

Evaluation of the Implementation and utilisation of a Case Based Diseases Surveillance (electronic Integrated Disease Surveillance and Reporting (eIDSR-CBS)) in the West Nile region: August 2018 to February 2019

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Abstract

Introduction: West Nile is vulnerable to repeated disease outbreaks due to instability and refugees from South Sudan and Congo. Uganda is implementing integrated disease surveillance (IDSR) and piloting electronic IDSR (eIDSR-CBS) with Global Health Security Agenda, Infectious disease institute (IDI) and HISP-Uganda between January 2018 to February 2019 in West Nile. This study determined utilization and challenges of implementing eIDSR-CBS, whose aim was improving real-time disease reporting and building capacity of surveillance staff in eIDSR-CBS real-time disease reporting.

Methodology: DSFP were trained to train others in eIDSR-CBS, trained other staff, distributed eIDSR-CBS materials and conducted support supervision. In a cross-section evaluation, project documents review and in-depth interviews provided data for utilisation, project relevancy, effectiveness of implementation, collaborations, sustainability, challenges and lessons learned.

Findings: eIDSR-CBS used SMS, Web and Android platforms, DSFP supported 1,071 staff in 256 e-IDSR trainings, supported 82% of 363 facilities, distributed 362 IDSR and 1072 eIDSR-CBS materials and 1953 SMS messages. Of 39 facilities, 79% conduct IDSR, 54% e-IDSR, 92% had IDSR and 98% eIDSR-CBS materials. The project built eIDSR-CBS capacity of staff, enhanced collaboration and communication among stakeholders, was sustainable with improved skills, utilised existing MoH structures and engaging stakeholders.

Conclusion: Implementing eIDSR-CBS is feasible in existing MoH structures, with cascade-trainings multiplier effect exponentially disseminating eIDSR-CBS knowledge, trainers and staff and effectively creating ownership, responsibility and sustainability. eIDSR-CBS cascading needs scale-up for early disease outbreak detection.

Keywords: SMS (6767) alerting, case-based disease surveillance, integrated disease surveillance, eIDSR-CBS, IDSR, West Nile Region Uganda.

Introduction

Communicable disease still remain a major burden in Uganda as a result of endemic human diseases such as malaria, HIV/AIDS, viral haemorrhagic fevers, tuberculosis and cholera^{1,2} and zoonotic diseases such as rabies, anthrax and brucellosis³ The West Nile region has been vulnerable to both human, zoonotic and animal disease outbreaks as a result of refugees migrating from the neighbouring South Sudan and the Democratic republic of Congo (DRC)⁴. The increasing human and animal refugee and resident populations has forced encroachment into wildlife habitat putting animals and humans in closer contact with the wild life. The West Nile region has had repeated human, zoonotic and animal disease outbreaks within the region.

The West Nile region of Uganda is has 9 districts that share international boundaries with South Sudan and Democratic Republic of Congo that puts them at risk of exporting epidemics from the neighbouring countries.⁵ The region also lies within the Sub-Saharan meningitis belt of Africa, making the region prone to epidemics of meningococcal meningitis.⁶ The West Nile region has experienced repeated outbreaks of epidemic diseases, with each district getting an outbreak or two each year with high case fatality rates.⁷

Uganda is implementing a functional integrated public health surveillance system, the integrated disease surveillance and response (IDSR), with early warning system to address the burden of repeated disease outbreaks.⁸ IDSR provides an integrated real-time case-based notification collection, analysis, interpretation, and dissemination of disease surveillance that is available for national and stakeholder review and use for response.^{9,10,11} The electronic component of IDSR, eIDSR-CBS, has been implemented for surveillance of acute febrile illnesses, (AFI surveillance), multi-drug resistant TB (MDR-TB surveillance) and anti-microbial resistance (AMR surveillance).¹²

From January 2018 to February 2019 Health Information Systems Program (HISP-Uganda) in collaboration with Global Health Security programme (GHS), Centres for Disease Control and Prevention (CDC) Uganda, Infectious Disease Institute (IDI) and Ministry of Health (MoH) Uganda implemented a pilot Case Based Surveillance (CBS) - eIDSR-CBS project in the 9 districts of West Nile Region.

The objectives of the pilot project were to strengthen the capacity of the region for early detection and response to potential diseases outbreaks through providing solutions for real-time case-based notification and communication among surveillance staff at points of diseases detection, the district and MoH. At the completion of the project an end of project evaluation was conducted to evaluate project implementation, utilisation and challenges faced in implementation of the project. This article describes the implementation of project, utilisation of eIDSR-CBS for notification and the challenges of implementation of the eIDSR-CBS pilot project within the West Nile region.

Objectives of the evaluation: The objectives of the evaluation were to describe the effectiveness of implementation of the pilot project, utilisation of the eIDSR-CBS system and to describe the challenges and lessons learned in implementation of the pilot project in the West Nile region.

Methods

Study design: The evaluation was a descriptive cross-sectional retrospective assessment of implementation, utilisation and challenges of the pilot eIDSR-CBS project in the West Nile region. The evaluation was conducted from 1st May 2019 to 15th May 2019.

Setting: The pilot project was implemented within 9 districts (Arua, Maracha, Koboko, Yumbe, Moyo, Adjumani, Pakwach, Nebbi and Zombo) at regional, district and health facility level. At the regional and district level the project was coordinated by surveillance focal persons at the region (Regional surveillance focal person [SFP]), district (District Surveillance focal persons [DSFP]) and health facilities (health facility surveillance focal person [HFSFP]).

Study Populations and Respondents. The regional, district and health facilities in West Nile region constituted the population for this evaluation. Purposively interviewed members of the Regional surveillance team (RSFP), the district surveillance focal persons, (DHOs, DSFP and DVOs) and the HFSFP (In-charges of health facilities) were selected.

