



Assessment of Drug Supply Chain Management Effectiveness in Selected Tertiary Care Hospitals in The Western Province of Sri Lanka

K. Jeyassuthan¹, G. Paul Roshan^{1*}, N. Gandharupan¹, B. Kayalvizhi¹

¹Ministry of Health, Colombo, Sri Lanka

*Correspondence: gproshan@gmail.com

<https://doi.org/10.4038/sljhr.v4i1.78>

 <https://orcid.org/0009-0008-9799-879X>

Abstract

Background: Access to essential medicines is vital for effective healthcare, especially in tertiary care hospitals, where complex medical cases are treated. However, despite regulatory frameworks and substantial investments in Sri Lanka, inefficiencies in drug supply chain management continue to hinder the availability and quality of medications. Evidence suggests that these challenges contribute to drug shortages, impacting patient care and the overall effectiveness of healthcare delivery in hospitals.

Objective: To assess the effectiveness of drug supply chain management in selected tertiary care hospitals in the Western Province of Sri Lanka.

Methods: A cross-sectional descriptive study was conducted in selected tertiary care hospitals in the Western Province using purposive sampling. Data were collected through self-administered questionnaires, document reviews, and drugstore observations.

Results: This study revealed significant gaps in supply chain management practices in tertiary care hospitals. Factors such as inadequate training, poor inventory management, and substandard storage facilities were identified as contributors to the inefficiency. Despite these efforts, none of the hospitals met the expected standards for drug availability or quality management.

Conclusion: This study highlights areas for improvement, such as drug availability and estimation accuracy, alongside success in mitigating drug wastage and maintaining inventory. Despite the limitations of the existing literature, this study provides valuable insights into enhancing drug management practices. Urgent interventions are needed to address these challenges and ensure uninterrupted access to essential medications, emphasizing the importance of targeted interventions in tertiary-care settings.

Keywords: Supply Chain Management; Effectiveness; Drugs Management; Tertiary Care Hospitals; Sri Lanka

Introduction

Modern healthcare administration places significant emphasis on supply chain management, which is crucial for effective healthcare delivery [1,2]. In Sri Lanka, drug management, encompassing a wide array of medical supplies, including pharmaceuticals, has evolved into a complex process. With a total of 920 pharmaceutical items, managing the Sri Lankan drug supply chain presents multifaceted challenges [3]. Pharmacists' knowledge also plays an important role in supply chain management [4,5].

Allopathic medicine dominates Sri Lanka's healthcare system, aligned with the government's commitment to providing free healthcare services and promoting public health [6]. The healthcare system comprises the public and private sectors, with the former playing a pivotal role in inpatient care provision [7]. Specialized hospitals managed by provincial health authorities contribute significantly to the healthcare landscape [3].

The Western Province of Sri Lanka comprises districts such as Colombo, Kalutara, and Gampaha. Western Province mirrors the national healthcare structure,

with governance overseen by the provincial authorities. Extensive healthcare facilities, including primary, secondary, and tertiary care institutions, are managed by the Provincial Health Department and line ministry [8].

The funds allocated to healthcare by the treasury support the procurement of pharmaceuticals, consumables, and supplies. Despite significant government investments, healthcare services are freely provided and adhere to national policies for universal healthcare access [9].

The Medical Supplies Division (MSD) oversees pharmaceutical supply to government healthcare institutions. MSD's functions include estimation, procurement, storage, monitoring, distribution, and accounting of medical supplies, aimed at ensuring the "6 Rs" - right item, quality, quantity, place, time, and price (SPC) [10]. The Sri Lankan Government provides priority to local manufacturers during the procurement process, but an inadequate number of them is one of the reasons leading to drug shortages [11].

Institutional drug management in hospitals involves estimation, procurement, storage, distribution, and utilization overseen by pharmacists [12]. The Medical Supplies Management Information System (MSMIS) facilitates real-time monitoring and management of medical inventory, ensuring standardization through ministry-issued guidelines [13].

Sri Lanka's healthcare system is facing challenges in terms of efficient drug utilization. Issues such as overprescription, pilferage, and poor quality compromise drug supply chain management. Despite ministry efforts, challenges persist, prompting research on the effectiveness, variations, contributing factors, and strategies for improvement in drug supply chain management.

