Study of Consumable Utilization Patterns in the Operation Theatre and Approaches for Effective Inventory Control at the Centre for Sight

A dissertation submitted in partial fulfillment of the requirements for the award of

Post-Graduate Diploma in Health and Hospital Management

By

Preeti Aggarwal

International Institute of Health Management Research
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under the guidance of

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ABSTRACT

Consumables are the supplies that are used in support of normal operations. Regardless of what the items are, if they are high value, high volume or readily pilfered, they should be inventoried and their usage benchmarked. Conducting regular inventories of these items will reduce loss, avoid surprise shortages, and allow the usage to be benchmarked against a volume measure of business. To ensure that the consumables were being utilized efficiently in the Operation Theatre of the Centre of Sight, this study was undertaken. The methodology adopted was collection of quantitative data from the OT Consumables records and stock ledgers over a period of six months. *ABC* analysis was done to select consumables which constituted 80% of consumption-value in the month of November 2010. There were 20 items in this category (category *A* items). Correlation between utilization of the category *A* items and the workload was calculated. For calculating per cent variation of monthly consumptions and workload, November 2010 was taken as benchmark. Results of the study showed that among category *A* items, blade side port 15 degree, injection Viscoat, BSS 500 and silicon oil consumed the highest cost. Utilization of selected items (category *A* items) increased with the increase in the workload of the operation theatre indicating that the assumption of 'increased consumption due to increased workload' was possibly true. Although, all the items showed a positive relationship between the consumption of the materials and the workload in the Operation Theatre, it was not perfect (correlation (r) < 1). Most of the items showed variation in consumption in parallel to variation in workload. However, this variation was not perfect. Possible reason was different utilization patterns in different surgeries which varied every month. Further, since all consumptions were being tracked manually, a few errors were found in the stock ledgers in terms that the stock quantity was not matching on physical verification. This could have also led to imperfect correlation between

variation in workload and variation in consumption. It was recommended that Operation Theatre Management System should to be installed so that better tracking of consumables and drugs used in the operation could lead to efficient management of surgical consumables/disposables & medicines. To avoid errors in consumption, issue of the category *A* items should be done on daily or at least weekly basis instead of present system of monthly issuance. *ABC* analytical technique should be performed every month as high consumption-value items (category **A** items) may change depending upon use of newer techniques of surgery and anaesthesia. Graphical analysis of the consumption of materials/consumables should also be done by the stores department every month so as to have a stricter inventory control over utilization of the consumables.

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ABBREVIATIONS USED IN THE DISSERTATION

1. **ABC – Always Best Control**
2. **CFS – Centre for Sight**
3. **DDD – Defined Daily Dose**
4. **HIS – Hospital Information System**
5. **ID – Identification**
6. **IPD – In Patient Department**
7. **ISO – International Organization for Standardization**
8. **OR – Operating Room**
9. **OT – Operation Theatre**
10. **RFID – Radio Frequency Identification**
11. **VED – Vital, Essential and Desirable**

PART I: INTERNSHIP REPORT

1.1 Introduction to Organization and its Profile (History, Location, Area, Departments/Programmes, etc.)

The Centre for Sight was setup in 1996 by Dr Mahipal Singh Sachdev, former Associate Professor, Ophthalmology from the prestigious Dr R.P. Centre, All India Institute of Medical Sciences, New Delhi, with the vision ***"To establish the most preferred brand of super specialized eye care centres in North India"*** *and with a motto* ***"Because every eye deserves the best."***

Centre for Sight is an ISO 9001:2000 Certified organization. Today it is possibly one of the largest eye care providers in the private sector in north India. It is a preferred tertiary referral centre for cataract, glaucoma, squint, opthalmoplasty and advanced vitreo-retinal surgeries. Centre for Sight is a pioneer in the treatment of age-related macular degeneration.

Mission: Centre for Sight is committed to deliver best quality care with personalized touch and cutting edge technology, to enhance patient satisfaction and provide continual improvement in its services.

Vision: To establish the most preferred brand of super specialized world class eye care facilities in and around India by 2020.

Objectives:

- To provide quality of care that exceeds patients' expectations
- To adhere to operational protocols of the institute in order to reduce errors and enhance patient safety
- To comply with all statutory and regulatory requirements
- To promote on the job training in order to improve skills and competence of the staff
- To ensure health and safety of the staff members.

Since its inception in 1996, Centre for Sight has always strived to offer the very best to the ophthalmic patients and has been in the forefront of delivering specialized eye care services for

various disorders of the eye. Within a short span, Centre for Sight has become an icon of dynamic progress in the field of ophthalmology. With SEVEN Centres running across NCR and beyond, be it South Delhi, East Delhi, North-West Delhi, Faridabad, Gurgaon or Agra, Centre for Sight is well on its course to be the largest eye care service provider across North India.

Safety, Expertise and Technology are the three words that describe what patients can expect from Centre For Sight.

Centre For Sight is recognized by the Central Govt. Health Scheme (CGHS), Delhi Govt. Health Scheme (DGHS) and registered by the Directorate of Health Services**,** National Capital Region, New Delhi. It is on the panel of reputed public sector undertakings like GAIL (India) Pvt. Ltd, Oil India, DERC, UGC, CPCB, Mother Dairy, ECHS, Indian Airlines, Seema Suraksha Bal, Punjab & Sind Bank, MTNL, etc. It is also empanelled with Multinational Corporates like Escorts JCB, Jet Airways,Taj Palace, Oberoi, Global Healthline 98.4 , Hero Honda, Hindustan Lever Ltd, Bennett, Coleman & Co. Ltd. etc, reputed Insurance Companies and a majority of the TPAs**.**

It is the **dedication, professionalism and perseverance** that make Centre for Sight a preferred destination for quality eye care not only for Indian Citizens but also for foreign internationals. In fact Centre for Sight is emerging in a big way in the field of Medical Tourism.

Centre For Sight uses the cutting edge technique of **Phacoemulsification** with a foldable lens implant for cataract surgeries. It uses the latest generation Phaco machine – Signature and Millenieum by AMO and Stellaris by B&L. In most cases, it is a ‘no injection - no stitch - no pad’ surgery resulting in ‘walk in - walkout’ cataract surgery, a very quick visual recovery and a quick rehabilitation.

The main centre is located at Safdarjung Enclave, New Delhi. There are several satellite centers across Delhi; other centres are in Faridabad, Gurgaon and Agra. It is coming up with a few more centers in north India. The main satellite centres are:

- Centre for Sight, Preet vihar

- Centre for Sight, Gurgaon
- Centre for Sight, Rohini
- Centre for Sight, Escorts Heart Institute, Okhla
- Centre for Sight, Sun flag hospital, Faridabad
- Centre for Sight, Agra

Centre for Sight is primarily a Super-specialty Ophthalmic hospital i.e. it caters to only eye care. It provides the following Medical and ancillary services:

Medical Services

- Complete solution for refractory errors
- Cataract
- Glaucoma
- Vitreo-retinal diseases
- Uveal diseases
- Corneal diseases
- Squint
- Pediatric ophthalmology
- Neuro-ophthalmology
- Occuloplasty and tumours
- Opticals and low vision aids
- Contact lenses
- Comprehensive eye check up

Ancillary Services

- Pharmacy
- Pathology lab for tests
- ECG

Facilities and Equipments

The centre has all the latest facilities and state of the art technology to cater to the needs of patients seeking eye care. These include:

- Intralase Femtosecond Lasik Laser (Blade-Free Lasik)
- Visx Lasik Laser

- Bausch & Lomb Zyoptix 100 LASIK Laser
- Xp-Microkeratome & Hansatome
- Allergan-Sovereign Phacoemulsification system
- Gemini Phaco & Vitrectomy system
- Millenium-Advanced Cataract and Vitrectomy System
- Glautec Excimer Laser for Glaucoma
- Zeiss YAG Laser
- Zeiss PDT Laser
- Optical Coherence Topography (OCT)
- Zeiss Digital Fundus camera
- Humphrey & Medmont Fields Analyzers
- Kowa Fundus camera
- OCULUS pentacam
- Topcon Fundus cameraz
- YAG Laser YC 1800
- OPD Scan
- AMO –Signature Phacoemulsification system
- AMO- Compact with ICE Phacoemulsification System
- Applanation Tonometers
- Vitrectomy machine

DEPARTMENT-WISE WORK PROCESS

1) Reception

It is the first point of interaction between the patient and the hospital. The flow of activities at the reception is as follows:

- In case of new patients, basic details are taken and new ID is generated. In case of an old patient, his profile is accessed upon arrival.
- New case incident is generated.(Unique Hospital Identification Number)
- After registration, blue slips are issued. The time of patients' entry into the system, doctors name and consultation charges are mentioned in these slips. They are sent

along with the files to the OPD directly. These files are color-coded. Blue files are for patients with appointment and pink files are used to indicate walk-in patients.

- Charges for consultation are collected at the reception itself and daily reconciliation is done.
- Appointment for next visit may be taken at the reception. However, appointments on phone are given only at the EPBAX cell.
- The "Appointment" module of I-Care (Hospital HMIS) is used at the reception.

  Different color codes are given to manage patient flow, i.e.

  - Blue — New appointment
  - Yellow — Follow up
  - Purple — One day post-operative
  - Light purple — One week post-operative
  - Dark pink — Three weeks post-operative
  - Brown colour — Check in
  - Green colour — For Lasik work up
  - Orange — For surgery
  - Red — Any information and blocks in OPD

2) EPBAX

- The electronic private automatic branch exchange is equipment that has made day to day working in the offices much simpler, especially in the area of communication.
- EPBAX is located in the basement reception and serves both the external and internal communication needs of the organization. Main features are call transferring, call forwarding, auto conferencing and automatic redialing of numbers found engaged in the first trial.
- EPBAX staff is responsible for giving appointments to patients on phone.

3) Counseling

- Upon his visit to the doctor at the OPD, a patient may be advised a specific procedure/surgery. Obviously, the patient would need some counseling to understand various options that are available to him.

- The counseling department basically acts upon the advice of the doctor and explains the relevant facts of the procedure/surgery to the patient.
- It includes discussion about the exact procedure, choice of lens, cost and investigations required.
- Once investigations are done, patient reports at the reception with his investigation results. They are put in a yellow folder and sent to the doctor. If the patient is fit for surgery, he again goes to the counseling room and a date is assigned to him for his surgery.
- A pre- and post-operative instruction card is given to the patient, which contains all necessary details regarding precautions and medicines.
- For CGHS patients, counseling procedure primarily remains the same. Again, they may fall in two categories:-
  a) Serving – Permission letter and copy of ID card.
  b) Pensioner – Only permission letter.
- Patient is informed about any extra amount that they might have to pay from their pocket in case they opt for an expensive lens. Discharge summary of CGHS patients is also prepared at the counseling room.
- For TPA patients, counselors tell them about the cashless procedure in brief, get the TPA guidelines and pre-authorization forms of their respective TPA's signed and submit them to the TPA cell.
- In addition to these, they inform all the patients about the timing of their surgery and give them preoperative instructions one day prior to their appointment.

4) Pharmacy

- With the increasing demand, the pharmacy at the Centre for Sight was established in February 2007, which just in few months of its establishment, has now grown in its size as well as contents. The pharmacy functions during the regular hospital hours of 9.00 AM to 6.00 PM.
- The facilities include:
  - All commonly used drugs are available to meet the demand.
  - Fully computerized transactions, generation of bills etc.

- Appropriate drug pricing.
- Computerized inventory control system that gives information about drug expiry date, reorder status for a particular drug, pricing etc.
- Good vendor relations and a little lead time in the receipt of order placed.

5) OPD

- Each and every stage of an eye examination is very crucial and important. Thus, the initial and foremost phase of examination (i.e. Outpatient Services) at the Centre for Sight is designed in such a way that it provides consistent monitoring to the patients by the staff with extreme comfort level of waiting areas, OPD working hours till the hospital functions, hence ensuring enhanced treatment facility with flexibility for the patients.
- The facilities include:
  - Spacious OPD located at both the ground and first floor with the Premium OPD located at third floor.
  - More than 20 chambers for the Consultants
  - Equipped with the latest technology equipments to examine and diagnose patients
  - Access to more than 14 renowned consultants, many of whom were faculty at AIIMS previously.
  - Professionally skilled and trained staff.

6) Optical and contact lenses

- The optical shop at Centre for Sight has an extensive selection of frames for every preference – traditional and designer for all ages in wide range of prices.
- The facilities include:
  - Skilled staff to help select the right frame and lens
  - Patients can choose from a variety of non-branded and major branded frames including Tommy Hilfiger, Versus, Gucci, Police, Guess, Versace, D&G, Hugo Boss, Carrera etc.
  - High standard of craftsmanship are set.
  - Quality of dispensing, using latest technology.
  - High accuracy.

- Time taken for making the spectacles is very less.
- Even the most difficult and complicated prescription can be made with ease.
- Other facilities like free adjustments, nose pads and repairs on any eye wear purchased at the optical are also provided
- Wide range of contact lenses i.e. soft, semi-soft, hard and bandaged contact lenses are available all the time. Colored lenses for cosmetic purposes can be made available in 24 hours time.

7) Billing and Accounts

- The main billing section of the hospital is located on the ground floor, near OPD. All the cash billing for empanelled, TPA and general patients is done here. Credit billing for empanelled patients is done in the basement office. Salient features are:
  - Entry in the department is for authorized personnel only. No one can enter until the security code is activated.
  - Daily reconciliation of receivables is done. Cash generated in other centers is also analyzed routinely in the main centre.
  - Reconciliation of accounts is done.
  - All the credit bills generated in a month are submitted within the first week of next month.

8) Medical records department

- This department in located in the basement along with the stores section. Approximately 40 inpatient records are generated each day. All the records are filled and sent to the store for filing. Here, all the records are supposed to be checked for deficiencies in the basic details, need to set them in order of hospital numbers and then to be filed in box files. Observations are:
  - These files are arranged vertically in racks made for storing the records.
  - A register is maintained in which the entry of all received records is done.
  - No set pattern is followed for filing and the storage space is insufficient.
  - Files of all the TPA/Insurance patients are also kept in the same department.

- Most of the older files are having incomplete data about patient's treatment, but the same information can be generated from the hospital information software.

- This department is centralized where records for both OPD and IPD patients are maintained.

9) Stores

- Hospital stores have the main responsibility of arrangement of lenses for surgery according to the patient's requirement. All details regarding this are taken from counseling 1-2 days prior to surgery so that right lens could be arranged for cataract patients. All other inventory is also maintained and checked routinely. Store is centralized and requirement of all other centers is fulfilled on a monthly basis depending on the requisitions generated by them. Inventory mainly consists of:
  - Consumables used in the surgery
  - OT drugs
  - Stationary and miscellaneous items
  - Lenses
  - Linen for OT
  - All the material required for camps
  - General purpose consumables like tea/coffee, cleaning agents etc.

10) IT department

- Main responsibility of this department is to see that all hospital systems and the server are working properly.
- The department gives assistance in case there is any problem related to hardware or software.
- Maintenance of hospital information software as well as incorporation of changes and its updation is done.

11) Operation Theatre

- 2nd floor has three OTs – Cataract, Retinal, Glaucoma and other surgeries are performed in these OTs.

- One pre-operative room and post-operative lounges are also on 2nd floor
- 3rd floor – Surgeries for refractive errors are done

12) Work-up room

- It is located on 3rd floor and is for refractive surgeries.
- Before a surgery, some work up is required to be performed on the patient. This includes: -
  - Refraction
  - Wave Scan – counter-checking of refraction.
  - Ob Scan - To check cornea's curvature
  - Aberometery – To know the final status of the eye.
- This information is stored in a memory disk, which is used during the refractive procedure.

13) TPA

- Hospital is empanelled with 31 TPAs; the list includes all major and some minor TPAs approved by IRDA.
- Department carries out all the processes required for cashless hospitalization and further settlement of claims.
- Maintains the database of all the cases processed till date in files and folders,
- The hard copies of all the claim documents are kept in box files stored in the MRD.
- All recent and old outstanding cases are kept separately for reference.
- The department gives assistance and guidance to patients regarding cashless hospitalization, and also help them in filing for reimbursements
- Empanelment with new TPAs and renewal of the same is one of the most important tasks that has to be carried out in coordination with the marketing department.
- Tracking of TPA receivables is done on a routine basis and received payments are checked for deductions, TDS, short payments etc. These deductions if not appropriate, are informed to TPAs and reason is sought.
- Co-ordination with billing and accounts department for financial status reconciliation.
- Presenting the current status of TPA financial recovery to the management.

14) Hospital Website

- Centre for Sight is having a very informative and interactive website
- Wide range of information about the eye, all kinds of eye ailments, signs and symptoms of various eye diseases and treatment options are available for the reference
- Host of information about the hospital, services, departments, doctors, facilities etc is also shown on the website.
- There is a provision to register online and take appointments.
- Location map and contact details are available for easy accessibility.
- Website is kept updated about all recent activities and changes.

15) Administration and HR department

- The main role of hospital administration is to oversee day to day operations of all departments.
- Makes sure that the hospital is working efficiently and providing adequate medical care to patients without causing them any discomfort
- Acts as a liaison between governing board, medical staff, and department leaders and integrate all the activities so that they function as a whole.
- Project management, budget planning, CFS expansion-related activities, and making key decisions are some of the important activities in which administration plays an important role.
- Human resource department is concerned with:
    - Recruitment, training and induction of new members.
    - Daily attendance of staff
    - Leave record for the current year
    - Making policies related to code of conduct
    - Performance appraisal of staff

16) Hospital marketing team

- All the marketing activities for the main centre are carried out from the corporate office in Green Park.

- All other centres have their own team of marketing executives and they report to the centre managers and in the head office at Green Park.
- Major activities include:
    - Arranging for camps, live shows, talks and continuing medical education (CMEs) programmes
    - Keeping the hospital website current and updated
    - Designing logos, charts, pamphlets, and brochures necessary for staff and patients education.
    - Empanelment with PSUs, TPAs, and other agencies for enhancing business.
    - Tie up with hospitals and doctors (small nursing homes) for referral and diagnostics.
    - Maintenance of public relations and networking inside and outside the hospital

1.2 Areas Worked in During the Internship

The main objective of internship is to gain exposure and hands-on experience in work related to the field of managing a health care organization. The internship period is necessary to gather working knowledge of a hospital setup and undergo on-the-job training to know about the various departments in a hospital in detail.

As a part of my training at the Centre for Sight, I was given an induction schedule whereby I had gone through all the departments and their work processes in details. The induction programme was for 10 days and it helped significantly in gaining knowledge about hospital operations. This included a visit to all the peripheral centers.

The area of hospital administration allotted to me was operations which mainly included looking after stores and inventory management apart from handling the general administrative activities. It also included working for the NABH audit where I was involved in preparing certain indicators for NABH like indicator for OT utilization, equipment downtime, stock out occurring in stores month-wise, and conducting internal audits of stores, pharmacy, operation theatres and biomedical equipments on a weekly or a fortnightly basis. I was also actively involved in ISO ISO 9001:2000 Audit that took place on 14th March, 2011.

1.3 A Brief Report on Managerial Tasks done during the Internship

The main department of the hospital operations in which I was engaged in was in managing the stores and inventory management at the Centre for Sight. I was also involved in working for NABH and the ISO audit.

