SECTION 1 : INTERNSHIP REPORT

CHAPTER 1

1.1 INTRODUCTION

Directorate General Defence Estates on behalf of the Ministry of Defence is responsible to control, monitor and supervise the Civic Administration in Cantonments (1). There are 62 Cantonments in India. These are located in 19 States, including the National Capital Territory of Delhi. The Cantonment Boards are Municipal bodies, functioning under the overall control of the Central Government and under the provisions of the Cantonments Act, 2006. Half of the members of the Cantonment Boards are elected. The Station Commander is the President of the Cantonment Board. Supervision and control over the working of these bodies is exercised through the General Officers Commanding in Chief and Principal Directors, Defence Estates at the intermediate level and by the Central Government through Directorate General Defence Estates at the apex level.

Cantonments in Delhi and Ahmedabad were originally established by the British. Delhi Cantonment is popularly referred to as Delhi Cantt and was established in the year 1914. Until February 1938, the Cantonment Board Delhi was known as the Cantt Authority. The Delhi Cantonment is a Class I Cantonment Board. The Delhi Cantonment houses the Indian Army Headquarters, IHQ of MOD(Army), HQ Delhi Area; the Army Environment Park & Training Area(AEPTA); the Defence Services Officers Institute (DSOI); military housing; Army and Air Force Public Schools; and various other defence-related installations. The cantonment also houses the Army Hospital (Research and Referral), AHRR and Base Hospital which are the tertiary care hospitals of the Armed Forces of India.

The Delhi Cantonment is also governed by the Cantonments Act, 2006 and various Policy letters and Instructions of the Ministry of Defence (MoD), Government of India, issued from time to time. The Board functions under the administrative control of the Directorate General Defence Estates (DGDE), New Delhi and Principal Director, Defence Estates, Western Command, Chandigarh.

The Cantonment Board consists of 15 members, eight elected Members, three nominated Military Members, three Ex-officio Members (Station Commander, Garrison Engineer and Senior Executive Medical Officer), one representative of the District Magistrate. An officer of the Indian Defence Estates Services, which is a Central Civil Service is posted as the Chief Executive Officer (CEO) as well as the Member Secretary of the Board. The board is headed by the President Cantonment Board (PCB) who is the Station Commander and also presides over the meetings of the Cantonment Board. Mr B Sankar Babu Reddy, IDES, is the present CEO and Brig B N Ratanpal, is the present President Delhi Cantt Board. The term of the elected Members is of 5 years. The Vice- President is elected from amongst the elected members

The Cantonment Act lays down both the mandatory and discretionary functions of the Board such as education, public health, sanitation, roads, street lighting, water supply and birth and death registration. For the purpose of administration and civil representation the cantonment board is divided into eight wards.
Fire fighting, water supply, public health, street lighting, birth & death registration, horticulture, primary education and sanitation are the prime departments of Delhi Cantonment Board. The various departments of Delhi Cantonment Board collectively operate to strengthen the civic infrastructure of the city.

The Delhi Cantonment has an area of 10,791.88 acres and has a population of 1,10,351 as per Census 2011. Cantonment Boards are maintaining 88 Hospitals, for providing Medical Services to the general public of Cantonments and nearby areas.

To provide primary education, Cantonment Boards run primary Schools. A number of Cantonment Boards are also maintaining Higher Secondary Schools and Intermediate/ Junior Colleges. The total number of Schools and Colleges maintained by Cantonment Boards is 201, besides 33 centres for differently abled children and 45 Vocational training centres.

1.2 Cantonment General Hospital

Urban living brings forth plethora of health challenges: Infectious diseases, non communicable diseases, addictive behaviours, accident cases, a spectrum of nutritional disorders etc. The Delhi Cantonment Board's endeavour is to provide broadband capacity to deal with all the above ailments. The Cantonment Board's vision is to encompass Health beyond Health Care by providing Clean Environment, Potable water, Good sanitation & Best treatment and Diagnostic Services.

Cantonment Board Hospitals have been raised in all Cantonments of the country to look after the civilian population living in and around the cantonments. Delhi Cantonment Board is maintaining a 100 bedded, Cantonment General Hospital, where best treatment and diagnostic facilities have been provisioned (2). The hospital made a modest beginning from one of the barracks of the old base Hospital building at Sadar Bazaar, Delhi Cantt. The hospital was shifted to its present location in 1963.

