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Review article

Pivotal role of pharmacist in supply chain management

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ABSTRACT

Supply chain management is incredibly fantastic and requisite aspect which has been very much understated in third world countries. Pharmacists can play a vital role with immense vitality and other intellectual elucidation in supply chain management. The logisticians and supply chain specialists keep an eye on the better track and improved record of society's health statistics. Giving an overview of how the pharmaceutical supply chain algorithm works directly at the usefulness and performance management of vital players required to achieve entire healthcare perspectives. The supply chain management has introduced many new challenges and opportunities that may lead to align the essential changes in the current system for positive outcome and overall improvement in the services and patient wellbeing.

Keywords: Supply chain management, Pharmaceutical industries, Healthcare sector, Quality drugs.

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INTRODUCTION

Supply chain management (SCM) is characterized as alignment of the main business system across the organization with the goal of generating value for stakeholders and customers ^[1]. SCM works through by sharing information and miscellaneous practical evidences in a flawless manner and by using various imperative and advanced technological programs like QR (Quick response), CRP (Continuous replenishment process) and JIT (just-in-time)^[2]. Wong and Boon-lit (2008) defined it as internal and external in a cooperative manner ^[3]. According to some experts, supply chain model is not a fixed system. It is a complicated, continuously growing system that requires maintenance throughout different cycles and includes group of players who work together in order to turn raw material and components into finished products, which are well needed for customers [4-5]. Cohen and Lee (1988) described SCM as a modelling chain composed of vendors, plants, distribution centers, warehouses, and customer areas ^[6].

Pharmaceutical supply chain

The pharmaceutical industry's competitive environment has changed as a result of shorter patent life spans, generic competition etc. Henceforth, pharmaceutical supply chain is considered very crucial that optimizes from manufacturing stages at 1° (primary) and 2° (secondary) sites to product delivery to markets. Supply chain management is noteworthy strength of the Indian pharmaceuticals and other healthcare departments ^[7]. Following the launch of a drug, a new set of objectives and constraints takes precedence. Multiple government agencies, distributors of drugs, hospitals, clinics, drug manufacturer, chain of pharmacies, retailers, research organizations, and the research and development segments are primary players in this supply chains (Figure 1). Supply chains are also in charge of distributing Over-the-counter (OTC) drugs and prescription drugs, generic drugs and biological manufactured goods as well ^[5].

SCM is extremely important and essential in today's society. SCM will ensure human survival by recovering healthcare, protecting people from unfavorable environment and sustaining life. Vital evidences and robust information system also play the key role in SCM. Information such as scheduling, shipment, or manufacturing of the pharmaceutical product to the supply chain can be helpful in the reduction of the cost. Sharing of information with hospitals, wholesalers can obtain precise and existing inventory status and drug usage volume to forecast the demand to make it more accurate, enabling the needed product to supply on time and to make it cost effective. In contrast, for the pharmaceutical manufacturer, it is a link between manufacturer and patients; they work to avoid medicine shortage in the market, to wholesalers and clinics, the on-time availability of medicines for which product integrity is ultimately assured.

For patients, it means the availability of medicines when and where they required as per prescription in correct condition and quality. It also means the disposal of unused or unwanted medicines. For the environment, it means that unused medicines are collected and destroyed in an environmentally approach ^[8].





Significance of supply chain management

Indian pharmaceuticals are improving and increasing their businesses overseas. Many factors such as quality aspects, interruptions tend to shorten the life cycle of product and henceforth, shipment dates have been shortened and quick delivery of products to customers take place. SCM model have a propensity to maintain the flow of product and avoid any delay and interruptions during each phase. Sometimes, companies have to collaborate together under some circumstances where SCM take opportunity and handle the sharing of information on different levels ^[6].

