The framework of Public Health Emergency Operations Center (PHEOC) for Public Health Emergencies Management

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Abstract

Public Health Emergencies and Disaster Management is an emerging public health priority, particularly given the COVID-19 pandemic. Public health emergency and disaster management is an ever-evolving need of society as the incidents of public health emergency and disaster keep on occurring of varying nature and a degree from sporadic to pandemic over a period of time. PHEOC is a physical facility or virtual space where certain public health emergency management functions are carried out. It is backed by the appropriate legislation and regulations and is designed and resourced with sustainability in mind. Coordination of information and resources is essential for quick, appropriate responses, and EOCs play a key role in this. Such a operations centre might be constructed in a permanent site or as a temporary structure. The International Health Regulations (IHR 2005) place a high priority on developing, enhancing, and sustaining capacity to react swiftly and effectively to public health emergencies of international concern (PHEIC). The response system to public health emergencies by the Government, Non-Government Organization (NGOs) and Civil Societies has improved a lot in India over the time and appreciated world over. This paper aims to highlight the Framework for a Public Health Emergency Operations Centre which provides high-level guidance for establishing or strengthening a PHEOC. To establish and/or strengthen a PHEOC, it is vital to align with standardized policies, guidelines, and tools.

Keywords: *Public Health Emergency Operations Center (PHEOC); Public Health Emergencies and Disaster Management (PHEDM), Response; Framework; India*

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1. Introduction

The Public Health Emergency Operations Centre (PHEOC) aims to oversee responses to public health events and crises by coordinating information and resources. A PHEOC is a focal point for organizing the planning, response, and recovery after public health events (for example: disease outbreaks). The preparation process includes activities such as planning, risk mapping, generating resource database and mapping, creating and developing the plans and procedures, and conducting trainings and exercises. In addition, the PHEOC improves communication and coordination among pertinent stakeholders and serves as a hub for organizing resources and information to aid response activities during a public health emergency.

To coordinate operational information and resources for the strategic management of public health events and crises, relevant employees assemble at the PHEOC, which serves as central meeting place. It also offers commanding leaders staff assistance in decision-making and coordinating responses to emergency occurrences. PHEOCs typically refers to physical locations where staff can gather and the response actions can be coordinated. However, it can be argued and consider that PHEOC functions are more significant than their actual location. In case, if the incident is minor and few resources are available/needed, the EOC's essential functions can be carried out by one or two people in a regular office setting.

PHEOCs are utilized in various situations, including natural disasters, food-borne illness outbreaks, radiological disasters, bioterrorism, chemical accidents, mass gatherings, blackouts, humanitarian emergencies, and disease outbreaks or pandemics. Field PHEOCs, local, regional, national, or international PHEOCs are just a few of the jurisdictional levels used. The successful handling of an emergency depends on efficient communication and coordination within PHEOCs and between responding organizations. PHEOCs have varied capacities and resources, as well as diverse staff, terminology, processes, and equipment; they also differ in structure and function across different nations and organizations. These variances severely hamper the interoperability necessary for efficient coordination between EOCs and response agencies.

PHEOCs staff often work with the principle of an incident management system/ incident response system (Parkash et al. 2021). Although this system's structure varies,

it frequently adheres to the United States Incident Command System (US-ICS). The US has employed this technique to combat forest fires for at least 30 years and has progressively gained acceptance in other crisis management fields. It started during a wildfire outbreak in California in 1970; when the fires spread across jurisdictions, it became evident that coordination between the many response agencies was a big issue. A common language, management principles, or communication methods were lacking among the respondents. California's firefighting organizations subsequently developed a structure that defined who was in control. The resultant incident command system (ICS) offers a hierarchical framework to manage a network of emergency responders from various organizations under a temporary hierarchical authority. The Government of India (GOI) decided to closely examine the Incident Command System (ICS) of the US in this pursuit after the High-Power Committee on Disaster Management, which the Government of India established under the chairmanship of Mr Pant, identified it as one of the global best practices in disaster management after becoming aware of some response shortcomings and a desire to address the critical gaps (NIDM 2005). US emergency management agencies, including health organizations, have adopted and modified the ICS since the terrorist attacks on September 11, 2001, and the ensuing national directives and guidelines on using the National Incident Management System (NIMS). Significant incidents that had an impact on public health, such as SARS in 2003 and the influenza pandemic in 2009, both of which involved numerous jurisdictions and responding agencies, have led to the gradual adoption of an incident command system by health agencies around the world to handle public health emergencies more successfully.

