Containing Hemorrhagic Fever Epidemic, The Ebola Experience in Uganda (October 2000 – January 2001)

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Abstract

The Ebola virus, belonging to the family of Filoviruses was first recognized in 1976 when it caused concurrent outbreaks in Yambuku in the Demcratic Republic of Congo (DRC), and in the town of Nzara in Sudan. Both countries share borders with Uganda.

A total of 425 cases and 224 deaths attributed to Ebola haemorrhagic Fever (EHF) were recorded in Uganda in 2000/01. Although there was a delayed detection from the community level, prompt and efficient outbreak investigation led to the confirmation of the causative agent on October 14th 2000 by the National Institute of Virology in South Africa, and the subsequent institution of control interventions.

Public health interventions to contain the epidemic aimed at minimizing transmission in the health care setting and in the community, reducing the case fatality due to the epidemic, strengthening coordination for the response and building capacity for on-going surveillance and control. Coordination of the Control interventions was through the Interministerial Committee, National Ebola Task Force, District Ebola Task Forces, and the Technical Committees at national and district levels. World Health Organization under the Global Outbreak Alert and response Network coordinated international response. The post outbreak control interventions addressed weakness prior to outbreak detection and aimed at improving preparedness for future outbreak detection and response.

Challenges to control efforts included in-adequate and poor quality of protective materials, especially at the beginning of the outbreak, nosocomial transmission of EHF. The quality of protective materials especially masks and goggles, in future outbreaks, needs to be taken into consideration. Other challenges to the outbreak control included deaths of health workers, numerous rumors and rejection of the convalescent cases by community members.

This was the first recognized and the largest reported outbreak of EHF in the world ever. Control interventions were very successful in containing the epidemic. The community structures used to contain the epidemic have continued to perform well after containment of the outbreak and have proved useful in the identification of other outbreaks as well. This was also the first outbreak response coordinated by the WHO under the Global Outbreak Alert and Response Network, a voluntary organization recently created to coordinate technical and financial resources to developing countries during outbreaks.

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Introduction

Ebola, which belongs to the Family of Filoviruses, is a severe acute viral illness, characterized by acute onset of fever, malaise, myalgia, headache, and pharyngitis followed by vomiting, diarrhea, maculopapular rash, limited renal and hepatic involvement and hemorrhagic diathesis. Incubation period ranges between 2 – 21 days. The case fatality rate (CFR) varies from 50 – 90%[1,6,8,11].

Diagnosis is by ELISA for specific IgG antibody (presence of IgM antibody indicates recent infection); by ELISA antigen detection in blood, serum or organ homogenates or by PCR. Postmortem diagnosis is through immunohistochemical examination of formalin –fixed skin biopsy specimens[1].

Person to person transmission occurs by direct contact with infected body fluids such as blood, sweat, saliva, semen, vaginal fluids, urine, sputum or through direct inoculation by contaminated instruments such as needles, pins, razors blades[13,14] etc. Nosocomial transmission through contaminated needles and syringes has been documented[1,11].

The Ebola virus was first recognized in 1976 when it caused massive concurrent outbreaks in Yambuku in the Democratic Republic of Congo (DRC), former Zaire and in the town of Nzara in Sudan[3,4,7]. Both the two countries border Uganda, with Sudan in the northern part and DRC to the west (Fig 1).

In the *Filiviridae* virus genus, Marburg virus was initially identified in 1967[6,10]. To date 4 distinct sub-types of the Ebola virus which derives it's name from the river Ebola in DRC, and are pathogenic to man have been isolated; namely *Ebola-Zaire*, *Ebola – Sudan*, and *Ebola –Cote d'Ivore*. A fourth strain, *Ebola – Reston*, identified in the USA, affects only primates[12]

Uganda, which experienced an outbreak of Ebola Haemorrhagic Fever (EHF) in 2000 to 2001, comprises of 56 administrative districts, which includes Gulu, Mbarara and Masindi Districts as well (fig.1). Each district is further sub-divided into counties, sub-counties and parishes. A village, manned by a local council one leader (LCI)[20], is the smallest administrative unit. A total of 425 presumptive* cases with 224 deaths attributed to EHF were registered in three of the 56 districts of Uganda[2,18].

This paper outlines the outbreak detection and subsequent organization and implementation of the control interventions, highlighting some of the issues missed out in previous publications.

* Presumptive cases include both the laboratory confirmed cases and those that met the clinical case definition of EHF and are epidemiologically linked to cases.

