

Assessing infectious disease surveillance infrastructure in Equateur province, Democratic Republic of the Congo in 2022

Abstract

Introduction: This study evaluates the infectious disease detection and surveillance infrastructure in Equateur Province, Democratic Republic of the Congo, conducted as part of the Infectious Disease Detection and Surveillance (IDDS) project. The province, with a population of 2.8 million inhabitants spread over 132,518 km², faces numerous challenges due to its ecosystem, making it highly susceptible to outbreaks. The assessment, conducted from January 28 to February 04, 2023, aims to assess the functionality of the diagnostic network, specifically focusing on the capacity of the national public health laboratory in Mbandaka, sample transportation logistics, and opportunities for waste management. The assessment of the capacity of the Mbandaka public health laboratory to detect infectious diseases such as COVID-19, Ebola virus, yellow fever, and measles reveals its significance in epidemiological surveillance in Equateur Province.¹ According to the World Health Organization guidelines, “laboratory biosafety is of crucial importance to ensure the safety of personnel and environmental protection when handling coronavirus samples.”²

Results: Results indicate that the national public health laboratory in Mbandaka possesses equipment for analyzing various infectious diseases, including COVID-19, Ebola Virus Disease (EVD), yellow fever, and measles. However, challenges such as a non-functional incinerator due to fuel shortages and difficulties in accessing health zones, predominantly accessible by river, hinder sample transportation and waste management efforts. Moreover, there is a lack of triple packaging materials for sample transportation and a need for training health workers on biosecurity protocols. To address these challenges, the study suggests potential solutions, such as utilizing drones for sample transportation to inaccessible health zones and improving collaboration between implementation partners and the Ministry of Health. Additionally, efforts should focus on enhancing communication infrastructure and securing fuel for laboratory operations.

Conclusion: In conclusion, despite the existing challenges, the Mbandaka provincial public health laboratory demonstrates the capacity to support the response to certain epidemics in Equateur Province. However, addressing the identified weaknesses is crucial for enhancing infectious disease surveillance and response capabilities in the region.

Keywords: disease surveillance, Equateur province, DR

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Abbreviations: IDDS, disease detection and surveillance; EVD, Ebola virus disease; GIS, geographical information systems; INRB, national institute for biomedical research

Introduction

Since 2015, the province of Equateur has been a province of the Democratic Republic of the Congo resulting from the break-up of the former province of Grand Equateur. It is bordered to the North and North-East by the Provinces of Sud Ubangi and Mongala, to the East by the Province of Tshuapa, to the South by the Province of Mai Ndombe and to the West by the Republic of Congo.

The province is relatively flat, crossed by the Congo River from northeast to southwest. With an average altitude of 340 m, Lake Tumba is its lowest point, at 320 m above sea level. The mouth of the Ubangi on the river is located in the western region of the province. The region is covered by an evergreen rain forest of high density and a great diversity of trees. The province is made up of the city of Mbandaka and 7 territories: Basankusu, Bikoro, Bolomba, Bomongo, Ingende, Lukolela, Mankanza with a total population of 2.8 million inhabitants in 2020 spread over an area of 132,518 km², either a density of 21 inhabitants per km².

At the request of USAID, the Infectious Disease Detection and Surveillance (IDDS) project is evaluating the possibility of extending its geographical coverage to other provinces of the country. Due to its ecosystem, the province of Equateur is the most exposed to the various outbreaks compared to the other provinces of the country and it is in this context that this basic assessment was carried out from January 28 to February 04, 2023. The assessment of the capacity of the Mbandaka public health laboratory to detect infectious diseases such as COVID-19, Ebola virus, yellow fever, and measles reveals its significance in epidemiological surveillance in Equateur Province.¹ According to the World Health Organization guidelines, “laboratory biosafety is of crucial importance to ensure the safety of personnel and environmental protection when handling coronavirus samples.”²

Methods

Methodologies for Enhancing Infectious Disease Surveillance in Equateur Province, Democratic Republic of the Congo.

Diagnostic network assessment

Conduct a comprehensive evaluation of the diagnostic network in Equateur Province, focusing on the capacity and functionality of healthcare facilities and laboratories. Utilize surveys, interviews, and

on-site inspections to assess the availability of equipment, trained personnel, and resources for diagnosing and responding to infectious diseases.

Capacity evaluation of national public health laboratory

Perform an in-depth analysis of the national public health laboratory in Mbandaka to evaluate its capabilities in diagnosing key infectious diseases. Assess the laboratory's infrastructure, equipment, and personnel training programs. Conduct interviews with laboratory staff and management to understand existing challenges and areas for improvement.

Transportation logistics mapping

Develop a transportation logistics map for sample transport across Equateur Province, considering the accessibility of health zones by land and river. Identify existing transportation routes and challenges faced in sample transportation. Utilize geographical information systems (GIS) and stakeholder consultations to optimize sample transportation routes and identify potential alternative modes of transport, such as drones.

Waste management assessment

Evaluate the current waste management practices in Equateur Province, particularly focusing on healthcare facilities and laboratories. Assess the availability of waste disposal infrastructure, such as incinerators and appropriate waste bins. Conduct interviews with healthcare workers and facility managers to understand challenges and best practices in waste management.

