

The East African Community's mobile laboratory network's rapid response during the first 2 weeks of the Ebola Sudan virus disease (SVD) outbreak in Uganda and pandemic preparedness activities in South Sudan, Rwanda, Tanzania, Burundi, Kenya

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INTRODUCTION

On 20 September 2022, the Ugandan Ministry of Health declared an Ebola Sudan virus disease (SVD) outbreak in the Mubende District of the country, with one confirmed SVD death and six probable deaths reported in the region since 1 September 2022.¹

Since 2017, and with funding from the German Federal Ministry for Economic Cooperation and Development through the KfW Development Bank, the East African Community (EAC) together with the Bernhard-Nocht-Institute for Tropical Medicine established a network of nine mobile EAC laboratories embedded within the National Public Health Laboratories (NPHLs) of six EAC Partner States (Tanzania, Kenya, Burundi, Rwanda, South Sudan and Uganda).^{2,3} These field-deployable mobile laboratories have the capacity to diagnose risk group four pathogens, such as SVD. The EAC project was conceived in response to the West African Ebola epidemic and the EAC mobile laboratories were designed based on the blueprint of the European Mobile Laboratories

SUMMARY BOX

- ⇒ Since 20 September 2022, Uganda is experiencing an Ebola outbreak caused by the Sudan virus strain.
- ⇒ Within the first 14 days after outbreak confirmation, the East African Community Mobile laboratory network was actively involved in providing Sudan virus disease and differential diagnostics in the epicentre at Mubende Regional Referral Hospital (and neighbouring districts), as well as in coordination of mobile laboratory preparedness activities in five other East African countries.
- ⇒ We demonstrate for the first time that a locally established mobile laboratory network, embedded within the National Public Health Laboratories and the respective Ministries of Health, has the potential of bridging the crucial diagnostic time gap by providing immediate Biological Safety Level (BSL)-3/4 laboratory capacity at the site of the outbreak until large scale international emergency response starts.

(EMLabs, www.emlab.eu), which were successfully deployed to Guinea in 2015. One major difference to the EMLab project is that the EAC Mobile Laboratories are owned by the NPHLs, and, following an intensive training

concept, can now be independently operated by NPHL staff—thus avoiding time-consuming shipping of mobile laboratories and technical teams from Europe to Africa and accelerating national responses, as demonstrated during the present SVD outbreak. On the same day of the SVD outbreak announcement (20 September 2022) by the Ugandan government, the EAC Health Department initiated their regional pandemic preparedness and response activities, which consisted of a two-pronged approach: while the mobilisation of the EAC mobile laboratory network commenced, the regional procurement of diagnostic kits for SVD and differential diagnosis was immediately initiated (for a detailed timeline of events, see [table 1](#)).

SVD OUTBREAK RESPONSE IN UGANDA

In Uganda, the Ministry of Health sent an official request to the EAC Secretariat for EAC mobile Laboratory and diagnostic kits support on 28 September. On the same day, the first batch of three reverse transcription PCR (RT-PCR) diagnostic kits for filoviruses (3×96 tests) from the EAC arrived in the country and one Ugandan EAC mobile laboratory was deployed to Mubende District. On 29 September, the laboratory was set up at the Mubende Regional Referral Hospital in the epicentre of the outbreak. The hospital also hosts an isolation ward for probable cases and an emergency treatment unit for patient management of confirmed cases. Coordinated and manned by mobile laboratory operators from the Central Public Health Laboratory, SVD testing started on 30 September, 10 days after outbreak confirmation and 2 days after the official request for support. The mobile laboratory is the focal point for all samples from Mubende and surrounding 21 districts (including Kassanda the second most affected district in the country). The current turn-around-time from sample reception in the laboratory to results release is approximately 7–8 hours. With a diagnostic capacity of 50–60 samples per day (with the current setup), the EAC mobile laboratory in Mubende screened 1646 samples from its catchment area (as of 13 November 2022). By 10 November, a total of 137 SVD countrywide cases were confirmed in Uganda.

Without the EAC mobile laboratory at the epicentre, samples would need to be transported to the Uganda Virus Research Institute in Entebbe, and mainly due to long transport routes, associated logistics, and unpredictable sampling times at health centres, the overall diagnostic turn-around-time from collection to results release would have been in excess of 24 hours.

