



Interventional Epidemiology: Strategic Pillar and Operational Lever of Modern Public Health in Africa

Malick Ngom^{1*}, Abdoulaye Diallo^{1,2}, Serigne Souhaibou Ba³, Elhadj Daouda Diop⁴, Bachir Mansour Diallo⁵, Kamadore Touré¹

¹Laboratory of Epidemiology and Public Health, University of Thiès, Senegal.

²Directorate of Planning, Research and Statistics, Ministry of Health and Public Hygiene (MSHP), Senegal.

³Department of Psychiatry, Marne Hospital, France.

⁴Laboratory of physiology and functional exploration, University of Thiès, Senegal.

⁵Department of Internal Medicine, Faculty of Health Sciences, University of Thiès, Senegal.

Article Information

Received: August 20, 2026

Accepted: August 28, 2026

Published: September 11, 2026

***Corresponding author:** Malick Ngom,
Laboratory of Epidemiology and Public Health,
University of Thiès, Senegal.

Citation: Ngom M, Diallo A, Souhaibou Ba S, Elhadj D Diop, Bachir M Diallo, Touré K. (2026) "Interventional Epidemiology: Strategic Pillar and Operational Lever of Modern Public Health in Africa". International Journal of Epidemiology and Public Health Research, 10(3); DOI: 10.61148/28362810/IJEPHR/221.

Copyright: © 2026. Malick Ngom, This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract

Background : Today, interventional epidemiology plays a key role in global public health. It's not just about describing diseases or crunching numbers; it focuses on turning data into decisions, and those decisions into actions. In a world that constantly faces health crises like COVID-19 or viral hemorrhagic fevers, this approach serves as a tool for management, quick response, and fairness. **Methods :** This editorial offers a reflection on the crucial role of interventional epidemiology in Africa. We conducted a general review of the main aspects of interventional (or field) epidemiology, supplemented by an analysis of the challenges to be addressed for its wider adoption by professionals. **Synopsis and results :** Through a critical review of the literature and field experiences, this article highlights the key role of intervention epidemiology, especially in prevention, response, and resilience of health systems in sub-Saharan Africa. Today, it's a strategic tool for monitoring, preventing, and controlling diseases, whether infectious or chronic. Despite significant progress, challenges remain: insufficient human resources, financial dependence, and weak institutional integration. The future hinges on strengthening local capacities, using new technologies, and better Pan-African collaboration. **Conclusion :** Moving forward, interventional epidemiology must be recognized as a pillar of the continent's health sovereignty.

Keywords: Interventional epidemiology; public health; governance; prevention; surveillance; resilience; Africa.

Introduction

The health crises that have occurred over the past two decades have profoundly changed global public health priorities. The emergence of new infectious diseases, the comeback of once-controlled epidemics, the rise in antimicrobial resistance, rapid urbanization, climate change, and the globalization of trade have all made threats to populations more frequent and complex. In this context, health systems now face events that often evolve quickly and whose impact goes far beyond just health to affect the economic, social, and political dimensions of countries [1, 2, 3, 4].

The COVID-19 pandemic was a particularly striking example of this reality. It showed that having health data available isn't enough on its own to protect people. The effectiveness of the response really depends on how well health authorities can gather reliable information, analyze it quickly, and turn the results into operational decisions suited to the local context.

Many countries had efficient surveillance systems, but the differences in how the pandemic was managed mostly came down to how fast data was interpreted, how well different levels of the health system coordinated, and how evidence-based interventions were implemented [1, 2, 5].

This shift in needs has gradually strengthened the role of intervention epidemiology, also known as field epidemiology. Unlike descriptive epidemiology, which mainly aims to measure the frequency and distribution of health problems, or analytical epidemiology, which looks to identify their determinants, intervention epidemiology stands out for its strongly operational focus. It aims to generate knowledge that can be directly used to guide decisions, organize field interventions, evaluate their effectiveness, and continuously improve disease prevention and control strategies [3, 4, 5, 6, 7].

