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# Stakeholder Collaboration and Coordination in Health Commodities Forecasting and Quantification: A Case Study of Namibia's Central Medical Stores

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**Abstract**

**Background**

Effective forecasting and quantification in public health supply chains are not isolated technical exercises but complex social processes requiring robust collaboration. This study explored the roles and dynamics of collaboration and coordination among stakeholders involved in these processes at Namibia's Central Medical Stores (CMS).

**Methods**

A qualitative case study was conducted. Data were gathered through 15 in-depth interviews with a purposively selected range of stakeholders from CMS, donor agencies, program departments, and health facilities. Documentary analysis of meeting minutes and reports supplemented the interviews. Thematic analysis was performed using ATLAS.ti.

**Results**

Key stakeholders include CMS's forecasting unit, procurement, program departments, health facilities, donors, and technical working groups. Their roles range from providing data and setting programmatic targets to financing and technical oversight. While collaboration exists, particularly in donor-funded vertical programs, it is challenged by a centralized approach, infrequent and crisis-driven communication, limited data sharing, and under-representation of frontline facilities in decision-making.

**Conclusion**

Collaboration at CMS is present but fragmented and sub-optimal. Strengthening it requires institutionalizing regular, structured multi-stakeholder forums, decentralizing the forecasting process to incorporate facility-level data, and leveraging technology for seamless information exchange. A shift from a centralized, transactional model to a networked, collaborative one is essential for a resilient and responsive supply chain.

**Keywords:** Stakeholder Collaboration, Supply Chain Coordination, Health Logistics, Multi-Stakeholder Engagement, Public Health, Namibia

## Introduction

The accuracy of health commodity forecasting and quantification is fundamentally a collective endeavor. No single entity within a health system possesses all the necessary information or authority to predict and meet population needs effectively. It requires the synchronized efforts of multiple stakeholders, including central medical stores, disease-specific program managers, health facility staff, donors, and suppliers (Subramanian, 2021). This process of collaboration and coordination is critical for transforming isolated data points into a coherent national supply plan.

In Namibia, the Central Medical Stores (CMS) operates within a network of such stakeholders. However, persistent challenges such as stock-outs and overstocking suggest potential fissures in this collaborative network (Ekandjo, 2022; Bowser et al., 2019). Poor coordination can lead to misaligned priorities, information asymmetry, duplicated efforts, and ultimately, failures in the supply chain that compromise patient care. While the importance of collaboration is widely acknowledged in global health supply chain literature (Ma & Kang, 2025; Healthcare Logistics Association, 2021), its practical functioning within specific national contexts like Namibia requires deeper examination.

Effective collaboration goes beyond mere communication; it involves shared goals, transparent exchange of information, mutual accountability, and integrated decision-making processes. Exploring these dynamics is crucial for moving from a theoretical appreciation of collaboration to its practical implementation. Therefore, this study addressed the third sub-objective of a broader evaluation: to explore the roles and nature of collaboration and coordination among stakeholders involved in forecasting and quantification at Namibia's CMS. By mapping the stakeholder landscape and diagnosing interaction patterns, the research aims to identify leverage points for building a more cohesive and effective supply chain ecosystem.

### *Research Objective*

To explore the roles of Collaboration and Coordination among Stakeholders in Forecasting and Quantification at the Central Medical Stores.

## Literature Review

### *Forecasting and quantification of Health Commodities*

Forecasting accuracy in Central Medical Stores is crucial for maintaining an efficient and reliable healthcare supply chain. Literature suggests that factors such as historical demand patterns, data quality, and forecasting model selection significantly impact accuracy. Research by Li et al. (2020) emphasises the importance of incorporating advanced statistical models to capture complex demand variations. Organisational factors like communication between different departments, collaboration with suppliers, and inventory management strategies play a pivotal role. Studies by Smith et al. (2022) highlight the need for a holistic approach that considers both internal and external factors influencing the supply chain.

Technological advancements is a very significant tool in accuracy and reliability of health commodities forecasting. Research by Chen et al. (2021) indicates that these technologies enhance forecasting precision by adapting to changing patterns and improving the adaptability of models. It is crucial to recognise the contextual differences in healthcare systems and adapt forecasting methods accordingly. Literature also underscores the significance of continuous monitoring and adjustment of forecasting models to address evolving healthcare demands and unforeseen events, as discussed in the works of Johnson et al. (2021).