Sampling and sample selection: The evaluation was conducted in all the 9 districts of the West Nile region (of Arua, Maracha, Koboko, Yumbe, Moyo, Adjumani, Pakwach, Nebbi and Zombo). A total of 69 key informants were provided in-depth interviews, two were regional level (RSFP and RLFP), 27 were at district (9 DHO, 9 DSFP and 9 DVO), and 39 were at health facility level (40 HFSFP or in-charges). A sample of 40 health facilities were selected, 4 from each district, except Arua where 4 additional health facilities were selected, because of many health facilities in Arua district. Selection of the facilities included half of the facilities that were provided with combined HISP-Uganda and DSFP support supervision and half supported by the DSFP alone.

Study methods: The evaluation applied a mix of quantitative and qualitative approaches to document. The quantitative methods were used to determine the implementation and utilisation of eIDSR-CBS, while qualitative methods were used to determine the challenges and lessons learned during implementation. The evaluation was implemented in two steps, starting with desk review of the project implementation plan and project implementation reports for training, support supervision, mentorships and cascade training. Other data was obtained through health observations within the health facility and review of Out Patient Department (OPD) register for occurrence of notifiable diseases and in-depth interviews with key informants.

Data collection: Data was collected from three main sources, including documents review, observations at health facilities and key informant interviews. The documents that were reviewed included the project proposal, implementation plan and health facility registers for records of notifiable diseases, within the previous two weeks, while the observations included seeing copies of IDSR guideline booklets, eIDSR-CBS posters and eIDSR-CBS Standard Operating Procedures (SOPs).

Qualitative data was collected by face-to-face in-depth interviews using key informant guides. The themes in the KII addressed the relevancy of IDSR and eIDSR-CBS project in West Nile; the effectiveness of the implementation strategies; collaborations with surveillance stakeholders that were developed; sustainability of IDSR and eIDSR-CBS at the end of the project; the effectiveness of eIDSR-CBS on disease surveillance; the challenges encountered during implementation and the lessons learned.

Ethical Consideration: The Ministry of Health of Uganda through the Public Health emergency operating Centre (PHEOC) and Infectious Disease Institute (IDI) gave approval to conduct this evaluation. The evaluation was determined not to be human subjects' research because the primary purpose was to evaluate a pilot MoH project in response to case-based surveillance for public health threats that may result from the influx of refugees within the west Nile region. Permission was also received from the districts of the West Nile region from the District Health Officers. The review of health facility documents was conducted after the in-charges of the health facilities provided permission to access the health facility record and the qualitative interviews were only conducted after informed consent was obtained from the respondents.

Findings

Project implementation: Project implementation document review revealed implementation of the activities against the planned timelines for the project presented in (Table 1) were all executed and in time. The West Nile project was part of the national scale-up of eIDSR-CBS that was implemented in phases. Implementation started with development of the eIDSR-CBS system based on the District Health Information Software (DHIS2) platform, followed by training of regional and district surveillance focal persons, mentorships of DSFP and cascade training, support supervision and mentorship of health facility surveillance focal staff.

Performance on the project activities: The project planning activities were implemented on time for all the deliverables including; development of the SMS, Web and Android eIDSR-CBS platforms, developed workplans for eIDSR-CBS implementation West Nile, development of user manuals and standard operating procedures for the three eIDSR-CBS platforms and development of posters for SMS alerting, registration and updating the eIDSR-CBS system. The materials for the eIDSR-CBS cascade training model for the lower health facilities were also developed (Table 1).

Table 1. Activities for the implementation of eIDSR-CBS project from January 2018 to end of February 2019

Activity	Indicators	Target	Achievement	Timeliness
Development of the SMS, Web and Android	Developed SMS, Web and Android eIDSR-CBS platforms	1	100	Within time
Develop strategy and work plan for managing eIDSR-CBS implementation West Nile	1. Development of user manuals and 2. Development of SOPs for SMS, android and web eIDSR-CBS platforms 3. Development of posters for SMS alerting, registration and updating the eIDSR-CBS system	1	100	Within time
Design eIDSR-CBS cascade training model to	A cascade model developed	1	100	Within time

lower facilities for West Nile				
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Development of the eIDSR-CBS system: The three platforms (SMS, Web and Android) of the eIDSR-CBS system were developed on the DHIS2 platform (Figure 1). The system provides real-time telephone-based toll-free SMS messaging with provisions for web-based registration and capture of lab requests, specimen tracking, test results, case monitoring and contact tracing. Registration and updating is done using either a computer or Android systems with internet connection.

