

EXPLORING SUPPLY CHAIN MANAGEMENT EFFICIENCY, A STUDY IN BENGALURU URBAN DISTRICT PUBLIC HEALTHCARE SYSTEM

**Chandrakala.C
Dr. H Rajeshwari**

Research Scholar, Dept. of Studies and Research in Management Karnataka State Open University
Mysuru, Karnataka, India.

Research Supervisor, Dept. of Studies and Research in Management Karnataka State Open
University Mysuru, Karnataka, India.

ABSTRACT: The Purpose of supply chain efficiency in primary healthcare (PHC) encompasses several critical objectives aimed at improving healthcare delivery, accessibility, and effectiveness at the grassroots level, by Enhancing Access to Essential and Supplies, Improving Patients care and outcomes, Optimising resource allocation and utilization, Supporting Disease prevention and Control efforts, Promoting Equity and Health equity, and Facilitating Data-Driven Decision making. “Exploring Supply Chain Efficiency, a study in Bengaluru Urban District Public Health Care System”, a part of PhD Thesis work relating to Pilot Study.

Methodology: In this study it's mainly focused on Primary Health Care of Bengaluru urban district in four zones of State PHC, Since Bangalore is one of the most populous cities in India, a pilot study was carried out in four main zones of Bengaluru using cluster sampling techniques to determine the supply chain efficiency in the state PHC's of the Bengaluru urban district.

Findings: There is a need for improvement in PHC's level in promoting equity and health equity by improving in is accessibility, waiting time, IEC, Distribution system, Cost effectiveness, Lead time and Storage Conditions.

Conclusion: Overall, the purpose of supply chain efficiency in primary healthcare is to strengthen health systems, improve health outcomes, and ensure that essential healthcare services and supplies are accessible to all individuals and communities, particularly those in resource-constrained settings.

KEYWORDS: Supply Chain Efficiency, Primary Health Care, Patients Care, Accessibility, Improve Health Outcomes.

I INTRODUCTION:

The basis of a nation's ability to address healthcare needs in the domain of public health is an efficient and dependable on supply chain. The public health system in India plays a critical role in safeguarding the health and well-being of its population. The public health system in India is instrumental in promoting population health, preventing diseases, reducing morbidity and mortality rates, and advancing the goal of achieving health for all.

Healthcare supply chain management includes a variety of processes, teams, and the transportation of drugs, medical equipment, and other supplies that healthcare professionals require in order to perform their jobs.

In the healthcare industry, supply chain management also seeks to avert issues by pinpointing departmental weak points. It looks for weak areas in order to improve global health investments and achieve desired health outcomes. Companies that use digital tools and technology to manage healthcare supply chains take advantage of actionable insights from multi-source data to make ongoing improvements and modifications to the structures and operations of their supply chains.

1. **Primary Health Centers (PHCs):** There are many PHCs in Bengaluru, which are dispersed throughout the city's different wards and neighbourhoods. At the local level, PHCs are the main point of contact for preventive care and basic healthcare services.

2. **Community Health Centers (CHCs):** Compared to PHCs, these facilities are outfitted to offer a higher caliber of healthcare services. They provide more comprehensive treatment options, diagnostic services, and specialized consultations.

Even with the large public healthcare system, problems like overcrowding, limited resources, and gaps in service delivery continue to exist. There is a continuous endeavour to tackle these obstacles and improve the caliber and availability of medical services in Bengaluru.

Importance of supply chain efficiency in public healthcare:

Here are several key aspects highlighting its importance:



Accessible Healthcare Services: The public health system makes sure that everyone, especially the most vulnerable and marginalized groups, has affordable and easy access to essential healthcare services, such as preventive, promotive, curative, and rehabilitative care.

• **Disease Prevention and Control:** Through vaccination campaigns, surveillance systems, and public awareness campaigns, public health programs and initiatives aim to stop the spread of communicable diseases like tuberculosis, malaria, HIV/AIDS, and diseases that can be prevented by vaccination.

• **Maternal and Child Health:** In order to lower rates of maternal and infant mortality and enhance the development of children, the public health system places a high priority on maternal and child health. To this end, it offers prenatal care, safe childbirth services, postnatal care, vaccinations, nutritional support, and family planning services.

