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IOA Field Exchange

INTEGRATED OUTBREAK ANALYTICS

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GOARN

In this issue

Integrated Outbreak Analytics (IOA), applies a multidisciplinary approach to understanding outbreak dynamics to inform outbreak response. It aims to drive comprehensive, accountable, and effective public health and clinical strategies by enabling communities, and national and subnational health authorities to use data for operational decision-making. IOA embraces a holistic perspective of outbreak dynamics throughout: from the research questions to the data that are collected or accessed, to the interpretation of results and the recommendations that follow. In addition, IOA promotes co-development and monitoring of evidence-informed recommendations with Ministries of Health

The IOA Field Exchange

The aim of the IOA Field Exchange is to share Integrated Outbreak Analytics (IOA) initiatives and experiences from across the world, at different levels, to facilitate dialogue between and learning opportunities for individuals and organisations working in IOA. We aim to highlight the benefits of IOA to public health emergency response and evidence-based decision-making but also to discuss the realities of IOA in practice, the challenges and lessons-learned. IOA will always vary context to context and we respect and encourage that diversity.

Integrated Outbreak Analytics (IOA) and One Health

Human and animal travelers on a motorcycle in Kenya help highlight the need for a "One Health" approach to global health security.
(Credit: Joseph Kibachio, Kenya Ministry of Health and TEPHINET)

Integrated Outbreak Analytics and One Health: A Collaborative Framework for Comprehensive Health Responses

Rachel Goodermote (IFRC)

Both Integrated Outbreak Analytics (IOA) and One Health are centered on the need for transdisciplinary, multisectoral collaboration. As the global landscape of disease outbreaks becomes more complex and interconnected, the importance of integrating diverse perspectives and datasets cannot be overstated. IOA represents a multidisciplinary approach to outbreaks and public health emergency response, aiming to gather and utilize a wide range of information to address specific challenges. In this way, IOA draws from epidemiology, sociology, anthropology, ecology, and more, to deliver a more holistic, evidence-driven approach to understanding outbreak dynamics at the local level.

When combined with One Health principles, IOA's approach is further enhanced. One Health recognizes the interconnectedness of human, animal, and environmental health, and emphasizes the need for cross-sector collaboration to optimize health outcomes. This framework enables a more holistic understanding of disease dynamics by incorporating data from not only public health, but also veterinary medicine, wildlife biology, environmental science, and many other disciplines. Figure 1 below shows examples of how multisectoral, transdisciplinary data from human, animal, and environmental sources can be applied through the IOA approach.

The integration of One Health principles with IOA enriches outbreak response by

Mapping IOA information use across One Health

Figure 1: Example of how the One Health approach can be applied through IOA

ensuring that animal and environmental data are considered in tandem with human-centred information. This multi-sectoral collaboration ensures that IOA not only responds to the immediate human impacts of an outbreak but also considers the broader ecosystem and behavioral factors that may contribute to the introduction, spread, and persistence of diseases. The complementarity of these two approaches enhances IOA's ability to provide timely, effective, and sustainable solutions in outbreak situations, making them a powerful duo in tackling public health emergencies.

This edition of the IOA Field Exchange focuses on how IOA and One Health come together to form a robust, data-driven, and collaborative response framework for disease outbreaks and issues of public health concern. We share examples from Ethiopia where the development of a One Health surveillance system has improved information-sharing across actors for more holistic responses. In Kenya, the application of One Health and the IOA approach to integrate ecological, environmental, and socioeconomic analyses has been used to inform mitigation efforts for snakebites. In the final example from Uganda, we learn how integrated community-sourced data has been used to collaboratively respond to a zoonotic outbreak of anthrax.