Outbreak detection and verification

On October 8th, 2000, the Acting District Director of Health Services (Ag. DDHS), Gulu District received two concurrent reports concerning an unusual illness and deaths in the community and at Lacor Hospital, a non-governmental hospital. The report, originating from the community attributed the illness and death to a poisoning at a funeral in a remote village, Rwot Obilo, in the far north of Gulu. The second report concurrently conveyed to both the Ag. DDHS and to the Ministry of Health (MoH), came from the Medical Superintendent (MS) of Lacor Hospital. He reported a clustering of cases and deaths, which included two dead student nurses and three critically ill. Most of these cases in the hospital reported history of deaths with similar manifestations in their households. He suspected a possible outbreak of Viral Haemorrahgic Fever (VHF).

On October 9th, a team was dispatched from MoH to support the district team in outbreak investigation and confirmation. The team reviewed clinical notes of patients, examined patients still admitted, and collected clinical specimens from 8 suspicious cases and 7 contacts for confirmation. Investigations in the surrounding villages revealed many other cases and deaths in the community.

Table 1: Symptoms and Signs of Cases Reviewed and Examined During Preliminary Investigation (N = 17)

SYMPTOMS / SIGNS	**NUMBER = (N) N = 17**	**PERCENTAGE** (%)
Acute Fever (>38^{o})	16	94.1
Generalized weakness	15	88.2
Joint pains	15	88.2
Vomiting	13	76.5
Severe headache	13	76.5
Muscle pain /myalgia	6	35.3
Difficult breathing	9	52.9
Loss of appetite	11	64.7
Difficult swallowing	3	17.6
Fatique	10	58.8
Diarrhoea	10	58.8
Haematemesis	7	41.2
Diarhoea with blood	9	52.9
Reduced urine output	9	52.9
Chest pains and coughs	12	70.6
Bleeding tendencies (eyes, mouth, ear, vagina)	7	41.2
Terminal shock	9	52.9
Maculopapular skin rash	1	5.9

Of these 17 cases, eleven had died (CFR = 64.7%) and 6 were still admitted. Each of the patients had a history of having attended a burial in the previous few days before onset of

fever. Some of the patients had lost one or more family members with similar symptoms, within a short duration. Investigations by the local laboratory indicated a three times increase in the level of transaminase (SGOT). The team suspected Marburg or Ebola.

On October 12th, the clinical samples from cases and contacts were forwarded through the WHO Country Office to a WHO collaborating laboratory in South Africa, the National Institute of Virology (NIV).

Based on the recommendation of the team, an isolation unit was set up at Lacor Hospital on October 10th, 2000. Protective materials for Barrier nursing was mobilized on October 12th, 2000. The team also recommended alerting the public about the risk of infection especially during funerals, safe disposal of bodies, providing information and training on VHF to the affected area, provision of a technical back up team from the center to assist the health staff in the district, and mobilization of more supplies and logistics for barrier nursing. A rudimentary active surveillance to identify suspects and their location was initiated. The initial cases and contacts were line listed on a form.

On October 11th, a team comprising of senior MOH staffs and the WHO country office, re-verified the existence and assessed the magnitude of the epidemic, helped the district set up a District Task Force for coordination purposes and prepared a preliminary district budget for the response.

The National Ebola Task Force (NETF) was constituted on October 12th 2000, to coordinate and mobilize resources for the outbreak. Following the confirmation of the outbreak to be due to *Ebola Sudan* virus on October 14th by NIV, an "Alert" was sent to all districts of Uganda for epidemic preparedness and response. Ministry of Health appealed for International Response and requested WHO to coordinate the internationals.

Description of Outbreak Response

Community response prior to outbreak detection

Barry S Hewlett (unpublished report) documented the local community response to the outbreak using the explanatory models of EHF among the Acholi's* (annex 1). He outlines how the local community first perceived the disease as a normal illness and sought for modern medical care. As the outbreak progressed and became more complex, the communities sought for treatment from both modern and traditional healers. As soon as the epidemic was confirmed to be due to Ebola, the community responded to the public health interventions and the advice of the health personnel[5].

Formal / Organized Public Health Interventions

Public Health interventions to control the epidemic were broadly categorized into;

a) Outbreak Control Interventions

* The Acholis are Nilotics and is the dominant tribe in Gulu District.

b) Post Outbreak Control Public Health Interventions

Outbreak Control Interventions

The outbreak control interventions aimed at minimizing transmission in the health care setting and in the community, reducing the case fatality due to the epidemic, strengthening coordination for the response and building capacity for on-going surveillance and control. The interventions comprised of; a) social mobilization, health education and training, b) case management, c) laboratory confirmation, d) active surveillance, e) resource /logistics mobilization and f) improved communication

