

Assessing the Effective Utilization of the National Public Health Emergency Operations Centre and Associated Barriers among Governmental and Non-Governmental Organizations in Lusaka District, Zambia, 2026

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APPROVAL

This dissertation of has been approved as partial fulfilment of the requirements for the award of Master of Disaster Studies at the Mulungushi University Research Ethics Committee (MUREC).

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DECLARATION

I, Karen Moompizho, hereby declare that this dissertation is my own original work and has not been submitted for the award of any degree at this or any other institution. All sources of information used in this study have been duly acknowledged and referenced in accordance with academic standards. This research was conducted independently under the supervision of my appointed supervisor. Any errors or omissions that remain are my responsibility.

Signature : 

Name : Karen Moompizho

Date : 25th August, 2026

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DEDICATION

This work is dedicated to my mother, Eunice Shibali, who instilled in me the importance of education and striving for excellence from an early age. Her continuous support and guidance have remained a steady source of inspiration throughout my academic journey.

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ABSTRACT

➤ **Background:**

Zambia established its National Public Health Emergency Operations Centre (NPHEOC) under the Zambia National Public Health Institute Act No. 19 of 2020, but little is known about how governmental and non-governmental stakeholders use it, or what constrains that use. This study assessed the utilization of the NPHEOC among stakeholders in Lusaka District.

➤ **Methods:**

A convergent mixed-methods design combined a survey of 51 stakeholders, 14 in-depth interviews, one focus group discussion, and a desk review of two national health-security assessments (the Joint External Evaluation, 2023, and the Cholera Intra-Action Review, 2024). Analysis included frequencies and cross-tabulations, Fisher's exact tests, composite indices with reliability testing, Spearman correlation, Firth penalized logistic regression, trend tests, and a purpose-built Coordination Performance Index (CPI). Qualitative data were analysed using thematic (Framework Method) analysis.

➤ **Results:**

Awareness was broad but shallow: 94.1% had heard of the Centre, yet only 27.7% could describe its role accurately. Awareness was positively associated with participation ($p = 0.46-0.50$; $p \leq 0.001$). Governmental respondents reported within 24 hours far more often than non-governmental respondents (76.9% versus 20.0%; $p = 0.022$), but in adjusted analysis, training was the strongest predictor of timely reporting within this sample ($aOR \approx 6.8$; $p = 0.007$) and the sector difference became non-significant. Utilization was moderate overall (mean CPI 63.9/100). Stakeholders valued the Centre as a unified coordination hub but described episodic, trust-mediated access constrained by unclear mandates, unsustainable financing, workforce gaps and poor interoperability; the desk review independently corroborated these findings.

➤ **Conclusion:**

Strengthening NPHEOC utilization depends less on raising awareness than on deepening operational knowledge, equalising training access across sectors, formalising partnerships and consolidating information systems. Given the small non-governmental subgroup ($n = 7$), sectoral findings are exploratory.

Keywords: Public Health Emergency Operations Centre, Emergency, Preparedness, Response, Stakeholder, Utilization.

CHAPTER ONE INTRODUCTION

➤ Introduction

Public health emergencies such as cholera, COVID-19, Ebola, measles and Mpox continue to pose major threats to global health security. These emergencies increasingly require rapid decision-making, coordinated communication and efficient resource mobilization across multiple sectors. As health systems confront more complex, frequent and cross-border events, countries have recognized the importance of structured coordination mechanisms to avoid fragmented responses and delayed interventions (WHO, 2018; Africa CDC, 2021). One such mechanism is the Public Health Emergency Operations Centre (PHEOC), which serves as the central platform for command, control, coordination and information management during emergencies. When effectively utilized, a PHEOC enhances situational awareness, harmonizes multi-sectoral actions and supports evidence-based decision-making (WHO, 2015).

- *Global Evolution of Public Health Emergency Operations Centres*

The concept of PHEOCs gained prominence following global outbreaks that exposed weaknesses in emergency coordination, including the 2003 SARS outbreak, the 2009 H1N1 influenza pandemic and the 2014–2016 West Africa Ebola outbreak. These events highlighted limitations in information sharing, cross-sectoral communication, and command structures across countries (WHO, 2016). In response, the World Health Organization developed the Framework for a Public Health Emergency Operations Centre (2015) to guide Member States in building functional systems aligned with International Health Regulations (IHR 2005) core capacities. The framework emphasizes standardized incident management structures, clear coordination procedures and strong linkages across health and non-health actors (WHO, 2015; WHO, 2021). Since then, countries have been encouraged to establish PHEOCs that are fully staffed, technically equipped and consistently utilized during emergencies.

- *Regional Developments in Strengthening PHEOCs*

Across Africa, the Ebola outbreak in West Africa accelerated political commitment to establishing PHEOCs as part of strengthening health-security systems. However, assessments indicate that although many African countries have created PHEOCs, only a minority function at optimal levels. An Africa CDC survey conducted in 2021 revealed that while approximately 80% of assessed countries had established PHEOCs, fewer than 30% met the minimum functionality standards relating to staffing, governance, information systems and operational readiness (Africa CDC, 2022). These findings informed regional commitments such as the Lusaka Call-to-Action (2022), which urges African Union Member States to operationalize fully functional PHEOCs by 2026. (UNDRR, 2017). The regional focus underscores the recognition that multisectoral coordination is central to achieving rapid and efficient emergency response on the continent.

- *Zambia's Public Health Emergency Landscape*

Zambia continues to experience recurrent public health emergencies, with cholera, measles and cross-border disease outbreaks posing significant risks to population health. The 2017–2018 cholera outbreak, the 2019–2021 COVID-19 pandemic and the 2023/24 cholera resurgence exposed systemic gaps in coordination, logistics, emergency communication and inter-agency collaboration (MOH, 2020; WHO Zambia, 2023). In response to these challenges, Zambia enacted the Zambia National Public Health Institute Act No. 19 of 2020, establishing the Zambia National Public Health Institute (ZNPHI) and mandating the creation and operation of the National Public Health Emergency Operations Centre (NPHEOC). The Act positions the NPHEOC as the national hub for multi-sectoral coordination of emergencies, data management, logistics coordination and after-action reviews (ZNPHI, 2020).

Although the NPHEOC has been activated during significant events including phases of COVID-19 and cholera responses various assessments highlight inconsistencies in stakeholder engagement, delayed activation and limited cross-sectoral participation. Evaluations conducted by WHO and ZNPHI note that some ministries, local authorities and non-governmental partners do not consistently participate in PHEOC activities or do not fully align their response actions with PHEOC directives (WHO, 2022; ZNPHI, 2023).

- *Importance of Multi-Sectoral Engagement in Zambia's PHEOC*

Public health emergencies in Zambia, including cholera, mpox, typhoid, anthrax and emergencies associated with flooding, require coordinated action across multiple governmental and non-governmental organizations because their prevention, preparedness and response extend beyond the health sector. Key governmental stakeholders include the Ministry of Water Development and Sanitation, Ministry of Local Government and Rural Development, Disaster Management and Mitigation Unit (DMMU), Ministry of Defense under public, health Ministry of Fisheries and Livestock, Ministry of Green Economy and Environment, and Lusaka City Council through its Department of Public Health. Therefore, institutions have complementary roles in addressing different dimensions of public health emergencies. The importance of such multisectoral engagement is reflected in Zambia's Joint External Evaluation, which identified the need for stronger coordination across human, animal and environmental health sectors WHO 2025. The Ministry of Water Development and Sanitation is central to water quality, sanitation and hygiene interventions, particularly in the prevention and control of cholera. The Ministry of Local Government and Rural Development and local authorities, including Lusaka City Council, support environmental health, waste management, sanitation and other public

health measures at community level. The Ministry of Fisheries and Livestock has an important role in the surveillance and management of zoonotic and animal-related health threats, while the Ministry of Green Economy and Environment contributes to addressing environmental risks that may affect public health. Similarly, non-governmental organizations such as the Zambia Red Cross Society and World Vision contribute to emergency preparedness, response, community engagement and delivery of essential services.

The effectiveness of this multisectoral system, however, depends not only on the existence of these institutional mandates but also on how effectively stakeholders utilize the NPHEOC as a platform for coordination, information sharing, reporting and joint emergency decision-making. Where relevant stakeholders have limited awareness of the Centre's mandate, inadequate access to information, inconsistent participation or weak linkages with NPHEOC coordination mechanisms, the ability to translate information into timely and coordinated action may be compromised. Thus, the critical issue is not merely whether the NPHEOC exists or whether institutions have defined emergency responsibilities, but whether the organizations expected to contribute to emergency preparedness and response are effectively engaging with and utilizing the NPHEOC to fulfil those responsibilities. Understanding the extent and depth of this utilization, together with the institutional, operational and coordination barriers that influence it, is therefore essential to strengthening multisectoral preparedness and response to public health emergencies in Zambia.

➤ *Statement of the Problem*

Effective management of public health emergencies in Zambia requires timely, coordinated and multisectoral action. The Zambia National Public Health Institute Act No. 19 of 2020 provides the legal basis for the National Public Health Emergency Operations Centre (NPHEOC) as a national mechanism for multisectoral collaboration and coordination public health emergencies. Multisectoral coordination is particularly important because effective emergency management require contributions from organizations outside the core health sector.

Ministries and agencies responsible for human health, animal health and the environment hold information, expertise and resources that are critical to public health emergency preparedness and response, while non-governmental organizations may provide additional technical, operational and financial support. The NPHEOC is intended to coordinate these stakeholders together through a common platform for information sharing, coordination, preparedness and emergency decision-making if these actors do not consistently use or participate in the (NPHEOC) operations, responses may become fragmented, with parallel communication channels, delayed information flow or duplication of activities.

Furthermore, existing assessments of PHEOCs have largely examined institutional functionality and system capacity Africa CDC, 2022, but they do not provide sufficient stakeholder-level evidence comparing governmental and non-governmental utilization across different institution or what institutional, operational and coordination barriers exist. Fekadu et al. (2023), for example, assessed PHEOC implementation across African countries using a standardized cross-sectional assessment of core components, while Eteng et al. (2023) examined PHEOC coordination and knowledge-sharing approaches during the COVID-19 response. These studies provide important evidence on PHEOC capacity and coordination but provide less evidence on stakeholder-level utilization, particularly whether awareness translates into active participation, timely reporting and effective information sharing.

Other assessments identify broad weaknesses in coordination, information management, resources and emergency response capacity, but there is limited stakeholder-level evidence explaining hinderance factors such as institutional, operational and coordination barriers that limit utilization of the NPHEOC in Lusaka. In particular, linking stakeholders' experiences of NPHEOC participation, awareness with issues such as unclear roles, communication and feedback gaps, resource constraints, and coordination are not clearly studied

These gaps are particularly important in light of the 2023–2024 cholera response in Lusaka, during which increasing cases overwhelmed treatment facilities and required the establishment of a high-volume cholera treatment centre at National Heroes Stadium (Chibuye et al., 2024). The subsequent experience with centralized and decentralized treatment also demonstrated the importance of timely coordination, surge preparedness, accessibility, logistics and resource allocation (Kaoma & Norizuki, 2025). The Heroes Stadium experience therefore illustrates why emergency coordination mechanisms need to be operationalized in advance and utilized effectively by the stakeholders responsible for emergency action

This evidence gap matters because the organizations expected to use the NPHEOC are also the organizations that must translate emergency information, coordination timely response and decisions into action. For example, ministry of water development and sanitation may need to act on outbreak information, local authorities may need to coordinate environmental interventions. Understanding how these stakeholders utilize the NPHEOC, and why utilization is uneven, is therefore necessary for strengthening the coordination mechanism itself.

Reports and after-action reviews indicate several gaps affecting NPHEOC utilization in Zambia. These include irregular participation of relevant ministries or sectors, weak adherence to the Incident Management System (IMS), delays in multisectoral activation, insufficient harmonization of community-level interventions, and weaknesses in information flow between the PHEOC

and key operational actors' insufficient data-sharing processes and inadequate integration of humanitarian partners (WHO, 2023). These gaps contribute to siloed responses, duplication of efforts and delays in critical decision-making during emergencies. The consequences were evident during the 2023/24 cholera outbreak, which spread across all ten provinces and resulted in over 14,000 cases, partly due to slow multi-sectoral coordination (MOH, 2024).

Consequently, it remains unclear whether broad awareness translates into deeper operational knowledge and participation, or information-sharing performance differs between governmental and non-governmental stakeholders, and which factors are statistically associated with timely reporting.

This study addresses this gap by assessing NPHEOC utilization among governmental and non-governmental stakeholder organizations and associated institutional, operational and coordination barriers in Lusaka District, therefore responding to a practical and evidence gap: Zambia has a national coordination mechanism, but there is insufficient stakeholder-level on how consistently and effectively it is being used by the organizations that are expected to participate in emergency preparedness and response. Establishing the extent and pattern of utilization, together with the barriers affecting it.