These articles share opportunities and challenges in applying the IOA and One Health lens together which are more pertinent today than ever as we face multiple mpox epidemics throughout the African continent and look to fresh ways to collaborate across disciplines to prepare and respond to zoonotic diseases. Considerations moving forward include: How can we improve the inclusion of environmental and ecological experts earlier in zoonotic outbreaks and environmental and toxicological exposures? How can the IOA approach be used to strengthen response to epizootic outbreaks and outbreaks among animals before they reach or begin having significant impacts on human populations? What elements from the One Health approach can we integrate more holistically to all IOA implementations to improve our understanding of an outbreak's dynamics, whether or not it is zoonotic in origin? We continue to collaborate across frameworks and outbreaks to enhance multisectoral coordination and improve the efficiency and timeliness of response efforts.

One Health surveillance and response: A case study from Somali regional state of Ethiopia

Yahya Osman[1,2], Jakob Zinsstag[1] and Rea Tschopp[1,3]

[1]Swiss Tropical and Public Health, Kreuzstrasse 2, 4123 Allschwil, Switzerland
[2]Jigjiga University, PO Box, 1020 Jigjiga, Ethiopia
[3]Armauer Hansen Research Institute, Addis Ababa, Ethiopia

Ethiopia has a large livestock population and ranks the second most populous country in Africa. More than 80% of citizens depend on agriculture, where livestock plays a significant role in the livelihood of communities. There is close contact between humans and animals, potentially putting communities at risk for zoonotic diseases. Countries where livelihoods depend on livestock are at risk of a substantial zoonotic disease burden (Pieracci, Hall et al. 2016). Furthermore, a recent cross-sectional study in the Somali region revealed exposure of both humans and livestock to Rift Valley Fever (RVF), brucellosis, and Q-fever, highlighting the importance of collaboration between human and animal health sectors in controlling zoonotic diseases. An evaluation conducted by the International Health Regulations (IHR) in 2016 indicated that in Ethiopia, communication and collaboration between animals and the public health sector is very weak and occurs on an ad hoc basis (WHO, 2016). In addition, there is no disease-sharing information mechanism; hence, the IHR recommends that the government establishes integrated human and animal disease surveillance and response for routine and emergency zoonotic diseases and strengthens joint interventions (WHO 2016). Subsequently, Ethiopia undertook significant efforts to enhance intersectoral collaboration in alignment with the One Health approach. These include the establishment of a national health steering committee, development of a national health plan, formation of technical working groups, prioritizing zoonotic diseases, and signing multisectoral agreements (Epiz 2019, Erkyihun, Gari et al. 2022). Moreover, the similarity between the surveillance reporting flow structures of human and animal disease surveillance systems in Ethiopia would help in the implementation of the One Health Surveillance and Response System (OHSRS). However, operationalizing the OHSR remains challenging in Ethiopia.

Given the identified challenges, a study was conducted to assess the feasibility of operationalizing a OHSRS in Adadle, Shinile and Gode districts of Somali Regional State of Ethiopia (SRS) between February 2020 to June 2024. The aim of the study was to improve the weak collaboration in disease surveillance-response between the human and animal sectors. We set up a community-based health surveillance system using existing surveillance systems where the staff of both human and animal health sectors were linked, and the human and animal health information (HAHI) communicated at all levels from the village (including community members) to the national level. At the community level, village community animal health workers (CAHWs) and community health workers (CHWs) were linked and shared HAHI. This information was then shared with the district focal point, where both human and animal health surveillance focal points shared the same office in the One Health Surveillance and Response Unit (OHSRU). Once the unit receives a call from the CAHWs or CHWs, and animal health or human health staff at kebele or village, the human and animal surveillance focal persons of the unit sit together, share the report and discuss whether the report meets the case definition of the prioritized zoonotic disease outbreak notification.

