Research Article

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Research Chronicle in Health Sciences

2024
Vol. 10 No. 2: 106

# Comprehensive Analysis of Medication Prescription and Utilization Trends among Healthcare Practitioners Affiliated with CHAG

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**Received:** October 11, 2024; **Accepted:** November 02, 2024; **Published:** November 14, 2024

**Citation:** Flesher W, et al. Comprehensive Analysis of Medication Prescription and Utilization Trends among Healthcare Practitioners Affiliated with CHAG. Research Chronicle in Health Sciences, 2024, Vol. 10 No. 2: 106

## Abstract

This study analyzed medicine consumption and related expenditure across 31 health facilities under the Christian Health Association of Ghana (CHAG) to identify usage trends of essential medicines and inform the development of a digital pharmaceutical supply chain management system for CHAG providers. A one-year retrospective, cross-sectional review of drug consumption and expenditure data was conducted using the Always Better Control (ABC) analytical framework. Medicines were classified into three categories based on their contribution to total annual consumption: Category A (top 80%), Category B (next 15%), and Category C (lowest 5%). The top twenty Category A essential medicines were further categorized according to their Anatomical Therapeutic Chemical (ATC) codes to determine the therapeutic groups with the highest utilization. The total expenditure on essential medicines in 2016 was GHS 29,327,267 (US$6,665,288) for hospitals and GHS 2,923,561 (US$664,445) for clinics. The ABC analysis indicated that 23.9% of hospital medicines accounted for 79.4% of the total drug budget, while 31.5% of clinic medicines accounted for 79.5% of the budget, representing Category A items. ATC categorization of the top twenty medicines highlighted a predominance of antibiotic use, which corresponded with the highest costs for the facilities. The findings demonstrate that ABC and ATC analyses provide an effective framework for prioritizing essential medicines, guiding expenditure management, and supporting cost-effective decision-making. In preparation for CHAG's planned digital supply chain system, this approach offers valuable insights for optimizing medicine selection, improving resource allocation, and achieving significant cost savings on high-value medications.

**KEYWORDS:** Medicine utilization; Consumption trends; Healthcare providers; Health facilities; Pharmaceutical supply chain; Therapeutic classification.

## INTRODUCTION

Medicines are fundamental to healthcare, playing a vital role in maintaining, restoring, and improving health by preventing and treating diseases. To ensure uninterrupted patient care, health facilities must maintain robust pharmaceutical supply systems that guarantee continuous access to essential medicines. An effective supply system integrates inventory management, quality assurance in distribution, and reliable procurement practices, all of which collectively enhance access to essential medicines and support sustained healthcare delivery. However, modern healthcare systems face increasing complexity due to operational challenges, high treatment costs, and the growing expense of medicines and medical consumables [21]. Ensuring an efficient supply chain requires substantial financial investment in procurement, and in situations where resources are limited,

careful planning, strategic design, and organized management become critical for sustaining clinical and administrative services [22].

Stock-outs of essential medicines have been widely documented to negatively impact morbidity, mortality, and the overall epidemiology of diseases, particularly in low- and middle-income countries [23–25]. In sub-Saharan Africa, key factors contributing to stock-outs include inadequate procurement financing, weak logistical planning, insufficient distribution resources, and limited personnel skilled in supply chain management [6–8]. In such resource-constrained settings, the efficient use of organizational resources is imperative, making effective inventory management a cornerstone for achieving significant cost savings and operational efficiency in hospital budgets [26].

Inventory control provides healthcare facilities with a structured approach to determine which items to order, the quantity, and the optimal timing for procurement. Effective inventory management minimizes both purchasing and storage costs while ensuring adequate medicine availability [2]. Beyond financial benefits, robust inventory systems enhance workflow transparency, reduce waiting times, optimize human resources, and support smooth operational processes. The hallmark of pharmaceutical inventory management is the dual goal of cost containment and operational efficiency, with studies demonstrating that effective inventory practices can substantially reduce total annual drug expenditure [27]. Pandya and Thakkar have noted that inventory control not only reduces financial outlays but also saves space, labor, and contributes to streamlined institutional processes [28].

