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Establishment of Subnational Public Health Emergency Operation Centers During the COVID-19 Pandemic, Kenya, 2020–2023

Tura Galgalo[*],
Daniel Wako[*],
Jonas Z. Hines,
Elizabeth Nzioka,
Muna Aden,
Jedidah Kiprop,
Stephen Mwatha,
Joseph Ogutu,
Daniel Macharia,
Jack Nyamongo,
Kevin Omondi,
Kaitlin Sandhaus,
Eric Marble,
Ahmed Abade,
M. Kamene Kimenye,
Hilary Limo,
Amy Herman-Roloff

Tura Galgalo, MSc, and Kevin Omondi, MSc, are Deputy Country Directors; Muna Aden, MD, MPH, and Joseph Ogutu, MSc, are Epidemiologists; Stephen Mwatha, MD, MSc, is National Emergency Operations Coordinator; Daniel Macharia, MSc, is a Geographic Information Systems Expert; and Jack Nyamongo, MD, MSc, is Country Director; all at Global Implementation Solutions, Nairobi, Kenya. Kaitlin Sandhaus, MA, is Chief Executive Director, Global Implementation Solutions, Chicago, IL. Daniel Wako, MPA, is Emergency Coordinator; Jonas Z. Hines, MD, is an Epidemiologist; and Amy Herman-Roloff, MD, is Country Director; all at the US Centers for Disease Control and Prevention, Nairobi, Kenya. Elizabeth Nzioka, MD, MSc, is an Epidemiologist, and Hilary Limo, MSc, is a Manager, National Public Health Emergency Operations Center; and M. Kamene Kimenye, MD, MPH, is Acting Chief Executive Officer, National Public Health Institute; all in the Ministry of Health, Nairobi, Kenya. Jedidah Kiprop, MD, is an Epidemiologist, and Ahmed Abade, PhD, is Resident Advisor; both at the Africa Field Epidemiology Network, Nairobi, Kenya. Eric Marble, MD, is Plans Team Lead, Office of Readiness and Response, Division of Emergency Operations, US Centers for Disease Control and Prevention, Atlanta, GA.

[*]Address correspondence to: *Tura Galgalo, Kenya Ministry of Health, PO Box 30016-00100, Nairobi, Kenya,* turaboru@gmail.com. (co-first authors).

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Abstract

The World Health Organization (WHO) assessment of the implementation status of national public health emergency operation center (PHEOCs) showed that African countries have made considerable efforts in setting up PHEOCs at national level. In 2017, Kenya established a national PHEOC to fulfill WHO Joint External Evaluation recommendations and as part of Ebola preparedness activities. In 2020, the COVID-19 pandemic provided an opportunity to establish subnational PHEOCs, as recommended by the national COVID-19 task force. We documented experiences in establishing and operationalizing subnational PHEOCs using contemporaneous start-up notes, PHEOC monthly reports, quarterly support supervision reports, outbreak reports, and baseline and follow-up standardized assessments adapted from WHO. From October 2020 through September 2021, PHEOCs were established in 17 of the 47 counties; priority was based on the burden of COVID-19 and other infectious diseases, population size, and proximity to an international border, among other factors. Existing physical structures were repurposed and supplied with communications equipment and furniture to host the PHEOCs. County government public health workers were deployed to PHEOCs to coordinate responses through an incident management system. Technical capacity was built through in-person training, virtual webinars, and onsite mentorship. National PHEOC plans and standard operating procedures were adapted to guide operations. Repurposed structures for PHEOCs and deployment of existing county health staff were seen as key sustainable best practices. Local government buy-in was critical to the establishment of subnational PHEOCs, which have been utilized to respond to 79 events during 2020–2023. The establishment of subnational PHEOCs strengthened local public health capacity to respond to COVID-19 and outbreaks of other diseases in Kenya. Lessons from Kenya may help other countries looking to establish subnational PHEOCs.

Keywords

Emergency operation center; COVID-19; Disease outbreaks; Public health practice; Emergency preparedness; Emergency response

Introduction

A PUBLIC HEALTH EMERGENCY operation center (PHEOC) is either a physical facility or a virtual center designed to coordinate information and resources during public health emergencies, facilitating the preparation, response, and recovery from such events.[1] It serves as a hub for coordinating preparation for, response to, and recovery from a public health emergency. A study done by the World Health Organization (WHO) Africa regional office to assess implementation status of PHEOC highlighted that while African countries have made considerable efforts in setting up PHEOCs at national level, there are several countries that either do not have a PHEOC or whose PHEOCs only partially meet the minimal requirements to function optimally.[1] In 2017, the Kenya's Ministry of Health (MOH) established a PHEOC in response to the WHO Joint External Evaluation (JEE) recommendation,[2] as well as for Ebola preparedness activities ongoing at the time. In conjunction with WHO and the US Centers for Disease Control and Prevention (US CDC), Kenya's Ministry of Health (MOH) established the national PHEOC to coordinate preparedness and response activities for public health incidents in the country. Since 2017,

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the national PHEOC has been activated to coordinate responses when major public health incidents occur, including preparedness for Ebola virus disease, cholera,[3] measles, Rift Valley Fever,[4] dengue, malaria, anthrax, visceral leishmaniasis,[5] acute flaccid paralysis/poliovirus,[6] and seasonal influenza-like illness. Outbreak responses have been coordinated via an incident management system (IMS), developed in the disaster response field, which utilizes a chain-of-command structure from a centralized location.[7] This practice has proven effective for public health incidents and is recommended for coordinating outbreak responses by WHO and US CDC.[8,9] Following the report of the first COVID-19 case in Kenya on March 13, 2020, the Kenya National PHEOC was activated to coordinate the public health response. The National COVID-19 Taskforce was constituted to guide policy and all other aspects of preparedness and response activities, including resource mobilization, rapid response team deployments for case investigations, contact tracing, and case management. The existence of national PHEOC also laid the groundwork for decentralization of emergency operations, a need which was accelerated by the overwhelming number of cases during the COVID-19 pandemic that made it difficult to respond to multiple, concurrent outbreaks at once. Despite various public health and social measures being implemented in Kenya, cases spread widely and through August 2020, 29 of 47 (62%) counties in Kenya had reported COVID-19 cases. By this point, with the swift and widespread transmission of COVID-19, central coordination by the national PHEOC was difficult to respond to multiple, concurrent COVID-19 outbreaks occurring across the country. Thus, the multisectoral COVID-19 task force recommended cascading PHEOC functions and activities to the subnational (county) level to support more localized responses. In this article we share lessons from Kenya's experience in establishing subnational PHEOC during the COVID-19 pandemic and their subsequent use for other public health incidents in Kenya.