Community Mobilization, Health Education and Training

Community mobilization was initiated as soon as the outbreak was confirmed on October 14th, 2000. "Alerts" were sent to all districts for epidemic preparedness and response. Ten DDHS's of districts surrounding Gulu District (Figure 1) were invited to Gulu for a one-day orientation on Ebola. Different cadres of professionals and community resource persons were trained on how to identify and control Ebola. Spots on Ebola coupled with live radio discussions were on all radio stations daily. There were aggressive film shows of documentaries of previous outbreaks to local communities and in institutions in the affected districts. Different posters and guidelines on Ebola were widely circulated to all districts. Awareness on the outbreak and control measures was enhanced through local drama and music groups, which were used to convey educational messages to the public. Community dynamics such as greetings through hand shake; large gatherings like "discos" and at funerals were temporarily halted in districts affected by the outbreak. Traditional healers were banned from practicing and burial rituals were also stopped.

Case Management

Enhanced case management was initiated on October 10th, with the creation of an isolation unit at Lacor Hospital. Subsequent isolation units were established at Gulu Regional Referral Hospital, Masindi and Mbarara Hospitals were cases were confirmed, and in all the districts that reported alert cases. Alerts were reported in eight other districts, which include Arua, Kampala, Kamuli, Jinja, Nebbi, Kitgum, Apac and Rakai (Fig 1).

Efforts in case management aimed at reducing case fatality and minimizing nosocomial transmission, provision of supportive care, training and supervision of health workers on clinical evaluation and appropriate case management, infection control and barrier nursing practices. Health workers and those at risk of infection (burial and skin biopsy teams, care takers) were provided with protective materials (masks, gloves, plastic aprons, gum boots and head wear).

Health workers were trained on counseling and given guidelines for proper discharge of patients as discharge and management of the convalescent patients became critical in the management of the epidemic.

Safe burial practices included identification and provision of a burial ground in districts where cases were identified, instituting trained burial teams and developing a guideline for burial. Burial team in Gulu District comprised of volunteers from the army (8), police (6), staffs of Lacor Hospitals (12) and DDHS staffs /community volunteers (8). Because there were no volunteers for burial in Masindi District, some of the trained burial team members in Gulu had to conduct burial in Masindi District as well. Ebola corpses were safely transported from the isolation units in body bags to the burial ground for burial. To avoid further spread of infection through transporting the dead bodies over long distance, suspicious community deaths were buried in the community by the trained burial team.

