Internship Training

On

INVENTORY MANAGEMENT OF LAB REAGENT IN BIOCHEMISTRY SECTION

At

Sitaram Bhartia Institute of Sciences and Research,

Qutab Institutional area,

New Delhi

By

SANDHYA SACHDEV

PGDHM

2012-2014

International Institute of Health Management Research

New Delhi

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At

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By

SANDHYA SACHDEV

Under the guidance of

Ms. ANUPAMA SHARMA

Post Graduate Diploma in Hospital and Health Management

2012-2014

International Institute of Health Management Research

New Delhi

care you can trust™

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The certificate is awarded to

SANDHYA SACHDEV

In recognition of having successfully completed her

Internship in the department of

LABORATORY DEPARTMENT

And has successfully completed her Project on

INVENTORY MANAGEMENT OF LAB REAGENT IN BIOCHEMISTRY SECTION
AT

SITARAM BHARTIA INSTITUTE OF SCIENCES AND RESEARCH, QUTUB INSTITUTIONAL AREA, NEW DELHI

Duration – February 3rd to May 3rd, 2014

She comes across as a committed, sincere & diligent person who has a
Strong drive & zeal for learning
We wish her all the best for future endeavors!

Saru Bhartia

Mrs. Saru Bhartia
Senior Manager- Quality & Administration
Sitaram Bhartia Institute of Science and Research

The certificate is awarded to

TO WHOMSOEVER MAY CONCERN

This is to certify that Sandhya Sahcdev is a student of Post Graduate Diploma in Hospital and Health Management (PGDHM) from International Institute of Health Management Research, New Delhi has done dissertation at Sitaram Bhartia Institute of Sciences and Research, Qutub Institutional area, New Delhi from February 3, 2014 to May 3, 2014.

The Candidate has successfully carried out the study designated to him during internship training and his approach to the study has been sincere, scientific and analytical. The Internship is in fulfilment of the course requirements. I wish her all success in all his future endeavours.

Dr. A.K. Agarwal
Dean, Academics and Student Affairs
IIHMR, New Delhi

Ms. Anupama Sharma
Assistant Professor
IIHMR, New Delhi

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Certificate of Approval

The following dissertation titled **"INVENTORY MANAGEMENT OF LAB REAGENT IN BIOCHEMISTRY SECTION"** at "Sitaram Bhartia Institute of Sciences and Research, Qutub Institutional area, New Delhi is hereby approved as a certified study in management carried out and presented in a manner satisfactorily to warrant its acceptance as a prerequisite for the award of **Post Graduate Diploma in Health and Hospital Management** for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the dissertation only for the purpose it is submitted.

Dissertation Examination Committee for evaluation of dissertation.

Name	Signature
Dr. A.K. Agarwal	
Dr. Ramteke	
Ms. Anupama Sharma	

Certificate from Dissertation Advisory Committee

This is to certify that **Ms. Sandhya Sachdev,** a graduate student of the **Post-Graduate Diploma in Health and Hospital Management** has worked under our guidance and supervision. She is submitting this dissertation titled "INVENTORY MANAGEMENT OF LAB REAGENT IN BIOCHEMISTRY SECTION" at "SITARAM BHARTIA INSTITUTE OF SCIENCES AND RESEARCH, QUTUB INSTITUTIONAL AREA, NEW DELHI" in partial fulfillment of the requirements for the award of the **Post- Graduate Diploma in Health and Hospital Management.** This dissertation has the requisite standard and to the best of our knowledge no part of it has been reproduced from any other dissertation, monograph, report or book.

Ms.Anupama Sharma
Assistant Professor, IIHMR

Saru Bhartia

Mrs. Saru Bhartia
Senior Manager,
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(Sitaram Bhartia Institute of Science & Research)

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(Certificate of original work)

INTERNATION INSTITUTE OF HEALTH MANAGEMENT RESEARCH, NEW DELHI

CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled INVENTORY MANAGEMENT OF LAB REAGENT IN BIOCHEMISTRY SECTION IN SITARAM BHARTIA INSTITUTE OF SCIENCES AND RESEARCH, QUTUB INSTITUTIONAL AREA, NEW DELHI submitted by SANDHYA SACHDEV, Enrollment No. PG/078/2012 under the supervision of Ms. Anupama... for award of Postgraduate Diploma in Hospital and Health Management of the Institute carried out during the period from 3rd February to 3rd May 2014 embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other Institute or other similar institution of higher learning.

Sandhya...

SIGNATURE

FEEDBACK FORM

- **Name of the Student:** SANDHYA SACHDEV
- **Dissertation Organization:** Sitaram Bharatia Institute of Science and Research, Hauz Khas
- **Area of Dissertation:** Laboratory Department
- **Project Title:** Inventory Management of Lab Reagents (Biochemistry section)
- **Attendance:** Full
- **Objectives achieved:**
  i) Understanding of the tools and processes of Quality Deptt.
  ii) Using these prospects in improvement of Operational deptts.
- **Deliverables:**
  Handling of Inventory system as per the Pattern of Consumption of Lab reagents (of biochem section); major project in hand.
- **Strengths:**
  - Sensitive to work
  - Fine-minded and Soft spoken.
- **Suggestions for Improvement:**
  Keep Learning and hence, improving.

MEGHA DHINGRA

- **Signature of the Officer-in-Charge/ Organisation Mentor (Dissertation)**

Jasu Bhatia

- **Date:** 9th May, 2014
- **Place:** Delhi

Sitaram Bharatia Institute of Science New Delhi

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This study is an accomplishment due to the timely help, guidance and consent support of several people. The investigator owes a deep sense of gratitude towards all those who have contributes to successful completion of this endeavor.

I am grateful to Mrs. Saru Bhartia, Head of the quality and training department. Sitaram Bhartia Institute of Science and Research for allowing to do the study in this hospital under their able guidance, direction and encouragement.

I offer my gratitude and respect to Ms. Megha, Senior Executive, Quality and Training department for constant support guidance and encouragement as Mentor who guided at every step of this project.

My sincere thanks to all the staff members of Laboratory Department of Sitaram Bhartia Institute of Science and Research for their kind cooperation in providing the needed information and help for the study.

I am also grateful to Dr A.K. Agarwal, Dean, IIHMR, New Delhi, for giving us an opportunity to take up this study at Sitaram Bhartia Institute of Science and Research and for his constant guidance and encouragement.

I offer my gratitude and respect to Ms. Anupama IIHMR, New Delhi, for his constant guidance and support in completion of this study.

INVENTORY MANAGEMENT OF LAB REAGENT IN BIOCHEMISTRY SECTION

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ABBREVIATION

SBISR-Sitaram Bhartia institute of science and research

Lab-Laboratory

LIS- Laboratory Information System

No.-Number

Avg-Average

Max-Maximum

INTERNSHIP REPORT

SITARAM BHARTIA INSTITUTE OF SCIENCE AND RESEARCH

Sitaram Bhartia Institute of Science and Research was established in the year 1990 with an aim to provide the quality medical services to the patients. SBISR provides both IPD and OPD services and is designed to conduct all its medical diagnostic investigations in commensurate to the clinical scope of the institution. Sitaram Bhartia Institute of Science and Research is a 70-bed not-for-profit multi-specialty hospital and research center located in New Delhi. Its largest clinical department is obstetrics and gynecology. There are over 350 full-time employees in the organization.

Sitaram Bhartia Institute of Science and Research is a paradigm – a human institution put together, being constantly improved and honed into maturity by a team of professionals committed to excellence in health care. From its roots in epidemiological research, today Sitaram Bhartia functions as a multi-specialty hospital and research center.

Core Purpose

The core purpose of Sitaram Bhartia is to serve society as a well-spring of excellence in healthcare delivery, research and education

Core Values

- Putting the interest of the patient first
- Treating others as you would want to be treated yourself
- Continuous learning and improvement
- Institution building

Envisioned Future

It will be a prolific medical center that will be known for its commitment to practicing evidence-based medicine and providing world-class care. It will have well established research programs that will focus on gaining a better understanding of the health care needs in our communities and developing practical solutions for addressing those needs. Sitaram Bhartia Institute of Science and Research will be widely acknowledged as an institution that serves as a symbol of excellence in our society.

Quality Department

Quality at Sitaram Bhartia Institute of Science and Research is an effort to provide patient-centered care. Sitaram Bhartia is inclined towards improving processes to ensure ease of workflow for staff. The department aims at increasing the level of transparency so that the patients can make informed healthcare decisions.