To enhance the system's effectiveness in facilitating timely disease information transmission and response, a digital reporting system was developed. This involved creating a joint Epidata collection application (JEPiCA) for prioritized zoonotic diseases. The JEPiCA enables OHSRU staff to enter data via Android smartphones, triggering immediate email alerts about the disease outbreak to the Public Health Disease Prevention and Control Directorate (PHDPC) and Animal Health Disease Prevention and Control Directorate (ADPC). The directorate received an alert of the outbreak, irrespective of zoonotic outbreaks occurring in animals or humans. The Somali Regional One Health Task Force (SROHTF) where the health bureau (represented by PHDPC), livestock bureau (represented by ADPC), environment bureau, Jigjiga One Health Initiative, the Food and Agriculture Organization, the World Health Organization and other relevant partners were responsible for overall follow up and monitoring of the surveillance system. The task force is co-chaired on a rotating six-month basis by the health and livestock bureaus. SROHTF triggers a response when a zoonotic alert is received. The detailed coordination mechanism and means of communication is illustrated in Figure 1.

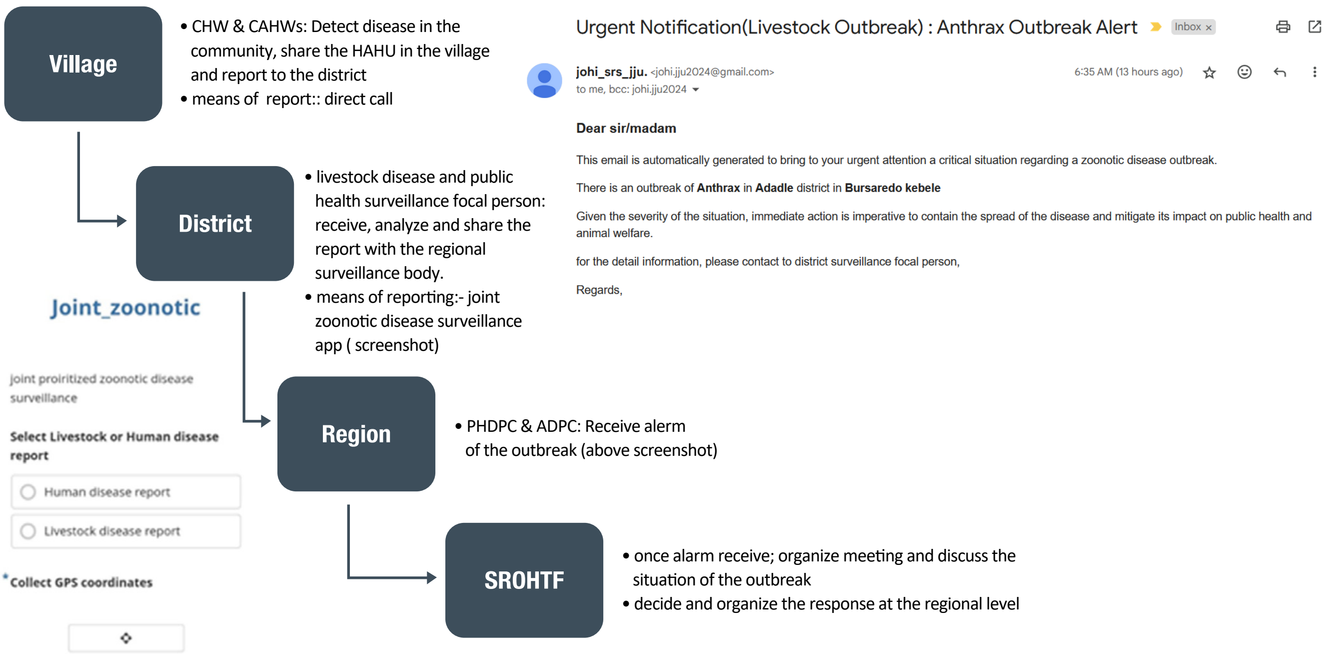

Figure 1: Coordination mechanism and means of communication of HAHI at different levels of administration.

During the study period, anthrax (Figure 2), rabies, suspected Rift Valley Fever (RVF) (mass abortions), foodborne illness and unknown disease outbreaks were detected and shared among the sectors at the different levels of surveillance . Joint responses were organized and conducted collaboratively by the sectors through the SROHTF to mitigate the impact of the zoonotic outbreaks. The linkage of both health staff and mobile technology applications contributed to the early detection and response to zoonotic diseases. Innovative technologies such as mobile applications have the potential to improve disease surveillance using the One Health approach (Karimuribo, Mutagahywa et al. 2017).