This field now holds a strategic place in the architecture of global health security. Field epidemiologists get involved at every stage of managing public health events, from the early detection of unusual signals to investigating outbreak clusters, identifying risk factors, implementing control measures, and evaluating their impact. Their role goes far beyond just analyzing data; they act as the link between scientific research, epidemiological surveillance, decision-makers, and affected communities, so that the information gathered can quickly turn into concrete actions [4, 8].

Over the past few years, the field of interventional epidemiology has grown a lot. Historically focused on infectious diseases, it now also helps monitor non-communicable diseases, environmental factors, occupational risks, natural disasters, and humanitarian emergencies. Advances in digital technologies, the increasing use of health information systems, real-time monitoring platforms, geolocation, epidemiological modeling, and artificial intelligence have also boosted the analysis and response capabilities of field teams. This shift shows the gradual move from mostly reactive surveillance to a more proactive, integrated, and risk-anticipating approach to public health [8, 9, 10].

In this context, international organizations, including the World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC), and the African Field Epidemiology Network (AFENET), now view strengthening national capacities in applied epidemiology as one of the key pillars of global health security. Field Epidemiology Training Programs (FETPs) have gradually been developed in many countries to train a critical mass of professionals capable of carrying out surveillance, investigation, and rapid response to public health emergencies. Beyond developing individual skills, these programs also help strengthen health institutions, improve the quality of surveillance systems, and promote a culture of evidence-based decision-making [5, 6, 7].

However, despite these advances, needs remain significant, especially in low-resource countries where epidemiological challenges are still multiple and evolving. Recent health crises have reminded us that having competent technical and human resources is essential to ensure a rapid, coordinated, and effective response to emerging threats. In this context, intervention epidemiology appears not only as a scientific discipline but also as a real public health governance tool, capable of bringing knowledge production closer to public action and sustainably improving the resilience of health systems [1, 10].

If the principles of intervention epidemiology are universal, their importance is especially noticeable in Africa, where health systems

operate in a context marked by high epidemiological diversity, sometimes limited resources, and constantly evolving health risks. The continent is simultaneously facing a persistent burden of infectious diseases, a rapid rise in non-communicable diseases, increasing humanitarian emergencies, and the health impacts of climate change. This complex epidemiological transition requires health authorities to have effective surveillance systems and investigative capacities capable of providing reliable information to guide public health interventions [5, 7].

Over the past few decades, several major events have highlighted the need to sustainably strengthen intervention epidemiology capacities in Africa. The successive outbreaks of Ebola virus disease in West Africa and the Democratic Republic of Congo, cholera, measles, yellow fever, dengue, Lassa fever, Mpox, as well as more recently the COVID-19 pandemic, have shown that the speed of case detection, the quality of field investigations, and the coordination of responses largely determine the effectiveness of control measures. In many situations, delays in identifying transmission hotspots or shortcomings in surveillance systems have helped spread epidemics, emphasizing the importance of national expertise capable of acting quickly at the first warning signs [2, 5, 7, 8].

In the face of these challenges, significant progress has been made. The development of Field Epidemiology Training Programs, supported by the World Health Organization, the Centers for Disease Control and Prevention, and the African Field Epidemiology Network, has made it possible to train several generations of epidemiologists capable of conducting investigations, analyzing surveillance data, and supporting health authorities during public health emergencies. In many African countries, these professionals now contribute to the functioning of surveillance systems, strengthening laboratories, improving data quality, and coordinating multisectoral responses to emerging health threats [4, 5, 6, 11].

The evolution of health challenges is also leading to a gradual transformation of intervention approaches. Emerging and re-emerging diseases are often influenced by complex interactions between human populations, animals, and their environment. This reality gives increasing importance to the 'One Health' concept, which encourages close collaboration between human health, animal health, and environmental sectors. Intervention epidemiology is one of the main operational tools of this integrated approach, helping with early risk detection, rapid information sharing, and coordinated interventions across different disciplines [20, 21].

At the same time, technological innovations are deeply transforming epidemiological surveillance practices. Health information systems like the District Health Information Software 2 (DHIS2), electronic reporting platforms, mobile data collection tools, geographic information systems, modeling techniques, and the gradual use of artificial intelligence offer new ways to improve the detection of public health events, track their development in real time, and support decision-making. However, making the most of these tools still depends on the quality of the data produced, the interoperability of information systems, the availability of qualified human resources, and the implementation of effective health data governance [8, 10, 18].