One of the main reasons to adopt SCM could be to centralize the structure of the company. As competition between companies is tangible factor to play hence, SCM model could be beneficial to participate in the streets of competition. SCM model can be the connection between citizens and companies and produce favorable environment for work ^[6]. Moreover, it offers certain benefits like, customers response time with fast delivery rate, low cost due to increased efficiency, better forecasting precision, reduced lead time and inventory ^[5].

Describing the supply chain Global supply chain management

The national policies and public sector pharmaceutical supply system continuously work to fulfill the need for medications, promote the use of qualified medicines, and ensure the quality, safety, and efficacy of medicines. Many programs and strategies are working with the supply chain to meet their goals with the involvement of the pharmaceutical management cycle ^[9]. The supply chain ensures the appropriate quantity of quality medicines in the accurate time frame for specific countries and market. International borders and their organizations have their significant role in global health and worldwide marketing ^[10]. During any national disaster, health crisis and pandemic, the major pharmaceutical companies play enormous role by increasing production rate and fulfill general requirements and furthermore manufacturing sites put high demands on their supply chains ^[11].

Maturity phases of supply chain

The maturity supply of chain gives some interesting idea about the economic soundness of particular country. The supply chain can be either private or public. The maturity of supply chain can be considered in four phases to describe capacity in the public health context (Figure 2) ^[9].

Ad hoc (phase 1)

This phase includes unstructured practices and processes. The demand and supply is not detectable. The private sector often works without rules and regulations and considered to be circulated as small portion of the population with reasonable cost.

Organized (phase 2)

In this, public sector processes are known to be logistic function and supply and demand information can be modified by considering ordering cycle. The product use and quality decided by logistics management without rule and regulations.

Integrated (phase 3)

This includes strategies to improve customer's services and satisfaction as guided by Ministry of Health. Under rules and regulations, medicines are included in the stand-alone system. Moreover, private sector works on areas to increase population so that they can afford total cost of medicines.

Extended (phase 4)

In this public sector works through institutionalized coordination

between the distribution systems and the supplies. The operating trust among different departments known to be as essential criterion for private sector supply chain in high-income countries. By covering demand and visibility, it leads to optimal performance and electronic data exchange reflects the supply chain objectives.

Figure 2: Various phases of supply chain management

Ad hoc			
(Phase 1)	(PBABiz 20	I (MAR BEER OF	Extended
Work without rules and regulation.			(Phase 4)
Includes unstructured practices and processes. Explored as small portion of population.	Work without rules and regulation. Processes known to be as logistic function. Logistic management decides product use and quality.	Work under rules and regulation. Use novel strategical approach to increase customer service and satisfaction. The work on area to increase population.	It works through institutionalized coordination. Operationing trust among different departments considered as essential criterian for private sector. Optimal performance gained by demand

Current status of pharmaceutical supply chain

According to India's Associated Chambers of Commerce (ASSOCHAM), the Indian pharmaceutical industry grows by \$55 billion by 2020. Indian pharmaceutical companies recognize challenges from other multinational companies across the globe. They have their place in the competition and also Indian pharmaceutical companies taking steps to maintain the supply chain and increase their production ^[12]. Indian pharmaceuticals face one of the critical challenges in cost reduction and drug wastage, manufacturing generic drugs, and continuously working on varied aspects to overcome the issues. Supply chain is one of the considerations to overcome challenging situations in pharmaceutical sectors. India's generic drugs market continues to grow, Indian drug exports now account 20% of the global generic drug exports, up from 22% in the previous decade. India is projected to capture between 10% and 12% of the 350 dollars billion global generics market by 2020.

Crucial factors affecting supply chain in health sector

There are several crucial factors which affecting supply

chain in health sectors are presented in (Figure 3).



Universal Health Care and Development Processes lack of resources as major factor reduces the chances to meet the goals and due to lack of medicines developing countries are facing problems during pandemic which affect countries economy. Moreover, high income countries help low income countries by overcoming the demand of medicines and hence developing health system to achieve universal health coverage ^[10].