Figure 2: Cattle with unclotted blood oozing from the nasal orifice, reported by CAHWs

This streamlined communication between sectors fosters rapid zoonotic outbreak detection and a more coordinated response. Therefore, we believe this system will help to operationalize OHSR in SRS and subsequently country-wide as it is designed to be implemented using the existing surveillance systems. The joint database/application used during the pilot study was validated and endorsed through a broad consultative workshop, in which all relevant stakeholders were involved in analysis and interpretation and the implementation of OHSR. Having stakeholders from various backgrounds engaged throughout the process brings a more holistic approach to understanding outbreak dynamics at the local level. However, challenges such as limited diagnostic capacity for zoonotic disease, limited capacity to respond to zoonotic diseases, under-resourced human and animal health services, traditional sectoral silos, and lack of data ethics/sharing agreements that enable partners to share information more easily and quickly across sectors should be addressed to successfully implement OHSR in Ethiopia.

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Mitigating snakebite occurrence using a One Health approach: a Case Study

Eleanor Collinson and Alex Bowmer (London School of Hygiene & Tropical Medicine, On the Edge, and the Zoological Society of London)

Introduction

Snakebites pose a significant threat to public health globally, with an estimated 1.8 million cases and 81,410 to 137,880 deaths annually (1,2). However, more recent studies suggest the actual burden may be much higher, particularly in remote regions where victims often do not access and receive treatment at a health centre (3–5). Snakebite risk is thought to be linked to factors such as poverty, land use change and occupation, but the extent is not fully known (6–8). Considering that global snake populations are declining rapidly due to a variety of threats, understanding the full burden of snakebites requires a One Health approach (9–11).

Our multidisciplinary research aims to address the challenges of underreporting of snake bites, to better understand how snakebite burden is changing with changing landscapes. By integrating ecological, environmental, and socioeconomic analyses, in an integrated outbreak analytics (IOA) approach, our research has begun to unravel the relationship between snake ecology, human activities, and climate change on snake bite risk.

Figure 1: Image depicting a Puff adder *'Bitis areitans'*, the species responsible for the majority of snakebite-related fatalities across Kenya and Africa as a whole (26)
(source: Google Images)

Snake ecology in Kenya

In Kenya, snakebite incidence is the leading cause of human-wildlife conflict (Figure 1), making up 44.8% of all claims made to the Kenya National Compensation Scheme (for victims of wildlife attacks), before snakebite was removed from the compensation scheme in 2019 (12). Regional studies in Kenya report conflicting information on bite patterns, with varying results on the time of day, season, sex and age of victim, location, and activities most associated with bites (13–19). Snake ecology likely plays a crucial role in understanding envenomation patterns and regional variations in snakebite incidence; however, it is currently an unexplored topic. Furthermore, a deeper understanding of snake ecology may better direct health care response and appropriate antivenom supplies. Antivenom supply is limited in Kenya, with stockouts commonplace in public facilities (a report from 2021 found that antivenom was only available in 45% of public health centres) and prohibitive costs in private facilities (median cost of a vial of antivenom equal to about 14 days wages) (20,21). These findings highlight the importance of preventative strategies in the mitigation of snake envenomation.

Additionally, the ecological role of snakes in balancing ecosystems and controlling vermin populations, which decimate food sources and spread diseases, is often overlooked (22,23). Many non-venomous or mildly venomous snake species fill this role around human settlements (24). However, these non-venomous species are also often killed on sight out of fear. It is important to understand snakebite occurs when human and snake activity overlap, that snakes do not actively hunt humans, and that envenomation occurs as a defensive action (25,26). Education on preventative measures and de-escalation techniques to avoid bite incidence are therefore of urgent importance (27). Understanding snake ecology in a changing world, such as which species are likely to increase with changing climate and land use, can also help inform preventative strategies and health care response. To address this knowledge gap, we are embarking on a One Health project, involving ecological, environmental, and socioeconomic data analysis; ethnographic fieldwork; spatial modelling; and community engagement and storytelling, over the next 3 years.