Function of the department are-

- ✓ Identification of current process and subsequent improvement
- ✓ Identification of outcomes and processes
- ✓ Identification and implementation of change ideas for improvement
- ✓ Creating Standard operating procedures for increasing efficiency in workflow
- ✓ Providing training for continuous quality improvement
- ✓ Conducting regular process and documentation audits
- ✓ Taking patient feedback and involving operational department for improvement
- ✓ Analyzing data and developing best practices
- ✓ Monthly review meeting with department heads to discuss the monthly performance.

Key learning

While a working with Sitaram Bhartia Institute of Science and Research as a Sr. Executive in Quality and Training Department, I learned many things:

- ✓ During induction period in quality department I learned to make u-chart p-chart, c-chart etc.
- ✓ Learned how to make Plan Do Study Act cycle and make flow chart in Microsoft office Visio software.
- ✓ Also enrolled myself in Institute for Healthcare Improvement to learn more about health care improvement and patient safety.
- ✓ Learned to take feedback from the patients and its analysis. Then forwarding it to the HOD of concern department. At times listen to the patient's problem and try to solve them there itself.
- ✓ During the lab project understand and observed the working of laboratory department and learned about LIS and how to retrieve data form LIS.
- ✓ Attended no. of training sessions on patient safety, biomedical waste, and maintain hygiene.

EXECUTIVE SUMMARY

This retrospective study was conducted in lab of the Sitaram Bhartia Institute of Science and Research. The objective of this study was to streamline the procurement process of lab reagents .The data was collected form LIS from April 13 to Feb 14.All reagents used in biochemistry and all the tests performed in this section were taken into account.

During the study it was found that procurement of reagents generally done on the basis of last month consumption and lab place the requisition for 45 days without considering factors like safety–stock, repeat tests ,reorder level and reagents consumed in the process of calibration and control causing shortage of reagents or sometime excess of reagents. And all stocks stored in the lab which may led to damage and pilferage. It was also found that the lead time is high because the internal process time for approval from higher management itself takes 4 to 5 days which can easily be reduced to 1 to 2 days.

So there was no proper calculations for procuring the reagents all ordering was done on assumed basis In this study ordering was done with proper calculation which including safety stock calculation ,lead time calculation, reagent consumed in repeat tests ,control and calibration measures. And also calculated reorder level so that stock gets replenished before reaching zero level.

In the lab all records are maintained properly. Lab maintained the proper stock register containing all details such as date of stock received, expiry date of each reagent, lot number of each reagent and date of opening of a reagent kit and FIFO (First in First Out) system is being followed.

INTRODUCTION

The last few decades have seen a spectacular growth in the Health and Hospital Industry of India. Establishing a successful hospital requires triad of good planning, good design and good construction but now it is quadruple with addition of good administration of services by the hospital. Today's patient is better informed and knowledgeable about the health services

The Department of Clinical Laboratory plays an important role in the hospital and has much information about patients and pathogens. It contains discrete departments for a variety of lab test types and houses sophisticated specialized instrumentation. Although often viewed as an ancillary service, doctors rely heavily on fast, accurate tests for disease prevention, diagnosis, and treatment. In fact, estimates show that clinical labs provide about two-thirds of all objective information on patients' health status.

Laboratory information enables physicians and other healthcare professionals to make appropriate evidence-based diagnostic or therapeutic decisions for their patients. Clinical laboratory services have a direct impact on many aspects of patient care including, but not limited to, length of stay, patient safety, resource utilization, and customer satisfaction.

Clinical laboratory services are the most cost effective, least invasive source of the objective information used in clinical decision-making. Clinical laboratorians provide information and services that contribute to maximizing the effective delivery of care in today's complex healthcare system by assuring that the correct test is performed on the right person, at the right time, producing accurate test results that enable providers to make the right diagnostic and therapeutic decisions using the right level of health care resources.

RATIONALE

Today's laboratory is one of a hospital's largest departments and produces vital information for effective healthcare delivery. It is well equipped with latest state of art technology to perform not only the routine as well as advanced diagnostic tests Clinical laboratory testing is an essential element in the delivery of health care services. Laboratory data are essential to support clinical physicians who diagnose and treat patients.

The management of reagents and supplies in the laboratory is often a challenging task. However, proper management of purchasing and inventory can produce cost savings in addition to ensuring supplies and reagents are available when needed. The procedures that are a part of management of purchasing and inventory are designed to ensure that all reagents and supplies are of good quality, and that they are used and stored in a manner that preserves integrity and reliability.

In laboratory of SBISR the procurement of reagents is generally based on the last month consumption but some important factors such as peak period requirement, number of tests performed in a month is not taken into consideration. Lab places the requisition for 45 days without calculating safety stock and reorder level. There is no proper reagent procurement system in lab due to which sometime lab faces shortage of reagents and sometime reagents expire for being stored for a long time. The shortage of the reagent also interrupts the working flow and delay in reports which creates bad impression on the patients whereas excess of reagent add on to the cost as well as the wastage.

INVENTORY MANAGEMENT

The objective of inventory management is to provide uninterrupted production, sales, and/or customer-service levels at the minimum cost. Effectiveness of an organization depends on the strength of inventory management. Inventory management is the core to whole system. In Laboratory the storage of reagents and supplies is a very important part of inventory control.

A well-managed laboratory will have a system for inventory maintenance and purchasing. The system will require planning and monitoring to ensure that appropriate quantities of supplies and reagents are always available, and to prevent wastage. The laboratory will need to maintain an inventory system for all reagents and supplies used in the laboratory; this system must include all areas where reagents and supplies are stored.

In implementing an inventory management system, the laboratory must assign responsibility for the programme, analyze the needs of the laboratory and establish the minimum stock needed for an appropriate time period. Appropriate logs and forms will be needed, as well as a procedure for receiving, inspecting and storing supplies.

Properly managing inventory will:

- increase the efficiency and effectiveness of the laboratory, because it will provide an uninterrupted flow of needed materials;
- Ensure products are available when they are needed;
- Ensure that patient and clinical needs are met.

DEFINITION

REAGENT

Reagents are substances or compounds that are added to a system in order to bring about a chemical reaction or are added to see if reaction occurs. Some reagents are just a single element. However, most processes require reagents made of chemical compounds.[8]

Reagents are compounds or mixtures, usually composed of inorganic or small organic molecules, which are used to effect a transformation on an organic substrate.

CONTROL

Control Laboratory quality control is designed to detect, reduce, and correct deficiencies in a laboratory's internal analytical process prior to the release of patient results, in order to improve the quality of the results reported by the laboratory. Quality control is a measure of precision, or how well the measurement system reproduces the same result over time and under varying operating conditions.[9]

Laboratory quality control material is usually run at the beginning of each shift, after an instrument is serviced, when reagent lots are changed, after calibration, and whenever patient results seem inappropriate. Quality control in the medical laboratory is a statistical process used to monitor and evaluate the analytical process that produces patient results. QC results are used to validate whether the instrument is operating within pre-defined specifications, inferring that patient test results are reliable. Once the test system is validated, patient results can then be used for diagnosis, prognosis, or treatment planning.

CALIBRATION

Proper calibration will ensure that equipment remains within validated performance limits to accurately report patient results. The calibration process generally involves using the instrument to test samples of one or more known values called “calibrators.” The results are used to establish a relationship between the measurement technique used by the instrument and the known values.[10]

REVIEW OF LITERATURE

Thomas M. McHugh, MS, MLS (ASCP), June 2012, Title of the article is Inventory management from counting supplies to analyzing expenses. Reagents, disposables and equipment are critical to operations of the medical laboratory. Inventory control is important for a number of reasons. Labs need to maintain sufficient reagents and supplies for patient testing. Analyze usage and expenses, coordinate the distribution of reagents and supplies to off-site laboratories, and calculate the value of the reagent, supply, and equipment inventory. The inventory management system used can take various forms, including a manual card system, a spreadsheet, or a software system which automates some of the tasks. While the system used may vary in structure. Reagents and supplies, the instrumentation and equipment used in the laboratory are an important part of the inventory. While reagents and supplies constitute a significant portion of the laboratory operating budget, they can be an overlooked expense. If storage space is plentiful, overstocking of reagents and supplies can occur, and wastage due to out-dating can be significant. Laboratories periodically determine the quantity on hand (QOH) by counting reagent and supply containers. This periodic counting system works well and can be expedited by categorizing reagents and supplies and automating the system using methods such as product barcode scanning. Laboratory managers routinely review workflow and work practices to improve operations. Inventory management of reagents, supplies, and instrumentation is required for patient testing and can contribute significantly to the operating budget. Profitability can be improved by proper management of these important resources.[1]