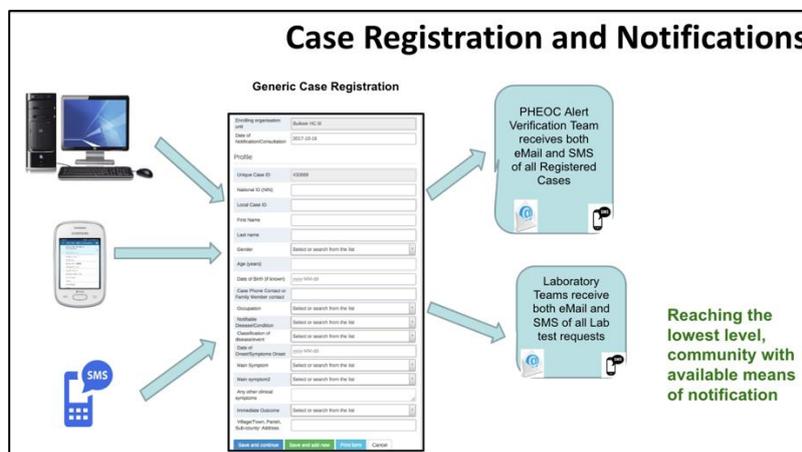


Figure 1. Design and functionality of the eIDSR-CBS system

Training of the regional and district surveillance staff: Training of regional staff in disease surveillance and case-based surveillance: A total of 97 West Nile region staff were trained in a five-days hands-on training covering both IDSR and eIDSR-CBS facilitated by HISP-Uganda, IDI, MoH and Uganda Virus Research Institute (UVRI) Laboratory teams. These were mainly health facility-based cadres (49%) and district political, health and veterinary administrative staff (43%), with 7% other staff (Table 1). Of the health facility staff, 69% of trainees were clinical, 23% laboratory and 8% were informatics or records staff. At the district level 21% were surveillance focal persons and 17% were biostatisticians while engaged in the management of surveillance data (table 2). For the districts, training had DHOs, DVOs and CAOs accounting for the trainees at district level (Table 2).

Table 2. West Nile region cadres trained in IDSR and eIDSR-CBS in Gulu (5th March 2018 to 9th March 2018)

Cadres trained	Number	Percentage of all trainees	Percentage for health facility or district level
Health facility-based staff	48	49%	
Medical Officers	9	9%	19%
Clinical Officers	16	16%	33%
Nursing staff	8	8%	17%
Laboratory staff	11	11%	23%
Other staff	4	4%	8%
District –based staff	42	43%	
DHO or assistants DHOs	12	12%	29%
Surveillance focal persons	9	9%	21%
Bio-Statisticians	7	7%	17%
Chief Administrative Officers	5	5%	12%
Other staff	4	4%	10%

Veterinary Doctors (DVO)	5	5%	12%
Other staff	7	7%	17%
Total trained from the West Nile region	97		

Issues addressed during training: The five-day training, conducted from 2nd May 2018 to 4th May 2018, addressed the principles of IDSR and eIDSR-CBS, the core and support functions for disease surveillance with one-day hands-on practice on eIDSR-CBS SMS alert messaging to 6767, responding to alert messages, registration of cases and updating suspected cases in the eIDSR-CBS web or android-based system. The training also provided the DSFP with copies of the national IDSR technical guidelines for reference.

Implementation of the eIDSR-CBS

Cascade training model: The After the training the DSFP were supported by HISP-Uganda staff to develop SOPs and schedules for cascading the training to all the health facilities within each district of West Nile region. During implementation the DSFP supported a total of 1071 health units' staff with hands-on training on eIDSR-CBS during 256 sessions of cascade trainings (Table 3). The training focused on how to use eIDSR-CBS to send SMS alert messages to 6767, registration and updating of registered cases within the e-IDSR system.

Mentorship and support supervision: On a quarterly basis, HISP-Uganda provided support supervision to the DSFP. HISP-Uganda staff with the DSFP reviewed the alerts that were being received through the system and conducted targeted visits to health units that were having challenges in utilisation of the eIDSR-CBS system. The team discussed the challenges and provided solutions, where necessary. The outcomes of the support supervision visits were used to upgrade the eIDSR-CBS system. The DSFP also provided support supervision to 298 (82%) health facilities, of the 363 that were targeted, during which 244 staff were supported (Table 3). During the support supervision sessions, the DSFP reviewed issues that the staff had with eIDSR-CBS and provided solutions to these issues in addition to reviewing health facility records for notifiable diseases that were either reported or not reported in eIDSR-CBS. During the support supervision visits the DSFP ensured that health facilities had adequate supplies of the relevant reporting forms at the health units. In the last quarter of the project each DSFP provided support supervision to health facilities within their respective districts to review utilisation of the eIDSR-CBS system and to address any challenges that health units' personnel were facing in implementing eIDSR-CBS.

Distribution of IDSR guidelines and eIDSR-CBS posters: A total of 362 IDSR guidelines and 1072 eIDSR-CBS posters were distributed during the cascade trainings and support supervision visits (Table 3).

Table 3. Cascade training, support supervision sessions conducted during the project in the West Nile region

Activities	Arua	Packwach	Nebbi	Koboko	Yumbe	Moyo	Adjumani	Maracha	Zombo	All
Cascade trainings	91	9	15	8	30	40	40	1	22	256
New HW trained	352	54	29	34	82	93	93	35	299	1071
Facilities targeted for SS	124	19	23	19	45	47	47	17	22	363
Facilities provided SS	91	18	22	16	32	40	40	17	22	298
HW provided with SS	142	13	43	10	20	4	4	8	0	244

Posters distributed	414	90	500	68	0	0	0	0	0	1072
Facilities using e-IDSR	98	3	23	1	3	0	0	14	9	151
Facilities missing reporting	73	16	12	8	5	1	1	0	22	138

Functionality of the e-IDSR system¹³: The eIDSR-CBS system uses the DHIS2 platform to provide real time case-based surveillance for notifiable diseases through sharing alerts for any suspicious disease condition that evokes a response from the PHEOC through the district surveillance system back to the health facility. The system is based on three platforms, the SMS, Web and Android versions.

Sending an alert through SMS messaging: When a notifiable disease case is suspected in the community or a health facility, the first person who identifies the suspect sends a message containing the person's age, gender, suspected disease, district, location to 6767.

Format of the message: Alert (space), Age, Gender of the suspected case, district, location, (Send to 6767).