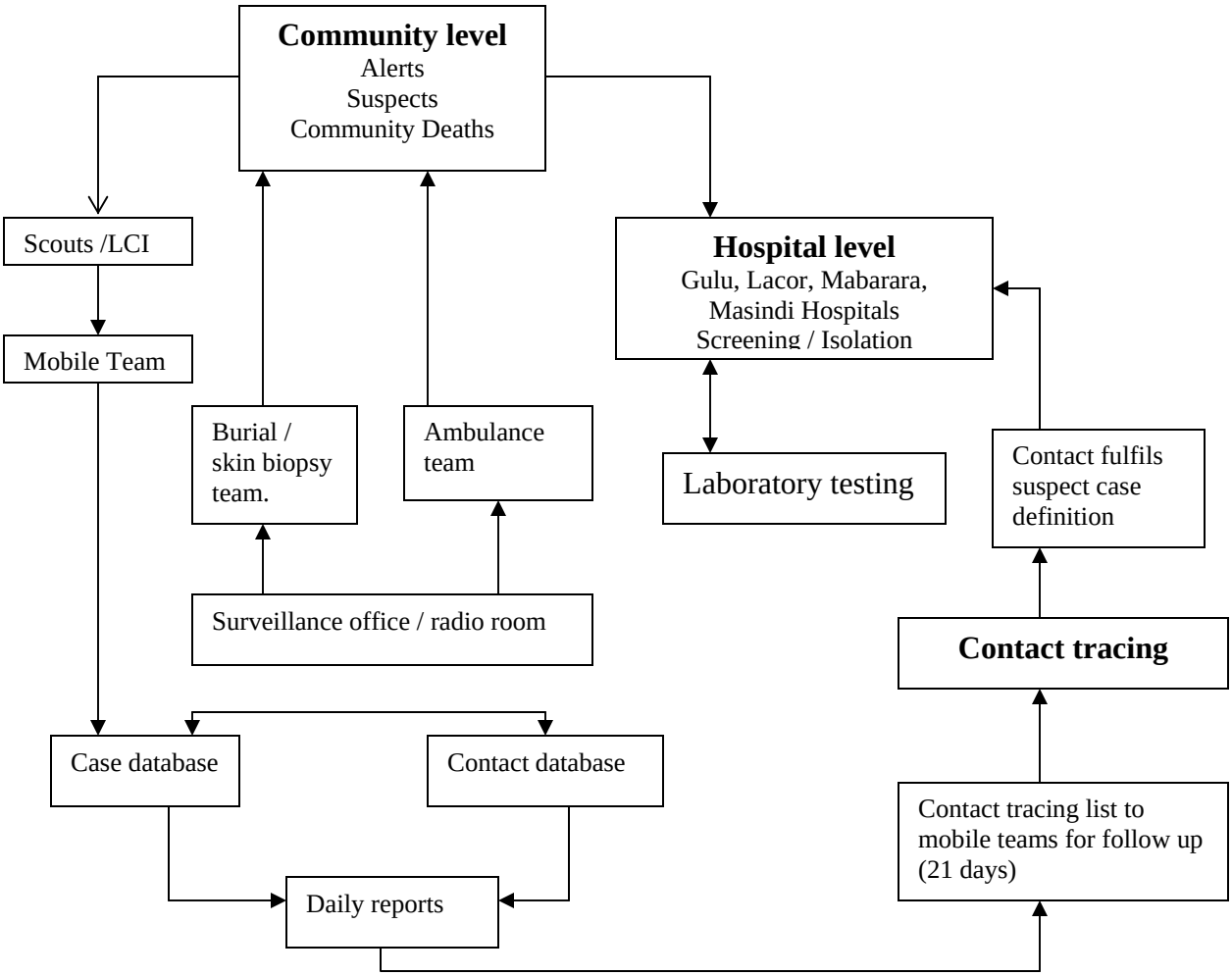
Laboratory screening

A temporary field-screening laboratory was set up at Lacor Hospital by the CDC team on October 21st, 2000. The aim was to provide on-site laboratory screening and confirmation of clinical and suspicious cases. Blood samples from alerts, suspects and probable cases reported from different parts of the country, (Gulu, Lira, Masindi, Mbarara, Nebbi, Jinja, Apac, Kitgum, Rakai and Kampala) were screened by this laboratory and cases where only confirmed in the three disricts of Gulu, Masindi, and Mbarara (Figure1). Four different tests were performed on each sample and they included IgG and IgM antibody tests and ELISA and PCR antigen detection tests. Serial testing was done on a number of cases and samples had to be submitted with clinical notes for ease of interpretation of test results. Test results were made available within 24 hours and were used to guide public health decisions and actions.

Surveillance and Epidemiology

Two surveillance systems (community and hospital based surveillance) complimented by laboratory screening were established. The objective of the surveillance was to contain further spread through enhancement of early case detection, timely commencement of case management, and the identification and monitoring of contacts of suspected and confirmed cases. The flow chart in Figure 2 below illustrates the surveillance activities.

Figure 2: Epidemiology and Surveillance Flow Chart



Four categories of the surveillance case definition adapted from the WHO/CDC manual were used and included the "Alert", "Suspect", "Probable" and "Laboratory confirmed" case[2,18].

At community level (village), a community leader (LCI) and a scout were identified and trained to identify cases and refer them using the "Alert" case definition. Mobile team members, comprised of different categories of personnel (Figure 3) verified the Alert cases using the "suspect" case definition. The mobile teams notified the ambulance team in case of a suspected case or the burial team in case of community deaths through established radio communication systems. The ambulance teams transported the suspects to the isolation units for further evaluation and screening. Burial teams buried the dead in the community after taking skin snips and /or performing a cardiac puncture for laboratory confirmation.

At each level of evaluation, Case report forms were filled on the cases, which were then categorized accordingly as "Alert", "Suspect", "Probable" or "Confirmed" Cases (Annex 2). All the contacts at community and isolation units were also registered. Information

from the case reports and contact recording sheets were entered into a case and contact EPIINFO-6 databases respectively. From the contact database, a daily lists of contacts for follow up by mobile teams was generated. Contacts were monitored for suspicious symptoms and signs for at least 21 days (the maximum incubation period for EHF).

In Gulu, security clearance to rebel infested areas had to be obtained from army personnel. Army escorts, on Armoured Personnel Carrier ACP) often escorted the surveillance teams to insecure areas.

The outbreak lasted for about four and half months[2,18], during which a total of 425 presumptive and confirmed cases of Ebola with 224 deaths were recorded (Table 2). The epidemic was declared over on February 27th, 2001, two incubation periods after the last case sero-converted and became negative.

