



This Working Paper has been written by Dr Pratheeba John, Associate Director – Health Financing, HSTP and Ms Sakshi Khemani, Research Associate – Health Financing & Planning, HSTP.

### **Contact**

In case of any queries or suggestions contact Dr Pratheeba John at [prathebaj@hstp.org.in](mailto:prathebaj@hstp.org.in)

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# **Best Practices in Procurement and Supply Chain Management Systems for Medicines**

## **Abstract**

*This paper aims to understand the different procurement and supply chain models that have demonstrated improved availability of medicines to the poor and vulnerable communities across the globe and in India. The focus is on innovative models and practices over the conventional supply chain systems that primarily include procurement and supply of medicines through state-run Medical Corporations or centralized procurement agencies like the Central Medical Services Society. While well-functioning and effective supply chain management aims to increase the availability and access to medicines, a tailored set of interventions that factor in the population's geographical challenges, epidemiological profile, and socioeconomic capabilities is inevitable to meet their needs and expand the state's service delivery capacity. This paper will 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. The lessons for India from this review are also discussed.*

## **1. Introduction**

Access to essential medicines is a major determinant of health outcomes as it plays a crucial role in preventing and treating diseases and keeps chronic conditions such as diabetes and hypertension under control. This in turn would reduce disabilities in the population, contribute to productivity, and eventually move towards economic growth of countries. In developing countries like India, where the income levels are low for the poor and vulnerable, economic constraints related to the ability to afford medicines constitute a major reason for out-of-pocket expenditures (OOPE). According to the National Health Accounts Estimates for India 2019-20, the total pharmaceutical expenditure is 35.1% of current health expenditure, including prescribed medicines, over-the-counter drugs, and those provided during inpatient, outpatient, or any other events involving contact with healthcare providers.

The Indian pharmaceutical industry is currently ranked third in pharmaceutical production by volume thereby evolving into a thriving industry growing at a Compound Annual Growth Rate of 9.43 per cent for the past nine years. It supplies over 50 per cent of the global demand for various vaccines, 40 per cent of the generic demand in the United States of America and 25 per cent of all medicines in the United Kingdom (IBEF Website). Based on these statistics, it can be presumed that the availability of medicines, price constraints and imports should not be issues of concern for the country.

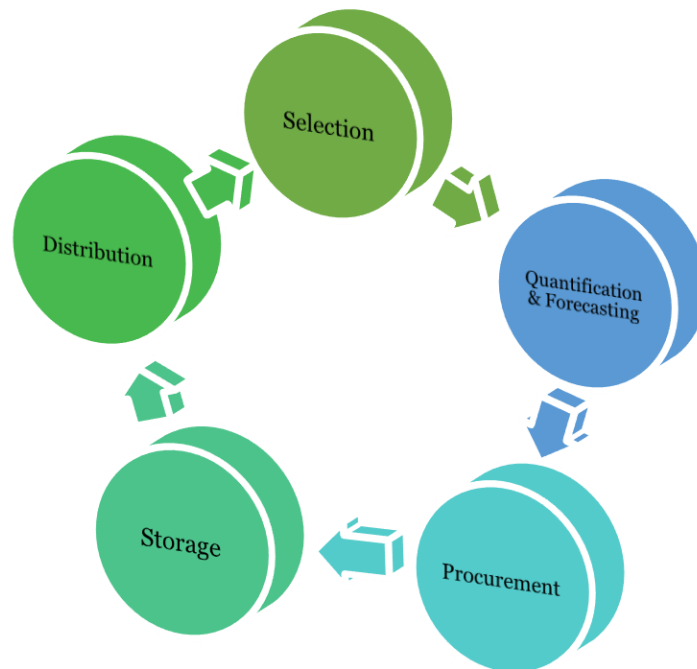
The WHO estimates that up to 90 per cent of the population in low- and middle-income countries purchase medicines through out-of-pocket payments. Medicines account for 20 to 60 per cent of health spending in low- and middle-income countries, compared with 18 per cent in the Organization for Economic Co-operation and Development (OECD) countries. (WHO, 2017). Lack of access to medicines remains one of the leading causes of poor health outcomes and affects the ability of countries to attain their Sustainable Development Goals.