The Cantonment General Hospital has engaged several Specialists. Emergency services / Emergency ward is available round the clock. Support / Diagnostic Services like Ultrasound, X Ray, ECG, Micro Biology Lab, Haematology Lab, Bio Chemistry

Labs have been provisioned. IPD facilities are available 24 x 7. In the year 2015-16 OPD figures were 3,10,406 whereas in 2016-17 the OPD was 2,18,782 (1,44,962 new and 73,820 old cases)..

The Cantonment Board is running dedicated clinic for Senior Citizens from 2 PM to 4 PM daily, during the year 2016-17, 26,882 Senior Citizens were treated. The Cantonment General Hospital is also running School Health Program, health checkups of students are being done twice a year, health cards are also being maintained.

The Cantonment General Hospital is providing free medicines to all patients. Besides, Cantonment residents, patients from adjoining areas around cantonment viz Sagarpur, Palam, Mahipalpur, Lajwanti Garden etc. are also utilizing health care services provisioned by the Board. Delhi Cantonment Board is maintaining two mobile dispensaries which are visiting various pockets in the cantonment for neighbourhood health care services. Medical health camps are being organized by the CG Hospital at regular intervals for best health care services. Board is also maintaining a hearse van and a critical care ambulance equipped with high- end life saving equipments.

1.2.1 Mission, Vision and Values The hospital has not developed any separate Mission, Vision or Value Statement.

FIGURE: 1.1 CANTONMENT GENERAL HOSPITAL, DELHI CANTT

FIGURE: 1.2 OPD BLOCK

1.2.2 Layout of the Hospital The Cantonment General Hospital is housed in a three storied building with the following constitution:

a) **Ground Floor**: Has the Reception and Registration centre, Emergency, Casualty room, Ortho, Gynaecology, Ophthalmology, ENT, Medical, Psychiatric, Skin, Ayurvedic and Homeopathic OPDs, Minor OT, Radiology (X ray & USG), ECG room. Immunisation and Injection room, Family planning Counselling room, Labour room, Physiotherapy room, a DOTS Centre, Dispensary, Dressing Room and Plaster Room.

b) **First floor:** The first floor has the Administrative block, Dental department, Pathology Lab, Pharmacy/Medical Store, Ayurvedic Store, Female ward (18 beds) and a Conference Room.

c) Second floor has the Major OT, VIP Rooms (06 capacity), Private wards (18 capacity), Male ward (20 capacity) and CSSD.

d) **Basement** has the AC plant, Linen Store, Furniture store, Pump house and the Generator set.

CHAPTER 2

2.1 OVERVIEW OF SERVICES PROVIDED BY THE CANTONMENT GENERAL HOSPITAL

Cantonment General Hospital provides care through the following Departments:

a) General OPD

b) Dental OPD

c) Specialist OPDs

i. Obs & Gynae

ii. Orthopaedics

iii. Medicine

iv. ENT

v. Ophthalmology

vi. Surgery

vii. Paediatric

viii. Psychiatry

ix. Skin

x. Radiology

xi. Anaesthetics

d) Ayurvedic OPD

e) Homoeopathy OPD

f) Emergency Services (Round-the-clock) – 06 beds

g) Major OT – 01, Action has been initiated for 2nd Major OT , work in progress.

h) Minor OT – 01 next to Casualty/ Emergency on ground floor.

i) Diagnostic Services (Lab, ECG & Radiology including X- Ray and Ultrasound),

j) Physiotherapy- Unit with best equipment working from 9 AM to 6 PM.

k) Indoor Services – IPD 100 beds (under expansion).

2.2 DISTRIBUTION OF BEDS

Gen Medicine	16	
Surgical Ward	16	
New Born	03	
Obs & Gynae (Maternity)	18	
Paediatrics	06	
Casualty & observation	04	
Isolation	04	
Post OP	18	
ICU*	06 allotted	*(ICU under construction)
Private Ward	09	
TOTAL	**100**	

2.3 Ambulances: The hospital has two mobile dispensaries to cater for distribution of medicines and critical care in remote areas of the cantonment, it has two BLS and one ALS.