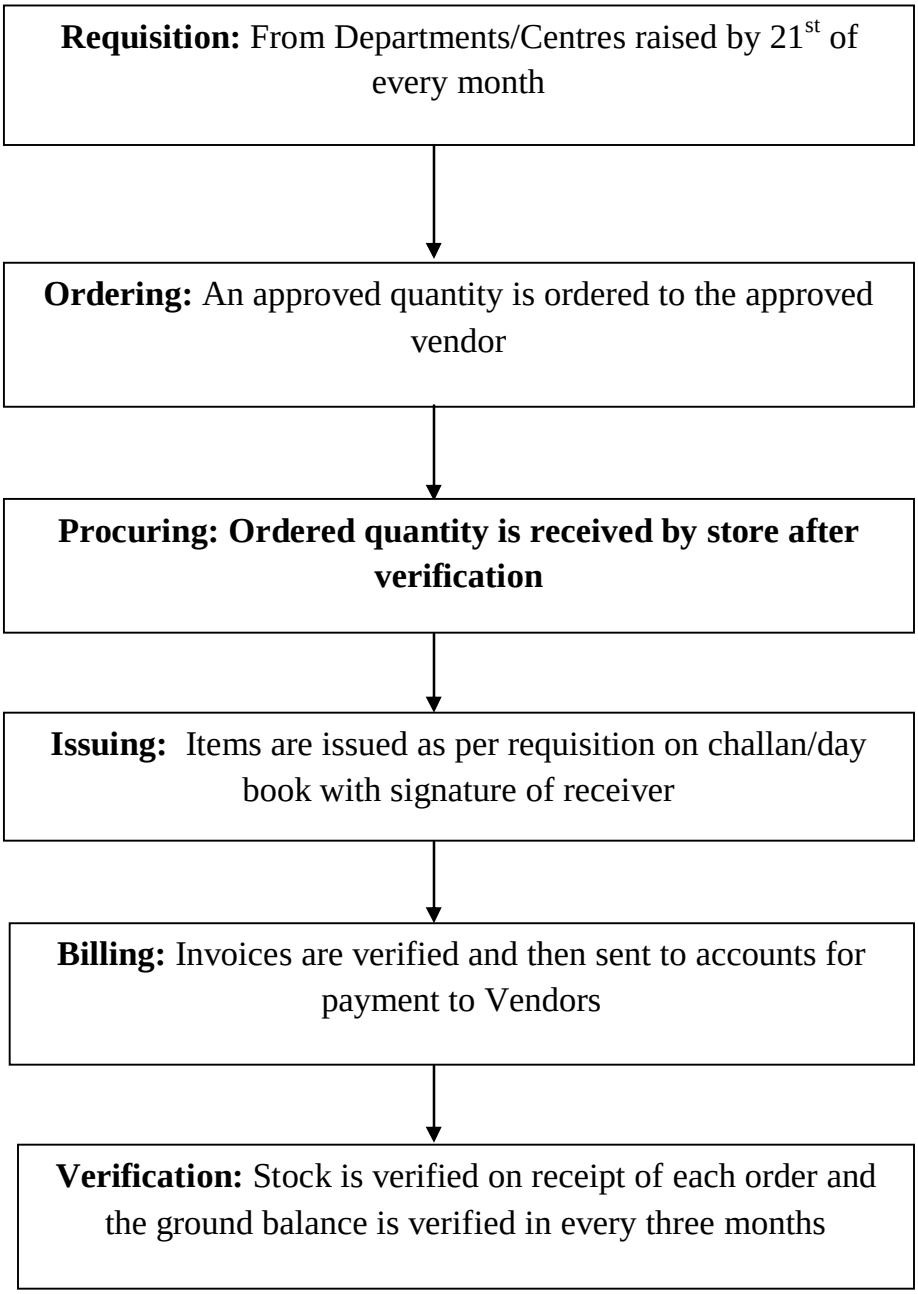
1.3.1 Stores and Inventory Management

The main area I was involved in at the Centre for Sight was in managing the inventory in the hospital stores. During the first few days of my internship, I first understood the whole process of the Stores Department so as to have an in-depth knowledge of its working. I also studied the protocols of this department for further enhancing my understanding about it. The work flow in the Stores is as follows:

1. Procuring of inventory at Centre for Sight is centralized; drugs, non-drug items and other consumables are procured by the Store of the main Center of Sight at Safdarjung Enclave, form where, these are distributed to various peripheral centres before the 5th of every month
    - Suppliers and Vendors of various items are fixed. These are approved based on five parameters: Supplier Availability, Quality, Cost, Delivery Schedule and Meeting Emergency Demand. These vendors are routinely evaluated on yearly basis, and also as and when required.
    - The orders are placed to the approved vendors only.
    - However, there are a few exceptions. The order may be placed to a vendor which is not approved in case of emergency, unavailability of items with the approved vendor, or a new item is requested. Approval from Asst. Manager – Operations is required.
2. Drugs, non-drugs and other consumables are classified as ABC on cost basis. The samples received from different vendors for new items are received in stores and then issued to OT/ concerned department along with Sample Feedback Form, which is filled by the Consultants and submitted to administration for further processing.

3. In case of Stock Out/Emergency Purchase a form is filled by the store keeper and approved by the Asst. Manager - Operations for the same.

Flow Chart - Process Flow for Stores



1.3.2 Tasks Performed in the Stores Department during Internship

1. Stock Verification: I was involved in verifying the stock of the stores:
   - I used to verify the stock monthly by verifying if any errors were made in making entries in the stock ledgers as regards the quantity of the consumables received and issued to the stores.
   - I was also involved in physical verification of the stock by annual inventory method at the close of the financial year i.e. on 31st March 2011. In this verification, I matched the entries mentioned in the stock ledgers of drugs, non-drugs and stationery with the physical quantities present in the stores.
   - After this, a report was made regarding the discrepancies noted which was discussed with the CEO of the hospital on 1st April 2011 along with the stores personnel.
   - I verified the entry of the opening stock in the new ledgers for 2011.
2. Buffer Level: A list was made in coordination with the store staff about the buffer level of all the consumables used so as to prevent any kind of stock outs.
3. I was also responsible for verification of the challans, the requisitions received form the peripheral centres, with the stock ledgers again to verify if any quantity as being wrongly written.
4. At the end of each month, I used to verify the invoices of the bills and then send it to the accounts department for payment of money to the vendors.
5. Evaluation of the vendors was done based on various parameters like quality, cost, stock availability, meeting emergency demand, stock availability, etc. I updated the new rate list of the various consumables and also the new vendor list.
6. Edited and updated the protocol of the stores department.
7. I was involved in giving my inputs for the parameters that can be introduced in the new software being introduced in the stores department by the company, Srishti. For this purpose, I prepared the item master list and the supplier master list which included the codification of all the items or the consumables so that they could be located easily in one go along with each item being divided into the following categories like:
   - Item unit
   - Stores Category
   - Item group

- Item type
- Item subtype
- Manufacturer name
- Generic name
- Supplier type

8. Coordinating sending various items and equipments to the peripheral centres for surgeries like endo-scleral buckling surgery, lasik surgery and C3R surgery.
9. I prepared the formats of different types of forms like the change of vendor form which is needed if there is a need to place the order to any other vendor other than the authorized vendor due to circumstances like short delivery, urgent requirement, poor quality etc. Various formats of forms included additional order format to place any additional order, stock out report format, rejected stock report, and sample feedback form.
10. I was involved in verifying the order-slips with the bills to check if any additional order was placed or not.
11. Prepared reports on consumption of tea powder, coffee powder and tea bags and also the blue folders at Centre for Sight.
12. Prepared the stock out report, emergency purchase report and additional order report for NABH indicator analysis
13. Updated different types of record maintained in stores along with preparing a file for the formats used in Centre for Sight for ISO Audit. Was also present during the stores audit to answer any queries of the auditors.
14. I was also involved in verifying the quantity of different types of lenses issued to various Centres and checking if there was any overconsumption or if entry was missed in the IOL Power register.
15. I was responsible for installing any new equipments at Centre for Sight and coordinating with their engineers for different procedures like installation, data transfer and transport of the old equipment.
16. I was responsible for maintaining the equipment maintenance record whereby in case of any problem with the equipment, a designated person of the concerned department would report to me by filling the equipment maintenance form and the problem equipment was having. After that, I would coordinate with the engineers to rectify the problem.

17. On a monthly basis, I had to regularly update the equipments and other inventory present in various department of the hospital along with their model no. and company name.
18. Conducted internal audit of stores and also conducted the training of the stores personnel on the standard operating procedures of stores.

1.3.3 Other Administrative Activities Performed

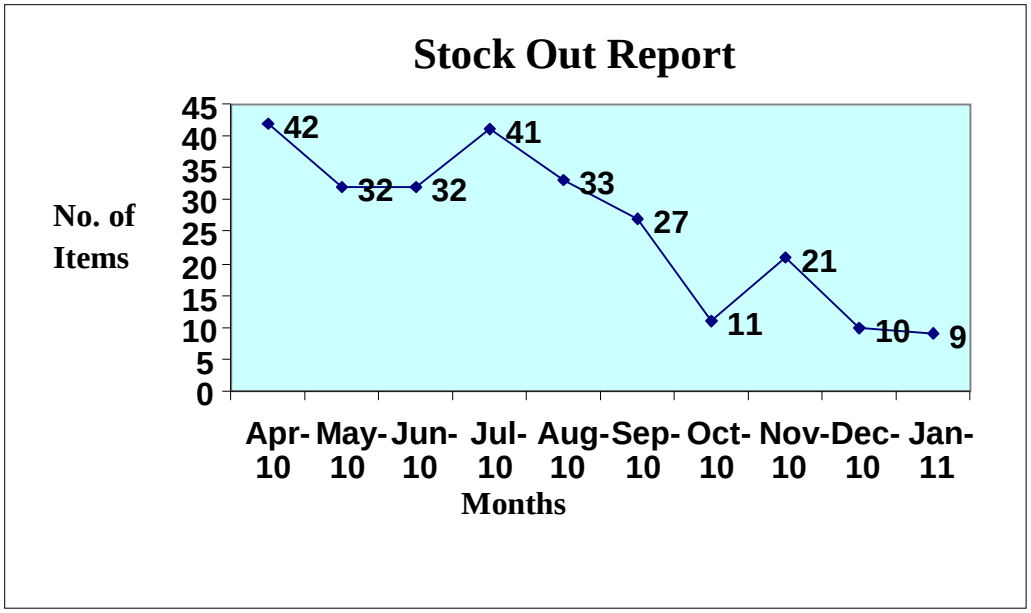
- Prepared the duty rosters of the doctors for the outpatient department and the operation theatre. Also prepared the on-rotation duty roster for doctors, early morning and evening duty roster, and roster and schedule for outstation visits of doctors.
- Prepared on a monthly basis the Directorate of General Health Services report regarding the OPD attendance, IPD attendance, and number of staff at Safdarjung Enclave, Preet Vihar and Rohini Centres.
- On a monthly basis, prepared report on the cornea transplants done at Safdarjung Enclave Centre.
- Carried out internal audits of pharmacy, biomedical equipment and operation theatres, and prepared the report on any non-compliance observed.
- Prepared a report on the vaccination status of employees for the HR department
- Sent the consumables or other items needed at the new branches of Centre for Sight like Rajouri Garden and Gurgaon. The items included lenses, inventory etc.
- Prepared a file consisting of the academic certificates of all the doctors and the OT staff for the new centre at Rajouri Garden.
- Calculated the OT utilization rate on a monthly basis as a part of NABH indicator analysis along with another indicator on equipment downtime.
- Prepared a presentation on the cataract surgery along with the process flow of what all tests the patient of cataract had to undergo in OPD.
- Prepared a presentation on infection control in the hospital.
- Prepared the list of patients to be called or to be fixed for appointments
- Answered queries of patients related to various surgeries like the cost of the surgery, duration, treatment procedure, insurance issues and availability of the doctor.
- Helped in making the purchase order for purchase of the Genevac vials for Hepatitis B vaccine (10 ml) for the vaccination of the staff of Centre for Sight

1.4 Reflective Learning during Internship

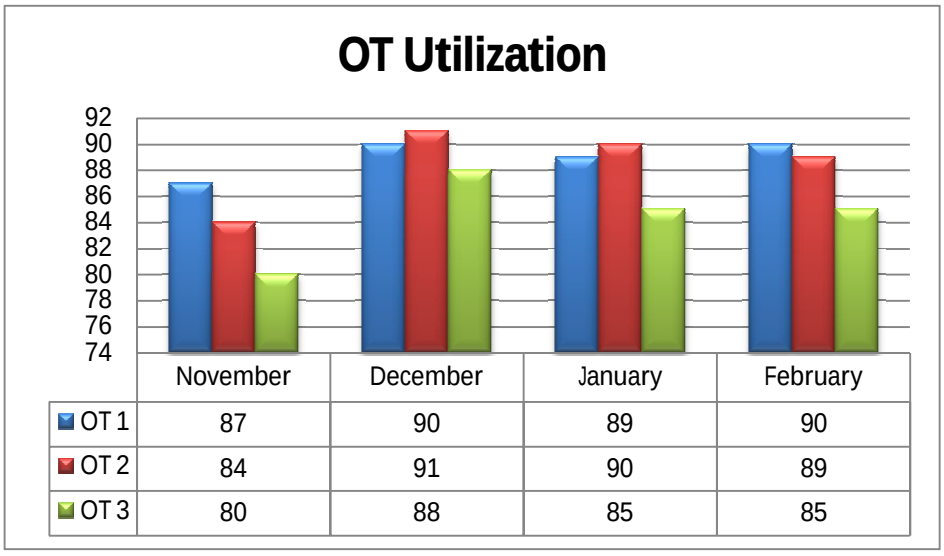
Following was the reflective learning during the Internship Period:

1. I learned the functioning and management of stores in general and how inventory is managed.
2. I learned how important stock verification is for an effective inventory management. It is an essential component of the material audit. The surplus and deficiencies revealed by stock taking is a good indicator of the efficiency and effectiveness of storekeeping methods, controls and procedures. All healthcare institutions should lay down policies and procedures for stock verification. Surprise verification of stores is the cornerstone for successful implementation of stock verification in healthcare institutions. The purpose of stock verification were as follows:
    - Verification of the stocks held physically against the quantity shown in the ledgers
    - Identification of areas which require more control (e.g. those areas where minor discrepancies are frequently observed).
    - Disclosing any fraud, theft, loss

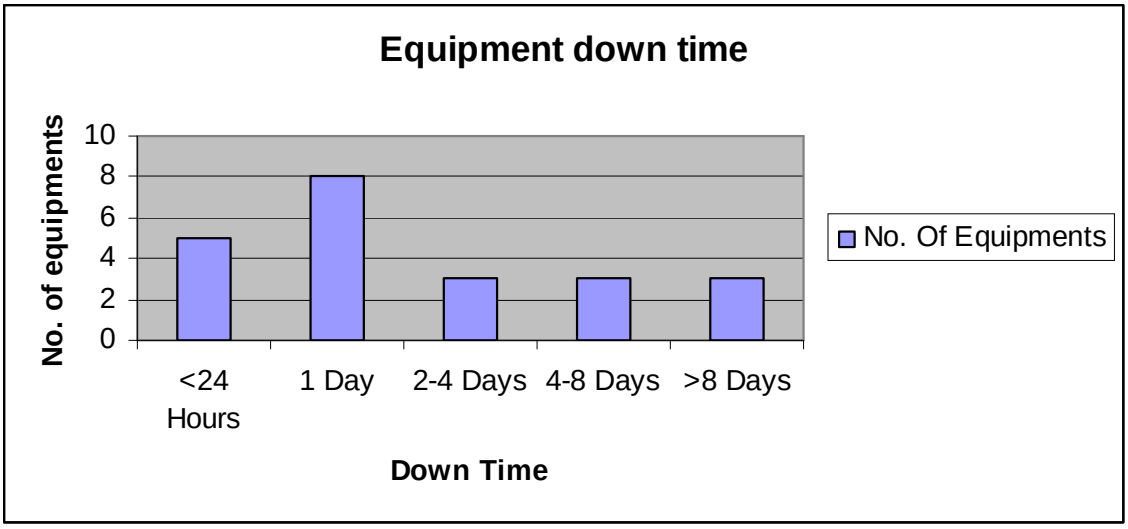
    The important causes of discrepancies were:
    - Issue without indents - This was common in medical stores, especially if asked for as urgent requirements or life-saving measure by user departments
    - Improper check on receipt of pharmaceutical products
    - Pilferage, theft
    - Error in posting of entries i.e. entry made in 'receipt' column rather than the issue column.
3. I learnt how to evaluate various suppliers or the vendors based on four parameters (quality, cost, meeting emergency demand and stock availability).
4. I learnt how to do codification of the inventory in stores. I did the coding according to the combined alphabetical and numerical system.
5. Stock outs occurring in stores could also be identified due to the report made on the monthly basis which is as shown below:



6. I learnt to calculate the OT Utilization Rate and Equipment Downtime for NABH indicator analysis. These are shown in the figures given below.



	November	December	January	February
OT 1	87	90	89	90
OT 2	84	91	90	89
OT 3	80	88	85	85



7. I learnt how to make the report for the Directorate of General Health Services. Also learnt how to prepare the cornea transplant report on monthly basis.
8. Preparation of order-slip and its verification was learnt during the internship period
9. Learnt about the new software to be installed in the stores by the company 'Srishti'
10. Equipment maintenance and handling their breakdown was also learnt.
11. I learnt how to do internal audits and to conduct training in various departments.
12. Learnt about different types of lenses and also verified their consumption in peripheral centres.
13. Learnt about various types of eye surgeries and procedures, precautions to be taken before and after surgery, their cost and insurance related problems.
14. Learnt how to coordinate supply of various requirements to the new Centres. Requirements for lasik surgeries were also learnt.
15. Verification of challans with stock ledgers was also an important learning experience.

PART II: DISSERTATION

INTRODUCTION

Introduction

Consumption of various kinds of goods and services is the part and parcel of human life. Almost every activity in which a human being may be engaged, involves consumption of goods and services. It has been stated that consumption is the sole end and purpose of all production.

In any enterprise, materials are a major cost factor in any enterprise. About one-third of the annual hospital budget is spent on buying materials and supplies, including medicines.[1] In health care institutions, about 40 percent of the budgetary allocation is on procurement and management of stores. Materials in the hospital are the second major area of the consumable cost, and approximately 60% of the total consumable cost is comprised of cost of medicines and disposable items. Approximate 20% of the medicine cost can be saved without impairing the quality of care and maintaining the satisfaction of the patients. In this era of cost containment, it is imperative the health care professionals should make fiscally prudent decisions.

Consumables are the supplies that are used in support of normal operations. Regardless of what the items are, if they are high value, high volume or readily pilfered, they should be inventoried and their usage benchmarked. Conducting regular inventories of these items will reduce loss, avoid surprise shortages, and allow the usage to be benchmarked against a volume measure of business.

To ensure that the materials are utilized properly and there is no wastage or pilferage, tracking of their consumption should be foolproof in the health care institutions or the hospitals along with proper inventory control. Inventory control is very essential in a developing country like India. India is a country of scarce resources and it is the primary responsibility of each organization whether it is a hospital, an industry, private enterprise or a government department, to ensure optimum utilization of available resources while providing good service or quality patient care.

Due to inflation, hospitals are faced with budgets that do not balance, prices that are not stable and costs that are not controlled. In this atmosphere, the hospital management is faced with choosing the alternatives of either lowering the quality of care, or adopting ways and means to reduce the cost on inventories. It is estimated that thousands of crores of rupees are being

blocked in inventories. Hence there is a strong need for developing an efficient and effective inventory control system.

Inventory Control is a tool of management which is used to maintain an economic minimum investment in materials and products for the purpose of obtaining a maximum financial return. Both quality and cost of service together contribute significantly to determine the level of patient care in a hospital since efficient care at a minimum cost is a primary obligation of the hospital. The entire concept of inventory control stems out of the basic economic principle "stretching the limited means to meet the unlimited ends"

Inventory control also helps in preventing pilferage as it is the major cost containment measure. Any measure taken to prevent pilferage is a step towards reduction in cost and is an essential requisite to prevent the occurrence of thefts/scams in stores of healthcare institutions where the consumables first arrive and are then distributed from there. If pilferage is not prevented, it leads not only to resource waste but also affects pharmaceutical product availability and procurement planning since the utilization figures would be faulty.

A strict inventory control is also necessary because its main principle is that the orders are placed frequently for the items whose annual consumption is high, so that the inventory level is as low as possible. However, for items whose annual consumption is not high, sufficient stocks are maintained and orders are placed less frequently

However, it is impossible and unnecessary too to monitor every drug used in the health system. High-cost and high-volume drugs come in priority, whose intervention is likely to cause the greatest clinical and economic impact. In the whole process, it is important to trace the costliest medicinal products first (as they consume the major portion of the budget), and then design a strategy to further study and identify their use pattern. The study of the use pattern will help in designing appropriate corrective measures. ABC analysis is an important tool used worldwide, identifying items that need greater attention for control[2-6]

ABC analysis is a method of classifying items or activities according to their relative importance It is also known as “separating the vital few from the trivial many” because, for any group, several items contribute to a common effect, but only a relatively few contributors account for a majority of the effects. The analysis classifies the items into three categories: the first 10-15% of the items account for approximately 70% of the cumulative value (cost) (category A), 20-25% items account for a further 20% of the cumulative value (category B) and the remaining 65-70% items account for a mere 10% of the total value (category C).[2-5,7-10]

New computer technologies like the RFID technology and the Bar coding can also help in tracking of the consumption of the consumables. Using patented RFID technology, the usage and consumption of consumables or materials can be tracked in real time. RFID Technology identifies tagged items through radio communications between an electronic reader and tags containing data on micro chips. Tracking of the consumption is also done through Bar coding. In this, each item in the store is labeled with a universal product code identifying the item. This helps in the inventory to stay updated at the same time.