Various inventory management techniques exist to enhance cost-effectiveness and operational efficiency. These include HML (High, Medium, Low) Analysis, VED (Vital, Essential, Desirable) Analysis, FSN (Fast, Slow, Non-moving) Analysis, SDE (Scarce, Difficult, Easily available) Analysis, GOLF (Government, Ordinary, Local, Foreign) Analysis, SOS (Seasonal, Off-Seasonal) Analysis, and ABC (Always Better Control) Analysis. This study employs the ABC analysis method, which classifies items into three categories based on their relative importance according to consumption frequency and monetary value. The method allows institutions to identify items that require enhanced control and monitoring. Although ABC analysis primarily considers monetary value and consumption rate, it has been widely recognized as a useful tool for guiding procurement strategies, prioritizing high-value items, and aligning inventory practices with public health priorities [29]. For instance, ordering Category A items more frequently in smaller quantities can reduce inventory holding costs while ensuring the availability of essential medicines. Previous studies applying ABC analysis in medical store management have shown that controlling a small proportion of high-value items can significantly reduce overall expenditure, demonstrating the method's utility in resource optimization [30].

### The Med4All Initiative and CHAG Medicine Consumption Patterns

The Christian Health Association of Ghana (CHAG) represents the second-largest healthcare delivery network under the Ministry of Health in Ghana. CHAG comprises 25 Christian church-affiliated organizations that operate hospitals, clinics, and training institutions. Despite representing just over 5% of national health infrastructure, CHAG facilities deliver approximately 35–40% of the country's inpatient and outpatient care [31]. In collaboration with the PharmAccess Group (PAG), an international non-governmental organization committed to improving healthcare access in sub-Saharan Africa, CHAG is implementing the Med4All initiative—a digital pharmaceutical supply chain management platform.

Med4All ("Medicines for All") is designed to connect medicine suppliers, healthcare providers, and payers to enhance the accessibility, affordability, and quality of medicines. The initiative addresses critical challenges such as fragmented supply chains, inadequate quality control, high medicine costs, and the prevalence of substandard and counterfeit medications, which the World Health Organization estimates at nearly 30% in low- and middle-income countries [32].

The initiative aims to support all 330 CHAG facilities, which primarily serve vulnerable and underserved populations. For example, in 2016, CHAG facilities contributed 29% of national inpatient and 20% of outpatient services. A baseline study conducted in mid-2017 assessed current medicine procurement practices and consumption patterns among CHAG providers for medicines listed in the Ghana Essential Medicines List, National Formulary, and National Health Insurance Medicines List. The present study focuses on the consumption patterns of essential medicines within CHAG institutions using ABC analysis, providing foundational data to integrate the ABC Analyzer tool into a digital platform that facilitates electronic payments for medicine procurement.

## MATERIALS AND METHODS

### Study Design and Sampling

This study was conducted across a representative sample of Christian Health Association of Ghana (CHAG) member health facilities and institutions. Facilities were selected using a combination of purposive and random sampling methods, taking into account geographical and ecological variations, urban-rural distribution, denominational representation, and the level of healthcare services provided. Adapting the World Health Organization (WHO) methodology for Level II facility surveys, five out of the then ten administrative regions in Ghana were selected to implement all study tools. Selection criteria for these regions included: (i) socio-economic and agro-ecological profiles, and (ii) the concentration of CHAG facilities within the region (Figure 1).

Within each selected region, six CHAG health facilities were randomly chosen, resulting in a total sample of thirty facilities. An additional facility was included in one region due to its unique status as a newly upgraded polyclinic providing inpatient services comparable to hospitals. Ethical approval for the study was obtained from the Ministry of Health and CHAG headquarters, while local facility managers provided operational clearance. Oral informed consent was obtained from all participants, who retained the right to withdraw at any point during the study [33].

The analysis is a widely employed inventory management technique based on the Pareto principle, which distinguishes the vital few items from the trivial many [19]. In the context of pharmaceutical supply, ABC analysis categorizes medicines into three groups based on their contribution to total expenditure:

- **Category A:** The top 10–20% of medicines that account for approximately 70–80% of the total budget.
- **Category B:** The next 10–20% of medicines, contributing about 15–20% of total expenditure.
- **Category C:** The remaining 60–80% of medicines, representing only 5–10% of the total budget.