Methods

Study Sites

The study sites included 18 counties: Busia, Garissa, Homabay, Isiolo, Kiambu, Kirinyaga, Kisii, Kisumu, Kitui, Makueni, Marsabit, Migori, Mombasa, Murang'a, Nakuru, Nairobi, Nyeri, and Siaya (Figure 1).

Study Design

Mixed-methods approach was used to describe Kenya's experience establishing subnational (counties) PHEOCs during the COVID-19 pandemic. This included desk reviews of PHEOC-related documents (eg, guidelines, policies, plans, standard operating procedures), stakeholder consultation, data collected during outbreaks, and outbreak and surveillance summary reports. The WHO PHEOC framework checklist was adopted and customized to country needs and context to conduct baseline and follow-up assessments to monitor selected key performance indicators. The process of adaptation included renaming sections of the tool for ease of implementation by nonexperts, rearranging the order of some sections, removing some questions and adding others and adding a section on "engagement" in addition to 5 core components of PHEOC framework to suite the Kenya context (Supplementary Table S1).

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Data Collection, Collation, and Storage

The data collection was done using Microsoft Excel (MS Excel) template, and the checklist was administered face to face by implementing partners staff during site visits to PHEOC staff and relevant department of health leadership. The tool was piloted during the baseline assessment and modifications based on implementation feedback were incorporated in the tool for subsequent assessments. The public health incidents (ie, outbreaks) beyond COVID-19 to which county PHEOC responded from 2020 to 2023 were retrospectively collected from subnational public health staff based on their own experience in a standardized data collection form in MS Excel (Supplemental Tool). The information collected included types of syndromes or outbreaks, number of outbreaks, number of suspected cases, number of confirmed cases, and median duration of the outbreak.

We adapted a paradigm that grouped subnational PHEOC establishment into 5 core components as outlined in the WHO PHEOC framework to assess PHEOC functionality[7]: plans and procedures, physical infrastructure, information and communication technology (ICT) infrastructure, information systems and standards, and human resources. An additional component, termed “engagement,” was added to assess interactions between various stakeholders during emergencies. This paradigm was used to describe the establishment of PHEOC based on information obtained from contemporaneous start-up notes, PHEOC monthly reports, quarterly support supervision reports, and the experiences of key staff who helped with this initiative. We adapted the WHO framework for implementing a PHEOC checklist to conduct routine assessment for subnational level PHEOC.[7] Additionally, a scoring system was devised that was easily displayed at the time of assessment to highlight local leadership key areas for improvement. A baseline assessment (July 2021) and 2 follow-up assessments (April 2022 and June 2023) were conducted using this tool to document progress in establishment and operationalization of subnational level PHEOC. The checklist was administered by implementing partners staff during site visits. Data from the 17 PHEOCs were merged, cleaned, and stored in password-protected computers.

Data Analysis

We conducted a descriptive analysis of the data by time (year), place (county), and type of outbreak using R (versions 4.4.2). Outbreaks were also categorized into the main body system affected by a given pathogen (eg, measles to dermatologic). Suspected and confirmed cases were summed from prior reports and the outbreak duration was calculated as the date of first report of an index case until the county declared the outbreak ended. The functionality across the 6 components was scored as 1 (no capacity), 2 (partial capacity), or 3 (full capacity) for a given metric. The cumulative score per domain was calculated by summing the scores and converting them to a percentage. Assessment scores were compared across years using a Wilcoxon rank sum test.

Ethical Considerations

The project was reviewed and approved by the Kenya MOH and US CDC nonresearch determination review panel and was conducted consistently with applicable federal law and CDC policy as provided for in the Code of Federal Regulations (45 CFR 46[10] and 21 CFR 56[11]). Verbal consent was obtained for all participants.

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Results

The subnational PHEOCs were established in 18 counties (Figure 1). The selection of the counties was based on defined criteria (Box 1), and the selected counties were home to approximately half of the Kenyan population.[12]

Plans and Procedures

The National PHEOC was operational before the COVID-19 pandemic and was activated for various disease outbreaks. Thus, the experiences from the National PHEOC in responding to local disease outbreaks were adapted for subnational PHEOCs. For example, the National PHEOC objectives (Box 2), standard operating procedures, tools, and strategic plans were adapted at the county to accelerate PHEOC operationalization. County PHEOCs adapted the IMS structure from the national PHEOC handbook to standardize operational structure and employ common terminology (Supplemental Supplementary Figure S1, Supplementary Table S2).[13] Standard operating procedures were tailored to county needs and approved by county leadership at the county level. The county PHEOCs also used the national PHEOC strategic plan to guide development of an annual work plan.[14]

Although all subnational PHEOCs developed an IMS structure, it was not implemented at the same pace across the counties. This was primarily due to a lack of the required full-time staff to manage the 5 PHEOC core staff roles. Additionally, lack of clarity about how and when to transition PHEOC from (1) watch, to (2) alert, to (3) response modes during potential public health incidents has been a challenge in some counties because of factors outside of technical considerations that the IMS structure is meant to reinforce. Additionally, there was a need to strengthen systematic use of different modes (watch, alert, and response) and activation levels (ie, low, medium, high).