FIGURE :2.1 ALS AMBULANCE

2.4 Staff : The hospital is headed by a CMO (Incharge) under whom the following staff is available

a) **Permanent –** Doctors -13 (4 including(1 x dentist) + 9 Newly inducted specialists); Nurse Grade B/ANM - 02, Technicians – 02, Pharmacists -02, Administrative Staff – 18.

b) **Contractual -** Doctors -35 (Specialist Doctors -19 Additional GDMO-11, Sr Resident-3, Jr Resident-2) Nurses - 39 (including 2 x OT Nurse), Technicians -21, Pharmacists – 02.

2.5 Outsourced services : The hospital has outsourced the following services:

a) Security – 30 persons

b) Housekeeping and waste disposal – 60 persons

2.6 Services not catered for in the Hospital : The hospital does not cater for the following services:

a) Blood Bank

b) Mortuary

c) Laundry

d) Dietary services

e) Manifold services

2.7 HOSPITAL TIMINGS (OPD)

a) **OPD** – 08.30 A.M to 11.30 A.M (Mon to Fri) & (Sat – 08.30 A.M to 11.00 A.M)

b) **Laboratory** - 08.00 A.M to 08.00 P.M (Mon to Sat)

c) **X-Ray** – 09.00 A.M to 04.00 P.M (Mon to Fri) & (Sat – 09.00 A.M to 01.00 P.M)

d) **Ultrasound** – 02.00 P.M to 05.00 P.M (Mon, Tue, Wed, Fri & Sat)

e) **Emergency** Services are available – 24X7

f) **Ambulance Service** is available through Toll Free No. – 1800 11 5300 (24X7)

2.8 OTHER SERVICES

a) Preventive Health Care

b) Pulse Polio Immunization

c) Immunization Programmes

d) Health Post Maternity and Immunization Services

e) DOTS Centre (Tuberculosis)

f) Maitri (NGO for HIV/AIDS Screening & Counselling)

g) Births & Deaths Registration

h) Care for Senior citizens

i) Kishori Clinic

j) School Health program

k) Care for Special children

l) Mobile Dispensary

m) Medical camps

n) Ambulances/ CATS

2.8.1 NATIONAL HEALTH PGME-INTENSIFIED PULSE POLIO (IPP) PGME

a) **House to House Activity**: Undertaken for 5 days in every phase (held every 4-6 weeks). About 12,000 – 14,000 houses are covered and 4,000- 4,500 children vaccinated in each phase.

b) **Booth-Based Activity**: On Sundays during each phase.

2.8.2 DOTS (DELHI GOVT CENTRE)

a) Sputum AFB (per Annum) - 744

b) Patients Found positive - 63

2.8.3 NUMBER OF CASES ON ART :

a) CAT – I - 645 (Previous) + 139 (New)

b) CAT – II - 171 (Previous) + 34 (New)

c) MDR - 36 (Previous) + 3 (New)

2.8.4 SENIOR CITIZEN PATIENTS

a) 2015-2016 - 22,682

b) 2016-2017 - 26,882

c) Senior Citizens clinic functions from 2 PM to 4 PM daily.

d) Free OPD for Senior Citizens.

e) Free medicine & Diagnostics services.

f) Senior Citizens left on their own, being attended at their house by medical staff deployed with Mobile Dispensary.

2.8.5 SCHOOL HEALTH PGME

a) Number of School Children Health Check up done in 2016-17 : 2430.

b) Health Cards have been issued.

c) Check up is done by one dedicated School Health Doctor. Following examination & systemic examination done during the health check up:

i. Pulse
ii. BP
iii. Temperature
iv. Pallor
v. Nerves
vi. Nails
vii. Teeth
viii. Mental Development
ix. CNS
x. Chest
xi. Abdomen

2.8.6 FACILITIES OFFERED AT CENTRE FOR DIFFERENTLY ABLED CHILDREN

a) Paediatric check up twice a year.

b) Psychiatry check up twice a year.

c) Audiometric check up by ENT department twice a year.

d) Differently abled School was established in 2011.