• **Development of Health Infrastructure:** To guarantee equal access to high-quality healthcare services in both urban and rural areas, public health infrastructure, such as district hospitals, primary healthcare centers, community health centers, and specialized healthcare facilities, is created and reinforced.

• **Health Promotion and Education:** By increasing public knowledge of health risks, healthy lifestyle options, sanitation habits, hygiene behaviours, nutrition, family planning, and the prevention of non-communicable diseases, public health campaigns and educational initiatives help to improve health outcomes and disease prevention.

• **Emergency Preparedness and Response:** By coordinating emergency response efforts, deploying medical teams, stockpiling necessary supplies, and putting containment measures in place to lessen the impact on public health, the public health system is prepared to respond to public health emergencies, natural disasters, disease outbreaks, and pandemics.

• **Health Equity and Social Justice:** In order to address health disparities and inequities, the public health system works to promote universal health coverage, lower out-of-pocket medical costs, remove obstacles to healthcare access, and address socioeconomic determinants of health like gender inequality, poverty, and access to clean water and sanitation.

• **Research and Innovation:** To address new health issues, strengthen healthcare delivery networks, and improve population health outcomes, public health research, surveillance, monitoring, and evaluation activities produce evidence-based practices, policy recommendations, and innovations.

II LITERATURE REVIEW:

Sean Donato et al. (2016), according to him Public health is transformed by strong supply chains, Supply chains promote healthy populations and regional health security by guaranteeing the timely and efficient delivery of medications and goods. Robust medical supply chains and health commodities enhance health outcomes and foster public confidence in healthcare systems. They ought to prioritize the needs of the patient and provide access to reasonably priced, superior products at the appropriate time and location.

Sturdy supply chains facilitate the provision of vital medications, vaccines, diagnostics, and other medical supplies that are needed for communicable disease response, control, and prevention initiatives. They contribute significantly to the regional and national security of health. As a result of the region's ongoing need for high-quality healthcare services, the pharmaceutical market in Asia is predicted to grow by 13% year. As supply chain costs make up about 25% of pharmaceutical costs, investments to strengthen their efficiency and effectiveness should be explored.(1)

Shailendra Sinhasane (2022) in his article investigated that businesses and organizations have been able to better meet the needs of patients and consumers by using the healthcare supply chains' digitization as a guide. The difficulties facing the healthcare industry's supply chain have also given rise to supply chain trends for 2022, which come with higher expectations. An effective healthcare supply chain is crucial to saving patients' lives. Using digital healthcare technology is a big step in the direction of increasing this efficiency.

Healthcare organizations are generating long-term value from the digital health supply chain's transformation of the conventional healthcare supply chain. Patients are receiving safer, more affordable, more efficient, and faster healthcare services thanks to it.

The Obstacles in the Conventional Healthcare Supply Network, is the regular supply and demand in the market cannot support the structure of the traditional healthcare supply chain. A good life at a reasonable cost is a good that cannot be stocked in the supply chain like other goods and services. Among the many difficulties the conventional healthcare supply chain faced were: unreliability in inventory data, slow innovation and manufacturing, supply hoarding, wastage of supplies, Lack of digital integration.

Digital supply chain's importance in the healthcare sector Healthcare supply chains produce vast amounts of data. Making the right use of the data is essential to changing the supply chain. At every stage of the supply chain, performance can be improved by integrating the best digital technologies. The difficulties facing by traditional supply chain management are mostly related to obtaining goods and supplies needed to provide patients with high-quality care. This may also raise the price and lower the value.(2)

AWL Pvt Ltd. Identified an effective healthcare supply chain is a prerequisite for the potential life-saving benefits of supply chain technologies, Moreover, utilizing technology is a big step in the direction of increasing productivity. Furthermore, one of the top warehouse service providers in India with the newest automation technologies is AWL India. Typical supply chain technologies include RFID, IoT, Data Analytics, Process Automation, and Artificial Intelligence.