Despite the progress made, several constraints continue to limit the full development of intervention epidemiology in Africa. Funding

shortages, a lack of qualified personnel in some countries, heavy reliance on technical and financial partners, difficulties in retaining trained professionals, as well as the still uneven integration of investigation results into decision-making processes all pose challenges. On top of that, there are disparities between countries in terms of laboratory infrastructure, health information systems, and institutional capacities, which directly affect the speed and effectiveness of responses to public health emergencies [9, 10, 17, 18, 19].

In this context, strengthening applied epidemiology now goes beyond just being a scientific discipline. It's a strategic investment to improve the resilience of health systems, boost national and regional health security, support evidence-based decision-making, and help African countries move towards greater health sovereignty. Building sustainable national skills, integrating technological innovations, promoting operational research, and strengthening regional collaborations all seem like key conditions to effectively tackle current and future health challenges [2, 6, 8, 14, 20].

This editorial is written from that perspective. Its goal is to offer some thoughts on the strategic role of intervention epidemiology in strengthening health systems in Africa, to look at its role in monitoring, prevention, and responding to public health emergencies, while highlighting the main challenges that remain and the prospects that could make this field a key operational tool for modern public health on the continent [1,21].

Methodology

This editorial is based on a narrative review of the scientific and institutional literature focused on intervention epidemiology and its role in strengthening health systems, with a particular interest in African countries. This methodological approach was chosen to provide a critical analysis of the available knowledge, identify the main current issues, and highlight both the opportunities and challenges related to the development of this discipline in the context of public health in Africa.

- Documentary sources

The literature search was conducted between January and May 2024 using several recognized bibliographic sources, including PubMed and Google Scholar, supplemented by technical reports and institutional documents published by the World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC), the African Field Epidemiology Network (AFENET), as well as other international organizations involved in strengthening global health security. The documents selected included peer-reviewed scientific articles, international recommendations, technical reports, strategic papers, and publications on field experiences conducted in Africa [1, 4, 5, 6].

- Documentary research strategy

The literature search was carried out using different combinations of keywords in English and French, including field epidemiology, interventional epidemiology, public health, health security, disease surveillance, Field Epidemiology Training Program, Africa, One Health, epidemic intelligence, épidémiologie interventionnelle, surveillance épidémiologique, and sécurité sanitaire. Boolean operators AND and OR were used to broaden or narrow the results depending on the topics explored. Special attention was given to recent publications with strong scientific relevance as well as key reference documents produced by major international public health institutions [1, 8].

- Literature selection

The publications were selected based on their relevance to the goals of this editorial. Priority was given to works describing the fundamental concepts of intervention epidemiology, experiences in implementing field epidemiology training programs, applications of this discipline in health emergency surveillance and management, as well as publications analyzing the organizational, technological, and institutional challenges encountered in Africa. Documents that contained redundant information, were insufficiently documented, or did not directly address the issue at hand were not included.

- Analysis of documentary data

The selected documents were critically read and thematically analyzed. The information was organized around several complementary areas: the role of intervention epidemiology in producing quality data for decision-making, its contribution to early detection and rapid response to public health emergencies, its integration into national surveillance systems, the development of human capacities through specialized training programs, as well as the opportunities offered by digital innovations, epidemiological intelligence, and the One Health approach. This analysis made it possible to identify the main trends reported in the literature as well as the ongoing challenges for African health systems [7, 9, 10, 11, 12, 13, 18, 20, 21].

- Methodological considerations

This piece is an editorial based on a narrative review rather than a systematic review of the literature. Therefore, it is not intended to provide an exhaustive summary of all available publications or to carry out a quantitative assessment of the data. Its goal is to offer a reasoned scientific reflection based on currently available knowledge, international recommendations, and experiences reported in the literature, to highlight the strategic role of intervention epidemiology in strengthening public health in Africa. The analyses presented should therefore be interpreted in light of the limitations inherent in any narrative review, particularly the risk of selecting sources and the absence of a systematic approach to summarizing evidence.