Training needs assessment

Conduct a training needs assessment to identify gaps in knowledge and skills among healthcare workers and laboratory staff related to infectious disease surveillance and response. Design and implement training programs on biosecurity protocols, sample handling, and waste management. Utilize interactive workshops, online modules, and on-the-job training sessions to enhance capacity and knowledge retention.

Stakeholder engagement and collaboration

Foster collaboration and coordination among stakeholders, including government agencies, non-governmental organizations, and community leaders. Organize regular meetings and workshops to facilitate information sharing and joint problem-solving. Establish partnerships with local implementation partners to leverage resources and expertise in addressing key challenges.

Results

Capacity of the national public health laboratory in Mbandaka

The virology unit of the National Public Health Laboratory in Mbandaka demonstrates capability in conducting analyses for several key infectious diseases, including:

- I. COVID-19
- II. Ebola Virus Disease (EVD)
- III. Yellow Fever
- IV. Measles

However, for analyses beyond these specified diseases, specimens collected from various health zones within the province are forwarded to the Mbandaka laboratory for packaging and subsequent shipment to the National Institute for Biomedical Research (INRB) in Kinshasa for further analysis. During the assessment, it was observed that amidst the monkeypox outbreak prevalent in Equateur Province, the provincial public health laboratory undertakes the receipt of specimens from affected health zones. These specimens undergo triple packaging procedures before being dispatched to INRB Kinshasa for analysis. Equipment available at the laboratory includes:

- I. 4 GeneXpert machines equipped with 16 functional modules for conducting diagnostic tests.
- II. An incinerator capable of reaching temperatures exceeding 1000 degrees Celsius. However, its functionality is impaired due to a shortage of fuel.
- III. Cold chain facilities comprising freezers and refrigerators, intended for the storage of both samples and reagents, ensuring their integrity and viability.

According to a study published in PLOS Medicine, the clinical performance of the GeneXpert Ebola assay for the rapid detection of Ebola virus RNA was prospectively evaluated, demonstrating its diagnostic accuracy.³ These findings underscore the laboratory's essential role in the surveillance and diagnosis of infectious diseases within Equateur Province. However, challenges such as fuel shortages impacting incinerator functionality may require attention to ensure uninterrupted laboratory operations and effective waste management practices.



Photos A et B: Genexpert of 16 modules and gloves box



Photos C and D: Incinerator of the Mbandaka provincial public health laboratory

Transport of specimens in the province of Equateur

The province of Equateur has 11 health zones, 10 of which are accessible by river and 1 by land, which makes the transport of samples very complicated across the province due to the means of transport used (canoe most of the time) to bring the samples from the different health zones back to the national public health laboratory in Mbandaka. To overcome this issue, an on-site implementation partner uses drones to transport vaccines and other lab reagents to health zones that are inaccessible by land. These drones have the capacity to travel at 115 km per hour and can transport more than 3 kg of samples and make several trips. Discussions with the village team focused on the possibilities of using their drones to transport TB samples and other epidemics, as well as the conditions to be met. The village team agreed, through the intervention of its team lead, to the IDDS request on the condition of making an official request for the use of drones and participating in health drone meetings with the Ministry of Health and other partners. These revisions clarify the study results and the available equipment while providing additional information on the use of drones for sample transport.

Recommendations

Strengthening Equateur's Capacity:

- I. Epidemiology Training:** Propose epidemiology training programs for healthcare professionals and laboratory workers to enhance their ability to detect, report, and respond to infectious diseases.
- II. Laboratory Strengthening:** Invest in laboratory infrastructure by providing modern diagnostic equipment and enhancing technical capacities of personnel.
- III. Improved Communication Infrastructure:** Develop robust communication networks to facilitate rapid information sharing among different levels of the healthcare system.
- IV. Special Attention to the Healthcare Sector:** Pay special attention to capacity strengthening in the healthcare sector, focusing on access to primary healthcare and awareness of disease prevention practices.

Building Integrated Multi-Disease Response Capacity:

- I. Develop integrated intervention plans that effectively respond to multiple diseases simultaneously, using coordinated and multidisciplinary approaches.

Analyzing Drivers of Success in Infrastructure:

- I. Examine key factors that have contributed to the success of previous initiatives to strengthen infectious disease surveillance infrastructure, highlighting best practices and lessons learned.

Suggested Ways to Improve Infectious Disease Surveillance in Equateur Using Digital Health Advances:

- I. Explore opportunities to use digital health technologies such as mobile applications, geographic information systems (GIS), and telemonitoring tools to improve data collection, analysis, and sharing on infectious diseases.

Weaknesses

- I. Difficult access to health zones thus delaying the sending of samples to the provincial public health laboratory.
- II. Lack of triple packaging materials and need to train health workers and providers on biosecurity and triple packaging for sample management.
- III. Recurrent network problem making telephone communication and internet connection very difficult.
- IV. Lack of fuel for the operation of the incinerator of the national public health laboratory
- V. Problem of waste management in the province (lack of appropriate bins and problem of incineration of waste, particularly used GeneXpert cartridges in the province).

Conclusion

By its ecosystem, the province of Equateur is the most exposed to different epidemics compared to the other provinces of the country. The Mbandaka provincial public health laboratory is able to support the response to certain epidemics in the Equateur province.

Acknowledgments

None.

Conflicts of interest

The author declares there is no conflict of interest.

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