e) The number of children enrolled year wise is

2011	18
2012	30
2013	48
2014	98
2015	102
2016	115

FIGURE : 2.2 VARIOUS FACILITIES AVAILABLE

FIGURE: 2.3 VARIOUS FACILITIES AVAILABLE

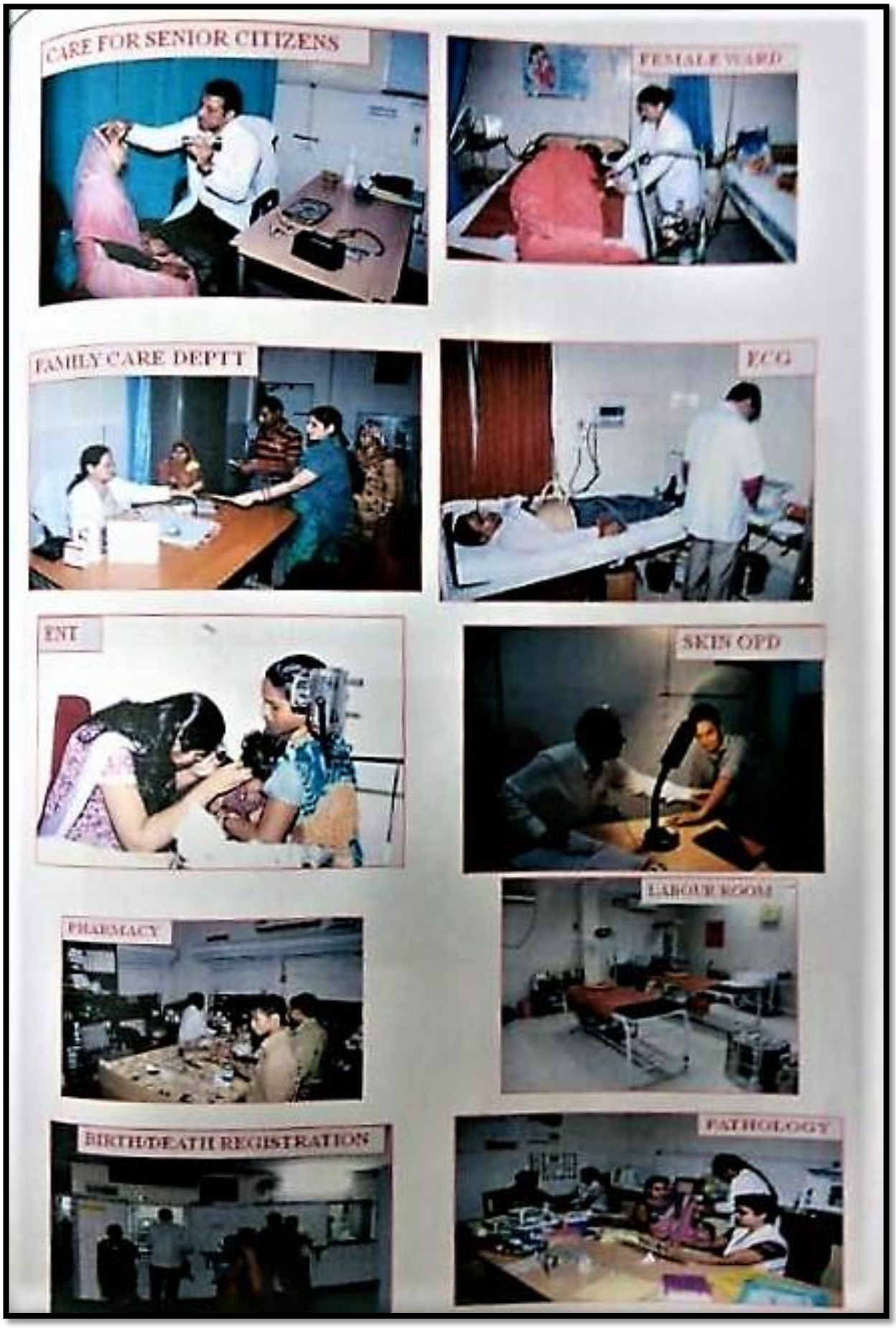


FIGURE : 2.4 VARIOUS FACILITIES AVAILABLE

MOBILE DISPENSARY

CRITICAL CARE AMBULANCE

FIGURE: 2.5 VARIOUS FACILITIES AVAILABLE

CHAPTER 3

OBSERVATIONS AND RECOMMENDATIONS

3.1 OBSERVATIONS (GENERAL)

Internship in a Delhi Government Hospital, being administered by Delhi Cantonment Board was an excellent opportunity to learn. It gave me an insight into the healthcare delivery system moving in consonance with the Government structural and policy format.