Table 2: Summary of Ebola cases and Contacts in Uganda by District

Affected Districts	Cases Detected	Laboratory confirmed cases	Contacts identified	Deaths	CFR
Gulu	393	188	5608	203*	51.7
Mbarara	5	4	56	4	80
Masindi	27	24	157	17	63
Total	**425**	**216**	**5821**	**224**	**52.7**

***** Some of the cases/deaths were identified retrospectively and are epi -linked.

Post outbreak interventions

Interventions after the outbreak was contained were focused in Gulu District that had the bulk of the outbreak. The interventions were many and varied and comprised of; a) Infrastructure development and Improvement in laboratory c) Infection control measures and d) Enhancement of surveillance for early warning e) revitalization of registration of births and deaths. These interventions aimed at improving preparedness for future outbreak detection and response.

Infrastructure development and laboratory improvement

In Gulu Hospital, the original three laboratories scattered in the three different buildings were replaced by a new purposeful laboratory structure for hematology, clinical biochemistry and microbiology. The initial medical ward was renovated and re-designed. One wing was rehabilitated to have 2 isolation / Infectious disease wards, plus a store and a changing room. The other wing remained a medical and an emergency admission ward.

The Infrastructure at Lacor Hospital changed in several aspects after containment of the outbreak. The original Ebola isolation unit was renovated into a pediatric ward. A new purpose built 28-beded rooms and one single room isolation unit was put up. The medical ward was extended to allow more space per patient. Although there was no

significant change in the laboratory aspects, the originally suspended laboratory activities during the Ebola outbreak returned to normal a few months after containment.

Infection Control Measures

A standard procedure for infection control was adopted and staffs received regular reinforcement of infection control procedures and concepts.

Enhancement of surveillance for early warning and registration of vital statistics

As recommended by WHO, surveillance activities for EHF was scaled down and integrated into the routine surveillance activities after the outbreak was declared over. The objectives of the surveillance for early warning is to enhance prompt detection of VHF and other epidemic prone / notifiable diseases in order to institute appropriate and timely response.

Efforts were geared towards addressing the weaknesses in the routine surveillance system. Districts were supported to develop work plans for Surveillance, Epidemic Preparedness and Response (EPR). To increase awareness of peripheral health workers, all health unit in-charges[*] were identified and trained on Surveillance and EPR. Rapid Response Teams (RRT) comprising of the DDHS, Surveillance Focal Persons (SFPs), District Health Educator (DHE), District Health Inspector (DHI) and a District Laboratory Focal Person was set up in all districts of Uganda and trained on concepts of rapid response and outbreak investigation. The roles of the rapid response team are to promptly verify all rumors and suspected outbreaks, recommend appropriate and timely response and notify the central level.

In Gulu District, a community health worker per village was identified and trained to implement community based disease surveillance activities. Their activities includes detection and notification of suspected cases of VHF and a few other diseases of epidemic nature e.g cholera, measles, meningitis etc. This is being done concurrently with the revitalization of registration of births and deaths, implemented at village level by the Local Council I (LCI).

Discussion

Outbreak detection and confirmation

Previous serological studies indicated the presence of circulating antibodies against Ebola virus in the eastern part of Uganda[21]. This outbreak however, represents the first recognized and confirmed outbreak of EHF in Uganda. It is also the largest reported outbreak of EHF in the world ever.

[*] A health unit in-charge is a doctor, medical assistant or a nurse who is mandated by the District Director of Health services, to be directly responsible and to over see implementation of activities at the Health faciliy.

The epidemic was not recognized until after six weeks. The delayed detection of the outbreak by the health care delivery systems is illustrated by the epidemic curve which shows the time lag between the earliest recognized case, identified retrospectively (August 30th, 2000) and the date when it was first notified to Ministry of Health (October 8th, 2000)[2,18], which is about one a half month later. By this time, a number of cases had occurred and many were incubating the disease. This delay in outbreak detection is attributed to a number of factors, which included a weak surveillance system especially lower down the levels of health care delivery system. The non specific symptoms of the Ebola disease makes it impossible to differentiate it from other endemic conditions in Uganda such as malaria, dysentery etc; The health care seeking behavior of the local community is such that many of the people resort to self medication, or consulting traditional healers. Data from such informal sources are not captured by routine surveillance systems, which are based on formal health care delivery and therefore greatly affects the detection. This delayed detection was the same situation with the Yambuku and Nzara outbreaks[22,23].

Because this was the first outbreak of EHF in Uganda, and the disease was characterized by non-specific symptoms and clustering of deaths, the local community members attributed the outbreak to some kind of poisoning or to witchcraft. Like in those previous outbreaks elsewhere, it was the clustering of cases, amplified by nosocomial infection that led to the recognition of the outbreak[4,19, 22].

While it is not easy to influence the health seeking behavior, improvement in early detection of outbreaks can be improved by involving the local communities in surveillance activities, a strategy now recommended by WHO through the Integrated Disease Surveillance Strategy[9]. Community Based Disease Surveillance strategy was thus, initiated in the district of Gulu as part of the early warning system for epidemics.