While the causes for the non-availability of medicines are varied and complex, the lack of medicines in the public health system is due to inefficiencies arising from inadequate human resources, poor access to services, lack of monitoring mechanisms and accountability, an agile IT system for supply chain management and a lack of public funding. Capacities of in-country supply chains to forecast, procure, and deliver essential medicines and other health supplies add to the woes. Therefore, ensuring well-functioning public sector medical commodities supply systems are critical to effectively deliver health services and realize primary healthcare goals.

## 2. Requisites of an Efficient Supply Chain Management System for Medicines

The supply chain management system for medicines involves different stages and stakeholders within the healthcare system to ensure that the right medicines reach the right patients at the right time. An efficient supply chain management system depends upon transparency in the choice and quantity of medicines, the procurement process, quality control procedures, storage, and distribution mechanisms. Inefficiency in any one of these areas can lead to sub-optimal performance of the system, resulting in frequent stock-outs and shortages of essential drugs.

### Stages in the Supply Chain



The different stages in the supply chain for medicines are briefly outlined below.

#### **Selection –**

Selection involves identifying and choosing the most appropriate medicines to procure and make available to the public. The epidemiological profile, prescription practices, consumption patterns and region-specific seasonal requirements are key factors that drive the selection of medicines. Effective selection processes help to ensure that the medicines procured are safe, effective, and of good quality. This also includes thoroughly reviewing available medicines, including their clinical effectiveness, safety profiles and cost-effectiveness. By identifying suppliers that can provide high-quality medicines at a competitive price, selection processes can help to reduce overall procurement costs.

#### **Quantification and Forecasting -**

Quantification and forecasting are crucial in procurement cycles for the availability of medicines at public facilities as per their needs. It also helps in ensuring the right quantities of medicines are procured, reduces stockouts, minimizes wastage, optimizes procurement costs, and promotes the rational use of medicines. This is generally indexed on the prevalence and incidence of the diseases and past consumption data.

## **Procurement –**

Effective procurement processes can help optimize resource use, including financial and human resources. Identifying opportunities for bulk purchasing, negotiating better prices with suppliers including volume discounts, and reducing administrative costs, can help to reduce overall procurement costs, thereby ensuring the availability of medicines at public facilities. Procurement processes should be designed to prioritize quality assurance and quality control measures, which include strict adherence to good manufacturing practices (GMP) and testing of drugs for quality control before procurement. Procurement processes should be transparent by instituting checks and balances throughout the procurement process. This includes pre-qualification of suppliers including inspection of factories to ensure that they are GMP compliant, regular audits, and monitoring of procurement activities.

## **Storage –**

Storage is a critical component of the procurement cycle. Proper storage conditions help maintain the quality, efficacy, and safety of medicines, prevent wastage, and promote efficient use of resources. By optimizing storage space and ensuring that medicines are organized and easily accessible, storage can help to reduce costs associated with overstocking or understocking medicines, prevent expiry, save the pharmacists' or medical officers' time, and make them more efficient in serving the patients.

## **Distribution –**

Effective distribution processes help to ensure that medicines are delivered to the right locations, in the right quantities and at the right time ensuring equitable access to medicines. A carefully designed distribution network will ensure that medicines are distributed to public health facilities across geographic locations and population groups more specifically to reach marginalized or underserved communities most in need.

### **3. Global Supply Chain Models for Medicines**

Given the significance of different components within the supply chain for ensuring the availability of essential medicines, understanding unique global supply chain models can recognize opportunities to optimize the supply chain and improve access to medicines, particularly in underserved regions. It would also help identify supply chain barriers and strategies to overcome them. Therefore, examining best practices and innovations across the world could be useful to governments and implementing agencies in India to identify new technologies, processes, and practices for innovative, cost-effective, and scalable supply chain solutions and learn from them.