➤ *Research Objectives*

• *Main Objective*

To assess the extent and patterns of utilization of the National Public Health Emergency Operations Centre (NPHEOC) and factors associated with its use among governmental and non-governmental stakeholders in Lusaka District, Zambia

• *Specific Objectives*

- ✓ To determine and compare the level and depth of awareness of the National Public Health Emergency Operation Centre mandate and functions among governmental and non-governmental stakeholders in Lusaka District.
- ✓ To assess the effectiveness and timeliness of information sharing between the NPHEOC and governmental and non-governmental stakeholders during public health emergencies in Lusaka District.
- ✓ To explore stakeholders' experiences and patterns of utilization of NPHEOC activities during public health emergencies in Lusaka District.
- ✓ To identify institutional, operational, resource, communication and coordination barriers associated with the utilization of the NPHEOC among governmental and non-governmental stakeholders in Lusaka District.

➤ *Research Questions*

- What is the level of awareness of the NPHEOC mandate among governmental and non-governmental stakeholders in Lusaka District?
- How effective are the information-sharing mechanisms between the NPHEOC and stakeholders in Lusaka District during public health emergencies?
- What are the experiences of stakeholders in utilizing NPHEOC activities during public health emergencies in Lusaka District?
- What institutional, operational, and coordination barriers limit the effective utilization of NPHEOC during public health emergencies in Lusaka District?

➤ *Significance of the Study*

This study is significant because it addresses a critical gap in Zambia's public health emergency preparedness and response system as there is limited and inconsistent utilization of the National Public Health Emergency Operations Centre (NPHEOC). Understanding the barriers that hinder effective engagement with the PHEOC is essential for improving coordination, communication, and decision-making during emergencies.

Firstly, the findings will provide evidence-based information to the Ministry of Health, Zambia National Public Health Institute (ZNPHEI), and the Disaster Management and Mitigation Unit (DMMU) on how multisectoral actors currently interact with the NPHEOC and what gaps exist. This will strengthen operational protocols, and guide effective implementation of the Incident Management System (IMS).

Secondly, the study will benefit line ministries and statutory agencies such as the Ministry of Water Development and Sanitation, Ministry of Local Government and Rural Development, and local authority (City Councils) by identifying the challenges affecting their engagement. The study will help enhance collaboration frameworks, and promote timely participation in emergency preparedness and response operations.

Thirdly, the research will be valuable to non-governmental organizations including civil society actors, and community-based organizations as it highlights how better integration with the NPHEOC can improve the effectiveness of community-level interventions and resource allocation during outbreaks.

Additionally, the study contributes to academic literature on emergency management in low- and middle-income countries by offering empirical evidence on PHEOC utilization barriers within a Sub-Saharan African context. This supports ongoing regional and global efforts to strengthen health security systems.

Ultimately, the study aims to inform practical, actionable strategies that can enhance Zambia's capacity to detect, prepare for, and respond to public health emergencies more efficiently, thereby reducing morbidity, mortality, and socio-economic impacts on communities. Therefore, by introducing measurable indicators and an implementation-focused assessment, this study moves beyond descriptive analysis and contributes to evidence-based strengthening of emergency coordination systems in Zambia.

➤ *Scope of the Study*

This study focuses on the utilization of the National Public Health Emergency Operations Centre (NPHEOC) and associated barriers among governmental and non-governmental organizations in Lusaka District, Zambia. It examines the extent and patterns of stakeholder utilization, including awareness and knowledge of the NPHEOC mandate and functions, participation in information sharing and reporting, and experiences of engaging with NPHEOC activities during public health emergencies.

The study involves personnel from governmental and non-governmental organizations whose roles are relevant to public health emergency preparedness, surveillance, response, coordination and information sharing. It compares governmental and non-governmental stakeholders to identify differences in awareness, information sharing, reporting timeliness and utilization of the NPHEOC.

The study further examines institutional, operational, and coordination barriers associated with NPHEOC utilization. It is geographically concentrated in Lusaka District and considers stakeholder experiences arising from public health emergencies, including cholera, COVID-19 and Mpox. The study focuses on the coordination and utilization of the NPHEOC. The quantitative component will be focused on measurable patterns of awareness, information sharing, participation, timeliness and utilization, including comparison between governmental and non-governmental stakeholders. The qualitative component explored stakeholders' experiences of NPHEOC utilization and the barriers associated with its use.

CHAPTER TWO

LITERATURE REVIEW

➤ *Introduction*

This chapter reviews existing literature related to Public Health Emergency Operations Centres (PHEOCs), their roles, functionality and barriers to utilization in emergency management systems. The purpose of the review is to establish the theoretical, conceptual and empirical basis for assessing the barriers to effective utilization of Zambia's National Public Health Emergency Operations Centre (NPHEOC) by governmental and non-governmental agencies. The chapter examines global and regional perspectives on PHEOCs, reviews empirical studies, presents relevant theories informing the study, outlines the conceptual framework, and identifies the existing research gaps.

➤ *National Public Health Emergency Operations Centre (NPHEOC)*

• *Role and Purpose of PHEOCs*

The Public Health Emergency Operations Centre is internationally recognized as a central hub for coordinating emergency preparedness and response. According to the WHO Framework for a Public Health Emergency Operations Centre (2015), a PHEOC provides structured incident management, real-time information flow, multi-sectoral coordination, resource mobilization, and operational decision support. When effectively utilized, the PHEOC ensures consistent situational awareness, reduces duplication, and creates a unified command system during emergencies (WHO, 2018).

The NPHEOC in Zambia was established under the Zambia National Public Health Institute Act No. 19 of 2020, which mandates it to coordinate public health emergencies through data analysis, logistics management, activation protocols, and multi-agency coordination platforms. The Act positions the NPHEOC as a national mechanism that links health, water and sanitation, local government, education, agriculture, and humanitarian sectors during emergencies.

• *Core Components of Functional PHEOCs*

Literature identifies several components required for PHEOC functionality:

- ✓ Governance and legal frameworks that define authority and coordination (WHO, 2015).
- ✓ Incident Management System (IMS) structures for standardized emergency activation (Hick et al., 2020).
- ✓ Trained and dedicated staff, including epidemiologists, logistics officers and communication teams (Africa CDC, 2021).
- ✓ Reliable information systems for surveillance, reporting and decision support (Chan et al., 2016).
- ✓ Multisectoral engagement, which ensures coordinated actions across line ministries and partners (WHO, 2019).

• *Challenges and Barriers to PHEOC Utilization*

Globally, Public Health Emergency Operations Centres (PHEOCs) continue to encounter several operational and structural challenges that limit their optimal utilization. Evidence shows that many centres struggle to achieve full multisectoral engagement, with key ministries and partners often absent from coordination platforms despite their critical mandates in emergency response (WHO, 2021). Weak communication and information-sharing systems further compound this challenge, leading to delays in decision-making and fragmented response efforts (Otolorin et al., 2020). Another commonly reported barrier is the limited awareness or understanding of the PHEOC's mandate among non-health sectors, resulting in poor interagency collaboration and minimal participation during emergencies (Africa CDC, 2022). In addition, inconsistent training, inadequate simulation exercises, and insufficient emergency management competencies weaken operational readiness and hinder coordinated response actions (Nelson & Lurie, 2020). Resource constraints including limited staffing, unreliable infrastructure, and logistical challenges also continue to undermine the ability of PHEOCs to function effectively, particularly in low-resource settings (Zhang et al., 2021).

Within the African region, the 2021 Africa CDC functionality assessment revealed that only 29% of established PHEOCs met the minimum criteria required to be classified as fully functional, indicating persistent institutional weaknesses, fragmented coordination mechanisms, and limited interoperability across sectors. The situation in Zambia reflects similar patterns. After-action reviews from recent public health emergencies including cholera and COVID-19 have highlighted delayed activation of the PHEOC, weak stakeholder engagement, and the emergence of parallel response structures operating outside the formal NPHEOC coordination system (MOH, 2024; WHO Zambia, 2023). These challenges collectively indicate the need for strengthened governance, improved communication systems, and enhanced multisectoral collaboration to ensure the effective utilization of the NPHEOC in managing complex public health emergencies.

➤ *Empirical Studies*

• *Global Empirical Evidence*

Empirical studies show that countries with effectively utilized PHEOCs tend to have faster and more coordinated emergency responses. For example, studies following the 2014–2016 Ebola outbreak reported that functional PHEOCs significantly improved

coordination and resource allocation in Liberia and Nigeria (Shuaib et al., 2016). Similarly, in South Korea, the PHEOC structure enhanced real-time communication during COVID-19, reducing delays in intervention (Kim et al., 2020).

A study by Katz et al. (2018) found that well-equipped PHEOCs contributed to effective risk communication, improved surveillance integration, and accelerated decision-making during global outbreaks.

- *Regional Empirical Evidence*

Africa CDC's multi-country study (2022) revealed that several African PHEOCs face challenges such as inadequate staffing, limited training, insufficient physical infrastructure, and weak inter-agency coordination. Another study in Uganda found that poor communication and unclear institutional roles weakened PHEOC functionality during outbreaks (Nakitto et al., 2019).

Kenya's experience during COVID-19 showed that successful PHEOC activation depended on consistent partner engagement and real-time data sharing (Wachira et al., 2021).

Fekadu et al. (2023) conducted a cross-sectional assessment of the implementation status of Public Health Emergency Operations Centres (PHEOCs) across Africa. The study used a standardized self-administered online questionnaire completed by national PHEOC focal points and assessed four core components of PHEOC functionality. Functionality criteria were developed from the collected indicators using expert consensus, and descriptive statistics were used to determine the proportion of PHEOCs meeting predefined minimum requirements. Of the 41 countries reporting an established PHEOC, only 12 (29%) met at least 80% of the minimum requirements and were classified as fully functional. The study demonstrated that the establishment of a PHEOC does not necessarily translate into full operational functionality.

- *Empirical Evidence from Zambia*

Zambia's emergency responses provide practical insight into PHEOC utilization challenges. WHO (2023) reported gaps in multi-sectoral involvement during the 2023/24 cholera outbreak, including insufficient engagement of water, sanitation, and local government sectors. MOH (2024) further highlighted delays in operational coordination and limited integration of humanitarian partners during the same outbreak.

The 2023–2024 cholera response also provides an important operational context for examining emergency coordination. Kaoma and Norizuki (2025) examined centralized and decentralized cholera treatment-centre approaches during the outbreak using semi-structured interviews with key stakeholders and publicly available situation reports. Their analysis highlighted the importance of flexible surge arrangements, coordination, resource availability and clearly defined emergency structures when response demands increase. While the study provides useful evidence on operational coordination and surge capacity, it focused on cholera treatment-centre arrangements rather than stakeholder utilization of the NPHEOC as the national emergency coordination platform.

Evidence from Zambia demonstrates the practical importance of multisectoral coordination during public health emergencies. Kateule et al. (2024) examined the multisectoral response to the 2023–2024 cholera outbreak in Lusaka District using a descriptive observational design. The researchers combined quantitative and qualitative non-participant observation, surveillance data and situation reports to document response activities and challenges. The study found that a coordinated multisectoral approach involving health authorities and other sectors supported technical assistance, resource mobilization and response activities during the outbreak.

During COVID-19, an operational review by ZNPHI (2022) noted challenges with information-sharing systems, inconsistent participation in the Incident Management System, and limited collaboration across sectors. These findings support the need to systematically assess barriers affecting NPHEOC utilization.

➤ *Theoretical Framework*

- *Systems Theory*

Systems Theory, developed by Ludwig von Bertalanffy, posits that organizations function as interconnected systems where each component influences the whole. In emergency management, this theory suggests that coordinated action among health, water, sanitation, local government, and humanitarian agencies is essential for effective response (Meadows, 2015). Limited PHEOC utilization disrupts system interconnectedness, leading to fragmented interventions.

- *Coordination Theory*

Coordination Theory (Malone & Crowston) emphasizes the need for shared goals, communication structures, defined roles and synchronized activities. It is relevant to PHEOCs because emergency operations require alignment of policies, roles and tasks across diverse actors. Barriers such as unclear mandates or poor communication directly hinder coordination.

- *Institutional Theory*

Institutional Theory explains how institutional norms, rules, and structures shape organizational behavior. This theory applies to PHEOC utilization, as agencies may not fully engage due to institutional culture, weak enforcement of coordination policies, or resistance to new operational frameworks (Scott, 2016).

Together, these theories provide a foundation for analyzing why some agencies engage effectively with the NPHEOC while others do not.

➤ *Conceptual Framework*

The conceptual framework links the study variables and illustrates how identified factors influence PHEOC utilization.

