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Challenges in the Medical Drug Supply Chain: A Focus on Procurement, Inventory management and Transport/distribution of Anaesthetic Drugs at the Bamenda Regional Hospital

Les défis de la chaîne d'approvisionnement des médicaments : un focus sur l'approvisionnement, la gestion des stocks et le transport/distribution des médicaments anesthésiques à l'Hôpital Régional de Bamenda

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Original Article

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ABSTRACT

Background: Effective supply chain management is critical for ensuring the availability of anaesthetic drugs, which are essential for surgical procedures and patient safety. In resource-constrained settings like in Cameroon's Northwest Region, systemic challenges compounded by socio-economic instability, may compromise drug availability and quality. This study aimed to identify and analyse challenges in the anaesthetic drug supply chain, focusing on procurement, inventory management, transport, and distribution, and to propose context-adapted recommendations for improving efficiency and reliability.

Methods: A descriptive cross-sectional study was conducted from November 2023 to March 2024 at Bamenda Regional Hospital (BRH) and the Northwest Regional Fund for Health Promotion. Participants included healthcare and logistics personnel involved in the anaesthetic drug supply chain. Data were collected via inventory records and a structured 19-item questionnaire assessing procurement, inventory management and transport conditions/distribution processes. Data was analysed using SPSS version 26.

Results: Of 18 personnel included, 55.6% reported poorly managed ordering, and 33.3% cited absent emergency resupply points affecting procurement. On inventory, 50.0% reported difficulties maintaining stock levels, 100.0% noted inefficient inventory software, and 22.2% reported infrequent monitoring. On transportation/distribution, 88.9% reported inadequate temperature control, 27.8% noted compromised drugs, and 55.6% cited inadequate storage causing wastage.

Conclusion: This descriptive study identified inefficiencies in procurement, inventory management, transport/distribution that were reported by staff at BRH. Recommendations include implementing real-time inventory software, enhancing staff training, upgrading storage facilities, and adopting temperature-controlled transport in resource-limited settings.

RESUME

Introduction : La gestion efficace de la chaîne d'approvisionnement des médicaments est essentielle. Le but de cette étude est d'identifier et décrire les difficultés rencontrées dans la gestion et la distribution des médicaments anesthésiques à l'Hopital Régional de Bamenda (HRB).

Méthodes : Une étude transversale descriptive a été menée de novembre 2023 à mars 2024 à l'HRB et au Fonds Régional pour la Promotion de la Santé du Nord-Ouest. Etaient inclus le personnel soignant et logistique impliqués dans la chaîne d'approvisionnement des médicaments anesthésiques. Les données étaient collectées via un questionnaire structuré de 19 items évaluant les processus d'approvisionnement, de gestion des stocks et de transport/distribution. Les réponses étaient analysées à l'aide de SPSS version 26.

Résultats : Sur 18 participants, 55,6 % ont signalé une gestion inadéquate des commandes, 61,1 % ont noté l'absence de rapports de réapprovisionnement, et 33,3 % ont mentionné l'absence de points de réapprovisionnement d'urgence. Concernant les stocks, 50.0 % ont rapporté des difficultés à maintenir des niveaux optimaux, 100.0 % ont signalé un logiciel d'inventaire inefficace, et 22,2 % ont noté un suivi peu fréquent. Pour le transport et la distribution, 88,9 % ont signalé un contrôle inadéquat de la température, 27,8 % ont noté des médicaments altérés, et 55,6 % ont cité un stockage inadéquat comme cause des pertes.

Conclusion : Cette étude descriptive a permis d'identifier des difficultés dans l'approvisionnement, la gestion des stocks et la distribution des médicaments anesthésiques à l'HRB.