Results

Document analysis highlights a growing consensus that intervention epidemiology has become an essential part of modern public health systems. The publications reviewed show that this field has seen significant growth over the past two decades, driven by international health crises, the evolution of surveillance systems, and the strengthening of national health security capacities. Field Epidemiology Training Programs, implemented in many countries with the support of international partners, have significantly helped train a new generation of professionals who can carry out epidemiological investigations, analyze surveillance data, and coordinate responses during public health emergencies. These initiatives have also helped structure national surveillance systems and strengthen collaboration between laboratories, health districts, and public health authorities [6, 7, 11, 14].

The documents analyzed also highlight that one of the main features of intervention epidemiology is its ability to quickly turn data into public health action. Unlike mainly descriptive epidemiological approaches, this field combines systematic data collection, real-time interpretation, and immediate implementation of control measures tailored to the local context. Field investigations not only help identify the factors driving outbreak

surges but also guide priority interventions, assess their effectiveness, and adjust response strategies as the health situation evolves. This approach thus helps shorten the time between detecting a public health event and making operational decisions [3, 8, 9, 12].

The review also highlights the gradual expansion of the scope of intervention epidemiology. Initially focused on monitoring and controlling infectious diseases, it now plays a role in preventing and managing non-communicable diseases, environmental risks, humanitarian emergencies, and natural disasters. This evolution reflects the adaptation of health systems to new global health priorities and underlines the growing role of field epidemiologists in planning, preparing, and evaluating public health interventions. The experiences reported show that this discipline now contributes to improving the resilience of health systems against increasingly complex and multidimensional health threats [4, 19].

The publications we looked at also highlight the progress made thanks to technological innovations. The rollout of digital monitoring platforms, health information systems like District Health Information Software 2 (DHIS2), mobile data collection apps, and digital mapping tools has greatly improved the speed of reporting, data quality, and the ability to track public health events. Recent advances in epidemiological modeling, geospatial analysis, and artificial intelligence also open up new possibilities for early detection of health threats, predicting epidemics, and improving prevention strategies. However, the literature points out that the effectiveness of these innovations largely depends on the quality of the data collected, the interoperability of information systems, and strengthening users' technical skills [8, 9, 10, 18].

The analysis of African publications also shows that intervention epidemiology has helped improve health system governance in several countries on the continent. Investigations during cholera, typhoid fever, Ebola virus, or COVID-19 outbreaks have helped strengthen coordination across different levels of the health system, improve information sharing between labs and field teams, and promote decision-making that's more evidence-based. In several countries, field epidemiology training programs have helped create a network of professionals capable of providing a quick response to health emergencies while supporting the development of national epidemiological surveillance systems [5, 6, 7, 14, 15, 16]. Despite these advances, the literature points out several constraints that still limit the development of interventional epidemiology in Africa. The most commonly reported challenges involve a lack of qualified human resources, limited availability of sustainable national funding, ongoing dependence on technical and financial partners, difficulties with the quality of surveillance data, and the still incomplete integration of investigation results into decision-making processes. Publications also highlight challenges in ensuring the interoperability of information systems, guaranteeing the cybersecurity of health data, and sustainably maintaining the skills of professionals trained in national public health structures [9, 10, 17, 18].

Finally, all the documents analyzed point to the same conclusion: intervention epidemiology is no longer just a tool for investigating outbreaks, but a real strategic lever for the sustainable strengthening of health systems. Its gradual integration into national public health policies, its alignment with the One Health approach, and its adaptation to new technologies now seem to be essential elements for improving prevention, preparedness, and

response to health emergencies in Africa. The authors agree on the need to continue investing in training, surveillance infrastructure, operational research, and regional cooperation in order to consolidate gains and reinforce health security across the continent [13, 14, 19, 20, 21].

Intervention epidemiology is not just about understanding diseases. It actively helps transform health systems into structures that can anticipate, adapt to, and withstand crises, establishing itself as a key pillar of public health in Africa. Its effectiveness relies less on the abundance of available resources and more on political will, technical leadership, and the synergy between different disciplines [19].