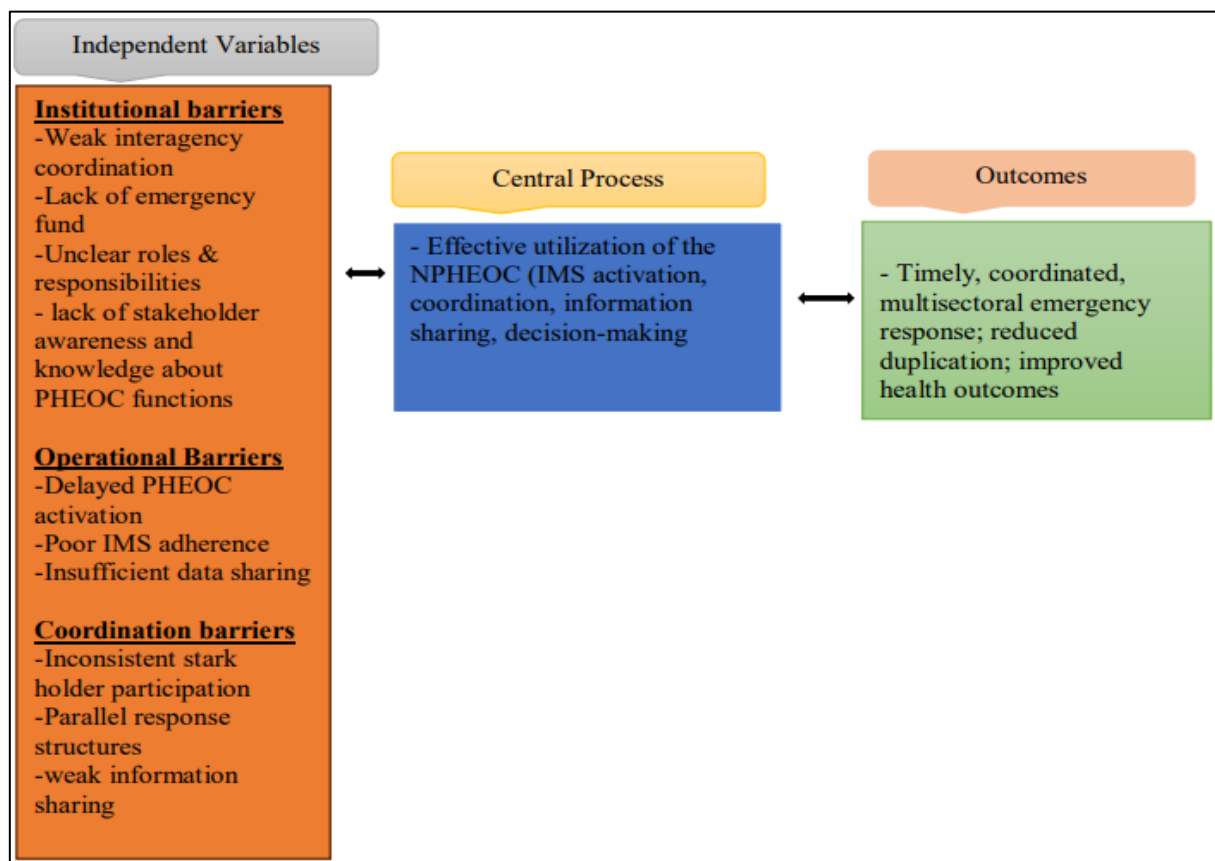


Fig 1 The Conceptual Framework

Figure 1 Conceptual framework linking institutional, operational, communication and stakeholder-engagement factors to NPHEOC utilization and response outcomes

A conceptual framework is a visual and logical representation of how key factors influence the outcome. Therefore, the conceptual framework is developed from a synthesis of the study objectives, relevant literature, the WHO Public Health Emergency Operations Centre (PHEOC) framework and the systems theory developed by Ludwig von Bertalanffy, posits that organizations function as interconnected systems where each component influences the whole. In emergency management, this theory suggests that coordinated action among health, water, sanitation, local government, and humanitarian agencies is essential for effective response (Meadows, 2015). Limited PHEOC utilization disrupts system interconnectedness, leading to fragmented interventions

The conceptual framework is developed from a synthesis of the study objectives, relevant literature. Additionally, the WHO PHEOC framework of 2015 identifies coordination of information and resources, communication, leadership, defined roles and collaboration among response agencies as important elements of a functional PHEOC. Based on these principles, the study groups the factors influencing NPHEOC utilization into institutional, operational and coordination barriers.

The framework therefore assumes that these barriers interact rather than operate independently. Institutional weaknesses can contribute to operational difficulties and weak coordination; operational and coordination difficulties can in turn reduce stakeholder engagement with the NPHEOC. Reduced stakeholder engagement is expected to result in lower NPHEOC utilization, reflected through stakeholder awareness and knowledge, participation, information sharing, reporting timeliness and perceived effectiveness.

➤ *Research Gap Analysis*

Existing literature demonstrates the importance of PHEOCs in coordinating public health emergency preparedness and response. However, much of the evidence focuses on PHEOC establishment, functionality and institutional capacity rather than how stakeholders actually utilize these coordination mechanisms. For example, Fekadu et al. (2023) assessed the implementation and functionality of PHEOCs across Africa using a cross-sectional institutional assessment. While the study identified important functionality gaps, it did not examine stakeholder-level utilization, including awareness, participation, information sharing and reporting practices.

Similarly, Eteng et al. (2023) examined knowledge sharing and coordination through PHEOCs during the COVID-19 response in Africa, demonstrating the importance of communication and stakeholder engagement. However, the study focused on a knowledge-management intervention rather than systematically assessing the extent and patterns of utilization of a national PHEOC by governmental and non-governmental organizations.

In Zambia, Kateule et al. (2024) documented multisectoral coordination challenges during the 2023–2024 cholera outbreak in Lusaka, while Kaoma and Norizuki (2025) examined coordination and surge arrangements during the same outbreak. These studies provide important evidence on emergency response and coordination challenges but are primarily outbreak-specific and do not assess stakeholder utilization of the NPHEOC across emergency contexts.

Consequently, there remains limited Zambia-specific, stakeholder-level evidence on the extent and patterns of NPHEOC utilization, differences between governmental and non-governmental stakeholders, and the institutional, operational, resource, communication and coordination barriers associated with its use. There is also limited evidence combining quantitative measures of awareness, information sharing and reporting timeliness with qualitative accounts of stakeholder experiences and barriers.

There is a lack of clearly defined and measurable indicators of effective PHEOC utilization. Most studies describe coordination challenges qualitatively without quantifying key outcomes such as participation rates, activation timelines, reporting efficiency, and decision-making turnaround. This limits the ability to assess performance and track improvements over time, making the organizational adoption and implementation fidelity of NPHEOC systems underexplored. There is insufficient evidence on whether Government and non-government institutions;

- Utilize Standard Operating Procedures (SOPs) and translate them into action during emergency response
- Maintain functional coordination mechanisms during both emergency and non-emergency periods
- Utilize the public Health Emergency Operations Centre during emergencies
- Consistently adhere to Incident Management System (IMS) structures

And an understanding of multisectoral participation dynamics, particularly why key sectors such as water, sanitation, local government, and humanitarian agencies engage inconsistently despite their critical roles in emergency response.

This study addresses this gap by assessing NPHEOC utilization among governmental and non-governmental organizations in Lusaka District and examining the barriers associated with its use. While regional assessments by Africa CDC (2022) highlight widespread PHEOC functionality gaps across the continent, these studies do not provide detailed, specific insights into utilisation challenges by key Government and Non-Governmental organisations

This study addresses these gaps by providing empirical, evidence on NPHEOC barriers associated with its utilization, focusing on measurable coordination outcomes, stakeholder engagement, implementation fidelity, and system sustainability within Zambia.

➤ *Summary*

This chapter reviewed literature on the role, functionality and utilization of Public Health Emergency Operations Centres (PHEOCs) at global, regional and national levels. The literature highlighted the importance of PHEOCs in multisectoral coordination, information sharing and emergency response, while also identifying institutional, operational, resource, communication and coordination challenges. The review further examined empirical studies and the approaches used to assess PHEOC functionality and emergency coordination.

The research gap analysis established that, although previous studies have examined PHEOC functionality and outbreak coordination, there is limited Zambia-specific, stakeholder-level evidence on the extent and patterns of NPHEOC utilization and the barriers associated with its use, particularly among governmental and non-governmental organizations. This gap provides the basis for the present study

The conceptual framework established the relationship between barriers (institutional, operational, communication and stakeholder engagement) and effective NPHEOC utilization. The research gap analysis demonstrated the limited Zambia-specific evidence on factors affecting PHEOC use, justifying the need for this study.

CHAPTER THREE

RESEARCH METHODOLOGY

➤ *Introduction*

This chapter describes the methods used to assess NPHEOC utilization and associated barriers among governmental and non-governmental stakeholders in Lusaka District. The methodology is written to correspond directly with the four study objectives and the analyses presented. It describes the research design, guiding framework, study area, study population, sampling unit, eligibility criteria, sample size and sampling techniques or procedures, data sources and instruments, operational definitions, quantitative and qualitative analysis, integration, data quality assurance, ethical considerations and methodological limitations.

The study will generate quantitative evidence on awareness and knowledge, information-sharing effectiveness and timeliness, stakeholder participation and utilization, and qualitative evidence on experiences and barriers. The unit of observation was the individual eligible stakeholder officer representing an organization expected to interact with the NPHEOC.

➤ *Research Design*

This study adopts a convergent mixed-methods design was used, comprising a quantitative cross-sectional survey and a qualitative exploratory component. The quantitative survey will measure awareness and knowledge, information-sharing practices, reporting timeliness, participation and effectiveness, while the qualitative component will explore stakeholder experiences of National Public Health Emergency Operation Centre utilization and associated institutional, operational and coordination barriers.

- Quantitative component: a structured stakeholder questionnaire will be used to generate frequencies, percentages, composite indices and inferential comparisons and associations corresponding to Objectives 1 and 2 and the cross-cutting assessment of utilization.
- Qualitative component: semi-structured in-depth interviews and one focus group discussion with the public health emergency operations centre and explore experiences of utilization and barriers corresponding primarily to Objectives 3 and 4 and provide contextual explanations of findings.

The two strands will be collected during the same study period, analysed separately and integrated during interpretation. The design is appropriate because the study sought both measurable evidence of the extent and pattern of utilization and contextual explanations of stakeholder experiences. The cross-sectional design.

➤ *Guiding Framework*

• *Systems Theory*

Systems Theory, developed by Ludwig von Bertalanffy, posits that organizations function as interconnected systems where each component influences the whole. In emergency management, this theory suggests that coordinated action among health, water, sanitation, local government, and humanitarian agencies is essential for effective response (Meadows, 2015). Limited PHEOC utilization disrupts system interconnectedness, leading to fragmented interventions. The framework therefore provided a common structure linking the study problem, variables, questionnaire domains, interview questions and interpretation of associated barriers. The WHO/PHEOC literature and national health-security documents were used as contextual and documentary sources, rather than as separate theoretical frameworks guiding the study.

➤ *Study Population*

The study population comprised individual officers representing governmental and non-governmental organizations whose responsibilities involved, or could require, interaction with the NPHEOC during emergency preparedness, surveillance, coordination, information sharing or response.

The study therefore did not sample institutions as statistical units. Institutions were used to identify the relevant stakeholder groups, while individual officers were the persons who were sampled and provided the data;

• *Governmental Stakeholders*

These will include institutions with functions in emergency preparedness and response such as;

- ✓ Ministry of Health (MOH)
- ✓ Zambia National Public Health Institute (ZNPHI)
- ✓ Disaster Management and Mitigation Unit (DMMU)
- ✓ Ministry of Water Development and Sanitation
- ✓ Ministry of Local Government and Rural Development
- ✓ Local authorities (e.g., Lusaka City Council)
- ✓ Ministry of Green Economy

- *Non-Governmental Stakeholders*

Non-governmental stakeholders will be comprised of organizations involved in public health emergency preparedness and response activities in Lusaka District. Eligible non-governmental respondents will be officers whose roles involve emergency preparedness, surveillance, coordination, information sharing, technical support, logistics, community response or other functions requiring interaction with the NPHEOC, such as organizations such as the World Vision, and Zambia Red Cross. The study will also categorize participants into: National-level sectors Subnational sectors.

Technical respondent will be represented within the selected organizations and these will include;

- ✓ Surveillance officers;
- ✓ Epidemiologists;
- ✓ Environmental health officers;
- ✓ Public health specialists;
- ✓ Laboratory officers;
- ✓ Medical officers/doctors;
- ✓ Veterinary officers;
- ✓ Early-warning officers; and other officers whose responsibilities involved emergency preparedness,

The selection of Lusaka was therefore criterion-based and purposive, based on the presence of the NPHEOC, concentration of relevant stakeholders, exposure to public health emergencies and the existence of organizations whose functions require interaction with emergency coordination, surveillance, information sharing or response systems.

➤ *Sample-Size Determination*

A distinction is drawn between the sample-size calculation (how many respondents were required) and the sampling technique (how they were selected). The required sample size was derived using Yamane's (1967) formula for a finite population, $n = N / (1 + N e^2)$, where N is the total eligible stakeholder population and e is the margin of error (0.05). With $N = 50$ eligible stakeholders across the participating institutions and $e = 0.05$, the formula yields $n = 50 / (1 + 50 \times 0.0025) = 50 / 1.125 \approx 44$. Because the eligible population of institutionally-mandated stakeholders is small and well defined, the study effectively enumerated it, enrolling 51 respondents in the quantitative survey.