This categorization allows supply managers to identify high-value items requiring strict monitoring while recognizing lower-value items that can be managed with less oversight. The analysis also helps determine which medicines may not need to be stocked continuously.

For this study, ABC analysis involved a one-year retrospective, cross-sectional review of drug consumption and related expenditure data for each surveyed facility. Medicine consumption data for 2016 were collected and analyzed individually per facility. Expenditure for each drug was calculated by multiplying the total number of units consumed by the unit price. The drugs were then arranged in descending order of annual expenditure, and cumulative expenditure percentages were calculated. Based on the cumulative percentages, medicines were classified into Categories A, B, and C, with Category A comprising 10–20% of items consuming 80% of the budget, Category B comprising the next 10–20% consuming 15% of the budget, and Category C comprising 60–80% of items accounting for only 5% of total expenditure. The primary outcomes included the number of medicines in each category and the proportion of the total annual expenditure they represented.

## Therapeutic Classification

All medicines included in this study were listed on the Ghana Essential Medicines List (GEML), which identifies drugs considered critical for meeting the priority health care needs of the population. The Anatomical Therapeutic Chemical (ATC) classification system, recommended by the World Health Organization, was employed to categorize the active ingredients of medicines according to the organ or system they target, as well as their therapeutic, pharmacological, and chemical properties [20]. As part of the ABC analysis, ATC codes were applied to the top twenty Category A medicines to identify the therapeutic categories with the highest utilization across surveyed facilities. This approach allowed for the identification of drug classes consuming the largest share of resources and informed strategies for cost-effective inventory and supply chain management [34].

# RESULTS

The study analyzed medicine consumption and expenditure across thirty CHAG health facilities for the year 2016. The total annual expenditure on essential medicines was GHS 29,327,267 (US$6,665,288) for hospitals and GHS 2,923,561 (US$664,445) for clinics. The ABC analysis revealed that a relatively small proportion of medicines accounted for the majority of the budget.

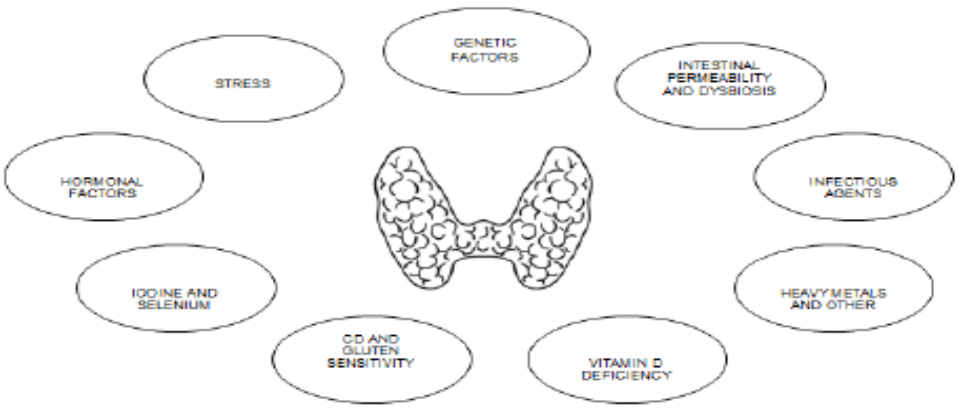


**Figure 1:** ABC analysis cumulative curve.

Category A medicines represented 23.9% of all hospital medicines and accounted for 79.4% of total hospital drug expenditure. In clinics, Category A medicines constituted 31.5% of items and consumed 79.5% of the drug budget. Category B medicines accounted for 10–20% of items and contributed 15–20% of the expenditure, whereas Category C medicines represented 60–80% of items but only 5–10% of total costs. These results indicate that monitoring a small proportion of high-value medicines could optimize resource allocation and reduce unnecessary expenditures (Table 1).

### Therapeutic Classification

The ATC-based analysis of the top twenty Category A medicines revealed that antibiotics were the most frequently consumed therapeutic category, followed by analgesics and anti-malarials (Table 2). This trend was consistent across hospitals and clinics, reflecting high demand for infection management and acute care interventions. The predominance of antibiotics also accounted for a substantial portion of the total expenditure, highlighting opportunities for targeted interventions to optimize use and reduce costs.