Figure 2. Sample of received alert by PHEOC

The message is received at PHEOC response desk (Alert Verification Team) where the recipient of the automated SMS and email notification (Figure 2); calls the sender to get more detailed information about the suspected case. If the information obtained in the return call is suspicious of a notifiable disease, the PHEOC staff calls the DSFP of the district where the alert came from and informs them of the suspected case for the DSFP to follow-up. The DSFP follows up and liaises with the nearest health facility to have the suspected case investigated by a health service provider.

Registration of suspected cases and updating the system: Suspected cases are registered in the system either by PHEOC staff (Figure 1), after receiving and verifying the reported alert or by the service provider after seeing the suspected patient in the health facility. Specimens for lab confirmation of the suspected case are taken off and thereafter, registered in the system, as an update and processed to be ready for transportation through the specimen transportation hub network.

Integration of results into the system: The specimens are transported through the national HUB transport network, picked by motorcycle riders and taken to the regional hub, or specimens may be transported directly to Uganda Virus Institute (UVRI) Research Institute or Central Public Health Laboratories (CPHL) for testing. After testing the results are compiled and either entered directly into the system or provided to PHEOC, where staff integrate the results into the system for each case. The final approved results are sent from the laboratory to PHEOC, who thereafter, relays the results through the DHO to the health facility. A DHIS2 integration module/app was also developed to automate laboratory results between eIDSR-CBS and other information systems with well-developed Application Program Interface (API) (Figure 3). However, this method was not used widely since most laboratories have no systems and those with systems have no developed API.

Integration of specimen testing results in the system

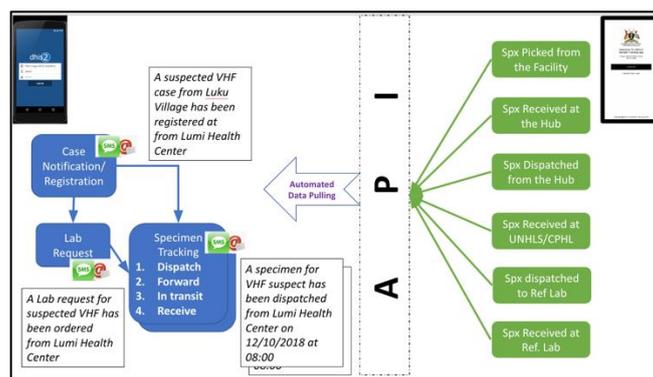


Figure 3. An eIDSR-CBS and Lab result integration (Generic tool for any DHIS2 integration)

Utilisation of eIDSR-CBS for sending alerts, registration and updating of cases

Utilisation of eIDSR-CBS as reflected with the number of SMS messages that were received in the e-IDSR system. A total of 1953 SMS messages were received between August 2019 and February 2019. The number of SMS messages received in the system increased from 134 in August to 345 in October and decreased to 169 and 121 in November and December respectively and later increased from January and February (Figure 3).

Implementation of the eIDSR-CBS project in the West Nile region

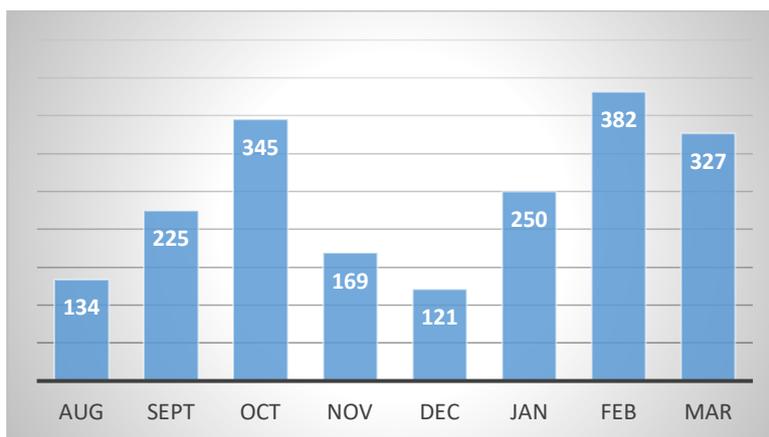


Figure 4. SMS alerts received in the eIDSR-CBS system from the West Nile region August 2018 to March 2019

Assessment of utilisation of the eIDSR-CBS system in the West Nile region during the KII

Health facility assessment: A total of 39 health facilities were visited during the assessment and almost all (97%) were engaged in IDSR activities with 54% actively using eIDSR-SMS. The project provided health facilities with IDSR and eIDSR-CBS IRC materials, including national IDSR guidelines, 68%, and eIDSR-CBS posters and SOPs, 47%. The facilities that received the IEC materials had the national IDSR guidelines available in 92% of health facilities and eIDSR-CBS posters and SOPs were available and displayed in 94% of those health facilities (Table 1).

The project also built the capacity of staff within the health facilities through training, cascade training and support supervision during the project period. Initial training by the HISP team and the DSFP was provided to 57% of health facilities in the evaluation, with the DSFP cascading the training and providing support supervision to 82% health facilities. The initial HISP-Uganda support to the DSFP, in training and support supervision, covered 15 (38%) health facilities, while cascade training and support supervision (by the DSFP) covered doubled the number (31, 82%) supported for eIDSR-CBS (Table 1).