The subnational PHEOC capacity was enhanced through mentorship by public health experts. Mentorship and training were enhanced by supportive supervisions field visits conducted to support operationalization of PHEOCs. During the early implementation phase, an “Adopt-an-EOC” campaign was initiated by US CDC that involved assessing and mentoring PHEOCs while conducting field activities for other CDC-supported programs. This increased focus on subnational PHEOC helped create awareness among frontline healthcare workers and county decisionmakers of the PHEOC concept as a public health emergency response coordination hub and an integral part of response for COVID-19 and other outbreak prone diseases. However, as the COVID-19 pandemic receded from central focus and other public health incidents are intermittent, maintaining engagement in PHEOCs has sometimes been a challenge.

Physical Infrastructure

All the 18 subnational level PHEOCs were housed in a dedicated repurposed physical structure which acted as response command center. The PHEOCs were established with sustainability in mind through a collaborative process with county governments and development partners. In this process, counties identified a physical space to host the PHEOC since purpose-built physical structures did not exist. Furthermore, new construction

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was not feasible with the available financial resources and the time constraints of the COVID-19 pandemic. Counties identified existing physical structures within health department campuses were repurposed and dedicated to hosting subnational PHEOCs. The size of PHEOC ranged from 1 room with multiple workstations to accommodate core PHEOC staff and a call center, to an entire apartment building floor with designated offices for core PHEOC staff, a call center, and a boardroom. Irrespective of the size, the physical PHEOC provided core staff with an opportunity to coordinate response activities from a dedicated location. Many identified spaces lacked essential features and amenities that required renovations for work area improvements. Yet, once the initial improvements were quickly addressed, the use of existing space was considered the best practice by the MOH because it kept costs low and increased county ownership of the PHEOC. Some counties collocated emergency medical services (ie, ambulance dispatch) with the PHEOC to leverage the physical infrastructure and communication technology procured as part of this scale-up. Although not part of the PHEOC objectives, this arrangement helped garner buy-in since emergency medical services were also a priority for some county governments. Furthermore, this colocation of PHEOC with emergency medical services helped maintain county engagement once the COVID-19 pandemic receded and activation for other public health incidents was intermittent.

ICT Infrastructure

To support smooth operations of the PHEOC as a response coordination hub, the refurbished physical PHEOC structures were equipped with communication equipment. The ICT equipment for each PHEOC included 1 TV monitor, 2 laptops, 2 desktops, 2 handset/fixed line phones, internet routers, google suite license, printers, stationery, airtime, and monthly subscriptions for internet services. The ICT equipment functionality was monitored and both routine and scheduled maintenance was conducted by county ICT support staff. ICT equipment start-up and operational costs accounted for the bulk of the PHEOC set up expenses (Supplementary Table S3).

Information Systems and Standards

As the COVID-19 pandemic unfolded in Kenya, new data collection tools were introduced at various times. However, not all subnational PHEOC implemented them in unison, resulting in challenges utilizing data for disease intelligence (Supplementary Table S4). Subnational PHEOC expedited use and dissemination of standardized tools like a case investigation form, a line listing form, a rumor log register, and an active case finding form. These tools were later digitized to improve data quality. Additionally, existing surveillance databases like DHIS2, Emergency Alert and Response System (EARS), facility-based electronic medical records (EMR) and event-based surveillance (EBS) were optimized with visual dashboards to collect routine data. The data analysis was done daily to filter the alerts that needed verification, further investigation and guided response. These data systems supported development of daily situation reports (SITREPs) and weekly trends including the listing of COVID-19 cases and deaths that were useful for decisionmaking by stakeholders.[15] These best practices developed during the COVID-19 pandemic have been carried forward as county PHEOC have been used to respond to other public health threats.

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During the COVID-19 pandemic, tollfree call centers at each subnational PHEOC were used as a surveillance tool where the public and health workers could call and report any alerts or observations. The alerts were recorded in the PHEOC rumor log register and analyzed daily to filter the alerts that needed verification and further investigation. With limited travel to the field due to movement lockdown at the peak of the COVID-19 pandemic, this event-based surveillance system was heavily used to initiate investigation and response, registering up to 100,000 calls per day.[16] While tollfree call centers proved useful at the beginning of the COVID-19 epidemic, they became less used with time. The monthly subscription for tollfree lines was ultimately discontinued with a plan to reactivate it if needed for another public health emergency.

To improve emergency data management systems for collection, analysis, and visualization of data, EARS, a web-based in-house digital emergency data management software, was developed as a “1-stop shop” for operating PHEOCs. EARS enabled direct data entry for phone calls received on the tollfree lines, case-based diseases, and public health incidents including unstructured data like social media posts and aggregated data for reports and provided alerts for response by the relevant authorities. Additional functionality included staffing rosters and calendars, tasks tracker, data mapping, and documents repository. However, the EARS system was inconsistently utilized after its launch, and without a champion within the MOH, has fallen into disuse at most subnational PHEOC.

Human Resources

The subnational PHEOCs were staffed with a median of 7 staff (range: 5 to 15), although this fluctuated by county and overtime. County departments of health assigned their surveillance units to the PHEOC to strengthen the linkage between surveillance and response functions, and the county surveillance coordinator typically filled the role of the EOC manager. In addition to surveillance staff, counties have a list of staff who have been trained with the understanding that they can be called upon and deployed to PHEOC during response operation(s). However, a database that compiles information about emergency preparedness and response training participants across counties does not exist. Although counties appointed core required staff to run the PHEOC, most of the staff assigned to PHEOC maintained additional responsibilities at their regular duty stations and thus could not always provide sufficient support to PHEOC responses. Competing demands sometimes meant delays in reporting and data analysis and quality during responses. This challenge has been exacerbated by staff attrition in counties.

