

## **Research Article**

### **Physical Facility and Organisation of Central Laboratory Services of A Tertiary Care Hospital**

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**Abstract:** The objective of present study is to ascertain the Physical facilities and organization of Central Laboratory at a tertiary care centre. A mixed methodology utilizing observational study of relevant records and interview technique. The Central Laboratory is located on the ground floor, near the service core area of the hospital. The Biochemistry section occupies 679 SFT & headed by an additional Addl. Professor and the hematology section 525 SFT, is under the administrative control of main Hematology department. The Biochemistry section is having staff strength of 22 laboratory technicians/technologists and four Laboratory assistant. The hematology section is having five technician/technologist. The Central Laboratory is well lit by both artificial and natural light. The electric supply is well augmented by an emergency backup and stabilization system. Filtered water is readily available in the Central Laboratory in addition to the normal water supply which is supplied to other areas of the hospital. The ambient temperature of various working areas is maintained by an efficient air conditioning system. The central laboratory has adequate number of seating. The reagents used are licensed under the drug and cosmetic act of India. Positive and negative controls are seen on every fresh batch of reagents used with every test run. 70% of the total equipment is in working condition. The study reveals that a physical facility (location, space, design and layout) and staff strength of Central Laboratory at SKIMS is accordance with the prescribed norms and guideline. There is provision for future expansion. Central laboratory has well developed organizational structures consisting of well established hierarchical chain, channel, job specification, job description and co-ordinate mechanism in accordance with standard guidelines and principles of management.

**Keywords:** laboratory ,technicians, air conditioning ,drugs and cosmetic act, controls

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#### **INTRODUCTION**

A laboratory is a facility that provides controlled conditions in which scientific research, experiments and management may be performed. A laboratory is a place of specialized work, research, clinical or diagnostic procedures and also a place for teaching and training. There are different types of laboratories and great number of hazards which may be found in them. Codes of practice and Guidelines are documented which specify safe practices for particular task or occupations [1].

The developments in clinical laboratory medicine in recent years have been impressive, clinical laboratories have evolved from relatively simple structures to facilities of great complexity. In many modern clinical laboratories the extensive use of instrumentation, automation and computerization has

created a commercial and industrial atmosphere. Regardless of the sophistication of the clinical laboratory, we, as clinical laboratory professionals, must remember that the goal of clinical laboratories is to provide services and not products. By offering the five services namely, analysis, data processing, consultation, education and research, it will ensure that the clinical laboratory will be recognized as an integral part of health care team[2].

Many recent changes in clinical chemistry including automation, increasing data processing capability, and increasing regulation of laboratory performance have brought about a search for better ways to quantify the quality of patient results coming out of clinical laboratory. This has resulted in a great diversity of approaches related to the definition and measurement of quality in clinical chemistry [3].

The modern quality system in an institution today is agreed organizational – wide, detailed operating work structure of technical, scientific, and managerial procedures for guiding the co-ordinate actions of humans, the equipment and the information of the institution in the best and most practical ways, to assure user quality satisfaction and reasonable costs of quality[4]. The efficient operation of a clinical laboratory and the effective delivery of Medical laboratory services to clinicians and their patients require a complex interdigitation of expertise in Medical, scientific and technical areas; of resources in the form of personnel, laboratory, and data processing equipment, supplies, and facilities, and of skills in organization, management, and communication[5]. Although the medical, scientific and technical expertise are an essential prerequisite for the provision of medical laboratory services, success in applying these techniques to benefit patient case is vitally dependent on the management and communication skills of laboratory directors, supervisors and technologists[5].

## METHODOLOGY

The study was carried out in Sher-i- Kashmir Institute of Medical Sciences (SKIMS) established in 1982 besides teaching and research, offers quality medical services in various surgical and medical super specialties. The Institute for purpose of patient care services has a modern hospital having about 650 beds with all required clinical, engineering and support services. The Institute has a strong back up of specialized laboratories which include clinical biochemistry, hematology, immunology and molecular medicine, microbiology including parasitological, clinical pharmacology and clinical pathology. In addition to departmental laboratories SKIMS hospital has a Central Laboratory located at ground floor of the hospital building. It caters to departments of Accident/ Emergency, Outpatient and Inpatients departments and provides services for 24 hrs x 365 days for conducting biochemistry hematology and cytology. The Central Laboratory was established in the year 1998 after 15½ years of the commissioning of the first phase of the SKIMS Hospital, as a measure of improvement in the investigative services. The study was undertaken for a period of one year to identify operations system in place at the Central Laboratory in SKIMS.

The study was conducted on the pattern of Donabedian's Structure Process and Outcome model. The structure essentially being the organization, physical and support facilities.