REGIONAL PREPAREDNESS ACTIVITIES

In the region, five other EAC Partner States increased their SVD preparedness with the help of the EAC mobile laboratory network (see [figure 1](#)).

On 22 September, the Rwandan Ministry of Health requested diagnostic kits, of which the first kit (96 tests) arrived on 28 September. As of now, the Rwandan EAC mobile laboratories are on stand-by at central level for potential deployment to Rwanda/Uganda border crossings in the North of the country.

In South Sudan, the EAC Mobile laboratory, which was already stationed at the Uganda/South Sudan border in Nimule to screen commuters for SARS-CoV-2,³ is now being upgraded for SVD screening of suspect cases and South Sudan has received their first kit (96 tests).

As part of the country's SVD preparedness, Tanzania deployed one EAC mobile laboratory from the NPHL in Dar-es-Salaam on 25 September, which arrived the following day at Kabyaile Health Centre in the Kagera region. The Health Centre also planned to host an isolation ward for confirmed cases. After subsequent arrival of two diagnostic kits (2×96 tests), the deployed EAC mobile laboratory is serving Kagera and nearby regions bordering Uganda.

Burundi is preparing the deployment of the mobile laboratory to the Kobero Border while Kenya are currently arranging the use of their EAC mobile laboratories as part of the country's SVD preparedness and both countries received SVD kits in early October.

DIAGNOSTIC WORKFLOWS, STANDARD OPERATING PROCEDURES AND SUPPLY OF DIAGNOSTICS KITS

The EAC Mobile laboratories consist of negative pressure gloveboxes (Könnecke, Germany) (see [figure 2](#)) for sample inactivation and Bio-Rad CFX96 RT-PCR platforms for molecular SVD diagnosis (for further details on the laboratory setup, see *Affara et al*²). The EAC mobile laboratory networks in Kenya, Burundi, Tanzania, Rwanda, Uganda and South Sudan—from project implementation to outbreak response against Dengue, Ebola, COVID-19 and epidemic-prone diseases. *BMC Med* 2021;19(1):160.). RNA extraction is done using the QIAmp RNA Minikit (Qiagen, Germany). For primary SVD diagnostics, the RealStar Filovirus Screen RT-PCR Kit 1.0 is used and Ebola-positive samples will be further analysed for speciation of five Ebolavirus species (including Sudan virus) with the RealStar Filovirus Type RT-PCR Kit 2.0. For differential diagnosis, countries received RealStar Crimean-Congo Haemorrhagic Fever Virus (CCHFV) Screen RT-PCR Kit 1.0 and the RealStar Rift Valley Fever Virus (RVF) Screen RT-PCR Kit 1.0 (all Altona Diagnostics, Germany). The EAC established a driver network for rapid delivery through-out the region after receipt of kits from the regional distributor in Nairobi (Excella Biotechnologies, Kenya). As of 12 October, 32 Filovirus Screening kits (or 3072 individual tests), 7 Filovirus typing kits, 12 CCHFV kits and 36 RVF kits were ordered through the EAC Secretariat, and dispatched to the countries. On 2 November, an additional ten Filovirus Screening kits (960 individual tests)



Table 1 Timeline of regional SVD outbreak response and preparedness activities in six East African countries

	Days following outbreak announcement													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SVD outbreak declared by Uganda MoH														
EAC secretariat														
Emergency pandemic preparedness meetings														
Emergency procurement initiated														
Logistical support (kit delivery)														
Technical country support														
Press Release														
No of SVD kits ordered/expected											1×96 tests (arrival day 20)			
Uganda SVD outbreak response														
Request for support to EAC														
Lab deployment from Kampala to Mubende														
Start of testing														
No of SVD kits ordered/received			4×96 tests											
No. SVD kits ordered / expected											15×96 tests (arrival day 20)			
Tanzania preparedness														
Lab deployment from Dar-Es-Salaam to Bukoba														
Refresher Training on workflows														
No of SVD kits ordered/received														
No of SVD kits ordered/expected												2×96 tests (arrival day 20)		
Rwanda preparedness														
Request for support to EAC														
No of SVD kits ordered/received										1×96				
No of SVD kits ordered/expected												2×96 tests (arrival day 20)		
South Sudan preparedness														
Lab deployed to Nimule														
Request for support to EAC														
No of SVD kits ordered/received														1×96
No of SVD kits ordered/expected													2×96 tests (arrival day 20)	
Burundi preparedness														
No of SVD kits ordered/expected													2×96 tests (arrival day 20)	
Kenya preparedness														
No of SVD kits ordered/expected														2×96 tests (arrival day 20)

The outbreak box in red, to signal alert. The response boxes were all done in green, to represent activation. EAC, East African Community; MoH, Ministry of Health; SVD, Sudan virus disease.