Specific skills and experience in handling emergencies varied among staff deployed to work in subnational PHEOCs. Many subnational PHEOC staff had skills in surveillance but lacked core emergency operation(s) and response skills needed to operate in a PHEOC. Thus, capacity building for staff assigned to PHEOC roles was done through in-person training, virtual webinars, and self-paced online training. Training topics included public health emergency management, Geographic Information Systems (GIS) for spatial data analysis visualization and dissemination, contact tracing, outbreak investigation, public health surveillance, Google workspace, and One Health (Supplementary Table S5). Additionally, several subnational PHEOC staff have participated in the US CDC Public

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Health Emergency Management Fellowship that builds expertise in PHEOC operations and public health response.[17] Lastly, emergency preparedness and response officers (EPROs) were recruited through implementing partners support for each county to mentor and support the subnational PHEOC operations. The EPROs were physically deployed to PHEOC and part of routine workforce for 2 years to provide direct support.

Engagement

Establishment of subnational level PHEOC was a team effort with various stakeholders involved. Key stakeholders consulted included county governments (departments of health and livestock), national government (Provincial Administration, MOH, Ministry of Agriculture and Livestock), and various implementing and development partners. The consultation was done through both in-person and virtual meetings. A letter of intent outlining the role of various stakeholders involved in the establishment of subnational level PHEOC was signed between implementing partners and county government. The COVID-19 task force was formed and cochaired by the governor and county commissioner. The COVID-19 technical working group, which included various county departments and development partners, was chaired by the director of the county department of health.

Assessments to Monitor Performance

Scores improved from baseline across all domains among the 17 subnational PHEOCs ($P < .05$ for all comparisons) (Figure 2). However, the scores declined from the first follow-up assessments in 2022 to the second follow-up assessment in 2023. From baseline (2021) to first assessment (2022), the greatest percentage increase was in emergency preparedness (10.9 points out of 100), which included elements related to plans, coordination, and self-assessments for public health emergencies (Supplemental Material). Score changes between assessments varied by county, but generally a pattern of increasing scores during the first follow-up assessment in 2022 when engagement and support were strongest (Supplementary Figure S1). Some counties showed notable increases in scores between the baseline and first assessment (eg, Busia, Kiambu, and Siaya counties), which coincided with the Adopt-an-EOC campaign by MOH in collaboration with US CDC (Supplementary Figure S2). Possible factors that might have influenced the differences in pace of subnational level PHEOC operationalization include power struggles between individuals or agencies especially on the leadership of coordination, deployment of surge staff with additional responsibilities other than pandemic response, and additional subnational level government competing priorities.

During the assessments, subnational level PHEOCs reported the long-term sustainability challenge post donor support, illustrating the need for increased advocacy at the county level to include the PHEOCs in their annual health budgets going forward. Other themes that emerged from the assessments were the need to expand skills building beyond PHEOC principles and operations to topics including logistics management, trauma care, mental health, and risk communications. There was also a need for strengthening public health emergency management in-depth training at the county level.

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Public Health Responses Beyond COVID-19

Between 2020 and 2023, beyond COVID-19, county PHEOCs responded to 79 public health incidents across 17 counties (median = 6 events; range: 0 Makueni to 10 Kiambu) (Table 1). The number of public health incidents that PHEOCs responded to increased each year, from 2 in 2020 to 41 in 2023. The median duration of a response was 25 days (range: 0 to 508 days; 14 missing end dates). There were 31 different types of events responded to by PHEOCs, with varying case counts and durations (Table 2) but the most common types of public health incidents that PHEOCs responded to were cholera (n=17) and measles (n=12). PHEOCs were also utilized to coordinate responses to noninfectious public health incidents, including adverse events following immunization, poisoning, and road traffic accidents, as well as events related to animal health such as a massive fish die-off in Lake Victoria.

Demand for Subnational-Level PHEOCs Since 2021

The experience of subnational PHEOC has generated demand for additional expansion in Kenya. Some counties without PHEOCs have carried out exchange visits to counties with PHEOCs and have engaged partners beyond US CDC to help create their own PHEOC. While the initial implementation phase during the early COVID-19 pandemic established 18 county PHEOCs, through 2023, 5 additional PHEOCs have been established: 1 in Isiolo County following a yellow fever outbreak (2022), and 1 each in Kajiado, Machakos, Nyandarua, and Uasin Gishu counties (2023). Additional subnational PHEOCs are planned to be established during 2024–2025.

Study Limitations

Establishing subnational PHEOCs was a complicated process that involved roles for many different stakeholders without any overarching legal framework to enforce its implementation at subnational units. In Kenya, this process was accelerated by the COVID-19 pandemic, therefore, our lessons are limited to establishing PHEOC during large scale outbreaks or pandemics. Additionally, we attempted to capture all reported public health events that county PHEOCs responded to retrospectively, meaning some events might have been missed. Because the Kenya PHEOC assessment checklist was adapted to the country context and needs, its 6 components do not align 1-to-1 the WHO checklist.

Discussion

Kenya has successfully implemented PHEOCs at the subnational level to improve preparedness and response coordination. Through a collaborative approach with partners and strategic application of resources, subnational PHEOCs established during the COVID-19 pandemic have been utilized to respond to a variety of public health incidents in Kenya. These PHEOCs have become important assets for the public health system in Kenya. In line with WHO and US CDC and Africa CDC guidance, other countries in Africa are adopting PHEOCs to address the myriad public health challenges facing the continent. While most countries in Africa had at least 1 national PHEOC during an assessment done by WHO in 2021, subnational PHEOCs were less common.[1] Thus, Kenya's experience can inform other countries seeking to enhance their public health response coordination and structures in service of better health security.