- *Quantitative Data Analysis will Consider;*

- ✓ Frequencies and percentages summarize categorical variables.
- ✓ Means and standard deviations summarize composite scores.
- ✓ Fisher's exact test compares categorical indicators between governmental and non-governmental stakeholders.
- ✓ Performance mean Score on the time taken to make decisions reporting time to the centre
- ✓ Coordination Performance Index; knowledge and awareness; participation and engagement; timeliness; and perceived effectiveness.

➤ *Sampling Techniques*

Purposive (judgemental) sampling will be used to select institutions and, within them, individuals with direct roles in emergency preparedness, coordination, surveillance, because these respondents possess the expertise and experience necessary to address the research objectives (Palinkas et al., 2015; Etikan, Musa & Alkassim, 2016). Where several eligible officers are available within an institution, convenience sampling will be used to select those available during data collection, which is acceptable in operational public health settings where officials face competing priorities. It will assess utilization based on the experiences, knowledge, participation and reporting practices of officers representing stakeholder organizations. For example, the Ministry of Health department will constitute part of the organizational sampling frame, but the actual respondent will be eligible officers such as a surveillance officer, epidemiologist, environmental health officer, laboratory officer or emergency focal points. The NPHEOC was the system being assessed, while the individual stakeholder officer was the person from whom information about utilization was obtained.

- *Qualitative Sample*

The study population will be a specialized stakeholder population rather than a general population from which a prevalence estimate will be required. Consequently, the sample size will not be derived using the yamene formula. Key informants will be selected on the basis of their institutional role in emergency preparedness and response, coordination and information sharing in emergency times, and breadth across governmental and non-governmental sectors. The FGD will be conducted with the PHEOC team because the group would provide complementary, insider information on the Centre's own coordination processes. Recruitment continued until data saturation the point at which additional interviews yielded no substantially new themes was reached; the final count of 14 IDIs reflects that stopping criterion rather than a statistical target.

The qualitative sample will be considered sufficient for the study because the interviews will be intended to produce recurring themes concerning utilization, access, coordination, communication and associated barriers, which will now subsequently be triangulated with the survey and document review findings, the PHEOC team will be selected for the FGD because the staff of staff has direct operational knowledge of the Centre's coordination processes and stakeholder engagement.

➤ Sources of Data

The study will use primary quantitative and qualitative data, supplemented by secondary data evidence for triangulation.

• Sources of Data and Instruments

Both primary and secondary data were used to enhance validity through triangulation (Fusch, Fusch & Ness, 2018). Primary data were collected through a structured questionnaire (administered electronically) and semi-structured IDI and FGD guides. Secondary data — the desk-review component — comprised NPHEOC reports, after-action/intra-action reviews, government policy documents, WHO publications and Africa CDC assessments; specifically, the Zambia Joint External Evaluation (2023) and the Cholera Intra-Action Review (2024) were reviewed and triangulated against the primary findings (Yin, 2018). The questionnaire was organized into domains aligned with the objectives; Table 3.1 shows the key domains, representative items and response formats.

Table 1 Key Questionnaire Domains, Representative Items and Response Formats.

Objective / domain	Example questionnaire item (as administered)	Response format
Awareness	“Have you heard of the NPHEOC?”; “Are you aware of the ZNPHI Act No. 19 of 2020?”	Yes / No
Awareness (depth)	“How would you rate your familiarity with the role of the NPHEOC?”; “How accurately can you describe its role?”	5-point Likert
Access / information sharing	“Does your organisation share information with the NPHEOC?”; “How frequently do you engage in information sharing during emergencies?”	Yes/No; frequency
Participation	Whether the respondent/institution participates in NPHEOC activities and serves as an emergency focal point.	Yes/No; categorical
Timeliness	“How soon does your organisation report a signal/event to the Centre?”; “How soon are decisions communicated?”	Ordered categories
Utilization / effectiveness	Use of the NPHEOC for coordination, information and decision-making; overall effectiveness of information sharing.	5-point Likert; categorical
Barriers (qualitative)	IDI/FGD prompts on institutional, operational and coordination challenges.	Open-ended

• Conceptual Framework and Study Variables

Consistent with Chapter Two, the study was guided by Systems, Coordination and Institutional theory and the conceptual framework linking institutional, operational, communication and stakeholder-engagement factors to NPHEOC utilization. Table 3.2 shows which framework domain informed each study construct; the same framework structures the qualitative barrier analysis (institutional, operational and coordination domains) in Chapter Four.

Table 2 Mapping of Study Constructs to the Study's Theoretical/Conceptual Framework.

Study construct	Informing framework domain
Awareness	Stakeholder-engagement factors (Institutional Theory — norms & understanding of mandate)
Participation	Stakeholder-engagement factors (Coordination Theory — engagement & synchronized action)
Information sharing	Communication/information factors (Coordination Theory — communication structures)
Utilization	Central process — effective NPHEOC use (Systems Theory — interconnected coordination)
Barriers	Institutional, operational and communication factors (all three theories)
Stakeholder experience	Institutional & coordination factors (Institutional Theory — culture & behaviour)

The principal binary outcome for inferential modelling was timely reporting to the Centre (within 24 hours: yes/no). Independent variables comprised sector (governmental vs non-governmental), operational level (national vs sub-national), years of experience, receipt of training, and focal-point status.

➤ Data Analysis Procedures

• Quantitative Data Analysis

Quantitative data will be coded and analysed to generate descriptive statistics and the inferential analyses specified below; qualitative data will be analysed using thematic (Framework Method) analysis. Every statistical method that will appear in Chapter Four is defined here.

- *Descriptive Analysis*

Categorical variables will be summarised as frequencies and percentages (excluding missing responses); index and continuous scores as means and standard deviations. Cross-tabulations described relationships between categorical variables (e.g., government vs NGO participation). Key indicators included participation rate (%), awareness level (%), information-sharing timeliness, frequency of coordination, and the proportion of agencies with focal points.

- *Reliability of Composite Scales*

Internal consistency of the composite indices (awareness/knowledge, information-sharing effectiveness, participation and the overall performance index) will be assessed using Cronbach's alpha, with $\alpha \geq 0.60$ taken as acceptable for the exploratory scales.

- *Comparative Analyses*

Each planned comparison is specified by what will be compared, between whom, why, and the method:

- ✓ Governmental vs non-governmental respondents on awareness, training, focal-point status and timely reporting — to assess sectoral differences — using Fisher's exact test (preferred over chi-square given small expected cell counts).
- ✓ Information-sharing effectiveness and composite indices between sectors — using the Mann–Whitney U test (appropriate for ordinal/skewed scores).
- ✓ Utilization (performance index) across respondent categories (sector and operational level) — using Mann–Whitney U and the Jonckheere–Terpstra trend test.
- ✓ Performance/utilization against a reference — index scores were classified against pre-defined performance bands (low <50; moderate 50–69; high ≥ 70).

- *Correlation Analysis (Awareness and Participation)*

Spearman's rank correlation will be used to examine the relationship between awareness of the NPHEOC and participation in NPHEOC activities. Spearman (not Pearson) was chosen because the variables are ordinal/derived index scores that are not normally distributed and the sample is modest. Awareness will be operationalised from the familiarity, role-description, alignment and training items; participation from the information-sharing-frequency, organisational-information-sharing, reporting-intensity and focal-point items. For each correlation the coefficient (ρ), the direction and strength of association, the p-value and the sample size (n) are reported, directly answering the question "Is awareness associated with participation?"

- *Regression Analysis*

The outcome is timely reporting to the Centre (within 24 hours: yes/no). The predictors entered were sector, operational level and receipt of training. Regression will be conducted to determine whether the bivariate sectoral difference persisted after adjustment. Because of the small sample and sparse cells, Firth's penalized logistic regression was used, as ordinary logistic regression is biased under separation. Both crude (bivariate) and adjusted estimates were considered; results are reported as adjusted odds ratios (aOR) with 95% confidence intervals and penalized likelihood-ratio p-values, with significance at $p < 0.05$. An adjusted odds ratio expresses the change in the odds of reporting within 24 hours associated with a predictor, holding the others constant. These estimates measure association, not causation; causal language is avoided.

- *Trend Analysis*

Trends across the ordered operational levels (sub-district $\rightarrow$ national) will be tested using the Jonckheere–Terpstra test (index/ordinal outcomes) and the Cochran–Armitage test (binary outcomes), with the test statistic and p-value reported.

- *Coordination Performance Index (CPI)*

To quantify utilization in a single measure, a Coordination Performance Index will be constructed. Its items will be drawn from the study questionnaire and organised, according to the conceptual framework, into four conceptually distinct domains: (i) awareness and knowledge; (ii) participation and engagement; (iii) timeliness; and (iv) perceived effectiveness. Each constituent item was rescaled to a common 0–100 metric; items within a domain were averaged to give a domain score; and the four domain scores were averaged to give the overall CPI (0–100). The domains were equally weighted, stated explicitly as a transparent default adopted in the absence of any basis for privileging one domain. The final score will be interpreted against bands (low <50; moderate 50–69; high ≥ 70), and internal consistency across the domains was assessed with Cronbach's alpha. This specification allows a reader to reproduce the calculation from the questionnaire items. Where a domain- or performance-profile chart is presented (Figures 4.3 and 4.7), the dashed reference line represents the descriptive overall mean of the plotted scores; it is an interpretive reference only and does not represent a statistical test, threshold or significance boundary.

- *Statistical Inference and the Interpretation of "Effectiveness"*

A clear distinction will be maintained between descriptive evidence of a difference (frequencies, percentages, and the visual spread of scores) and statistical evidence of an association or difference (hypothesis tests). Conclusions are will not be drawn from visual differences in graphs alone; wherever an inferential claim is made, the relevant test statistic, p-value and, where appropriate, confidence interval and effect estimate are reported. Because the study was not designed to test the NPHEOC's effectiveness as a

causal outcome, it does not conclude that the Centre is simply “effective” or “not effective”; it reports performance and utilization against the defined indicators and the accompanying statistical findings.

- *Alignment of Analyses with Objectives*

Table 3 Objective–Analysis–Result Alignment.

Objective	Analysis
Awareness of the NPHEOC mandate	Frequencies, percentages; Knowledge-Depth Index & reliability
Effectiveness & timeliness of information sharing	Frequencies; Info-Sharing Effectiveness Index; comparative tests
Comparison between stakeholder groups	Cross-tabulation; Fisher’s exact; Mann–Whitney
Awareness–participation relationship	Spearman correlation
Predictors of timely reporting / utilization	Firth regression; trend tests; CPI
Barriers & stakeholder experience	Thematic (Framework Method) analysis

➤ *Qualitative Data*

Qualitative data from key informant interviews and the FGD will be analysed using thematic content analysis operationalised through the Framework Method: transcribing, coding (inductively and against the study’s framework), charting into a framework matrix, developing themes, and comparing across stakeholder groups (triangulation). Findings were integrated with the quantitative strand through a joint display and meta-inference typology (Nowell et al., 2017; Fetters et al., 2019).

One focus group discussion with the PHEOC will be conducted, because, the group could provide complementary, insider informat will be conducted ion on the Centre’s own coordination processes. Recruitment will continue until data saturation the point at which additional interviews yielded no substantially new themes will be reached; the final count rather than a statistical target. Ssecondary evidence will comprise of documents from the national PHEOC and Country reports including the International Health Regulations core capacities.

➤ *Ethical Concerns*

Ethical approval will be obtained from the relevant ethics committee prior to commencement of the study, consistent with standard research requirements (Resnik, 2020). Participants will be informed about the purpose of the study and will provide voluntary informed consent before participation. Confidentiality will be ensured by safeguarding identifiers and restricting data use strictly for academic purposes. Anonymity will be maintained by omitting personal and institutional names in the final report. These ethical standards are critical for studies involving institutional and professional participants (WHO, 2015).

➤ *Limitations of the Study*

The study may face several limitations. Access to key officials may be constrained due to competing work demands and the unpredictable nature of emergency response activities. The reliance on purposive sampling may reduce the generalizability of findings, although it remains suitable for specialized institutional research (Etikan et al., 2016). Additionally, self-reported data may introduce response bias; however, triangulation through document review minimizes this risk (Yin, 2018). Despite these limitations, the methodology is robust enough to generate credible insights into NPHEOC utilization barriers.

CHAPTER FOUR PRESENTATION OF FINDINGS

➤ Introduction

This chapter presents the findings of the convergent mixed-methods study. Quantitative results from the stakeholder survey (N = 51) are presented first, organised by objective and moving from basic descriptive analysis to advanced inferential and composite-index analysis. These include a comparative analysis of governmental and non-governmental sectors, a correlation analysis of awareness and participation, penalized regression and trend analysis, and the construction of a Coordination Performance Index to quantify NPHEOC utilization. The qualitative findings from 14 in-depth interviews and one focus group discussion follow, and the chapter closes with an integrated joint display of the two strands. Each study objective is addressed in turn and its corresponding evidence reported: awareness (§4.3); information-sharing effectiveness and timeliness (§4.4); the governmental–non-governmental comparison (§4.5); the awareness–participation relationship (§4.6); predictors of timely reporting (§4.7–4.8); overall utilization (§4.9); and barriers and stakeholder experiences (§4.10–4.11).