Outbreak Response

Outbreak verification was prompt (within 48 hours of reporting) and institution of the response activities was fast and efficient.

Barry documents Acholi protocol (annex 1) that is useful in limiting disease outbreaks. However, cultural practices before outbreak detection e.g caring for the sick, bathing dead bodies and communal hand washing from a common basin amplified further transmission and spread of the Ebola disease in Gulu District. This is because Ebola virus is transmitted through contact with infectious body fluids. It is also documented that a high concentration of the virus is secreted on the skin of the dead cases[15,24]. Consequently, whole families were wiped out before outbreak detection and initiation of public health interventions.

As a measure for epidemic preparedness and response, the DDHS for 10 districts surrounding Gulu (figure 1) received a one-day's orientation on Ebola. This was because the chance of having the epidemic spill over to neighboring districts was perceived to be high due to uncontrolled movements. This helped in the early recognition of the Masindi

outbreak, which apart from the health care workers, the outbreak was limited to a single-family chain of transmission.

Previous analysis of the outbreak response indicates no difference in the quality of response as compared to previous outbreaks. The argument is that there appears to be no significant decrease in the overall CFR of 53%, which is similar to the CFR in the Sudan outbreak. It should be noted that most of the deaths recorded occurred before outbreak detection and therefore before institution of public health interventions. By the time the epidemic was detected, and control interventions instituted, most of the cases had already been exposed and were incubating the disease. As opposed to the outbreak in Yambuku (DRC) and in the town of Nzara (Sudan), the Ebola outbreak in Uganda provided the first opportunity for implementation of organized outbreak control interventions. Interventions were based on recommended scientific principles adapted to the existing systems and structures. Similarly, while in the Zaire outbreak a lot of time was spent on applying inappropriate control strategies because the investigating teams had suspected yellow fever instead of Ebola, the response in Uganda was targeted right from the beginning as VHF was immediately suspected. The impact of the effectiveness of the control interventions is reflected in the epidemic curve, which shows a drastic decrease in the number of cases on implementation of organized control interventions[2,18]. The CFR also reduced form 64.7% at the beginning of the outbreak to finally 52.7%.

The organization of the outbreak control activities was unique especially with regards to the active surveillance, resource mobilization, and management of the dead, coordination and media management. The surveillance case definitions applied was flexible for use at different levels and was sensitive enough to identify all potential cases in the community but less specific. While in the Zairean outbreak it was impossible to follow contacts and movement of people in between villages had to be stopped by employing soldiers[16], in Uganda there was no quarantine instituted and emphasis was on isolation of cases and close monitoring of contacts. The role of the media was greatly recognized than in previous outbreaks and helped to minimize rumors.

Because of the excellent response, it was easy to win the confidence of the local community and get their participation in the response. However, community response varied for example, for fear of contracting Ebola disease, people, especially community leaders, market vendors and bank tellers adopted the practice of wearing latex gloves initially as they got information about Ebola and it's transmission. Refusing handshake eventually became the norm. In the case of Gulu District where the outbreak was detected after it had affected many households with resultant numerous deaths, they were very responsive as compared to the population of Masindi District, which because the outbreak was limited to a family that had migrated from Kenya, were relatively less cooperative.

The epidemic was limited to only three districts of Uganda. The family chain of transmission in Masindi District occurred in a family that originated from Kenya and settled in Uganda. Spillage to Kenya was prevented through notification to the WHO/MoH Kenyan counterpart, isolation and aggressive monitoring of all contacts.

This represents a good inter-country collaboration on disease surveillance and response and should be encouraged in future outbreaks.

It is during this outbreak that a field laboratory was first established and used for screening cases. This was invaluable in guiding case management and surveillance activities. The laboratory was useful in preventing further transmission by helping to identify cases from non-cases. The site for the laboratory was provided for at Lacor Hospitals, which had moderate facilities as compared to many facilities in the developing world. This meant that the international laboratory personnel had to stay on sight until the end of the epidemic.

Challenges like "false" positives and negatives were quite contentious issues. Repeating the tests and interpreting the test results in the light of clinical symptoms of the cases helped to overcome some of the problems. This could only be possible because the laboratory was at the epi-center of the outbreak.

In-adequate and poor quality of protective materials, especially at the beginning of the outbreak, was a big problem and contributed to transmission of the Ebola virus within the health care setting. This resulted in nosocomial transmission among the health care professionals, patients with other medical problems and caretakers. For future outbreaks, the quality of protective materials especially masks and goggles needs to be taken into consideration. Other challenges to the outbreak control included deaths of health workers, numerous rumors and rejection of the convalescent cases by community members.

