Assessment of Pharmaceutical Store and Inventory Management in Rural Public Health Facilities–A study with reference to Udupi District, Karnataka

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ABSTRACT

Inventory management is the core of pharmaceutical supply system. It is all about ordering, receiving, storing, issuing, and again reordering of limited list of products. On a realistic bases inventory management is a difficult task, because in many countries possession of a poor inventory management system in the pharmaceutical supply system has resulted in wastage or blockade of financial resources, shortage and overage of essential drugs, increase in out-of-pocket expenditure and decline in quality of healthcare services. **Objective:** This study is undertaken to assess the pharmaceutical inventory management and store keeping practices followed at the rural primary health centers in Udupi district, Karnataka. **Methods:** Retrospective data was collected by conducting a situational analysis in selected 20 primary health centers located across Udupi district. The collected data is related to the system of inventory management adopted, procurement practices, purchasing documents, essential drug lists, stock records, rate of correct items received and supplied, rate blacklisted and expired drugs, and rate of drug storages. The key performance indicatorswere collected from 2013 to 2015 to study the system and to identify the existing bottlenecks. **Results:** The inventory management and store keeping system implemented in primary health care (rural division) is still a piecemeal and ad hoc in nature. With the provided infrastructure, work force, complex procedures, manual system of record maintenance, lack of co-ordination between the activities and players only causes plethora of bottlenecks resulting in irrational usage of limited resources. **Conclusion:** Overall, there are still chances for improvement within the public pharmaceutical supply system at the primary healthcare level in the state. If corrective standardized measures are implemented in the areas of procurement, drug quantification, distribution, and inventory control, then the problems associated with stock-outs and wastage can be minimized.

Key words: Drug inventory control, Stock management, Primary health centers in Karnataka, Pharmaceutical storage, Drug supply, and distribution.

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INTRODUCTION

Pharmaceutical drugs are the prime crucial and indispensable resource element of a healthcare system, irrespective of varying size of the health institution. To ensure better accessibility and availability of adequate quantity of drugs in the required dosage and strength, they need to be stocked. All pharmaceutical drugs possess a defined shelf life and many require precise storage facilities (USAID| Deliver Project, 2013). A balance needs to be maintained between the service level and the stock level considering the concept of essential drugs. Adaptation of a scientific approach of Inventory management in healthcare manages all the issues regarding stocking of pharmaceutical items, there by ensuing safety, stability, efficacy, availability, and maintenance of drug quality to provide better healthcare services (A.T Kearney Inc., 2004).

Inventory Management is the core of pharmaceutical supply management, without which the entire supply chain structure is not viable. The concept of inventory management sounds easy when it is just described as the process to order, receive, storage, issue and then reordering of a limited list of product. In reality, implementation of a robust inventory system for a pharmaceutical supply is a difficult task. A poor inventory management in a public pharmaceutical supply can creep in wastage or blockade of financial resources, irrational utilization of drugs, shortage or overage of essential medicines resulting in expiration, increase in holding cost, reduction in enterprise's flexibility and decline in quality of healthcare service. Researches in the field of supply chain, concentrate more on optimizing the supply chain system itself for its efficiency and proficiency in the market. Only limited studies focus on the concept of inventory management in supply chain. An effective inventory management system plays an important role in reducing the associated costs across different stages of the supply chain system (Management Sciences for Health, 2012).

A "sick" inventory arise due to individual decision making on frequency of reordering and quantity to be ordered, ad hoc structuring, inaccurate stock recording, lack of transparency, increase in complexity, and absence of systematic monitoring. These problems mainly arise due to lack of awareness or knowledge about of scientific stock keeping and warehouse practices. In developing countries like India, where budget is tight, overstocking of certain pharmaceutical items may block a substantial portion of the drug budget, resulting in insufficient funds for procuring drugs that are more important. For this reason, it is important to implement or upgrade an inventory control system in a public pharmaceutical supplyto maintain a steady supply of drugs to the public. This ensures good health to all while minimizing the costs associated with inventory holding, lowering order processing, procurement or delivery costs, controlling stock levels and minimizing stock out conditions (Surabhi Dwivedi, 2012).