Research indicates that the accurate forecasting of medical supplies is contingent upon an understanding of demand drivers. Factors such as population health trends, disease prevalence, and demographic shifts impact the demand for various medical products. Studies by Jain et al. (2018) emphasise the need for forecasting models to incorporate epidemiological data for a more robust understanding of demand patterns.

The role of data quality in forecasting accuracy cannot be overstated. Poor data quality can lead to erroneous predictions and hinder the effectiveness of forecasting models. Research by Wang et al. (2018) highlights the importance of data cleansing, validation, and regular audits to ensure the reliability of the input data. Collaboration between healthcare providers, suppliers, and government agencies is crucial for accurate forecasting. Literature by Razak et al. (2023) suggests that establishing strong partnerships can facilitate the exchange of information, reducing uncertainties and enhancing the accuracy of predictions. Transparent communication and information sharing create a more responsive and adaptable supply chain.

The selection of an appropriate forecasting model is a critical decision. The literature underscores the significance of choosing a model that aligns with the characteristics of the medical supply chain. For instance, recent studies by Kim et al. (2024) emphasise the importance of evaluating various forecasting models, including time series

analysis, machine learning algorithms, and simulation methods, to identify the most suitable approach for a particular context. Government policies and regulatory frameworks also play a role in forecasting accuracy. Changes in regulations, reimbursement policies, or public health initiatives can influence demand patterns. Scholars like García-Cáceres et al. (2024) emphasise the need to integrate regulatory insights into forecasting models to account for external factors affecting the healthcare supply chain. Lastly, the dynamic nature of the healthcare landscape requires continuous monitoring and adaptation of forecasting methods. Real-time data analytic, as suggested by Zhang et al. (2021), enable timely adjustments to forecasting models in response to emerging trends or unforeseen events, ensuring the resilience and reliability of the medical supply chain.

Steele et al. (2019) identified two significant hurdles affecting the proficient management of medical supplies as: insufficiency and unreliability of data concerning consumption, coupled with deficiencies in quantification and forecasting skills. By assessing these methods, this study sought to contribute positively towards reducing the issue of accessibility and availability of medical resources, thereby enhancing healthcare service delivery in Namibia.

## Methods

### *Study Design*

This research employed a qualitative, exploratory case study design situated within the constructivist paradigm. The focus was on understanding the lived experiences, perceptions, and interactions of diverse stakeholders within the specific context of CMS's forecasting and quantification processes (Holloway & Galvin, 2017).

### *Study Setting and Population*

The research was conducted at the CMS headquarters in Namibia. Participants were key personnel directly involved in the quantification and procurement cycle, including procurement pharmacists, senior pharmacists, procurement officers, and logistics managers. These individuals were responsible for making or informing decisions on what quantities of which items to order.

### *Sampling and Data Collection*

A purposive sampling strategy was used to select 15 participants with deep operational knowledge of quantification. Primary data collection involved semi-structured interviews guided by a protocol that probed: "How do you decide which method or approach to use when determining how much of a particular medicine to order?" and "What factors make a quantification method 'right' or 'wrong' for a specific product?" Interviews were recorded and transcribed. Documentary analysis of CMS's Standard Treatment Guidelines (STGs), procurement plans, and past quantification reports provided additional context (Holloway & Galvin, 2023).

### *Data Analysis*

Thematic analysis, following the framework by Braun and Clarke (2012), was conducted using ATLAS.ti software. The analysis focused specifically on extracting and categorizing the reasons, rules-of-thumb, and formal factors participants described using when selecting and applying quantification methods. Transcripts were coded inductively, and codes were subsequently clustered into overarching themes representing the core criteria for appropriateness.

### *Ethical Considerations*

The study received ethical approval from the Namibia University of Science and Technology and the Ministry of Health and Social Services. All participants provided informed consent. To encourage candid responses, especially regarding inter-organizational challenges, strict confidentiality was assured, and data were presented in an aggregated, non-attributable manner.

## Results

Participants identified a clear, though complex, network of stakeholders involved in forecasting and quantification. Their primary roles are summarized in Table 1.