Medicine availability the pharmacist plays major role by maintaining equilibrium between optimal uses of medicines with market needs and also provides right medicine at right time. Overall, pharmacist manages manufacturing, wholesaling and dispensing of medicines and increases patient health care system under supply chain management.

Medicine shortages somehow high demand of medicines produces

shortage or "stock out" situation under supply chain management. The shortage can be due to manufacturing problems or supply chains, and additional factors include environment and storage.

Product storage various biological products require special storage condition for their stability and shelf life like blood, sera and vaccine. If environment is not suitable then its stability gets decreases and might be dangerous. The cold chain should ensure that the perishable goods are healthy and of good quality during consumption.

Supply chain security due to the rise of demand in the pharmaceutical products market, fraud is also making its place by forming substandard and counterfeit medicines. For such type of medicines, European Union implement end to end verification techniques at every level of the supply chain till they supply to the public ^[13].

Working criteria of pharmaceutical supply chain

Pharmaceutical supply chain working criteria is divided into five steps (Figure 4) ^[14].

Figure 4: Steps of pharmaceutical supply chain



Performance indicators

We identified three main performance indicators that organizations use to gauge their overall supply chain health and readiness for growth as to assess the state of the industry.

Customer service

The pharmaceutical companies should confirm the availability of the production or medicine at every level of the supply chain. Quality and quantity are the paramount necessity of any pharmaceutical product ^[15].

Inventory levels

Due to fragmentation, we have a large number of stocking locations. India can provide a proficient distribution network through

collaboration aspects. Pharmaceutical companies are willing to maintain higher stocks levels. They have to maintain sophisticated preparation scheme along with long manufacturing lead time and permission from regulatory agencies.

Supply chain costs

Cost varies with the type of product. The cost could decrease or increase as per requirement, such as during vaccine programs, cost increase due to cold chain requirements.

Current scenario, challenges and issues

Every business has its difficulties, and the pharmaceutical supply chain in India is no exception. The industry is multi-layered, and the outbound supply chain is extremely complex, involving numerous stakeholders such as C&F, CSA, dealers, and distributors. Trade distributors, hospital stockiest, generic pharmaceutical distributors, medical equipment suppliers, and consignment agents are only a few examples of distributors. The problems don't stop here. There are over 300,000 brands available, with 300 new brands being introduced every month. Incentives are focused on primary or secondary sales, rather than actual demand ^[16]. The pharmaceutical industry has been slow to embrace change, depending on supply chain and manufacturing paradigms that have existed for decades but not for much longer. Due to the fact, that technology and digitalization have disrupted every industry ^[17]. There are mainly six categories as challenge in pharmaceutical supply chain (Figure 5).





Strategic Issues Pharmaceutical supply chain runs through some strategic problems such as counterfeiting, unfavorable effects, issues with raw material such as poorly processed raw material, or the material having high impurities and incorrect labeling, manufacturing problems such as inappropriate input of raw material, cross contamination, false labeling etc ^[18-19].

Global Health Supply Issues Important global heath supplies

related issues include lack of coordination, control of inventory, absent market detail, shortage of stuff, warehouse management, management of temperature and transportation ^[20].

Quality and Regulatory Issues Quality is the most significant and essential factor considered across global regulatory agencies. The export area comes into lime line due to plant shutdowns; an import bans critical observations across the value chain, which dramatically

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affects companies' revenue and credibility. Central Drugs Standard Control Organization (CDSCO) playing essential role by forming inspection agencies to address the issue of low-quality drugs ^[12].

Product Proliferation Change of dosages forms, changes on the packaging, labeling etc. leads to proliferation of the product ^[17].

Supply Chain Fragmentation Indian pharmaceutical supply network is very concerned about product quality and safety but sometimes, lack of integration among players at each level impact the visibility and traceability of the product.