During a public health emergency, the Centers for Disease Control and Prevention (CDC) EOC personnels conduct the following actions:

- Utilizes the scientific specialists
- Organizes the transport of equipment and supplies to the site of the crisis event
- Observes how people are responding

  Provides resources to State and Local Public Health agencies

Till now, CDC EOC has reacted to more than 60 public health risks, including disease outbreaks, environmental crises, and natural catastrophes like hurricanes and food-borne illness epidemics (e.g., Ebola, Zika virus, and COVID-19).

The details of the CDC Emergency Operations Center: CDC Public Health Response Timeline is represented in Figure 1.

Figure 1: CDC Emergency Operations Center: CDC Public Health Response Timeline

(Source: www.cdc.gov)

Core components of PHEOC

The EOC's responsibilities include providing an operational or strategic overview of the crisis, information gathering and evaluation, making choices that safeguard lives and property; maintaining the organization's continuity; disseminating decisions to all stakeholders; planning for future response activities or recovery and return to normal condition.

According to EOC framework, plans and procedures, physical infrastructure, ICT infrastructure, information systems and data, and human resources are the essential elements that makes a PHEOC smooth functioning. The PHEOC can meet the International Health Regulation (IHR 2005) Joint External Evaluation's minimal criteria

by meeting the minimum requirements for each component. So, the essential elements of a PHEOC are as follows (Figure 2):

- A facility/location, physical or virtual
- A body of data and information
- A set of policies, plans and procedures
- A roster of skilled, trained personnel

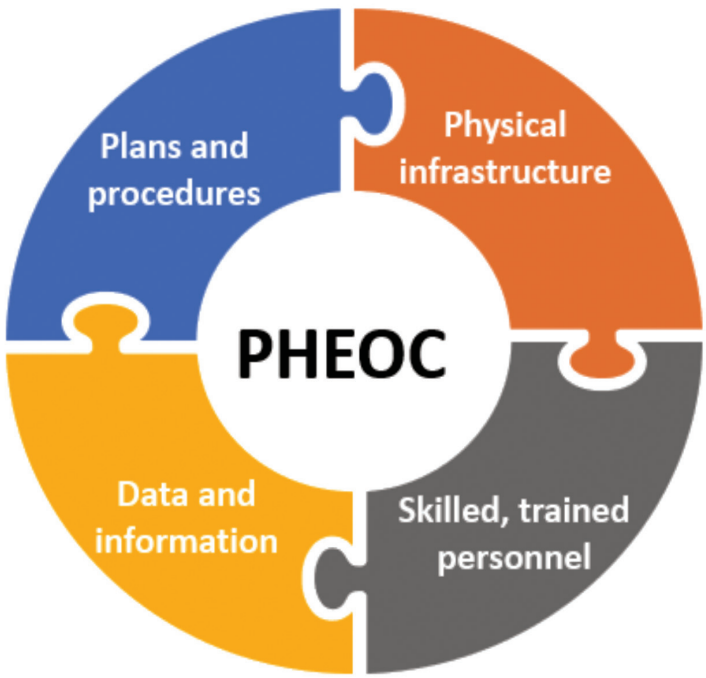

Figure 2: Core components of PHEOC

Concept of Operation (CONOPS)

There are two types of EOC staff in PHEOC i.e., Permanent staff and Surge staff. The responsibility of permanent staff is the daily management of the PHEOC which includes PHEOC manager, the primary functional area leaders. Whereas the staff members who work in each area.

The PHEOC keeps a list of professionals from various fields and industries who can be called upon to staff the PHEOC whenever necessary. Positions will be recognized in the Incident Management System when it is activated, depending on the severity of the incident.

Modes of Operations

There are three typical modes of operations for PHEOC, i.e., Watch, Alert, and Response.