**Structure:** The total area occupied by central laboratory was measured and recorded. To study the organization, physical and support facilities, manpower equipment and material of Central Laboratory a mixed methodology was used i.e. Study of records, Observational study and Interview with the staff of

Central Laboratory, Material Management, and engineering departments was undertaken and for this purpose a pretest questionnaire was designed.

**Electrical supply:** The various aspects of electric supply to the Central Laboratory were studied by direct observation. This included - electrical unit available to each section of the Central Laboratory were assessed in comparison with recommended CIBSE (Central Institute of Bioluminescence Standards in electricity) standards. All the sections of central laboratory including the storage and refrigeration, the night room were identified as areas requiring alternate power supply in case of failure of the main supply.

**Allied Engineering Services and Amenities:** were taken up for study by direct observation, interview and record study and include physical and comfort facilities provided to each section of the central laboratory i.e., seating, worktables, shelves and cabinets and provision for filtered water as well as distilled /reagent grade water for laboratory areas.

**Reagents:** All the reagents used in various laboratory tests were compared with standard preparations recommended by Drugs and Cosmetic Rules of 1945 and its subsequent amendments. The reagent which had exceeded their date of expiry or showed turbidity, flocculation, change in colour was identified. The temperature at which these reagents were stored was noted to compare with the recommended storage temperatures.

**Equipment:** All the equipment in Central Laboratory was studied in terms of its life and working condition. The equipment was listed and compared with recommendations and norms on the subject to determine the extent to which it followed expected standards. Calibration of equipment and the use of controls, the frequency of calibration and availability of written records of the same was determined. Preventive maintenance records of all equipment were studied to determine the maintenance policy and its implementation.

**Staffing:** The staffing of central laboratory in terms of its strength was obtained and the degree to which the strength of staff met the norms recommended for a tertiary care hospital was noted. Through one to one interview with staff the qualifications of staff; nature of job and job description was obtained. Work experience of the staff in years was recorded. Full credit was given for experience > 10 years, 75% was given for work experience between 5 – 10 years, 50% for work experience between 1 – 5 years and no credit was given for experience < 1 years. The percentage of the staff who attended continuing medical educations/ orientation / in service training programmes was also recorded.

**RESULTS**

The findings for the ‘structure’ exiting in The Central Laboratory revealed:

*Space and Location:* The Central Laboratory is located on the ground floor, near the service core area of the hospital. The Laboratory is 160 meters from Accidental and Emergency department and 250 meters from the out patients department. Functionally the laboratory area is broadly divided into two sections i.e. Biochemistry and Hematology having a total floor area of 1203.83 SFT (Table 1). The Biochemistry section occupies 679 SFT and the hematology section 525 SFT. Laboratory area is constituted by processing and preparation rooms one each for biochemistry section (440 Sqft) & Hematology section (285.43 Sqft), administrative office/reagent room (291.74 SFT) and circulation area (186.66 SFT). The administrative office/ reagent room and circulation area is shared by both the sections.

*Staffing:* The Biochemistry section of central laboratory (Table 2) is headed by an additional Addl. Professor while the hematology section is under the administrative control of main Hematology department. Each section of the central laboratory is supervised by one in charge senior resident. There is also one senior resident who is in charge of reporting section. Biochemistry area is constituted by processing and preparation room 440 Sqft. The Biochemistry section is having staff strength of 22 laboratory technicians/technologists and four Laboratory assistant. The hematology section is having a staff strength five technician/technologist. In addition to this permanent staff strength there are three casual day workers to assist in washing of tubes and disposal of samples. There is one store clerk for the both the sections of the Central Laboratory. 45.45% of technical staff have B.Sc and diploma qualification while 54.55% has diploma. 77.41% of Technical staff have a work experience of > 10 years while 22.59% have time since recruitment < 10 years.

*Lighting:* - The Central Laboratory is well lit by both artificial and natural light. The electric supply is well

augmented by an emergency backup and stabilization system, especially for the technical equipment and refrigerators. The area is having an adequate number of tube lights of 40 watts. Working area is having adequate number of electrical sockets of 15 and 40 volts.

*Water supply:* Filtered water is readily available in the Central Laboratory in addition to the normal water supply which is supplied to other areas of the hospital. There seems to be a distinct lack of distilled or reagent grade water which is usually transported from the main departments of Biochemistry and hematology to the Central Laboratory.

*Air conditioning:* - The ambient temperature of various working areas of The Central Laboratory is maintained by an efficient air conditioning system.

*Physical facilities:* - The central laboratory has adequate number of seating arrangement in the form of comfort chairs, work tables, cupboards and refrigerators available in the various sections. The resting room and administrative office has adequate seating arrangement and comfort facilities for the staff.