The global healthcare industry is experiencing rapid growth, improved security, and efficient operations due to the integration of innovative and disruptive supply chain technologies into supply chain management (SCM). By the end of 2025, the global market for healthcare supply chains is expected to have grown from \$2.2 billion in 2020 to \$3.3 billion. Moreover, the widespread use of supply chain technologies, especially in the healthcare industry, is proving to be incredibly advantageous for people's lives. Therefore, it is safe to say that these supply chain technologies can significantly enhance the healthcare supply chain management. (3)

Pratheeba John et al.(2023) The goal of the paper is "Best Practices in Procurement and Supply Chain Management Systems for Medicines," is to comprehend the various supply chain and procurement models that have shown to increase the accessibility of medications to underprivileged and vulnerable populations in India as well as throughout the world. Instead of concentrating on traditional supply chain systems, which mostly involve the purchase and distribution of pharmaceuticals through government-run Medical Corporations or centralized procurement organizations like the Central Medical Services Society, the emphasis is on creative models and practices.

While efficient supply chain management seeks to improve the accessibility and availability of medications, in order to meet the needs of the population and broaden the available options, a customized set of interventions that take into account the geographic difficulties, epidemiological profile, and socioeconomic capabilities of the population is unavoidable. Also it enable readers to understand the most effective models that could be suited to specific contexts, identify efficient models to reach the last mile and help policymakers make informed decisions on sustainable models that can be adapted to scale and integrated into the existing models. (4)

NEED FOR THE STUDY: Studying supply chain management in primary healthcare settings is critical for improving access to healthcare services, enhancing patient care and outcomes, optimizing resource allocation, ensuring continuity of care, supporting public health initiatives, promoting health equity, and responding to emerging challenges and trends in healthcare delivery. By addressing these needs, stakeholders can strengthen PHC systems and improve health outcomes for individuals and communities worldwide.

RESEARCH GAP:The potential research gaps in PHC supply chain management efficiency is Integration of technology, Contextual factors and local adaption, Patient Centered Approaches, Resilience and Emergency Preparedness and Measurement and Evaluation Metrics. Addressing these research gaps requires interdisciplinary collaboration, methodological innovation, and partnerships between researchers, policymakers, practitioners, and communities to generate evidence-based insights and inform policy and practice in PHC supply chain management efficiency.

STATEMENT OF THE PROBLEM:The statement of the problem in primary healthcare (PHC) supply chain efficiency is typically revolves around identifying specific challenges or issues that hinder the effective management and delivery of essential medicines, vaccines, and medical supplies to primary healthcare facilities.

OBJECTIVES:

1. To assess the current Supply Chain process in Essential Medicines.
2. To identify the bottlenecks and Inefficiencies in Accessibility and Quality Care.
3. To Evaluate the Resource Utilization and Allocation in Primary Health Care Centre.

III RESEARCH METHODOLOGY:

The study was conducted among four main zones of Bengaluru i.e. North, South, East, and West. According to data available from the most recent census, Bangalore's population density has increased by 47% in the last ten years as people have been drawn to India's Silicon Valley by job opportunities and economic growth. 16% of the state's population currently resides in the urban area, which has grown three times faster than the state overall. "Bangalore is home to one in six people in Karnataka." The current estimate for Bangalore's population in 2024 is 14,008,262.

Since Bangalore is one of the most populous cities in India, a pilot study was carried out in the main zones of Bengaluru using cluster sampling techniques to determine the supply chain efficiency in the state PHC of the Bengaluru urban district. In 2023, the estimated population of Bengaluru's urban area was 13,608,000 million. There are 42 state PHC in Bengaluru urban area, other than BBMP and Namma Clinic which is recently established in 2023, however, the study focused on five PHC in each zone, for a total of 20 PHC is considered in the study.

The study's primary data collection method involved conducting in-person interviews with medical officers, pharmacists, patients, local medical shops, warehouse managers, procurement offices, and manufacturing units, using a semi-structured questionnaire. The PHC level supply is the main focus of this investigation.

In this study it is more focused with PHC level supply chain efficiency and Patients feedback mechanisms for following 7 factors:

PHC LEVEL



PATIENT FEEDBACK



By regularly monitoring and analysing the above factors, healthcare organizations can identify areas for improvement and implement strategies to enhance supply chain efficiency in primary healthcare settings.

IV FINDINGS:

Inventory Management: In all the Primary Healthcare Centers optimal level of essential medicines are not maintained and timely replenishment based on consumption patterns is not seen, but due to unavoidable reason there is a overstocking of essential medicines than required found in 80% (16) PHC’s of all zones of Bengaluru region.