Beheshti, H. M., Grgurich, F.W. Gilbert , Nov 2013 conducted study on ABC Inventory Management Support System with a Clinical Laboratory Application. This paper presents a decision support system\for ABC inventory management that can be used by managers to determine the efficiency of their inventory policies and to evaluate inventory decisions. The ABC support system is a well-established inventory planning and control method that is used to manage different classes of inventory and reduce inventory costs concurrently. The ABC classification allows managers to establish reorder policies for each class based on the days of supplies, lead time and safety stock and not the optimum order quantity for each item in a given class. The mathematical formulas to support inventory decisions are discussed. Data for a group of 29 coagulation and hematology reagent were used to examine inventory ordering policy from the management perspective grouped by total annual dollar value rather than by cost per item or quantity demanded. Since managers must manage in term of dollars, the quantitative tools are explained in terms suitable for management.[2]

The article titled “Systematic Management of Laboratory Supplies” was written by DLMP members Raymond Frick, Joy Gomez, Jerry Dietenberger, and Kari Solak and posted on August 13 2013. The study was conducted at Mayo Medical Laboratories, part of Mayo Clinic’s Department of Laboratory Medicine and Pathology located in Rochester .The objective of this study to maintain the Laboratory Supplies. In Lab the cost of supplies and materials consumes approximately 20% of the overall laboratory budget. Thus, the quality, availability, and management of these products can have a significant impact on lab efficiency and productivity. There are numerous strategies, tools, and resources (both human-based and automation-based) that can assist in the proper management of laboratory. Mayo has implemented the 5S methodology—Sort, Set in order, Shine, Standardize, and Sustain—in its

laboratories, which is the basic foundation of any Lean system to Improve Supply Management. This methodology helps manage physical inventories accurately and efficiently while promoting the creation of a smooth flow of material and information up and down the supply chain. The uses of electronic data interchange order information to the appropriate vendor is to eliminate the need for human intervention and thereby remove human error factors from the process. The most effective way to manage inventory in the laboratory is to make sure all lab personnel have some degree of responsibility related to inventory management.[3]

Thomas McHugh, MS, MT (ASCP) conducted study on Supply Chain Management in the Clinical Laboratory at the University of California-San Francisco Medical Center. This study emphasis on material management and the implementation of a structured computerized system have allowed to focus on each area of the supply chain. The clinical laboratory's typical inventory includes a variety of items, including disposables (gloves, tubes, gauze, and tourniquets), bulk chemicals (saline, hydrochloric acid, and bleach), and individual reagent sand reagent kits. Material management application has reduced the time needed to manually count inventory, as well as the time required to generate purchase orders. To efficiently manage supplies, it is critical to determine the optimum quantity of supplies to be kept on hand, as well as the most effective reorder times. In conclusion, it was found that the implementation of a computerized supply management system has helped us organize all of our supply, vendor, storage location, PO, and equipment data. Approximately an 8 percent reduction in QOH due to improved management of supply chain and able to respond more rapidly and accurately to inquiries for information related to our inventory, purchase order activity and supply usage. This system has proven to be effective and has to make significant improvements to material management system with the net saving in operating expenses.[4]

OBJECTIVE

General Objective

To streamline the procurement process of lab reagent in bio-chemistry section of laboratory of Sitaram Bhartia Hospital.

Specific Objective

1) To analyze the consumption pattern of reagents in bio-chemistry section
2) To reduce the wastage of lab reagents due to expire for being stored for a long time
3) To reduce the shortage of lab reagents

RESEARCH METHODOLOGY

Research Technique

This is a retrospective study was conducted at laboratory department of Sitaram Bhartia Institute of Science and Research. Data was collected through the laboratory Information System

Study Duration

Duration of the study form 20th April 14 to 15th March 14

Study Population

All reagents use in all the section of laboratory to perform the lab test.

Study Frame

All reagents use in biochemistry section of laboratory.

LABORATORY DEPARTMENT OF SBISR

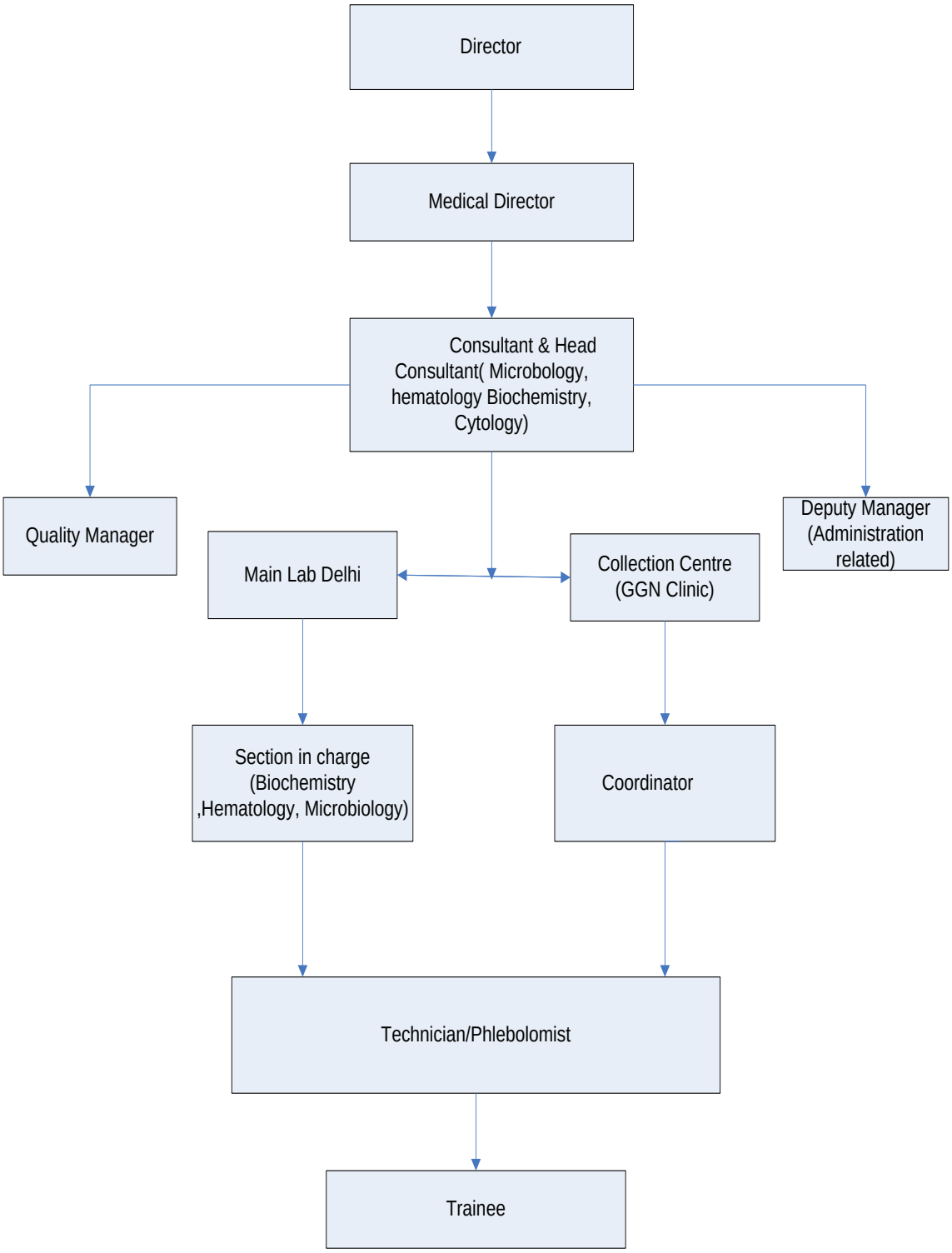
The department of laboratory medicine is one of the earliest NABL accredited laboratories in India. The laboratory endeavors to provide the highest level of quality and patient-centric services. The laboratory offers services round the clock of more than a hundred routine and advanced diagnostic tests. The laboratory offers tests in many sub-specialties including biochemistry, immunoassay, hematology, clinical pathology, microbiology, cytopathology and serology.

The laboratory is supported by experienced doctors, some of them NABL/NABH assessors in their field of expertise. The laboratory is equipped with fully automated equipment, a bar code system of sample identification, and bi-directional interface systems that ensures that reports are generated promptly, efficiently and without any manual errors.[11]

In addition, an important function is the specialized role it plays in controlling hospital-acquired infections. Apart from providing state-of-the-art infectious disease diagnoses, it provides consultative services for the clinical staff and physicians of the hospital and information to all the support staff.[11]

The laboratory has a sample collection unit at the Gurgaon clinic. The laboratory provides home collection of samples anywhere in Delhi and NCR, on prior appointment. The laboratory has defined reporting for all investigations. The reports can be delivered via e-mail and patients can print their reports at home, at their own convenience, without physically coming to collect their reports.