How will we do this?

Kenya is home to 29 species of venomous snakes, of which 13 are considered medically significant by the World Health Organisation (26). We conducted an unpublished literature review on the suspected drivers of snakebite incidence across Kenya and identified prominent ecological and human risk factors for being bitten. We will use these risk factors to model landscape risk maps for Kenya, indicating areas of high and low risk for snakebite (and the species responsible for this risk), as well as highlighting species of conservation concern. This will be done for present-day and future projections (under different SSP-RCP scenarios, as laid out by the United Nations Intergovernmental Panel on Climate Change (IPCC's) sixth Assessment Report (AR6) (28)). These prediction maps will be validated at a local level using an in-country network of snake catchers, in collaboration with in-country partners at the Zoological Society London - Kenya branch, and the National Museums of Kenya (NMK).

We will also carry out ethnographic fieldwork within communities in contrasting regions of high and low land use change. In these villages, we will conduct participatory walking and mapping exercises and the recording of oral histories with community members from different occupational backgrounds. This will be done to investigate if perceived human-snake conflicts have changed over people's lifetimes, and exploring any links to land-use, climate, and human population changes (Figure 2). Finally, we will observe current community engagement programs for snakebite awareness run by our in-country partners and measure the impact of these programs. This will be done to assess changes in community attitudes and knowledge regarding venomous and non-venomous snakes before and after educational interventions. We will use the results of the study to develop and improve community engagement activities, which will include working with experts and community members to provide clear advice on what to do when encountering a snake, to de-escalate the situation and avoid a bite occurring.

Our research uses multisectoral data to create predictions that can contribute to practical solutions, grounded in

Figure 2: Agricultural and land use practices in Kenya

Photo Credit: Sam Bisso

science and community engagement, to mitigate the burden of snakebites in Kenya. By understanding the ecological drivers and human-snake interactions, we aim to pave the way for effective prevention strategies that protect both human and snake populations, upholding the delicate balance of ecosystems.

Conclusion

Embracing a One Health and IOA approach, our research seeks to increase awareness and unravel the complexities surrounding snakebite burden, emphasizing the interconnectedness of human health, environmental health, and conservation efforts. We aim to empower communities with the knowledge needed to prevent snakebites and promote coexistence between humans and snakes.

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Integrating Community-Sourced Information to Respond to an Anthrax Outbreak in Kyotera District, Uganda

Suudhi Bamutya[1], Joseph Kasumba[1], Henry Mbatha Musembi[2], Harriet R. Kagoya[1]

[1]Uganda Red Cross Society
[2]International Federation of Red Cross and Red Crescent Societies (IFRC)

Background

On 29th November 2023, the Ugandan Ministry of Health (MoH) declared an outbreak of Anthrax in Kyotera district. In fact, the outbreak is believed to have started much earlier, in June 2023, in cattle that died suddenly but went unreported. The disease gained more attention when it spread to humans resulting in 35 people becoming ill and the sudden and mysterious death of 12 people. This prompted the district and ministry officials to conduct investigations. Uganda Red Cross Society (URCS) with support from the International Federation of Red Cross and Red Crescent Societies (IFRC) joined the Ministry of Health (MoH), Ministry of Agriculture Animal Industry and Fisheries (MAAIF), and the District Task Force to support the strengthening of information coming from community structures including public health and animal disease surveillance, key stakeholder mapping, and community feedback data and analysis linked to risk communication and community engagement (RCCE).