To support this, a few systems are discussed below: -

#### **Automated Real-Time Tracking System – Ghana**

During the COVID-19 pandemic in Ghana, an electronic logistics management information system – Ghana Integrated Logistics Management Information System (GhiLMIS) was introduced. This LMIS system leveraged the availability of modern innovative technology and information management systems to provide end-to-end visibility and facilitate accessibility to quality supply chain data aimed at driving strategic decision-making across the value chain, connecting more than 1500 medical facilities across the country.

Its key functionalities include procurement, storage, distribution, and reporting. A team from the Ministry of Health supported by a technology partner was set up to develop strategies to address the COVID-19 supply chain needs, identify disruption challenges, and align the supply chain capability outputs with customer needs. Data was critical to determine the items needing

urgent replenishment and understand the consumption trends. It was then triangulated with patient data and infection rates, to make better procurement decisions. Using both pandemic and supply chain data, the team managed to create a balance in distribution and demand.

*Capturing data in real-time, tracking the medical commodities and triangulating data with disease burden leads to evidence-based decision-making and improves procurement and supply chain efficiencies.*

The system enabled health workers to facilitate appropriate planning to ensure a constant supply of life-saving medicines for patients and provide real-time information to managers across all levels to track and monitor the entire supply chain including inventory levels, stock movements and delivery schedules. This system ensured that the health facilities receive the necessary supplies on time and sufficient stock is maintained to meet the demand. It not only captures real-time data on medicine availability in an automated manner but also triangulates with other information sources like patient data and disease burden from facilities to understand the population's needs and thereby enable better informed evidence-based procurement decisions and reduction in logistics transaction cycle time from a week to an hour.

### **Inclusivity in Practice – Sub-Saharan Africa**

A mobile-based logistics management system c-Stock implemented in Malawi, Kenya, Mozambique, and Senegal to improve the availability and distribution of essential medicines and medical supplies in low-resource settings was designed to empower Community Health Workers (CHWs) to participate in the supply chain management process. The system utilizes mobile technology, such as smartphones, to allow CHWs to send real-time data on stock levels and consumption filling a paper form, clicking pictures and sharing them with a centralised database.

This data is then collated at a centralized platform for managing the inventory of medical commodities at the community level. The system also sends automated alerts to CHWs and district officials when stock levels are low, indicating the need for resupply. Based on the data received from CHWs, health facility managers and national health authorities make informed decisions regarding stock replenishment, ensuring a consistent supply of essential health commodities and minimizing wastage.

CHWs receive a message when their commodities are packed for distribution so that they save time and resources by not travelling when products are unavailable. In Malawi, the CHWs who used cStock reported 14% fewer stockouts. Moreover, 56% of CHWs who used cStock required less than 20 minutes to report stockouts. Based on these results, cStock was scaled up by the Ministry of Health in Malawi in 2014. This initiative has been co-designed with marginalized hard-to-reach CHWs and their supervisors. It aims to achieve health equity and improve commodity security and access by increasing data visibility and use through digital reporting (Baatartsogt et al., 2022b).

### **An alternative to government and private drug stores – Kenya**

In Kenya, a Revolving Fund Pharmacy model (RFPM) provides backup supplies of crucial medications if pharmacies in government health facilities run into stockouts. The medical commodities that are sold at facilities under this model are made available at subsidised prices, lower than the price at private pharmacies. Under this model, a central warehouse or supplier purchases essential medicines and medical supplies on a large scale and then distributes them to regional or district-level warehouses. These warehouses then distribute

the supplies to health facilities in their respective regions. The revenue generated from the sales is then used to replenish the stocks at the health facility and, in turn, the district and regional warehouses thereby ensuring continuous availability of essential medicines and eliminating shortages of life-threatening medicines. This creates a self-sustaining cycle where the pharmacy can continuously purchase and distribute essential medicines and medical supplies.

