observation in many rural health units. Proper management of hospital waste should equally be taken more seriously than before. The outbreak prompted a programme to promote infection control in hospital and health facility settings. This should remind health workers of the potential hazards in their working environment.

Some non-medical supporting staff were equally affected, which indicates that awareness and education should be extended to include them, especially drivers. Transportation and referral of cases presented special risks because the available guidelines were intended for medical workers. In particular, minimum specifications for ambulances and guidelines for their use should be established to guarantee safety.

The principle of isolation of cases proved useful but sometimes gave false confidence to health workers. It was not unusual to detect occasional new cases in the general wards. Therefore, risk assessment and intensive sensitization about the risks are vital to all.

Expanding partnerships with communities

Important alliances were built within the community to contain the disease. There were opportunities for volunteerism and expanded partnerships with NGOs and other community-based resource persons and communities. In Gulu district, for instance, various community organizations played a critical role in social mobilization. Many, including the Uganda Red Cross and World Vision, participated fully in case detection, information dissemination, data collection, care and burial. Within the country, the outbreak led to solidarity at all levels. Even the antigovernment rebels who had been fighting government suspended their activities and supported the interventions.

Forging links and working with the media for public information

Public information on this high profile epidemic was carefully managed. Factual updates through daily and regular press briefings were disseminated internationally and extensively through local mass media in absolute openness. Media personnel were trained early on Ebola and barrier nursing. This enabled them to avoid risky situations, and they curbed panic as a result of their knowledge about the disease. This assisted in the positive management of rumour. Good communication was established with communities quite early, facilitating community participation in education, case detection, timely reporting of suspected cases and risk assessment. By forging links with the media and working with them, members of the media became one of the great forces behind positive mobilization.

The need for international guidelines to reduce discrimination

Ugandans encountered discrimination at all levels – at local, district and international levels. At one time neighbouring districts had almost closed borders with the affected districts. Several countries imposed unnecessary trade and travel restrictions to Uganda and Ugandan goods. The excessive measures taken may have been a result of many concerns including fear and prejudice.

Ebola is a relatively new disease not adequately covered by the standard International Health Regulations. The WHO should therefore reach consensus on policies on how to deal with such emergencies to enable member states to adopt rational national policies in anticipation of future similar disasters. In our experience, the IMTF assisted in the managing and defusing such sensitive interdistrict and intercommunity stigma in the interim.

Rationalizing the legal, ethical and social issues

Several legal and ethical issues emerged during the epidemic. For instance, individual confidentiality was breached by promoting shared confidentiality in the community. Information about affected individuals was shared freely with relatives and the community in view of the highly fatal nature of the disease and the possibility of sexual transmission. The government recognized the occupational hazards associated with patient care and enacted a rational Workman's Compensation Act, which entitles those involved or their dependents to compensation. This is an important direction for many developing countries who may not yet have updated their legislation.

The social consequences of this epidemic were far-reaching. Burial in cemeteries away from one's home was against tradition and only accepted after extensive counselling. Difficulties in sexual relationships after recovery were problematic. Nearly 500 children lost their parents. Both orphans and survivors needed counselling plus

material, medical and financial support. To address these issues, a post-Ebola association was formed and a special clinic to investigate and provide service to survivors opened. The Gulu Ebola Association of Survivors was formed to follow-up their special needs. This cohort of survivors is being followed and could in future provide answers to treatment, care, vaccines and important social parameters.

International resources and collaboration

The government promptly mobilized the nation and the international community. The primary response of the international community, led by the WHO, was commendable. WHO support was critical. Technical expertise was available within a week from many countries through bilateral and international partners, each with a highly specialized and unique contribution. WHO could maintain an inventory of all experts (old and new) at national, regional and subregional levels. Indeed an inventory of local and regional experts should be made and circulated. Another important lesson is that subregional stocks should be maintained. Continuing medical education in this area should be a priority for all health care workers.

Adequate and immediate funding from international and bilateral partners arrived within days to support intervention measures. This immediate and selfless generosity and support from the international community should be commended, emulated and institutionalized in future.

Conclusion

This was one of the largest Ebola epidemics reported so far. Leadership from the government of Uganda with support from the Global Outbreak Alert and Response Network contained the disaster much more quickly than in previous epidemics. Cases were clustered and many of the victims were women, a manifestation of risky cultural and traditional practices.

Programmes for increased surveillance and appropriate research are continuing both locally and at international level. At community level the infrastructure already put in place for community mobilization is now serving as an entry point for other public health programmes such as malaria, sanitation and immunization.

The origin of the epidemic remains unknown. Further research is needed to throw more light on the knowledge of reservoirs and natural history of the disease and future prospects for control of the disease. Future studies could also explore the potential for vaccine development and evaluation. There is thus a need to establish a functional international agenda to promote timely global response and alliance to contain new emerging infections. Technical cooperation should be strengthened to ensure early detection and control of future potential outbreaks.

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