Objective

To assess the effectiveness of drug supply chain management in selected tertiary care hospitals in the Western Province of Sri Lanka.

Methods

This study comprised two distinct phases.

Phase 1: Development of criteria for assessing the effectiveness of drug supply chain management and operationalization of variables.

Phase 2: Implementation of quantitative approach using relevant tools.

Criteria and variables for evaluating the effectiveness of drug supply chain management were developed using qualitative research techniques, including brainstorming and focus-group discussions. A panel of experts, including officials from the Medical Supplies Division (MSD), hospital directors, medical superintendents, and chief pharmacists, contributed to the generation, selection, and validation of these variables. The following variables were identified: availability of drugs; accuracy of estimation; wastage of drugs; quality of drugs; effectiveness of human resources; inventory management; storage quality; supervision and monitoring; customer satisfaction

Indicators were developed to quantify and measure these variables, using inputs from supervisors and field experts. Customer satisfaction was omitted from the measurement because of feasibility constraints.

This study employed an institutional cross-sectional descriptive design and was conducted in the Western Province of Sri Lanka

The study population included pharmacy departments and operative staff (pharmacists and dispensers) working in selected tertiary care hospitals in the Western Province of Sri Lanka, excluding the National Hospital of Sri Lanka, which is a special hospital under central government jurisdiction.

Based on feasibility and convenience, four tertiary care hospitals were selected for inclusion in this study: Colombo North Teaching Hospital (CNTH), District General Hospital Gampaha, and District General Hospital Negombo.

These hospitals were chosen to ensure representation at different levels (teaching hospitals and district general hospitals) and to maintain a balance between central and provincial government institutions.

Given the relatively small number of operative staff in each hospital, the entire population of operative staff working in all selected hospitals was included in the purposive sample (Table 1). Operative staff members on maternity leave or overseas leave during the data-collection period were excluded.

This study employed several data collection methods. Direct observations were conducted at hospital

drugstores using a checklist on randomly selected days. Information from registers, records, and the Medical Supplies Management Information System (MSMIS) for 2018 was compiled using data collection sheets. Inventories and MSMIS records related to drug supply chain management were reviewed with the assistance of the chief pharmacist using a checklist. Additionally, a self-administered questionnaire survey was conducted among the operative staff to assess their knowledge, skills, and attitudes regarding drug supply chain management.

Data collection tools included a self-administered questionnaire, checklist, and compilation sheet, all of which were carefully designed and refined with expert input. The questionnaire, structured to gather socioeconomic, demographic, knowledge, skills, and attitude data, underwent rigorous review and pre-testing with 10 operative staff members at the Teaching Hospital Batticaloa to ensure clarity and accuracy. Checklists for drug store observations and inventory document reviews were developed based on drug management manuals and refined using expert feedback. Compilation sheets were systematically prepared to collect data for all indicators, ensuring consistency and comprehensive coverage.

To assess the knowledge of the operative staff, five questions on medicine and five on drug management were posed. Based on the accuracy of their responses, they were categorized into the following three groups: Good: More seven correct responses; average, three to seven correct responses; and poor, fewer than three correct responses.

The accuracy of drug estimation was assessed based on the annual average of the supplementary lists used in 2018. It was categorized as good if there were fewer than 10 supplementary lists, average if there were 10–20 lists, and poor if there were more than 20 lists. Of the hospitals surveyed, 75% (n=3) were classified as good and 25% (n=1) were deemed poor.

Drug waste was assessed using the average annual number of items expired in 2018. Hospitals were categorized as “good” if they had fewer than ten expired items. Fortunately, all four hospitals fall within this category.

Wastage was evaluated considering the annual average number of damaged items in 2018. Damaged

items refer to those that are compromised during transportation or storage, such as crushed, broken, or contaminated drugs, making them unsuitable for patient use. Hospitals were classified as “good” if they had fewer than ten damaged items.