Further, in Kenya under this model, decentralized warehouses were set up in peripheral health facilities. In response to the social distancing directives during the COVID-19 pandemic, staff of the revolving fund pharmacy scheme worked in partnership with the county health authorities to corroborate the types and quantities of medicines and to work out a delivery plan. Before the COVID-19 pandemic, most of the revolving fund pharmacy scheme's medicines were stored in a central pharmacy warehouse. After March 2020, the supply was decentralized by redistributing the central stock of essential medicines for chronic disease management and acute ailments to 11 health facilities throughout Western Kenya (Tran et al., 2021b).

A system was also developed for the direct delivery of medicines to patients who faced problems in reaching the nearby health facilities (such as informal sector labourers, full-time caregivers, or patients with disabilities). Patients who were due for medicine refills were identified using a point-of-care electronic medical record system. A member of the pharmacy staff was expected to call each patient to verify demographic, clinical, and medical information and request the patient to come to a conveniently located medicine drop-off location in the community. People are left with no choice when public facilities run out of medicines but to turn to the private sector which is profit oriented. This model has proven the need for an intermediary service provider between the public and the private providers.

### **Fast-track Delivery Services – Rwanda**

Drones have been used to deliver services for medical supplies and blood products in hard-to-reach areas with poor road infrastructure and limited transportation options, especially in Africa and other parts of the world. These drones are equipped with a Global Positioning System and other sensors that enable them to fly autonomously to their destination, even in adverse weather conditions, and can carry a payload of up to 1.75 kg and travel up to 160 km on a single battery charge. Once the drone arrives at the health facility, it drops the package by parachute, and the medical staff collects it.

Rwandan Government in partnership with a North American robotics company, Zipline have attempted to strengthen the healthcare supply chain and address malnutrition in Rwanda. Drones were used to deliver products such as medicines, medical supplies, and nutritional supplements for humans as well as animals. Zipline has also partnered with several governments and health organizations in Africa, including the United States of America, Rwanda, Ghana, and Nigeria. During the COVID-19 pandemic, these drones were also used to pick up COVID-19 test samples from rural Ghana areas and deliver them to laboratories in urban centres. In the United States, it was tasked with delivering medical supplies and Personal Protective Equipment (PPE) during the COVID-19 pandemic. The Zipline drones have flown around 38,992,366 miles, made 542,963 commercial deliveries, and delivered 4,974,180 products (Zipline Website). There was an 88 per cent reduction in hospital maternal deaths due to postpartum haemorrhage in Kenya owing to this intervention (Out of Africa, 2022b).

Insights from Rwanda’s national blood delivery network and Ghana’s COVID-19 vaccine and PPE distribution revealed that drones have generated a quantifiable impact. Due to the instant delivery network, more than 400 hospitals and clinics in Rwanda have received the required blood and medical commodities within minutes of ordering, thereby enabling them to treat both medical conditions and emergencies daily.

*Innovative technology-driven supply chain solutions like drones can solve logistical issues and fast-track delivery of medical and life-saving commodities to reach last mile in time.*

Although this system of delivering medicines is in its nascent stage and can be costly for a country like India, it would be beneficial to have the option of drones for hard-to-reach areas to fast-track services for life-threatening conditions. It can be noted that a few pilots have been conducted using this technology in India and is discussed in the subsequent section.

### **Limited Liability Partnership Model**

To strengthen global, regional, and in-country supply chains and expand the delivery of public health commodities to people in need, the USAID Deliver Project has provided technical assistance in 65 countries and also provided medicines and health supplies to 114 countries including Africa, Asia, Latin America, the Caribbean, Eastern Europe, and Central Asia. Some of the specific countries where the project is currently being implemented include Afghanistan, Bangladesh, Ethiopia, Ghana, India, Kenya, Nigeria, Pakistan, Peru, and Tanzania. The project purchased and shipped more than 8.5 billion health products, thereby supplying a large portion of developing countries’ contraceptives and malaria prevention and treatment commodities (USAID Deliver Project, 2016, Task Order 4).