The Ebola film, documented during the 1976 outbreak of Ebola in Zaire illustrates the burning of contaminated materials within the hospital. This elicited the same response among the local communities who acted by burning all properties of the suspect and convalescent cases. This had some negative impact on the control strategies as it led to a temporary hiding of cases in the community. It would be important to produce many local films that provide flexibility of use within different circumstances and environment.

Through the Ebola National Task Force and the Global Outbreak Alert and Response network, it was possible mobilize human, financial and logistical resources that was critical for outbreak response and control.

The post outbreak control interventions were geared at improving on the Epidemic Preparedness and Response in case of a re-surgence, or a new epidemic. It is expected that registration of vital statistics (births and deaths) will compliment the efforts of surveillance practices for early warning of epidemics. The information collected will also show the evolution of the disease burden in the community, by detecting unexpected or severe health events.

A number of lessons were learnt in this particular outbreak and could be useful in tackling future outbreaks[17].

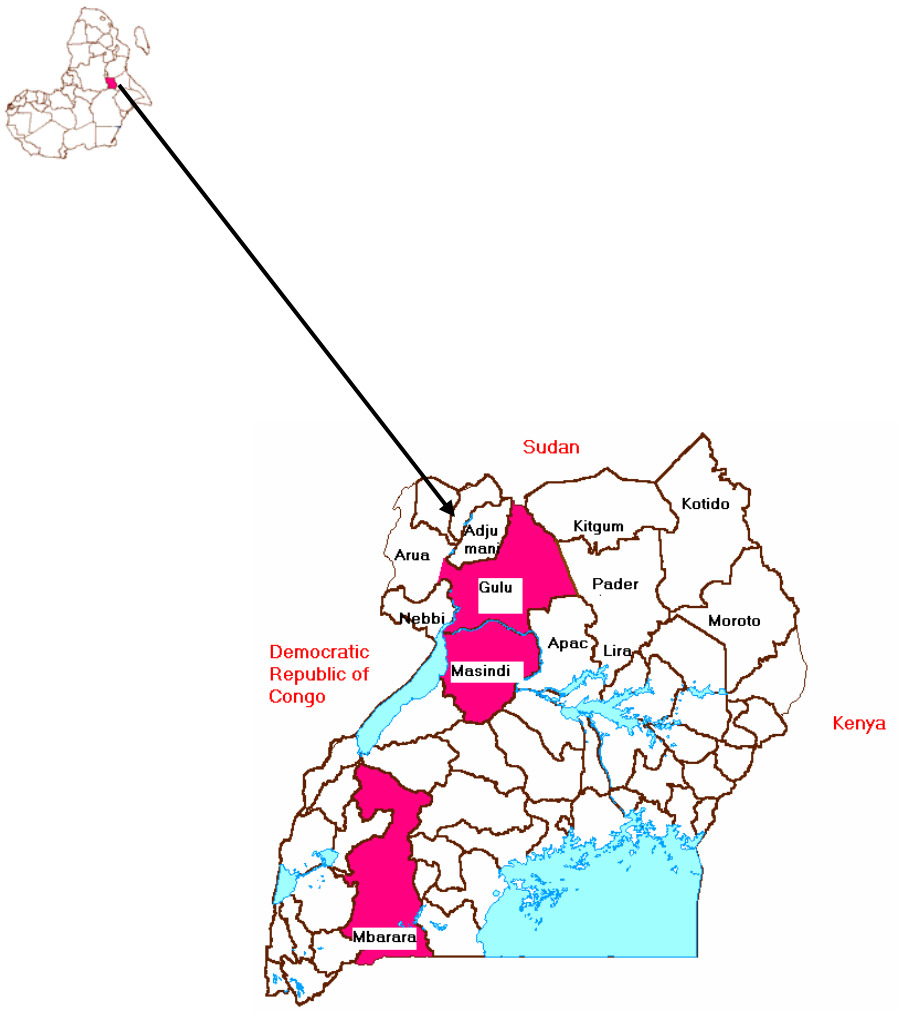
Conclusion

This was the first recognized outbreak of EHF in Uganda. Control activities successfully contained this largest reported outbreak of EHF. Despite implementation of barrier nursing techniques, health care workers still circumed to infections. Community structure set up for surveillance activities have continued to perform well post Ebola outbreak containment and has proved useful in the identification of other outbreaks as well. There is need to extend the community based disease surveillance practices to all the other districts of Uganda for the early detection of epidemics.

