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Improving medical stores management through automation and effective communication



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ABSTRACT

Background: Medical stores management in hospitals is a tedious and time consuming chore with limited resources tasked for the purpose and poor penetration of Information Technology. The process of automation is slow paced due to various inherent factors and is being challenged by the increasing inventory loads and escalating budgets for procurement of drugs.

Methods: We carried out an in-depth case study at the Medical Stores of a tertiary care health care facility. An iterative six step Quality Improvement (QI) process was implemented based on the Plan–Do–Study–Act (PDSA) cycle. The QI process was modified as per requirement to fit the medical stores management model. The results were evaluated after six months.

Results: After the implementation of QI process, 55 drugs of the medical store inventory which had expired since 2009 onwards were replaced with fresh stock by the suppliers as a result of effective communication through upgraded database management. Various pending audit objections were dropped due to the streamlined documentation and processes. Inventory management improved drastically due to automation, with disposal orders being initiated four months prior to the expiry of drugs and correct demands being generated two months prior to depletion of stocks. The monthly expense summary of drugs was now being done within ten days of the closing month.

Conclusion: Improving communication systems within the hospital with vendor database management and reaching out to clinicians is important. Automation of inventory management requires to be simple and user-friendly, utilizing existing hardware. Physical stores monitoring is indispensable, especially due to the scattered nature of stores. Staff training and standardized documentation protocols are the other keystones for optimal medical store management.

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Introduction

Medical services are an important part of the logistic support system of the Armed Forces of any country, during times of peace, war and also during operations other than war (OOTW). It will be appreciated that comprehensive healthcare cannot be provided realistically without professional management of medical stores, which include but are not limited to the armamentarium of pharmaceuticals and expendable and non expendable items of medical use. Thus, this is a crucial component of any organized medical services be it in the military or civilian sector. The effectiveness and efficiency of healthcare delivery in a hospital setting depends on the smooth and proper functioning of the medical stores department.¹

The major components of medical stores management are inventory and warehouse management. For healthcare managers, monitoring of performance is essential and ground realities dictate that effective communication within the hospital hierarchy and system should be an integral part of logistics management initiatives.

In Armed Forces hospitals, especially those still located in vintage buildings, there may sometimes be a lack of proper infrastructure for medical stores. Often there may be a shortage of qualified pharmacists relative to the workload due to various organizational constraints, such as field and operational deployments besides training capacity limitations. There is also an additional load due to the increasing numbers of military veterans and their dependents, from the Ex Serviceman Contributory Health Scheme (ECHS).

The peculiar requirements of patient care often dictate the provisioning of 'short shelf life' life saving items at short notice. The various contingencies that medical care of a spectrum of patients and illnesses cannot be provisioned for in advance in some situations. The financial and procurement provisions of the Govt may at times also pose an impediment especially in case of emergent purchases of life saving drugs.

Therefore it is very important to have simple yet stringent medical stores management techniques to cope up with the various challenges that provisioning of healthcare is fraught with. The aim of such management is thus, to protect stored items from loss, damage, theft or wastage and to manage reliable movement of supplies from source to user in the most economical and expeditious way.

During an internal audit at a tertiary care hospital, it was found that expired medicines were not being replaced by the vendors as per contractual requirement, thereby blocking funds expended. The aim of our study, was to look into the causes leading to expiry of large numbers of medicines and devise a system for effective medical store management in resource constrained settings.

Materials and methods

The case study methodology² is being utilized in this paper to present our approach. The setting is that of a tertiary level healthcare center of the Indian Armed Forces. An iterative six

step Quality Improvement (QI) process based on the well established Plan-Do-Study-Act (PDSA) cycle³ (Fig. 1) was implemented in Sep 2013 and the situation was re-evaluated at predefined intervals. The six steps were modified to fit into effecting improvement in medical stores management. The six step problem solving discipline approach⁴ is depicted in Fig. 2.