In Ethiopia, the project worked with the Ministry of Health to improve the procurement and distribution of health commodities, which led to a significant increase in the availability of essential medicines in health facilities. In Ghana, the project helped to establish a National Logistics Management Information System, which helped improve the efficiency of the country’s supply chain for health commodities and led to a reduction in stockouts of essential medicines (discussed on page 4). In Nigeria, the project helped to establish a National Essential Medicines List and improve the procurement and distribution of essential medicines, which led to an increase in the availability of essential medicines in public health facilities.

In India, the USAID Deliver Project in partnership with the National Health Mission of Haryana, Himachal Pradesh, Jharkhand, and Uttarakhand, has built capacities to strengthen the supply chain systems and the skills of personnel in charge of the supply chain. Senior-level state officials were introduced to an interactive training program on supply chain management fundamentals and its application in their daily operations. These have enabled the participating states to develop standardized inventory control systems.

Country experiences from this project revealed that strategic partnerships with governments with limited capacities helped them enhance the capacities of health personnel in supply chain management. It also facilitated collaborative learning among supply chain management personnel from different countries. The resources and tools developed, the standard operating procedures, guidelines and the knowledge gained helped to ensure that the supply chain management was consistent, effective, and sustainable in the intervention countries.



#### 4. Indian Supply Chain Models

This section outlines a few innovations and pilots carried out across India for strengthening supply chains as well as improving the availability of medicines at public health facilities as a part of certain specific projects or initiatives.

##### **India Hypertension Control Initiative – A partnership model**

India Hypertension Control Initiative (IHCI) was launched in November 2017 as a collaborative effort of the Ministry of Health and Family Welfare, the Indian Council of Medical Research (ICMR), state governments, Resolve to Save Lives, and the World Health Organization – India Office. It focuses on implementing evidence-based interventions to improve hypertension diagnosis, treatment, and follow-up care. This project was expanded in a phased manner to cover more than 130 districts across 23 states in India. Around 3.4 million people with hypertension are undergoing treatment in government health facilities, including the Ayushman Bharat Health and Wellness Centers (Correspondent, H., 2022).

One of the key components of the IHCI is the drug management system, which is designed to ensure that essential hypertension medications are available and accessible to patients at all levels of the health system. This includes measures to improve procurement and distribution systems by working with the governments to strengthen the supply chain for hypertension medicines as well as building capacities for effective drug storage. It also involved developing streamlined procurement processes, establishing a central warehouse for medicines, and improving logistic distribution. IHCI also works closely with the manufacturers to ensure a steady supply of quality medicines at the public health facilities in the intervention areas.

*Every life and every dose of medicine matters...*

The project also promotes the use of evidence-based treatment protocols to ensure that patients receive an adequate quantity of protocol medications. It uses data monitoring and evaluation systems to track drug availability, utilization, and adherence. This allows for real-time adjustments to drug management strategies and interventions.

During COVID-19, patients with comorbidities such as hypertension, diabetes, and heart disease were at increased risk of severe illness. Maintaining the continuity of essential health services for them was of paramount importance (WHO, 2020b). Therefore, IHCI in coordination with the WHO India office, ICMR and Resolve to Save Lives developed a community-level door-to-door drug supply model to ensure that patients get the timely refill of their medicines irrespective of the lockdown. These medicines were procured by the government and distributed by the IHCI. The community-level door-to-door drug distribution initiative was done with the help of frontline health workers such as Mid-Level Health Providers (MLHPs), Auxiliary Nurse Midwives (ANMs), and Accredited Social Health Activists (IHCI Website).

##### **Leveraging Intermediaries**

An effort like the RFPM in Kenya was tried by the Government of Kerala through the Kerala Medical Services Corporation in 2011 known as the **Karunya Community Pharmacies**. The Karunya pharmacies are designed as a market intervention initiative to negotiate procurement directly from the producers through volume and other discounts on the commonly used drugs, branded and branded generics and sell the medicines at a large discount ranging from 10 per cent – 93 per cent from its maximum retail price (KMSCL Website). This is in addition to the generic essential medicines supplied free of cost in government facilities. The Karunya Community Pharmacies also provides drugs for other beneficiary schemes such as PMJAY, various schemes of local governments etc. on payment.