To build these solid foundations, three major levers are essential. First, it is important to institutionalise the training and practice of intervention epidemiology, then to ensure sustainable funding and ongoing technical support, and finally to promote close cross-sector collaboration, especially through the 'One Health' approach that links human, animal, and environmental health. When these conditions are met, they form the cornerstone of public health that can respond to emergencies, prevent risks, and innovate [20, 21].

Despite its crucial importance, intervention epidemiology continues to face many obstacles on the African continent. One of the main challenges is the chronic shortage of human resources, with the number of trained specialists in the field still falling far short of growing needs. On top of that, there is a heavy reliance on international partners, with many investigations still depending largely on the involvement of external organizations, which raises legitimate questions about health sovereignty. The quality and accessibility of data are another major obstacle: even though surveillance systems such as DHIS2 are expanding significantly, they still have gaps in completeness, speed of transmission, and reliability. Finally, the weak integration of investigation results into national policies and strategic plans limits the practical impact of this work, which does not always lead to concrete decisions on the ground [4, 8, 9, 10].

To overcome these limitations, several strategic approaches are worth exploring and implementing. It is essential to strengthen training by expanding continuing education programmes and specialised master's courses for health professionals, while standardising and regularly evaluating the teaching content. It is also important to make the most of local data and foster a genuine culture of evidence-based decision-making within ministries and health districts. Investing in digital innovation is another key area, through the use of real-time monitoring platforms and mobile tools aimed at improving early detection and epidemic modelling. At the same time, developing regional cooperation and strengthening networks of African epidemiologists should make it easier to share experiences and pool expertise. Finally, it is crucial to ensure that investigation results are systematically integrated into public health policies and national strategic plans [13, 14, 16].

Discussion

The results of this narrative review confirm that intervention epidemiology now plays a central role in strengthening modern public health systems. Beyond its historical role in investigating epidemic outbreaks, this field has gradually established itself as a strategic tool that links the production of scientific knowledge to operational decision-making. The various publications analyzed show that its contribution now goes beyond simply monitoring infectious diseases and extends to all public health priorities,

including emergency preparedness, strengthening health system resilience, managing non-communicable diseases, and improving health governance [3, 8, 12, 19].

One of the key lessons from this analysis is that the value of intervention epidemiology doesn't just lie in the quality of the data collected, but especially in the ability to quickly turn that data into informed decisions and appropriate actions. This approach is now a fundamental part of global health security because it allows us to spot threats early, limit their spread, and efficiently direct available resources. The experiences shared during recent international health emergencies, like the COVID-19 pandemic and various emerging disease outbreaks in Africa, clearly show the importance of having national expertise capable of conducting rapid investigations, coordinating multi-sector responses, and providing decision-makers with reliable, real-time information [1, 2, 7, 8].

The results also highlight the progress made thanks to the development of Field Epidemiology Training Programs. Since being implemented in many African countries, these programs have helped strengthen the technical skills of health professionals, improve national surveillance systems, and foster a real culture of evidence-based response. Several studies report that epidemiologists trained through these programs now play a key role in the early detection of health events, carrying out investigations, analyzing data, and supporting health authorities during emergencies. These observations match the recommendations of the World Health Organization, the Centers for Disease Control and Prevention, and AFENET, which see the sustainable strengthening of national capacities as a priority investment to improve health security and the resilience of health systems [4, 7, 14].

The African context, however, gives this field a special importance. The continent is facing a complex epidemiological transition, marked by the coexistence of infectious diseases, non-communicable diseases, humanitarian emergencies, and the growing effects of climate change. This situation requires surveillance systems capable of producing quality information and field teams able to respond quickly in environments that can be challenging due to logistical, financial, and organizational constraints. In this context, intervention epidemiology is a key tool for strengthening national capacities to anticipate, prepare for, and respond to public health emergencies [5, 8, 13, 20].

The analysis also points out that technological innovations today offer significant opportunities to improve the effectiveness of interventions. The development of digital surveillance platforms, health information systems, mobile apps, digital mapping, epidemiological modeling, and more recently, artificial intelligence tools, is gradually transforming surveillance and investigation practices. These technologies make it easier to detect health events early, improve data quality, and allow for faster decision-making. However, their potential can only be fully realized if countries simultaneously invest in strengthening digital infrastructure, continuously training professionals, and improving health data governance, especially regarding interoperability, privacy, and cybersecurity [9, 10, 18].