Infrastructure Gaps Gaps become a vital factor in the pharmaceuticals supply chain, including transportation, storage, and

power supply. The lack of a robust cold chain network in storage can add a significant gap in today's pharmaceuticals infrastructure. Vaccines and other unique products should be kept according to their favorable condition to maintain their safety and potential throughout their shelf life. However, the current infrastructure is unable to do so and thus unable to meet requirements.

Role of vital players

The vital players include manufacturer, wholesaler and distributors, pharmacies and PBMs (Pharmacy benefits managers) run pharmaceutical supply chain network very effectively and smoothly (Figure 6) ^[14].



Figure 6: Vital players of pharmaceutical supply chain

Manufacturer

Pharmaceutical manufacturer from production to the wholesalers or may be directly to pharmacy chain or hospital pharmacy or specialist pharmacy manage the products distribution. Manufacturer widely makes the availability of pharmaceutical products to the wholesaler's distributors as they distribute product even directly to government purchaser, including any vaccine programs. Rare cases are found where delivery of the product is made directly to the patients or a self-insured employer.

Prescription drug manufacturers are playing a vital role in prescription drug pricing. They produce the wholesale acquisition cost (WAC) by analyzing demand, future growth and marketing costs. WAC is the 'price list' of any branded drug without discount ^[2]. It is said to be the baseline price for the wholesaler to purchase the prescribed medicines. Manufacturers can have their interest to give the discounts that are based on share market and other factors. Wholesalers have to pay a distribution services fee in exchange of the services including data processing, finance management etc.

Wholesaler & distributors

The wholesaler is playing their role by making purchasing products from manufacturer more efficient. Manufacturers provide their bulk of pharmaceutical drug products to a few numbers of wholesaler's warehouses versus shipping of thousands of pharmacies ^[21]. Wholesale are widely available for a number of specialized services such as pharmaceutical repackaging, drug product buyback programs, electronic order services and specialty drug distribution etc.

Pharmacies

It includes food or big box stores with pharmacies, independent and chain pharmacies. Some pharmacies are impressive and provide better cost drug products. Online pharmacies and internet/mail-order pharmacies have been developed in the last few years by reason of mandated use by major PBMs. Pharmacies took over 75% of the prescription drug market; the rest, 25%, comprised non-retail provider's viz. hospitals, several Health management organizations, clinics and nursing homes etc. Pharmacies act as an inter link between manufacturer, PBMs, wholesalers, pharmacies facilities, consumer billings and payments. Pharmacies have a large stock of drugs and pharmaceutical products to fulfill the need for medicaments during demand; therefore, manufacturer competes to sell drugs to pharmacies. Generally, pharmacies purchase drugs from a wholesaler at contracted money off the WAC. The rate difference occurs due to size and demand.

Pharmacist and supply chain

Pharmacists play an essential role on both sides of the supply chain. Firstly, he has to choose medicines for the benefit of patients and secondly to provide and dispense the medicines to the patients and giving them informative knowledge about the usage of the medicines [9].

Pharmacists worldwide give their contributions to the supply chain and have the right to make changes where anything deviates from standard procedure. These are the front-line committee to hear and solve problems with medications, making pharmacists more trustworthy and also the connection between manufacturing companies and patients. Pharmacist communicates with patients, knows their problem, and reports to other authorities for solutions.^[22] As pharmacist can directly connect with patients and solve their problems and can ask backup capability from any pharmacy company if they have some problem with medication production, such as if a production company suffers a shortage of medication during a natural disaster, pharmacists can assess information on drug and FDA's recall and they should verify letters or inspection records of any manufacturer before purchasing as per safety [23] and interact with companies and have a conversation regarding drugs manufacturing, their modifications, and substitution to increase their therapeutic window. After modification or substitution, pharmacists should contact patients to assess if the patient is doing good or not, i.e., about their situation after administration. This conversation should continue if the patient is changing brand or follows generic medicines after brand medicines to know the results and review. Pharmaceutical supply chain role is increasing in every country due to its beneficial guidelines, which provides information regarding good storage and distribution.