At the Centre for Sight, utilization patterns of consumables in the operation theater have not been studied. In order to place inventory control in position, it is desirable to know these patterns. Hence the present study was undertaken.

Problem Statement/Purpose of the Study

In the Operation Theatre at the Centre for Sight, the consumption of the consumable materials are being tracked only through a consumable sheets which is sent every month to the stores and then to the accounts for further cost analysis. There is no system to ensure whether the consumption of the consumables in the operation theatre is foolproof i.e., strict inventory control regarding the consumption or the usage of the consumables is not in place. A strict inventory control is essential for preventing any kind of wastage, pilferage and also for cost containment. Thus I took up this dissertation to study the consumption patterns of the consumables and their correlation with the workload of the patients in the operation theatre. This would also give an idea whether their utilization is appropriate or not. This study was also done so as to recommend a strict inventory control regarding the usage of the consumables at the operation theaters of the Centre for Sight.

REVIEW OF LITERATURE

Review of Literature

The operating room (OR) of any hospital has an aura of mystery.[11] Bold signs restrict personnel. Special attire, hats, and masks hide faces and bodies from view. Patients enter, are anesthetized, 'cut and opened', 'repaired' and closed, and emerge, groggy but cured.

The mystique of the OR can create significant barriers to managing expenses. Often there is the underlying hint of clinical blackmail. Cost reductions and restricted spending will drive away key surgeons. Financial managers should remove barriers to efficiency, cost effectiveness, and cost reduction in the OR relating to inventory and inventory control. Strategies to achieve this include using members of the medical staff to set product standards and negotiating more advantageous contracts with vendors.

Controlling operating room inventory is critical to cost reductions in the OR. In an operating room suite of eight or more rooms, inventory value may exceed $1 million. This sum can be reduced by 10 percent to 30 percent, not including related savings such as holding costs. Although the inventory control process is lengthy and complicated, it is well worth pursuing.

Controlling OR inventory requires a detailed inventory plan that considers the complexities and nuances of the surgical suite. The basic tenets[2] of an OR inventory plan are:

- Count
- Value
- Reduce the value
- Implement controls.

There are several reasons for using this inventory plan. Counting and valuing the inventory helps create a plan for inventory reduction. Second, and perhaps more important, this process provides key information for negotiating with vendors. Melson and Schultz[2] explained the ways of overcoming the barriers which hinder in inventory control in the operation theatre**.** According to them, simple controls can reduce a hospital's operating room (OR) inventory by 10 percent to 30 percent. Controlling OR inventory involves a four-step plan: count the materials, estimate their

value, reduce the value, and implement controls. This process provides valuable information for negotiating with vendors. Armed with inventory data, financial managers may be able to save their healthcare organizations $200,000 or more through carefully planned vendor meetings. The ability to complete this negotiation process is an equally important reason to count, value, and analyze the OR inventory. Also, product standardization and vendor relations are critical factors in reducing the OR inventory**.** It was suggested that the process that leads to supply cost savings in the OR begins with a complete physical inventory, and the approach is very different from that of a storeroom or central supply inventory**.** Market shifts can also yield valuable savings to an institution.

The only truly useful OR inventory counts everything. It accounts for the total value of all single patient use items in every location of the OR -- not just the storage areas, but also the operating rooms and the special carts. This approach permits the comparison of inventory internally by fiscal year or externally among peers. Less complete inventories do not provide these advantages.

Managing the process is also another way of inventory control in operation theatre. An effective inventory control team includes staff members from materials management, operating room, administration, and medical staff. The concept of team brings together diverse experience and needs; and helps ensure successful implementation of cost control measures. Administration's participation in inventory control is especially important in mediation with physicians and working toward product standardization. The OR manager's role is to lend support to the project and involve the appropriate OR staff. Materials management representatives, the manager, and the staff member most familiar with the OR products supply vital purchasing information.

Several measures have been suggested to improve the inventory control in operation theatre.[(2)] These include the following:

- Determine the primary stocking location and stocking procedures;
- Develop procedures for stocking secondary locations, such as suites and specialty carts;
- Identify obsolete products;
- Determine the maximum on-hand quantity based on average reorder time and usage;

- Determine the mechanisms for depleting excess stock;
- identify the reorder mechanisms and time frame;
- Identify the person responsible for maintaining the system; and
- Develop order mechanisms such as par-level stocking sheets by location.

Many operation theaters do not have a strict inventory control or do not have an effective inventory control system in place. Some of the reasons[12] cited by the staff of the hospital for lack of an effective inventory control system in operation theatres are:

1. The hospital may say that their focus is on the patient and it can't expect nurses and doctors to become "bean-counters" a they are too busy.
2. Supplies and materials are often needed urgently. The hospital cannot slow down to fill out paperwork or transact what it needs, because the hospital feels that it is too time consuming.
3. The hospital cannot afford to hire any new FTEs to track materials, because it considers this to be just another overhead expense, which is not required as the costs need to be controlled.
4. Simply stating that the things are just not done in that way in a hospital.

Rahn R[12] has given some solutions to the above mentioned problems. The simplest suggestion is to have a quick-response stockroom in the OR, with individuals assigned to inventory control, inventory transactions and patient service for materials**.** An intermediate-level solution would involve the use of bar-codes to speed up transactions and reduce errors. Nurses and technicians can be trained to use the bar-code system, and reduce the workload on the materials staff. Bar-coding is not a new technology, and virtually every inventory system supports it. A high-tech solution is to install RFID-based cabinets. An RFID cabinet is a locked storage container that is able to track what is inside via a Radio Frequency Identification tag attached to each high-dollar item. In order to unlock the cabinet, an employee badge and a patient case number are needed. The RFID cabinet has the advantage of being able to capture billing information in addition to inventory information, and greatly reducing human error.

Introduction of Hospital Information System in Hospitals has also helped to improve the managing of inventory in the hospitals. Chadha SR, et al(13) developed a Decision Support System (DDS) for optimizing the inventory management in the Operation Theatres**.** For this optimization, they coined the dossier concept. Dossier is the medical inventory for an operation, which includes items like drugs, sutures, surgical, sterilized items, etc., associated with the operation. These items could then be issued and returned and can finally be updated after the operation. The Inventory DSS basically provides the usages of these items and acts as a feedback mechanism to optimize the quantity that needs to be fine tuned in each dossier. The template that has been proposed by them consists of an OT Dossier Master which has different categories and needs to be entered into the system. The categories could include whether the item is a store item or not, item type for entry (whether surgical or anesthetic), item name and the item quantity. Such type of a template would help in tracking the average consumption of the items for a particular operation. This would help the hospital management, surgeon and patients. By studying the pattern of item consumption during similar operations, the hospital management can fine tune the optimized number of items required per operation. This enables them to maintain inventory by taking appropriate actions and projecting the stock requirements in advance. The surgeons gets the entire items ready as part of preparation of the operation. This is specifically advantageous to hospitals in which patient has to get the items for operation as it enables the patient to have a complete understanding of the items required and the budgeted cost for the same well in advance. This also facilitates the Hospital Management in clearly defining the costing of various operation packages

The major reason for studying the consumption pattern and utilization in hospitals, apart form having a strict inventory control, is cost containment. Controlling the costs which are incurred due to utilization of the consumables is an important aspect as operation theatres are the major cost centre in the hospital and so appropriate allocation is an important part.

Richharia HH et al[14] conducted a study with a view to determine the scope of utility and efficacy of inventory analysis system and also to educate staff working in the depot regarding techniques of inventory analysis system. Two hundred and ninety two drugs were selected and were studied for one year (April 1991 to March 1992). The expenditure on drugs without application of inventory analysis during 1990-91 was Rs. 60, 82,926. After application of inventory analysis technique, the expenditure was only Rs. 51,61,589. A significant reduction in the consumption pattern of drugs was noted which led to a significant reduction in expenditure by Rs. 9,21,337. An uninterrupted supply of vital and essential drugs was ensured to great extent.

Devnani M et al[15] used ABC and VED analysis in the pharmacy store to identify the categories of items needing stringent management control. Their study showed that if ABC anlaysis is considered alone for drug inventory it would effectively control the recommended 58 (13.7%) items in the A Category, with almost 70% of ADE of the pharmacy. This is the group requiring greater monitoring as it has fewer drugs from the desirable category. Categorization of the drugs by the ABC-VED matrix model also helps to narrow down on fewer drugs requiring stringent control. In another study conducted in a 1,500-bedded state-funded hospital by Pillans et al[16], review and control measures for expensive drugs brought about 20% savings.

In another study[17] Polk R, et al reported the consumption of adult antimicrobials in 130 hospitals in USA by using Defined Daily dose and the correlation analysis. They concluded that on measurement of aggregate hospital antibiotic use by DDDs per 1000 patient days and DOTs per 1000 patient-days was discordant for many frequently used antibacterial drugs. This was because the administered dose was dissimilar from the DDD recommended by the World Health Organization. DDD methods are useful for benchmarking purposes but cannot be used to make inferences about the number of DOTs or relative use for many antibacterial drugs.

Various methods of effective requisition and issue system in hospitals have been discussed by Sakharkar BM.[18] Adequate control by stores officer over issues and distribution would ensure that the wards and the departments are not allowed to hoard supplies. According to the author, three types of issue and distribution systems to the various departments of a hospital are possible.

1. Each ward/department keeps track of its inventory levels. When the ward or department stock becomes low, a requisition for the required materials is forwarded to stores, which issues the materials.
2. In the topping-up system, the maximum stock level for each item for each ward/department is predetermined based on their usage. At specified intervals, the stores person visits the ward/department, checks the stock in balance, and replaces the depleted stock.
3. A modification of the above is that the stocks of the ward/department are held in a cart and a similar cart is also kept full in the stores with predetermined level of all items for the ward/department. At predetermined intervals the stores person takes the full cart from the stores to the ward/department and exchanges it with the depleted cart of the ward/department.

In many hospitals, the users have a tendency to build up the private, unofficial inventory in the ward; this must be curbed.[18] Ward will normally not resort to these tactics if the inventory control system is working efficiently. Special attention in respect of "A" items and "V" items should be paid at the stores level and this can be achieved by stores office by monitoring the consumption levels of each ward, both in units and rupee value. By comparing the supply and the usage of materials to workload, effective control is possible. At the ward level, the nurse-incharge should be motivated to organize control over materials and minimize misuse.

Thus, an effective inventory control, particularly of "A" category of materials is essential in any hospital.

OBJECTIVES

Objective of the Study

The objective of the study is to assess the utilization patterns of the materials used in the Operation Theatre of the Centre for Sight so as to minimize wastage, prevent pilferage and to ensure that an efficient inventory control specific to the consumables selected for the study.

Specific Objectives of the Study

Specific Objectives of the study are:

- To identify the high-cost consumables utilized in the Operation Theatre by using the ABC Analysis technique
- To assess whether the consumption of materials at the operation theatre is commensurate with the surgical workload
- To analyze the relationship between workload and consumption of materials using correlation coefficient
- Use of a benchmark period to compare consumption of different consumables
- Develop a strategy for effective inventory control within the operation theatre department

MATERIALS AND METHODS

Methodology

Study Design

It was a cross-sectional study based on the observations done on two days with regard to the utilization of consumables in the operation theatre. Quantitative data was also collected from operation consumable sheets and stock ledgers. The study was conducted using the data of 6 months i.e. from September 2010 to February 2011.

Sample Size and Sampling Technique

- The utilization of consumables were collected from the OT consumable sheets for a period of 6 months (from September 2010 to February 2011).
- *ABC* analysis was done to select consumables in category *A* (i.e. those which constituted 80% of consumption-value) in the month of November 2010 [by calculating the consumption value of each material (Cost * Quantity)].

Phases of Data Collection

1 Actual utilization of the consumable during surgery was observed over two days during the study.

2 Secondary sources were used to obtain data on the quantity of the consumables consumed. This included the OT consumables sheets and store ledgers. This was done to:

- To perform *ABC* analysis to find category *A* items in the month of November 2010.
- Calculate utilization of category *A* consumables in each of 6 months of study.

3 Inclusion and exclusion criteria used for selecting the samples included the following:

- **Inclusion Criteria:**
  - All consumables which constituted 80% of total cost incurred in the purchase of consumables used in the operation theater. This was based on *ABC* analysis.
- **Exclusion Criteria:**
  - All consumables falling below the cut-off value of 80% as determined by *ABC* analysis.

4. A total of 20 consumables were identified on the basis of the consumption value (*ABC* analysis technique).

5. After this, the utilization patterns of the category *A* consumables were collected for 6 months (September 2010- February 2011) from the OT consumable records.
6. The data of the workload (total OT surgeries for the past 6 months from September 2010 to February 2011) along with types of surgeries were taken from the Hospital Information System.
7. Following assumptions were made before analyzing the data:
    - The consumption of the consumables must increase with the increase in the workload in the operation theatre
    - A variation of less than 10% of consumption above or below the benchmark set was considered as acceptable level of consumption.
8. Comparative analysis was done to identify the relationship between the workload and the consumption by using line charts and by applying correlation coefficient.
9. Consumables having positive and negative correlation with the workload of the operation theatre were identified.
10. To know the level of consumption in comparison to workload (i.e., whether the consumption was high, appropriate or low compared to workload), the month of November was taken as a benchmark with which the quantity of items consumed in other 5 months was compared.
11. Variation in consumption in different months (September, October, December, January, February) from the benchmark month of November, was calculated as percentage variation (consumption in a particular month – consumption in November/consumption in November X 100).This variation in utilization of consumables was then depicted through line graphs. Any variation more than 10% (low or high) was noted as unacceptable and attempt was made to find the possible reasons for that, including relation with type of surgeries done.
12. Root cause analysis was then done to identify the major causes leading to the high consumption of the consumable used in the operation theatre.
13. After identifying the major bottlenecks, recommendations were developed so as to ensure minimum wastage, to prevent pilferage and to ensure that an efficient inventory control in the hospital.

RESULTS

ANALYSIS OF DATA AND FINDINGS

- The consumables used in the operation theater in the month of November 2010 along with their consumption, costs, consumption-value and categorization by *ABC* analysis are listed in **Appendix 1.**
- Data in appendix 1 was used for ABC analysis. Twenty consumables were identified (10 drug and 10 non-drug items) which constituted 80% of total cost incurred on consumables **(Figure 1)**. These 20 items were used as samples for further analysis.

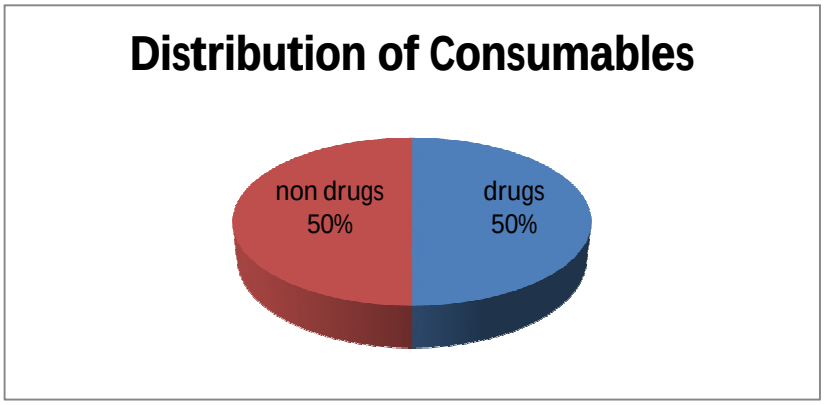


Figure 1: Category-wise distribution of the category *A* consumables

- The data for the types of surgeries is as shown in the **Table 1**.

Table 1: Types of surgeries in various months

Month	Cataract	Oculoplasty	Trabecule-ctomy	C3R	Penetrating keratoplasty	Squint	Diode laser cyclophoto-coagulation	Misc.
September 2010	348	24	7	4	5	3	5	76
October 2010	342	24	7	11	2	2	1	250
November 2010	342	13	7	4	3	2	3	212
December 2010	456	24	9	8	8	4	5	318
January 2011	322	15	7	4	2	7	2	257
February 2011	378	24	10	4	4	3	0	273
TOTAL	**2188**	**124**	**47**	**35**	**24**	**21**	**16**	**1386**

- The data for monthly workload and quantity of selected 20 consumables utilized every month is shown in **Appendix 2**.
- Positive or negative correlation of consumption with workload was determined using correlation coefficient (**Table 2 and Figure 2**) using MS Excel.

Table 2: Correlation coefficient of 20 consumables

S. No.	Name of the materials	Correlation Coefficients
1.	Blade Side Port 15 degree	0.73
2.	Inj Viscoat	0.79
3.	BSS 500	0.87
4.	Silicon Oil	0.96
5.	Inj Viscomet 2 ml	0.95
6.	Suture 6.0 Vicryl (2670)	0.36
7.	Gloves	0.95
8.	Blade Keratome 2.8	0.87
9.	Betadine Scurub500ml	0.94
10.	Cap and Mask	0.94
11.	Inj Hynidase 1 ml	0.96
12.	Drapes	0.87
13.	IV Cannula	0.29
14.	Needles	0.78
15.	Inj Dexamethasone	0.78
16.	Blue Rhex	0.83
17.	Inj Adernaline	0.89
18.	Inj Xylocaine 2 %	0.68
19.	Inj Ringer Lactate 500ml	0.66
20.	Inj Senseorcaine 20 % 0.5	0.96

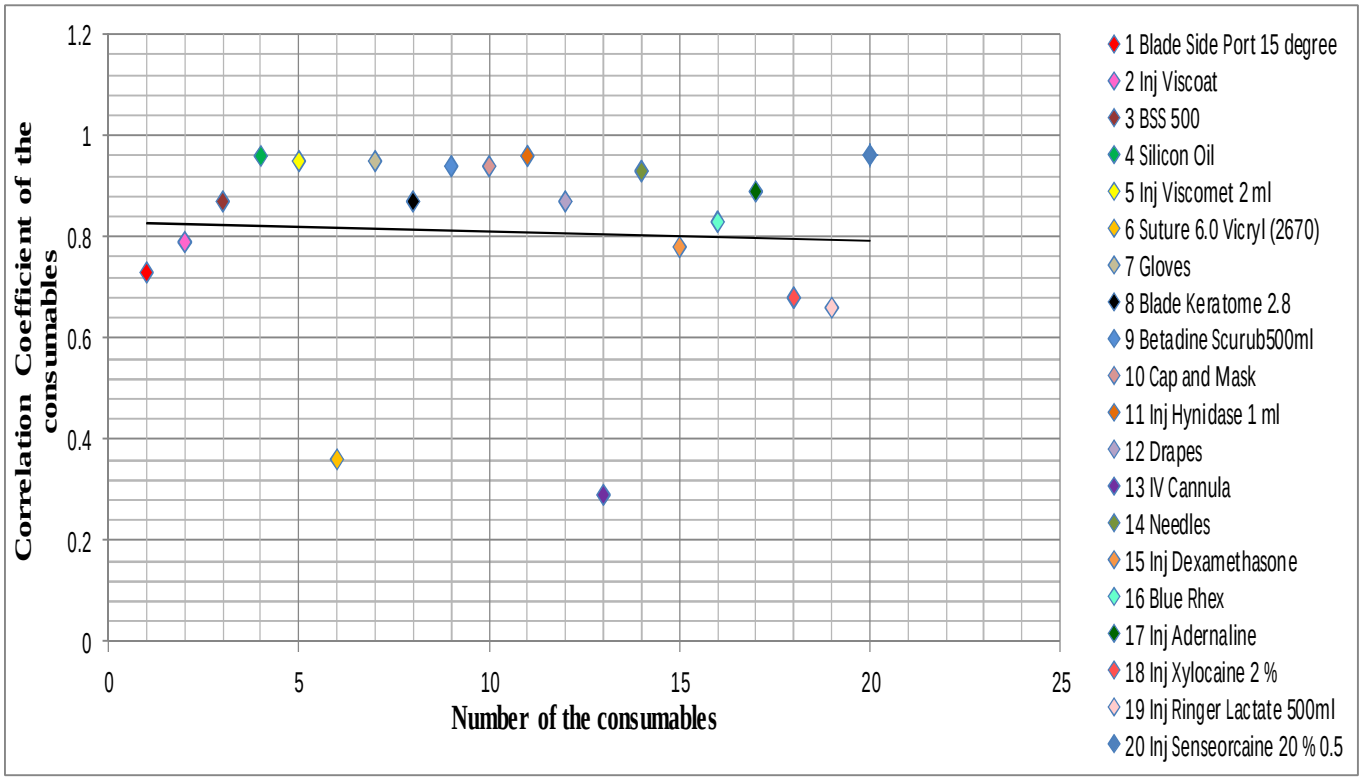


Figure 2: Correlation coefficient of 20 consumables

- The line diagrams (**Figures 3 to 22**) show the relation between monthly consumption and monthly workload (number of patients) for the 20 selected items.
- Assumption made was that as the no. of surgeries increased the consumption of the items also increased.