An Integrated Outbreak Analytics (IOA) Approach: Different community data sources and their use in the response

1. Community-based surveillance data

Uganda Red Cross supported the multi-sectoral Kyotera District Task Force with identification and training of 100 community health volunteers in epidemic preparedness and response in communities and Community-based surveillance (CBS). The deployed volunteers undertook RCCE activities in the sub-counties of Kabira, Nabigasa, Kyotera town council, Kalisizo town council, Kasaali and Kasasa, covering 100 villages, and reported suspected cases for the period December 2023 to February 2024 (Figure 1)

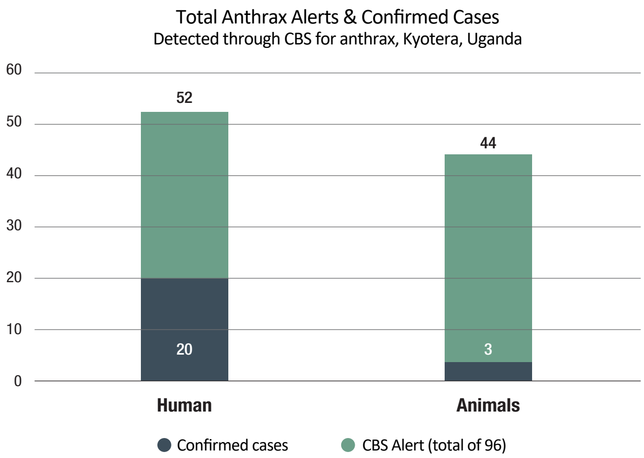

Figure 1: Community-based surveillance for anthrax, Kyotera, Uganda

Three human alerts and one animal alert tested positive for anthrax on laboratory testing, and 28 of the animal alerts were animal deaths that manifested classic signs of anthrax. These activities supported the district task team in enhancing the sensitivity of existing human and animal health surveillance systems while also building capacity at the community level to support district human and animal health authorities to act on information as it was shared.

2. Community Feedback data

In communities, rumours are usually based on widely held perceptions and can often come from misinformation.

When such rumours are not tracked and addressed, they can hamper public health interventions at the community level. A Community Feedback mechanism can be used to understand underlying factors of an ongoing public health event in the community, and community perceptions during the response.

In the 2023 Kyotera district anthrax response, several pieces of information were received and recorded by Red Cross community health volunteers using a rumour tracking log which captured the details about the rumour, including date, exact location, and the channel through which the rumour was spread. In the process of following up on rumours, 2,165 community members were engaged to get their understanding and feedback on what anthrax is plus any rumours about the disease. The feedback collected was categorized into 5 broad themes as outlined below:

- The disease is a falsehood
- The entire response was a political move to frustrate farmers' livelihoods through blocking livestock markets
- Anthrax illness is caused by witchcraft and spiritual powers that can only be treated by traditional healers
- Anthrax was an illness for those who practice cannibalism
- Anthrax was an illness of only the poor

'Anthrax is caused by witchcraft and spiritual powers which can only be treated by traditional healers' was the most commonly collected feedback reported through different sources. Through collaborative analysis, this feedback was found to be a driving factor for morbidity and mortality for Anthrax as it influenced community members to seek care from traditional healers, but not health centres. Therefore, future community messaging was developed and disseminated in coordination with local traditional healers to improve health outcomes.

3. Mapping and engagement of traditional healers.

Due to the large-scale spread of the rumour about anthrax being caused by witchcraft, several community members opted to seek health services from traditional healers which posed a significant threat to the lives of communities through enhanced community spread, delayed treatment and eventual death.

This prompted URCS and the Kyotera District Task Force (comprised of colleagues from both MOH and MAAIF) to work with several members of sub-county lower local governments and community health volunteers to map out all traditional healers in the most affected sub counties. A total of 100 traditional healers were mapped and engaged about anthrax. This involved visits to traditional healers' places of work, as well as targeted meetings for traditional healers in Kabira sub-county which was the epicentre of the outbreak (Figure 1). Furthermore, traditional healers were oriented on how they could support community-based surveillance for anthrax in their communities by reporting signals to community volunteers related to patients who sought care with signs and symptoms of Anthrax or referring them to the nearest health facilities. Following these efforts, 36 of the trained traditional healers referred a total of 58 patients to health facilities for additional treatment. Four survivors from health facilities were also engaged to serve as health champions who encouraged others to take patients to health facilities.