Step 1: Defining the problem: We went through the list of expired drugs in the medical stores and found a large number of drugs lying expired from 2009 onwards. We then prepared a data sheet of these drugs as per date of expiry; details of vendors/dealers or manufacturer, supply order number, quantity purchased and quantity expired. We also found out that the supplying vendors had been intimated of the expiry, but there was no record of any return communication from the vendors. In many cases the expired quantity was more than 50% of the supplied quantity of the medicine. We updated the list of expired drugs from the ledgers after confirming the ground and ledger balance. Certain medicines which were slow moving and nearing their expiry with a high stock position were listed separately.

Step 2: Identify all possible causes and confirming data gathered in Step 1: We confirmed the accuracy of data from the ledgers and through a physical verification of stock position. After confirmation and updating the data we prepared a cause and effect diagram to ascertain all possible causes for the expiry of the drugs as depicted in Fig. 3. Based on the cause and effect diagram we could determine reasons for the issues with inventory management leading to expiry of medicines. This allows planners to prioritize and focus on areas for improvement.

Step 3: Developing the action plan: After consultative efforts based on the cause and effect diagram and its analysis we prepared an action plan and an action chart was finalized (Fig. 4). The data management system was

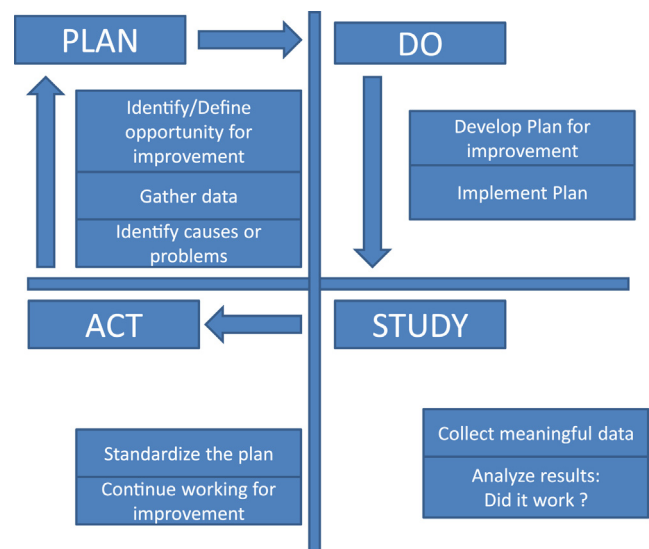


Fig. 1 – Plan-Do-Study-Act cycle.

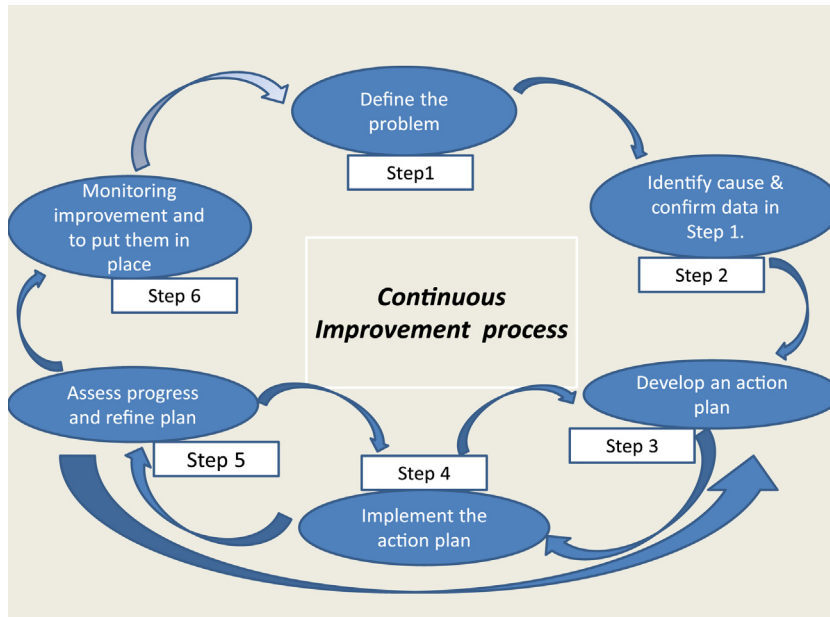


Fig. 2 – Quality improvement process.

made using ASP (Active Server Pages), supported on the server IIS (Internet Information Services, formerly called Internet Information Server).