Ordering and Procurement: Procurement of Essential Medicine is done by Medical Officer and Pharmacist at PHC level based on requirement by annual indenting of medicine, as discussed in Therapeutic committee meeting which is held once in a year. Every month for indenting they will make use of Aushadha software which is user friendly in nature, it even tracks expiry nearing drug list, consumption pattern of drugs every month and prioritize first-in-first-out (FIFO) practices in PHC level.

Storage Conditions: It ensures in the study that 55% (11) of PHC’s storage facilities adhere to proper conditions, including temperature and humidity control is well maintained. This helps to prevent the degradation of medicines and ensures their efficacy.

Distribution System: When assessed the distribution system from the central storage to point of use it is delayed by 15 days and not having proper vehicle facility to supply the drugs from district warehouse to Primary Healthcare Centres, the Pharmacist of the PHC as to manage the centre by procuring the drugs by using his own vehicle and no monitoring and evaluation in the system to ensure the delay, Sometimes from the warehouse the drugs are supplied more than intended to the PHC level, stating the reason that there is no space in the warehouse to store the medicine which is earlier intended are being supplied now.

Data Management: Data Management System of monitoring check list of stock levels, consumption patterns and expiration dates of Essential Medicines of all PHC's, can be commonly made visible in the Aushadha software portal by depicting in Graphs and Diagrams on weekly basis.

Supply Chain Visibility: There is no visibility across the entire supply chain to track the movement of medicines from suppliers to end-users.

Training and Education: Training programs for staff involved in managing the supply chain in Aushadha software is seen in all PHC.

Quality Assurance: Overall Monitoring of Storage conditions with regular inspection is not seen and few medicines which is used by children like Vitamin A are not added with good flavour and sweetener to mask the bitter taste and children rejects to consume, the purpose of supplementing the Vitamin A is not serving, this major issue of getting wastage in medicine should be taken care.

Lead time: Ordering of monthly Essential medicines and medicines received by the PHC level is not matching and there is timely delay in arrival of medicines by 15days.

Cost-effectiveness: Overall Essential Medicine managing and maintaining the Supply Chain at the PHC Level is not sufficient in 90% of the PHC's.

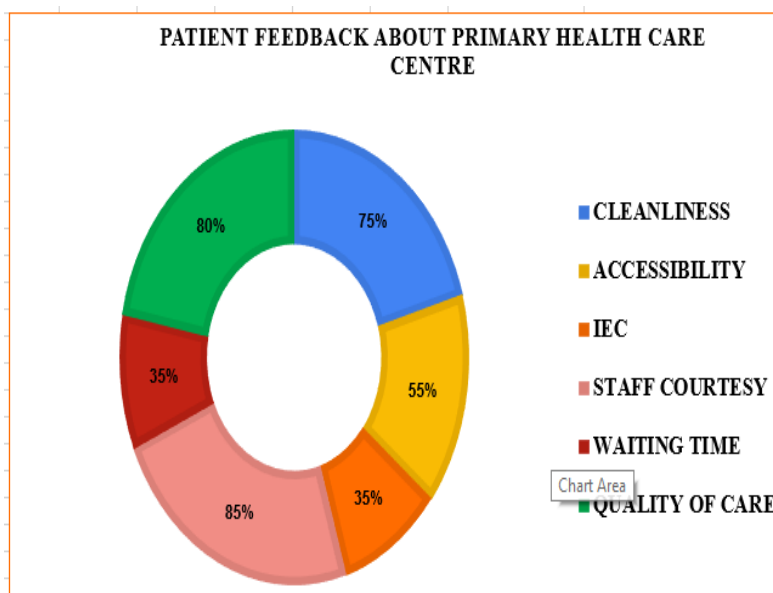


Patient Feed Back Mechanism:

Cleanliness and Comfort: In 15 (75%) of the PHC's it is well maintained with respect to Cleanliness and Comfort inside the PHC as per the PHC's standard it is been build.

Accessibility: Only 11 (55%) of the PHC's are approachable at the time of emergency care, as it is interior of the city area and bus convenience is good, remaining PHC's are exterior part of the city area and not reachable due to less convenience of bus and it is not utilized by maximum of the public.

Communication Information and Education: In all PHC's of Bengaluru urban district region, availability of colour printer in the PHC level is not seen and IEC program cannot be made more effective and reachable to common people in the community, this fails the program implementation at the base level.