1. Blade sideport 15 degree

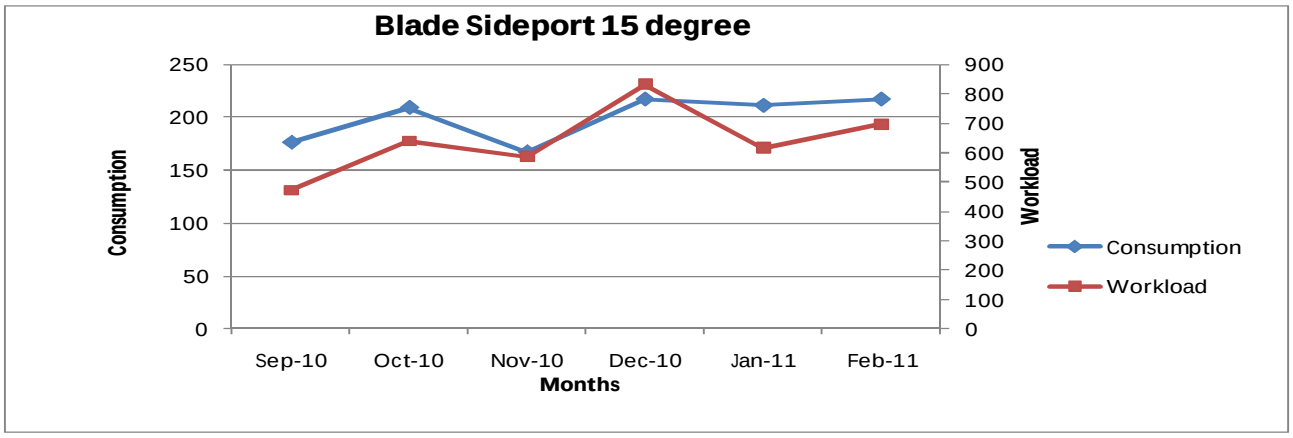


Figure 3: Monthly consumption pattern of Blade sideport 15 degree

2. Injection Viscoat

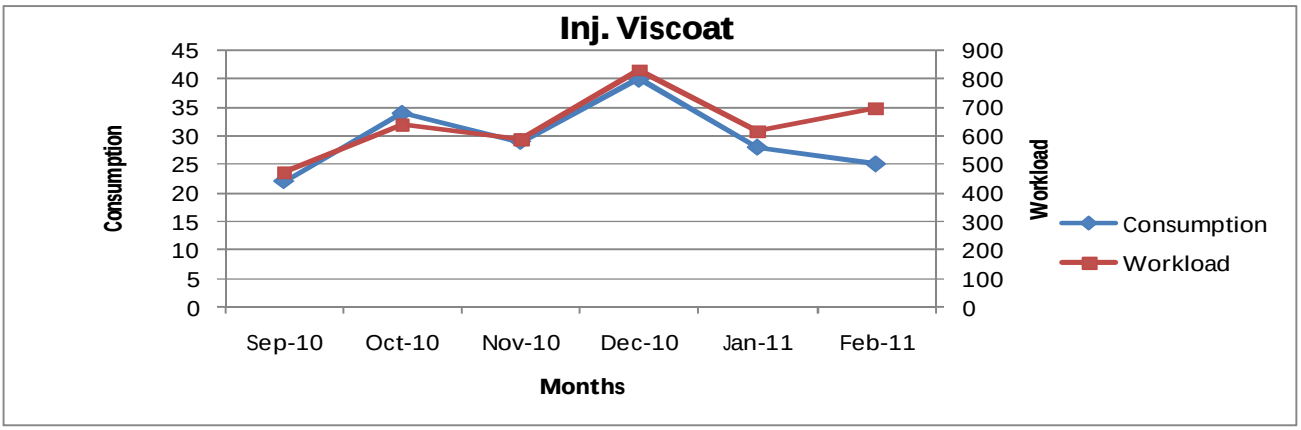


Figure 4: Monthly consumption pattern of Inj. Viscoat

3. BSS

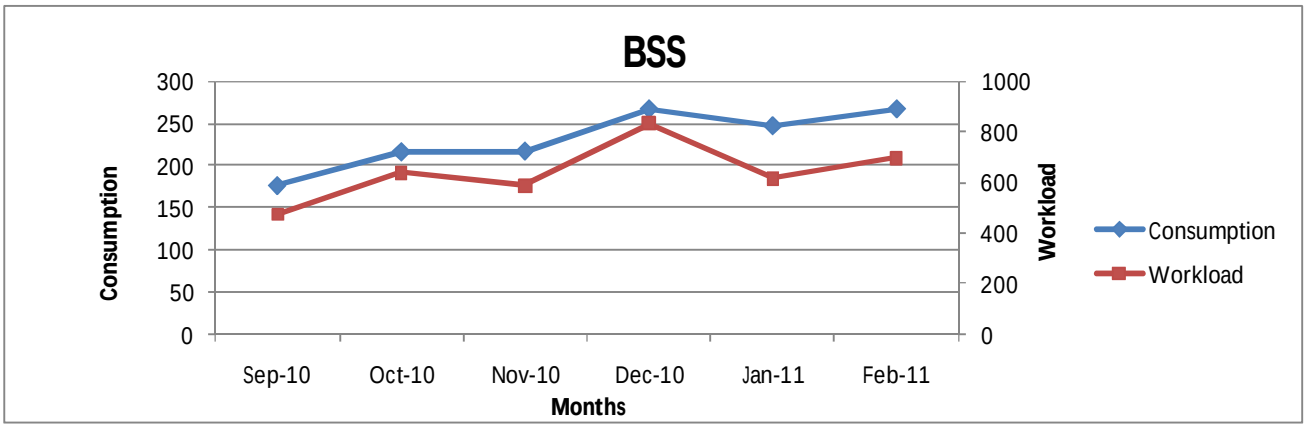


Figure 5: Monthly consumption pattern of BSS

4. Silicon oil

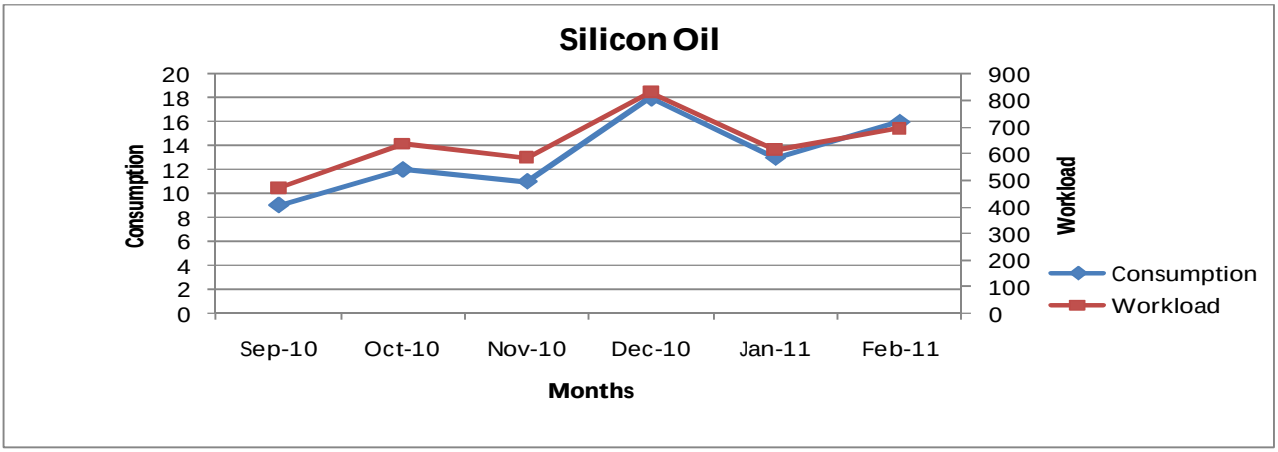


Figure 6: Monthly consumption pattern of Silicon oil

5. Injection Viscomet

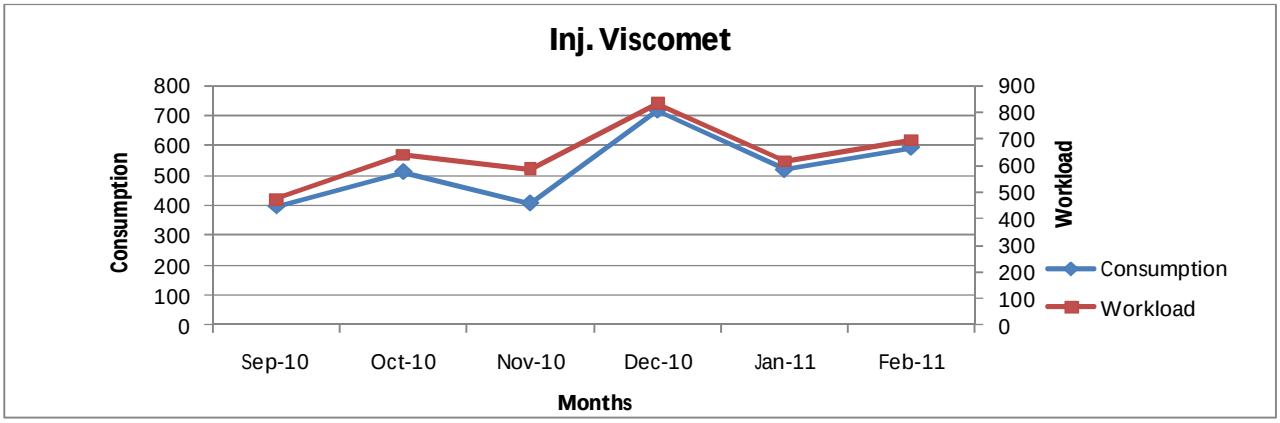


Figure 7: Monthly consumption pattern of Inj. Viscomet

6. Suture 6.0 Vicryl

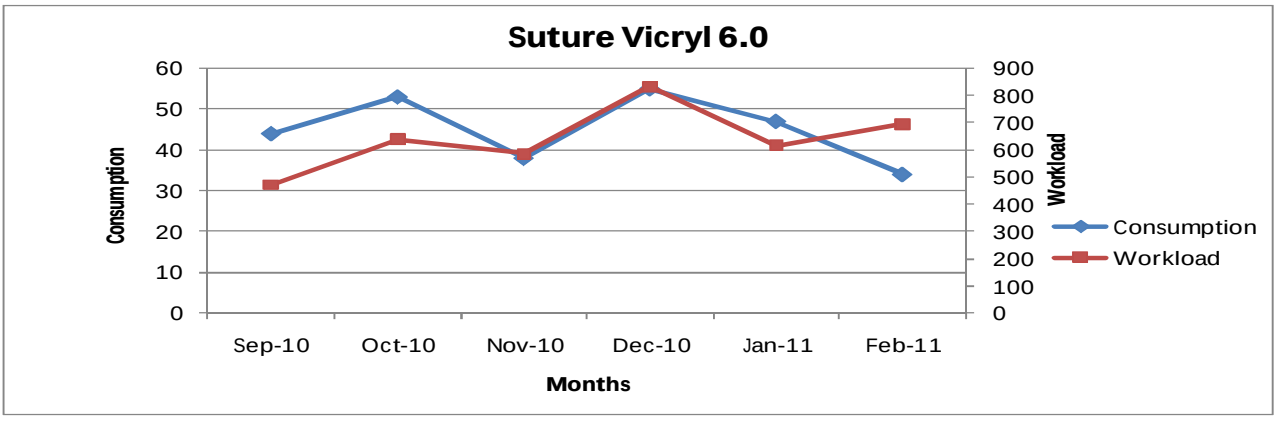


Figure 8: Monthly consumption pattern of Suture 6.0 Vicryl

7. Gloves

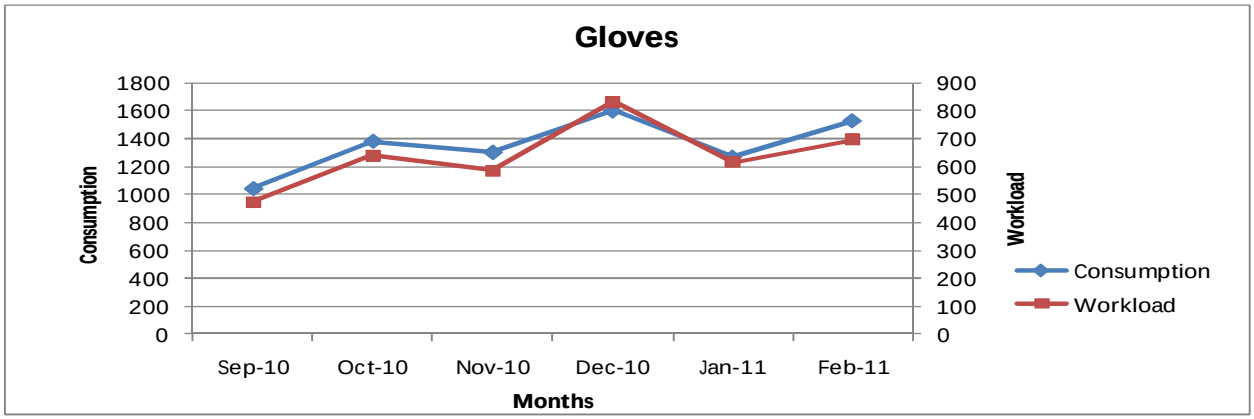


Figure 9: Monthly consumption pattern of Gloves

8. Blade Keratome 2.8

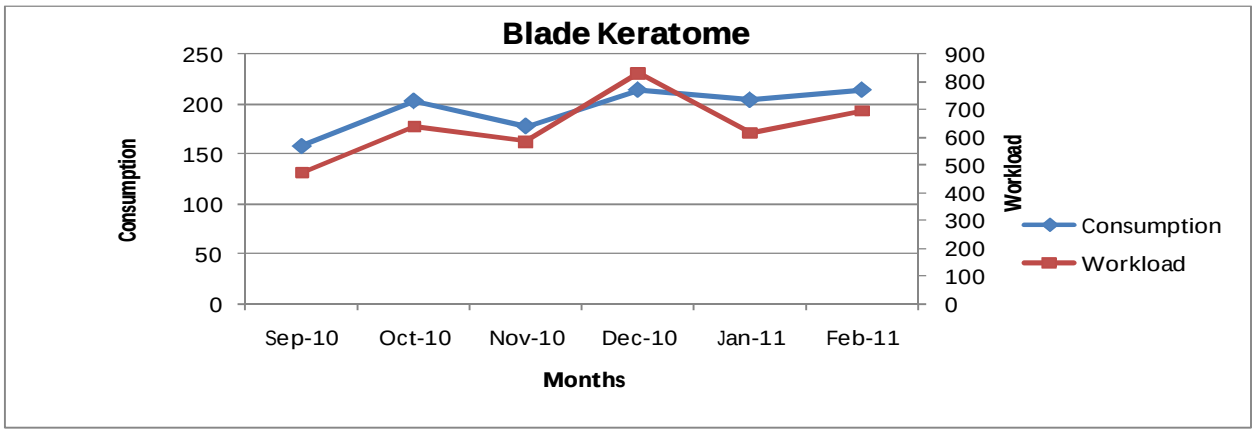


Figure 10: Monthly consumption pattern of Blade Keratome 2.8

9. Betadine Scrub 500ml

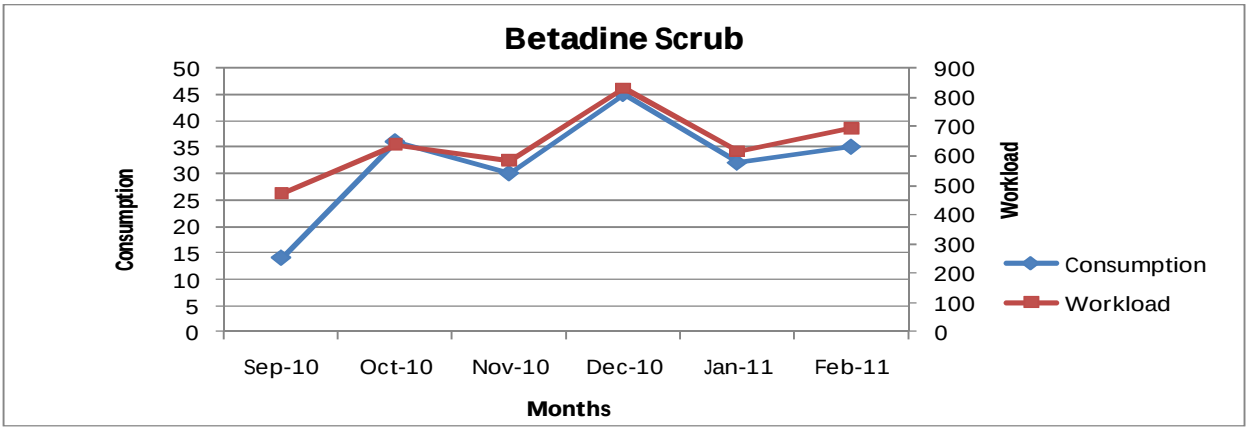


Figure 11: Monthly consumption pattern of Betadine Scrub 500ml

10. Cap and Mask

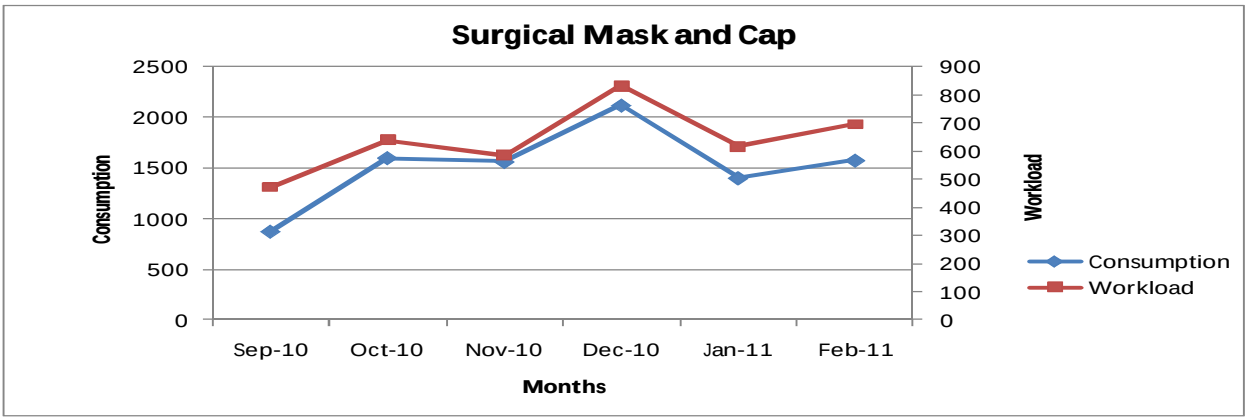


Figure 12: Monthly consumption pattern of Caps and Masks

11. Injection Hynidase 1 ml

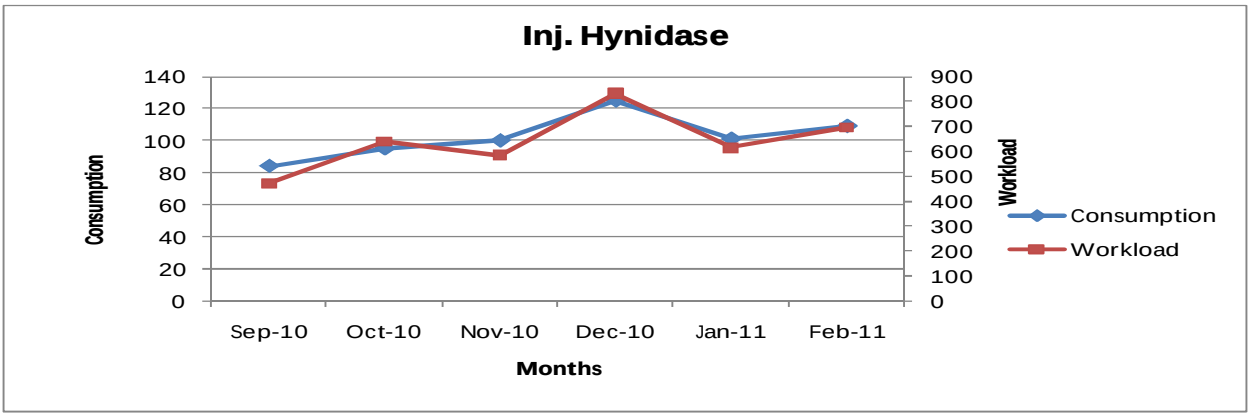


Figure 13: Monthly consumption pattern of Inj. Hynidase 1 ml

12. Drapes

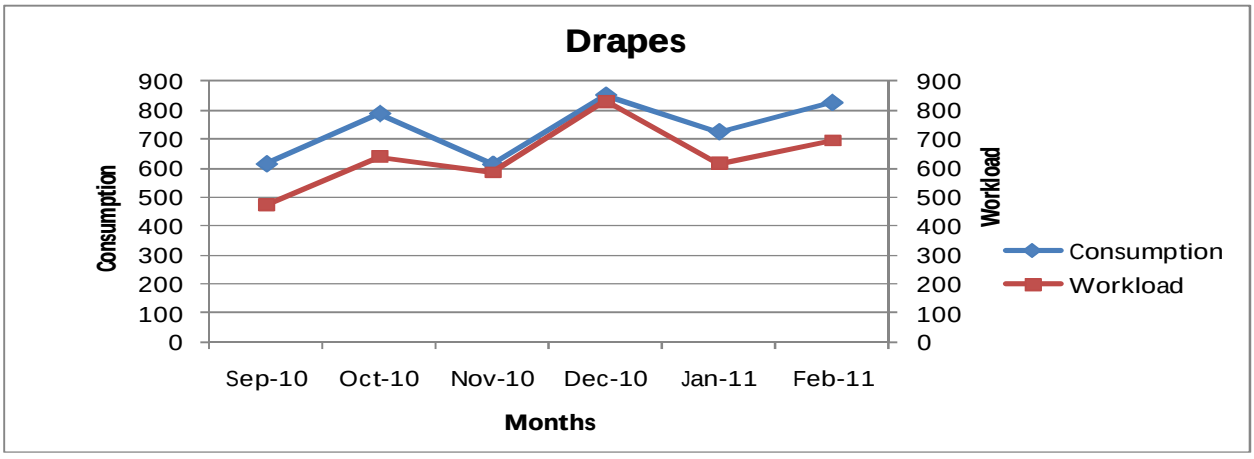


Figure 14: Monthly consumption pattern of Drapes

13. IV Cannula

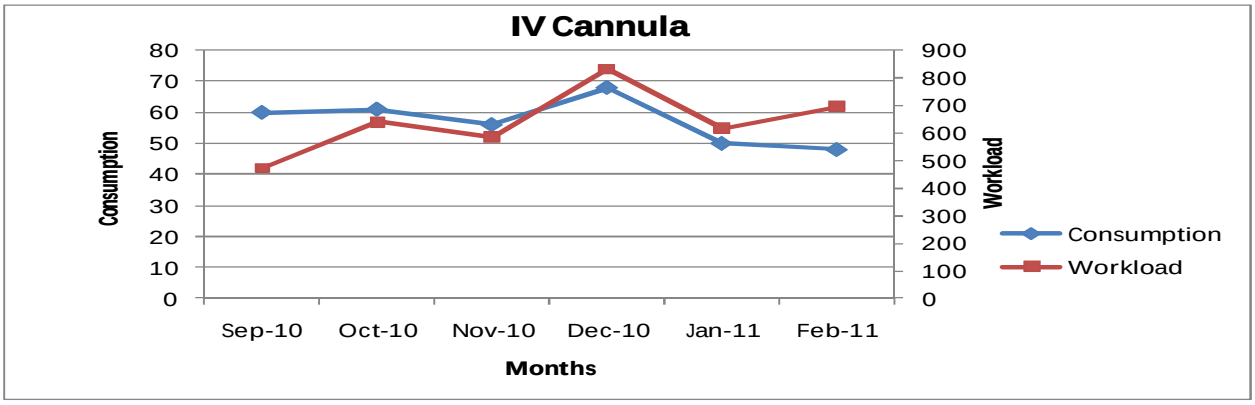


Figure 15: Monthly consumption pattern of Cannula

14. Needles

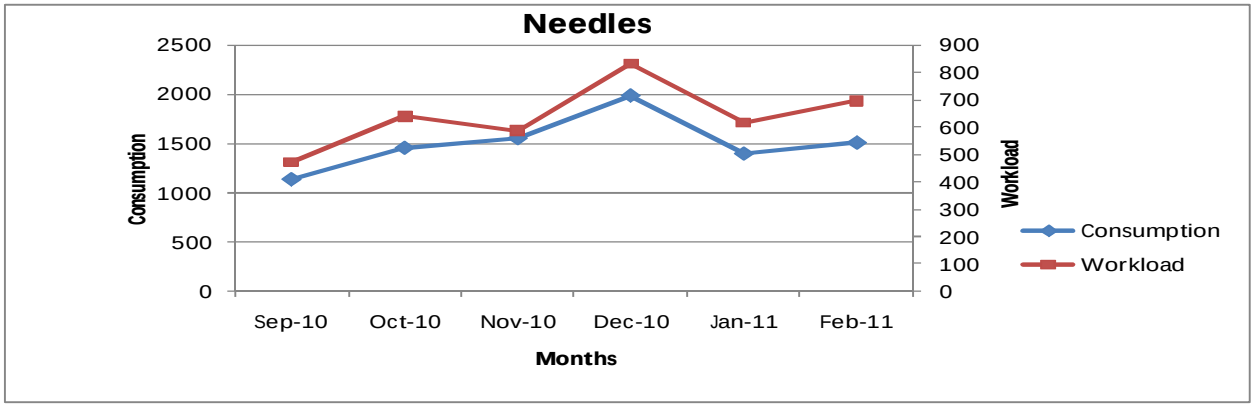