Watch mode reflects typical day-to-day company operations. The watch team facilitates the gathering, organizing, analyzing, distributing, and archiving of information to continuously monitor and prioritize information on public health occurrences. Throughout the numerous operation modes, the PHEOC is constantly in watch mode. Even when the PHEOC is in alert or reaction mode, the personnel still keeps an eye on happenings. When operating in this mode, the PHEOC is constantly ready to support any escalation at the operational level. The watch staff's duties and responsibilities include monitoring and prioritizing incoming information, drafting or preparing reports, distributing reports, documents, and notifications to the appropriate section or person responsible, and ensuring the PHEOC is stocked with supplies and equipment in working order. When necessary, organize or direct briefings, and assist in the administration of small-scale events that don't satisfy the criteria for activation.

The alert mode is used when an incident or event has already happened or is about to happen. To be ready for a potential PHEOC activation, the PHEOC closely monitors an incident or event. Increased monitoring, Rapid Response Team (RRT) deployment for an inquiry, collaboration with other sectors, planning for deployment of financial and logistical resources, and identification of specialists to staff the PHEOC are just a few examples of alert mode operations. The PHEOC typically needs more workers and later hours to complete these tasks. The PHEOC determines whether more surge staff is required and makes the appropriate requests.

Activation and De-escalation

The PHEOC is either fully or partially activated during response mode. According to levels of response, the centre should define levels of activation. Low-level augmentation is needed for all response actions at the lowest level of response, which deals with smaller-scale occurrences for which the PHEOC's capabilities and resources are

more than adequate. The names of activation levels differ from nation to nation. The activation levels specified in the national health response plan should correspond with the activation levels used in the grading and alignment process, which should be in accordance with national policies, plans, and procedures.

De-escalation of the activation level should be considered when the extent, complexity, and severity of the health emergency reduce. The PHEOC is deactivated when the reaction is deemed to be complete and regular monitoring resumes. The issue being addressed no longer poses a threat to public health, the sub-national level is no longer overburdened and has the capacity to handle the incident, resources are no longer needed, and the competent authority has declared over the incident or a state of emergency are some of the criteria for deactivation of PHEOC.

Information Management

There are three categories of information, i.e., Incidents-specific information, Event information, and Contextual information, are listed in the EOC framework as necessary for PHEOC decision-making. Information essential for timely decision-making in a PHEOC across all IMS functions is an Essential Element of Information (EEI). EEIs have several characteristics, including common information and data elements for normal situational awareness, give context for the analysis, assist in determining response actions and material needs, and are included in response situation reports.

The urgency and demand for action set Critical Information Requirements (CIRs) apart from EEIs. In the CIRs, information on public health risks, epidemic investigation and response, needs assessment, overall health sector response, gaps, and performance are gathered, analyzed, and disseminated. The knowledge is essential for promoting situational awareness and decision-making. It is used to prompt immediate or required action and is a high-priority subset of EEIs. In the course of activation, incident-specific targeted CIRs are created to direct data collection and event-specific reporting. The CIRs are created by the PHEOC manager in collaboration with the IM.

It is extremely important to coordinate the information on public health emergencies. The PHEOC should act as a centre for coordinating information and reporting on public health-related events. The PHEOC should get systematic flow of all PHE-related information that travels from communities, event locations, and health institutions

(including treatment centres and point of entry) at the ward, district, regional, and national levels.

The PHEOC information system should record information on the PHEOC. This involves recording actions, monitoring the deployment of human resources, monitoring the activities of partners, assigning tasks, scheduling, etc. Accurately recording the steps conducted during emergency preparation and response is crucial. As a result, the success of the response operations may be tracked and monitored. Therefore, it is necessary to archive all papers connected to an event appropriately. The PHEOC requires a single repository where all pertinent information about occurrences is kept, preferably online, to make access easier. The planning function is in charge of documentation and must ensure that all pertinent response activity data is properly recorded.

The PHEOC needs to routinely analyze epidemiological data and create maps of the current condition. The PHEOC needs to present maps and trends. Key analytical tools like GIS are essential for the PHEOC. The PHEOC must specify the information shown on its walls, noticeboards, and screens, such as PHEOC schedules, event maps and trends, task monitoring, etc.