This study was conducted at Udupi district, Karnataka to assess the pharmacy and inventory management at the primary health centers under rural division. The assessment highlighted that drug quantification are not forecasted based on the actual needs, no standardized practices are followed in store keeping, manual paper based documentation is followed in stock recording, increase in out-of-pocket expenditure, alarming stock-out situation, irrational utilization of drugs and various cases of understocking and overstocking of pharmaceutical requirements.

Factors contributing to the poor performance are deficiency of standardized scientific approach of logistics and inventory management practices and pitiable skill level of the personnel involved at various levels of the supply chain system. Therefore, the main objective of this study is to forward the information regarding the various bottlenecks related to poor store management practices in the present system that will cater policy makers and service provider to put forth certain measures for betterment.

MATERIALS AND METHODS

The study was conducted in twenty rural primary health centers located in Udupi district, Karnataka. Udupi district comprise of three taluks Kundapur, Karkala and Udupi. Located along the coastline of Karnataka, the district experiences a tropical type of climate. The duration of the assessment lasted from June until December 2014. A district focused, prospective cross-sectional study was designed and conducted using checklist as per the criteria proposed by the Indian Public Health standards (IPHS) and the World Health Organization (WHO) to evaluate the quality of pharmaceutical inventory management system at the primary health center facilities. In detail, the assessment involves gauging the infrastructure, storage facility conditions, arrangement of stock keeping units (SKUs), availability of drugs, rational utilization of drugs, extent of out-of-pocket expenditure, logistic skill level of personnel and other secondary recordkeeping approaches like stock record ledgers and bin cards.

Under the consent, granted by the Directorate of Karnataka State Health and Family Welfare, Bengaluru, Karnataka the study was carried out. For the review of the document, the PHC's attached pharmacies, stock keeping units, inventory management methods and all the associated documents are involved in the study. The researcher has visited 20 rural primary health centers listed in Table 1[1] located across the Udupi district to record the key findings with an observational checklist that was generated and filled by the physical observation at the pharmaceutical division at the primary health centers. Assurance of data quality for better clarity of the checklist and completeness of data was done before and after the process of data collection. Confidentiality was maintained with the collected records. Along with the checklist, the logistic skills of the personnel dealing with the supply of pharmaceutical needs including the medical officer and the pharmacist was assessed with an unstructured questionnaire with their willingness to participate in the assessment. Confidentiality of the data is maintained.

RESULTS

Infrastructure of primary health center (rural division) in Udupi, Karnataka

As per the norms of the Indian Public Health Standards (IPHS), for every 30,000 population in plains and 20,000 in tribal or hilly area, one primary health center need to be established. Out of which for every population scaling up to 5000 in plains and 3000 in tribal and hilly areas a sub center has to be erected. In reality, due to inconsistent distribution of population density, establishing health facilities based on the strategies of IPHS is not feasible. Under Udupi district jurisdiction, there are totally 59 primary health centers and 328 sub-centers.

PHCs are the cornerstone in the public healthcare system. It is a first port of call for a qualified doctor (under public health sector) in rural areas for the sick and those who directly report or referred from Sub-Centers for curative, preventive, and primitive health care. PHC acts as a referral

unit for every six sub-centers. The services delivered by the sub-center are minimal assured services that include preventive, promotive, referral and a few curative services and all the national health programs declared by the central government. Functionality and administration of the sub-center is monitored by the primary health center heading that area. The sub-center acts a linkage between the communities at the grass root level and the most primitive health care services. It occupies the lowest rung of the referral pyramid of health facilities.