Despite the progress made, this review highlights several ongoing challenges that still limit the development of intervention epidemiology in Africa. National funding shortages, dependence on technical and financial partners, the still insufficient number of qualified professionals, staff mobility, and difficulties in

integrating research results into decision-making processes remain major obstacles. These constraints sometimes reduce the ability of health systems to provide continuous monitoring and a quick response to emerging threats. Available studies thus emphasize the need to strengthen national investments to ensure the sustainability of training programs, surveillance systems, and public health infrastructure [9, 10, 17, 18].

The results also highlight the growing interest in an integrated health approach based on the One Health concept. The interdependence between human health, animal health, and the environment makes close collaboration between the different sectors essential. From this perspective, intervention epidemiology emerges as a preferred operational framework to promote information sharing, early detection of zoonotic risks, and the implementation of coordinated actions. This integrated approach should play an increasingly important role in African public health policies to better address the challenges related to emerging diseases and environmental changes [20, 21].

This editorial nevertheless has some limitations. It is based on a narrative review of the literature and is not a systematic review. The conclusions drawn come from a critical analysis of the available scientific publications and institutional documents and may be influenced by the characteristics of the sources selected. Despite this methodological limitation, the variety of references used, covering the main international organizations and the most recent African experiences, allows for a broad reflection on the evolution of intervention epidemiology and its growing importance in strengthening the continent's health systems [21].

Given these factors, several priorities seem essential to sustainably strengthen this field in Africa. It's necessary to keep developing field epidemiology training programs, strengthen national surveillance systems, improve the quality and use of health data, promote operational research, and increase national investment in public health infrastructure. Strengthening regional cooperation, sharing experiences between African countries, and integrating digital innovations into monitoring practices will also help improve preparedness and response to future health emergencies. In a context where health threats are becoming increasingly complex and interconnected, intervention epidemiology appears not only as a scientific discipline but also as a real tool for governance, resilience, and health sovereignty for African countries [6, 7, 8, 14, 19, 20].

Conclusion

Interventional epidemiology has gradually become an essential part of modern public health systems. By directly linking data collection, analysis, and the implementation of evidence-based interventions, it is now a strategic tool for strengthening epidemiological surveillance, improving emergency preparedness, and supporting quick and appropriate decision-making. Its development shows the shift from a mainly descriptive approach to a discipline clearly focused on action, able to help decision-makers prevent, control, and assess public health events.

In the African context, marked by the coexistence of communicable diseases, non-communicable diseases, humanitarian emergencies, and the growing effects of climate change, intervention epidemiology is a key investment to strengthen the resilience of health systems. The progress made through field epidemiology training programs, improvements in surveillance systems, and the gradual integration of digital

innovations shows that developing this field can significantly help improve health security and the quality of public health interventions.

However, making these gains last will require a lasting commitment from governments, academic institutions, and technical and financial partners to strengthen national capacities, ensure sustainable funding, and promote better use of evidence in decision-making processes.

The future of intervention epidemiology in Africa will also rely on stronger collaboration between human health, animal health, and environmental sectors, following the principles of the One Health approach. Developing interoperable information systems, responsibly using digital innovations, strengthening operational research, and fostering regional cooperation between public health institutions will be key to anticipating emerging health threats and improving African countries' response capacity.

Ultimately, intervention epidemiology should no longer be seen solely as a technical specialty meant for investigating epidemics, but as a real pillar of health governance, global health security, and the sustainable development of health systems. Investing in this discipline is like investing in the ability of African countries to detect threats early, respond effectively to health crises, and build health systems that are more resilient, efficient, and fair. In an increasingly complex and interconnected health environment, sustainably strengthening intervention epidemiology is therefore a strategic priority to help Africa achieve greater health sovereignty and better protect the health of its populations.

Declarations

Funding : this article received no external funding.

Ethics approval and consent to participate : not applicable.

Consent for publication : not applicable.

Availability of data and materials : data sharing is not applicable to this article as no datasets were generated or analyzed.