Drug quality was measured using the annual average number of reported quality failure events due to institutional causes in 2018. Hospitals were classified as “good” if they had fewer than 10 such events, “average” if the number fell between 10 and 50, and “poor” if it exceeded 50.

The effectiveness of inventory management was evaluated on a scale of 10 points, with hospitals categorized as “good” if they scored more than 7 points, “average” if their score fell between 3 and 7, and “poor” if it was less than 3.

The storage quality was assessed by allocating points during the assessment. The assessment involved assigning points, with hospitals deemed “good” if they scored more than 25 points, “average” if their score fell between 15 to 25, and “poor” if it was less than 15 points.

Supervision at the institutional level was evaluated based on the number of hospital management supervision visits to the pharmacy department in 2018. Hospitals were classified as “good” if they conducted more than 9 supervisory visits, “average” if they conducted between 6 to 9 visits, and “poor” if they conducted fewer than six visits. Regrettably, all four hospitals (100%) were classified under the “poor” category during the assessment. Continuing with the evaluation of supervision, the number of Drug Therapeutic Committee (DTC) meetings held in 2018 was also considered in assessing this. Hospitals were classified as “good” if they conducted more than 9 DTC meetings, “average” if they conducted between 6 to 9 meetings, and “poor” if they conducted fewer than six meetings.

Ethical approval for this study was obtained from the Ethical Review Committee of the Postgraduate Institute of Medicine, University of Colombo (ERC/PGIM/2019/68). Administrative clearance was also secured from the Provincial Director of Health Services (PDHS) of Western Province, relevant Regional Directors of Health Services (RDHS), and the heads of all participating institutions.

During the data collection stage, the investigators visited the selected hospitals and explained the questionnaire to the operative staff with the assistance of the chief pharmacist.

The data were carefully coded and entered into the SPSS software to ensure accuracy. The researchers performed all the data entry tasks using double-entry verification to minimize errors. Additionally, checklists were entered into a worksheet prepared by the researchers with thorough data entry and rechecking procedures in place.

Results

A response rate of 91.67% was achieved, with 110 of the 120 operative staff members participating in the study. Ten individuals were exempt from participation for various reasons. The collected data encompassed selected measures aimed at assessing relevant variables and factors related to human resource effectiveness.

A notable presence of females accounted for 74.54% (n=82) of the total staff. Additionally, approximately 53% of the staff were under the age of 40 years, with a mean age of 40.5 years (SD=1.78) and a median age of 40 years. The age range varied from less than 20 years to > 50 years.

Regardless of gender, approximately 92.72% (n=102) of the staff relied entirely on government salaries and other financial incentives. Considering civil status, 79.09% (n=87) of the operative staff were married, while 17.27% (n=19) had never been married. Of the staff, 80.9 % (n = 89) had between one and three children, and almost 83.15% (n=74) were employed in either the government or the private sector. Of the staff, 59.09 % (n = 65) lived more than 10 km away and 41.81% (n=46) travelled for more than one hour. Of the operative staff, 95.45 % (n = 105) reported satisfactory health status.

Competency of operating staff

Of the operative staff, 88.18 % (n = 97) had the Basic Certificate of the State Pharmacist Training Institute qualification.

Table 2 indicates that 58.18% of the operative staff demonstrated average knowledge, whereas only 38.18% exhibited good knowledge. With regard to years of service experience, approximately 67.26% (n=74) of the staff had a good service experience of

more than 10 years, while 11.81% (n=13) fell into the 5-9 years' service experience category.

In terms of training programs, 60.55% (n=66) of the operative staff indicated that they had never participated in any training program related to drug supply management throughout their tenure. When considering the IT knowledge of the operative staff, 47.71% (n=52) had average IT skills, whereas 33.03% (n=36) had good skills. In the sections on training programs and IT knowledge, one operative staff member did not respond. Therefore, the calculations are based on 109 operative staff members.

Attitude of the operative staff

Among the operative staff, 51.82 % (n = 57) reported a high workload. Interestingly, 34.54% (n=38) of the staff members indicated that they had experienced a very high workload. When queried about their perceptions of their profession, 95.45% (n=105) affirmed that they considered their job nobles. When asked about their stance on responding to patient inquiries, 97.27% (n=107) of operative staff affirmed that it was the patient's right to ask questions.