PHCs are allocated with individual buildings with clean surroundings. The premise is located in an easily accessible location with adequate supply of electricity and water, connecting roadways, and communication networks. The building comprises of a separate waiting area, outpatient department, labor room, wards to accommodate 4-6 beds, minor operation theatre, laboratory, and general (main) store for storing medicines, chemicals and other consumable materials. The dispensary is attached with dispensing counters that is accessible to the public. All PHC are supplied with refrigerators, cold storage, and fire handling equipment. The PHC is staffed with medical officer (MBBS), pharmacist, account cum data -entry operator, staff nurse, health workers (male and females), laboratory technicians, multi- skilled group D worker, and sanitation worker cum guard.

The PHC's receives financial resources from both the state government and National Health Mission (NHM). The budget is allocated depending on the type of the health facility (Jayashri, 2014). Table 2[2] shows the funding allocated to the primary health center in Udupi district by the state and central through NRHM. As per the allocated budget, the drugs and other medical equipment are procured through Karnataka State Drug Logistics and Warehousing Society (KDLWS). The requirements are indented on an annual base from an electronic based system called Drug inventory Management System administered by KDLWS. The drugs are supplied every quarterly through the District Drug Warehouse located in Mangalore. The pharmaceutical procurement model followed is an independent demand system with procurement of finished pharmaceutical products. It uses a combination of both push-pull system for distribution (Gupta, 2013). Figure 1[3] illustrates a pictorial representation of Pharmaceutical supply chain system followed in the state.

Storage facility conditions at the primary health facility level

Proper storage facility for drugs ensures the effectiveness, safety, strength, and quality of drugs. Unless the drugs are segregated from other non-pharmaceutical items and stored properly, long shelf life of the drugs are not guaranteed. Medicines need to be stored to maintain the intended quality and prevent damages while handling until it reaches the consumer.

Compared to the set-up of the primary health centers located at the urban areas, the condition is compromised in the rural regions. Only in the recent past, PHCs with the help of government aids are improvising the infrastructure, work force, medical aids and health services. Among the visited PHCs, the conditions and standards describing the level of quality that a health facility are expected to meet or aspire to, is achieved in most parts of Udupi and Karkala taluk. However, the PHCs in the Kundapur taluk, is still struggling to meet the standards, especially the once in remote location (far from the urban inhabitants). In PHCs with heavy caseload, the infrastructure and facilities are inadequate.

Every PHC has a separate location for storing drugs and other medical supplies and it is called the main drug store. In newly established or renovated PHCs the main drug store is located attached to the premises

[1]Source: District Health Office, Udupi district, Karnataka
[2]Source: Financial Department, The District Health and Family Welfare, Udupi, Karnataka
[3]Source: KDLWS- District Drug Warehouse, Mangalore, Karnataka

Table 1: List of Rural Primary Health Centers (PHC) under study

Primary Health Center, Padubidri , Udupi Taluk	Primary Health Center, Koteshwara, Kundapur Taluk	Primary Health Center, Donderangandi, Karkala Taluk
Primary Health Center, Kaup, Udupi Taluk	Primary Health Center, Bidakalkatte, Kundapur Taluk	Primary Health Center, Bailur, Karkala Taluk
Primary Health Center, Pernankila, Udupi Taluk	Primary Health Center, Shankarnarayana, Kundapur Taluk	Primary Health Center, Kukandur, Karkala Taluk
Primary Health Center, Hirebettu, Udupi Taluk	Primary Health Center, Siddapur, Kundapur Taluk	Primary Health Center, Bajegoli, Karkala Taluk
Primary Health Center, Hriadka, Udupi Taluk	Primary Health Center, Haladi, Kundapur Taluk	Primary Health Center, Belman, Karkala Taluk
Primary Health Center, Malpe, Udupi Taluk	Primary Health Center, Byndoor, Kundapur Taluk	Primary Health Center, Sacheripet, Karkala Taluk
Primary Health Center, Kemmanu, Udupi Taluk	Primary Health Center, Kollur, Kundapur Takul	-