Figure 16: Monthly consumption pattern of Needles

15. Injection Dexamethasone

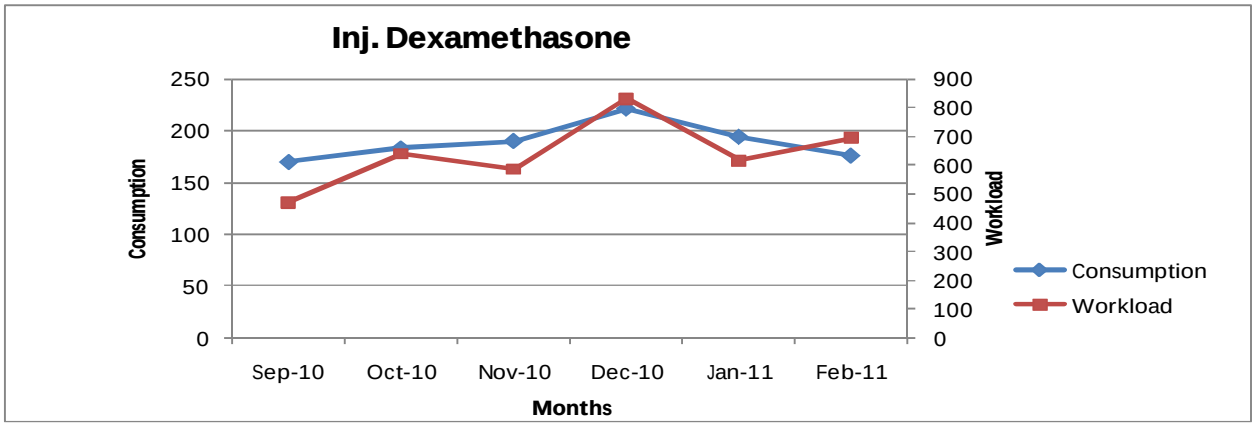


Figure 17: Monthly consumption pattern of Inj. Dexamethasone

16. Blue Rhex

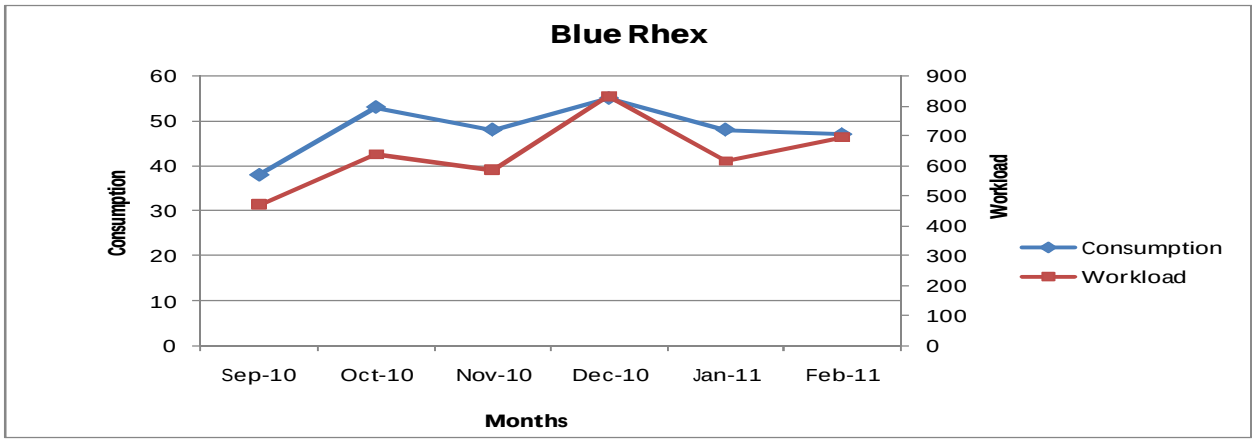


Figure 18: Monthly consumption pattern of Blue Rhex

17. Injection Adernaline

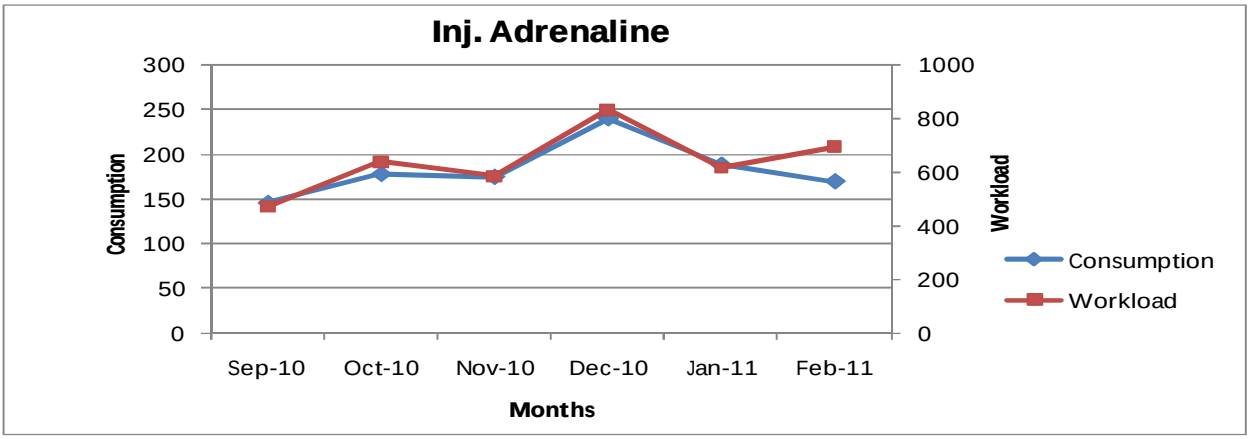


Figure 19: Monthly consumption pattern of Inj. Adrenaline

18. Injection Xylocaine 2%

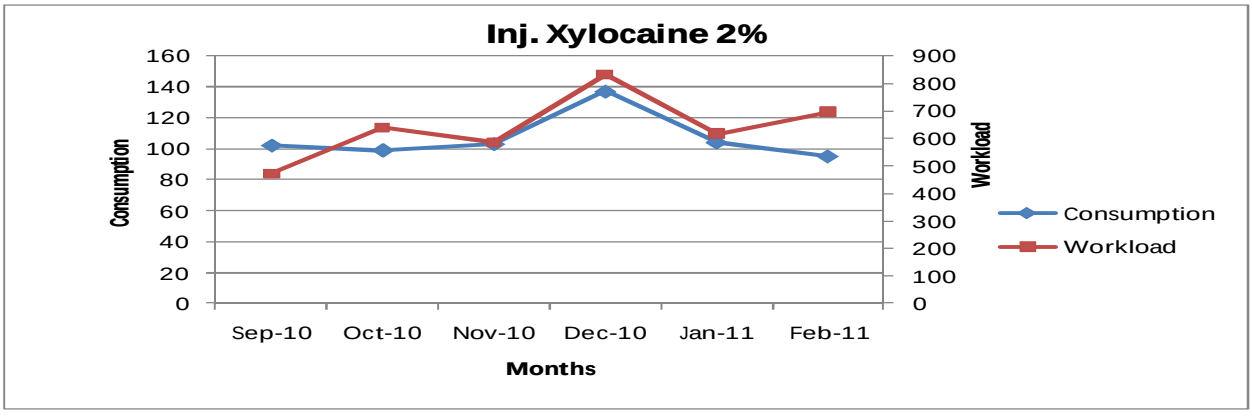


Figure 20: Monthly consumption pattern of Inj. Xylocaine 2%

19. Ringer Lactate 500ml

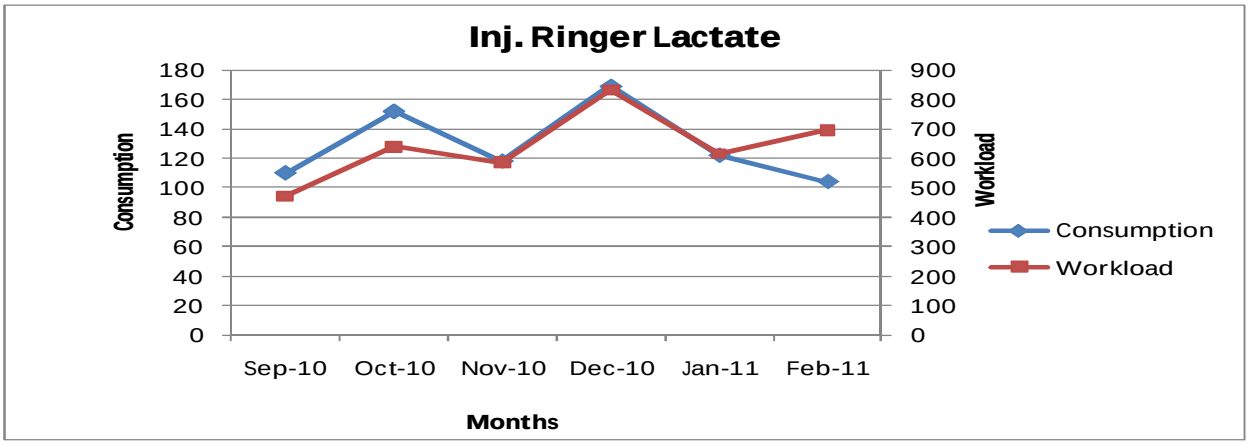


Figure 21: Monthly consumption pattern of Inj. Ringer lactate 500 ml

20. Injection Senseorcaine 20%

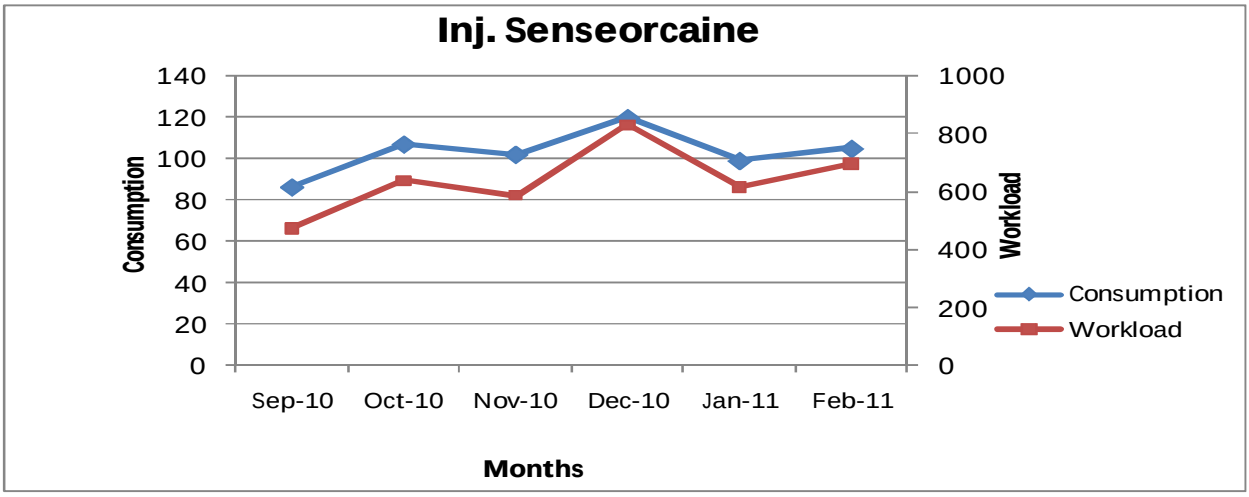


Figure 22: Monthly consumption pattern of Inj. Senseorcaine 20%

- The per cent variation of monthly consumption of 20 items with regard to November 2010 (taken as benchmark) was calculated as:

$$\frac{\text{(Consumption in a particular month} - \text{Consumption in November 2010)}}{\text{Consumption in November 2010}} \times 100$$

- The per cent variations are shown in **Tables 3-22** and **Figures 23-42**

Table 3: Per cent variations in monthly consumption of Blade Side Port 15 degree and workload with November 2010 as reference

Months	% variation in workload	% variation in consumption
Sep	-19.45	5.39
Oct	9.04	25.15
Nov	0	0
Dec	29.57	46.71
Jan	5.12	26.35
Feb	18.77	29.94

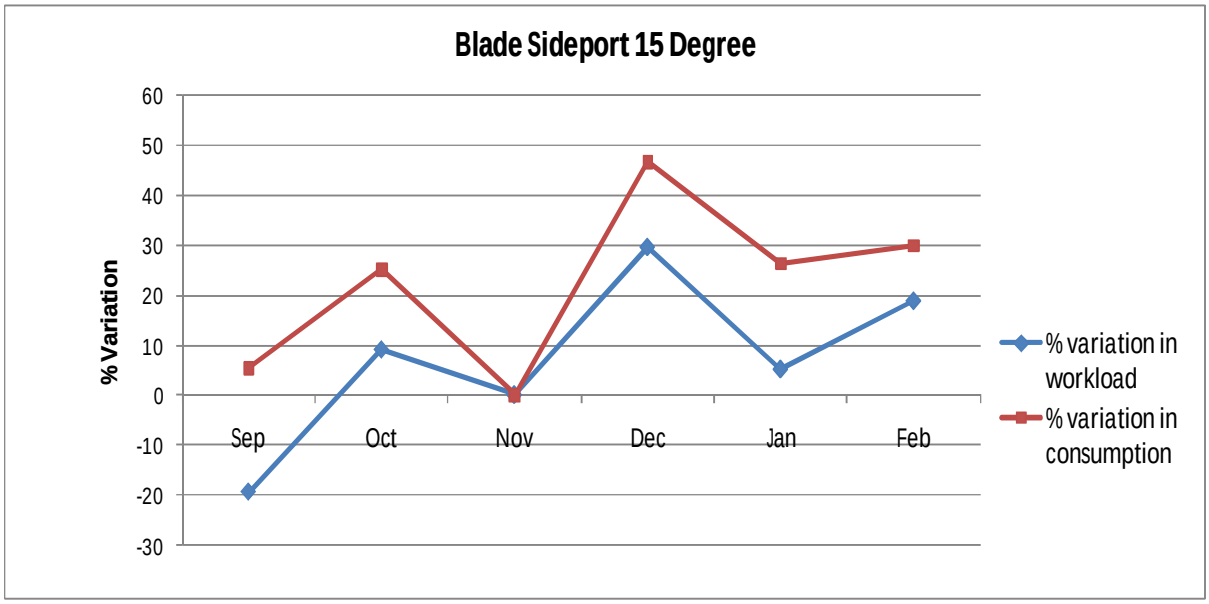


Figure 23: Per cent variations in monthly consumption of Blade Side Port 15 degree and workload with November 2010 as reference

