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TECHNICAL BRIEF

USE OF TECHNOLOGY IN THE EBOLA RESPONSE IN WEST AFRICA

KEY MESSAGES

1 The severity of the Ebola epidemic and limited information on new cases and geographic spread calls for the rapid deployment of information and communication technology (ICT) tools, including eHealth and mHealth, to **optimize the response**.

2 A number of technology tools have **already been used** in the response and others are in development. Open-source platforms such as DHIS2, Open Data Kit, Enketo, RapidPro, iHRIS, and the DCP form the technology suite known as mHero. In Liberia, this suite is emerging as a set of tools endorsed by many actors in the response and **builds on existing government ehealth systems**. Numerous other platforms are in use by nongovernmental organizations (NGOs) and other mhealth practitioners.

3 **Integration, harmonization, and accessibility of ICT infrastructure** by public, private, and civil society actors is critical to the response to the Ebola humanitarian crisis, as well as the long-term economic development and security of the region.

4 **Better coordination** is needed in the deployment of technologies to avoid duplication of efforts and data fragmentation. Coordinating the tech component of the response should be integrated in the overall National Ebola Outbreak Response Plan of the affected countries and in the preparedness plans of non-affected countries.

5 Whenever possible, governments and partners should seek to **use and endorse proven platforms** and tools before developing new ones to ensure interoperability. New tools are unproven and will lead to further lack of coordination and data fragmentation.

The United States Agency for International Development's (USAID) Africa Bureau and their project, African Strategies for Health (ASH), in collaboration with colleagues from USAID's Global Health Bureau and Global Development Lab, prepared this Technical Brief in November 2014 in the midst of the West Africa Ebola Outbreak. At the time, Ebola transmission rates remained intense or increasing in Guinea, Liberia, and Sierra Leone, while other countries, including Nigeria and Senegal, had successfully halted the epidemic. The situation has since changed, with caseloads declining or eliminated in all countries. This brief provides a summary of information and communication technology (ICT) tools, including eHealth and mHealth, which have or will be used to optimize the Ebola response. It also provides recommendations for policymakers and program managers seeking to deploy ICT tools in outbreak settings that are applicable beyond the 2014 Ebola crisis.

OVERVIEW: THE EBOLA OUTBREAK

The 2014 epidemic of Ebola Virus Disease (EVD) in West Africa is the largest in history. Of the more than 13,500 cases, 4,900 have resulted in deaths.[1] The overwhelming size and nature of the epidemic has led to the collapse of already fragile health care systems in Liberia, Guinea, and Sierra Leone. The Ebola epidemic has been hampered by misinformation and a lack of information about critical aspects of the response, including EVD transmission, case notification, infection control options, geographic spread, and health service availability. In addition, health workers were neither trained nor equipped for EVD outbreaks and government-imposed travel restrictions make reaching them (for training, communication, and equipment) difficult. With up to $33 billion in economic losses, the severity of the epidemic calls for the rapid deployment of technology, including ehealth and mhealth, to accelerate and optimize the response.[2]

TECHNOLOGY USE IN THE EBOLA RESPONSE

ICT tools are critical to the Ebola response. As the epidemic continues to rise at an exponential rate in Liberia, the strategy of expanding containment through a limited number of treatment facilities will soon be outstripped by the number of new cases. The number of available beds in the Ebola Treatment Units (ETUs) as currently planned will meet only a small portion of isolation and treatment needs. Mobile network platforms provide a vital set of tools to support these hard-to-reach populations of infected individuals and affected households with life-saving information, essential commodities and financial support, and monitoring of vital epi-surveillance information.

Technology is currently being used to **map and geolocate Ebola outbreaks** and to collect and share **data in near real-time**. Other types of technological innovations—including **tools for point-of-care diagnostics, case management, logistics management, community mobilization, payment and financial support distribution, and big data analytics solutions** for Ebola responders and affected communities—have and can be used in the response.

The World Health Organization (WHO) and other agencies are **adapting existing ehealth tools** to Ebola and **building capacity** to use them. Moreover, some tech firms are deploying short-term communication infrastructure solutions to **boost broadband connectivity**.

CURRENTLY USED TECH TOOLS

The communication system **mHero** is the recognized and most proven system in the field by the donor and practitioner communities, sponsored by the US Agency for International Development (USAID), UN Children's Agency (UNICEF), IntraHealth, ThoughtWorks, Jembi Health Systems and WHO. mHero is a suite of open-source mobile phone-based communication systems for contacting, informing, surveying, and polling facility-based and community health workers on information, such as training materials, Ebola lab test results, and equipment/supplies. The system builds on and interacts with existing government/partner systems, including DHIS 2.0, RapidPro, Data Coordination Platform (DCP), and iHRIS.