Table 2: Financial Resource allocated to Primary Health Center in Udupi dist., Karnataka

Healthcare Services			State Budget (INR)	NRHM Fund		
				Un-tied fund (INR)	Maintenance fund (INR)	Arogya Raksha Samiti fund (INR)
Community Health Center	CHC	Brahmavar	8,00,000	50,000	1,00,000	1,00,000
		Hebri	8,00,000			
		Nitte	6,00,000			
		Shirva	5,00,000			
		Kota	5,00,000			
		Byndoor	5,00,000			
Primary Health Center		PHC	1,00,000	25,000	50,000	1,00,000
		PHC (24*7)	1,25,000	25,000	50,000	1,00,000
Sub- center		SC w/o building	5,000	10,000	10,000	-
		SC with building	5,000	10,000**	-	

**Funds expended only if the sub-center is facilitated with a building.

Table 3: Storage condition and arrangement of pharmaceutical products in the PHCs under study

Sl.no	Pharmaceutical storage conditions	Udupi Taluk (PHC – 7Nos)		Karkala Taluk (PHC – 6Nos)		Kundapur Taluk (PHC – 7Nos)	
		Yes	No	Yes	No	Yes	No
1.	Well ventilated, spacious, dry, laminated, temperature controlled and pest free store	7	0	5	1	3	4
2.	Securely Locked cabinets for drug storage	7	0	6	0	2	5
3.	Fire proof areas for combustible substances	0	7	0	6	0	7
4.	Presences of Fire extinguishers or sand filled containers in case of fire emergency	7	0	6	0	7	0
5.	Cold storage facilities for vaccines, biological and blood products	7	0	6	0	7	0
6.	Accumulation of expired/ Damaged/ Blacklisted drugs	2	5	4	2	1	6
7.	Storage of non-pharmaceutical products along with drugs	6	1	4	2	2	7
8.	Systematic storage of indents, pharmacy records, stock records, ledgers etc.	1	6	0	6	0	7
9.	Pharmacy completely controlled and operated by pharmacist	7	0	3	3	2	5
10.	Scientific method of categorizing, arrangement and labelling of drugs as per the batch number and expiry date	6	1	4	2	4	3

and as in case of old PHC or First Referral Units (FRU) converted into PHC, the main store either is in a separate building away from the main premises or occupies a small room within the premises. Compared to all the drug storage facility in the district, the condition in PHCs located in Kundapur needs to be improved when compared to those in Udupi and Karkala. Out of seven PHCs visited in Kundapur taluk, only three PHCs had an acceptable storage infrastructure. Others had a narrow space for storing drugs along with other non-pharmaceutical objects. The area was not well ventilated and well lit but dry and shady. Combustible and non-combustible products were stored together with low sighting of the drug names. A scientific and discipline method of categorizing of drugs for storage was absent though, drugs are segregated as per dosage form. Flammable trash like packing material, cartons, and boxes are accumulated in the main storing area. Considerable quantity of expired and black listed drugs that need to be discarded by the authority is still stored in the same premises and has accumulated over the time. Similar situation is observed in a few PHCs located in Karakal taluk. The condition of the pharmacy infrastructure deteriorates as the location drifts towards the interiors away from the city limits. Table 3[4] summarizes the storage conditions and arrangement of pharmaceutical products in the PHCs under study. Figure 2 exemplifies the process followed arranging drugs at the primary health centers.

ARRANGEMENT OF DRUGS AND MEDICAL EQUIPMENT AT THE PRIMARY HEALTH FACILITY LEVEL

The management of the store should assist the flow of supplies from the source to the end user in the most reliable and economical way without a significant loss of quality, wastage, or larceny. The main purpose of managing a store is to cater the needs of receiving, holding and dispatch stock. On visit to the sampled PHCs, it was observed that on receiving the drug consignment from the drug warehouse, the drugs are stored in the main store. Depending upon the patient statistics, sub stores are maintained, if the patient coverage is on a large scale then the weekly requirement of drugs is moved from main store into the sub-store and then into the dispensing area as and when it is required in order to monitor the flow of drug consumption. On the other hand, if the patient population is less, the weekly requirement is moved directly into the dispensing area.