Step 4: Implementation of action plan: After formulating the action plan as per Step 3, we implemented the same by utilizing a Gantt chart⁶ prepared with the approval of the hospital administration. We included outcome indicators and descriptors for making a time bound action plan chart (Fig. 4). Emphasizing on inventory management particularly FIFO (First In First Out) and daily updating of data on

computers, it was reiterated that this was a routine process rather than a standalone event, so as to integrate with the daily work schedule for the technical staff. The baseline/initial data entry took one week for approximately 6000 items to be inventorized, after that daily updating of the data was done.

Step 5: Assessing the progress in achieving goals and refine action plan: After implementing the action plan we assessed performance towards improvement in the management of the medical stores.

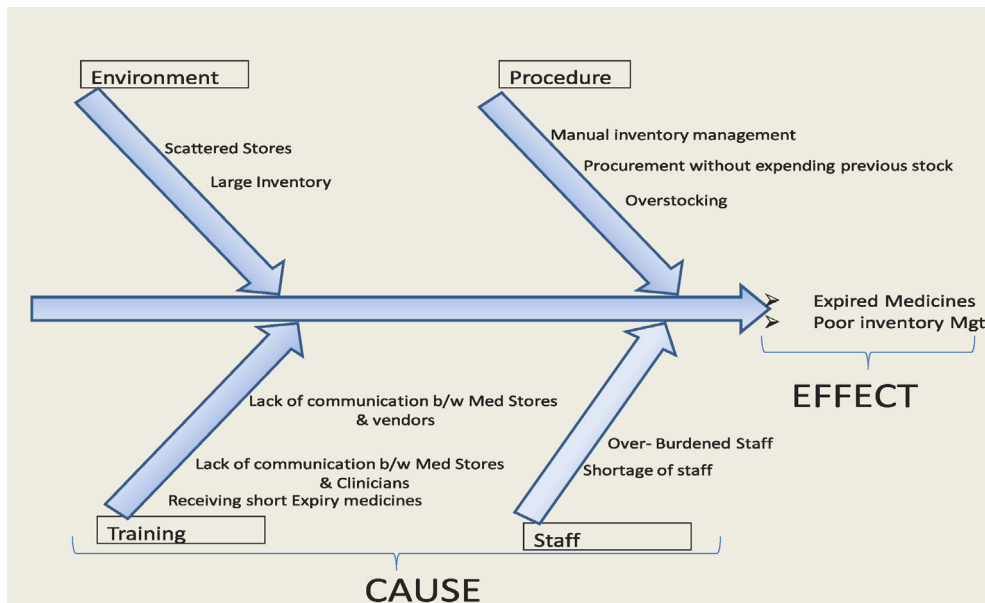


Fig. 3 – Fish bone diagram (showing cause and effect).⁵

| <u>Action Plan</u> | <u>Measurement</u> | <u>Measurement outcome</u> | <u>Person responsible</u> | <u>Time limit</u> |
|--|---|---|---------------------------|-------------------|
| Automation of inventory | No of days for computerization of inventory | 100% medicines entered into computer database | Med stores manager | Oct |
| Preparing an updated list of expired drugs, short expiry drugs (4 mths left) & overstocked drugs with date of expiry, qty, supplied by vendor with contact details | No of expired and short expiry drugs | 100% expired drugs | Pharmacist | Sep |
| Communication with supplier/ manufacturers on telephone or e- mail. | No of vendors contacted | 100% vendors communicated | Med stores manager | Sep |
| Communicate with Clinicians through bulletin or personally. | Bulletin of short- expiry and slow moving medicines | Fortnightly bulletin | Med stores manager | Nov |
| Training of Staff on inventory management | 100% staff participate in training | 100% staff attended training program | Med stores manager | Dec |
| Regular maintenance of bulk store and keep a check on flow of items from bulk store as per policy- FIFO. | Pharmacist staff to visit bulk stores | Weekly visit to bulk store. | Pharmacy staff | Oct |
| Timely disposal of slow moving or overstocked items. | Pharmacy staff to follow issue of stocked items | Monthly disposal orders | Med stores manager | Oct |

Fig. 4 – Action plan for medical stores management.

