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SPECIAL ISSUE ON GLOBAL RESPONSES TO COVID-19 PANDEMIC: CHALLENGES AND OPPORTUNITIES

REVIEWS

Leveraging the Public Health Emergency Operation Center (PHEOC) for pandemic response: opportunities and challenges

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ABSTRACT

Public Health Emergency Operation Center (PHEOC) was conceptualized and established for coordinating information and resources towards goal-oriented response in large scale public health emergency. Yet, the activities undertaken by PHEOCs and their intended goals have not been fully optimized in current scenario. This paper revisited the collective efforts invested in PHEOC conceptualization and development, identified the opportunities and challenges in compliance with standards and framework, demonstrated the accountability of PHEOC network, thereby promoted best practice guidance for global public health emergency preparedness and response. This review will help navigate emergency response complexities leveraging PHEOC partnerships and advance the ability to detect and respond to public health emergencies in low resource settings. The review shows that the information on how to adapt best practice guidance to local circumstances could incentivize the full implementation of prevention, early detection and response to outbreaks. Identifying and correcting deficiencies in effectiveness evaluation will provide the basis for continuous PHEOC improvement. With the gradually reopening economies and public services in some countries, there is an urgent need to emphasize and validate the collective efforts undertaken by PHEOCs for tackling the COVID-19 pandemic.

1. Introduction

The unprecedented outbreak of the coronavirus disease 2019 (COVID-19) exposed the poor state of emergency preparedness and response among the global public health community. It was identified as the first unknown disease (or “Disease X”) on the list of WHO Blueprint priority diseases for research and development in emergency contexts; however, to date, there have been no licensed vaccines proven in terms of safety and efficacy.^{1–2} On September 15, the number of cases approached 29.1 million with nearly 926,000 deaths worldwide.³ Over 90 percent of countries have activated multi-agency coordination plans to achieve timely detection of and response to COVID-19.⁴ However, the activities undertaken by Public Health Emergency Operation Centers (PHEOCs) and their intended goals have not been fully optimized. A large number of confirmed cases represent “community transmission” and “cluster of cases,” evidenced by the inability to trace, monitor, and control the spread of the virus.³ The scale of the pandemic and its detrimental economic and social impacts prompted national governments to overhaul and validate their emergency operation structures.

Clear information on the concept of operations decreed by international regulations and evidence-based adaptation to local contexts will help improve their effectiveness, especially in resource-constrained settings. This state-of-the-art review revisits the conceptualization and development of a PHEOC and analyzes the opportunities and challenges in complying with its standards and framework. It will assist in navigating the complexities of emergency response, leveraging PHEOC partnerships, and promote best practice guidance for global public health emergencies.

2. Concept and development of a PHEOC

In response to lessons learned from several major public health events, the WHO and states parties have identified the significance of establishing a central location for strategic management of emergencies to fulfill the *International Health Regulations (2005)* (IHR) and *Global Health Security Agenda* (GHSA). A large-scale public health emergency requires multi-sectoral and interagency response capacities and capabil-

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ities. Thus, a functional PHEOC is an essential platform for the coordination of information and resources toward a goal-oriented response.⁵

A PHEOC follows general emergency management principles with a wide range of risk assessment, preparedness, response, and recovery.⁶ It integrates traditional public health services into the foundational emergency management model, and could be embedded in either national or subnational disaster management authorities or entities.⁶ Although applying the standard organizational model is highly beneficial, the functions and structures of a PHEOC vary across countries; further, the scope of necessary management activities and the required amount of collaboration among response agencies differ depending on contexts.⁷ These variations significantly challenge the interoperability of operations, which is essential for multi-sectoral and transnational response coordination.⁸ In 2012, to promote best practices and support PHEOC capacity building, the WHO Department of Global Capacities, Alert, and Response (GCR) established the PHEOC Network, namely EOC-NET. Its first major accomplishment was the development and publication of the *Framework for Public Health Emergency Operations center* (hereinafter, EOC Framework).

Compared to the other public health emergency management (PHEM) standards and guidelines, the EOC Framework features as the best single source for PHEOC development and operation with minimum common standards.^{9–10} It is built upon the incident management system (IMS), internationally recognized as the best practice model for all hazards and emergencies. In essence, the IMS is a scalable and adaptable command-and-control system with the flexibility of organizing emergency response and resources in individual events, agencies, and jurisdictions.⁹ Within the IMS, five essential PHEOC functions are theorized, including “management, operations, planning, logistics, finance and administration.”⁵ An integrated PHEOC platform requires “plans and procedures, physical infrastructure, information and communications technology infrastructure, information systems and data standards, and human resources.”⁵ The EOC Framework outlines the core components and essential capabilities for planning and implementing a PHEOC, and serves as a useful international reference for public health practitioners and policymakers to design, develop, and strengthen centers. The must-read checklist and implementation guidance were consolidated based on the requirements stated in some of the published standards.⁸ Later, the *Handbook for Developing a Public Health Emergency Operations center* was developed with more designated emergency management operations to interlink and support the EOC Framework.¹¹ These documents provide valuable information for countries to tailor their public health emergency preparedness and response strategies to the specific geopolitical and socioeconomic contexts.

3. Opportunity of EOC for pandemic response

The development and implementation of PHEOCs have advanced public health preparedness and response capabilities in many countries. One great example was Nigeria’s rapid actions to the 2014–2016 Ebola outbreak. Its positive role in containing the virus in Africa was attributed to an early established EOC that was set up for the 2012 polio eradication program. The coordinated response guided by best practices and the framework led to the successful control of the reported cases in cascade. The on-scene adaptation of PHEOCs to local circumstances managed to contain the outbreak with streamlined actions, limiting social and economic disruptions.