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Introduction

Anaesthetic drugs are essential for surgical procedures, pain management, and critical care [1]. A robust supply chain ensures their timely availability, preventing delays or complications during medical interventions [2]. The supply chain encompasses procurement, inventory management, transport, and distribution, which requires effective coordination among stakeholders to ensure that drugs are available in the right quantities, at the right time, and in optimal condition for patient use [3]. Low-income countries often face issues like inadequate forecasting, limited funding, poor infrastructure, and staffing shortages which lead to stockouts, overstocking, wastage, and compromised drug quality, particularly for temperature-sensitive anaesthetic drugs [4,5]. The ongoing crisis disrupts transportation networks, increases costs, and limits financial resources for many sectors [6] including healthcare facilities with potential impact on timely delivery and storage of anaesthetic drugs, exacerbating supply chain inefficiencies [7]. Inventory management involves maintaining optimal stock levels to avoid shortages or excesses. It requires accurate tracking systems, trained staff, and real-time data to meet demand without wastage [8,9], a critical issue in resource-limited settings like BRH. Similarly, anaesthetic drugs often require temperature-controlled transport to maintain efficacy. However, inefficient transport systems, poor road infrastructure, and unreliable delivery schedules can lead to delays or drug spoilage, compromising patient safety [10,11].

The present descriptive study aimed to identify and describe challenges in the anaesthetic drug supply chain at Bamenda Regional Hospital (BRH), focusing on procurement, inventory management, transport, and distribution, and to propose context-specific recommendations for improving efficiency and reliability. By documenting reported bottlenecks and proposing solutions, the study seeks to contribute to improving the availability of anaesthetic drugs at BRH and provide insights for other healthcare facilities in similar contexts.

Methods

This was a descriptive cross-sectional study. The study took place from November 2023 to March 2024 at Bamenda Regional Hospital (BRH), the primary referral hospital in Cameroon's Northwest Region, and included the Northwest Regional Fund for Health Promotion (NWRFFHP), a region affected by the ongoing socio-political crisis, which could have impacted healthcare logistics. BRH serves a population of approximately 1,968,578 people [12] and functions as a teaching hospital.

Eligible participants included healthcare professionals and logistics personnel directly involved in the anaesthetic drug supply chain at BRH and NWRFFHP. Inclusion criteria were staff with roles in inventory management, transport, or distribution of anaesthetic drugs, and availability of documented data related to these processes. Exclusion criteria included temporary or short-term staff lacking significant experience with supply chain processes, personnel absent during data collection (e.g., due to leave or illness), and incomplete or unavailable records. A purposive sampling technique was used to select participants based on their roles and access to relevant data. The study examined variables in three domains to capture drug supply chain challenges:

- Procurement systems: Outcomes measured were the management of ordering/reordering processes, requirements for resupply reports, and presence of communication gaps between BRH and NWRFFHP.
- Inventory Management: Outcomes measured were the presence and efficiency of software, challenges in maintaining optimal stock levels, frequency of inventory monitoring, presence of personnel overseeing inventory, availability of emergency resupply points, and requirements for resupply reports.
- Transport and Distribution: Outcomes measured were the adequacy of temperature control, instances of compromised drugs due to transport conditions, frequency of delivery delays, adequacy of warehouse storage, and impact of the socio-economic crisis on delivery.

A pretested, structured 19-item questionnaire was administered to participants, capturing demographic information (age, sex, profession, organisation), and drug supply chain challenges. The questionnaire included Likert-scale questions to assess process efficiency and challenges. Questionnaires were coded for confidentiality to ensure data integrity. To minimize selection bias, purposive sampling targeted only personnel with direct involvement in the supply chain. Information bias was addressed by using pretested questionnaires and validating data against hospital records. Non-response bias was mitigated by ensuring all eligible participants were approached and consent was obtained.

The sample size was determined by the availability of staff meeting inclusion criteria during the study period. No formal sample size calculations were done. Continuous variables (e.g., age) were summarized using median and interquartile ranges. Categorical variables (e.g., profession, satisfaction levels) were reported as counts and percentages. Data were entered into SPSS version 26 for analysis. Descriptive statistics were used to summarize findings, with results presented in tables and bar charts for clarity. No inferential statistics were applied due to the descriptive nature of the study. Ethical clearance was obtained from the Institutional Review Board of

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the Catholic University of Cameroon (Ref No. 007/CATUC-IRB/WFM/LKN/24). Administrative approvals were secured from the Regional Delegation of Public Health for the Northwest Region and the Director of BRH. Participants provided informed verbal and written consent after being informed of the study's purpose, risks, and benefits. They were assured of their right to withdraw at any time, and data were kept confidential, used solely for research purposes.