Availability of drugs

When assessing the availability of items in hospitals, 50% (n=2) of the hospitals reported being out of stock for 1 to 10 items, while the remaining 50% (n=2) reported an out-of-stock level exceeding 10 items. Each of the four hospitals had an average local purchase ranging from 1 to 50 items owing to the lack of drug supply throughout 2018.

Accuracy of estimation

The accuracy of the estimation was deemed good if the annual average of the excess items in a hospital was less than 10. All the four hospitals surveyed fell within this category.

Wastage of drugs

All four hospitals were classified as "good" because they had fewer than ten damaged items.

Quality of drugs

This study found that all four hospitals fall under the average category.

Inventory management

Among the hospitals assessed, 50% (n=2) were classified as "good," while the remaining hospitals were categorized as "average."

Storage quality

Out of the four hospitals evaluated, only one (25%) was classified as “good,” while the remaining three (75%) were categorized as “average”.

Supervision at the institutional level

All four hospitals (100%) were classified under the “poor” category based on both criteria i.e. number of hospital management visits and number of DTC meetings held in 2018

Discussion

This study, a descriptive cross-sectional analysis in Western Province hospitals, aimed to assess the effectiveness of drug supply chain management. By evaluating drug availability, estimation accuracy, waste, quality, human resource effectiveness, inventory management, storage quality, and supervision, this study provided comprehensive insights. Prompted by recognized issues in institutional drug management, this study addressed gaps in existing research to inform hospital management and national health policies.

Despite the lack of similar studies, rigorous data collection and analysis has yielded meaningful conclusions. The Ministry of Health (MOH) employs a systematic approach to ensure pharmaceutical availability, beginning with drug requirement estimation at various healthcare levels. The responsibility falls on institutional heads, Regional and Provincial Directors of Health Services, and teaching hospital directors.

Effectiveness of human resource

In tertiary care hospitals, the majority of operative staff were female, and a significant proportion were under 40 years of age, reflecting a potential preference for the profession among females. Most staff relied solely on government salaries and incentives, indicating a dependence on public sector employment. A large percentage of staff members were married and had children, with many facing challenges in commuting to work, primarily using public transportation. Despite these challenges, most staff members reported satisfactory health conditions.

Educationally, the majority held only basic certificates for pharmaceuticals, with only a small percentage possessing additional qualifications. A significant portion of the staff demonstrated average knowledge,

while a smaller percentage exhibited poor knowledge, potentially due to limited in-service training. Experience-wise, the majority had over ten years of service, reflecting challenges in recruitment and professional development. Participation in the training was limited, emphasizing the need for comprehensive in-service training in drug management. Additionally, a considerable proportion of the staff had average IT skills, highlighting the importance of IT proficiency in modern management practices.

Despite reporting high workloads, the majority of staff maintained positive attitudes towards their profession and patient care. Staffing shortages in pharmacy departments may contribute to the perceived high workload. Nonetheless, the overwhelming majority expressed positivity towards their roles and patient care.

Availability of drugs

In tertiary care hospitals, drug availability remains a significant concern, which is echoed by media reports. The findings indicate that none of these hospitals achieved good availability of essential drugs; instead, they all fell into the average category, particularly regarding local purchasing practices. This recurring issue aligns with reports from the Medical Supplies Division (MSD) and the Health Master Plan 2003, attributing the problem to factors such as insufficient funding, inaccurate estimations, underutilization of existing data, and inadequate storage facilities. Addressing these challenges is crucial to ensure uninterrupted access to essential medications [8,13,14].

Accuracy of estimation

An accurate estimation of the required quantity of drugs is vital for effective management. The findings suggest that most tertiary care hospitals demonstrated satisfactory estimation accuracy, with the majority ordering fewer than 10 supplementary lists in 2018. However, one hospital faced challenges that exceeded the recommended number in the supplementary list. Despite this, all hospitals effectively managed excess items and maintained surplus items below a certain threshold. These results emphasize the significance of precise estimation practices for optimizing drug inventory management.