➤ Respondent Profile

A total of 51 stakeholders participated in the survey. The majority were drawn from the Ministry of Health (25), followed by government agencies (9), non-governmental organisations (7) and line ministries (6); institutional type was unstated for four respondents. For sectoral comparison, respondents were grouped as governmental (n = 40) and non-governmental (n = 7). Respondents operated predominantly at national level (24), with the remainder at sub-district (12), district (7) and provincial (4) levels. The workforce was experienced: 36 of 47 respondents had more than five years of relevant experience, and just over half (26) served as an emergency focal point for their organisation.

Table 4 Respondent Profile (Percentages Exclude Missing Responses).

Characteristic	Category	n	%
Institution	Ministry of Health	25	49.0
	Government agency	9	17.6
	NGO	7	13.7
	Line ministry	6	11.8
Sector	Governmental	40	85.1
	Non-governmental	7	14.9
Operational level	National	24	51.1
	Sub-district	12	25.5
	District	7	14.9
	Provincial	4	8.5
Focal point	Yes	26	55.3

➤ Objective One: Awareness of the NPHEOC and its Mandate

Awareness of the NPHEOC as an institution was near-universal: 94.1% (48/51) had heard of the Centre, 95.7% were aware of the types of emergencies it handles, and 83.0% were aware of its enabling legislation, the ZNPHEOC Act No. 19 of 2020. Depth of knowledge, however, was more modest. Just over half (53.2%) rated their familiarity with the NPHEOC's role as high or very high, and only 27.7% felt able to describe that role highly or completely accurately. Some 68.1% agreed that they understood the Centre's operations, and 69.6% considered their organisation well or fully aligned with it. Formal training was the most common route to awareness (21 respondents), yet only 56.9% had received any NPHEOC-related training at all.

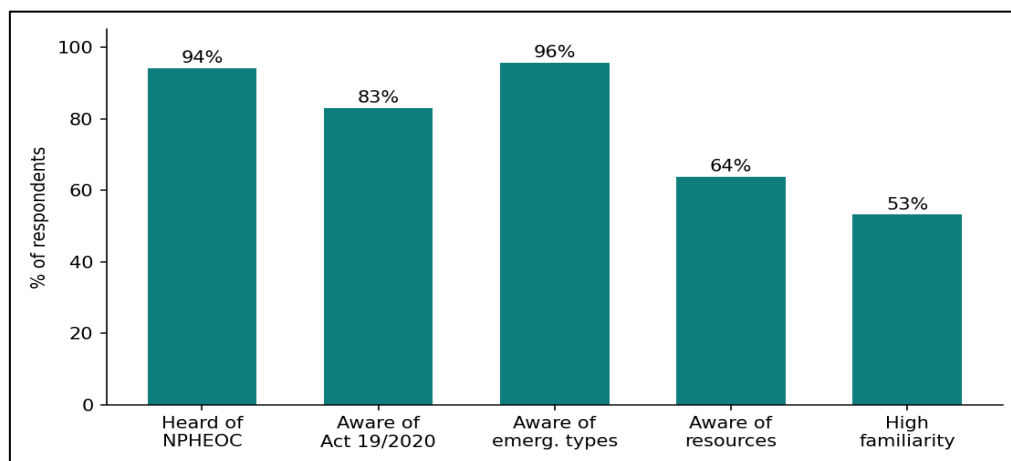


Fig 2 Awareness Indicators for the NPHEOC (Percentage Responding Affirmatively).

To quantify depth of awareness, awareness items were combined into composite indices (each component rescaled 0–100). A full six-item Awareness Index showed low internal consistency (Cronbach's $\alpha = 0.31$), indicating that awareness is multidimensional rather than a single latent construct; the self-rated “understanding” item correlated negatively with the remainder. A reduced four-item Knowledge-Depth Index (familiarity, accuracy of role description, structural alignment and training) was coherent ($\alpha = 0.64$), with a modest mean of 55.9/100 (SD 16.5). Awareness is therefore broad but shallow.

➤ *Objective Two: Effectiveness and Timeliness of Information-Sharing Systems*

Three-quarters of respondents (76.1%) rated the NPHEOC's information-sharing systems as effective or very effective, and 93.5% regarded timely information sharing as important or extremely important. Engagement was frequent: 57.4% shared information daily or weekly during health emergencies, and 73.9% reported that their organisation actively shares information with the Centre. The dominant communication channels were virtual meetings (35 respondents), instant messaging via WhatsApp (29), email (23) and physical meetings (26). These ratings are descriptive, self-reported appraisals on the defined indicators rather than a test of the Centre's causal effectiveness; the inferential comparisons that test whether groups differ statistically are reported, with test statistics and p-values, in §4.5.

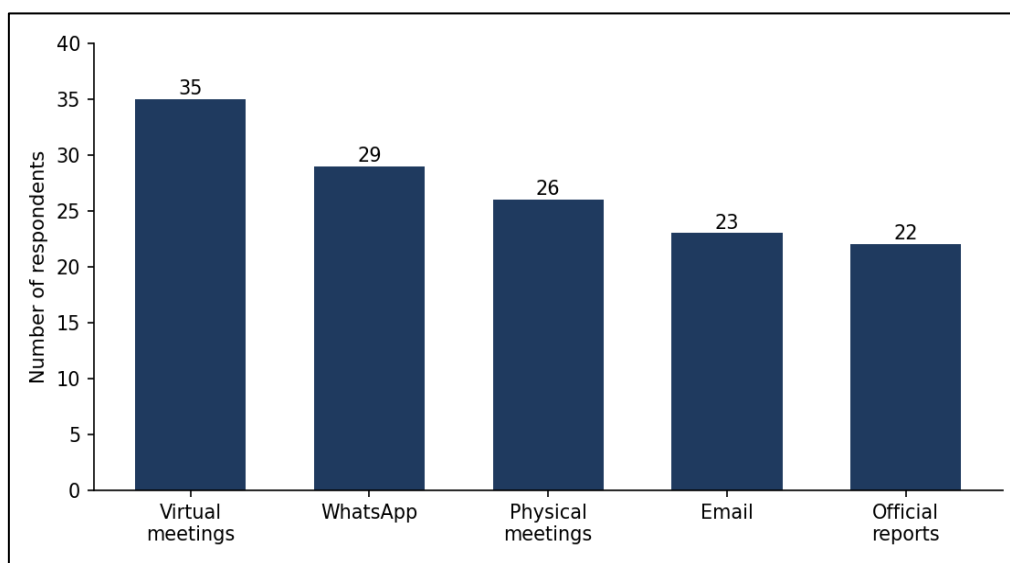


Fig 3 Communication Channels Used to Share Information with the NPHEOC (Response Counts).

Timeliness was more variable. Overall, 66.0% of respondents reported to the Centre within 24 hours, but the speed of alert receipt and time-to-act were the weakest attributes in the system. The nine timeliness and quality items were combined into an Information-Sharing Effectiveness Index with acceptable reliability ($\alpha = 0.68$; mean 65.1/100). A performance profile of its components (Figure 4.3) locates the priority gaps: speed of alert receipt (52/100), time to act (59/100) and clarity of reporting lines (62/100) performed least well, whereas reporting discipline and decision-communication time performed comparatively better.

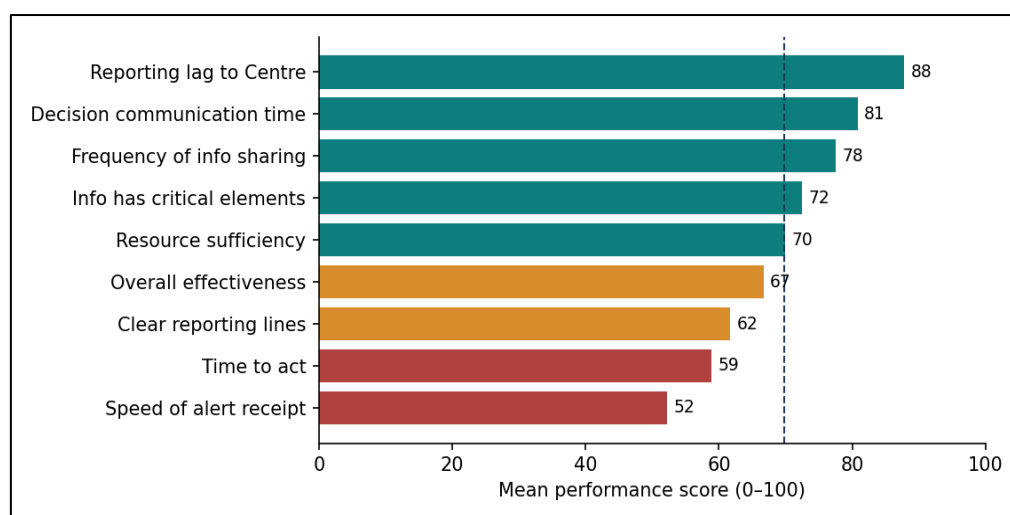


Fig 4 Performance Profile of Information-Sharing Attributes (Red = Priority Gap below 60/100). The Dashed Vertical Line Marks the Descriptive Overall Mean Performance Score Across the Attributes; it is an Interpretive Reference Only, not a Statistical Threshold or Significance Boundary.

➤ Comparative Analysis: Governmental versus Non-Governmental Sectors

A central objective was to compare the two sectors. Using Fisher's exact test (appropriate for the small cell sizes), the sectors differed most sharply on the timeliness of reporting: governmental respondents were far more likely than non-governmental respondents to report to the Centre within 24 hours (76.9% versus 20.0%; $p = 0.022$). Differences in training receipt (67.5% versus 28.6%; $p = 0.089$) and awareness of the ZNPHI Act (87.5% versus 57.1%; $p = 0.084$) trended in the same direction but did not reach significance. Awareness familiarity and focal-point status did not differ between sectors.

Table 5 Governmental Versus Non-Governmental Comparison (Fisher's Exact Test; Shaded Row Significant at $p < 0.05$).

Indicator	Governmental %	Non-gov %	Fisher p
Reports within 24 hours	76.9	20.0	0.022
Received NPHEOC training	67.5	28.6	0.089
Aware of ZNPHI Act No. 19/2020	87.5	57.1	0.084
High/very-high familiarity	55.0	42.9	0.690
Serves as emergency focal point	55.0	57.1	1.000

The composite indices reinforced this picture. Comparing indices by sector (Mann–Whitney U), awareness and knowledge depth did not differ significantly, but the experienced effectiveness of information sharing did: the Information-Sharing Effectiveness Index was significantly higher among governmental respondents (67.3 versus 52.4; $p = 0.049$). The sectoral divide is therefore specific to the timeliness and experienced effectiveness of information sharing, not to awareness itself.

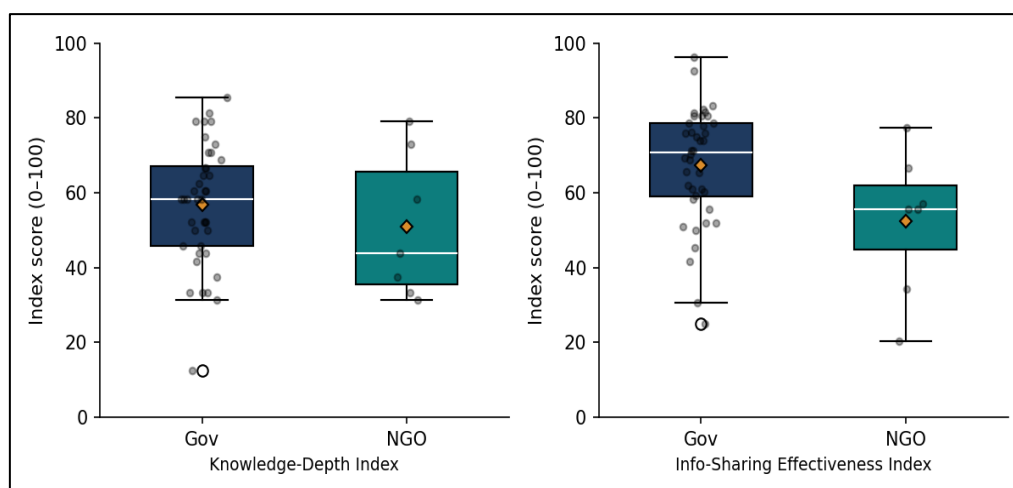


Fig 5 Composite Index Scores by Sector (Box = Interquartile Range; Diamond = Mean).

➤ Correlation Analysis: Awareness Levels and Participation Rates

To test whether awareness is associated with participation, a Participation Index was constructed from four engagement behaviours — frequency of information sharing during emergencies, whether the organisation actively shares information with the Centre, intensity of reporting, and focal-point status (each rescaled 0–100; mean 71.4/100). Awareness and participation were then correlated using Spearman's rank correlation, which is appropriate for the ordinal, non-normally distributed data and the modest sample.

A significant, moderate positive association was found. The Awareness Index correlated with the Participation Index at $\rho = 0.46$ ($p = 0.001$), and the Knowledge-Depth Index correlated even more strongly at $\rho = 0.50$ ($p = 0.0003$). Awareness was also positively associated with the frequency of engagement ($\rho = 0.44$; $p = 0.002$). Consistent with this, 91.5% of respondents agreed that higher awareness improves participation in emergency response. Stakeholders who understand the NPHEOC more deeply participate in it more actively.