Results

Participant characteristics

Of the 28 eligible participants, 10 were excluded due to limited knowledge of the supply chain, leaving 18 participants (64.3%) for analysis. The median age was 37.4 (IQR: 29.4-44.2), with 55.6% male and 44.4% female. Professions included pharmacy technicians (38.9%), storekeepers (27.8%), pharmacists (16.7%), and nurses (16.7%) as shown in Table 1. Most participants (72.2%) were from BRH, with 27.8% from NWRFFHP.

Table 1: Participants Socio-Demographic Characteristics

Category	Variable	Frequency (N=18)	Percentage (%)
Sex	Male	10	55.6
	Female	8	44.4
Age Group	20–30 years	4	22.2
	31–40 years	7	38.9
	41–50 years	7	38.9
Profession	Pharmacy Technician	7	38.9
	Storekeeper	5	27.8
	Pharmacist	3	16.7
	Nurse	3	16.7

Procurement Challenges

Many participants (55.6%) reported that ordering and reordering of anaesthetic drugs were not closely managed as shown in Figure 1. Additionally, 61.1% noted that no report was required for resupply. Furthermore, 33.3% highlighted the absence of an emergency resupply point. Communication gaps were reported by 16.7%, contributing to procurement issues. Lastly, 44.4% acknowledged a significant impact from the socio-economic crisis.

Inventory Management Challenges

Half of the participants (50.0%) reported difficulties maintaining optimal stock levels of anaesthetic drugs, leading to stockouts or overstocking. All participants (100.0%) acknowledged the presence of inventory management software but noted its inefficiency and need for updates. Infrequent monitoring of inventory levels was reported by 22.2%, contributing to inefficiencies. Additionally, 11.1% noted challenges in identifying maximum and minimum stock quantities. Lastly, 22.2% indicated a lack of personnel responsible for overseeing inventory.

Transport and Distribution Challenges

A significant proportion of participants (88.9%) reported inadequate temperature control during anaesthetic drug transport, with 27.8% confirming instances of compromised drugs due to temperature issues. Delivery delays were frequent or very frequent for 38.9%, disrupting supply reliability. Additionally, 55.6% noted inadequate warehouse storage, contributing to drug wastage. The socio-economic crisis significantly impacted delivery for 44.4%, exacerbating logistical challenges. Lastly, 55.6% reported that the Northwest Regional Fund for Health Promotion did not provide transport means, hindering reliable drug delivery to BRH.

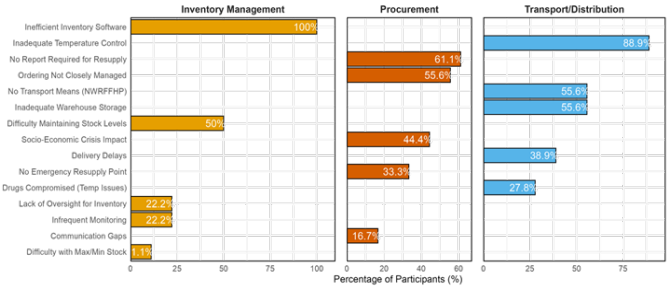

Figure 1: Key Challenges in the Anaesthetic Drug Supply Chain

Discussion

This descriptive study at Bamenda Regional Hospital (BRH) identified staff-reported challenges in the anaesthetic drug supply chain. Procurement issues included poorly managed ordering (55.6%) and absent emergency resupply points (33.3%). Inventory management challenges related to difficulties maintaining stock levels (50.0%), inefficient software (100.0%), and infrequent monitoring (22.2%). Transport and distribution problems included inadequate temperature control (88.9%), compromised drugs (27.8%), reported frequent delivery delays (38.9%), inadequate storage (55.6%), and socio-economic crisis impacts (44.4%).

Difficulties in maintaining optimal anaesthetic drug stock levels were prevalent, primarily attributed to inadequate staffing and outdated, inefficient software, a finding consistent with Odhiambo & Kihara (2018) [13]. This software inefficiency, requiring urgent updates, directly mirrors issues observed by Currin et al. (2020) [14], who linked such systems to increased costs from inaccurate hospital pharmacy records and overall supply chain disruptions. Furthermore, infrequent inventory monitoring (22.2%) and the absence of emergency resupply points (33.3%) highlighted poor coordination, similar to challenges in Kenyan hospitals where inaccurate inventory records significantly impacted supply chain performance [13]. These systemic issues collectively exacerbate the difficulties in effective anaesthetic drug stock management.