During the analysis of the stores in Kundapur and Karkala area, the medicines are stored on open shelves in the main store and only a limited number of PHCs in Udupi have close cabinets to store medicines. These shelves are labelled and drugs are arranged and dispatched on FEFO/FIFO basis. Arrangement of the medicines is done according to the pharmacologic – therapeutic order. It was noticed that the drugs are not organized according to alphabetical order. The arrangement is zoned out as per the dosage form, tablets and capsules are stored together, and injections, oral liquids, ointments, creams and tropical liquids are stored separately. Sufficient number of open racks, steel shelves, and cupboards are provided for storing drugs and other supplies. The drugs are stored in loose boxes hampering the visibility to the drug details. Inspection and housekeeping are not done on regular base. Cold storage facilities are also provided to store drugs like vaccines that require temperature controlled storage. Metal buckets are filled with sand and stored near the main stores in case of fire emergencies. Even though the PHCs are supplied with fire extinguishers, the staffs are not well trained with its usage and the system itself is not serviced on regular bases.

The drugs that are blacklisted and expired are separated from the

main stock and stored separately in the same main store waiting to be disposed by the authority. A separate dispensing area is established where the patients can receive the prescribed medications. Pharmacy keys are kept under the main pharmacist control and cabinet keys for controlled drugs. Normally, pharmacies are operated by the main pharmacist but in reality in few instances, because of understaffing, a single pharmacist is allocated to manage the pharmacy section of 3-4 neighboring PHCs. In such cases, weekly drug requirement is moved to the sub-store by the pharmacist, making appropriate entries in the store records. From the sub-store, it is operated by the staff nurse or medical officer until the drugs are dispatched to the end users. The pharmacist is accountable for maintaining safety stock, drug expiry, inventory control, medicine availability, and drug supply records.

Pharmaceutical stock management techniques

Stock management in all the visited primary health centers is on a similar stand. Only the drugs enlisted in the essential drug list are available. Settlement of drug receipts with exchange of supplies and issuing with the other health facilities are practiced. Bin cards and stock ledgers book are used to document the stock movement in the health facility. Bin cards are file cards that are physically placed along with the stocks. It documents the status of the stock held in the storeroom. Each card is maintained for different batch numbers of the same drug supplied. Every time the drug is removed for consumption or replenished, entries are made in the bin card. Stock ledgers are maintained to record all the details of every product of varying batch numbers supplied to the health facilities or warehouse. Maintenance of ledger records represents a perpetual inventory system, as it traces and tracks the current quantity of stock in hand. It was observed that no standardized method or formulas are used to calculate safety stock, reordering quantity, or the reordering frequency. Computers are not utilized for stock management. Instances of stock out remains common in most of the PHCs. Due to unavailability of required drugs the patients are forced to purchase drugs from local pharmacies, increasing out-of-pocket expenditure. Black listed and expired drugs are accumulated over the years and there is no recent event of disposing such drugs by the authority. Reviewing the indent books and methods practiced for drug quantification, it can be concluded that no ideal criteria is followed for quantification. Theoretically, quantification of medicines are based on following clauses –

- Availability of funds
- Human resources capacity
- Population coverage
- Disease pattern
- Seasonal variation in the disease pattern
- Rate of monthly drug consumption
- Lead time taken for delivery of drugs from the nearest drug warehouse
- Time delay between the placing an indent and receiving the orders
- Stock keeping – the knowledge of quantity of drugs of each form that is consumed regularly

In reality, indent preparation is completely based on the individual perception of the personnel involved in the therapeutic committee at the PHC level.