HIERARCHY OF LABORATORY DEPARTMENT



The Laboratory is under the responsibility of the head-Laboratory Medicine, who has the adequate and required qualifications and experience for efficiently running the department. Head-Laboratory is also responsible for ensuring that the lab is run in accordance with the established protocols. The head reports to the Medical Director, SBISR.

A senior consultant microbiologist looks after microbiology and serology. Consultant pathologist is responsible for the section of hematology and clinical pathology and biochemistry. Quality Manager Assurance has an overall responsibility for implementation and monitoring of the quality system and Deputy Manager has responsibility for all administrative work.

LAB TIMING: Round the clock for inpatient and 8:00 am to 8:00 pm for outpatient.

STAFF TIMING: The staff works on the basis of shifts from 8:00 am – 4:00 pm (Morning shift), 9:00 am – 5:00 pm (General shift), 12:00 pm – 8:00 pm (Evening shift), and 8:00 pm – 8:00 am (Night shift).

RESULTS AND FINDINGS

The laboratory offers services round the clock of more than a hundred routine and advanced diagnostic tests for inpatient and outpatient. In a laboratory around the 20000 test are performed in a month.

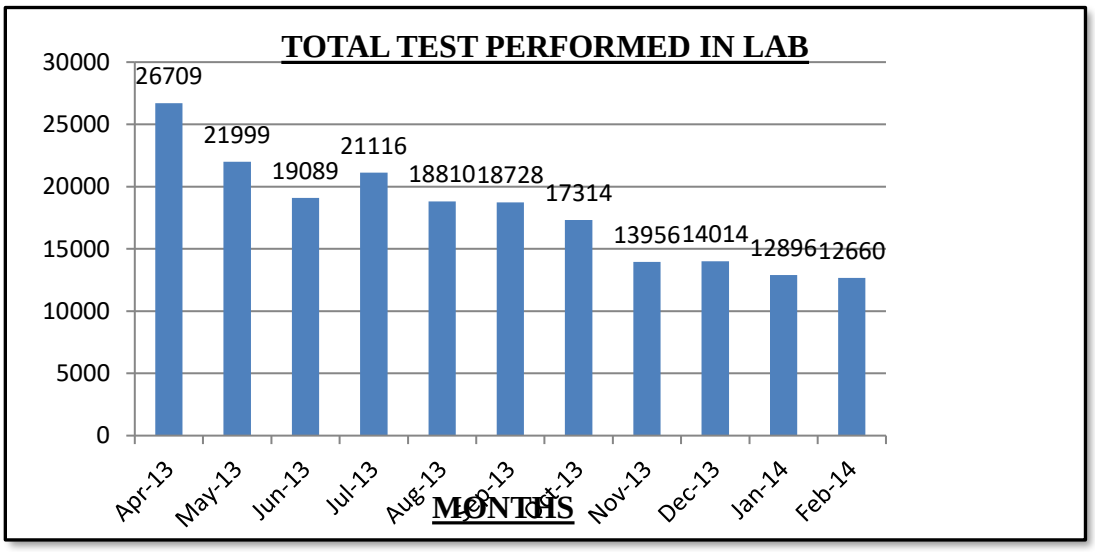
The objective of the study is to streamline the procurement process of lab reagents consumed in the lab. To achieve these objective following steps were followed:

1) **First we calculate total no. of tests performed in the lab**

Chart No.1 shows the no. of tests carried out from April 13 to Feb 14 in the laboratory. The chart shows that the test performed in the month of April, May and June are on the higher side and the test perform in the month of Nov, Dec ,Jan are on lower side.

TOTAL TEST IN LAB

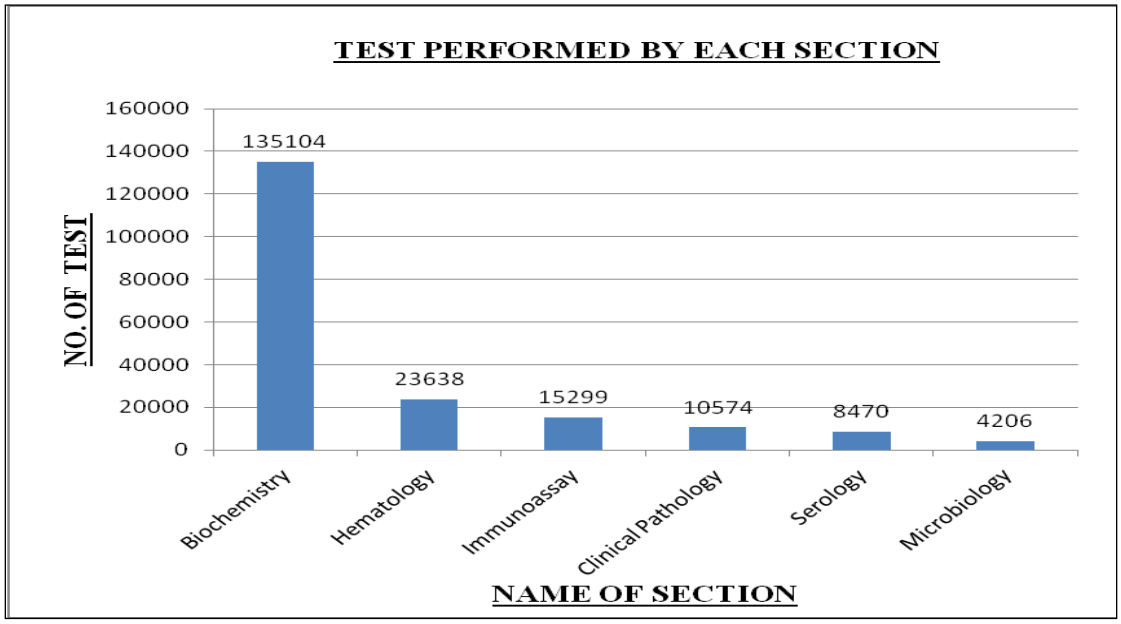
Chart 1



2) Calculate no. of test performed in different section of lab from April 13 to Fed 14

Section vise test performed

Chart 2



In Chart No: 2 explains the no. of tests performed in a month in each section. It clearly shows that the biochemistry section performed the maximum no. of test as compared to other sections. So **biochemistry section** was chosen for our project study purposes.

BIOCHEMISTRY SECTION

The Biochemistry section at SBISR offers both routine as well as specialized chemistry and hormone parameters. The department provides a comprehensive clinical biochemistry service to inpatient and outpatient.

Currently the section has undertaken six sigma approaches to quality control and stocks. It aims to deliver excellent, cost-effective and evidence-based patient care, within a clinically relevant turn-around time.

3) Calculate no. of test performed in Biochemistry section

Chart 3

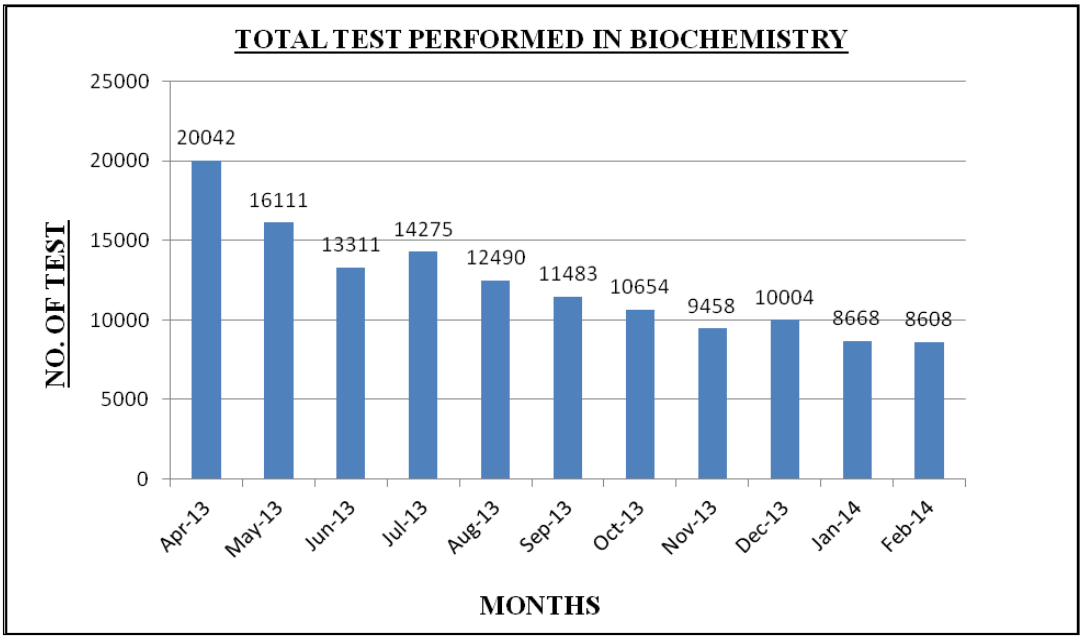


Chart No: 3 shows that in bio chemistry more than thousand performed in a month.