Table 4. Performance of health facilities in implementing eIDSR-CBS project in the west Nile region

Doing disease surveillance	%age
• Engagement in disease surveillance in the last 12 months	97%
• Using eIDSR-CBS for disease surveillance	54%
• Provision of IEC materials and supplies for disease surveillance	
• Received IDSR guidelines	68%
• Have IDSR guidelines available	92%
• Received eIDSR-CBS posters	47%
• Have eIDSR-CBS posters displayed in the health facility	94%
• Training, support supervision and cascade training	
• Trained in eIDSR-CBS	57%
• Ever received training and or support supervision from DSFP	82%
• Ever received support supervision from HISP-Uganda	38%
• Utilisation of eIDSR-CBS in the health facility	
• Notifiable disease reported in registers	66%
• Notifiable disease in the register reported in eIDSR-CBS	40%
• Noted changes in reporting	43%
• Equipment and supplies for implementing eIDSR-CBS	
• Access to a telephone	100%
• Access to a computer	67%
• Computer is facility owned	50%
• Ever had stock out	32%
• Internet access available	50%
• Internet available for 4 or more days a week	44%
• Internet available for less than 4 days a week	56%

The main role of the health facilities in the implementation of eIDSR-CBS was providing registration and sending alerts for suspected cases of notifiable diseases. Most facilities (68%) had registered notifiable disease condition within the previous two weeks, with 40% of them having used eIDSR-CBS system for reporting and the (43%) in-charges of these health facilities noted increased utilisation of disease notification in their health facilities (Table 1).

eIDSR-CBS primarily used telephones for sending alerts, and if they had an android phone it could also be used for case registration and data capture purposes. All the health facilities had access to a telephone, owned by the facility, except four (11%) health facilities where the telephone was privately owned. However, availability of computers was found in 67% of health facilities, which belonged to the facility in half of the health facilities that had access to a computer. Internet access was found in 50% of health facilities, where it was available in only 44% of the health facilities for more than 4 days in a week (Table 1).

Findings from the key informant interviews

Participants in the 9 districts of West Nile were asked to provide their comments on relevancy of the project, effectiveness of implementation of the project, collaborations with other stakeholders, challenges that were faced during the implementation of the project, sustainability and the way forward with the project.

Relevance of the eIDSR-CBS project in the west Nile region

Vulnerability of the region to disease outbreaks: All the key informants from the 9 districts described the eIDSR-CBS project relevant to the needs of the regions through providing solutions for potential real-time notifications for disease surveillance. The region is high vulnerability to disease outbreaks and has faced repeated outbreaks of both human and zoonotic diseases, including anthrax, plague, cholera and meningitis among others, in the recent past years. With most districts in the region sharing borders with either the DRC or South Sudan, countries each have some forms of political instability that have resulted in people and animals from these countries to seek refuge in Uganda. These countries have also had repeated outbreaks of epidemic diseases that are likely to spread across the borders as the refugees come into the region to live in refugee camps with their animals.

Providing real time information and response on possible disease outbreaks: In these circumstances eIDSR-CBS is relevant and has provided a platform that ensures real-time reporting of suspected disease outbreaks in the districts through real time disease message alerts to PHEOC that provoke immediate follow-up of the suspected disease from the person sending the alert, and a quick response from the district for any suspicious diseases. This real-time early detection and investigation provides opportunities for early containment of any potential disease outbreaks in the region. The immediate response to the alert messages from PHEOC provides a platform for regular feedback and a communication channel between PHEOC, the District surveillance office, the health facilities and the communities on issues of disease surveillance within the region.

The utilisation of the eIDSR-CBS system at all levels of care from the district, health facilities and community cadres has opened their minds to the importance of reporting any suspected disease as soon as they detect it while they are at work. Thus, saving time for reporting suspicious disease conditions and provided fast responses from the district and MoH and reduced the time of response to limit spreading of infectious diseases. "eIDSR-CBS saves time for reporting and provides an avenue for faster response from the Ministry of Health and the district" DSFP Maracha district.

Building the capacity of staff for case-based disease surveillance: Implementation of eIDSR-CBS has provided a team of staff with skills to handle both IDSR and case-based surveillance through training staff in integrated disease surveillance (IDSR) and the electronic component, eIDSR-CBS from the, regional, district, health facility levels up to the community level cadres. eIDSR-CBS which is the platform for case-based disease surveillance provides for real-time detection, reporting and eliciting an immediate response from MoH-PHEOC and the district. Starting with the December 2017 training of DHOs, DVOs, DSFP and some health facility in-charges in Gulu, the cadres trained from Gulu have cascaded eIDSR-CBS training to other staff in the same and other health facilities and in some cases up to the community cadres. These trainings came at a good time because the staff had never had coordinated trainings IDSR training before. The cascade training enabled the Gulu trainees to train their colleagues in eIDSR-CBS from hospitals to HCIIIs by both HISP-Uganda and the DSFP in the region. These trainings have put in place a team of staff from the District up to the community with skills and capacity in managing eIDSR-CBS and have provided confidence and opportunities to make disease surveillance a responsibility for every staff from the district to the community levels. At the same time eIDSR-CBS has also made district officials sensitive, accountable, responsible and responsive to the alerts that arise from their respective districts. *"eIDSR-CBS has provided capacity building for staff at district and health centres levels and has provided an opportunity to make disease surveillance a responsibility of everyone at the health facility and the districts accountable and responsive for the alerts" DHO Maracha and DFSP Koboko.*

Enhancement of collaboration among different stakeholders: Related to building skills the district officials feel that the implementation of eIDSR-CBS in the districts has made different district stakeholders more responsive to doing disease surveillance as a team and provided opportunities for engaging human and animal disease surveillance stakeholders as a team¹⁴. *"After the IDSR training in Gulu and the eIDSR-CBS workshop in Arua, the veterinary work force has managed to cascade the training to the local veterinary officers. This has led to increased reporting of animal deaths that happened during the suspected anthrax outbreak in the district" DVO Arua district.*

The main focus of eIDSR-CBS was to improve surveillance of human diseases, however, eIDSR-CBS implementation in the region has spilled over to the veterinary leading to increased communication

on disease surveillance among the districts' veterinary staff, although the communication currently relies on costed SMS and telephone calls. This is evidenced by the DVO Koboko district who observed that, *"Although eIDSR-CBS was implemented on the human side, it has provided an avenue for increased communication among the veterinary staff to the DVO and alerting MAAIF through a simple form of communication. An example is the increased SMS reporting of animal related diseases to the DVO in Koboko and Arua districts during the recent Anthrax outbreak in Koboko district"*. The DVO Maracha district also had similar observations that eIDSR-CBS has had an effect on disease reporting of zoonotic diseases *"eIDSR-CBS has improved people's awareness of diseases especially those that infect both humans and animals"*.