Even if the most accurate stock data is recorded in the stock records, it possesses very little significance if the information is not compiled in to stock reports. Routine stock reports need to be generated for better decision making and periodic analysis. The inventory facilities must report on

- Stock position
- Opening and closing stock for the year
- Monetary value of all the stock received and distributed during the year

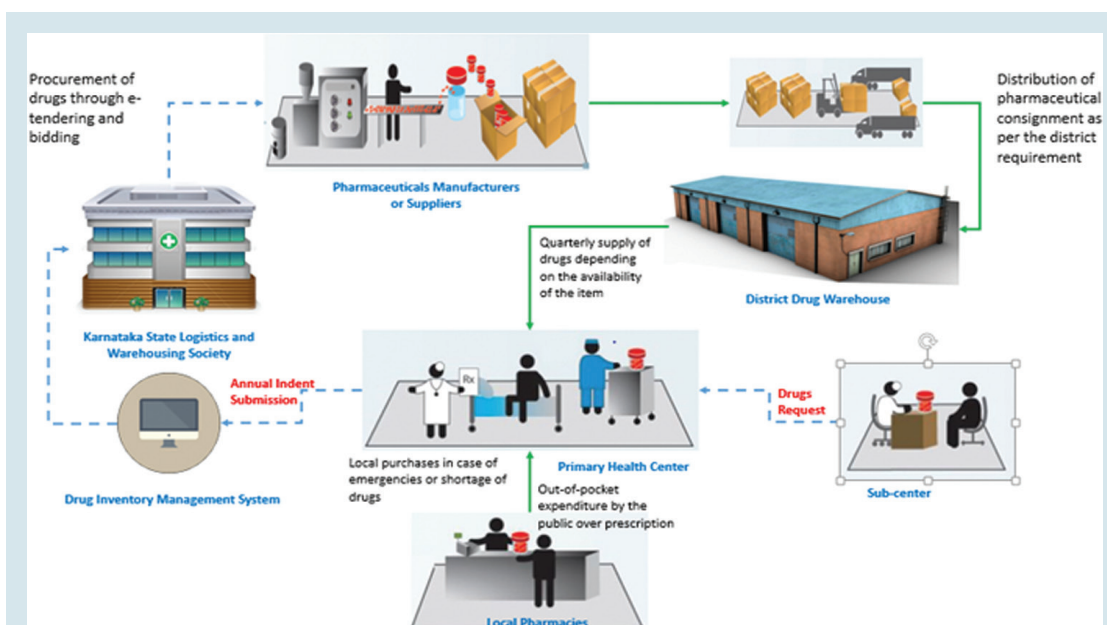[4,5,6]Source: Analytical Observation on Visits to Primary Health Center, Udupi District, Karnataka

Figure 1: Pharmaceutical supply chain system at the primary healthcare level

Figure 2: Images of drug arrangements in the main stores at the visited PHCs

- Changes in inventory level due to any discrepancies
- Stock adjustments
- Consumption pattern
- Quantity of medicines nearing expiry
- Value of obsolete and expired drugs waiting to be disposed and
- Recording the transactions between warehouses and health facilities

Even though ledgers and other documents are maintained to document the stock position, stock adjustments and changes in inventory level and passbook records the transactions between the drug warehouse and health facilities, reconciled reports could not be generated. Thus, deteriorating the transparency in the existing system. Physical counting of stock unit is a rare event. Tracing the functionality of the inventory control at the PHC level is a difficult task and this makes reordering process impossible. The records are maintained in the conventional paper based records, entries are sometime made in local languages, no uniformity and data standardization is followed across the visited PHCs. Sloppy warehouse, and storekeeping practices followed at the PHC tier adds to the existing misery. Figure 3[6] illustrates a few methods followed for storing and tracking the movements of drugs at the primary health center level.