Table 6 Correlation between Awareness Levels and Participation Rates ($n = 47$; all Significant at $p < 0.01$).

Awareness measure	Participation measure	Spearman ρ	p-value
Awareness Index	Participation Index	+0.46	0.001
Knowledge-Depth Index	Participation Index	+0.50	0.0003
Awareness Index	Engagement frequency	+0.44	0.002
Knowledge-Depth Index	Engagement frequency	+0.41	0.005

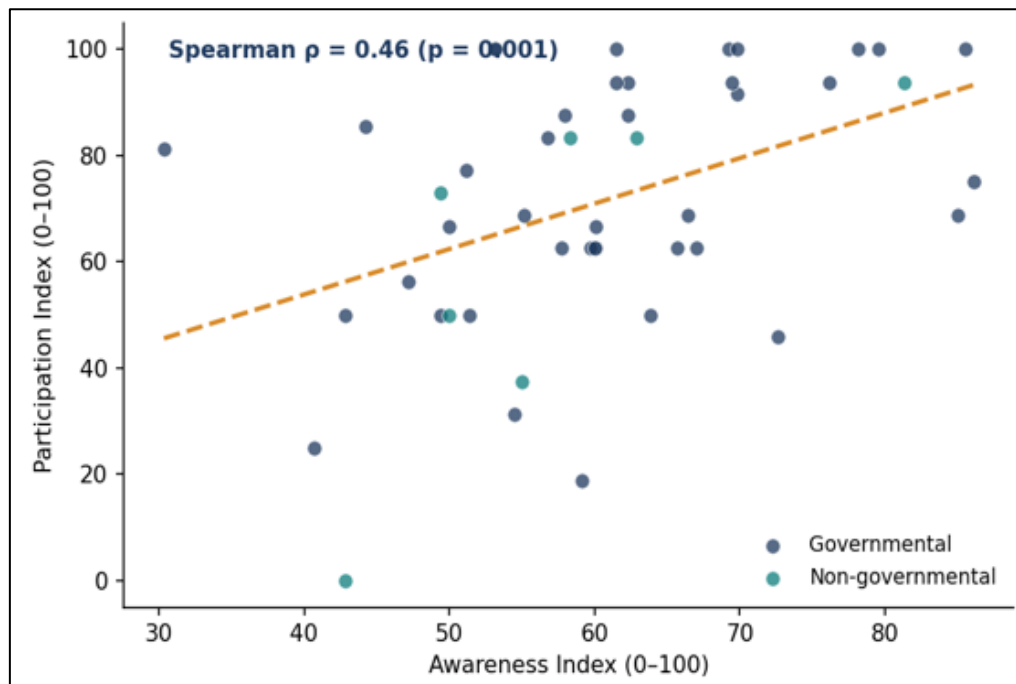


Fig 6 Awareness Versus Participation, with Fitted Trend Line.

➤ *Predictors of Timely Reporting: Firth Penalized Regression*

Because the bivariate sector gap in timely reporting could reflect confounding, a Firth penalized logistic regression was fitted (outcome: reporting within 24 hours; $n = 44$, 31 events). Firth's method is the appropriate choice given the small, sparse cells, and p -values are from penalized likelihood-ratio tests. Training emerged as the dominant and robust predictor (adjusted odds ratio ≈ 6.8 ; 95% CI 1.4–32.0; $p = 0.007$), whereas the governmental/non-governmental difference attenuated to non-significance once training was included (OR 0.30; $p = 0.38$). The apparent sector gap is thus, to a substantial degree, a training-access effect. These adjusted odds ratios quantify the strength of association between each predictor and the odds of reporting within 24 hours, holding the other predictors constant; they measure association and do not establish causation.

Table 7 Firth Penalized Logistic Regression — Odds of Reporting Within 24 Hours.

Predictor	OR	95% CI	Penalized-LR p
Non-governmental sector (vs gov)	0.30	0.03 – 3.61	0.378
Subnational level (vs national)	2.79	0.53 – 14.55	0.159
Received training (vs not)	6.76	1.43 – 31.99	0.007

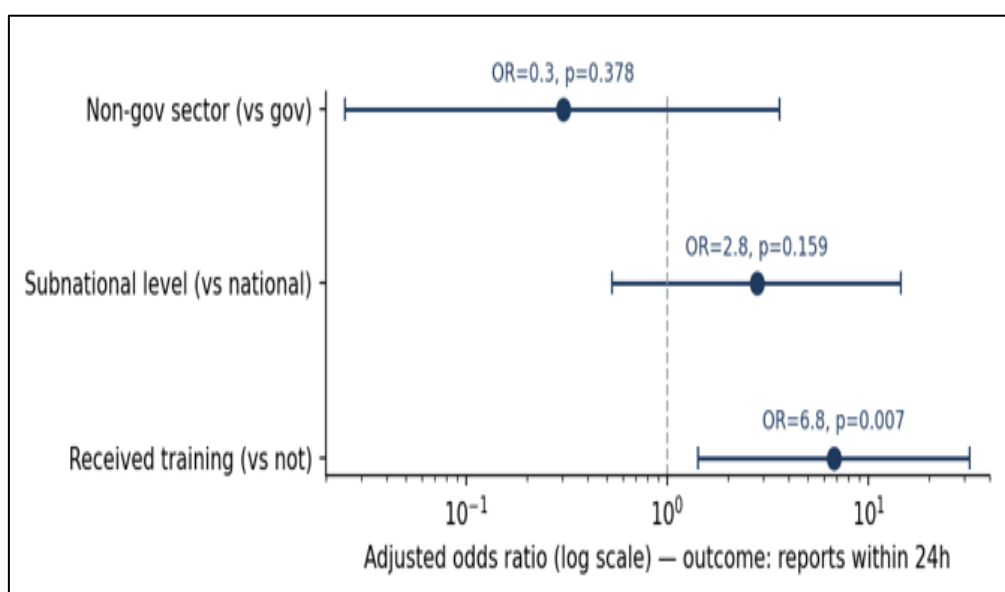


Fig 7 Adjusted Odds Ratios (Log Scale); Training is the Dominant Predictor of Timely Reporting.

➤ Trend Analysis Across Operational Level

It was hypothesised that awareness would decline from national to sub-district level. Trend tests (Jonckheere–Terpstra for index outcomes; Cochran–Armitage for binary outcomes) did not support an awareness gradient on any measure (all $p > 0.15$). The only significant level-related trend was in reporting timeliness, which ran inversely — reporting within 24 hours was more common at lower operational levels than nationally (Cochran–Armitage $Z = -2.09$; $p = 0.037$) — consistent with frontline units detecting and reporting events upward.

Table 8 Trend Tests Across Operational Level (Sub-District → National).

Outcome	Test	Statistic	p	Trend?
Knowledge-Depth Index	Jonckheere–Terpstra	$Z = +0.19$	0.849	No
Info-Sharing Effectiveness Index	Jonckheere–Terpstra	$Z = -1.19$	0.234	No
Aware of ZNPHI Act	Cochran–Armitage	$Z = +0.85$	0.397	No
Reports within 24 hours	Cochran–Armitage	$Z = -2.09$	0.037	Yes (inverse)

➤ Development of a Coordination Performance Index (CPI)

To quantify NPHEOC utilization in a single summary measure, a Coordination Performance Index (CPI) was developed from four equally-weighted, non-overlapping domains, each scored 0–100: (i) awareness and knowledge (the Knowledge-Depth Index); (ii) participation and engagement (the Participation Index); (iii) timeliness (speed of alert, time to act, reporting lag and decision-communication time); and (iv) perceived effectiveness (overall effectiveness, criticality, clarity of reporting and resource sufficiency). The CPI is the mean of the four domain scores.

The index showed good internal consistency across its domains (Cronbach's $\alpha = 0.80$). The overall mean CPI was 63.9/100 (SD 16.6), indicating moderate utilization. When classified into performance bands, 40.4% of respondents fell in the high band (≥ 70), 44.7% in the moderate band (50–69) and 14.9% in the low band (< 50). The domain profile (Figure 4.7) shows that participation and engagement was the strongest domain (71.4), while awareness and knowledge was the weakest (55.9) — identifying awareness depth as the principal drag on overall coordination performance.

Table 9 Coordination Performance Index Domain Profile (Domain $\alpha = 0.80$).

CPI domain	Mean (0–100)	Interpretation
Participation & engagement	71.4	Strongest domain
Timeliness	64.4	Moderate
Perceived effectiveness	63.8	Moderate
Awareness & knowledge	55.9	Weakest — priority
Overall CPI	63.9	Moderate utilization

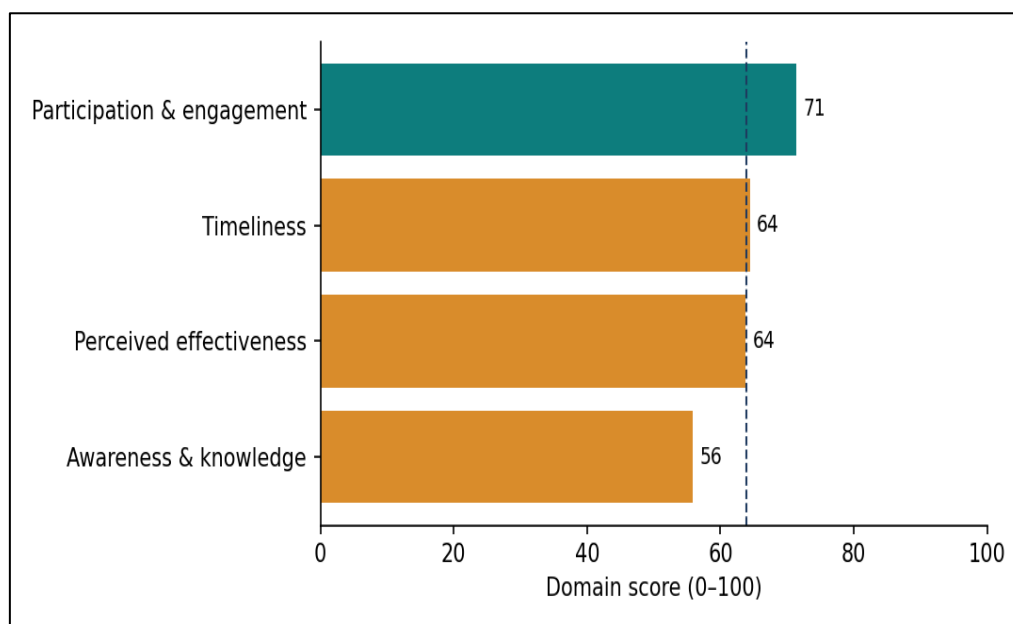


Fig 8 CPI Domain Profile. The Dashed Line Marks the Descriptive Overall Mean CPI Across the Four Domains; it is an Interpretive Reference Only, Not a Statistical Threshold.

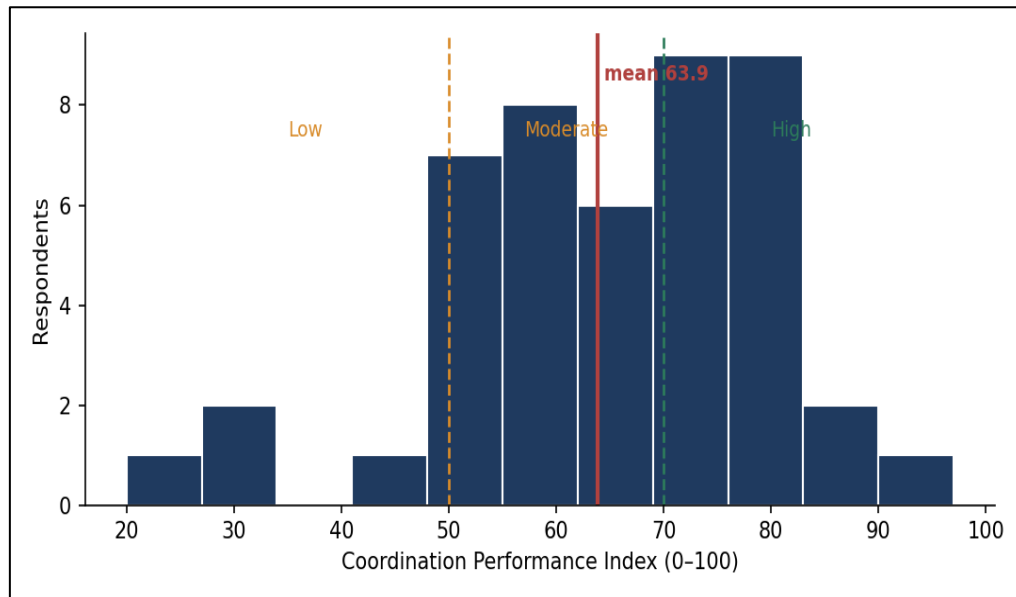


Fig 9 Distribution of the Coordination Performance Index with Performance Bands.