Improved communication and feedback between the different cadres in the district: eIDSR-CBS improved communication between the different cadres from clinicians to the laboratory staff. Information is immediately available to the staff, through the system for information on sample collection and tracking along the hub system. The system also provides immediate information feedback and short turn-around time for information flow across a wide spectrum of stakeholders from clinicians to the local laboratories, hub laboratories and the central animal and human laboratories. *"eIDSR-CBS has also improved communication, feedback and turn-around time for information flow"*. *"The system has created an improved and effective real time sample tracking system related to the sample hub system"*. This was an observation by the Koboko Biostatistician and was also echoed by the Maracha DHO who noted that, *"eIDSR-CBS has reduced the time of diagnosis through suspecting diseases early and having specimens taken for diagnosis through the hub"*. The improved communication has also provided a wider geographical scope where to gather information starting from the community level up to the national level, according to the DHO Koboko district *"The inclusion of the community and lower health facilities has widened the geographical scope of where to gather information from deeper within the community up to the village level."* Koboko district DHO.

1. Effectiveness of the implementation strategies for eIDSR-CBS in the West Nile region

The main strategy used to implement the eIDSR-CBS project in the West Nile region was effective because all the activities of the project were based on strengthening the capacity of the existing MoH systems and structures to enhance disease surveillance activities within the region.

Utilisation of existing MoH structures: The project integrated the surveillance activities into the existing and functional MoH health sub-district structures from the district level through the health facilities (Hospital to HC II) and the community Village Health Team (VHT) system. Through these structures, health facility and community staff were able to send alerts messages that were responded to through the MoH and district surveillance structures. Utilising the existing MoH structures ensured that eIDSR-CBS activities became part of MoH activities that could be integrated into the activities of MoH staff from MoH headquarters to the village level. Specifically, the integration of eIDSR-CBS activities and engaging the district staff in implementation was a good strategy to get buy-in from the district to the extent that the activities of eIDSR-CBS have been incorporated into the regular reports that are submitted to the district. This has provided a platform to engage the district leaders and politicians to support eIDSR-CBS. *" The district staff provided support supervision and cascaded eIDSR-CBS training to the lower health facilities"* *The district has also provided meetings that give a platform for implementation and improvement of eIDSR-CBS in the district".....* *"The reports that have come from the project have been used to engage the politicians to support coordination"* DHO Koboko and DHO Maracha district.

This has resulted in the district supporting activities of eIDSR-CBS through providing MoH structures, allocating resources for transport, time and fuel to support cascade training, providing access to telephones, internet and computers for eIDSR-CBS reporting and availed extra time for DSFP to support cascade training and supervision to health facilities. *"The district provided the district and MoH structures for the implementation IDSR.....District provided internet, telephones and computers for use in eIDSR implementation.....The district has provided staff and resources for transport (Motorcycles, time and fuel) to facilitate cascade training and support supervision."*

Integration of eIDSR-CBS activities into daily activities and surveillance activities: The integration of eIDSR-CBS activities into the activities of the existing MoH and district staff, ensured

that project did not require new human resources for implementation and exploited the existence of staff who were in place and already engaged in surveillance activities (the district surveillance focal person (DSFP), were capable of handling surveillance data (the district bio-statistician and health information officers) and were handling patients at the primary level (community VHTs and health inspectors) and within the health facilities (clinicians, laboratory staff and health facility data and information assistants). These staff were also already familiar with the areas where surveillance activities needed to be focused. This strategy of engaging existing staff created a sense of ownership and responsibility among the district staff and reduced the costs that would have been used to engage new staff for eIDSR-CBS. *"The project is part of health systems strengthening in disease surveillance in the district..... eIDSR-CBS has provided training to staff from the district to the health facility level through cascading the training by DSFP and HISP staff" DSFP Maracha district.*

Building the capacity and providing skills to existing staff: The project provided life-long eIDSR-CBS surveillance skills through DSFP, DHOs, DVOs and facility in-charges in IDSR and eIDSR-CBS, provided training and mentorship skills among the DSFPs, who became trainers of other staff in eIDSR-CBS during the cascade trainings and mentorships.³ These trainings enabled to the DSFP to cascade eIDSR-CBS training to other staff and to conduct support supervision and mentorships after the training. This strategy put in place a team of eIDSR-CBS trainers and mentors in the region with hands-on experience in eIDSR-CBS and with skills in training, mentoring and supervising other staff in eIDSR-CBS activities in the region. The strategy also provided opportunities to carry out more trainings within the short time of the project. *"The implementation of the project was effective and provided a platform for mentoring and training the staff in the lower health facilities to have knowledge of IDSR through the cascade trainings and support supervision". DHO Maracha district.*

Using simple and available resources for messaging: The utilisation of toll-free SMS services for alerts whose training was delivered in using simple instructions, simple short messages and using a code 6767, which the staff were already familiar with ensured that the tasks and activities of eIDSR-CBS were simple enough and not time consuming for staff to integrated within their daily routine activities. The code 6767 is also used for the weekly surveillance reporting mTrac (Rapid Pro implementation). However, mTrac users need to have their telephone numbers registered, while for eIDSR-CBS related SMS messaging does not require registration, making alerting concerned staff about possible disease outbreaks a responsibility for almost all persons from within the community up to the health facility levels.