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Government buy-in was paramount for ownership and sustainability of subnational PHEOCs in Kenya, including providing space and staff to enhance sustainability and integration with current systems. The national MOH helped create the political will for county governments to embrace PHEOCs, which was a relatively esoteric concept in Kenya prior to COVID-19. The COVID-19 pandemic itself helped catalyze government interest in county PHEOCs. County leadership engaged through signing letters of intent during introductions that outlined roles and responsibilities of implementing county governments and partners as well as helped troubleshoot challenges and recommend solutions. Engaging counties in the creation of the PHEOCs and encouraging ownership through investment of their own resources reduced the overall costs of this initiative and helped to make it successful even in absence of legal framework that outlines PHEOC mandates at national and subnational levels. Given the recurring costs for subnational PHEOCs and growing use, additional government resources will be needed to sustain these health security assets. Enacting national legislation that stipulates PHEOC mandates will greatly improve enforcement at subnational level.

At the start of COVID-19 pandemic information sharing was siloed and not timely. This affected the coordination and efficiency of the COVID-19 response. Through replicating the National PHEOC IMS structures at the county level, coordination of a local, multiagency response improved and demonstrated the added value of PHEOCs. Utilization of COVID-19 structures for response to outbreaks of other infectious diseases like cholera, polio, dengue fever, yellow fever, measles, and visceral leishmaniasis highlights health system benefits of what was initially a COVID-19-focused activity.

PHEOCs benefitted from being housed physically and administratively near or within the surveillance units of the county health departments. This proximity established the PHEOC as a working hub readily accessible by public health staff. Yet, the relatively small workforce responsible for surveillance and response-related activities remains a challenge for PHEOC operations.[9] Despite being staffed by public health professionals, not all PHEOC staff initially possessed the necessary skills and working knowledge to fulfill their assigned roles so training and mentorship were needed to equip staff to respond to public health threats. Furthermore, anticipating ongoing training needs, given expected staff attrition, is important to ensure competent PHEOC operations. This was further complicated by the lack of national integrated databases and the roster of trained and skilled surge staff across counties who can be deployed to the PHEOC during response operations. Nigeria encountered a similar challenge with knowledge gaps in public health emergency management and staff attrition even though subnational PHEOCs improved coordination of public health incidents overall.[18] To increase county engagement and experience, non-PHEOC county health staff who have completed basic core training could be given the opportunity to rotate through the PHEOC during activations to solidify their skills with real-world experience. Such training and experience could also contribute to staff continuous professional development credit. Kenya has also expanded core PHEOC operations knowledge and skills through integration of didactics and a PHEOC rotation in the Kenya Field Epidemiology and Laboratory Training Program curriculum. Having dedicated PHEOC staff, a database, and a roster of surge staff might strengthen PHEOC utilization and public health responses.

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Fragmented data systems made timely analyses and data use difficult.[19] County PHEOCs enhanced collaboration locally and with the national PHEOC, contributing to improved data quality during COVID-19 pandemic. Digitalizing data transmission enhanced PHEOC capacity to provide real-time updates for decisionmaking. With more reliable surveillance and laboratory data, appropriate PHEOC activation and deactivation could lead to more effective health resource utilization. These lessons have been carried forward for subsequent outbreaks in Kenya, including through a collaborative and consultative process to develop interoperable digital data systems for case-based epidemiological and laboratory data that is readily accessible to the PHEOC during outbreak responses.[20] An all-in-one PHEOC data system solution might have been too ambitious and was hampered by development without adequate engagement of key stakeholders.

In resource limited settings, establishment of a physical PHEOC with minimal infrastructure and workforce can serve continuously as operational hub for surveillance, yet ready for activation during emergencies.[9] In Kenya, repurposed physical structures have been used to host PHEOC. In Cameroon, the country was able to respond to numerous public events even when adequate space was not available, highlighting the importance of processes for effective coordination during public health incidents. While having a space is helpful, it need not be an impediment if there is adequate technical capacity for and knowledge of PHEOC operations and outbreak response. Additionally, while Kenya's MOH has targeted a PHEOC for all 47 counties in the country, a regional approach for subnational PHEOCs might be more appropriate for countries where resources are limited and/or there are too numerous subnational administrative units.

Developing PHEOC systems is foundational to guide daily operations and during outbreak responses. Additionally, monitoring and evaluating PHEOC infrastructure and operations are needed to ensure the ability to support responses to public health incidents. Using an assessment tool adapted from the WHO PHEOC framework,[7] scores initially improved over the first year of implementation, but then backslid somewhat during the second assessment, which could have reflected regression following an initially vigorous scale-up catalyzed by the COVID-19 pandemic. This suggests a need for ongoing monitoring to ensure quality even after initial implementation and continued engagement with county decisionmakers. Additional frameworks to assess performance during public health incidents could be helpful to assess continuous improvement in detection and response and highlight PHEOC relevance. WHO published EARS guidance that adopts the 7–1-7 methodology for performance improvement, which is part of the larger package of tools that includes intra- and after-action reviews and simulation exercises for strengthening public health response and thus compliance with the International Health Regulations (2005).[21,22] Kenya is introducing EARS into the Field Epidemiology and Laboratory Training Program to institutionalize the practice of continuous quality improvement among public health in-service trainees. Standardized data collection tools and reporting templates will support this effort to implement EARS. For example, in Uganda implementing a process to measure achievement of key response metrics helped the country identify improvements overtime and guide on areas for improvement moving forward.[23]

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Ensuring subnational PHEOC operations in Kenya for future public health threats requires continuous financial and technical support. Ongoing PHEOC operations cost remains dependent on external support, posing a challenge to further scale-up in other counties and longer-term sustainability in Kenya. Some of the proposed strategies to promote increased government investment include advocacy at county level to include PHEOC in annual county health budgets and considering virtual PHEOCs in case continued support for physical PHEOC becomes a challenge. This investment can save time and money by improving local capacity to contain outbreaks at the source, minimizing health and economic impacts.