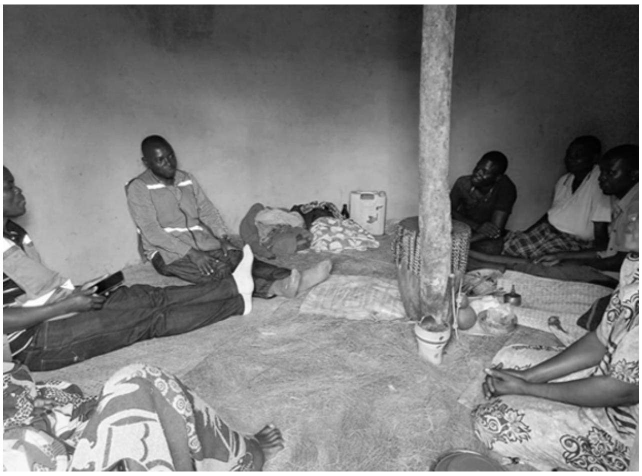

Figure 1: URCS response team members engaging a group of traditional healers in Kabira sub county, Kyotera district

(Photo: Dennis Kamanyi, URCS)

Conclusion

The Integrated Outbreak Analytics (IOA) approach, with its strong multi-disciplinary and inter-agency focus, enabled the teams to dig deeper into the local context and identify specific actions and groups to include within the anthrax outbreak response in Kyotera. The deployment of trained community-based volunteers helped in enhanced risk communication and community engagement on anthrax, with early detection, early reporting, and community referral of suspected sick persons. This was further augmented by the targeted engagement of traditional healers in Kyotera district. Community Feedback Mechanisms´ enabled capturing of critical information as well as misinformation that was influencing the communities. The collaborative approach to include this information in analysis at the district level enabled response teams to get to the root cause of delayed care-seeking and reporting of anthrax, leading to work with local leaders, traditional healers and community members to design targeted messages to counter misinformation and support a more targeted response.

[1] Uganda MOH. SitRep 1, 26 Nov 2023.

What is the IOA Approach?

IOA aims to:

1. Drive comprehensive, accountable, and effective public health and clinical strategies for outbreak management and control
2. Produce data from multidisciplinary perspectives that can rapidly and systematically inform operational decisions
3. Drive a holistic understanding of outbreak dynamics, and highlight the impacts of both the outbreak and response control interventions
4. Advance mechanisms and methods for relevant, useful, and rapid evidence-generation
5. Build, strengthen and scale-up sub-national and national, regional, and global capacity to conduct IOA
6. Provide support via field deployment, remote assistance (analytics/helpdesk), technical and normative guidance, tool development or dissemination and online trainings.

IOA is produced through partnerships and a multi-disciplinary community of practice (a network of agencies and organisations that work or are interested in working with this approach have come together under the Global Outbreak Alert and Response Network (GOARN)*). It is primarily a field-based initiative that leverages support from national, regional, and international experts to reinforce pre-existing local capacity. The IOA partnership welcomes all individuals, actors, agencies to contribute, learn and exchange in ways which are best suited and adapted to their needs.

IOA Core Team

- Simone Carter, UNICEF
- Marie-Amélie Degail, WHO
- Pascale Lissouba, MSF-Epicentre
- Rachel Goodermote, IFRC (Editor)
- John Rossow, CDC (Editor)
- Ruby Siddiqui, UNICEF (Editor)
- Yajna Elouard, WHO
- Emelie Yonally Phillips, MSF-Epicentre
- Lana O'Son, CDC

IOA Field Exchange is published quarterly and we invite you to contribute!

If you have an idea for an article or would like to write about your own IOA experiences, please feel free to contact us. The focus of the IOA Field Exchange is field experiences, how IOA contributed to the understanding of an outbreak or public health emergency, how it has been used to influence decision-making, or how IOA has been applied to improve community health outcomes.

We look forward to hearing from you.

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Graphic design and Layout: Chris Ngoma (ngobayis.ch@gmail.com), DRCongo