It is crucial to know who is doing what, where, and when to coordinate response activities and prevent redundancy. Throughout the response, this data is kept in the PHEOC, updated often, and distributed (the PHEOC to determine frequency). This report will be distributed to the leadership, incident management team, and partners.

Coordination and Communication

The control of the response depends on an efficient, rapid, and accurate communication mechanism, and the PHEOC provides this platform. The PHEOC establishes external communication with partners, the government, the commercial sector, and the general public, in addition to internal communication inside the Incident Management System (IMS). The PHEOC's operation must continue from a different location if the PHEOC's physical infrastructure fails and cannot be used. Some good practices of PHEOC implementation are mentioned below.

Examples of PHEOCs

1. Strategic Health Operations Center (SHOC) in India

The Strategic Health Operations Center (SHOC) was founded with the intention of offering an emergency management facility with a single point of contact. The SHOC is designed to serve as the actual site where information and resources are coordinated to support incident management and response operations. The SHOC is equipped with cutting-edge technology that enables video and audio conferences, high-speed data, audio, and video transfers, real-time information interchange, operations planning, and virtual networking, among other things.

The Federal Emergency Management Agency (FEMA), USA, provided online training on incident response systems to NCDC Staff members designated for response through SHOC. Three times in 2015—once in 2016, once in 2017, and once in 2018, when it is still active—SHOC was activated.

2. Polio Eradication programme in Nigeria

The recent Nigerian polio eradication programme results have been attributed to PHEOCs. In their article, Shuaib et al (2017) described the composition and operation of a typical emergency operations centre (EOC) for handling public health emergencies in low-resource environments. They attributed effective polio, and Ebola responses in Nigeria to a number of elements, including governmental commitment, population engagement, accountability, and operational and strategic reforms brought about by an EOC and Incident Management System used to their fullest potential. The EOC offers a way to enhance performance and use data to hold health workers accountable by utilizing cutting-edge technologies like geographic information systems, dashboards, and scorecards in nations like Nigeria, where the central or federal government does not directly hold states accountable. Some of the highlights of successful implementations were: a comprehensive approach to resource management by implementing an incident command system through the PHEOC; Ebola and other viral hemorrhagic diseases quickly diagnosed in laboratories; availability of trained human resources; leadership that was devoted to making sure that everyone worked together to achieve goals; performance of specified tasks expected of every member of the team working on the epidemic response; swiftly identification of Social Mobilization Teams (SMT) during the outbreak, including healthcare professionals, to dispel misconceptions and false information about it.

3. Severe Acute Respiratory Syndrome (SARS) response

The Centers for Disease Control and Prevention (CDC) engaged all of the organization's resources throughout the spring and summer of 2003 in an effort to address the problems brought on by the outbreak of Severe Acute Respiratory Syndrome (SARS). The CDC used the talents of more than 850 employees throughout the 133-day emergency response phase of the SARS outbreak. The CDC's PHEOCs, institutes, and offices, as well as the Agency for Toxic Substances and Disease Registry, sent out personnel to assist with this operation (WHO 2013). They welcomed travellers and personnel from these places upon their arrival in the US, offered technical aid to nations reporting a high number of cases and asking for assistance, and ensured the syndrome was reported and properly examined in the US.

4. Flood and public health management in North Dakota

The North Dakota Department of Health (NDDoH) now has the resources to develop emergency response systems that were largely lacking before 2002, thanks to the availability of the Public Health Emergency Preparedness (PHEP) cooperative agreement and the Hospital Preparedness (HPP) cooperative agreement (Wiedrich et al. 2013). Recurrent floods in North Dakota throughout 2009, 2010, and 2011 necessitated the NDDoH putting flood response strategies into place, evaluating their efficacy, changing them, and retesting them. Particularly, the agency's management of communications, command personnel, resource deployment, data administration, reaction to healthcare system demands, and volunteer management have all undergone significant modifications as a result of repeated flood responses. The North Dakota Department of Health (NDDoH) has used the resources, personnel, and systems of PHEOCs to address public health threats since 2002, including the H1N1 pandemic of 2009 and a hospital damaged by a tornado in 2007. The availability of funds for readiness will determine how the response capability is maintained and improved in the future.