Spreading eIDSR-CBS training and ensuring on-going support to eIDSR-CBS users: Cascading training through the DSFP increased the coverage of eIDSR-CBS training within a shorter time and the follow-up with mentorships and support supervision by HISP-Uganda ensured that the DSFP were able to support the lower facilities, while the support supervision and mentorships by the DSFP ensured that the staff trained through the cascade can be able to implement eIDSR-CBS in facilities that could not be reached by HISP-Uganda and that the staff implementing eIDSR-CBS in the facilities were supported by each district to implement eIDSR-CBS. This provided a platform for on-going engagement of the DSFP and the staff implementing eIDSR-CBS staff for addressing challenges and difficulties staff faced in implementation regularly. *"The implementation was effective and provided a platform for mentoring and training the staff in the lower health facilities to have knowledge of IDSR through the cascade trainings and support supervision." DHO Koboko district....."The provision of support supervision has enabled on-going support for the staff within the health facility and has provided trouble shooting for staff that were experiencing problems".*

Using simple instructions that are written and displayed within the places of work: Implementation of eIDSR-CBS is based on the IDSR guidelines that are enhanced by simple instruction and guides on using eIDSR-CBS for case-based surveillance. These simple instructions were easy to the eIDSR-CBS implementers to understand and use for disease notification. These instructions were provided to staff in hard copies and displayed in places where staff were operating for ease of reference whenever they were needed. *"Project provided training of existing staff, distributed posters and SOPs that had short and simple instructions on how to use the system for staff to refer to.....". The DHO, DSFP and health facility staff.*

2. Collaborations with stakeholders in disease surveillance

Implementation of eIDSR-CBS in West Nile engaged the different stakeholders with interest in disease surveillance from the level of ministries to the community level. The project was implemented on behalf of MoH from the Public Health Emergency Operating Centre (PEOC) to district health structures up to the community level. Specifically, the project has increased collaboration and contacts with the veterinary disease surveillance and communication between the DHO and DVO offices at the district level. With eIDSR-CBS being implemented for human disease surveillance in the region there has been increasing collaborations with the DHO and DVO regularly exchanging information about possible zoonotic disease outbreaks and the veterinary and human health staff have become more aware of the importance of zoonotic diseases surveillance *"eIDSR-CBS has established collaborations with the veterinary side of disease surveillance and has improved awareness of diseases that need to be reported especially the diseases that affect both humans and animals."* DHO Koboko and DVO Maracha.

The district leadership has provided collaborations with the district surveillance officer and included surveillance plans and budgeting in the district work plans for future funding. The district leadership has also provided more support to health facilities and communities for eIDSR-CBS related cascade training, mentorships and support supervision. The district rapid response team (DRRT) has also been provided with more resources for following up cases that are reported through the eIDSR-CBS SMS alerts. The implementation of the eIDSR-CBS project brought together several partners including African epidemiological network (AFENET), Infectious Disease Institute (IDI), HISP-Uganda, MoH-EOC and the West Nile region districts, including public and private health facilities. Infectious Disease Institute (IDI), as the West Nile implementing partner, who were funded by CDC-Uganda Global Health Security, while HISP-Uganda and MoH-EOC provided technical support during the implementation of the project. AFENET provided technical support by training staff in IDSR supported by HISP-Uganda who provided the case-based surveillance component as eIDSR-CBS during the training. This training created a network of human and veterinary staff with IDSR and eIDSR-CBS knowledge in the region.

After the Gulu training, HISP-Uganda, working with the regional surveillance and laboratory focal persons of the west Nile region, oriented the DSFP of the nine West Nile region districts in eIDSR-CBS and techniques for cascade training, mentoring and support supervision of the health facilities. IDI, the primary implementers of the project in West Nile and HISP-Uganda, provided technical experts in eIDSR-CBS who worked with the regional MoH structures in the West Nile Region to support the DSFP in providing support supervision and mentorships to the health facilities within the region. IDI, also supported the production and distribution of eIDSR-CBS IEC materials that were distributed to the health facilities. *"IDI has provided support, funding and staff to supervise the implementation of the project.....HISP-Uganda has provided funding, training and support supervision to DSFP and health facilities in eIDSR-CBS.....and before thatAFENET has provided training to the DSFP in IDSR with support from HISP-Uganda for the eIDSR-CBS component."*

3. Challenges faced by the implementers of eIDSR-CBS within the region

Limited availability of android phones, computers and internet access for eIDSR-CBS: The users of eIDSR-CBS at the facility level had challenges related to lack of android phones for registration and capturing data on suspected cases. This limits most users from going beyond sending alerts. Related to this is the registration and updating the eIDSR-CBS system that require one to be registered in addition to using android phones or computers and requirement for internet access and connection for use. Android phones and computers are not readily available within the lower health facilities and in community, while internet connection, that also attracts a cost for connection is also not easily accessible. These facilities face limitations in registration and updating cases in the system, thus leaving cases that are investigated not registered within the system, however, there are options for using the tollfree SMS messaging to have the cases registered and updated through MoH-EOC and HISP-Uganda. Much as the android version of eIDSR-CBS has offline capabilities, it also requires internet connectivity to synchronize data with the central server.

Lack of access rights for cascade trainees to the eIDSR-CBS system: This also related to having rights and access to registration of cases and updating in the system. The system was designed to have

access rights for one to register and update cases. However, during training staff are required to be provided with access rights to the system. Although the primary trainees and the first level cascade trainees are provided with access to the system through the DSFP, the project did not have measures to have the subsequent cascade trainees to be provided with access, thus limiting them to only sending alerts to 6767, a procedure that does not require one to be registered in the system. *“Much as more staff are trained to use the free SMS alert sending component to 6767, there are fewer staff who have the ability and access to do registration and updating the system. This specifically is a challenge for the secondary and subsequent cascade trainees who have to rely on HISP-Uganda to get access to using the system beyond sending alert SMS”*. DHO Marach district.