4) Note down different reagent used in biochemistry section with their respective quantities

30 types of reagents are used in bio chemistry section to perform the tests. Table no. 1 shows the no. of reagents and the test performed per pack by that reagent in biochemistry section.

For example a cart of albumin 50T ideally performs 50 tests whereas a cart LDL 100 T performs 100 tests.

Table 1

No.	Name of Reagent	Unit	Pack	No.	Name of Reagent	Unit	Pack
1	Albumin 50T	Cart	50	16	Glc 60T	Cart	60
2	Alkaline Phosphatase 60T	Cart	60	17	HbA1C	Kit	400
3	ALT 50T	Cart	50	18	HDL 60T	Cart	60
4	Amylase 18T	Cart	18	19	Iron 18T	Cart	18
5	AST 60T	Cart	60	20	LDL 100T	Cart	100
6	Calcium 60T	Cart	60	21	Micro albumin 50T	Cart	50
7	Chloride 50T	Cart	50	22	Phosphorous 60T	Cart	60
8	Cholestrol 60T	Cart	60	23	Potassium 50T	Cart	50
9	CK 18T	Cart	18	24	Sodium 50T	Cart	50
10	Creatinine 60T	Cart	60	25	Total bilirubin	Cart	60
11	CRP 18T	Cart	18	26	Total protein	Cart	50
12	Direct Bilirubin 60T	Cart	60	27	Triglycerides	Cart	60
13	dTIBC	Cart	50	28	Trop T	No.	1
14	G6PD	Vial	75 ml	29	Urea 60T	Cart	60
15	GGT 50T	Cart	50	30	Uric Acid 60T	Cart	60

5) Test performed by each reagent

No of test data retrieved from laboratory information system. Table no. 2 explains the no. of test performed by each reagent from April 13 to Feb 14.

Table 2

No.	Name of Reagent	Apr' 13	May' 13	Jun' 13	Jul' 13	Aug' 13	Sep' 13	Oct' 13	Nov' 13	Dec' 13	Jan' 14	Feb' 14	Total
1	Albumin 50T	606	514	483	536	466	478	440	339	360	332	297	**4851**
2	Alkaline Phosphatase 60T	635	551	513	580	489	507	479	363	389	366	319	**5191**
3	ALT 50T	698	573	548	616	565	566	545	377	415	369	344	**5616**
4	Amylase 18T	22	18	12	23	17	22	21	5	16	9	12	**177**
5	AST 60T	688	566	540	605	556	554	536	372	405	358	334	**5514**
6	Calcium 60T	604	581	521	573	463	487	461	339	370	380	342	**5121**
7	Chloride 50T	630	583	546	614	472	491	473	333	391	368	353	**5254**
8	Cholestrol 60T	644	570	449	495	475	397	380	329	366	344	343	**4792**
9	CK 18T	14	15	6	6	11	15	14	5	7	3	5	**101**
10	Creatinine 60T	903	776	727	852	706	675	648	519	543	532	510	**7391**
11	CRP 18T	80	100	65	133	103	119	101	78	79	71	60	**989**
12	Direct Bilirubin 60T	681	589	565	647	560	576	548	434	421	404	376	**5801**
13	dTIBC	27	19	25	33	28	15	15	19	9	12	18	**220**
14	G6PD	59	49	48	64	84	66	77	42	47	47	50	**633**
15	GGT 50T	632	519	488	556	497	504	484	341	360	330	298	**5009**
16	Glc 60T	1584	1203	1244	1299	1259	1028	1095	936	978	927	949	**12502**
17	HbA1C	356	324	274	294	241	240	221	204	217	208	241	**2820**
18	HDL 60T	638	553	439	470	469	387	364	325	360	338	337	**4680**
19	Iron 18T	31	23	25	34	28	15	18	19	11	12	18	**234**
20	LDL 100T	638	553	439	471	470	387	364	326	360	338	339	**4685**
21	Microalbumin 50T	101	102	95	109	74	75	77	71	88	93	95	**980**
22	Phosphorous 60T	116	99	75	109	101	87	72	49	78	91	67	**944**
23	Potassium 50T	675	631	586	650	495	520	500	383	411	401	379	**5631**
24	Sodium 50T	672	643	584	652	495	522	499	374	408	392	373	**5614**
25	Total bilirubin	682	589	565	649	560	576	548	434	423	404	376	**5806**
26	Total protein	615	525	489	539	469	480	447	346	362	338	306	**4916**
27	Triglycerides	642	562	442	483	474	390	375	327	363	340	339	**4737**
28	Trop T	32	42	19	36	30	22	16	16	25	26	28	**292**
29	Urea 60T	750	630	597	716	599	568	563	390	427	423	386	**6049**
30	Uric Acid 60T	752	618	583	663	589	563	546	361	424	408	391	**5898**

6) Calculate consumption of reagent in repeat test

At times test results are abnormal (doubtful value) so rechecking is done by repeating the test and this repeatation of test also consumes the reagent. Table no. 3 explains the no. repeat test carried out in the biochemistry section by different reagent over a period of 11 months starting from April 13 to Feb 14.

Table 3

Repeat Test

No.	Name of Reagent	Apr' 13	May' 13	Jun' 13	Jul' 13	Aug' 13	Sep' 13	Oct' 13	Nov' 13	Dec' 13	Jan' 14	Feb' 14	Total
1	Albumin 50T	1		1	1	2		1					**6**
2	Alkaline Phosphatase 60T					1		1					**2**
3	ALT 50T							2					**2**
4	Amylase 18T									1			**1**
5	AST 60T					1		3					**4**
6	Calcium 60T	3	8	11	3	4		4	7	6	2	4	**52**
7	Chloride 50T	2	5	4	2	3	1	1	1	3		1	**23**
8	Cholestrol 60T	6	2	1		1	1			1			**12**
9	CK 18T											1	**1**
10	Creatinine 60T	4	5	3	4	1	1	1	3	2		2	**26**
11	CRP 18T	1	1		1		1			2			**6**
12	Direct Bilirubin 60T	4	1						1				**6**
13	dTIBC			2									**2**
14	G6PD									2			**2**
15	GGT 50T	1						1					**2**
16	Glc 60T	4	3	3	1	1	2	4	1		1		**20**
17	HbA1C	2					1					1	**4**
18	HDL 60T	6	3	1		1							**11**
19	Iron 18T		1	2									**3**
20	LDL 100T	6	2	1		1							**10**
21	Microalbumin 50T										1	2	**3**
22	Phosphorous 60T	2	2	3									**7**
23	Potassium 50T	6	3	8	5	4	2	5	8	13	3	7	**64**
24	Sodium 50T	4	8	7	3	4	2	4	3	4	1	1	**41**
25	Total bilirubin	6	4	1	2	1		1	1			1	**17**
26	Total protein	1	2	1	3	3		1				1	**12**
27	Triglycerides	6	2	1	1	1	1		1	1			**14**
28	Trop T									1			**1**
29	Urea 60T	5	2	2	5		1	3		1		1	**20**
30	Uric Acid 60T	3	3	4	3	1	3	5		1		1	**24**

7) To validate the quality measures of the test performed calibration and control process was done

a) Calculate reagent use in the process of calibration

Proper calibration is done to ensure the accuracy in test results. Calibration of instrument is generally carried out in the beginning of each lot of a reagent. This calibration process again consumed some reagent. Table no.4 shows no. of calibration and reagents used. (Data retrieved from machine)