Conclusion

Kenya has established subnational PHEOCs to improve preparedness and response coordination to public health threats. We swiftly adopted existing PHEOC tools, standard operating procedures, and guidelines; repurposed physical infrastructures to host PHEOC; and conducted emergency preparedness and response rapid training courses for core and surge staff during COVID-19 pandemic. Our experience demonstrated key lessons for other countries on how subnational PHEOC can be established, implemented, and utilized in other African countries with similar health systems landscape to address a variety of public health threats. Ensuring robust public health emergency response capability in Africa will be critical to addressing the challenges of future epidemics and pandemics.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

1. Fekadu ST, Gebrewahid AL, Mankoula W, et al. . Public health emergency operations centres in Africa: a cross-sectional study assessing the implementation status of core components and areas for improvement, December 2021. BMJ Open. 2023;13(6):e068934.
2. World Health Organization (WHO). Joint External Evaluation of IHR Core Capacities of the Republic of Kenya. Mission Report: 27 February to 3 March 2017. Geneva: WHO; 2017. Accessed October 31, 2025. https://extranet.who.int/sph/sites/default/files/document-library/document/JEEReportKenya 2017.pdf
3. Okunga E Updates from Kenya Presented at: 10th Global Task Force on Cholera Control Annual Meeting; June 26–28, 2023; Veyrier-du-Lac, France. Accessed October 31, 2025. https://www.gtfcc.org/wp-content/uploads/2023/03/10th-annual-meeting-gtfcc-2023-15-kenya-emmanuel-okunga.pdf

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4. Hassan A, Muturi M, Mwatondo A, et al. Epidemiological investigation of a Rift Valley Fever outbreak in humans and livestock in Kenya, 2018. Am J Trop Med Hyg. 2020;103(4): 164–1655. [PubMed: 32342836]

5. Dulacha D, Mwatha S, Lomurukai P, et al. Epidemiological characteristics and factors associated with visceral leishmaniasis in Marsabit County, Northern Kenya. J Interv Epidemiol Public Health. 2019;2(3):1–14. Available from: www.afenet-journal.net/content/article/2/3/full/

6. World Health Organization (WHO). Circulating vaccine-derived poliovirus type 2 (cVDPV2) – Kenya. Published July 28, 2023. Accessed February 27, 2024. https://www.who.int/emergencies/disease-outbreak-news/item/2023-DON479

7. World Health Organization (WHO). Framework for a Public Health Emergency Operations Centre. Geneva: WHO; 2015. Accessed October 31, 2025. https://iris.who.int/bitstream/handle/10665/196135/9789241565134_eng.pdf?sequence=1

8. World Health Organization (WHO) Regional Office for Africa (AFRO). Handbook for Public Health Emergency Operations Center Operations and Management. Brazzaville: WHO AFRO; 2021.

9. Balajee SA, Pasi OG, Etoundi AGM, et al. Sustainable model for public health emergency operations centers for global settings. Emerg Infect Dis. 2017;23(13):S190–S195. [PubMed: 29155649]

10. Protection of Human Subjects. 45 CFR 46 (1991). https://www.ecfr.gov/current/title-45/subtitle-A/subchapter-A/part-46

11. Institutional Review Boards. 21 CFR 56 (1981). https://www.ecfr.gov/current/title-21/chapter-I/subchapter-A/part-56

12. Kenya National Bureau of Statistics. Summary report on Kenya's population projections. Published September 2022. Accessed October 31, 2025. https://www.knbs.or.ke/wp-content/uploads/2023/09/2019-Kenya-population-and-Housing-Census-Summary-Report-on-Kenyas-Population-Projections.pdf

13. Ministry of Health (MOH). Kenya Public Health Emergency Operations Center (KPHEOC) Handbook. Nairobi: MOH; 2021. Accessed October 31, 2025. http://guidelines.health.go.ke:8000/media/Kenya_Public_Health_Emergency_Operations_Center_KPHEOC_Handbook_-_March_2021.pdf

14. Kenya Public Health Emergency Operations Centre. National Strategic Plan, 2021–2026. Nairobi: Ministry of Health; ND. https://www.nphi.go.ke/sites/default/files/KPHEOC_NSP.pdf

15. Ministry of Health. COVID-19 updates. Accessed February 27, 2024. https://www.health.go.ke/covid-19

16. Herman-Roloff A, Aman R, Samandari T, et al. Adapting longstanding public health collaborations between Government of Kenya and CDC Kenya in response to the COVID-19 pandemic, 2020–2021. Emerg Infect Dis. 2022;28(13):S159–S167. [PubMed: 36502403]

17. Centers for Disease Control and Prevention (CDC). Emergency management and global health security. February 21, 2024. Accessed February 27, 2024. https://www.cdc.gov/orr/deo/emergency-management.htm

18. Oyebanji O, Ibrahim Abba F, Akande OW, et al. Building local capacity for emergency coordination: establishment of subnational public health emergency operations centres in Nigeria. BMJ Glob Heal. 2021;6(10):e007203.

19. Castillo-Salgado C. Trends and directions of global public health surveillance. Epidemiol Rev. 2010;32:93–109. [PubMed: 20534776]

20. Centers for Disease Control and Prevention (CDC). Global Public Health Data Innovation. Last reviewed September 13, 2023. Accessed February 27, 2024. https://stacks.cdc.gov/view/cdc/133056/cdc_133056_DS1.pdf

21. World Health Organization (WHO). Guidance for Conducting an Early Action Review (EAR): Rapid Performance Improvement for Outbreak Detection and Response. Geneva: WHO; 2023. Accessed November 3, 2025. https://www.who.int/publications/i/item/WHO-WPE-HSP-CER-2023.1

22. World Health Organization (WHO). After Action Reviews and Simulation Exercises Under the International Health Regulations 2005 Monitoring & Evaluation Framework (IHR MEF). Geneva:

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

WHO; 2018. Accessed November 3, 2025. https://www.who.int/publications/i/item/WHO-WHE-CPI-2018.48

23. Ario AR, Aliddeki DM, Kadobera D, et al. Uganda's experience in establishing an electronic compendium for public health emergencies. PLOS Glob Public Health. 2023;3(2):e0001402.