Table 4: Per cent variations in monthly consumption of Inj Viscoat and workload with November 2010 as reference

Months	% variation in workload	% variation in consumption
Sep	-19.45	-24.14
Oct	9.04	17.24
Nov	0	0
Dec	29.57	37.93
Jan	5.12	-3.45
Feb	18.77	-13.79

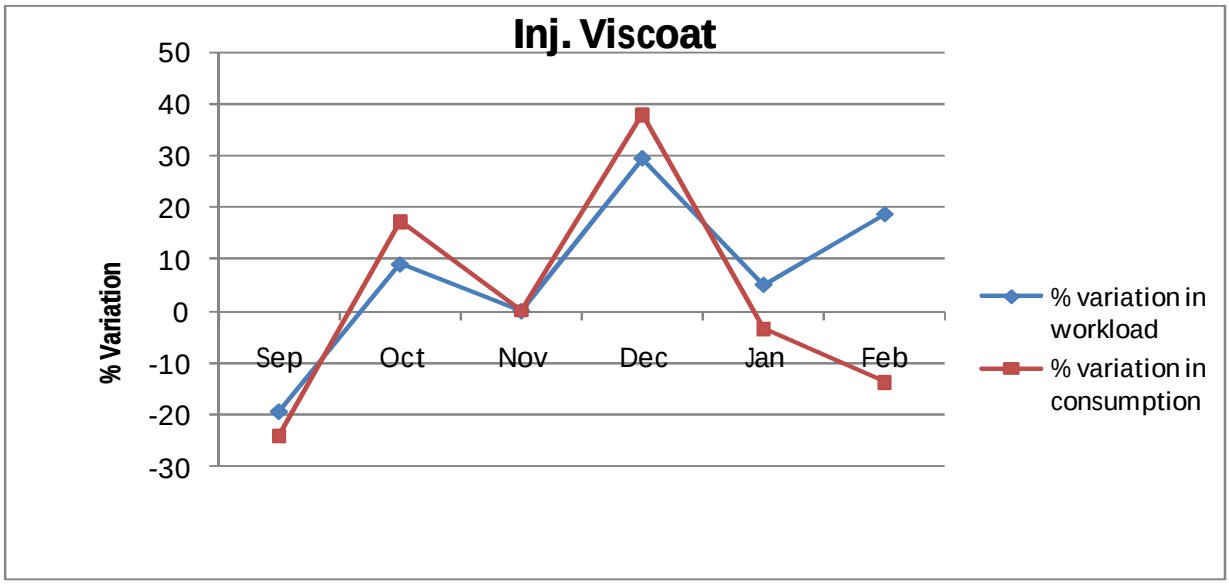


Figure 24: Per cent variations in monthly consumption of BSS 500 and workload with November 2010 as reference

Table 5: Per cent variations in monthly consumption of BSS 500 and workload with November 2010 as reference

Months	% variation in workload	% variation in consumption
Sep	-19.45	-18.89
Oct	9.04	-0.46
Nov	0	0
Dec	29.57	35.94
Jan	5.12	13.82
Feb	18.77	23.041

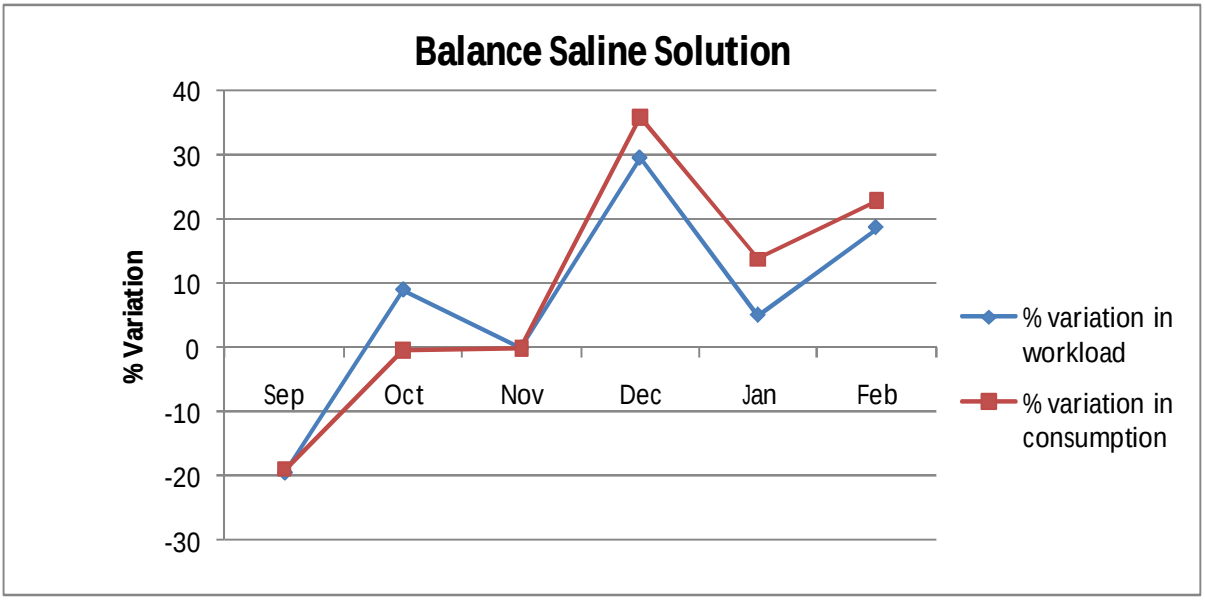


Figure 25: Per cent variations in monthly consumption of BSS 500 and workload with November 2010 as reference

Table 6: Per cent variations in monthly consumption of Silicon Oil and workload with November 2010 as reference

Months	% variation in workload	% variation in consumption
Sep	-19.45	-18.18
Oct	9.04	9.09
Nov	0	0
Dec	29.57	63.64
Jan	5.12	18.18
Feb	18.77	45.45

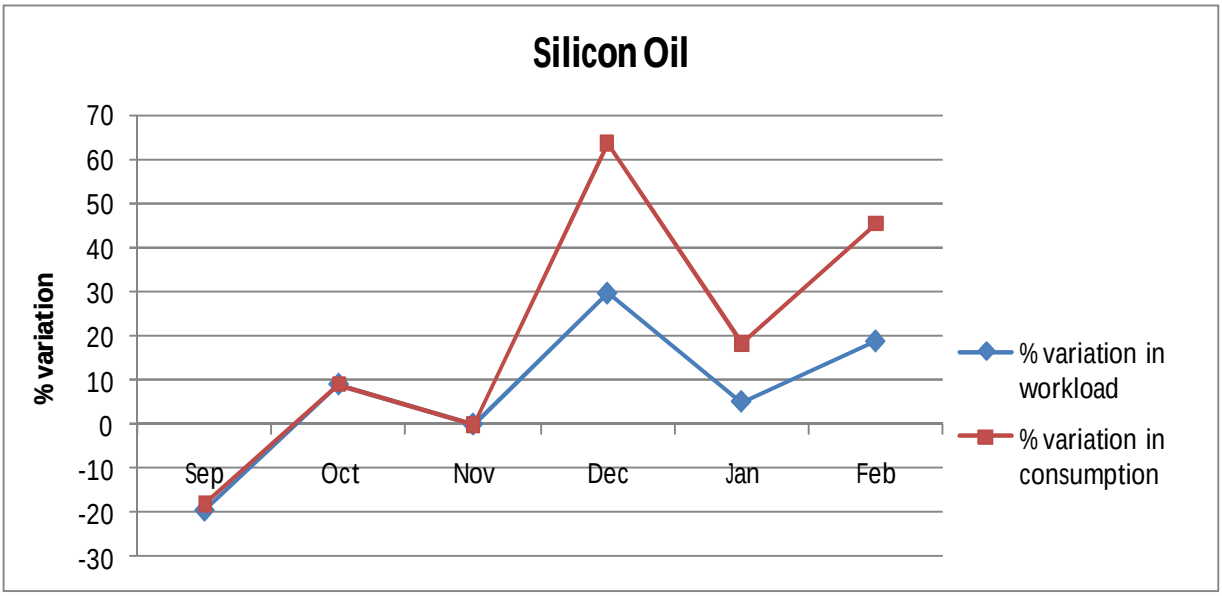


Figure 26: Per cent variations in monthly consumption of Silicon Oil and workload with November 2010 as reference

Table 7: Per cent variations in monthly consumption of Inj. Viscomet 2 ml and workload with November 2010 as reference

Months	% variation in workload	% variation in consumption
Sep	-19.45	-2.46
Oct	9.04	25.55
Nov	0	0
Dec	29.57	75.92
Jan	5.12	27.27
Feb	18.77	45.45

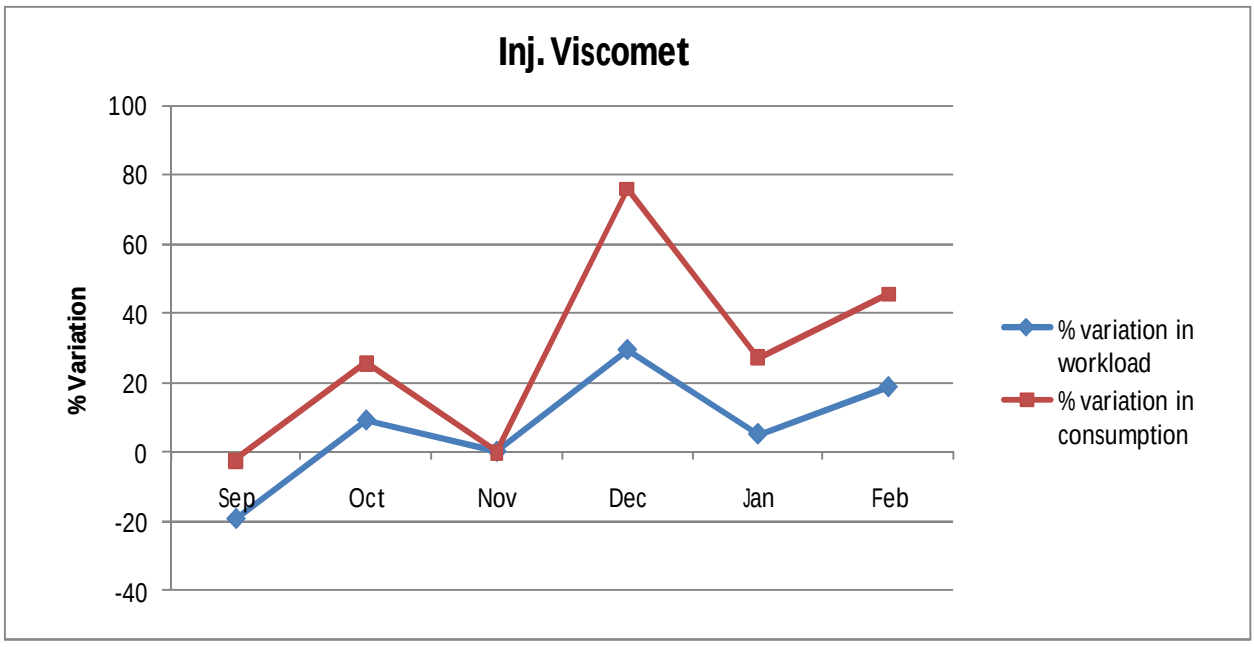


Figure 27: Per cent variations in monthly consumption of Inj. Viscomet 2 ml and workload with November 2010 as reference

Table 8: Per cent variations in monthly consumption of Suture 6.0 Vicryl and workload with November 2010 as reference

Months	% variation in workload	% variation in consumption
Sep	-19.45	15.79
Oct	9.04	39.47
Nov	0	0
Dec	29.57	44.74
Jan	5.12	23.68
Feb	18.77	-10.526

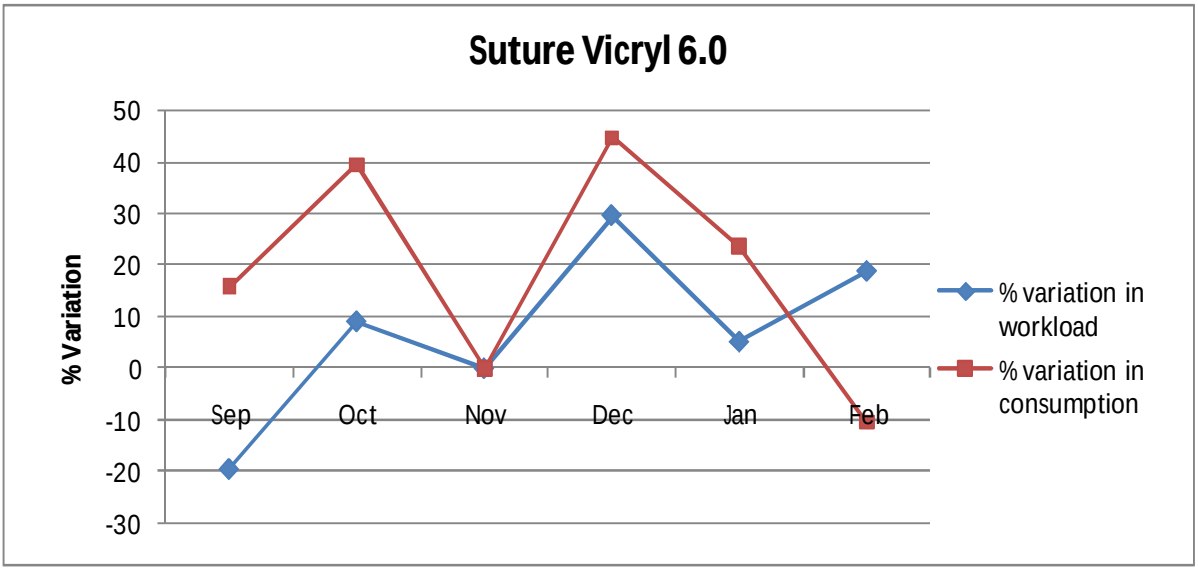


Figure 28: Per cent variations in monthly consumption of Suture 6.0 Vicryl and workload with November 2010 as reference

Table 9: Per cent variations in monthly consumption of Gloves and workload with November 2010 as reference

Months	% variation in workload	% variation in consumption
Sep	-19.45	-20.11
Oct	9.04	6.06
Nov	0	0
Dec	29.57	22.79
Jan	5.12	-2.72
Feb	18.77	17.42

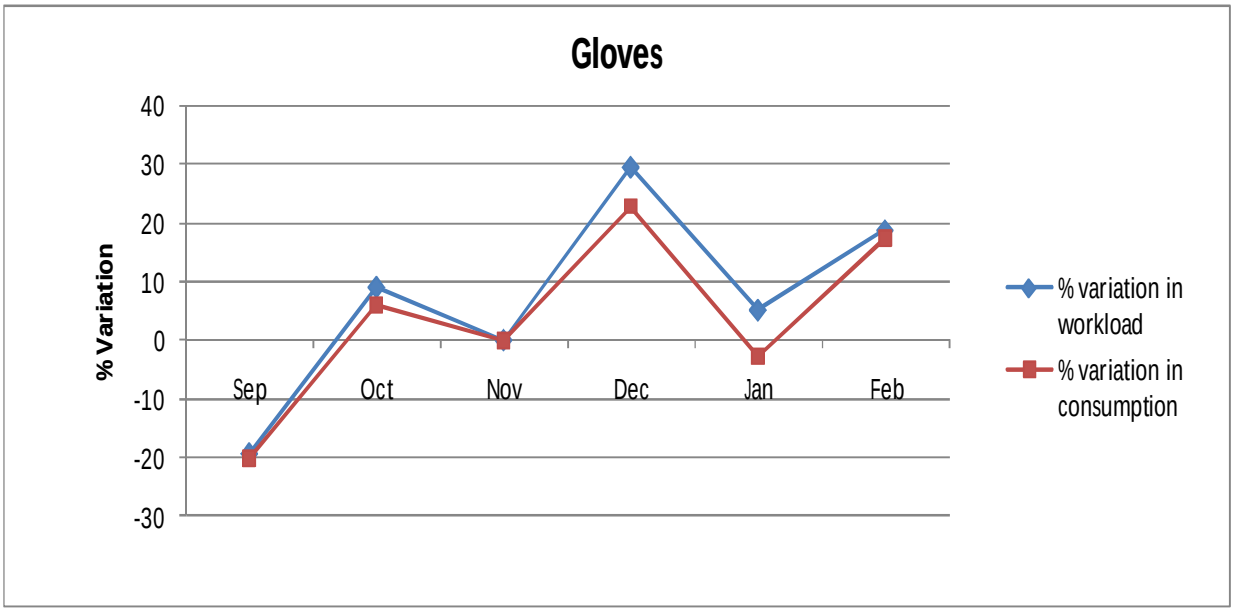


Figure 29: Per cent variations in monthly consumption of Gloves and workload with November 2010 as reference

Table 10: Per cent variations in monthly consumption of Blade Keratome 2.8 and workload with November 2010 as reference

Months	% variation in workload	% variation in consumption
Sep	-19.45	-11.24
Oct	9.04	14.04
Nov	0	0
Dec	29.57	43.26
Jan	5.12	14.61
Feb	18.77	20.22

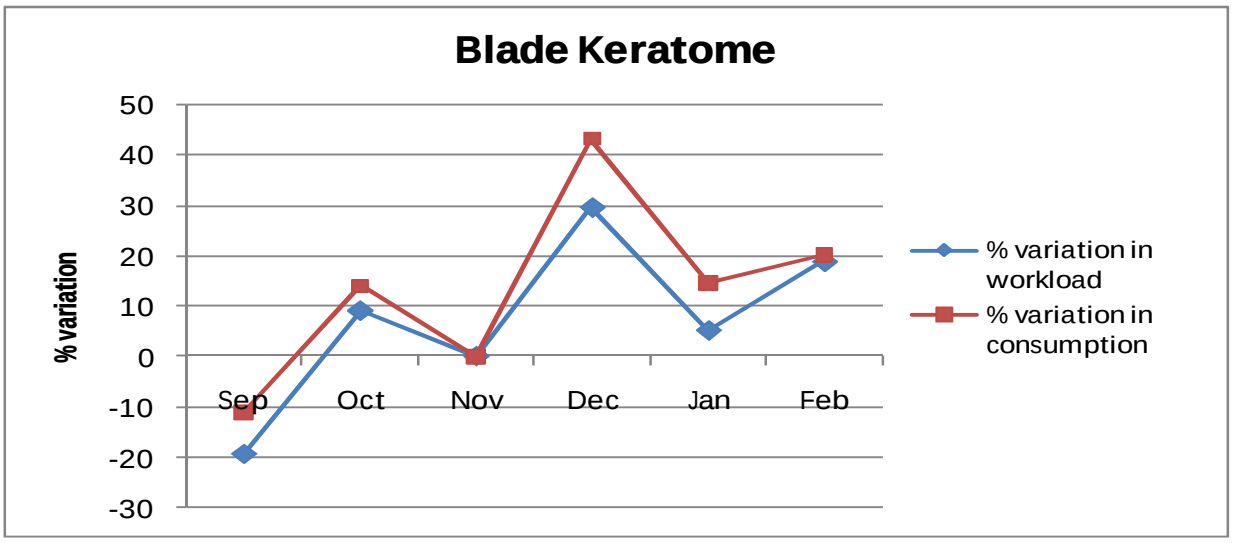


Figure 30: Per cent variations in monthly consumption of Blade Keratome 2.8 and workload with November 2010 as reference

Table 11: Per cent variations in monthly consumption of Betadine Scrub 500ml and workload with November 2010 as reference

Months	% variation in workload	% variation in consumption
Sep	-19.45	-54.30
Oct	9.04	16.99
Nov	0	0
Dec	29.57	48.11
Jan	5.12	6.05
Feb	18.77	15.82