Challenges with knowledge about eIDSR-CBS and trainings

Cascade trainings not covering the full IDSR training content: eIDSR-CBS is regarded as the electronic component of IDSR that provides real-time case-based surveillance for cases. However, while the initial training to the DSFP covered both IDSR and eIDSR-CBS, the cascade training only covers the eIDSR-CBS component therefore limiting the knowledge gained through cascade training to only eIDSR-CBS. Although staff can get the IDSR information from the guidelines provided in the “Blue book”, there are very few copies that are available in the districts and at health facilities.

Limited cadres of staff in the district trained in eIDSR-CBS at the district and community levels: eIDSR-CBS training have covered some staff within the district, focusing on DHOs, DVOs, DSFP and health facility staff. However, the politicians at the district and except for very few community cadres have been sensitised about eIDSR-CBS and have not been provided with access to the system. Similarly, although IDSR has been practised in the region through sending weekly surveillance reports using mTrac (again to 6767), the component of eIDSR-CBS is seen as a new addition, with which people are not very familiar, to the extent that some staff expect to get extra remuneration for the services.

eIDSR-CBS utilisation has not yet been fully implemented at community level: eIDSR-CBS has been implemented up to the facility level, however, the implementation at the community level is still limited to very few cadres, thus many cases that occur in the community and not getting to health facilities may not be reported.

Limitations of resources dedicated to eIDSR-CBS: The districts have limited resources for their operation and implementation of eIDSR-CBS. This makes staff implementing IDSR and eIDSR-CBS in the district to have low motivation and poor attitudes towards implementing the project, ending up not sending alerts, and the DSFP have challenges with fuel and transportation to investigate reported cases.

Discussion

This evaluation established that implementation of the eIDSR-CBS system is feasible in the West Nile region. The pilot project provided a real-time case-based system for notification of disease outbreaks in the region and put in place staff with capacity to utilise the system within the region, starting from the regional and DSFP with skills to train other surveillance staff in eIDSR-CBS. The project is relevant for the West Nile region due to its vulnerability as a result of the many numbers of refugees and refugee camps within the region and the occurrence of repeated epidemic diseases outbreaks that occur in the neighbouring countries.

The success of the pilot project relied on the utilisation of the cascade method to train lower health facility staff in eIDSR-CBS provided both trainers, with capacity to train many other staff in implementing eIDSR-CBS within a short time. The project also utilised the existing MoH structures and integrated eIDSR-CBS surveillance activities into the daily activities and surveillance activities and built the capacity and skills to existing staff.

The project achieved the following; enhancement of collaboration among different stakeholders; improved communication and feedback between the different cadres in the district. However, the project experienced challenges that included limited availability of android phones, computers and internet access for eIDSR-CBS, lack of access rights for cascade trainees to the eIDSR-CBS system, the limited knowledge about eIDSR-CBS and trainings among the staff who are yet to be trained. Other

challenges were limited utilisation of eIDSR-CBS utilisation at community level and the limited of resources dedicated to eIDSR-CBS.

Conclusion and recommendations

Implementation of eIDSR-CBS is feasible in resource limited setting through utilisation of existing MoH and district structures¹⁶. eIDSR-CBS is very effective in case-based surveillance through providing real-time reporting of disease outbreaks. However, the staff from the district, through the health facilities and the community cadres need to be trained in using the system for effective early disease detection and early containment of any potential disease outbreak.

Cascade trainings is a very effective way of dissemination of eIDSR-CBS knowledge to lower cadre staff and creates ownership, responsibility and increases the human resources that are available for both cascading the training to lower cadres and an exponential work force available for disease surveillance. This method makes scaling-up and dissemination of training feasible within limited resource settings without starting the available low resources. Cascade training up to the community level staff provided a large number and wide range of cadres available for disease surveillance in the districts, in addition to increasing the geographical scope of human resources coverage for disease surveillance within the region.

The instruction for eIDSR-CBS are very simple and can be understood and performed by a wide range of cadres without being limited by level of education and professional training. This enabled the engagement of community cadres, including VHTs, Health Assistants local leaders and health inspectors. Engagement of these cadres is more likely to have disease outbreaks detection done earlier within the community that at health facility level.

Engagement of local district politicians and local leaders in IDSR and eIDSR-CBS activities will enhance the sustainability of disease surveillance in the region. Once these leaders are aware of the importance of disease surveillance, they are likely to integrate and budget for disease surveillance activities. Similarly, engagement of corporate organisations within the region to exercise corporate responsibility will provide more resources that will be available for disease surveillance activities in the region.

Disease alerts are sent to MoH-PHEOC from all over the country after which, PHEOC communicates with the DSFP. As eIDSR-CBS is scaled up in the country, these alerts may overwhelm PHEOC and reduce their effectiveness in timely response to alerts. The future may require directing these alerts to the district level for earlier response to the alerts and to reduce the alert load for PHEOC to respond to. This is related to the activities for surveillance by the DSFP, who has to support surveillance in addition to other duties. The creation of the DSFP as a position in the district and giving them duties of responding to alerts, will reduce the burden of work from other duty responsibilities and create a sense of responsibility to be able to respond to disease surveillance alerts.

The evaluation also recommended some improvements in the design like adding more data elements for more informed case investigations and development of a rumour module that will include all levels of health structures while broadcasting the initial alerts.

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