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Box 1.

County-Level PHEOC Selection Criteria

- COVID-19 and previous disease outbreaks disease burden
- Counties with a point-of-entry (land, sea, or air)
- Counties with ongoing support from US CDC Kenya Country Office to leverage on existing programs support
- Counties with population distribution that cover the largest number of people

Abbreviation: PHEOC, public health emergency operations center.

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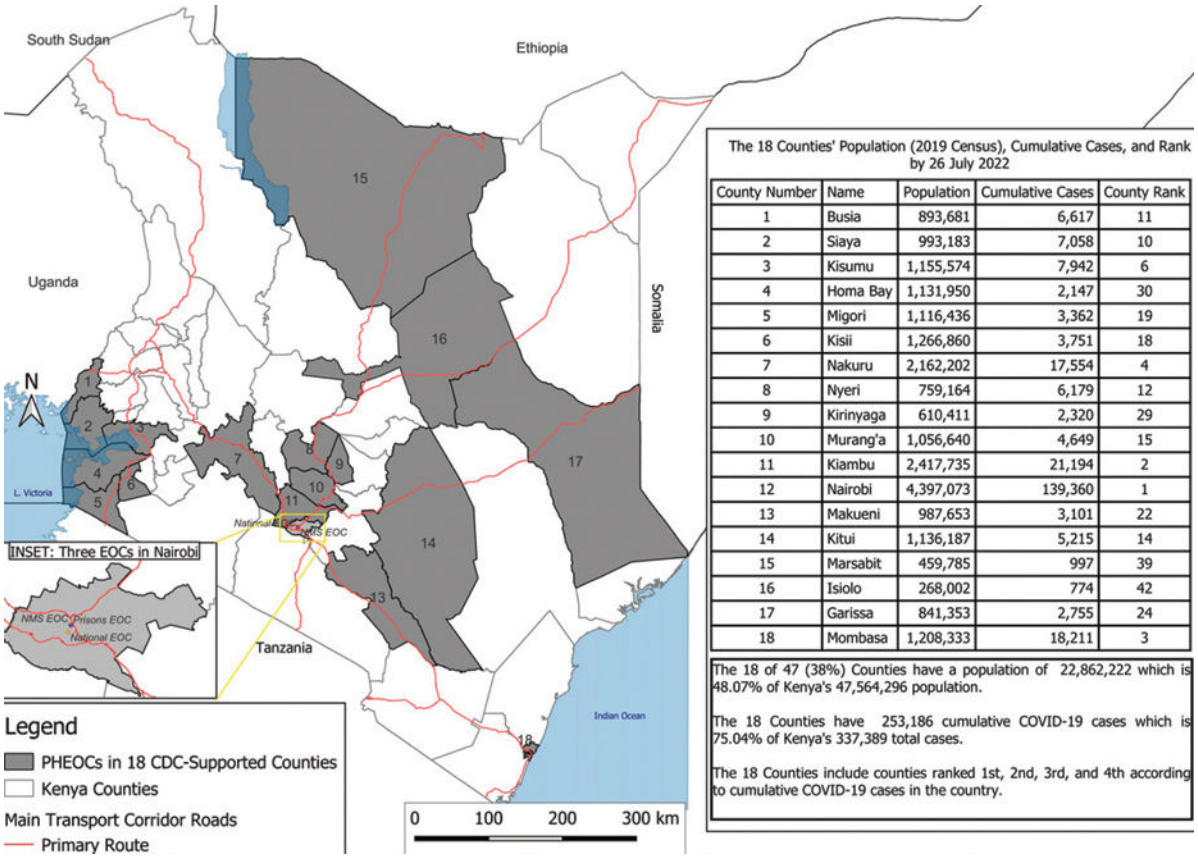
Box 2.

County-Level PHEOC Objectives

- **Coordination** – mobilization and deployment of resources, including surge capacity, services, and supplies to support all PHEOC functions with input and consensus from all relevant stakeholders, including county and national government entities and nongovernment agencies
- **Communication** – collection, collation, analysis, presentation, and utilization of health event data and information to guide the response
- **Collaboration** – ensuring that partners can work together and share resources and information to minimize duplication
- **Decisionmaking** – timely, event-specific operational decisionmaking using available information, policy, technical advice, and plans

Abbreviation: PHEOC, public health emergency operations center.

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The 18 Counties' Population (2019 Census), Cumulative Cases, and Rank by 26 July 2022

County Number	Name	Population	Cumulative Cases	County Rank
1	Busia	893,681	6,617	11
2	Siaya	993,183	7,058	10
3	Kisumu	1,155,574	7,942	6
4	Homa Bay	1,131,950	2,147	30
5	Migori	1,116,436	3,362	19
6	Kisii	1,266,860	3,751	18
7	Nakuru	2,162,202	17,554	4
8	Nyeri	759,164	6,179	12
9	Kirinyaga	610,411	2,320	29
10	Murang'a	1,056,640	4,649	15
11	Kiambu	2,417,735	21,194	2
12	Nairobi	4,397,073	139,360	1
13	Makueni	987,653	3,101	22
14	Kitui	1,136,187	5,215	14
15	Marsabit	459,785	997	39
16	Isiolo	268,002	774	42
17	Garissa	841,353	2,755	24
18	Mombasa	1,208,333	18,211	3

The 18 of 47 (38%) Counties have a population of 22,862,222 which is 48.07% of Kenya's 47,564,296 population.

The 18 Counties have 253,186 cumulative COVID-19 cases which is 75.04% of Kenya's 337,389 total cases.

The 18 Counties include counties ranked 1st, 2nd, 3rd, and 4th according to cumulative COVID-19 cases in the country.

Figure 1.
Map showing subnational-level public health emergency operation centers in Kenya.