Comparing the CPI across groups, governmental respondents scored higher than non-governmental respondents (65.6 versus 54.1), though this did not reach significance given the small non-governmental sample (Mann–Whitney $p = 0.26$). The CPI did not vary significantly across operational level ($p = 0.80$) or with years of experience ($p = 0.04$), indicating that utilization is not simply a function of seniority or position but of the awareness, training and access factors identified above.

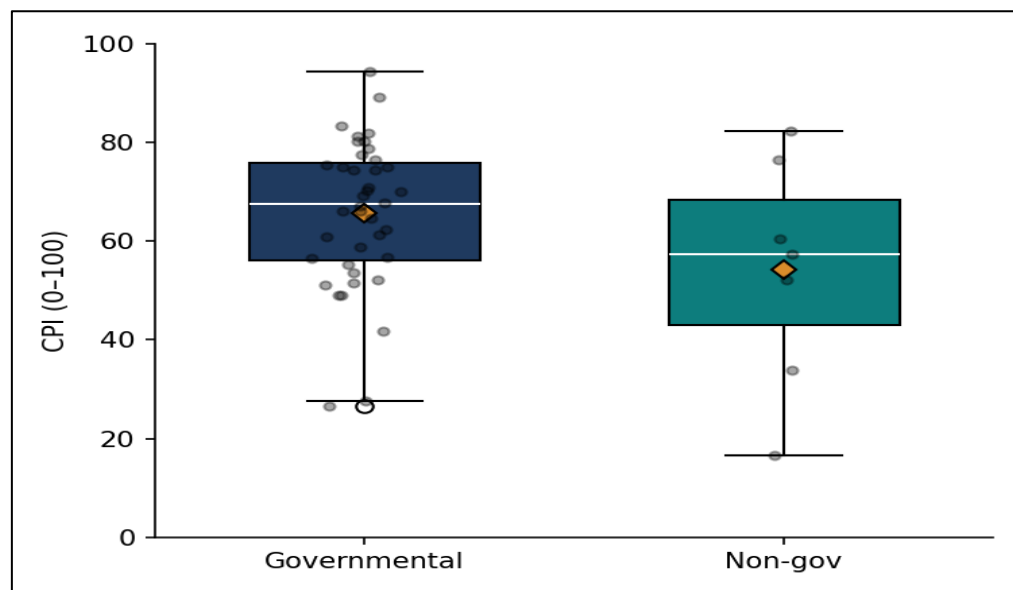


Fig 10 Coordination Performance Index by Sector.

➤ *Objective Three: Stakeholders' Experiences of Utilization*

Analysis of the 14 in-depth interviews (P1–P14) and the focus group discussion with the PHEOC team yielded four cross-cutting experiential themes, illustrated below with verbatim extracts.

• *Theme 1 — A Valued Unified Coordination Hub.*

Stakeholders consistently described the NPHEOC as the single platform convening government and partners under one incident-management structure:

“The NPHEOC served as the central hub for aligning government and partner actions, ensuring timely information sharing, and mobilizing critical resources such as PPE and laboratory support.” (P11, NGO)

“So, the NPHEOC is really our national coordination platform — whenever there’s a public health emergency, that’s where everyone comes together. What we do is activate the Incident Management System, and that pulls in the technical people and the decision-makers from whichever ministries are relevant.” (FGD, PHEOC team)

- **Theme 2 — Episodic, Outbreak-Driven Utilization.**

Engagement was reported to rise during active emergencies and recede between them, a rhythm participants felt undermined sustained preparedness:

“Occasionally, especially during outbreaks. Utilization tends to increase significantly during active emergencies and may be less frequent during routine periods.” (P1, MOH)

“We engage with the Centre mainly during declared public health emergencies or major incidents when coordination and reporting are required. Outside these periods, interaction is limited, which means routine engagement and continuous use of NPHEOC systems is not always sustained.” (P7, Line Ministry)

- **Theme 3 — Uneven Access and Utilization.**

Non-health ministries and non-governmental actors frequently described themselves as peripheral, pointing to restricted access and trust deficits:

“Minimal — we’re not contacted to participate.” (P4, Line Ministry)

“The level of utilization ... is very low. The institutions that utilize the center are mostly those that provide funding directly to ZNPHI. Even when they do provide funding, they are restricted in their utilization.” (P5, NGO)

“The EOC is under-utilized at facility. The concept of EOC is not even known at sub-district level by many cadres.” (P6, MOH)

- **Theme 4 — Effectiveness: Positive But Qualified.**

Participants valued the Centre's coordination and joint planning while tempering this with concerns about delays and integration:

“The effectiveness of NPHEOC coordination during emergencies is moderate ... coordination is sometimes affected by delays in communication and limited integration across sectors, which can reduce the speed and consistency of response.” (P7, Line Ministry)

“The NPHEOC’s coordination effectiveness has generally been moderate to good, though it depends heavily on the prior establishment of clear roles, communication channels, and the availability of pre-positioned resources.” (P12, NGO)

➤ **Objective Four: Barriers to Utilization**

Barriers clustered into three domains, mapped to the Consolidated Framework for Implementation Research and the WHO PHEOC core-component framework. Each is illustrated with verbatim extracts below and summarised in Table 10.

- **Institutional and Governance Barriers.**

These centred on unclear roles, a weak mandate over non-health sectors, trust deficits and unequal participation:

“Issues of trust and access to the center stand out. Counterparts are not trusted to work in the center. They are perceived as spies.” (P5, NGO)

“Government ministries and well-resourced international partners tend to dominate, while civil society, private sector, and community-level actors are often underrepresented or engaged only peripherally.” (P12, NGO)

“Other vital sectors — like disaster management, agriculture (for zoonotic spillover), and finance — often treat PHEOC activities as peripheral until a severe crisis forces full activation ... Partners see it as not their mandate.” (P8, MOH)

- **Operational and Resource Barriers.**

Participants described unsustainable financing, workforce shortages, weak logistics and a subnational deficit:

“Funding sustainability ... allocating limited medical and logistical resources across a massive geographical area often results in a subnational coverage deficit, where rural or district-level capacities are severely sparse compared to central hubs ... identifying and rapidly deploying surge personnel remains difficult.” (P8, MOH)

“Insufficient staffing of trained epidemiologists at district level, limited logistics for field deployment, and inadequate physical infrastructure and equipment within the NPHEOC itself.” (P12, NGO)

- **Coordination and Communication Barriers.**

These included delays and feedback gaps, fragmented channels, poor interoperability and restricted data sharing:

“Delayed feedback from the personnel that do investigations — sometimes someone may do an investigation with you, write up a report and not share the feedback.” (P6, MOH)

“Data ownership disputes, lack of interoperable systems, delayed reporting, and reluctance to share sensitive epidemiological data across institutional boundaries.” (P12, NGO)

“Strict data protection and privacy regulations further complicate cross-sector data exchange ... data owners fear confidentiality breaches, accidental disclosure of proprietary data, or the weaponization of intelligence.” (P8, MOH)

“Our information systems don't always talk to each other, so there's no smooth interoperability. Connectivity is a real problem in some areas, especially the rural districts. And sometimes having too many reporting channels actually creates bottlenecks rather than helping.” (FGD, PHEOC team)

Notably, the FGD corroborated the awareness-depth barrier from the Centre's own vantage point, observing that some stakeholders “do not fully utilize the NPHEOC ... largely due to limited understanding of its functions, activation processes, and the support it can provide during emergency response” (FGD, PHEOC team).

Table 10 Barriers to NPHEOC Utilization by Domain (Objective Four).

Domain	Principal barriers identified
Institutional / governance	Unclear and overlapping roles (“too many conflicting instructions”); weak legal mandate to compel non-health sectors; trust deficits and absent MOUs; unequal participation dominated by well-resourced actors; bureaucracy.
Operational / resource	Donor-dependent, unsustainable financing; shortage of trained epidemiologists and surge capacity; limited logistics and transport for field deployment; subnational infrastructure deficit.
Coordination / communication	Delays and feedback gaps; proliferation of non-standardised channels and tools; poor interoperability between digital systems; connectivity and power constraints; restricted cross-sector data sharing.

➤ **Integration of Findings: Joint Display**

Bringing the strands together through a meta-inference typology shows that the two methods largely confirm and expand one another rather than diverge.

Table 11 Joint Display of Integrated Quantitative and Qualitative Findings.

Focus	Quantitative	Qualitative	Integration
Awareness	Broad (94%) but shallow; Awareness Index $\alpha = 0.31$	Recognition high; depth thin at facility level	Expansion
Timeliness gap	Gov 77% vs NGO 20% report < 24h ($p = 0.022$)	Restricted access; trust deficits; no MOUs	Confirmation
Driver of gap	Training OR ≈ 6.8 ($p = 0.007$); sector attenuates	Training/orientation deficit among NGOs	Confirmation + expansion
Awareness–participation	$\rho = 0.46\text{--}0.50$ ($p \leq 0.001$)	Deeper understanding → more active engagement	Confirmation
Utilization (CPI)	Mean 63.9; awareness weakest domain	Valued but episodic; uneven access	Expansion

CHAPTER FIVE

DISCUSSION

➤ *Introduction*

This chapter interprets the findings in relation to recent regional and global evidence on public health emergency operations centres (PHEOCs), and in light of two complementary theoretical lenses. The first is implementation science, and specifically the Consolidated Framework for Implementation Research (Damschroder et al., 2009), which frames NPHEOC utilization as an implementation outcome shaped by the intervention itself, the inner and outer settings, the characteristics of individuals, and the process of engagement. The second is the health-security architecture of the International Health Regulations (WHO, 2005), which positions the NPHEOC as the operational hub for a whole-of-government and whole-of-society response. The discussion proceeds by objective, integrating the quantitative and qualitative strands throughout, consistent with best practice for mixed-methods integration (Fetters, Curry and Creswell, 2013), and closes by drawing out the theoretical, methodological and policy implications of the study.

➤ *The Awareness Paradox: Broad Recognition, Shallow Knowledge*

The study's first substantive contribution is to characterise awareness of the NPHEOC as broad but shallow. Recognition of the Centre as an institution was near-universal (94.1%), and awareness of its enabling legislation, the ZNPHEOC Act No. 19 of 2020, was high (83.0%); yet only 27.7% of respondents felt able to describe the Centre's role highly or completely accurately. The gap between recognition and comprehension is not a peripheral measurement detail but a central finding, because it distinguishes symbolic awareness — knowing that the NPHEOC exists — from the functional awareness required to engage with it operationally.

This interpretation is reinforced by the psychometric behaviour of the awareness items. The full six-item Awareness Index was internally weak (Cronbach's $\alpha = 0.31$), and the self-rated “understanding of operations” item correlated negatively with the remaining items. Rather than dismissing this as noise, the study reads it as evidence that awareness is genuinely multidimensional: recognition, legal awareness, self-assessed understanding and demonstrable role-knowledge do not move together. The negative loading of self-rated understanding is consistent with a mild overconfidence effect, in which those who rate their own understanding most highly are not necessarily those who describe the Centre's functions most accurately — a pattern with clear implications for how sensitisation is designed and evaluated, since self-report alone may overstate true competence.

At the regional level, this awareness paradox is unsurprising. The first continent-wide assessment of African PHEOCs found that only 29% of established centres met at least 80% of the minimum requirements for full functionality, with recurrent shortfalls in plans, procedures and trained personnel (Fekadu et al., 2023). Many centres, including Zambia's, were operationalised rapidly during the COVID-19 pandemic (World Bank, 2020), and institutional awareness has since outpaced the slower diffusion of deep operational knowledge across the wider stakeholder community (WHO Regional Office for Africa, 2023). The implication is that awareness-raising campaigns that maximise reach may inadvertently entrench shallow awareness unless they are paired with structured, competence-oriented training.

➤ *The Awareness–Participation Nexus*

A key advance of this study is the demonstration of a significant, moderate positive association between awareness and participation. The Awareness Index correlated with the Participation Index at $\rho = 0.46$ ($p = 0.001$), and the more coherent Knowledge-Depth Index correlated more strongly still at $\rho = 0.50$ ($p = 0.0003$); awareness was also associated with the frequency of engagement. This quantitative signal is triangulated by a striking perceptual consensus: 91.5% of respondents agreed that higher awareness improves participation in emergency response. Taken together, the two strands provide stakeholder-level empirical support for the theory of change that underpins PHEOC sensitisation — that deepening operational knowledge translates into more active engagement rather than merely passive recognition.

Two interpretive cautions are warranted. First, the correlation is cross-sectional and therefore associational: the relationship is likely to be reciprocal, since participation itself builds familiarity through exposure, feedback and social learning, just as awareness enables participation. The mechanism is thus better understood as a virtuous cycle than as a one-directional pathway, which strengthens rather than weakens the policy case for investing at either entry point. Second, the association is moderate, not deterministic; awareness is a necessary but not sufficient condition for participation, and structural enablers — invitations, agreements and access — remain essential, as the qualitative strand makes clear. Nonetheless, the finding elevates awareness depth from a descriptive characteristic to an actionable lever, and it provides a measurable rationale for prioritising the awareness domain that the Coordination Performance Index later identifies as the weakest.