The reported inadequate temperature control during

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transport, reported by 88.9% of participants, with 27.8% noting compromised drugs, deflects from WHO guidelines emphasizing stringent temperature monitoring to maintain anaesthetic drug efficacy [15]. The Royal College of Anaesthetists (2025) further underscores the need for robust systems to ensure reliable medicine management, including temperature-controlled storage and transport to prevent degradation [16].

The socio-economic crisis significantly disrupted anaesthetic drug delivery, with 44.4% reporting a major impact and 38.9% noting frequent delivery delays, consistent with literature highlighting how poor infrastructure and unreliable schedules compromise drug availability in African healthcare settings [10,11]. These disruptions increase costs and risks to patient safety.

The few pharmacists compared to technicians may reflect staffing challenges, aligning with Wong's findings on conflict-driven workforce shortages in African settings [17]. This may lead to switching to alternative drugs or doses to manage shortages as reported by Hallal (2025) in Lebanese hospitals facing economic crises [18]. Inadequate warehouse storage, reported by 55.6% of participants, led to anaesthetic drug wastage, echoing Meseret's findings that up to 15% of hospital pharmacy budgets are consumed by anaesthetic drug losses due to poor storage practices [19]. This preventable wastage strains hospital budgets and contributes to shortages, impacting surgical efficiency.

Purposive sampling ensured relevant data from 18 participants, with ethical approvals maintaining study integrity. However, the small sample limits generalizability. Excluding 10 participants, including anaesthetic staff, restricted clinical perspectives on supply chain issues. Limited participation from the Northwest Regional Fund for Health Promotion (5 staff) underrepresented regional logistics insights. Moreover, because this study is purely descriptive and cross-sectional, it identifies staff-reported challenges and associations but does not establish causal relationships between observed difficulties and outcomes such as stockouts, wastage, or compromised patient care. Lastly, BRH's urban context may not reflect challenges in remote facilities.

Future research should employ larger, longitudinal studies and qualitative methods to explore challenges in remote facilities. Policy should prioritize modern inventory systems, temperature-controlled transport, and storage upgrades. Incentives for retaining skilled staff could address coordination issues. In practice, BRH should implement real-time inventory software, enhance staff training, establish emergency resupply points, and improve coordination with NWRFFHP to reduce stockouts, wastage, and ensure drug quality, potentially serving as a model for similar settings.

Conclusion

This descriptive cross-sectional study identified several staff-reported challenges in the supply chain of anaesthetic drugs at Bamenda Regional Hospital, including inadequate procurement procedures, inefficient inventory management systems, poor temperature control during transport, and insufficient storage facilities. These difficulties were frequently reported in a context of ongoing socio-economic crisis. Although the descriptive design does not permit establishment of causality, the consistency and magnitude of the reported problems highlight priority areas for intervention. Recommended actions include the adoption of real-time inventory management software, regular staff training, establishment of emergency resupply mechanisms, improvement of temperature-controlled transport, and upgrading of storage facilities. Future studies using mixed methods, larger samples, or longitudinal designs in both urban and rural facilities are needed to further explore these issues.

Declarations

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Authors' contributions: Study concept and design: NJ and EEA. Data collection: EEA. Analysis and interpretation of data: EMM. Manuscript writing: NJ, NMIP, NAG, MMJ and EMM. Final approval of manuscript: All authors. JB supervised the study. EEA had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. All authors agreed to submit the manuscript in its current form.

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Data availability: The data supporting this study's findings are available from the corresponding author upon reasonable request.

Ethics approval and consent to participate: Ethical clearance was granted by the Institutional Review Board of the Catholic University of Cameroon (Ref No. 007/CATUC-IRB/WFM/LKN/24). Informed consent was obtained from participants in their first official language, with a third party signing for those unable to read or write.

Consent for publication: Not applicable.

Competing interests: The authors declare no competing interests

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