Table 4

No.	Name of Reagent	Calibration		
		No. of times	No. of Test	Total
1	Albumin 50T	1	6	**6**
2	Alkaline Phosphatase 60T	3	6	**18**
3	ALT 50T	4	6	**24**
4	Amylase 18T	1	6	**6**
5	AST 60T	3	6	**18**
6	Calcium 60T	3	6	**18**
7	Chloride 50T	2	4	**8**
8	Cholestrol 60T	3	6	**18**
9	CK 18T	1	6	**6**
10	Creatinine 60T	2	6	**12**
11	CRP 18T	4	6	**24**
12	Direct Bilirubin 60T	5	8	**40**
13	dTIBC	3	6	**18**
14	G6PD	NA	NA	**NA**
15	GGT 50T	1	6	**6**
16	Glc 60T	3	6	**18**
17	HbA1C	11	2	**2**
18	HDL 60T	1	6	**6**
19	Iron 18T	1	6	**6**
20	LDL 100T	6	6	**36**
21	Microalbumin 50T	2	8	**16**
22	Phosphorous 60T	1	6	**6**
23	Potassium 50T	4	4	**16**
24	Sodium 50T	4	4	**16**
25	Total bilirubin	2	6	**12**
26	Total protein	1	6	**6**
27	Triglycerides	1	6	**6**
28	Trop T	NA	NA	**NA**
29	Urea 60T	3	6	**18**
30	Uric Acid 60T	2	6	**12**

Note: G6PD and Trop T are qualitative tests so there is no need of calibration

b) Calculate the reagent used in control measure

Laboratory quality control material is usually run at the beginning of each shift after an instrument is serviced when reagent lots are changed after calibration, and whenever patient results seem inappropriate and these controls measures also consumes reagent. Table No. 5 shows the no. of reagent consumed while carried out the control measures. (Data retrieved from machine).

Table 5

No.	Name of Reagent	Control		
		No. of times	Days	Total
1	Albumin 50T	3	341	**1023**
2	Alkaline Phosphatase 60T	3	341	**1023**
3	ALT 50T	3	341	**1023**
4	Amylase 18T	NA	NA	**177**
5	AST 60T	3	341	**1023**
6	Calcium 60T	3	341	**1023**
7	Chloride 50T	3	341	**1023**
8	Cholestrol 60T	2	341	**682**
9	CK 18T	NA	NA	**101**
10	Creatinine 60T	3	341	**1023**
11	CRP 18T	NA	NA	**989**
12	Direct Bilirubin 60T	3	341	**1023**
13	dTIBC	NA	NA	**220**
14	G6PD	NA	NA	**NA**
15	GGT 50T	3	341	**1023**
16	Glc 60T	3	341	**1023**
17	HbA1C	1	341	**341**
18	HDL 60T	2	341	**682**
19	Iron 18T	NA	NA	**234**
20	LDL 100T	2	341	**682**
21	Microalbumin 50T	1	341	**341**
22	Phosphorous 60T	2	341	**682**
23	Potassium 50T	3	341	**1023**
24	Sodium 50T	3	341	**1023**
25	Total bilirubin	3	341	**1023**
26	Total protein	3	341	**1023**
27	Triglycerides	2	341	**682**
28	Trop T	NA	NA	**NA**
29	Urea 60T	3	341	**1023**
30	Uric Acid 60T	3	341	**1023**

Note: G6PD and Trop T are qualitative tests so there is no need of control

c) Total consumption can be calculated by summing up above mentioned consumption

Table no. 6 shows the total consumption of reagent in bio chemistry section over a period of April 13 to Feb 14.Total consumption of reagent means:

- Reagent consumed in performing test
- Reagent consumed in repeat test
- Reagent consumed in control
- Reagent consumed in calibration

Table 6

No	Name of Reagent	Apr'13	May'13	Jun'13	Jul'13	Aug'13	Sep'13	Oct'13	Nov'13	Dec'13	Jan'14	Feb'14	Controls	Repeats	Calibration	Total
1	Albumin 50T	606	514	483	536	466	478	440	339	360	332	297	1023	6	6	5886
2	Alkaline Phosphatase 60T	635	551	513	580	489	507	479	363	389	366	319	1023	2	18	6234
3	ALT 50T	698	573	548	616	565	566	545	377	415	369	344	1023	2	24	6665
4	Amylase 18T	22	18	12	23	17	22	21	5	16	9	12	177	1	6	361
5	AST 60T	688	566	540	605	556	554	536	372	405	358	334	1023	4	18	6559
6	Calcium 60T	604	581	521	573	463	487	461	339	370	380	342	1023	52	18	6214
7	Chloride 50T	630	583	546	614	472	491	473	333	391	368	353	1023	23	8	6308
8	Cholestrol 60T	644	570	449	495	475	397	380	329	366	344	343	682	12	18	5504
9	CK 18T	14	15	6	6	11	15	14	5	7	3	5	101	1	6	209
10	Creatinine 60T	903	776	727	852	706	675	648	519	543	532	510	1023	26	12	8452
11	CRP 18T	80	100	65	133	103	119	101	78	79	71	60	989	6	24	2008
12	Direct Bilirubin 60T	681	589	565	647	560	576	548	434	421	404	376	1023	6	40	6870
13	dTIBC	27	19	25	33	28	15	15	19	9	12	18	220	0	18	458
14	G6PD	59	49	48	64	84	66	77	42	47	47	50	NA	0	NA	633
15	GGT 50T	632	519	488	556	497	504	484	341	360	330	298	1023	2	6	6040
16	Glc 60T	1584	1203	1244	1299	1259	1028	1095	936	978	927	949	1023	2	18	13545
17	HbA1C(1 kit for 400 tests)	356	324	274	294	241	240	221	204	217	208	241	341	20	2	3183
18	HDL 60T	638	553	439	470	469	387	364	325	360	338	337	682	4	6	5372
19	Iron 18T	31	23	25	34	28	15	18	19	11	12	18	234	11	6	485
20	LDL 100T	638	553	439	471	470	387	364	326	360	338	339	682	0	36	5403
21	Microalbumin 50T	101	102	95	109	74	75	77	71	88	93	95	341	3	16	1340
22	Phosphorous 60T	116	99	75	109	101	87	72	49	78	91	67	682	10	6	1642
23	Potassium 50T	675	631	586	650	495	520	500	383	411	401	379	1023	0	16	6670
24	Sodium 50T	672	643	584	652	495	522	499	374	408	392	373	1023	3	16	6656
25	Total bilirubin	682	589	565	649	560	576	548	434	423	404	376	1023	7	12	6848
26	Total protein	615	525	489	539	469	480	447	346	362	338	306	1023	64	6	6009
27	Triglycerides	642	562	442	483	474	390	375	327	363	340	339	682	41	6	5466
28	Trop T	32	42	19	36	30	22	16	16	25	26	28	NA	17	NA	309
29	Urea 60T	750	630	597	716	599	568	563	390	427	423	386	1023	12	18	7102
30	Uric Acid 60T	752	618	583	663	589	563	546	361	424	408	391	1023	0	12	6933

8) To find out total consumption of reagent for 45 days calculate the lead time and safety stock

a) Lead time

Lead time differs from delivery time in that it also includes the time required to place an order and the time it takes to inspect the goods and receive them into the appropriate store. In short Lead time is the time that elapses between the placing of an order and actually receiving the goods ordered[7]

In Sitaram Bhartia hospital generally take 11 to 12 days to place an order and actually receiving it. The steps involved in lead time calculation are:

Lab generating the order approved by the HOD and forwarded to the purchase department which in turn generates a requisition and sends it to the higher management for their approval and it generally takes 4 to 5 days. After the receiving the approval purchase department generates purchase order and sends it to vendor. It takes 6 to 7 days by the vendor to deliver the order. So under normal circumstance it takes 11 to 12 days (Lead time) to place an order and actually receiving it. But some time due to unavailability of some reagent with the vendor it takes 18 to 20 days (Lead time) in receiving the stocks.

Table 7

Table no. 7 shows time taken by the vendor in delivering the reagents after receiving the confirm order. Lead time taken by vendor does not include the internal process time (Approximately 5 days).so every order in total takes lead time plus internal process time (4 to 5 days) for delivery.