Similarly, the Pradhan Mantri Bhartiya Janaushadhi Pariyojana (PM-BJP), launched in 2008, is a scheme based on a Public Private Partnership model, implemented by the Pharma and Medical Bureau of India (PMBI). The Jan Aushadhi Kendras can be set up by an individual entrepreneur or proprietor, partnership, charitable institute or hospital, NGO, Trust or society, Government or government-nominated agency can open a Pradhan Mantri Janaushadhi Kendra (PM-BJP Website). The objective of the scheme is to provide medicines at affordable prices to the masses through dedicated outlets called ‘Pradhan Mantri Bhartiya Janaushadhi Kendra’. This scheme has more than 9400 Jan Aushadhi Kendras established to provide generic medicines (1800 drugs and 285 surgical items) at significantly lower costs to the population. The procured generic medicines are sold at 50-90 per cent lesser prices as compared to the market prices of branded medicines. The medicines available in these stores are quality checked through empanelled NABL-approved laboratories and are supplied to the Kendras through a distribution network.

### **Fast -Track Delivery Services for Medicines and Medical Commodities**

The ‘Medicines from the Sky’ project was a pilot launched by the Government of Telangana to deliver medicines, vaccines, units of blood, organs for transplantation and lifesaving equipment to remote areas of Telangana through drones, in 2020. The project aimed to assess the reliability of the drone delivery system using payloads of different sizes. It was discovered that drones can cover 6 kilometres in five minutes to reach a Primary Health Center (Javaid, 2021b).

A similar pilot was conducted by the Government of Meghalaya in December 2022 where drones were used to deliver medicines in West Khasi Hills. Using this technology, the delivery time for life-saving drugs was reduced from three hours to 25 minutes covering a distance of 25 kilometres. These drones are believed to potentially improve the lives of 18,50,000 citizens of Meghalaya (Abrar et al., 2021b).

*Drones have the potential to reduce delivery time and improve access to essential medicines in remote and underserved areas.*

The Arunachal Pradesh government also conducted a pilot drone service, from Seppa to Chayang Tajo in the East Kameng district. The Himachal Pradesh government tried drones for delivering medicines and agricultural commodities. Similarly, a pilot to deliver medicines by drone was carried out from the Flipkart Health warehouse in Baruipur, West Bengal, to several Health Buddy over-the-counter sites in Kolkata and its suburbs. Health Buddy is an online and offline pharmacy company acquired by Flipkart. It enables access to affordable genuine medicines and healthcare products, healthcare devices, and wellness products at the doorsteps as well as at designated Health Buddy stores. Around 20 flights were made available each day, delivering a payload of up to 5 kgs of medicines covering 16 kilometres (Times et al., 2022).

### **The Passbook System**

Passbook System is a process of record keeping of drugs with a specific budget that has been allotted to each public health facility based on the number of beds, patient load, and the population it caters to. This system is being adopted by the state governments of Tamil Nadu, Rajasthan, and Uttar Pradesh for the distribution of health commodities.

The passbook is not a financial tool. It works on a notional budget but acts as a record-keeping tool. Each facility is responsible for picking up supplies as per their requirement within the allocated budget. The passbook system ensures that the budget is being spent on drugs that are being consumed. This system provides visibility of drug consumption patterns among

health facilities, facilitates rational budget usage, links high footfall facilities with drug usage, forecasts drug requirements and prevents pilferage due to the double-entry system.

### **Leveraging India Post**

The health system in Odisha, for many years, relied on the services of state-owned vehicles to transport family planning commodities to district warehouses. The Government of Odisha in partnership with the India Post, the world's biggest postal network with more than 155,000 offices across the country transported family planning supplies from a warehouse in Odisha to its depots in five districts in January 2020.

*Leveraging inter-sectoral coordination mechanisms can be cost-effective, expand coverage, and increase timely access to medicines and medical goods.*

The government of Odisha now uses India Post's express parcel services to transport small quantities of commodities like IUDs, injectable contraceptives, and tubal rings. Larger shipments of condoms, emergency contraceptive pills, and pregnancy testing kits are still supplied through state-owned transport designated for the distribution of medical goods (Path Website). This intervention has strengthened the supply chain and distribution network for contraceptives throughout Odisha at lower costs and faster delivery.