Pharmaceutical supply chain is the better and most exciting part of the health care system. The supply chain plays essential role from the drug manufacturer till being dispensed to patients. The pharmaceutical supply chain ensures the security and integrity of the product throughout the process. Even a single mistake at any step could lead to the dangerous state of the drug; hence remain unused or lethal, which means that all the cost and essential APIs has been wasted.

Pharmacist benefits managers

PBMs provide an entity favoring the improvement of costsaving, expediency and security for employers, consumers, Government programs and union.^[14] PBMs continuously growing as an organization that provides services such as developing formulation strategies, claims processing and adjudication, manufacturer rebate negotiation, reporting, disease management, determine therapeutic and generic substitution, developing pharmacy network, developing quality focused programs and consultative services viz. helping clients, providing online pharmacies and record management.

Why pharmaceutical supply chain is projected to change? It involves five significant factors

• New project type with a shorter shelf-life dictates the need for better and multifaceted manufacturing and distribution

processes. It is also an initiative for the expansion of various supply chains ^[21].

- Greater public scrutiny leads to risk management and risk assessment capability requirement across the pharmaceutical supply chain due to increased regulations and incidences.
- Novel way of healthcare delivery is generating boundaries among acute and primary care owing to affordable care act and patient protection.
- Raised emphasis on patient outcomes. Pharmaceutical companies should also interact with payers, providers, and patients and IT companies. They also have their focal point over health care management employing state-of-the-art-technologies. Pharmaceutical supply chains are continuously working to conserve cost in a wonderful manner. As to preserve gross margins at every phase of product alteration needs to focus on producing a lean and flexible structure of cost.
- Live licensing is required to modify the dynamics of the pharmaceutical industry and changes clinical phases into controlled and separate launches. This may also enhance the process of research of market, early assets expansion and other factors. As the adaptability of live licensing increases, it can increase and decrease fast which is affecting the pharmaceutical supply chain.

FUTURE PROSPECTS

As pharmaceutical industries growing continuously which offers promising technologies and talented pharmacist may find themselves as trusted medical professionals for fostering sustainability and development. In last few years, pharmacy forecast report provided different trends and phenomena which affected pharmacy practice and patient health care system. The health system pharmacists are the key professionals which determine the value of the pertinent report. Patient health care system always has been an issue and attracted great visibility and attention. Therefore, development of new communication technology and advancement in pharmacist's scope provides better extension of pharmacy services based on population needs. Greater public scrutiny has been developed to risk management and assessment capability requirement under supply chain management. New potential approaches for assessing, approving and monitoring of therapeutic interventions have emerged in order to increase patient health care system.^[24-25] The supply chains for pharmaceuticals and medical devices design, production, distribution, as well as those delivering healthcare services, will be integrated so that all stakeholders can see the big picture and plan ahead more efficiently. Supply chain management is evolving utilizing well organized new strategies and it eventually enables suppliers to work more effectively and efficiently across the

board and improvements are being made in response to recent developments in SCM in several respects ^[26-29].

CONCLUSION

Let us move into a new phase of sustainable development goals and universal health coverage. It is worth noticing that onethird of the world's population still lacks access to life-saving medicines. Sophisticated advanced research should be focused to ensure an efficient and secure seamless supply chain which will encourage a position for pharmacologist in the global context of problems such as substandard and falsified drugs and shortage of human capital in the health sector. In this literature, information and encouraging findings provided a global overview of the pharmacist's impressive position in the pharmaceutical supply chain. Given the complexity and length of the pharmaceutical supply chain, which necessitates the expertise of various disciplines with varying ability levels, it is unsurprising that the position of the pharmacist varies across the world; even if the model can differ and provide highquality services. Pharmacists and other people involved in the supply, safety and distribution of medicines must consider how to best use the expertise of the personal hand, provided obtain training as appropriate, and keep their systems and jobs description under review to respond to changing circumstances.

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