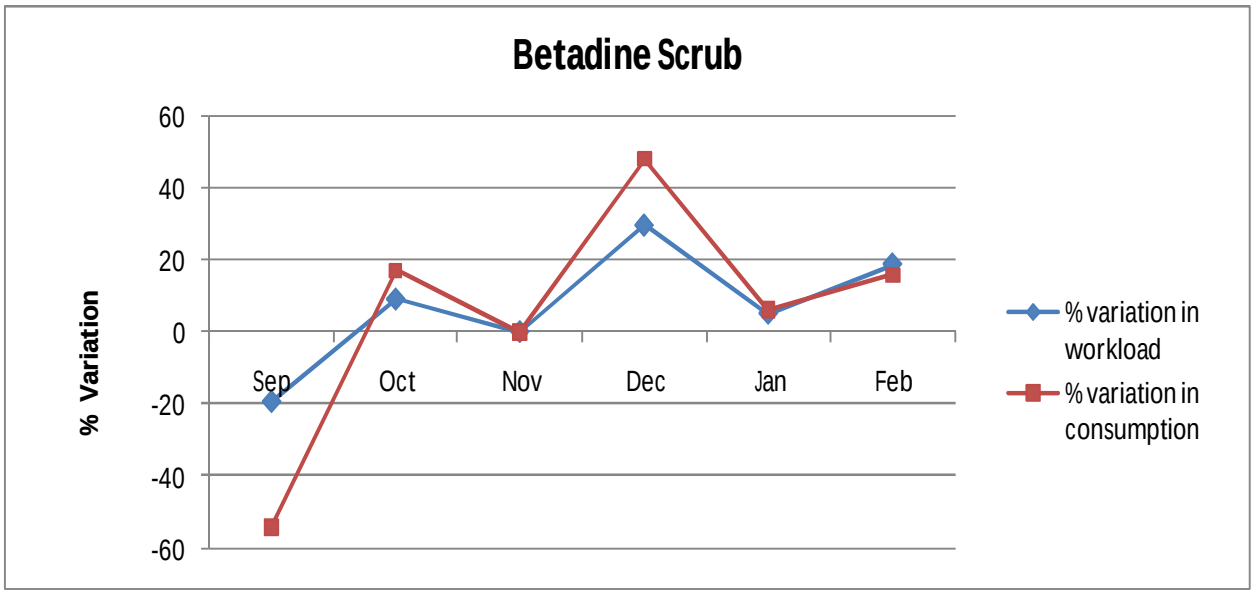


Figure 31: Per cent variations in monthly consumption of Betadine Scrub 500ml and workload with November 2010 as reference

Table 12: Per cent variations in monthly consumption of Cap and Mask and workload with November 2010 as reference

Months	% variation in workload	% variation in consumption
Sep	-19.45	-44.30
Oct	9.04	2.43
Nov	0	0
Dec	29.57	35.85
Jan	5.12	-10.37
Feb	18.77	0.83

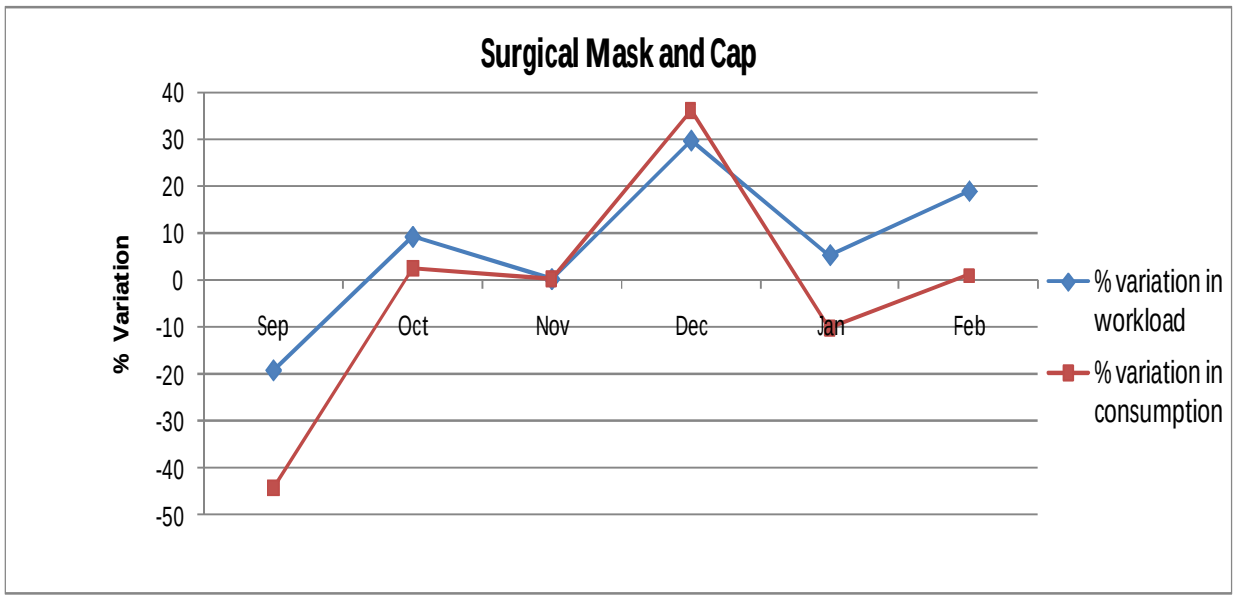


Figure 32: Per cent variations in monthly consumption of Cap and Mask and workload with November 2010 as reference

Table 13: Per cent variations in monthly consumption of Inj Hynidase and workload with November 2010 as reference

Months	% variation in workload	% variation in consumption
Sep	-19.45	-16
Oct	9.04	-5
Nov	0	0
Dec	29.57	25
Jan	5.12	1
Feb	18.77	9

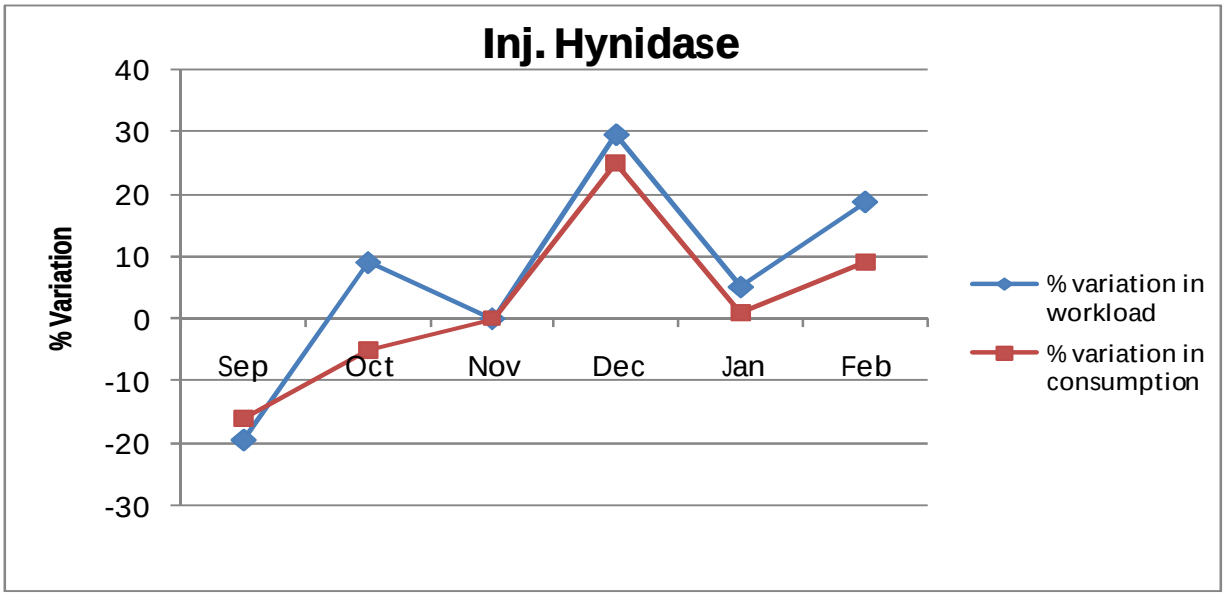


Figure 33: Per cent variations in monthly consumption of Inj Hynidase and workload with November 2010 as reference

Table 14: Per cent variations in monthly consumption of Drapes and workload with November 2010 as reference

Months	% variation in workload	% variation in consumption
Sep	-19.45	0.33
Oct	9.04	28.38
Nov	0	0
Dec	29.57	38.66
Jan	5.12	18.27
Feb	18.77	34.58

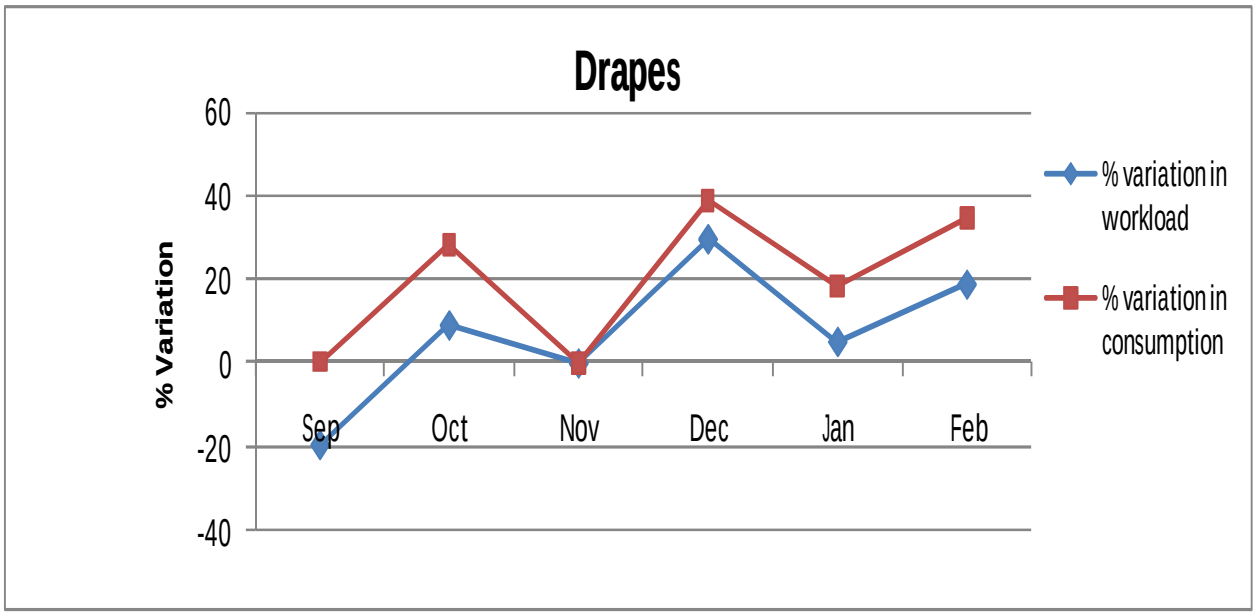


Figure 34: Per cent variations in monthly consumption of Drapes and workload with November 2010 as reference

Table 15: Per cent variations in monthly consumption of IV Cannula and workload with November 2010 as reference

Months	% variation in workload	% variation in consumption
Sep	-19.45	7.14
Oct	9.04	8.93
Nov	0	0
Dec	29.57	21.43
Jan	5.12	-10.71
Feb	18.77	-14.29

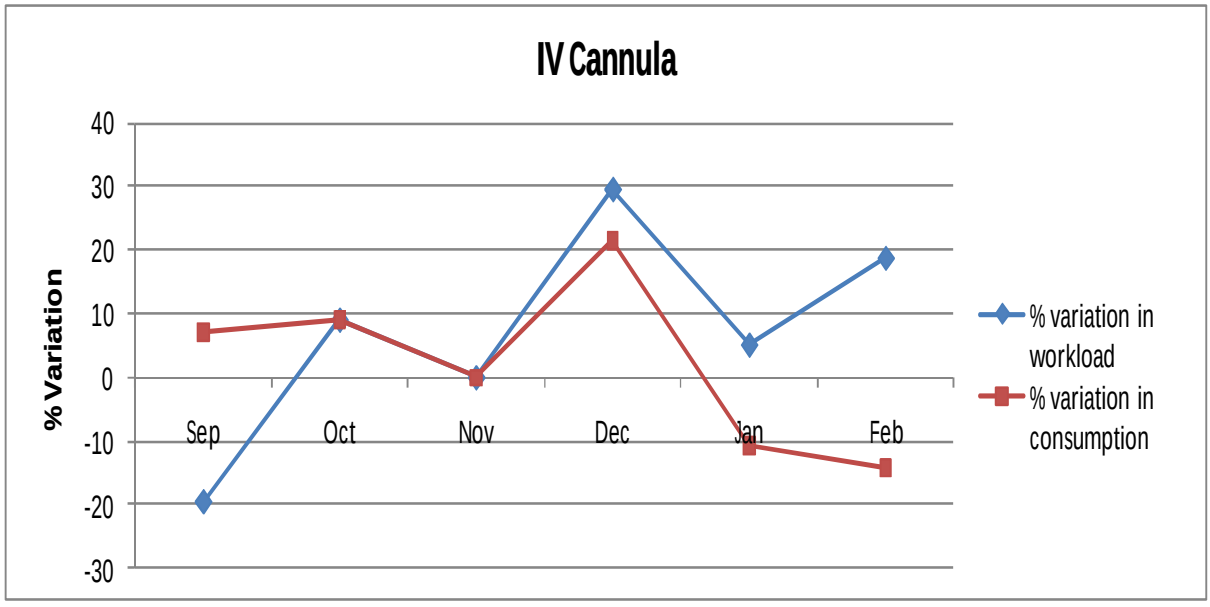


Figure 35: Per cent variations in monthly consumption of IV Cannula and workload with November 2010 as reference

Table 16: Per cent variations in monthly consumption of Needles and workload with November 2010 as reference

Months	% variation in workload	% variation in consumption
Sep	-19.45	-23.86
Oct	9.04	-2.48
Nov	0	0
Dec	29.57	32.84
Jan	5.12	-6.43
Feb	18.77	1.01

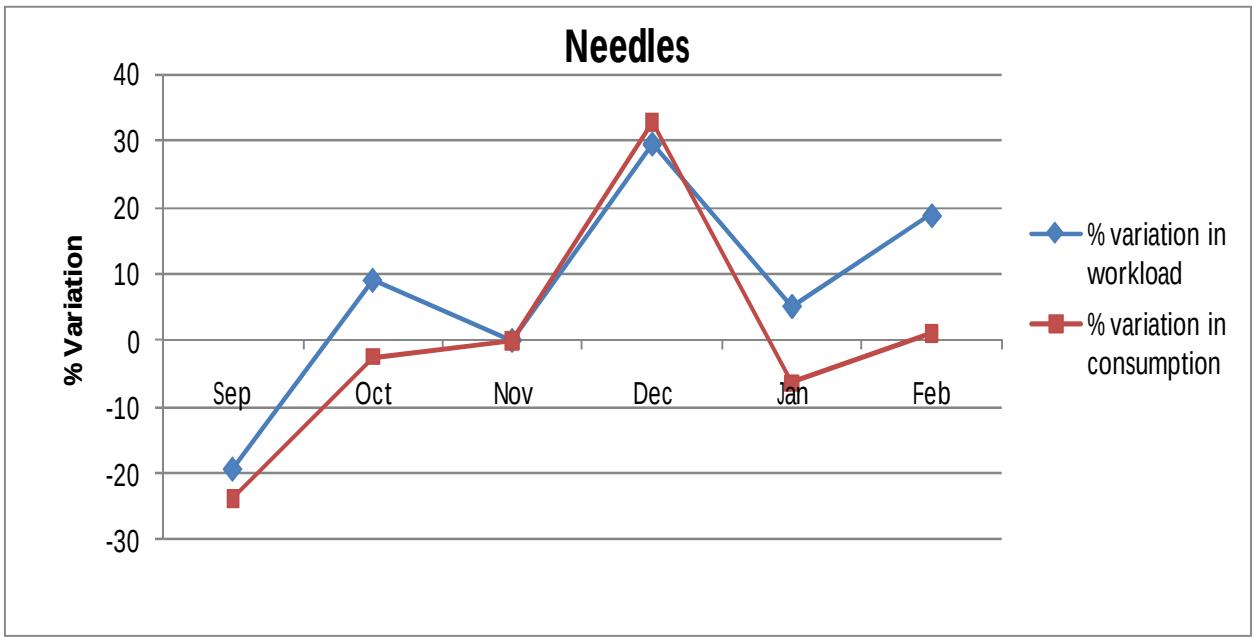


Figure 36: Per cent variations in monthly consumption of Needles and workload with November 2010 as reference

Table 17: Per cent variations in monthly consumption of Inj. Dexamethasone and workload with November 2010 as reference

Months	% variation in workload	% variation in consumption
Sep	-19.45	-10.53
Oct	9.04	-3.68
Nov	0	0
Dec	29.57	16.32
Jan	5.12	2.11
Feb	18.77	-7.37

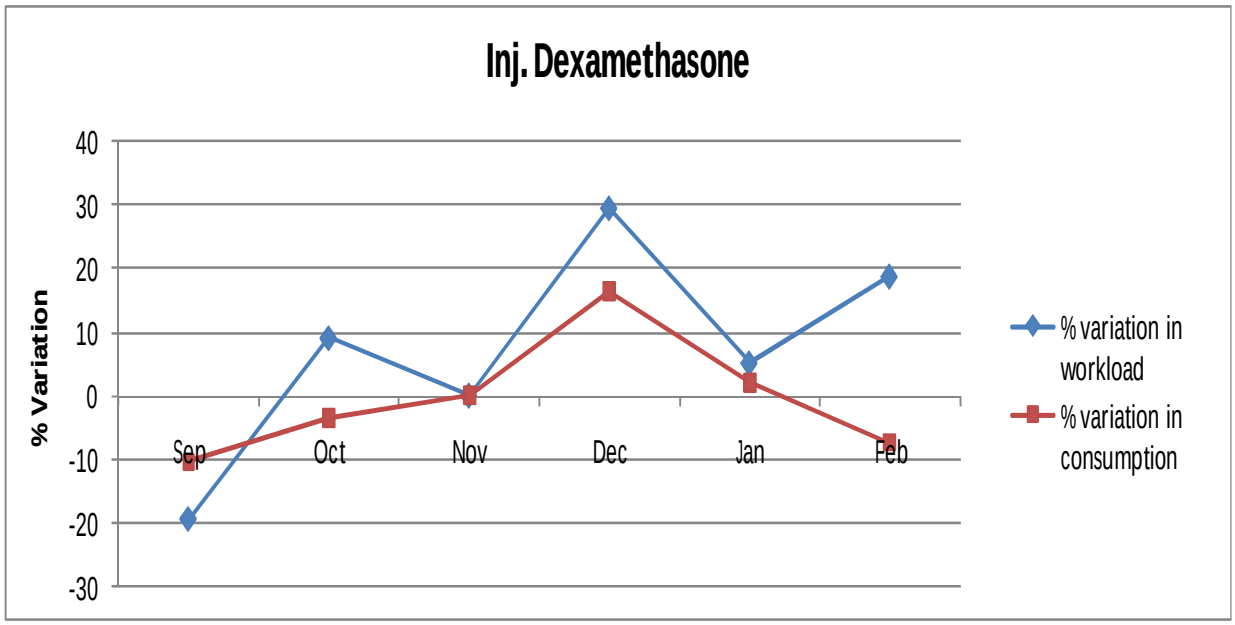


Figure 37: Per cent variations in monthly consumption of Inj. Dexamethasone and workload with November 2010 as reference

Table 18: Per cent variations in monthly consumption of Blue Rhex and workload with November 2010 as reference

Months	% variation in workload	% variation in consumption
Sep	-19.45	-20.83
Oct	9.04	10.42
Nov	0	0
Dec	29.57	14.58
Jan	5.12	0
Feb	18.77	-2.08