### **Drug Logistics Chain**

The Karnataka government continuously faced the challenge of poor visibility of tracking and tracing of medicines across different facilities as most of the supply chain stakeholders maintain their registers and are not accessible at the central level. To overcome this challenge, the Karnataka State Drugs Logistics and Warehousing Society (KSDLWS) with support from the National Informatics Centre and the Digital Health Mission established the Drug Logistic Chain (DLC) for supply chain management system for essential medicines and healthcare products.

DLC is based on Blockchain Technology. The system uses a centralized procurement mechanism to purchase medicines and other healthcare products from approved suppliers. The products are then stored in KSDLWS-managed warehouses across the state, which are equipped with proper storage facilities to ensure the quality and safety of the products. The products are then distributed to healthcare facilities across the state through a well-established distribution network. The distribution network includes district-level warehouses, cold chain facilities and delivery vehicles that are equipped with GPS tracking systems to ensure the timely delivery of the products (Drug Logistics Chain, n.d.-b).

DLC captures the transactions of the supply of medicines from procurement until delivery to citizens. The stakeholders send the signed transactions to the DLC immediately after the transaction takes place and DLC links these transactions, builds the chain, and stores them. It also provides a mechanism for the citizens and hospitals to verify the quality of the drugs being supplied or issued.

### **Radio-Frequency Identification**

The Central Medical Services Society (CMSS) in India has implemented the Radio-Frequency Identification (RFID) based tracking system for the distribution of medicines and other healthcare products under the Pradhan Mantri Bhartiya Janaushadhi Pariyojana (PMBJP) scheme. RFID track-and-trace wireless technology uses radio waves to transfer data from an electronic tag attached to each unit of medicine or healthcare product and these tags are scanned at various stages of the supply chain from the central warehouse to the retail outlets.

These tags usually include the product name, the lot number, the electronic product code, and the national drug code. An RFID reader accesses this information for each package of product throughout the supply chain.

The system uses a centralized database to store information on the movement of medicines and healthcare products, which can be accessed in real time by authorized stakeholders, including the government, suppliers, and retailers. This allows stakeholders to monitor the movement of products and identify any issues related to stockouts, overstocking, or wastage. Some of the corporate hospitals in India have been using this technology. To better monitor and strengthen the supply chain management for blood and blood products. RFID has been introduced in the blood banks of two hospitals in Tamil Nadu - Rajiv Gandhi Government General Hospital in Chennai and Rajaji Medical College Hospital in Madurai (The New Indian Express, 2021). This technology eliminates lengthy manual processes and reduces the scope for human error.

### **Dhanwantari Scheme**

Assam Government in the year 2020 launched the Dhanwantari Scheme for home delivery of medicines in 2020 whereby, patients can send their prescriptions over the phone and the health department ensures that the order is delivered to them even if it is not on the list of free-of-cost medicines (Dhanwantari Scheme, 2021). All essential and life-saving medicines, inclusive of family planning commodities, are delivered to the doorstep of beneficiaries. A total of 4,000 multi-purpose workers (MPWs) and accredited social health activists (ASHAs) in the state are directly engaged in this service. Under this scheme, the users in need of medicine call a toll-free helpline number to place their order.

Subsequently, the requests are forwarded to the District Drug Store Managers (DDSM) of the National Health Mission in respective districts. After receiving the request from the DDSM the MPW/block pharmacist follows up with the user via phone, collects particulars and validates necessary information such as prescription details following which ASHA workers and MPWs collect the medicines and deliver them to patients' families. While medicines up to Rs. 200 are given free of cost, the patients pay the bill if the cost of the medicines exceeds this amount, however, the rates remain subsidized.