### Cost Management Observations

The study found that high-cost medicines, despite being limited in number, dominated the overall expenditure. By focusing on Category A items, facilities could implement cost-saving strategies such as bulk procurement, demand forecasting, supplier negotiations, and use of generic alternatives (Table 3). Clinics and smaller facilities, which consumed a higher proportion of their budget on fewer items, stood to benefit significantly from such targeted interventions.

## DISCUSSION

The findings demonstrate that ABC analysis is a powerful tool for identifying high-impact medicines and optimizing resource allocation in healthcare facilities. In CHAG hospitals and clinics, a small subset of medicines (Category A) consumes the majority of the budget, a pattern consistent with global observations in resource-limited settings. By concentrating efforts on monitoring, procurement, and utilization of these high-cost items, facilities can achieve significant cost savings without compromising patient care [35].

The predominance of antibiotics in the top expenditure category highlights the importance of antimicrobial stewardship programs. Rationalizing antibiotic use can reduce unnecessary expenditure, minimize the risk of resistance, and improve patient outcomes. Analgesics and anti-malarials were also major contributors to the budget, reflecting the burden of acute conditions and endemic diseases in Ghana.

Integrating ABC analysis with a digital supply chain platform, such as the Med4All initiative, offers an opportunity to enhance procurement efficiency, reduce waste, and improve medicine availability. Digital tools enable real-time tracking of consumption, automated forecasting, and streamlined supplier interactions, which are particularly valuable for Category A medicines. Additionally, adopting generic alternatives and centralized procurement could further reduce costs while maintaining quality [36].

This study reinforces the need for systematic inventory management and therapeutic categorization as integral

**Table 1:** ABC Analysis of Medicines in CHAG Facilities.

| Category | % of Medicines | % of Total Expenditure | Description |
|---|---|---|---|
| A | 23.9 (Hospitals) / 31.5 (Clinics) | 79.4 (Hospitals) / 79.5 (Clinics) | High-cost, high-consumption medicines |
| B | 12.1 / 10.3 | 16.1 / 15.0 | Moderate-cost, moderate-use medicines |
| C | 64.0 / 58.2 | 4.5 / 5.5 | Low-cost, low-use medicines |

**Table 2:** Top Therapeutic Categories (Category A Medicines).

| Therapeutic Category | No. of Medicines | % of Category A Expenditure | Common Examples |
|---|---|---|---|
| Antibiotics | 8 | 42% | Amoxicillin, Ciprofloxacin |
| Analgesics | 5 | 20% | Paracetamol, Ibuprofen |
| Anti-malarials | 3 | 15% | Artemether-Lumefantrine |
| Vitamins/Supplements | 2 | 12% | Multivitamins, Iron |
| Others | 2 | 11% | Antacids, Cough preparations |

**Table 3:** Suggested Cost Management Strategies for High-Value Medicines.

| Strategy | Description | Potential Impact |
|---|---|---|
| Bulk Procurement | Pooling orders across facilities | Reduced unit costs |
| Generic Substitution | Replacing branded drugs with equivalent generics | Cost savings |
| Demand Forecasting | Estimating accurate consumption needs | Minimized stock-outs, reduced waste |
| Supplier Negotiation | Engaging suppliers for discounts | Lower overall expenditure |
| Inventory Monitoring | Frequent review of Category A medicines | Efficient stock management |

components of health system strengthening. By combining analytical tools with digital supply chain solutions, CHAG facilities can improve access to essential medicines, optimize expenditures, and strengthen healthcare delivery for vulnerable populations.

## CONCLUSION

Therapeutic category analyses provide critical insights into medicine consumption patterns and expenditure priorities in CHAG facilities. A small proportion of high-value medicines (Category A) drives the majority of expenditure, underscoring the potential for cost savings through targeted inventory control and procurement strategies. Antibiotics, analgesics, and anti-malarials dominate resource utilization, emphasizing the need for rational prescribing and stewardship interventions. The integration of ABC analysis with digital supply chain platforms, such as Med4All, can enhance inventory management, reduce costs, and ensure continuous access to essential medicines. These strategies are essential for sustaining high-quality healthcare delivery in resource-limited settings.

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