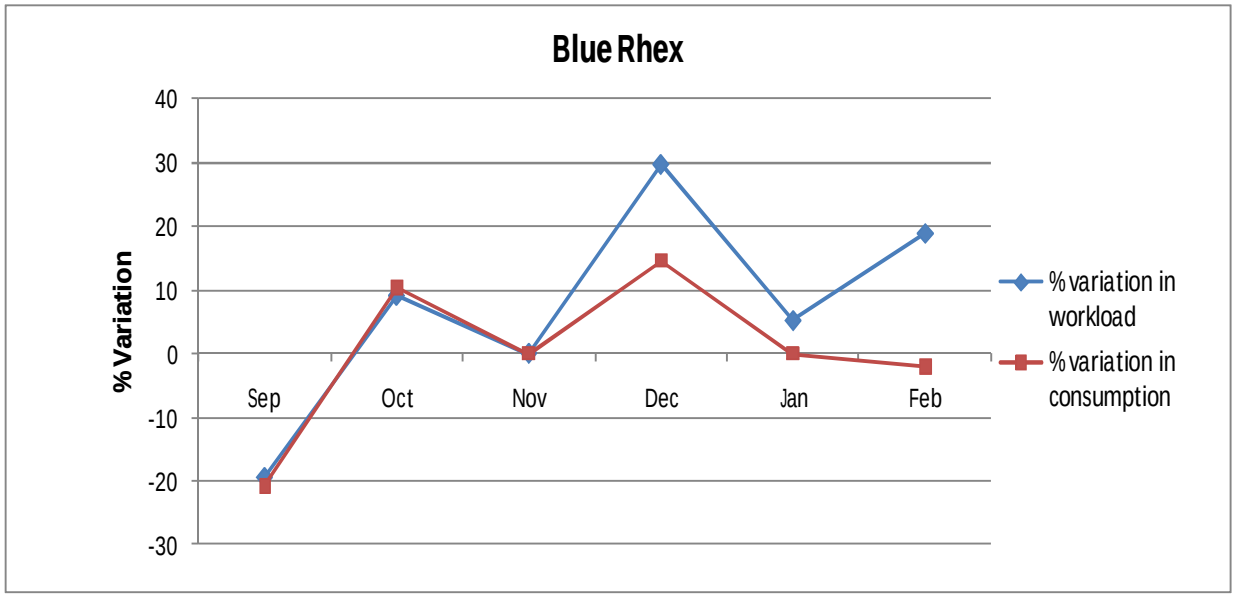


Figure 38: Per cent variations in monthly consumption of Blue Rhex and workload with November 2010 as reference

Table 19: Per cent variations in monthly consumption of Inj Adernaline and workload with November 2010 as reference

Months	% variation in workload	% variation in consumption
Sep	-19.45	-16.57
Oct	9.04	1.71
Nov	0	0
Dec	29.57	37.14
Jan	5.12	7.43
Feb	18.77	-2.86

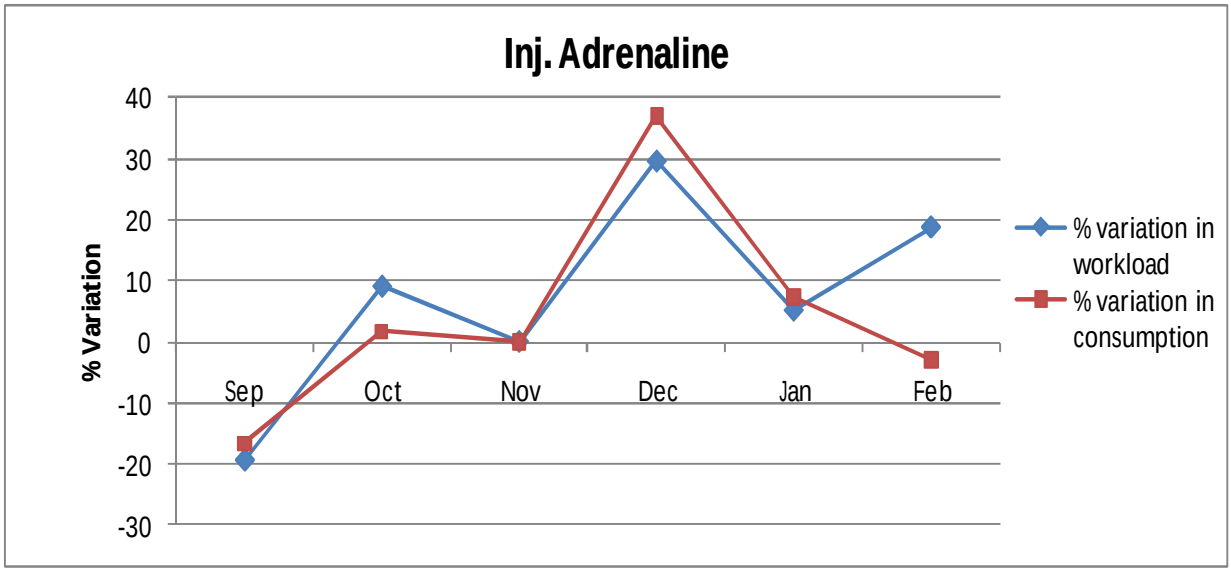


Figure 39: Per cent variations in monthly consumption of Inj Adernaline and workload with November 2010 as reference

Table 20: Per cent variations in monthly consumption of Inj Xylocaine 2% and workload with November 2010 as reference

Months	% variation in workload	% variation in consumption
Sep	-19.45	-0.97
Oct	9.04	-3.88
Nov	0	0
Dec	29.57	33.01
Jan	5.12	0.97
Feb	18.77	-7.77

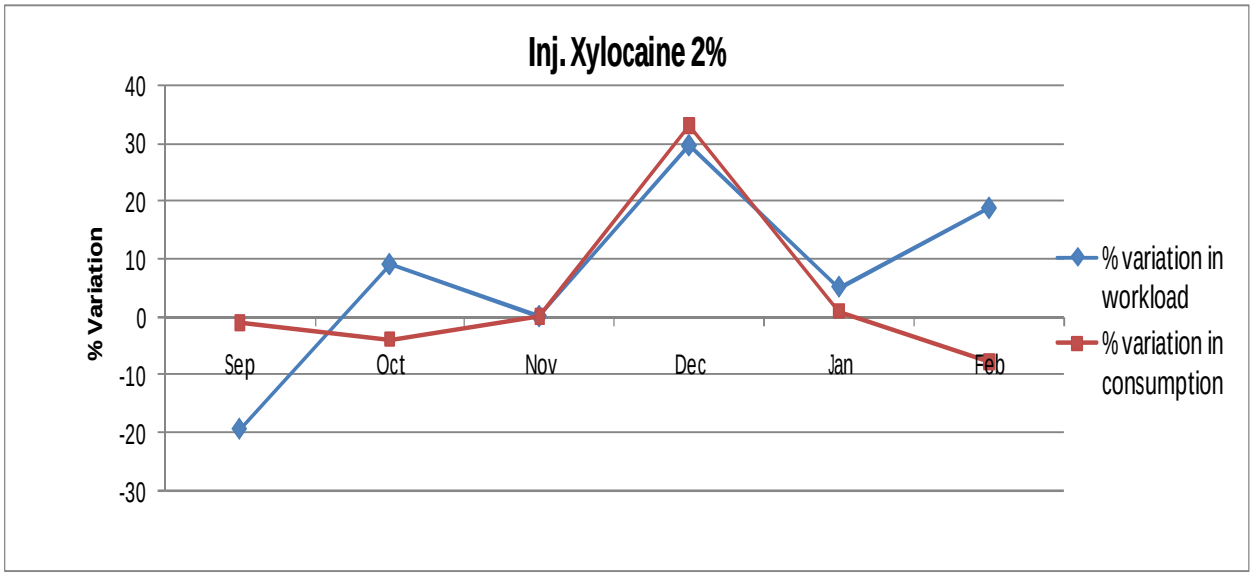


Figure 40: Per cent variations in monthly consumption of Inj Xylocaine 2% and workload with November 2010 as reference

Table 21: Per cent variations in monthly consumption of Inj Ringer Lactate 500ml and workload with November 2010 as reference

Months	% variation in workload	% variation in consumption
Sep	-19.45	-6.78
Oct	9.04	28.81
Nov	0	0
Dec	29.57	43.22
Jan	5.12	3.39
Feb	18.77	-11.86

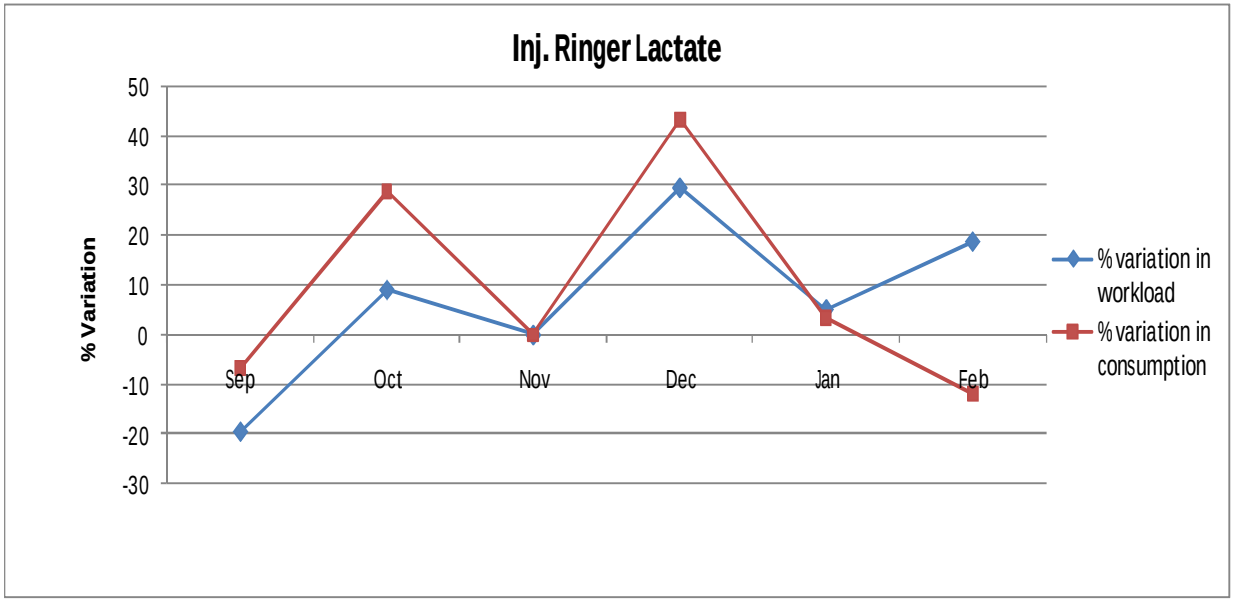


Figure 41: Per cent variations in monthly consumption of Inj Ringer Lactate 500ml and workload with November 2010 as reference

Table 22: Per cent variations in monthly consumption of Inj Senseorcaine 20% and workload with November 2010 as reference

Months	% variation in workload	% variation in consumption
Sep	-19.45	-15.69
Oct	9.04	4.90
Nov	0	0
Dec	29.57	17.65
Jan	5.12	-2.94
Feb	18.77	2.94

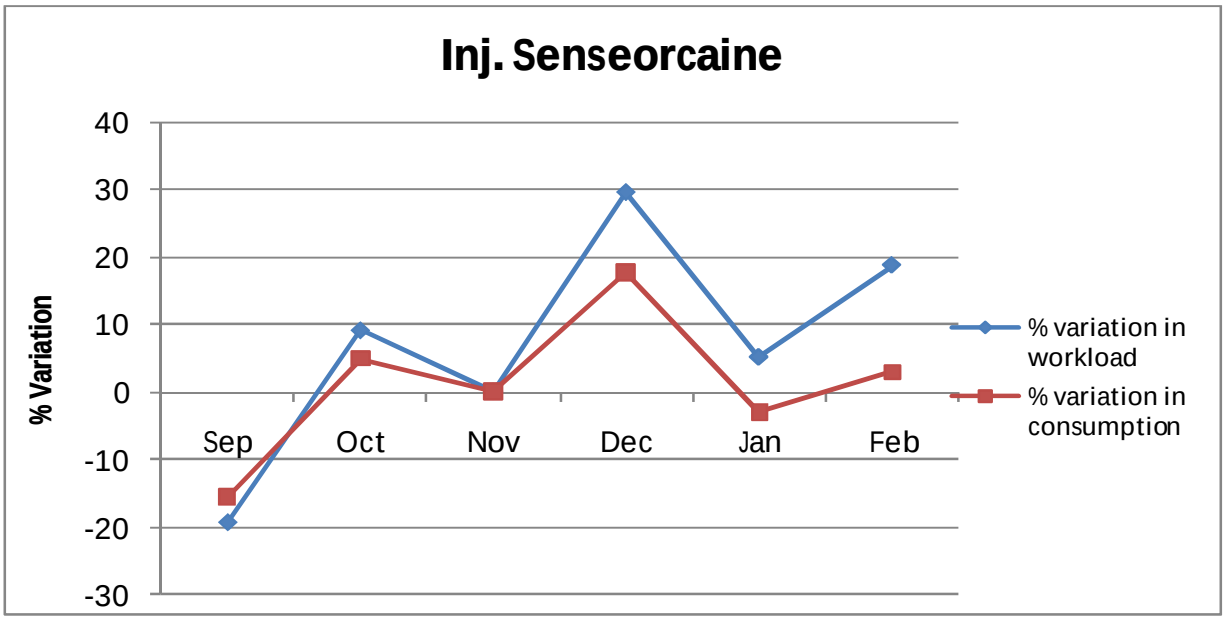


Figure 42: Per cent variations in monthly consumption of Inj Senseorcaine 20% and workload with November 2010 as reference

ROOT CAUSE ANALYSIS

The root cause analysis of the reasons for high consumption of the materials in the operation theatre was then done **(Figure 43)**

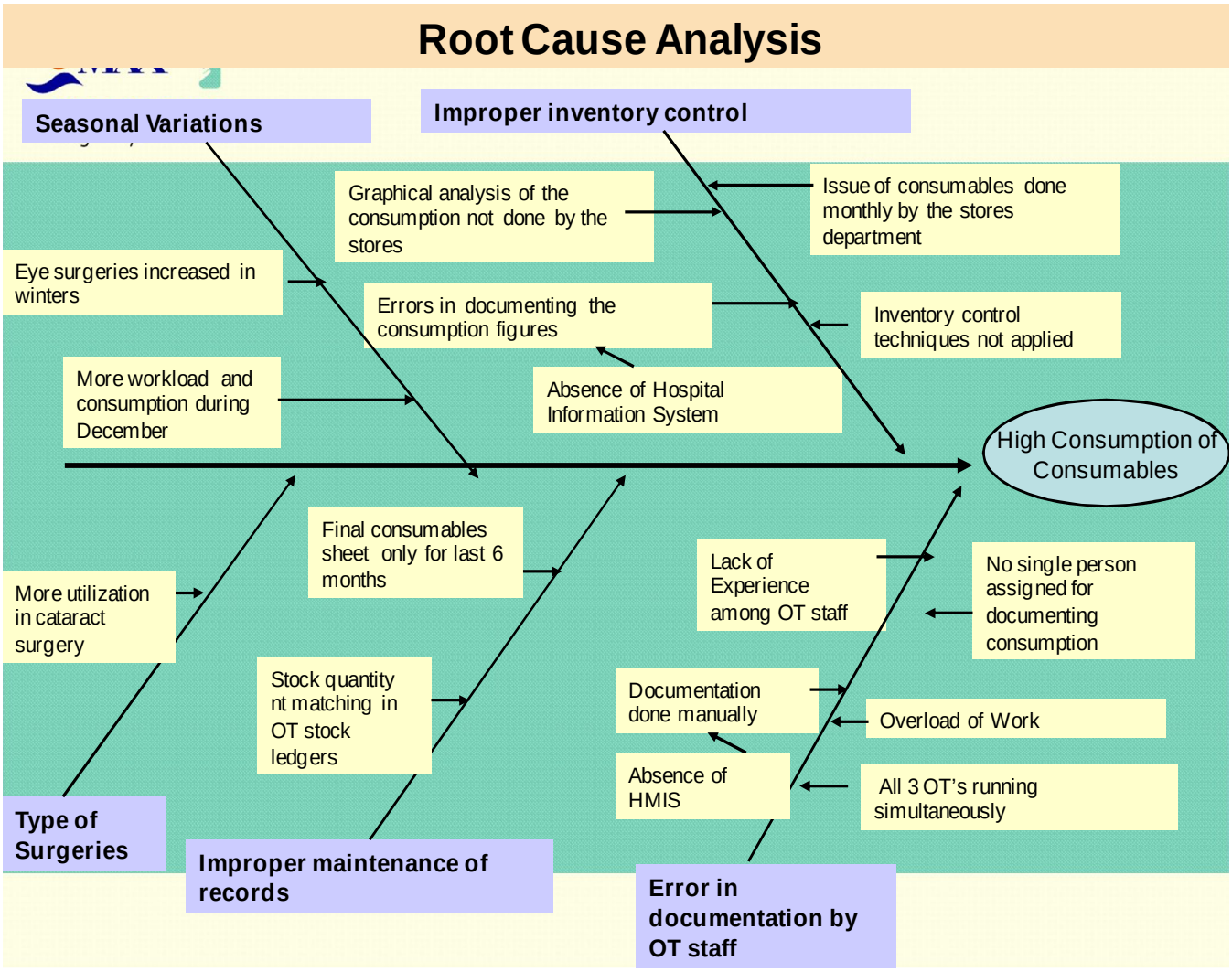


Figure 43: Root cause analysis of utilization patterns of consumables

After identifying the major causes of high consumption of the materials, recommendations were given to prevent the high consumption of the consumables.

DISCUSSION

AND

CONCLUSIONS

Discussion

During this study, it was observed that a more strict inventory control is needed to keep a check on the utilization of the consumables in Operation Theatre.

A high variation of more than 10% was found in utilization of consumables in some of the months of the study period. This variation was highest in the month of December due to large no. of surgeries being conducted during that month. Another reason was that the types of surgeries conducted were a little different from other months, some of which consumed higher no. of consumables.

All the consumables showed a positive but not a perfect relationship between workload and consumption, thus proving our assumption true that as the no. of surgeries increase in the operation theatre, the quantity of consumption of the consumables also increases.

Per cent variation was observed in the Month of February for Injection Viscoat because less no. of cases with hard cataract visited the operation Theatre. Consumption of Betadine Scrub was found to be low in the month of September probably because the total no. of surgeries conducted in the OT were less than that in rest of the 5 months (i.e 472).

Since suture Vicryl is mostly used in retina surgeries which for the month of February were found to be around 14 thus accounting for its less use in February.

Injection Ringer lactate showed a variation in the month of February from the benchmark of November because probably a large no. of surgeries were mostly clubbed which led to its less.

Conclusions

- More strict inventory control is needed to prevent any errors in the ledgers and to prevent high consumption of the consumables/materials
- Since all consumption is being tracked manually there are some errors found in the stock ledgers and the Operation Theatre Consumable Records in terms that the stock quantity is not matching on physical verification.
- The consumption of all items/materials are increasing with the increase in the workload of the hospital proving the assumption made as true.
- All the items showed a positive but not a perfect relationship between the quantity of consumption of the materials and the workload in the Operation Theatre
- Out of the 20 Consumables studied injection, Viscoat showed a high per cent variation in the month of February; Betadine scrub consumption was low in September as compared to the workload; utilization patterns of of Inj. Adrenaline, Inj. Xylocaine 2%, Inj Ringer Lactate and suture vicryl were not commensurate with the workload in February. Intravenous Cannula showed the least correlation between workload and consumption. Blue Rhex showed a slight decrease in the consumption in the month of February as compared to the workload
- Silicon Oil, Inj. Senseorcaine and Inj. Hynidase were found to be highly correlated with the workload with r = 0.96 (most close to 1). IV Cannula (0.29) and suture Vicryl 6.0 (0.36) did not correlate with the workload (more close to -1).

Recommendations

The recommendations given for having strict inventory control, minimizing wastage and preventing pilferage are:

1. There should be a hospital information system so that errors in writing the consumption pattern or any manual errors are avoided.
2. Operation Theatre Management System to be installed which will lead to efficient management of Surgical Consumables/Disposables & Medicines by tracking of consumables or drugs used in the operation. It should be able to track the consumables used per patient per surgery on a daily basis and this was proposed to the management
3. The issue of the materials which are at present being done monthly should now be done at least weekly or daily to avoid any errors in consumption.
4. Analytical techniques like ABC should be properly documented to exercise an efficient inventory control.
5. Graphical analysis of the consumption of materials/consumables should be done by the stores department every month
6. A experienced person should be assigned the authority to track the consumption of the consumables/materials so as to avoid any confusion
7. Regular training should be given to the OT staff on using the consumables in right quantity. Should be included in the OT training schedule
8. Regular verification of the stock ledgers must be done so as to identify any wrong entries
9. Surprise audits of the stores must be done on fortnightly or monthly basis and non-compliances should then be worked upon.
10. Routine requisitions to the stores should be carried out on a daily basis as per the day allotted by the stores
11. It would be useful to calculate average no. of different consumables used in each type of surgery so that the present data could be compared with future data to make meaningful results.
12. The consumables showing higher variation (more than 10%) should be closely observed for the next six months and then monitored on an annual basis.

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