Pharmacist and other staffs involved in stock and store management are poorly trained and motivated. There are not exposed to modernization
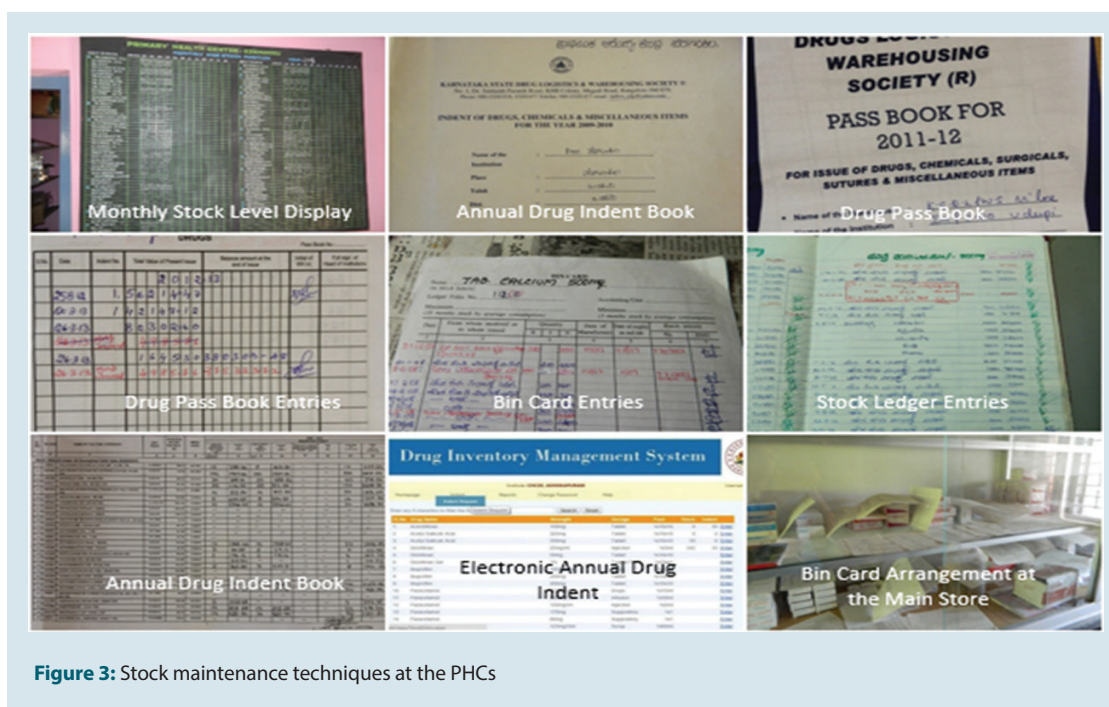
Figure 3: Stock maintenance techniques at the PHCs

and they follow the conventional method, leading to wastage of the limited resources. They are not aware of the scientific approach in controlling inventory and quantification of drugs.

Erratic fund release, dearth of skilled workers, unplanned scheduling of supply, ambiguous drug requirements, and intermittent submission of procurement requirements, irrational selection, and consumption of drugs, unpredictable distribution schedule, and poor knowledge in logistics and supply management only deepens the situation and makes the existing system slow, cumbersome and error prone.

CONCLUSION AND RECOMMENDATIONS

The medicine distribution in the health facilities run by the state government is free of cost with the main intention to reduce associated costs and out-of-pocket expenditure. The entire process is monitored and controlled by KDLWS. This society was initiated in the year 2002; it has evidently improvised the availability and accessibility of drugs. However, the existing structure is piecemeal. There are still major challenges related to stock –out and irrational usage of essential drugs that need to be addressed. Attempts to resolve the bottlenecks vitally require co-ordination of various involved stakeholders and have a modernized holistic approach with better technology. This situational analysis undertaken anticipates the public healthcare providers to incorporate the recommendations listed for plans of action to mitigate the linked glitches in the mechanism.