Wastage of drugs

Despite being a prevalent concern in prior research, this study found that all tertiary care hospitals effectively managed expired and damaged items. The number of hospital-maintained incidents was less than ten in 2018. This success can be attributed to the implementation of the MSMIS and the facilitation of inter-institutional drug transfers, indicating significant progress in addressing drug wastage [15].

Quality of drugs

To assess the quality of drugs, all four hospitals were rated as average and reported quality failure events ranging from 10 to 15 in 2018. This could be attributed to the large volume of drugs handled by tertiary care hospitals. Reports from the IDB/WB project of the Health Master Plan have identified several factors contributing to poor drug quality, including manufacturing failures, short drug expiry, delivery delays, delivery standards, and inadequate storage facilities [14].

Inventory management

Inventory management across all hospital levels was satisfactory, with none falling into the poor category. The implementation of MSMIS appears to have played a significant role in enhancing inventory management practices.

Storage quality

Storage quality remains crucial, as emphasized by previous studies, such as Dr. Ekanayaka's investigation in 2003, which identified insufficient space and basic facilities in hospital drugstores [16]. Similarly, the Health Master Plan highlighted the inadequacy of many hospital drug stores for storage [14]. This study revealed that the majority of hospitals (n=3, 75%) demonstrated average storage quality, with only one hospital (25%) exhibiting good storage conditions, notably after recent renovation.

Supervision and monitoring

Inadequate supervision and monitoring of drug management practices were evident across all hospitals. This study identified irregularities in DTC meetings and infrequent supervisory visits by the institutional heads. Additionally, access to supervisory reports is limited to a few institutions. Despite the critical importance of supervision and monitoring in ensuring effective management, these measures have been inconsistently

implemented, as indicated by previous administrative reports from the Ministry of Health (MOH), Medical Supplies Division (MSD), and Health Master Plan of 2003 [8,13,14]. Dr. Ekanayaka's 2003 study on drug supply monitoring in the Kalutara District also emphasized deficiencies in control measures [16].

Conclusion

This study rigorously assessed the efficacy of drug supply chain management in tertiary care hospitals in the western provinces. Through a thorough analysis of factors such as human resource effectiveness, drug availability, estimation accuracy, waste, quality, inventory management, storage quality, and supervision, valuable insights were gleaned into the strengths and weaknesses of the system. Despite the dearth of similar comprehensive analyses in the literature, this study provides crucial data to illuminate areas for improvement in drug management practices. The findings emphasized persistent challenges, such as drug unavailability and difficulties in accurate estimation, alongside success in mitigating drug wastage and maintaining inventory. These results highlight the ongoing need to address systemic challenges and bolster the effectiveness of drug supply chain management to ensure uninterrupted access to essential medications and enhance overall healthcare delivery in tertiary care hospitals.

Recommendations

To enhance pharmaceutical management, key recommendations should focus on human resources and institutional functions. Continuous in-service training for pharmacists should address drug management, communication skills, and IT proficiency, while fostering competitive departmental cultures and supporting further certifications. Long-term strategies include increasing pharmacist output from training centers, comprehensive university-level training, and the strategic deployment of pharmacists based on institutional needs. Adherence to the manual of drug management as the standard reference is critical, alongside updates on rational drug use and mandatory participation in Drug and Therapeutic Committee (DTC) meetings. Improving facilities and capacity in Institutional Drug Stores (IDS), supported by inventory management training and regular supervision, is essential. Promoting effective communication among

staff and establishing a dedicated unit to oversee drug supply chain activities is also recommended. Recognizing hospitals with exemplary practices and encouraging national-level research on drug supply chains will drive excellent and continuous improvement in pharmaceutical management.

Limitations

The complexity of the drug management process involving multiple sectors and interdependent staff

may have affected its validity. The observational data were partly subjective, with a limited observation period for consistency. The study was confined to the Western Province due to time, resources, and financial constraints, limiting generalizability. Missing data in store observations, supervisory visits, documents, and training impacted comprehensiveness, and the lack of standard institutions with well-functioning drug supply chains restricted the comparative assessment.

Author declaration

Author contributions: All authors contributed significantly to the creation of this manuscript, each fulfilling the criteria established by the ICMJE.