Staff Courtesy:In all PHC's the staff courtesy is good and people in the community were happy with the treatment they are getting.

Waiting Time:The average waiting time in the PHC's which is considered in the study indicates 30 to 45 minutes and the people who visits 90% are all BPL card holders. In a year they visit 6 to 7 times for regular and periodic seasonal health issues.

Quality of Care:All Patients who visits are happy with quality treatment care given at the PHC's Level for prevention aspects of disease and act as a referral unit. The only drawback is few essential medicines drugs are not available timely and it is their out of pocket expenditure, to avail from nearby Jana Aushadhalaya.

V SUGGESTION: For Proper Inventory Management, there should be region wise Monitoring system in place, so that overstocking of Essential Medicine which is closer in expiry dates by delay in supplying can be avoided.

The need for improvement in Aushadha software is currently required, relating to the feasibility of transmission of essential medicines which is nearing to 6 months expired date for region where is necessarily needed, within Bengaluru region. This indication can be displayed in the Aushadha Software Portal. So that it can be seen by other PHC's in the portal and Intra level request can be made to the PHC's, this can reduce wastage and proper utilisation of medicines.

For proper maintenance of Essential Medicines, there should be good power backup supply and Expansion in Storage space which is currently need to be focused, as the Non Communicable Disease (NCD) are increasing and price of the medicines are high, it is out of pocket expenditure for the public. So the real time data can aid in making informed decisions about restocking and managing inventory within the PHC level itself, so that delay in time for goods arrival can be managed well.

Innovative Health Management Information System (HMIS) portal can be introduced in the PHC level, so that Individual patient who are regularly visiting can be tracked easily and treated according to their health issues and prevention aspects of controlling the disease can be well managed in reducing NCD's. Colour Printer should be made available, so that the IEC material can be effectively communicated in prevention and promotion aspects.

Average waiting time can be reduced by introducing treatment/day wise time interval schedule for visiting public to PHC. Research & Development plays a major role for improvement and betterment of medicines at PHC level.

The PHC wise Specialist doctors can be recruited, so that it attracts all income level people to PHC's and State health can be protected for good health status of people and future economic development.

VI CONCLUSION:

According to WHO estimates, 80 percent of people on the planet reside in nations with either no or very limited access to necessary medications for treating moderate to severe pain (WHO, 2017). Evidence from medicine supply chain models and systems in India and around the world shows that supply chain inefficiencies can directly affect patient safety and health outcomes. Even though the various models seem disjointed or only apply to a particular nation, they offer insights for developing nations like India that differ in terms of their geographical features and state-level health systems.

Certainly, it doesn't appear that Health for all everyone, everywhere approach will improve India's supply chain management and acquisition of medications. Rather, to guarantee a steady and dependable supply of vital medications and health supplies, it must be adjusted to the unique requirements of the populace.

As observed in the study at PHC level Storage conditions, distribution system, Lead time, cost effectiveness, accessibility, IEC and waiting time are below 60%, In Ordering and procurement, data management, quality assurance, inventory management, cleanliness are between 60 to below 80% range, The supply efficiency of 80 to 90% is found only in Training and education, staff courtesy and quality care.

In order to ensure that medications and medical supplies are delivered in a timely and effective manner, it is crucial to learn from the current supply chain system about how various innovations and pilots can be tailored to the needs of the nation or state.

This paper offers insights from a range of practices that can be applied independently or integrated into the current supply chain systems. It is not enough to have an advanced online system for monitoring. In order to ensure that health professionals feel involved and take greater ownership in providing services to the population they serve, an effective supply chain must also be guided by incorporating stakeholder perspectives from the very beginning, as strategic alliances can assist in strengthening the capacities of medical officers, pharmacists, and drug warehouse managers by providing technical support on effective supply chain management techniques. Investigation into cutting-edge technologies like block chain and radio-frequency identification is warranted.

There are several advantages to the healthcare industry's supply chain digitization, including potential cost savings. A digital health supply chain increases decision-making capabilities and streamlines workflows by automating tasks. The supply chain staff will have an easier time doing their jobs because technology-based operations and solutions will make them more efficient. When making decisions, integrated digital health system can assist in creating a system that helps to remove any manual labour and obtain information in real time.

LIMITATIONS: Study is limited to only Bengaluru Urban District State PHC's.

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