Step 6: Monitoring improvement to put them in place: Quality improvement and medical stores management is not an event but is a cyclic process. It is very essential that this continues and becomes a routine process. This was emphasized to all the administrative echelons so that the improvement would be continuous and sustainable.

Results

Our study effectively conducted a situational analysis of the existing system of manual management of the medical stores inventory. After the implementation of the QI process and PDSA cycle, the data collected was analyzed. We developed an inventory management system which was intended to be user

friendly in its simplicity. Since the Inventory Management System was simple and user friendly in its interface, no special training was required and the staff adopted the system without any hassles. The orientation training of the staff was in the form of 'on the job' training and took about an hour.

Our method generated a list of medicines four months prior to their expiry along with its stock position and along with Monthly Maintenance Figures (MMF) so that timely action could be taken towards its disposal. It also generated a list of medicines when the stock in the medical stores depleted below two months MMF, so that timely demand for procurement could be initiated. We also generated a list of overstocked medicines (more than eight MMF) so that timely disposal order could be initiated. A total number of 55 expired medicines which were lying expired since 2009 onwards were replaced with fresh stock after institution of our Inventory Management System in Sep 2013 (Table 1).

Table 1 – Replacement of drugs (expired/short expiry).

| Year of expiry | No of drugs (expired/with short expiry) | Replacement done |
|-----------------|---|--|
| 2009 | 02 | 01 |
| 2010 | 05 | 01 |
| 2011 | 22 | 02 |
| 2012 | 30 | 02 |
| 2013 (Till Sep) | 12 | 02 till Aug 2013 55 replaced after Sep |
| After Sep 2013 | 37 | 35 replaced, 02 in process |

Out of these 55 medicines, the procurement and disposal of fifteen were under observation by the financial audit authorities. After replacement of these expired drugs by the vendors, the audit objections were dropped by the audit authorities. Another 35 drugs with short expiry were replaced with fresh stock by the dealers. Besides this, due to correct documentation procedures being instituted, more pending audit observations were dropped by Local Audit authorities.

The inventory documentation was observed to have improved, in that the monthly expenditure summary was ready within a ten day period on conclusion of the calendar month. Earlier before implementation of the QI process, this used to take between one to two months to complete. Key Informant interviews with staff of the medical stores and the administration, revealed satisfaction with the changes brought about in inventory management. This clearly illustrates that there was an evident improvement after implementation of the Continuous Quality Improvement Process. No expenditure was incurred in any of the process, since the inventory management was developed internally.

Discussion

The acute shortage of pharmacists in our hospitals and the ever increasing inventory of medical stores due to introduction of newer medicines and their variants/combinations, have resulted in a situation where it is extremely difficult to maintain medical stores manually. This leads to a large number of medicines which are unused and which eventually expire. In addition, due to communication gaps between the pharmacy and clinicians, a large variety of medicines, both generic and branded, are prescribed with wide variations in consumption. This frequently leads to 'stock outs' of some essential medicines with some other medicines becoming slow moving and then eventually expiring. This leads to a financial loss to the hospital and decreases both patient and clinician satisfaction.