In **Nigeria**, an emergency presidential decree enabled officials to access mobile phone records and use law enforcement agencies where necessary to track down people at risk. Contact tracers used mobile data platforms on their phones to administer their questionnaires and report contact responses. Mobile data platforms were used to track temperatures with real-time data transmission to a dashboard (normal temperatures indicated in green and elevated temperatures in red). Geographic information system (GIS) technology was used for follow-up and outreach visits. Mobile technology meant live updates could be made to the contact list. The Government of Nigeria and UNICEF also used the SMS-based community dialogue platform called U-report. (Partners: Government of Nigeria, Emergency Operations Center, WHO, UNICEF, eHealth Africa)

In **Uganda**, UNICEF supported Uganda's National Task Force on Ebola to operationalize an mhealth platform, mTrac, into their response to the 2012 Uganda Ebola outbreak. mTrac enables real time alerts and surveillance and uses mobile phones via SMS from communities and health workers. It is viewed and managed through an online dashboard by District Health Teams (DHTs) and the Ministry of Health (MoH). mTrac's role in the fight against Ebola included: 1) engaging the community via a free SMS hotline to report suspected Ebola cases; 2) receiving suspected Ebola case alerts from DHTs and health facility workers free of charge; and 3) sending targeted MoH-approved messages to DHTs, health facility workers, and village health teams (VHTs) in the affected districts. The messages reached 2,000 DHTs and health facility workers in these districts every two days and also in tandem with the spread to new districts.[3]

In partnership with major mobile phone operators, **Senegal's** MoH sent four million SMSs to the general public warning of the dangers of Ebola and how to prevent it—encouraging individuals to alert health authorities of anyone showing signs of a fever and bleeding by calling a toll-free number. Sent in response to Senegal's first EVD case, the SMSs were delivered using the mDiabetes platform, which was developed with support from WHO, the International Telecommunications Union, and Alcatel-Lucent.

Current data collection and sharing in near real-time

DHIS2

The District Health Information System 2 (DHIS2) is the flexible, web-based open-source district health information system being used in 49 countries, including Liberia, where it was adopted by the Ministry of Health and Social Welfare (MOHSW) prior to the Ebola outbreak to serve as the government's repository for all aggregate health data. Visualization features include dashboards, GIS, charts, and pivot tables.

RapidPro

Supported by UNICEF, RapidPro is a tool for basic mobile phone SMS systems. RapidPro allows program staff with minimal technical knowledge to quickly create communication campaigns, monitor programs and activities, collect critical indicators on areas such as essential medicines, and engage directly with beneficiaries and community members.

WHO DCP

WHO and UNICEF have developed harmonized data collection and management tools for the Ebola response, targeting health workforces, facility safety, and infection prevention and control. The WHO Data Coordination Platform (WHO DCP) is part of the mHero technology suite for Ebola response and monitoring.[5]

iHRIS

An open-source health workforce information system which helps countries track and manage data on their health workers, iHRIS is implemented in Sierra Leone, Liberia, Nigeria, Senegal, Mali, and 14 other countries.[6]

U-Report

U-report is an SMS-based communication platform developed by UNICEF and deployed in Nigeria in April 2014 as part of the social mobilization strategy against Ebola. To enhance citizen engagement and promote behavior change even in hard-to-reach areas, U-report allows individual subscribers to ask questions about issues, get real time answers, and share information with other U-reporters across the country. In the month after the start of the outbreak, subscribers increased from 19,000 to 63,000. Many people were asking for and contributing information on Ebola – causes, symptoms, treatment, and how to prevent it – as well as sharing with non-U-reporters.[7]

Frontline SMS

A free, open-source texting service that sends out messages to groups, Frontline SMS is being used by the United Methodist Church to send out text messages twice a day that both inform and help allay the fears of its 225,000 United Methodists in 324 churches in Sierra Leone and 148,382 members in 609 churches in Liberia. United Methodist Communications (UMC) started sending Frontline SMSs in mid-August 2014.[8]

Magpi (formerly EpiSurveyor)

The International Rescue Committee is using Magpi to do a village-by-village survey of Ebola cases in Sierra Leone.[9] Magpi delivers a configurable, cloud-based application that enable users in the field to quickly and easily collect data via SMS or Web entry and create broadcast messaging campaigns.