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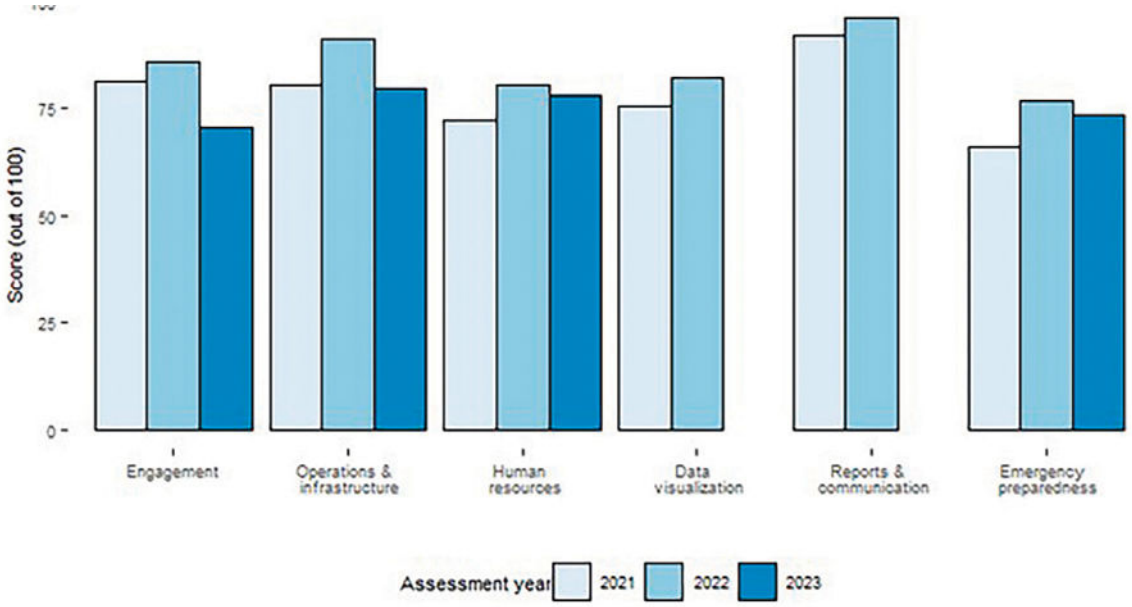


Figure 2.

Change in domain score between baseline (June 2021) and follow-up (April 2022, June 2023) assessments. Data were collected using a standardized assessment adapted from the World Health Organization. In 2023, 2 issues occurred: (1) Kiambu and Murang'a counties were not assessed, and (2) an error in the software program used for the country assessment meant that the data for domains of "data visualization" and "reports & communication" were not captured.

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Table 1.

Characteristics of Public Health Incidents (Outbreaks) Responded to by Public Health Emergency Operation Centers, Kenya, 2020–2023 (N=79)

Characteristic	n (%)
Year	
2020	2 (2.5)
2021	11 (13.9)
2022	25 (31.6)
2023	41 (51.9)
County	
Busia	6 (7.6)
Garissa	6 (7.6)
HomaBay	1 (1.3)
Kiambu	10 (12.7)
Kirinyaga	1 (1.3)
Kisii	6 (7.6)
Kisumu	8 (10.1)
Kitui	7 (8.9)
Makueni	0 (0.0)
Marsabit	6 (7.6)
Migori	4 (5.1)
Mombasa	6 (7.6)
Murang’a	6 (7.6)
Nairobi	5 (6.3)
Nakuru	5 (6.3)
Nyeri	1 (1.3)
Siaya	1 (1.3)
Clinical syndrome	
Dermatologic	23 (29.1)
Gastrointestinal	23 (29.1)
Hepatic	7 (8.9)
Neurological	7 (8.9)
Febrile illness	5 (6.3)
Respiratory	4 (5.1)
Poisoning	3 (3.8)
Other events	7 (8.9)

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Table 2.

Types of Public Health Incidents (Outbreaks) Responded to by Public Health Emergency Operation Centers, Kenya, 2020–2023 (N=79)

Syndrome/Type of Outbreak	Number of Outbreaks	Suspected Cases	Confirmed Cases	Median Outbreak Duration	Outbreak Duration Missing
Dermatologic					
Anthrax	4	59	5	32	0
Chickenpox	2	22	0	85	0
Jiggers	1	5	12	30	0
Measles	12	811	186	23	6
Monkeypox	3	11	0	0	0
Scabies	1	0	15	0	0
Gastrointestinal					
Cholera	17	6,160	1,924	81	3
Gastroenteritis, not specified	3	50	56	7	0
Rotavirus	1	133	73	47	0
Salmonellosis	1	67	5	7	0
Vibrio albensis	1	31	3	25	0
Hepatic					
Hepatitis, not specified	3	11	5	184	0
Leishmaniasis	4	2	1,031	41	3
Neurological					
cVDPV-2 (circulating vaccine-derived poliovirus type 2)	4	31	32	217	2
Rabies	3	20	3	25	0
Febrile illness					
Dengue/chikungunya, mixed	1	0	1,715	508	0
Dengue fever	1	3	1	13	0
Malaria	1	1,144	142	11	0
Yellow fever	2	9	1	90	0
Respiratory					
Influenza	3	309	730	97	0
Pertussis	1	0	2	0	0

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Syndrome/Type of Outbreak	Number of Outbreaks	Suspected Cases	Confirmed Cases	Median Outbreak Duration	Outbreak Duration Missing
Poisoning					
Alcohol	1	0	17	7	0
Cyanide	1	0	3	11	0
Mercury	1	0	5	14	0
Noninfectious					
Adverse event following immunization	1	1	0	5	0
African swine fever	1	0	0	1	0
Building collapse	1	0	10	2	0
Gunshot incident	1	0	6	0	0
Lightning	1	0	1	6	0
Massive fish die-off	1	0	0	60	0
Road traffic accident	1	21	0	7	0
Total	79	8,900	5,983	25	14

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