*Reagents:* The reagents used in the Central Laboratory are licensed under the drug and cosmetic act of India. 100% of the reagents supplied by various companies are in consonance with the regulation of the act. All (100%) of the reagents which are used in the central laboratory are daily checked for expiry, temperature of storage and evidence of deterioration. Positive and negative controls are seen on every fresh batch of reagents used with every test run.

*Equipment:* - 70% of the total equipment is in working condition. 33% of the equipment present in the laboratory is under service maintenance contract. 60% of the total equipment, in working condition is subjected to periodic calibrations. 40% of the equipment has user manuals from the manufacturing companies available with them. Most of the instruments available for use in the Central Laboratory are in service from more than 20 years (Table 3)

**Table-1: Spacing of different sections of the central laboratory**

Section	Subsections/ areas	Area
Biochemistry	Processing and preparation room	440 SFT
	Administrative / reagent room (shared facility )	291.74 SFT
	Circulation area (shared facility)	186.66 SFT
Hematology	Processing and preparation room	285.43 SFT
Administration	Administrative office / reagent room (shared facility)	291.74 SFT
Circulation	Circulation area (shared facility)	186.66 SFT

**Table-2: Staffing in the central laboratory**

Section	Staff/designation	Numbers
Biochemistry	Add. Prof. /in charge	1
	HOD	-
	Senior resident	1+1 for reporting
	Laboratory technologist/technician	22
	Laboratory assistant	4
	Casual day labour	3 (shared commonly)
Hematology	HOD hematology	1
	Senior resident	1
	Technologist/technician	5
	Causal day labour	3 (Shared commonly for both section)
	Store clerk	1 shared

**Table-3: List of equipment**

1	Analyzer	8
2.	Calorimeter	1
3	Microscope	1
4	Centrifuge	2
5	Water bath	2
6.	Hot air oven	1
7.	Incubator	2
8.	Computer	2
9.	Refrigerator	2
10	Syringe destroyer	1

## DISCUSSION

The Central Laboratory SKIMS were studied on the pattern of Donabedian's model revealed that the central laboratory is located on the ground floor, near service core area of the hospital with a total surface area of 1204 sq ft which is functionally divided into biochemistry and hematology sections. Sakharkar et al recommends a surface area of 395 square meters in a 300 bedded hospital for various laboratory sections and 30% of above area for circulation space.<sup>[6]</sup> Research by Rapoport suggests that with semi automation 91 tests / square feet were being performed, with partial automation 252 tests/ square feet and then 1258 test/ square feet with total automation[7]. Staffing of the Central Laboratory revealed that the Biochemistry section is headed by an Additional Professor while Hematology section is under direct administrative control of main department. All the sections of the Central Laboratory are supervised by in charge senior residents. The workforce of the central laboratory is constituted by 22 laboratory technicians/ technologists and four laboratory assistants while hematology section having staff strength of five technicians/ technologists. The staff strength viz a viz number of test performed revealed that each technologist / technician carries out 11300 tests per year. In line with findings, Owen S. E et al; recommends one technician/ technologist for 9600 biochemical tests per year and one technician/

technologist for 13400 hematological investigations per year[8]. Study by Sakharkar et al in a large hospital showed 2840 tests on average per technician per month where as the actual requirements of technicians based on time study and standard time was 14 technicians for same number of tests[6]. The physical facilities of the laboratory services revealed adequate natural and artificial lighting in various areas of the laboratory. There seems to be an adequate supply of filtered water supply with in the central laboratory. Distilled and reagent grade water required for various biochemical and hematological investigations is transported from the main departments. The ambient temperatures in the central laboratory are well maintained by an efficient centralized air conditioning system. The seating and comfort facilities of the laboratory seem to be adequate. Arora DR recommends the laboratory to be well lit with dust free, air conditioned environment and uninterrupted power supply. The laboratory must monitor, control and record environmental conditions, like biological sterility, electromagnetic disturbances, radiation humidity and temperature [9]. The 70% of equipment resource of the central laboratory is in working condition with 40% having user manuals from the manufacturing companies available with them. 33% of the equipment present in the laboratory is under service maintenance contract. College of American Pathologist (CAP) and Centre For Disease Control

(CDC) established that accredited laboratory should have an organized Quality control program, which include maintenance and function verification, standardization, calibration control and proficiency testing[10].

### CONCLUSION

The study reveals that a physical facility (location, space, design and layout) and staff strength of Central Laboratory at SKIMS is accordance with the prescribed norms and guideline. There is provision for future expansion. Central laboratory has well developed organizational structures consisting of well established hierarchical chain, channel, job specification, job description and co-ordinate mechanism in accordance with standard guidelines and principles of management.

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