**Table 1: Key Stakeholders and Their Roles in Forecasting & Quantification**

| Stakeholder | Primary Role(s) |
|---|---|
| CMS Forecasting & Quantification Unit | Central technical lead; develops national forecasts and quantification plans using available data. |
| CMS Procurement & Distribution | Executes procurement based on quantified lists; provides data on supplier lead times and past procurement. |
| Program Departments (HIV, TB, Malaria, EPI) | Set programmatic targets and patient numbers; provide disease-specific guidelines and consumption data from supported sites. |
| Health Facilities | Generate ground-level consumption data through routine reports; flag stock imbalances and local demand shifts. |
| Donors & Funding Agencies | Provide financing for specific commodities; often have separate reporting and forecasting requirements. |
| Technical Working Groups (TWGs) | Serve as advisory/coordination forums for specific therapeutic areas (e.g., Antiretroviral TWG). |
| Implementing Partners (NGOs) | Support last-mile distribution and data collection in some regions; provide implementation insights. |

A participant from a program department explained, "*We provide essential information on commodities use in specific programs, regions, and campaigns*" (R5). A donor representative added, "*Our financial support for procurement is based on the forecasts and quantification plans they [CMS] develop*" (R2).

### *Patterns and Mechanisms of Collaboration*

Collaboration occurred through both formal and informal channels:

1. Technical Working Groups (TWGs): These were the most structured forums. However, attendance by program personnel was reported as inconsistent. "*Program personnel have limited attendance at TWG meetings, hindering comprehensive information exchange*," noted a CMS staff member (R8).
2. Annual/Bi-annual Planning Meetings: Major forecasting exercises for the annual procurement plan involved workshops with key stakeholders. Participants indicated these were valuable but often rushed and sometimes triggered by impending stock crises rather than proactive planning.
3. Vertical Program Collaboration: Collaboration was strongest for donor-funded, vertically-managed commodities like Antiretroviral drugs (ARVs). "For ARVs, the process is more integrated with the national program. Data flows better, and meetings are regular," stated a respondent (R6). This contrasted with "general" pharmaceuticals, where collaboration was weaker.
4. Data Sharing: The primary collaborative transaction was the sharing of data. Health facilities reported stock levels to CMS; programs shared patient enrollment data; CMS shared forecast reports with donors. However, this was often a one-way, extractive flow rather than a dynamic exchange. The lack of Electronic Data Transfer (EDT) tools for most commodities was a noted barrier.

### *Challenges to Effective Collaboration*

Five major themes emerged as barriers to effective collaboration:

1. The forecasting process was predominantly driven from the CMS center with limited substantive input from regional or facility levels. "*The limited consultation from regional representatives… might result in stock-outs at health facilities*," observed a regional pharmacist (R10).
2. Infrequent and Crisis-Driven Interaction: Communication was often reactive. "*Annual data sharing meetings occur infrequently, often in crisis situations, leading to inadequate planning*," reported a program officer (R12).

3. Different disease programs often worked in parallel with CMS, leading to fragmented efforts. There was limited collaboration between program departments themselves during the CMS-led quantification.
4. Donors and large programs, by virtue of their funding, sometimes wielded disproportionate influence, while the operational intelligence from frontline health facilities was undervalued in central planning.
5. The underutilization of integrated information systems meant there was no single source of truth. Data resided in separate spreadsheets, reports, and systems (e.g., SYSPRO, program databases), making seamless collaboration difficult.

## Discussion

This study illuminates the intricate web of stakeholder relationships that underpins forecasting and quantification at Namibia's CMS. The identified roles align with established models of health supply chain coordination, where central agencies, technical programs, and service delivery points must align their actions (Goel et al., 2024; Ma & Kang, 2025). The finding that collaboration is most effective in vertically-funded programs like HIV is consistent with global observations, where dedicated resources and governance structures can create "islands of excellence" within otherwise fragile systems (Bowser et al., 2019).

The core challenge, however, lies in the architecture of collaboration (Waiganjo et al., 2021). The prevailing model is characterized by centralization, informality, and fragmentation. The centralized, top-down process marginalizes the critical intelligence held by peripheral health facilities, a known pitfall that reduces supply chain responsiveness (Bossertt et al., 2007). The infrequent, often crisis-triggered nature of multi-stakeholder meetings points to a reactive rather than a proactive, planning-oriented culture. This reflects a transactional approach to collaboration engaging only when necessary to exchange data or solve a crisis rather than a relational one built on ongoing partnership and shared ownership of supply chain outcomes.

The siloed nature of interactions, especially between different disease programs during central quantification, risks creating a supply plan that is merely an aggregation of disconnected vertical plans, rather than an optimized, integrated national plan. This fragmentation is exacerbated by technological gaps, as paper-based or standalone digital systems hinder the real-time visibility and data integration that are hallmarks of collaborative supply chains (Anke & Bolstad, 2019).