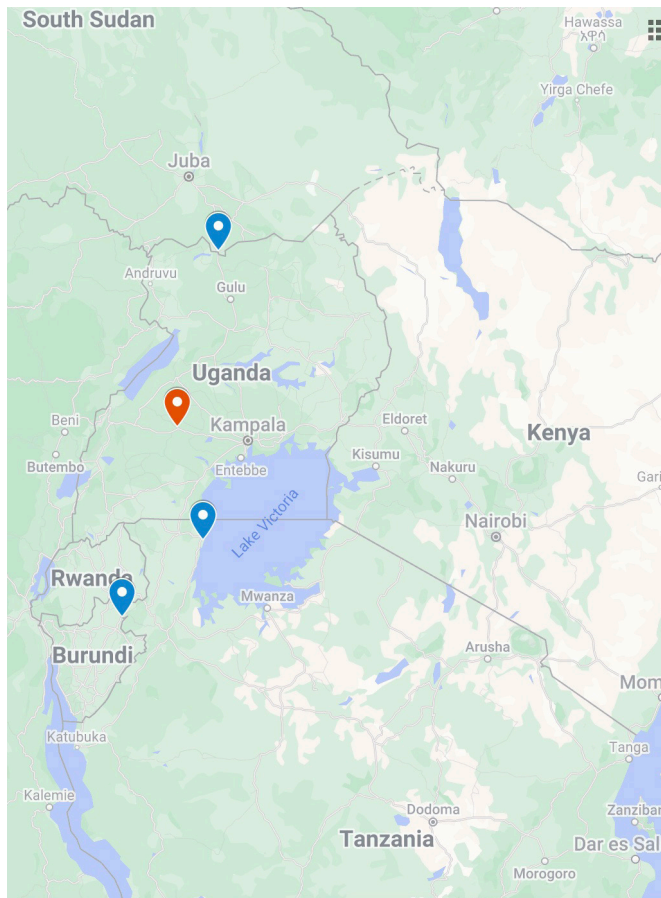


Figure 1 The map shows the locations of the mobile laboratories in East Africa. In Uganda, one EAC mobile laboratory is deployed into the outbreak at the Mubende Regional Referral Hospital for providing diagnostic SVD capacity (red pin). In South Sudan (Nimule), Tanzania (Kabyaile) and Burundi (Kobero) the mobile laboratories are supporting preparedness activities at border crossings (blue pins). The map was created in Google Maps. EAC, East African Community; SVD, Sudan virus disease.

were ordered for Uganda and arrived in East Africa on 14 November. All EAC mobile laboratory standard operating procedures are controlled through the centralised



Figure 2 The negative pressure glovebox workstation of the EAC Mobile laboratory at Mubende Regional Referral Hospital, Uganda. EAC, East African Community.

EAC ISO-accredited Quality Management System and all EAC mobile laboratories operators were given access.

CONCLUSION

The EAC Mobile Laboratories were activated in six countries, and started testing in Mubende/Uganda within the first 10 days following the outbreak declaration. Therefore, we successfully demonstrated that a regionally hosted mobile laboratory network, paralleled by full knowledge transfer to the NPHLs, can play a significant role in accelerated pandemic preparedness activities on national and regional level in East Africa. Deploying the mobile laboratories to identified high-risk areas (such as the epicentre of the outbreak or cross-border areas),² reduces the diagnostic turn-around-time to 7–8 hours,² thus avoiding diagnostic delays due to shipment of samples to centralised or regional reference centres. In turn, such fast and accurate patient diagnosis leads to efficient case management, accelerated quarantine measures and will ultimately block ongoing transmission.

Due to its rapid response time, the mobile laboratory network was therefore able to bridge the crucial initial diagnostic time gap from the start of the SVD epidemic until further international, large-scale support capacities are arriving in the region. It is of note that this mobile laboratory network shall also be considered in the planning of emergency activities by international health agencies and other stakeholders for further SVD outbreak response.

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