The PDSA cycle is increasingly being used in the healthcare settings to undertake routine and novel interventions for QI.^{7,8} The remedial measures that were instituted as a result of our QI process, resulted in many changes and transformations with adoption of the approach by the hospital administration. Within six months, most of the expired medicines were replaced with fresh stock and the dealers and manufacturers responded suitably by compliance with contractual requirements towards replacement of expired medicines. We had to refine our plan in a few cases, where the supplying dealers had

ceased to exist. For these, we approached the manufacturers directly, and they in turn replaced the expired medicines with fresh stocks. We focused on certain key result areas (KRAs) while working towards the QI process (Box)

Key result areas:

Improving communication systems

- **Vendor database management:** Establishing channels of communication with registered vendors including updating of addresses and contact details after verification of authenticity and commercial sustainability.
- **Reaching out to clinicians:** A monthly bulletin for clinicians with information on short expiry medicines, slow moving medicines and high stock medicines.

Automation of inventory management

Simple, user user-friendly inventory management software system, utilizing existing hardware, to control stocks, expiry date monitoring, accounting of demands and issues.

Stores monitoring

Weekly rotational visits of all pharmacy staff to scattered bulk stores, to undertake physical check of the stock and expiry dates.

Staff training

Inventory management training of all categories of staff with regular reminders about procedures such as FIFO (first in first out), indenting processes etc.

Disposal of overstocked drugs

A systematic plan to issue overstocked and slow moving medicines to other hospitals where they could be better utilized within shelf life.

Standardized documentation protocols

This is essential for optimal medical store management, and includes checks and balances for ensuring correct demands based on stock positions and forecast of requirements.

In any large hospital most of the budgetary outlay (excluding salaries of staff), is spent in the procurement of medicines. A tertiary care hospital in the Armed Forces usually has a large inventory of more than 6000 consumable items. Even in today's high technology world, such a large inventory is being managed manually at most similar hospitals in the governmental sector. This makes it very difficult and time consuming to obtain reliable data about consumption patterns, submitting of timely demands for procurement, shelf life of medicines, slow moving, fast moving and overstocked

drugs and other such data for medical stores inventory management. In addition at most such hospitals, there is lack of infrastructure for safe stocking of medicines and other consumables, which are usually in scattered stores across the hospital complex. It is unrealistic to expect to be able to keep a suitable watch on the medical stores, in the absence of a systems driven approach. This often leads to underutilization of funds and blocking of an important portion of the budget which otherwise could be utilized in a more judicious manner.

Thus to overcome these problems it is very important to automate the inventory management system to the extent possible. Any such system should not be very technology intensive, and should be user friendly, so that it is effectively used.⁹ As most government hospitals have a transferable staff population, these systems should have a common platform by utilizing ordinary computers. If the computerized system is complicated it will not be utilized properly as has been happening in our hospitals, despite so much effort being put in developing various software stores management modules.

Communication between the medical stores managers and the clinician is very important since the latter are responsible for prescribing the drugs and control of consumption pattern. Hence any approach to bridge the communication gap, will address issues of lack of awareness of availability as also shelf life. Indirectly, this will also improve patient satisfaction due to increased availability of drugs being prescribed by clinicians. Automation in drug inventory management has been shown to have a positive effect on the working condition in hospitals, and also saves personnel time and budget.^{10,11}

It is recommended that similarly positioned tertiary care hospitals can benefit by the implementation of a QI process and utilization of the inventory management system. Administrators should also be aware that an emphasis on automation, requires to be matched with development of effective communication between different categories of hospital staff. It is also essential to focus on training and reorientation of staff to effectively improve inventory management of medical stores.

The main limitations perceived by us are the issue of adequate time being available in a busy tertiary care hospital to cope with the workload, with technically trained manpower also being a scarce resource.

There is a need to expand the automation process to include dispensaries, wards and polyclinics for physician order entry, automated dispensing and online indenting linked and integrated subsequently with procurement procedures. Further, non-expendable medical stores can similarly

also be taken onto the same platform. On a larger scale, entire hospitals of the Armed Forces can be taken on board a similar platform (has been effectively done in management of Ordnance stores inventory) to create a virtual directory for optimum utilization of budgetary allocations and improve patient satisfaction. In the interim, it is recommended that other hospitals can undertake measures to implement similar local level initiatives to streamline their medical stores management.

Conflicts of interest

All authors have none to declare.

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