Conflicts of interest: The authors declare no conflicts of interest concerning the research, authorship, and/or publication of this article

Ethics approval and consent to participate: Ethics review committee (ERC) approval was obtained for the ERC of the Postgraduate Institute of Medicine, University of Colombo

Funding: This study did not receive grants from any funding agencies in the public, commercial, or not-for-profit sectors

References

- [1]. Agami N, Saleh M, Rasmy M. Supply chain performance measurement approaches: review and classification. *J Oper Manag Sci*. 2012 [cited 2024 Apr 25];2012:20. Available from: <http://www.ibimapublishing.com/journals/JOMS/joms.html>.
- [2]. Buckley DS, Facha. Modern health care administration. *J Healthc Manag*. 1985 May;30(3):126–7.
- [3]. Ministry of Health Sri Lanka. Annual Health Bulletin 2015. Colombo: Ministry of Health Sri Lanka; 2015.
- [4]. Ministry of Health Sri Lanka. Manual on Management of Drugs. Colombo: Ministry of Health Sri Lanka; 2008.
- [5]. Pérez-Salazar MDR, Lasserre AAA, Cedillo-Campos MG, González JCH. The role of knowledge management in supply chain management: a literature review. *J Ind Eng Manag [Internet]*. 2017 Oct 26 [cited 2024 Apr 25];10(4):711–88. Available from: <https://www.jiem.org/index.php/jiem/article/view/2144>.
- [6]. GSP R, PwC P, SM S. Strengthening the drug supply chain management in a tertiary care hospital in Sri Lanka. *Int J Sci Res Publ [Internet]*. 2021 [cited 2024 Apr 25];11(6):22. Available from: www.ijsrp.org.
- [7]. Thekkur P, Fernando M, Nair D, Kumar AMV, Satyanarayana S, Chandraratne N, et al. Primary health care system strengthening project in Sri Lanka: status and challenges with human resources, information systems, drugs and laboratory services. *Healthcare (Switzerland)*. 2022 Nov 1;10(11):2577.
- [8]. Ministry of Health Sri Lanka. Administrative Report. Colombo: Ministry of Health Sri Lanka; 2002.
- [9]. Wijegunasekara JLHR. Drug supply management in healthcare institutions in Sri Lanka: a case study. *J Drug Deliv Ther*. 2021 Jan 15;11(1):3–7.
- [10]. Panapitiya PWC, Ranasinghe GSP, Hamdani AN, Amarasinghe PVNP, Perera DAK. Study to identify the issues on supply chain management of medical/diagnostic items and to propose a strategic framework. *Sri Lankan J Med Admin [Internet]*. 2020 Dec 30 [cited 2024 Apr 25];21(1):72. Available from: <https://sljma.sljol.info/articles/10.4038/sljma.v21i1.5383>.
- [11]. Wijayasiriwardhana J. Study on issues of drug availability and recommendations for improving the availability in healthcare institutions of Sri Lanka. *World J Pharm Res [Internet]*. 2020 [cited 2024 Apr 25];9:128. Available from: www.wjpr.net.
- [12]. Wijesinghe PR, Jayakody RL, Seneviratne RDA. An assessment of compliance with good pharmacy practice in an urban and rural district in Sri Lanka.

- Pharmacoepidemiol Drug Saf. 2007 Feb;16(2):197–206.
- [13]. Medical Supplies Division. Step-by-Step Guide for Introducing Medical Supply Management Information System (MSMIS) to Provincial Institutions. Colombo: Ministry of Health Sri Lanka; 2017.
- [14]. Japan International Cooperation Agency (JICA). Master Plan Study for Strengthening Health System in the Democratic Socialist Republic of Sri Lanka. Tokyo: JICA; 2003.
- [15]. Mathew J, John J. New trends in healthcare supply chain. J Health Supply Chain Manag. 2013;10:1–15.
- [16]. Ekanayake M. Effectiveness of the monitoring system for supply of drugs in Kalutara District [Internet]. 2003 [cited 2024 Apr 25]. Available from: <http://librepository.pgim.cmb.ac.lk/handle/1/1631>.