5. Guinea PHEOC

Guinea lacked an emergency management framework before the Ebola virus disease (EVD) epidemic in 2014–2016. The creation of public health emergency operation centres (PHEOCs) at the national and district levels during the outbreak

was made feasible by funding from the Global Health Security Agenda (GHSA) 2014-2019 (Martel et al., 2021). Since the completion of the reaction, the National Agency for Health Security in Guinea, which is in charge of managing epidemics, has further strengthened the architecture, personnel, and systems of these PHEOCs and successfully incorporated them into daily operations. Without substantial support from the Ministry of Health, creating PHEOCs as emergency management tools for epidemics in Guinea would not have been feasible. The PHEOC network in Guinea is in an excellent position to serve as an example of excellence for other Ministries and Ministries of Health in other West African nations.

6. PHEOC in Eastern Mediterranean Region

The effectiveness of a nation's Public Health Emergency Operations Centers (PHEOCs) is crucial to its ability to respond. Elmahal et al. (2022) developed and carried out an online survey between May and June 2021 to evaluate the state of National PHEOCs in the 22 nations of the Eastern Mediterranean Region. There were only 12 nations that reported having PHEOC, and of those 12, 10 said they used it for response operations.

7. Public Health Emergency Operations Centre Network (EOC-NET) by WHO

In order for countries to have the response skills and capabilities needed by the International Health Regulations of 2005, Health Emergency Operations Centres (HEOCs) are essential (IHR). In order to support HEOC capacity building in countries, promote HEOC best practices and standards, and strengthen multisectoral collaboration and coordination among HEOCs and response partners for the effective management of public health events and emergencies, WHO established the Public Health Emergency Operations Centre Network (EOC-NET) in 2012. The goal is for all HEOCs to be able to carry out essential, auxiliary tasks that will guarantee an efficient response to public health concerns and emergencies. In 2015, WHO released the PHEOC Framework for a public health emergency operations centre.

8. COVID-19 Preparedness in South Sudan

In South Sudan, the National Steering Committee is supported by the Public Health

Emergency Operation Center (PHEOC), which includes a number of Technical Working Groups (TWGs). In order to coordinate with the PHEOC at the state level, pre-existing protocols that were previously established for controlling the Ebola virus disease are used (EVD). Planning, coordination, and further instructions are needed to make the PHEOC run more efficiently in South Sudan.

9. Avian Influenza Virus in Cameroon

As a result of an avian influenza virus A (H5N1) epidemic on a poultry farm in Yaoundé, the PHEOC in Cameroon was established in May 2016 to facilitate the early detection of human cases, act swiftly to stop human transmission, and manage case management (Balajee et al., 2017). To ensure effective communication between the National Veterinary Laboratory and the PHEOC, a veterinary FETP fellow acted as the PHEOC's point of contact with MINEPIA, Cameroon's Ministry of Livestock, Fisheries, and Animal Industries. None of the human connections had tested positive by the time the PHEOC was decommissioned in June 2016 (FAO 2016).

10. PHEOC in Vietnam

As part of a GHSA demonstration project in 2013, the General Department of Preventive Medicine (GDPM) created a national PHEOC with assistance from CDC and the Defense Threat Reduction Agency's Cooperative Biologic Engagement Program. Since then, the PHEOC has been used to coordinate responses and risk assessments to a variety of threats, such as a national measles outbreak, worries about the importation of the Ebola virus infection and Middle East respiratory syndrome, and, more recently, the emergence of the Zika virus infection.

To summarise, Experience has demonstrated that prompt adoption of a PHEOC offers a crucial framework for managing public health emergencies and may help prevent frequent mistakes, including unclear leadership that causes decision-making to be delayed, resource mismanagement, and a lack of cooperation. Future integration within the three-tiered healthcare system, reinforced community-based surveillance, expanded referral networks, and increased laboratory capacity are all envisioned in India's Vision 2035 for Public Health Surveillance. Electronic health records would serve as the foundation for surveillance, periodic national, state, and local surveys, and specialized research. The foundation of this concept

is an interconnected federated structure of governance between the Center and the States, as well as innovative data sharing that is positioned above and beyond current disease monitoring programmes and is not dependent on conventional data input methods.