Competing interests : the authors declare that they have no competing interests.

References:

1. A Mukanga D, Tshimanga M, Wurapa F, et al. The genesis and evolution of the African Field Epidemiology Network. *Pan Afr Med J*. 2011;10(Suppl 1):2.
2. Jones DS, Dicker RC, Fontaine RE, et al. Building Global Epidemiology and Response Capacity with Field Epidemiology Training Programs. *Emerg Infect Dis*. 2017;23(Suppl 1):S158-S165.
3. André MA, Lopez A, Perkins S, et al. Frontline Field Epidemiology Training Programs as a Strategy to Improve Disease Surveillance and Response. *Emerg Infect Dis*. 2017;23(Suppl1):S166-S173.
4. Martin R, Fall IS. Field Epidemiology Training Programs to accelerate public health workforce development and global health security. *Int J Infect Dis*. 2021;110(Suppl 1):S3-S5.
5. Koyie SL, Muehlen M, Dhand N, et al. A scoping review on how field epidemiology training programs are addressing regional and global health priorities. *Front Public Health*. 2024;12:1490125.
6. Kumar R, Kateule E, Sinyange N, et al. Zambia field epidemiology training program: strengthening health security through workforce development. *Pan Afr Med J*. 2020;36:323.
7. Masiira B, Antara SN, Kazooru HB, et al. Building a new platform to support public health emergency response in Africa: the AFENET Corps of Disease Detectives, 2018–2019. *BMJ Glob Health*. 2020;5(10):e002874.
8. Williams GS, Impouma B, Mboussou F, et al. Implementing epidemic intelligence in the WHO African region for early detection and response to acute public health events. *Epidemiol Infect*. 2021;149:e261.
9. Heymann DL, Shindo N. COVID-19: what is next for public health? *Lancet*. 2020;395(10224):542-545.
10. Tessema SK, Nkengasong JN. Understanding COVID-19 in Africa. *Nat Rev Immunol*. 2021;21(8):469-470.
11. Nkengasong JN, Iversen J. Africa needs a new public health order to tackle infectious disease threats. *Science*. 2020;368(6490):493-495.
12. Gebremeskel AT, Otu A, Abimbola S, et al. Building resilient health systems in Africa beyond the COVID-19 pandemic response. *BMJ Glob Health*. 2021;6(6):e006108.
13. Witter S, Thomas S, Topp SM, et al. Health system resilience: a critical review and reconceptualisation. *Lancet Glob Health*. 2023;11(9):e1454-e1458.
14. Moyo E, Mhango M, Moyo P, et al. Emerging infectious disease outbreaks in Sub-Saharan Africa: Learning from the past and present to be better prepared for future outbreaks. *Front Public Health*. 2023;11:1049986.
15. Farnham A, Loss G, Lyatuu I, et al. A roadmap for using DHIS2 data to track progress in key health indicators in the Global South: experience from sub-saharan Africa. *BMC Public Health*. 2023;23:1030.
16. Mremi IR, George J, Rumisha SF, et al. Twenty years of integrated disease surveillance and response in Sub-Saharan Africa: challenges and opportunities for effective management of infectious disease epidemics. *One Health Outlook*. 2021;3:22.
17. Nsubuga P, Johnson K, Tetteh C, et al. Field Epidemiology and Laboratory Training Programs in sub-Saharan Africa from 2004 to 2010: need, the process, and prospects. *Pan Afr Med J*. 2011;10(Suppl 1):24.
18. Heymann DL, Chen L, Takemi KP, et al. Global health security: the wider lessons from the west African Ebola virus disease epidemic. *Lancet*. 2015;385(9980):1884-1901.
19. Elnaïem A, Mohamed-Ahmed O, Zumla A, et al. Global and regional governance of One Health and implications for global health security. *Lancet*. 2023;401(10377):688-704.
20. Rasmussen SA, Goodman RA, eds. *The CDC field epidemiology manual*. 4th ed. New York: Oxford University Press; 2018.
21. Kaboré A, Kitson Laframboise K, Meda N, et al. *Technical guidelines for integrated disease surveillance and response in the African Region*. Brazzaville: World Health Organization Regional Office for Africa; 2010.