## 5. Conclusion

The WHO estimates that 80 per cent of the world's population lives in countries with zero or very little access to essential medicines for relieving moderate to severe pain (WHO, 2017). Evidence from the global as well as Indian supply chain models/systems for medicines indicates that inefficiencies in the supply chain can have a direct impact on patient safety and health outcomes. Although the different models appear to be fragmented or are relevant to a specific country context, they present lessons for developing countries like India which are distinct by their regions as well as state-level health systems. A 'one-size fits all' certainly does not seem to be the solution for India's medicine procurement and supply chain management. Instead, it needs to be contextualized and aligned with the specific needs of the population to ensure a continuous and reliable flow of essential medicines and health commodities.

Furthermore, the top global pharmaceutical supply chain challenges include lack of coordination, insufficient demand system, shipment visibility and development of human resources including expertise, training, and personnel capacity (Natalie Privett and David Gonsalvez 2014). Therefore, it is critical to derive lessons from the existing supply chain models regarding how the different innovations and pilots can be adapted to the country or state-specific needs so that medicines and medical commodities are delivered in a timely and efficient manner.

This paper presents learnings from varied practices that can be incorporated as part of the existing supply chain systems or can be independently put into practice. Having an advanced online system is essential for not just monitoring purposes but also for ensuring adequate service delivery and evidence-based decision-making for procurement as evidenced by the Ghana Integrated Logistics Management Information System. An efficient supply chain also needs to be guided by including stakeholder's perspectives right from the grass root level as observed in cStock such that the health personnel feel included and own greater responsibility in the delivery of services among the population that they serve.

Strategic partnerships can help build the capacities of drug warehouse managers, pharmacists, and medical officers through technical support on efficient supply chain management practices as evident from the Deliver Project. Leveraging partnerships with existing last-mile delivery systems like the India Post can be cost-effective as well as reach remote locations if delivery mechanisms are systematically planned. Models such as the Revolving Fund and Karunya Community Pharmacies emphasize the fact that competition is essential among providers to bring down the cost of life-saving medicines. Advanced technologies such as Radio-Frequency Identification and blockchain should be explored to make the supply chain an end-to-end integrated system.

### ***Lessons for India***

India could consider redesigning its existing systems for the procurement and distribution of medicines and medical commodities in accordance with the demographic profile of the country. Cost-effective solutions and targeted innovations could be integrated within the existing institutional mechanisms, especially under the ambit of Medical Corporations at the state level for reliable and efficient supply chain management systems for medicines. The review of best practices indicates some directions for improving the procurement and supply chain management systems for medicines in India. These include:

- Availability of real-time data, tracking and monitoring of the entire supply chain, including inventory levels, stock movements and delivery schedules will prevent stockouts and improve medicine availability at the health facilities.
- Leveraging technologies such as in the cStock model that is comprehensible even to health workers with a limited educational background will facilitate user interface capabilities and prompt reporting for evidence-based decisions to make medicines

available, especially in remote and hard-to-reach locations as well as digitize the system.

- Innovative approaches to logistics and transportation such as the Zipline model or the 'Medicines from the sky' model are cost-effective, assure the timely supply of medical commodities to the last mile and have an impact on the health systems to save lives and improve health outcomes.
- Supply chain models such as the Revolving Fund Pharmacy, Jan Aushadhi Pariyojana and the Karunya Community Pharmacies can serve as reliable purchase points for essential and lifesaving medicines and reduce out-of-pocket medicine expenditure for the poor and middle-income population when compared with private pharmacies whose prices are exorbitant. They are also market interventions leveraging economies of scale and bypassing middlemen to limit the prices of commercial enterprises.
- For states that face a financial crunch for medicines and resultant stockouts, sustainable revenue-generating models such as the RFPM can help replenish depleted medicine stocks, serve as alternate service delivery points for essential medicines and consistently ensure medicine availability.
- Partnerships with the private sector and leveraging from existing mechanisms through inter-sectoral coordination with department counterparts who have a country-wide reach for services would be cost-effective, help expand coverage and improve access to critical medicines and supplies, as evident from the postal supply chain system where the postman becomes the conduit for last-mile delivery.

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