➤ *Timeliness, the Sector Gap, and Training as the Equaliser*

The comparative analysis revealed a pronounced sectoral disparity in the timeliness of reporting: governmental respondents were far more likely than non-governmental respondents to report to the Centre within 24 hours (76.9% versus 20.0%; $p = 0.022$), and rated the effectiveness of information sharing significantly higher (Information-Sharing Effectiveness Index 67.3 versus 52.4; $p = 0.049$). On its face, this suggests an inherent governmental advantage. The Firth penalized regression, however, tells a more

precise and more actionable story. Once training was entered into the model, it emerged as the dominant and robust predictor of timely reporting (adjusted odds ratio ≈ 6.8 ; 95% CI 1.4–32.0; $p = 0.007$), while the sector effect attenuated to non-significance (OR 0.30; $p = 0.38$). The headline sector gap is therefore, to a substantial degree, a training-access effect rather than an intrinsic property of sector identity.

These reframing matters because sector status is fixed whereas training is modifiable. The wider field-epidemiology literature provides strong external corroboration of the mechanism and its magnitude. In Tanzania, the timeliness of Integrated Disease Surveillance and Response reporting in participating districts rose from 4.2% to 52.1% following the FETP Intermediate course (Wilson et al., 2021), and in Benin the first Frontline cohort improved average reporting timeliness from 37% to 85% (CDC, 2017). These are not marginal gains; they are step-changes of the same order implied by the odds ratio observed here. The plausible causal pathways are well understood: training instils the technical competencies of case detection and reporting, socialises trainees into standardised procedures, and — critically — embeds them within professional networks that lower the transaction costs of reporting. Zambia is unusually well positioned to exploit this pathway, having trained hundreds of field epidemiologists through its own FETP who are now distributed across national and subnational levels (CDC, 2024).

The equity implication is direct. If timely reporting is a function of training rather than of sector, then the exclusion of non-governmental partners from structured NPHEOC orientation is both the mechanism of the observed inequity and the lever for its correction. Extending orientation to non-state and non-health actors is therefore not merely a capacity-building nicety but a targeted intervention on the single most influential determinant identified in this study. This conclusion should nonetheless be held with appropriate caution, given the small non-governmental subgroup ($n = 7$); it is best regarded as a strong, testable hypothesis that a larger evaluation should confirm prospectively.

➤ *Quantifying Utilization: The Coordination Performance Index*

Prior assessments of PHEOCs have tended to score institutional functionality against minimum-requirement checklists at the level of the centre itself (Fekadu et al., 2023). This study complements that approach by quantifying utilization from the perspective of the stakeholders who are meant to use the Centre, through a Coordination Performance Index (CPI) built from four non-overlapping domains — awareness and knowledge, participation and engagement, timeliness, and perceived effectiveness. The index demonstrated good internal consistency across its domains (Cronbach's $\alpha = 0.80$) and yielded a mean of 63.9/100, situating utilization in the moderate range, with 40.4% of respondents in the high band, 44.7% moderate and 14.9% low.

The diagnostic value of the CPI lies in its domain profile. Participation and engagement was the strongest domain (71.4), whereas awareness and knowledge was the weakest (55.9). This convergence with the correlation analysis is analytically important: the same domain that is most strongly associated with participation is also the domain dragging overall coordination performance down, which sharpens the case for prioritising awareness depth in any strengthening strategy. Equally instructive is what does not predict the CPI. It did not vary significantly by operational level ($p = 0.80$) or with years of experience ($p = 0.04$), indicating that utilization is not simply a by-product of seniority or position but is shaped by the modifiable factors — awareness, training and access — emphasised throughout this discussion. As a reusable, reliable metric, the CPI offers the NPHEOC a practical instrument for monitoring utilization longitudinally and for benchmarking it across stakeholder groups, complementing centre-level functionality scoring with a demand-side measure.

➤ *The Coordination Hub and the Problem of Episodic Utilization*

Qualitatively, stakeholders consistently valued the NPHEOC as a unified coordination hub that convenes government and partners under a single incident-management structure — precisely the function for which PHEOCs are designed (WHO, 2015). This endorsement of the Centre's convening role is an important asset and should not be understated. Yet participants also described utilization as episodic and outbreak-driven, intensifying during active emergencies and receding in quiet periods. This activation–deactivation rhythm is a recognised structural vulnerability of the PHEOC model, because the competencies, relationships and situational awareness built during a response decay between events unless deliberately maintained (Fekadu et al., 2023).

The experience of Zambia's own 2023–2024 cholera outbreak in Lusaka is instructive here. Coordination structures that were well established during the emergency nonetheless encountered practical difficulties in sustaining timely, inclusive information flows, and sustainable financing and preparedness were flagged as gaps in the subsequent intra-action review (Kateule et al., 2024). The continental response to COVID-19 suggests one route to counteracting episodic decay: the deliberate cultivation of continuous learning and virtual communities of practice, which sustained engagement between peaks of activity across African PHEOCs (Eteng et al., 2023). The heavy reliance on virtual meetings and instant messaging observed in the present study indicates that the channels for such continuous engagement already exist in Zambia; the challenge is to institutionalise their use for routine, inter-outbreak coordination rather than only for acute response.

➤ *Governance, Trust and the Multisectoral Deficit*

The most consequential barriers identified were institutional and relational rather than narrowly technical. Participants pointed to unclear and overlapping roles (“everyone wants to be a boss”), a weak legal mandate to compel engagement from non-health sectors, and a pervasive trust deficit — captured most vividly by non-governmental partners describing themselves as “perceived as

spies” and operating without memoranda of understanding. These findings speak directly to the outer-setting and inner-setting constructs of the implementation framework (Damschroder et al., 2009): the NPHEOC's authority to convene is well recognised, but the external policy levers and internal relational scaffolding needed to convert recognition into routine, equitable participation are underdeveloped.

This matters because the health-security paradigm is explicitly multisectoral. The International Health Regulations envisage a whole-of-government and whole-of-society response (WHO, 2005), and Africa CDC's One Health framework makes multisectoral coordination and data sharing central to national public-health institutions (Africa CDC, 2022). The gap between this normative aspiration and the lived experience of peripheral actors is the multisectoral deficit at the heart of this study. The absence of formal agreements is particularly telling: without memoranda of understanding, non-health and non-governmental actors have neither a defined role nor a durable claim to participation, which leaves their engagement contingent on ad hoc invitation and vulnerable to the trust breakdowns that participants described. The recognised need for dedicated PHEOC legal-framework guidance (WHO Regional Office for Africa, 2023) reflects exactly this problem, and Zambia's own Joint External Evaluation had previously identified IHR coordination as an area of limited capacity (World Bank, 2020).

➤ *Operational and Information-System Constraints*

Alongside governance, two operational constraints stood out. The first is financing sustainability. Participants described a preparedness architecture that is donor-dependent and reactive, funded more readily during outbreaks than between them — a pattern that undermines the continuous engagement discussed above and that echoes sustainability concerns raised regionally (Fekadu et al., 2023) and in Zambia's cholera intra-action review (Kateule et al., 2024). The second is workforce: shortages of trained epidemiologists and limited surge capacity, especially subnationally, which is the same constraint that the training analysis identifies as decisive for timely reporting.

The information-system findings deserve particular emphasis because they illustrate how technical fragmentation compounds coordination problems. Participants reported a proliferation of non-standardised channels and tools and poor interoperability between digital systems. This is a structural feature of Zambia's digital-health landscape, in which multiple parallel platforms — SmartCare, DHIS2, IDSR/eIDSR and Go.Data — operate alongside one another (CDC, 2024; WHO Regional Office for Africa, 2026). Fragmented, non-interoperable systems are among the most frequently reported barriers to health-information exchange in low- and middle-income settings, generating data silos, duplicated reporting burdens and delays. The finding that restricted cross-sector data sharing was itself a barrier adds a governance dimension to the technical one: in the absence of clear, emergency-appropriate data-sharing protocols, legitimate information flows can be obstructed by data-protection caution, so that governance and technology must be addressed together rather than in isolation.

➤ *Theoretical and Policy Implications*

Read through the implementation-science lens, the findings cohere into a single narrative. Utilization of the NPHEOC is constrained less by the intervention's perceived value — which stakeholders endorse — than by characteristics of individuals (shallow operational knowledge, uneven training), the inner setting (fragmented systems, unclear roles, resource limits) and the outer setting (weak cross-sectoral mandate, absent agreements, donor dependence). Because the most influential of these determinants — awareness depth and training access — are modifiable and mutually reinforcing, the strategic priority that emerges is not to raise awareness in the broad sense, which is already high, but to deepen operational competence, equalise training across sectors, formalise multisectoral partnerships and consolidate information systems. Framed this way, the study's practical recommendations follow directly from its theory, and its principal empirical contributions — the awareness-participation association, the training-driven reinterpretation of the sector gap, and the Coordination Performance Index — each map onto a specific, actionable lever.

➤ *Strengths and Limitations*

The study's principal strength is its convergent mixed-methods design, combined with an analytical approach tailored to the data: Firth penalized regression to handle sparse cells, exact and non-parametric tests, composite indices with formal reliability testing, and a structured joint display that integrates the strands rather than merely juxtaposing them. The development and validation of the Coordination Performance Index is a further methodological contribution that is transferable to other settings.

Several limitations temper the conclusions. The survey sample was modest ($N = 51$) and the non-governmental subgroup small ($n = 7$), so the sectoral inferences — including the training reinterpretation — should be read as exploratory and hypothesis-generating rather than definitive. The cross-sectional design precludes causal claims and as noted, renders the awareness-participation relationship reciprocal in interpretation. Reliance on self-reported awareness and timeliness introduces potential social-desirability and recall bias, and the negative behaviour of the self-rated understanding item suggests self-report should be interpreted cautiously. The study was confined to Lusaka district, which limits transferability to rural and subnational contexts whose infrastructural realities differ. Finally, the configurational (crisp-set QCA) analysis was a first-pass calibration intended as an analytic template and requires researcher verification against the full transcripts before its solutions are interpreted. These caveats notwithstanding, the convergence of the quantitative and qualitative strands across multiple analyses lends credibility to the central conclusions.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

➤ *Conclusion*

The NPHEOC is widely recognised and valued as a unified coordination hub, but its utilization is uneven, episodic and moderate overall (mean CPI 63.9/100). Awareness is broad but operationally shallow; awareness is significantly and positively associated with participation; the governmental/non-governmental gap in timely reporting is driven principally by differential access to training rather than by sector; and utilization is constrained by interlocking institutional, operational and coordination barriers, of which an unclear cross-sectoral mandate, unsustainable financing, workforce and infrastructure deficits, and poor interoperability are the most consequential. Strengthening utilization is therefore less a matter of raising awareness than of deepening operational knowledge, equalising training access, formalising partnerships and consolidating information systems.

➤ *Recommendations*

• *Policy and Governance*

- ✓ Strengthen the cross-sectoral mandate so that multisectoral engagement is required rather than discretionary, supported by a PHEOC legal-framework review (WHO Regional Office for Africa, 2023).
- ✓ Formalise partnerships through standing memoranda of understanding with non-governmental and non-health stakeholders to address trust deficits and invitation-based exclusion.
- ✓ Clarify roles and reporting lines within the incident-management system to reduce duplication.

• *Training and Workforce Development*

- ✓ Extend structured NPHEOC orientation to all stakeholder categories, since training — not sector — drives timely reporting, leveraging the Zambia FETP (CDC, 2024; Wilson et al., 2021).
- ✓ Invest in subnational surge capacity through frontline and intermediate field-epidemiology training at district and sub-district levels.

• *Information Systems and Interoperability*

- ✓ Consolidate and standardise channels into a smaller set of interoperable platforms to reduce reporting burden and silos (CDC, 2024; WHO Regional Office for Africa, 2026).
- ✓ Establish enabling data-sharing governance that reconciles cross-sector information flow with data-protection obligations.
- ✓ Strengthen feedback loops from the Centre to reporting units.

• *Financing, Sustainability and Subnational Strengthening*

- ✓ Secure sustainable, domestically anchored financing through a dedicated preparedness budget line (Fekadu et al., 2023; Kateule et al., 2024).
- ✓ Decentralise capacity by investing in subnational infrastructure, connectivity and logistics.

➤ *Recommendations for Future Research*

- Conduct a larger, multi-district study with a stronger non-governmental sample to confirm the sectoral and training effects.
- Undertake a social network analysis of the coordination structure to map information flows and peripheral actors.
- Finalise and apply the configurational (csQCA) analysis with verified case calibration.
- Prospectively evaluate the effect of extending NPHEOC orientation to non-governmental partners on reporting timeliness.
- Track the Coordination Performance Index longitudinally as a monitoring instrument for NPHEOC utilization.

➤ *Contribution to Knowledge*

This study provides one of the few stakeholder-level, mixed-methods assessments of NPHEOC utilization in Zambia. Its principal contributions are the demonstration that an apparent sectoral inequity in emergency reporting is, in substantial part, a training-access effect; the finding of a significant awareness–participation association; and the development of a reliable Coordination Performance Index that quantifies utilization and can be reused for monitoring and for comparable assessments elsewhere in the region.

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