Acknowledgement

We would like to acknowledge the contributions of the Global Outbreak Alert and Response Network for the technical, resource and logistical contribution, Government of Uganda for the good political support that formed the basis of a favorable working environment for the containment of the outbreak, Ministry of Health – Uganda and all it's partners for their tireless efforts and the entire community of Uganda for their responsiveness. A lot of thanks also go to Dr. Nsubuga Peter of CDC – Atlanta for the editorial input.

Figure 1. Map of Africa Showing Uganda and it's districts



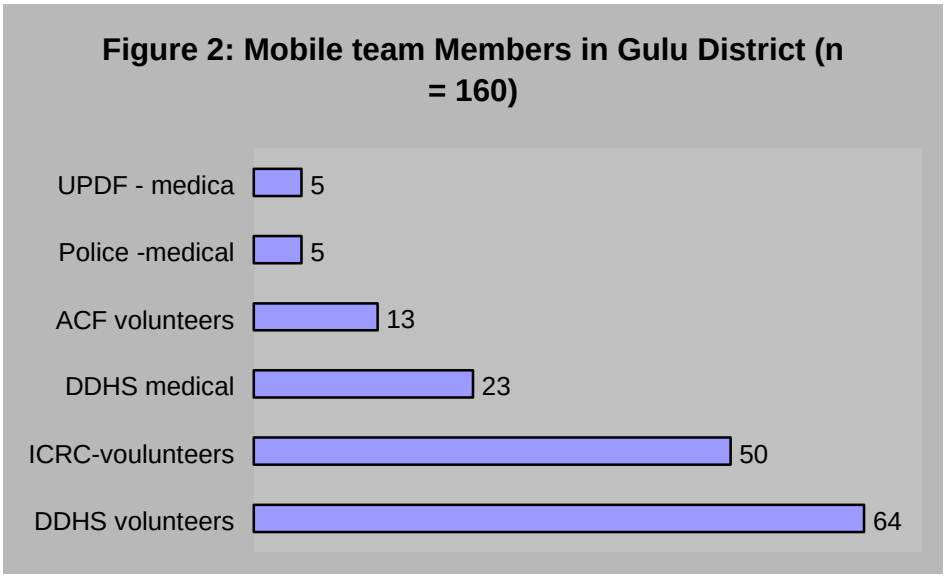


Figure 2: Mobile team Members in Gulu District (n = 160)
UPDF - medica
5
Police -medical
5
ACF volunteers
13
DDHS medical
23
ICRC-voulunteers
50
DDHS volunteers
64

Annex 1: Acholi protocol to control epidemics (gemo); an extract from prof. Barry's report.

These methods are utilized only when the illness has been identified and categorized as a killer epidemic (gemo).

1. Quarantine /isolate (gengo) the patient in a house (ot) at least 100 meters away from all other houses. Nobody should be allowed to visit the patient.
2. A survivor of the epidemic feeds and cares for the patient. If no survivors are around, an elderly woman or man will be the caregiver.
3. Houses with ill patients should be identified with two long poles of elephant grass (lum-lagada); one on each side of the door.
4. Villages/households (doggang) with ill patients should place two long poles with a pole across them to notify those approaching the village/household.
5. Every one should limit their movements – stay in your household (doggang) and do not move between villages.
6. Do not eat any food from outsiders
7. Pregnant women and children are especially prone to epidemics and should be especially careful to avoid the patient.
8. Increase harmony with the household; no harsh words or conflicts within the family.
9. No body should have sex
10. No body should dance
11. Do not eat rotten or smoked meat; only eat fresh cattle meat.
12. Once the patient gets better (no longer has symptoms), they should remain in isolation for one full lunar (dwe) cycle before moving freely in the village.
13. If the person dies, the survivor /attendant buries the person and the person is buried at the edge of the village / homestead.

Annex 2: Surveillance Case definitions
Four categories of the surveillance case definitions were in use:

The "**Alert**" which was any case of sudden onset of high fever **OR** Sudden death **OR** any form of bleeding. The peripheral health center or mobile teams would be notified on such cases.

The **"Suspect"** case definition was all persons, living or deceased with:
History of contact with EHF case and fever **OR** Fever **and** 3 or more of the following symptoms: (headache, vomiting, loss of appetite, diarrhea, weakness or severe fatigue, abdominal pain, body aches or joint pains, difficulty in swallowing, difficulty in breathing and hiccoughs) **OR** unexplained bleeding of any kind **OR** any unexplained death.

A **"probable case"** was defined as a suspect but had the assessment done by a clinician,

A **confirmed case** was one who met the clinical case definition and confirmed to be Antigen, IGg or PCR positive in the laboratory.

A contact was defined as someone who slept in the same household as the case within one month, or had direct contact with the case (dead or alive) or touched his/her linens or body fluids.

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