WhatsApp Ebola

The BBC has launched an Ebola public health information service on WhatsApp, with the intention of servicing in West Africa. The service can provide audio, text message alerts, and images to help people get the latest public health information to combat the spread of Ebola in the region. WhatsApp is the biggest "chat app" in use in Africa. Content is limited to three items a day with service in both English and French.[10]

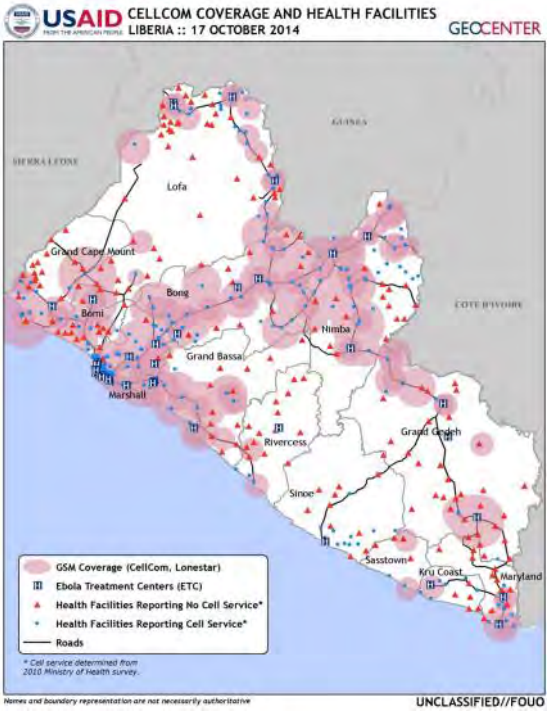
Mapping and geolocating Ebola outbreaks

HealthMap crowdsources online informal sources (including online news aggregators, eyewitness reports, expert-curated discussions, and validated official reports) for Ebola outbreak monitoring and real-time surveillance on the freely available Web site "healthmap.org" and mobile app "Outbreaks Near Me."[11]

OpenStreetMap uses satellite images and volunteers around the world to build OpenData maps with the names of roads and towns that proved much more useful than the topographical maps for Médecins Sans Frontières (MSF).[12]

The Centers for Disease Control and Prevention (CDC) and Liberia's Health Ministry

are tracking the approximate locations of mobile phone users in West Africa who dial emergency call centers in an effort to predict the onset and spread of Ebola outbreaks. The data is just the number of calls by cell tower (i.e. call traffic), which conveys the general area from which the calls originate (i.e. tower location). Census and neighborhood data can then be derived from that area. By collecting tower data from telecommunications providers, CDC can visualize the beginnings of an outbreak. A spike in the number of calls could suggest a crisis.[13]



Current big data analytics solutions

IBM's Watson Supercomputer

In Sierra Leone, IBM has launched an analytics system to track the spread of EVD by having citizens report Ebola-related issues and concerns via text message or phone calls. The goal is to provide the country's government with insight into communities affected by Ebola and improve its strategy for containing the disease. IBM has pledged $100 million towards using its Watson supercomputer to find patterns in the Ebola virus: how it is mutating, how it could possibly lead to a vaccine, and eventually, how it could cure the sick and dying. Watson is openware, a "community computer" that anyone can feed information to.[14]

PLANS FOR FUTURE USE OF TECH TOOLS

A number of organizations are currently developing technology to support the Ebola response. The Economic Community of West African States, WHO, and mobile network operators in West Africa are planning one of the largest-scale mobile technology initiatives for EVD.

Point-of-care diagnostics

i-calQ

Developed in 2007 to diagnose Ebola on the Uganda-Democratic Republic of Congo border, i-calQ is a smartphone-based point-of-care biosensor device that quantifies, interprets, and records point-of-care diagnostic tests and transmits the data to a centralized database.[15]

Fionet

A system that provides health workers with mobile companion devices that embed data capture into health care delivery. The Fionet system offers a universal reader for rapid diagnostic tests (RDTs) that automatically captures point-of-care data. The data is uploaded to a secure cloud and available for real-time data mining and remote oversight. Fionet is collaborating with several diagnostic companies that are developing Food and Drug Administration-approved Ebola RDTs as they are tested in the lab and in the field in West Africa. Fionet can aid Ebola response efforts by providing automated workflow, contact tracing, and timely data to program managers, funders, and stakeholders.