No.	Purchase Order no.	Purchase Order Date	Stock Received	Lead time for vendor (days)
1	15213	4/8/2013	4/11/2013	3
2	15312	4/25/2013	5/3/2013	8
3	15393	5/8/2013	5/9/2013	1
4	15462	5/23/2013	5/31/2013	8
5	15484	5/28/2013	5/30/2013	2
6	15638	6/26/2013	7/2/2013	6
7	15653	6/28/2013	7/11/2013	13
8	15797	7/22/2013	7/23/2013	1
9	15797	7/22/2013	7/30/2013	8
10	15887	8/6/2013	8/8/2013	2
11	15951	8/22/2013	9/4/2013	13
12	16143	9/25/2013	10/7/2013	12
13	16143	9/25/2013	10/11/2013	16
14	16143	9/25/2013	10/14/2013	19
15	16305	10/24/2013	10/26/2013	2
16	16444	11/29/2013	11/30/2013	1
17	16540	12/21/2013	12/24/2013	3
18	16545	12/24/2013	12/26/2013	2
19	16677	1/24/2014	1/27/2014	3
20	16838	2/22/2014	2/26/2014	4
Average lead time				**6.35**
No. of Days for internal Process*				**5**
Total Lead Time				**11.35**

Note: No. of Days For internal process includes Management approval and time for generating purchase order

b) Calculate Safety Stock

Safety stock (also called buffer stock) is a term used by logisticians to describe a level of extra stock that is maintained to mitigate risk of stock outs (shortfall in raw material or packaging) due to uncertainties in supply and demand.[6]

Safety stock is an additional quantity of an item held in inventory in order to reduce the risk that the item will be out of stock. Safety stock acts as a buffer in case the sales of an item are greater than planned and/or the supplier is unable to deliver additional units at the expected time.

Safety Stock = (Maximum Daily Usage − Average Daily Usage) × Lead Time

Table 8

Table 8 explains the safety stock calculation:

On the basis of the data retrieved from LIS table 8 shows no. of test performed by each reagent on monthly basis it also explains the maximum no. of test performed by each reagent in a day and average no. of tests per day. Now to calculate the safety stock one need to find out maximum no. of test performed in a day and average no. of test performed in a day.

Maximum no. of test performed in a day = Maximum no. of test performed in a month/ 30 days

Average no. of test performed in a day = Average no. of test performed in a month/30 day

Safety stock in terms of no. of test= (Maximum no. of test performed in a day – Average no. of test performed in a day) x Total Lead time

Safety stock in terms of pack size = safety stock in terms of no. of test / pack size

It is clear from the table that for most of the reagent safety stock calculated is in fraction so it is rounded off to 1 pack.

No.	Name of Reagent	Pack size	Apr'13	May'13	Jun'13	Jul'13	Aug'13	Sep'13	Oct'13	Nov'13	Dec'13	Jan'14	Feb'14	Average of test	Avg. no. of test/30 (Per day)	Maxi-mum no. of test	Max. no of test /30(Per day)	Safety Stock	Safety Stock /Pack Size
1	Albumin 50T	50	606	514	483	536	466	478	440	339	360	332	297	441	14.7	606	20.2	66	1.3
2	Alkaline Phosphatase 60T	60	635	551	513	580	489	507	479	363	389	366	319	472	15.7	635	21.2	65.2	1.1
3	ALT 50T	50	698	573	548	616	565	566	545	377	415	369	344	511	17	698	23.3	75	1.5
4	Amylase 18T	18	22	18	12	23	17	22	21	5	16	9	12	16	0.5	23	0.8	2.8	0.2
5	AST 60T	60	688	566	540	605	556	554	536	372	405	358	334	501	16.7	688	22.9	74.7	1.2
6	Calcium 60T	60	604	581	521	573	463	487	461	339	370	380	342	466	15.5	604	20.1	55.4	0.9
7	Chloride 50T	50	630	583	546	614	472	491	473	333	391	368	353	478	15.9	630	21	60.9	1.2
8	Cholestrol 60T	60	644	570	449	495	475	397	380	329	366	344	343	436	14.5	644	21.5	83.3	1.4
9	CK 18T	18	14	15	6	6	11	15	14	5	7	3	5	9	0.3	15	0.5	2.3	0.1
10	Creatinine 60T	60	903	776	727	852	706	675	648	519	543	532	510	672	22.4	903	30.1	92.4	1.5
11	CRP 18T	18	80	100	65	133	103	119	101	78	79	71	60	90	3	133	4.4	17.2	1
12	Direct Bilirubin 60T	60	681	589	565	647	560	576	548	434	421	404	376	527	17.6	681	22.7	61.5	1
13	dTIBC	50	27	19	25	33	28	15	15	19	9	12	18	20	0.7	33	1.1	5.2	0.1
14	G6PD	75 ml	59	49	48	64	84	66	77	42	47	47	50	58	1.9	84	2.8	10.6	
15	GGT 50T	50	632	519	488	556	497	504	484	341	360	330	298	455	15.2	632	21.1	70.7	1.4
16	Glc 60T	60	1584	1203	1244	1299	1259	1028	1095	936	978	927	949	1137	37.9	1584	52.8	179	3
17	HbA1C(1 kit for 400 tests)	1	356	324	274	294	241	240	221	204	217	208	241	256	8.5	356	11.9	39.9	39.9
18	HDL 60T	60	638	553	439	470	469	387	364	325	360	338	337	425	14.2	638	21.3	85	1.4
19	Iron 18T	18	31	23	25	34	28	15	18	19	11	12	18	21	0.7	34	1.1	5.1	0.3
20	LDL 100T	100	638	553	439	471	470	387	364	326	360	338	339	426	14.2	638	21.3	84.8	0.8
21	Microalbumin 50T	50	101	102	95	109	74	75	77	71	88	93	95	89	3	109	3.6	8	0.2
22	Phosphorous 60T	60	116	99	75	109	101	87	72	49	78	91	67	86	2.9	116	3.9	12.1	0.2
23	Potassium 50T	50	675	631	586	650	495	520	500	383	411	401	379	512	17.1	675	22.5	65.2	1.3
24	Sodium 50T	50	672	643	584	652	495	522	499	374	408	392	373	510	17	672	22.4	64.7	1.3
25	Total bilirubin	60	682	589	565	649	560	576	548	434	423	404	376	528	17.6	682	22.7	61.7	1
26	Total protein	50	615	525	489	539	469	480	447	346	362	338	306	447	14.9	615	20.5	67.2	1.3
27	Triglycerides	60	642	562	442	483	474	390	375	327	363	340	339	431	14.4	642	21.4	84.5	1.4
28	Trop T	1	32	42	19	36	30	22	16	16	25	26	28	27	0.9	42	1.4	6.2	6.2
29	Urea 60T	60	750	630	597	716	599	568	563	390	427	423	386	550	18.3	750	25	80	1.3
30	Uric Acid 60T	60	752	618	583	663	589	563	546	361	424	408	391	536	17.9	752	25.1	86.3	1.4

Calculate 45 days consumption of reagent

Table no. 9 explains the consumption of each reagent over a period of 11 months and by dividing this consumption with the pack quantity of that particular reagent we can get the total pack quantity consumed and further dividing this pack quantity by no. of months to know the monthly consumption and then dividing it by 30 days to calculate the per day consumption .Now this per day consumption by multiplying with 45 days can give 45 days' consumption of a particular reagent in biochemistry section .Reordering should include safety stock also. So safety stock (as per table no. 9) has been added in 45 days consumption.

Table 9

No	Name of Reagent	Total Test	Unit	Pack size	Pkt. Consumed for 11 months (Total Test/Pack size)	Duration	Per month consumption(Cart)	Per day consumption	45 days consumption	Safety Stock	45 days consumption +safety stock
1	Albumin 50T	**5886**	Cart	50	118	11	11	0.36	16.1	1.3	**17**
2	Alkaline Phosphatase 60T	**6234**	Cart	60	104	11	9	0.31	14.2	1.1	**15**
3	ALT 50T	**6665**	Cart	50	133	11	12	0.40	18.2	1.5	**20**
4	Amylase 18T	**361**	Cart	18	20	11	2	0.06	2.7	0.2	**3**
5	AST 60T	**6559**	Cart	60	109	11	10	0.33	14.9	1.2	**16**
6	Calcium 60T	**6214**	Cart	60	104	11	9	0.31	14.1	0.9	**15**
7	Chloride 50T	**6308**	Cart	50	126	11	11	0.38	17.2	1.2	**18**
8	Cholestrol 60T	**5504**	Cart	60	92	11	8	0.28	12.5	1.4	**14**
9	CK 18T	**209**	Cart	18	12	11	1	0.04	1.6	0.1	**2**
10	Creatinine 60T	**8452**	Cart	60	141	11	13	0.43	19.2	1.5	**21**
11	CRP 18T	**2008**	Cart	18	112	11	10	0.34	15.2	1.0	**16**
12	Direct Bilirubin 60T	**6870**	Cart	60	115	11	10	0.35	15.6	1.0	**17**
13	dTIBC	**458**	NA	50	9	11	1	0.03	1.2	0.1	**1**
14	G6PD	**633**	Bottle	75 ml		11	0	0.00	0.0	0.0	**0**
15	GGT 50T	**6040**	Cart	50	121	11	11	0.37	16.5	1.4	**18**
16	Glc 60T	**13545**	Cart	60	226	11	21	0.68	30.8	3.0	**34**
17	HbA1C(1 kit for 400 tests)	**3183**	Kit	1	3183	11	289	9.65	434.0	39.9	**474**
18	HDL 60T	**5372**	Cart	60	90	11	8	0.27	12.2	1.4	**14**
19	Iron 18T	**485**	Cart	18	27	11	2	0.08	3.7	0.3	**4**
20	LDL 100T	**5403**	Cart	100	54	11	5	0.16	7.4	0.8	**8**
21	Microalbumin 50T	**1340**	Cart	50	27	11	2	0.08	3.7	0.2	**4**
22	Phosphorous 60T	**1642**	Cart	60	27	11	2	0.08	3.7	0.2	**4**
23	Potassium 50T	**6670**	Cart	50	133	11	12	0.40	18.2	1.3	**19**
24	Sodium 50T	**6656**	Cart	50	133	11	12	0.40	18.2	1.3	**19**
25	Total bilirubin	**6848**	Cart	60	114	11	10	0.35	15.6	1.0	**17**
26	Total protein	**6009**	Cart	50	120	11	11	0.36	16.4	1.3	**18**
27	Triglycerides	**5466**	Cart	60	91	11	8	0.28	12.4	1.4	**14**
28	Trop T	**309**	No.	1	309	11	28	0.94	42.1	6.2	**48**
29	Urea 60T	**7102**	Cart	60	118	11	11	0.36	16.1	1.3	**17**
30	Uric Acid 60T	**6933**	Cart	60	116	11	11	0.35	15.8	1.4	**17**