In terms of infrastructure development, recent steps taken by the Indian government toward establishing a Health Emergency Operations Center under the PM-ABHIM are encouraging. EOCs are already in operation due to actions taken by the Disaster Management Authorities. We still need to work on integrating the health component into these operating centres. Along with providing an effective reaction, it would also lessen resource and duplication of effort waste.

Conclusion

India has a well-established system for handling public health emergencies, disaster planning, and response that has been created through time based on local and international evidence and experiences. The staff needed to carry out the strategy is already in place, and there is a system in place to increase their capability while concentrating on an integrated, coordinated, multisectoral, and multilayer approach. The infrastructure for readiness and response capabilities can be strengthened. The Strategic Health Operations Center (SHOC), Control Room, Command Room, or War Room at the National Level at MOHFW, NCDC, and some of the States have recently constructed to address COVID-19 pandemic are operational and represent the idea of PHEM and PHEOC in the nation.

Building nations' emergency response capabilities require the creation of PHEOCs to support the proper coordination, response, and management of public health emergencies. PHEOCs should serve as central hubs for collecting, analyzing, and visualizing surveillance data from various sources. These hubs make the development of information systems a crucial aspect of PHEOC operations. In order to increase the value and usability of surveillance data, mechanisms should be developed that combine data streams, produce data dashboards, automate routine analysis, and set up the PHEOC's continuous operation. Each PHEOC needs to be tailored for the specific legislative setting in which it is located.

Reference

1. Balajee A, Pasi OG, Etoundi AGM, Rzeszotarski P, Do TT, Hennessee I, et al. (2017) Sustainable model for public health emergency operations centers for global settings. Emerg Infect Dis. 2017 . https://doi.org/10.3201/eid2313.170435.
2. Elmahal OM, Abdullah A, Elzalabany MK, et al. (2022) Public health emergency operation centres: status, gaps and areas for improvement in the Eastern Mediterranean Region. BMJ Global Health 2022;7:e008573. doi:10.1136/bmjgh-2022-008573.
3. FAO (2016) Food and Agriculture Organization of the United Nations. Addressing H5N1 highly pathogenic avian influenza: Qualitative risk assessment on spread in the Central African region. 2016. Oct [cited 2017 Sep 1]. http://www.fao.org/3/a-i6348e.pdf.
4. Martel, L.D. et al., (2021) Public health emergency management capacity building in Guinea: 2014-2019. International Journal of Emergency Management, Vol. 16(2).
5. NIDM (2005) Training Module: Incident Response System Basic & Intermediate National Institute of Disaster Management, New Delhi-110 002, Page 150 ISBN: 978-93-82571-17-9. https://nidm.gov.in/PDF/modules/irs-1.pdf.
6. Parkash S, Thapa R, Bindal MK, Kaur H, Kathait A, (2021): Training Module on Communications for Disaster Management. National Institute of Disaster Management, New Delhi - 110042, Page 157. https://nidm.gov.in/PDF/Modules/NIDM_CDM2021.pdf.
7. Shuaib, F.M.; Musa, P.F.; Muhammad, A.; et. al., (2017) Containment of Ebola and Polio in Low-Resource Settings Using Principles and Practices of Emergency Operations Centers in Public Health. Journal of Public Health Management and Practice, 23(1), pp. 3-10(8). DOI: https://doi.org/10.1097/PHH.0000000000000447.
8. WHO (2013) A Systematic Review of Public Health Emergency Operations Centres (EOC) by World Health Organization (WHO). https://apps.who.int/iris/rest/bitstreams/461280/retrieve.
9. Wiedrich TW et al. (2013) Critical Systems for Public Health Management of Floods, North Dakota. Journal of Public Health Management and Practice. 19(3):259-65. doi:10.1097/PHH.0b013e3182641b39. PubMed PMID: WOS:000316945900014.