To move forward, CMS and its partners need to consciously redesign their collaborative infrastructure. This involves shifting from ad-hoc gatherings to institutionalized, regular coordination mechanisms with clear mandates. It requires decentralizing the forecasting process to incorporate a genuine "bottom-up" flow of information from facilities, empowering frontline workers as active partners (Trap et al., 2018). Critically, it demands investing in interoperable information systems that create a common operating picture for all stakeholders, turning data sharing from a burdensome task into a seamless by-product of routine operations.

## Conclusion

Collaboration and coordination among stakeholders are not peripheral concerns but central determinants of success in health commodities forecasting and quantification at Namibia's CMS. While a necessary network of stakeholders exists and plays defined roles, the current collaborative model is hampered by centralization, irregular engagement, siloed operations, and technological limitations. To build a more resilient and responsive supply chain, stakeholders must transition from a loose, reactive coalition to a formalized, proactive collaborative network. This can be achieved by: (1) establishing a standing, multi-stakeholder Supply Chain Coordination Committee with decision-making authority; (2) implementing a structured bottom-up forecasting cycle that formally integrates facility-level data and insights; and (3) prioritizing the full implementation and integration of an electronic Logistics Management Information System (LMIS) to serve as a shared platform for data and dialogue. Enhancing collaboration is ultimately about fostering a shared commitment to a single goal: ensuring the right medicines are in the right place at the right time for the people of Namibia. Strengthening these human and systemic connections is as vital as improving any technical forecasting model.

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## Author's Contributions

Execution of the experimental protocols, data analysis, and preparation of the original manuscript draft.

## Ethics

No potential conflict of interest was reported by the authors.

## References

Anke, M., & Bolstad, J. (2019). *Digitalisation and Sustainability in Hospital Supply Chain Management* (Master's thesis, Handelshøyskolen BI).

Bossert, T. J., Bowser, D. M., & Amenyah, J. K. (2007). Is decentralization good for logistics systems? Evidence on essential medicine logistics in Ghana and Guatemala. *Health Policy and Planning*, *22*(2), 73-82.

Bowser, D., Krech, L., Mabirizi, D., Chang, A. Y., Kapaon, D., & Bossert, T. (2019). Associations between practices and behaviors at the health facility level and supply chain management for antiretrovirals: evidence from Cameroon, Namibia, and Swaziland. *Global Health: Science and Practice*, *7*(2), 300-316.

Braun, V., & Clarke, V. (2012). Thematic analysis. In H. Cooper, P. M. Camic, D. L. Long, A. T. Panter, D. Rindskopf & K. J. Sher (Eds.), APA handbook of research methods in psychology, Vol. 2. Research designs: Quantitative, qualitative, neuropsychological, and biological (pp. 5771). Washington, DC: American Psychological Association.

Ekandjo, J. (2022). *An assessment of the strategies for mitigating pharmaceutical supply chain disruption during covid-19 at the Central Medical Stores Namibia* (Doctoral dissertation, University of Namibia).-19 at the Central Medical Stores Namibia* [Master's thesis, University of Namibia].

Goel, L., Nandal, N., Gupta, S., Karanam, M., Prasanna Yeluri, L., Pandey, A. K., ... & Grabovy, P. (2024). Revealing the dynamics of demand forecasting in supply chain management: a holistic investigation. *Cogent engineering*, *11*(1), 2368104.

Holloway, I., & Galvin, K. (2023). *Qualitative research in nursing and healthcare*. John Wiley & Sons

Ma, J. Y., & Kang, T. W. (2025). The Impact of Digital Technology Characteristics on Operational Decision Optimization: The Mediating Role of Information System Agility in Healthcare Supply Chains. *Sustainability*, *17*(18), 8471.

Subramanian, L. (2021). Effective demand forecasting in health supply chains: emerging trend, enablers, and blockers. *Logistics*, *5*(1), 12.

Trap, B., Musoke, R., Kirunda, A., Oteba, M. O., Embrey, M., & Ross-Degnan, D. (2018). Article 2: longitudinal study assessing the one-year effects of supervision performance assessment and recognition strategy (SPARS) to improve medicines management in Uganda health facilities. *Journal of Pharmaceutical Policy and Practice*, *11*(1), 15.

Waiganjo, M., Godinic, D., & Obrenovic, B. (2021). Strategic planning and sustainable innovation during the COVID-19 pandemic: A literature review.

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