Currently, the EOC-NET serves as a central PHEOC hub for capacity strengthening, regional collaboration, and peer experience sharing among member states. As an increasing number of developing countries work with regional and global public health agencies to build PHEOC infrastructures, engendering sustainability of cohesive actions can strengthen policy commitment and government support to maximize the benefits of multilateral international response and cooperation. To demonstrate the accountability of national and international PHEOC partnerships, it would be valuable for stakeholders to have evidence-

based information on: (1) How a PHEOC best practice guidance has been performed in the COVID-19 crisis; (2) What challenges and benefits exist in compliance with the EOC Framework; and (3) What factors should be considered when evaluating PHEOC performance. Further studies will help navigate the complexities of emergency response leveraging PHEOC partnerships and advance the ability to detect and respond to future epidemics.

4. Challenge in implementing EOC best practice guidance

4.1. The best practice guidance remains, in effect, less compatible with resource-limited countries

Since the concept of a PHEOC is still relatively new, high-level government support in terms of money and expertise must be cultivated to make a difference.¹² However, for underdeveloped countries, the national governments must prioritize limited financial and human resources to the most immediate and dire threats. Emergency preparedness planning, which requires freestanding, regularly staffed, and dedicated PHEOCs, seems like an unaffordable luxury of time and resources.¹⁰ Moreover, the proper establishment of PHEOCs lies not only on the commitment and input from national governments, but also requires a comprehensive, progressive, and coordinated emergency management system to be fully operational.¹⁰ For Africa, major challenges encountered in disaster management include: (1) loose coordination between federal, state, district, and local government agencies; (2) weak health systems to cope with “surged” emergencies; and (3) lack of public awareness and response.¹³ Even though a central coordinating body is established for the system, few or no activities were coordinated at state and district levels, not to mention the isolated and vulnerable communities.¹³

Another question that needs to be raised is how PHEOCs maintain readiness between activation periods.¹⁴ This issue is particularly relevant to low resource settings, as they cannot scale up human resources and technical capacity in the short interval. As Muhammad Ali Pate, the former minister of State for Health in Nigeria said: “Potentially it could increase the capacity of African countries or it could be more of the same... I want to be optimistic but this will not work if the structure and capacity is weak like other health agencies.”¹⁵ The EOC Framework appears to be over-ambitious in terms of its feasibility and utility applied to resource-limited nations.

4.2. Existing evidence of the EOC framework does not take into account its internal and external generalizability

Internally, there is an ongoing debate regarding the application of the IMS structure to public health, upon which the EOC Framework is principally built. Although early efforts to adopt the IMS for multi-agency responses proved successful on a global scale, such expositions failed to specify whether these systems had been implemented appropriately, consistently, or equally effective across different contexts of hazards and threats.^{10,16} The strict application of a structured command-and-control model for disease outbreaks may have unfavorable impacts on the collaborative cultures and decision-making process concerning public health environments.^{9,17} This problem is also exemplified in a paper by Papagiotas et al., where public health scientists and emergency managers handled a major emergency event in different manners.¹⁸

Externally, since the EOC Framework was established based on consultation with global stakeholders and lessons learned, it focuses on strengthening health system preparedness capabilities to integrate national and worldwide efforts.⁵ However, these findings cannot be extrapolated to all areas. The empirically derived evidence to inform best practice guidance remains blank for local and regional public health agencies.¹⁹ Most up-to-date literature has been documented in a primarily descriptive and anecdotal nature.¹⁹ Researchers have not treated

variable geopolitical and socioeconomic cultures in much detail. Therefore, rigorous operational research needs to be conducted to strengthen the evidence base targeted to contextually relevant practice and policy questions.

4.3. The knowledge gap in measuring PHEOC effectiveness and impact impedes the cycle of generating a sustainable and optimal public health preparedness and response program

To the best of our knowledge, no documents specifically related to measuring PHEOC effectiveness and impact were found. The US Centers for Disease Control and Prevention advances in measuring the performance of its public health preparedness capabilities.²⁰ However, the number of capabilities could be arguably expanded for PHEOC measurement. In addition, the WHO's Joint External Evaluations Tool (JEE Tool) is a data-gathering instrument for evaluating a country's health security capabilities, which includes all relevant sectors of the IHR and GHSA at the national level.²¹ Nevertheless, it provides a useful baseline for all GHSA action items, not just for PHEOCs. A systematic understanding of how a PHEOC contributes to public health preparedness and response is still lacking. This indicates an urgent need to develop a comprehensive PHEOC evaluation system.

5. Conclusion

At the heart of IHR is the creation of an all-hazard PHEOC, working as an “epidemic intelligence hub” for the strategic management of public health emergencies. Every country requires a functional PHEOC with the capacities and capabilities of coordinating information and resources for an outcome-oriented response among multi-sectoral agencies. National, provincial, and district agencies can collaborate and share information effectively in order to provide health services through a clear command hierarchy. Information on adapting a best practice guidance to local circumstances could incentivize the full implementation of prevention, early detection, and response to outbreaks. Identifying and correcting deficiencies in the evaluation of effectiveness can provide the basis for continuous PHEOC improvement. With the gradual reopening of economies and public services in some countries, there is an urgent need to emphasize and validate the collective efforts undertaken by PHEOCs to tackle the COVID-19 pandemic.

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Author contributions

JM conceived the study and drafted the manuscript. YH and ZZ edited and provided guidance for revision.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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