→Production of annual reports on drug procurement, inventory at the health facility level and distribution will help in analyzing the par- capita allocation of drugs, comparison across districts, samples failing quality criteria and the replacing batches of medicines, drug consumption rate, trends in diseases, tracking of expired or black-listed drugs and locating days of stock outs or drugs nearing expiry.

→Utilization of an efficient customized electronic drug inventory management system instead of cumbersome annual paper-based system. Computerization of all processes with guaranteed services will ensureinventory control and tracking and tracing of drug movements from the suppliers to the warehouses until it reaches the health facilities and ultimately to the patients.

→Coordinating the actions of various departments involved in the drug selection, quantification, procurement and distribution of pharmaceutical products and the health facilities. This will provide better visibility and control in the system which will help in tracking the products and tracing the real evidence based requirements of the of the public.

→Reviewing the system and strategies followed in drug quantification and inventory management at the health facility level. Implementation of improvised drug forecasting and quantification strategies based on past drug consumption for estimation for drug need and stock control without any ambiguity by considering stock-out periods and lead time.

→Revising the store management practices with a scientific stringent standardized approach and better storage infrastructure

→Responsible promotion of rational and optimum utilization of the available limited resources both the financial aspect and the pharmaceutical products among the health facilities and health professionals. Monitoring the drug usage through prescription audit, prescription through electronic system, identification of inappropriate medical practiceslike over usage of injections, antibiotics etc.

→Establishment of a proactive therapeutic and drug committee to initiate quantification and selection of drug requirement based on real time necessities and continuous monitoring on the drug usage. Pharmacists should review the structure of logistic management system in order to avoid stock out and depletion of drugs.

→Increase hiring and training health facility staff with knowledge on modernized store and inventory management practices and pharmacology for management of drugs.Regular training on medical and pharmacy education is vital.

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- Primary Health Centers, Udupi District, Karnataka
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- District Health Office, Udupi, Karnataka
- NRHM Office, Udupi, Karnataka
- District Drug Warehouse, Mangalore, Karnataka.

CONFLICT OF INTEREST

The terms and conditions of this research has been reviewed and approved by the Manipal University at Manipal, Karnataka in accordance with its policy on objectivity in research.

ABBREVIATIONS USED

WHO: World Health Organization; **IPHS:** Indian Public Health Standards; **PHC:** Primary Health Centers; **SKU:** Stock-Keeping Units, **MBBS:** Bachelor of Medicine, Bachelor of Surgery; **NHM:** National Health Mission; **NRHM:** National Rural Health Mission; **KDLWS:** Karnataka State Drug Logistics and Warehousing Society; **FRU:** First Referral Unit; **SC:** Sub-center; **FEFO:** First Expiry First Out; **FIFO:** First In First Out.

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PICTORIAL ABSTRACT
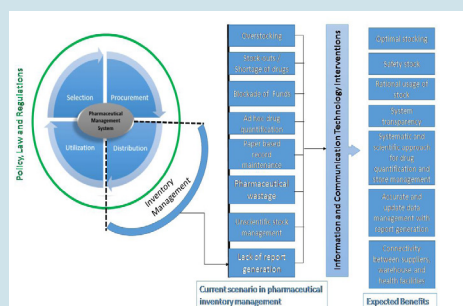
SUMMARY

- The inventory management and store keeping system implemented in public primary health care (rural division) located in Udupi dist. is still a piecemeal and ad hoc in nature.
- With the provided infrastructure, work force, complex procedures, manual system of record maintenance, lack of co-ordination between the activities and players only causes plethora of bottlenecks resulting in irrational usage of limited resources.
- There are chances for improvement within the public pharmaceutical supply system at the primary healthcare level in the state.
- If corrective standardized measures are implemented in the areas of procurement, drug quantification, distribution, and inventory control, then the problems associated with stock-outs and wastage can be minimized.

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