Novarum DX

A mobile point-of-care diagnostics solution that can enable health workers in the field to quickly test patients, then send those results through a smartphone to public health experts for real-time tracking. The smartphone app allows the user, such as health workers or patients, to accurately read the result of a diagnostic test using a smartphone. Those readings, in turn, can be shared in near real-time and combined with location data to generate a geo-referenced map that health workers and managers could use to view Ebola hot-spots for action.[16]

Nanobiosym

An iPhone-sized device that can detect Ebola and other diseases in less than an hour. Numerous other companies are working on technologies that can be used to support Ebola containment efforts.[17]

FilmArray

A device that scans for the genetic markers of Ebola and a number of other viruses. It takes the Ebola cells, breaks them open, exposes the ribonucleic acid and matches the data against an identified target. U.S. military troops deployed to West Africa are screening suspected patients with the FilmArray device from BioFire Diagnostics[18].

Data collection and sharing in (near) real-time

Kobo Toolkit software is an open source suite of tools for data collection, surveillance, and analysis in humanitarian emergencies. Symptomatic patients will be reported to local response teams using cell phones equipped with the Kobo Toolkit software. (Partners: Harvard Humanitarian Initiative and Management Sciences for Health)

Communication infrastructure for high-speed connectivity

Communication, Connectivity, and Infrastructure: Inveneo and Volo Broadband are partnering with Facebook to design, deploy, and support improved broadband access to health facilities and international organizations in partnership with local carriers. In addition to ICT expertise, the partnership plans to deploy portable satellites (BGANs and VSATs) as well as wireless and networking equipment kits that allow for quickly underlaying a new fixed wireless network on existing carrier physical infrastructure. As part of its plan to improve connectivity and communication between health facilities and partners in Ebola-affected areas, NetHope will deploy stand-by ICT experts, along with portable satellites (BGANs and VSATs), Android smartphones, modem USB sticks, and solar panels.

Big data analytics solutions

Constellation - The Department of Defense has reconfigured a system geared for identifying weapons of mass destruction (WMD) to instead flag the onset of Ebola outbreaks. The WMD biosurveillance prototype, dubbed Constellation, harvests, synthesizes, and visualizes data of interest across the military and intelligence communities. Through Constellation, information gathered from Ebola threat reduction activities, when integrated with other relevant partner information, will provide decision-makers and operational personnel a holistic view of the Ebola landscape.[19]

KEY RESOURCES

ICT Response to the Liberia Ebola Crisis

An assessment by USAID and NetHope on first-hand reports from multiple response organizations, discussions with USAID mission staff in Liberia and implementing partners, and desk research. The assessment is meant to provide a snapshot of the current on-the-ground situation in Liberia and is a first step toward a longer, more exhaustive assessment necessary to gather empirical data. Available at http://solutionscenter.nethope.org/assets/collaterals/USAID_LiberiaICTDeskReview_Final_Oct2914.pdf

Ebola Resource Document

How Can ICTs Improve Our Ebola Response? TechSalon compiled eight pages of links to blog posts, news articles, and other publications detailing the ways that ICT can be used in the ongoing Ebola response. Available at https://docs.google.com/document/d/1-WI1OBkMp9ewOCPWw2fcIqrYdcZ_1k7lBZt0tK2gsoM/edit#

GSMA Ebola Mobile Response Blueprint

This document provides guidance for the use of mobile technology in Ebola response. It covers: 1) technology and nontechnology considerations; 2) product features; 3) suggested Ebola content; 4) public relations and marketing guidelines; 5) reporting guidelines; 6) and commitment required from government and local authorities. Available at http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2014/10/gsma-Ebola-Mobile-Response-Blueprint.pdf

Free Ebola Webinar Series "Training Health Workers for Ebola—Protection, Detection, and Response"

Developed by TechChange, mPowering, and IntraHealth, this free webinar series includes presentations and discussions which (1) describe how to leverage available resources to train, support, and communicate with frontline health workers and others involved in the direct Ebola response through mobile technology; (2) consider ways to connect implementers to resources, collaborators, and sources of information; and (3) explore how to improve opportunities to enable implementers and programmers to share efforts, collaborate, and avoid duplication. Available at http://techchange.org/2014/10/16/ebola-response-free-training-webinar-mpowering-intrahealth

Ebola Social and Behavior Change Communication (SBCC) Resources and Tools

The Ebola Communication Network (ECN) is an online collection of more than 150 Ebola resources and tools from and for the global health community - including not only SBCC materials such as posters, brochures, and infographics, but also demographic and health surveys of affected regions, customized maps, and peer-reviewed journal articles. Responsive to mobile devices, ECN is also easily searchable. Users can also upload their own materials, which are posted after a brief review process. Available at http://ebolacommunicationnetwork.org

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