Note: 1) One bottle of G6pd used for six months.

2) One kit of HbA1C performed 400 tests so one kit of HbA1C is sufficient for one month

As per table 9 stocks for 45 days has been calculated while placing the order one should deduct stock in hand from 45 days stock.

E.g. Total consumption (45 days) –Stock in hand = Requisition Quantity

Also calculate the reorder level to check the need of sufficient stock

Reorder level

The **reorder level of stock** is the point at which stock on a particular item has diminished to a point where it needs to be replenished. The reorder level of stock is often set at a figure higher than zero to take this time period into account. Therefore, the reorder level is set so that the stock level will reach at or around zero about the time the next shipment of stock is anticipated to arrive.[5]

Reorder Level signifies the quantity of a Stock Item in hand, after reaching which you must place orders for your supplies. The importance of Reorder Level arises from the need to have sufficient stocks to service customer orders and, at the same time, not to unnecessarily accumulate stock.

(Lead Time x Average demand per Day) + Safety Stock

Though the Lab have a fix reordering date every month but at times consumption of a particular reagent may go higher than expected and replenishing of this reagent required before reordering date in these cases reordering level calculation are helpful.

Reorder level calculation are done on the basis of data given in the table no.10.It shows pack size ,average consumption of each reagent on daily basis(taken from table no.8) and safety stock.

Calculation:

Reorder level = (Total lead time* x Average consumption per day) +Safety stock

*Total lead time taken form table no.7

Table No: 10

No.	Name of Reagent	Pack size	Average (Per day)	Safety Stock	Reorder level as per test	Reorder level as per pack
1	Albumin 50T	50	15	66.0	242.4	**4.8**
2	Alkaline Phosphatase 60T	60	16	65.2	254	**4.2**
3	ALT 50T	50	17	75.0	279.2	**5.6**
4	Amylase 18T	18	1	2.8	9.2	**0.5**
5	AST 60T	60	17	74.7	275.2	**4.6**
6	Calcium 60T	60	16	55.4	241.6	**4.0**
7	Chloride 50T	50	16	60.9	252	**5.0**
8	Cholestrol 60T	60	15	83.3	257.6	**4.3**
9	CK 18T	18	0	2.3	6	**0.3**
10	Creatinine 60T	60	22	92.4	361.2	**6.0**
11	CRP 18T	18	3	17.2	53.2	**3.0**
12	Direct Bilirubin 60T	60	18	61.5	272.4	**4.5**
13	dTIBC	50	1	5.2	13.2	**0.3**
14	G6PD	75 ml	2	10.6	33.6	**0.0**
15	GGT 50T	50	15	70.7	252.8	**5.1**
16	Glc 60T	60	38	179.0	633.6	**10.6**
17	HbA1C	1	9	39.9	142.4	**142.4**
18	HDL 60T	60	14	85.0	255.2	**4.3**
19	Iron 18T	18	1	5.1	13.6	**0.8**
20	LDL 100T	100	14	84.8	255.2	**2.6**
21	Microalbumin 50T	50	3	8.0	43.6	**0.9**
22	Phosphorous 60T	60	3	12.1	46.4	**0.8**
23	Potassium 50T	50	17	65.2	270	**5.4**
24	Sodium 50T	50	17	64.7	268.8	**5.4**
25	Total bilirubin	60	18	61.7	272.8	**4.5**
26	Total protein	50	15	67.2	246	**4.9**
27	Triglycerides	60	14	84.5	256.8	**4.3**
28	Trop T	1	1	6.2	16.8	**16.8**
29	Urea 60T	60	18	80.0	300	**5.0**
30	Uric Acid 60T	60	18	86.3	300.8	**5.0**

OBSERVATION

This is a retrospective study conducted at laboratory department of Sitaram Bhartia Institute of Science and Research to streamline the procurement process of lab reagents used in performing the test. Data was collected from lab information system .During this study it was observed that:

1) All records are maintained properly. Separate file are being maintained for stock issue, repeat test, control and calibrations.

2) Lab maintained the proper stock register containing all details such as date of stock received, expiry date of each reagent, lot number of each reagent and date of opening of a reagent kit.

3) In lab FIFO (First in First Out) system is being followed.

4) But the requisitions of reagents are made on the basis of last month consumption only due to which some time shortage or excess of stocks occurred.

5) Safety stock calculations are not taken into account.

6) Reorder level calculation are not done as a result stock level of some reagents will reach at or around zero at the time the next order.

7) Stock received is being stored in the lab, causing space crunch and increasing the chances of pilferage.

RECOMMENDATION

1) Stock should be kept in store instead of lab to avoid the space crunch.

2) Only one week requirement is to be issued to the lab to have more control on consumption and reduce the chances of pilferage. For this sub- store system can be developed and reordering can be done on weekly basis.

3) Time taken for internal process approval should be reduced.

4) Safety stock calculation and reordering level calculations should be taken in to consideration while placing the order to the vendor.

5) Apart from standard calculation peak period requirement should also be taken into consideration.

6) All sections are advices to follow the similar step.

CONCLUSION

This study was conducted at biochemistry section of laboratory in Sitaram Bhartia Institute of Science and Research. The objective of this retrospective study is to streamline the procurement process of lab reagent and to analyze the consumption pattern of reagents in bio-chemistry section. The data was collected from April 2013 to Feb 2014 from LIS.

The proper management of reagents and supplies in the laboratory is often a challenging task. However, creating and adopting systems for purchasing and inventory control can enable cost savings in addition to ensuring supplies and reagents availability when needed. Labs need to maintain sufficient reagents and supplies for testing.

The lab is well maintained but the procurement process of reagents is not proper. At present requisition is generally done on the monthly consumption basis and it does not include others factors like safety stock and reorder level which can led to the occasional shortage or sometime excess storage of reagents

To avoid that requisition of lab reagent should be based on average of few months' consumption and factors like safety stock and reorder level should also be taken in to account. Stock should be kept in a proper place and all record should be maintained to reduce the chance of pilferage and wastage.

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ANNEXURE

1) Total Test Performed in the Lab

Month	Total Test
Apr-13	26709
May-13	21999
Jun-13	19089
Jul-13	21116
Aug-13	18810
Sep-13	18728
Oct-13	17314
Nov-13	13956
Dec-13	14014
Jan-14	12896
Feb-14	12660

2) Test performed by each section

Month	Biochemistry	Hematology	Immunoassay	Clinical Pathology	Serology	Microbiology
Apr-13	20042	2532	1609	1324	796	406
May-13	16111	2082	1623	1023	761	399
Jun-13	13311	1985	1597	1081	696	419
Jul-13	14275	2488	1828	1235	783	507
Aug-13	12490	2369	1584	1141	781	445
Sep-13	11483	3188	1507	944	1112	494
Oct-13	10654	2972	967	968	1404	349
Nov-13	9458	1664	1298	651	611	274
Dec-13	10004	1510	855	765	567	313
Jan-14	8668	1436	1278	736	477	301
Feb-14	8608	1412	1153	706	482	299
Total	**135104**	**23638**	**15299**	**10574**	**8470**	**4206**