During the internship period I was attached with various Departments of the hospital. This internship provided an interactive platform to learn about all aspects of Hospital, from Clinical to Administrative operations. All the departments of CGH including support services, were specially visited to gather ground inputs on the overall functioning of the hospital.

3.1.1 CONSTRAINTS

a) Synchronisation among activities such as the General administration & engagement of manpower needed more emphasis.
b) More consistency & continuity in the appointment of Specialist's on contractual basis was needed.
c) Procurement of Equipment is a long and tedious process involving several processes as is the case in Government organisations.

3.2 SPECIFIC OBSERVATIONS AND RECOMMENDATIONS

The major observations and recommendations based on the interaction during internship are elucidated below:

3.2.1 Services related:

a) The Cantt General Hospital is like any other Government hospital. Any citizen of the country can take treatment from the hospital.

b) A yellow card is issued on payment of Rs 5/-, after which any citizen can avail treatment.

c) A white card is issued for the patients who are staff of CGH, staff of DCB & IDES, no payment is required to be made.

d) A light green card is issued for patients from the senior citizen fraternity.

e) There is a daily footfall of 500-800 patients attending various OPD services in the hospital (Weekdays-500, Mondays & Saturdays-800 approx).

f) The hospital caters to patients from the middle class / lower strata of the society.

g) OPD Services are the mainstay of the hospital and start at 0800hrs and continue till 1500 hrs

h) There is also a requirement to automate the registration process to reduce the rush and also to ease data management and billing. At present, the registration for the OPD is done at the counter with two windows, where a person has to give his/her demographic data which is then fed into the computer at the desk. A slip is physically filled and given to the patient directing him to report to the specialist or to a general physician. Once registered the OPD slip is valid for 7 days only.(Details of Patient Registration Slips Yellow, White & Light Green have already been spoken above)

i) There is a huge rush at the Registration counters as well as at the OPD area in the ground floor which has most of the consultant rooms. Lesser rush is seen at the Ayurvedic and Homoeopathic OPD areas as they are in different locations.

j) The common waiting area in the gallery is crowded during the OPD time and the patients and their attendants are seen standing in the gallery due to limited

seating capacity. There is a requirement to create a bigger waiting area with a electronic token number display system to streamline the OPD system.

k) Many times patients coming for treatment, are illiterate & are unable to clearly describe their problem, hence leading to wastage of time at the registration counter as well at the OPD in redirecting them to the correct OPD.

l) OPD registration number is started afresh on 1st of April, each year. The numbers run into lakhs & become unwieldy as the year progresses. The registration number is common for all OPDs and it becomes difficult and problematic to distinguish between patients of various OPDs. The OPDs don't have any separate identification number other than the common Registration number given manually at the registration counter.

m) Sign boards showing the details of the facilities in the hospital, fire prevention measures, hand washing rules, action to be taken during an Earthquake, etc are displayed, but there is still scope of additional sign boards for easy understanding of the patients.

j) There is also a requirement for introduction of EMRs in the hospital in the times to come.

k) Citizen charter and Patient charter need to be displayed in the OPD.

l) Emergency/ casualty services are functional 24x7. However the ICU is not yet functional. Space has been allocated but further construction is held up for want of funds.

m) Location of CGH is on the road connecting South-west Delhi & West Delhi, which is an important transit route, hence emergency signages should be visible from the main road, so that the services can also be utilised by any serious patients in an emergency.

3.2.2 Human Resources Management:

a) Manpower requirement of the hospital requires to be reassessed and staff / technicians adequately placed for effective and efficient management of the hospital.

b) To improve the sense of responsibility and belonging among the staff, there is a need to increase the ratio of Permanent vis-à-vis Contractual staff.

c) Pharmacy/ Medical Store need more Pharmacists to be employed.

3.2.3 Training

a) Staff should be trained in BLS/ACLS.

b) Staff should be made aware of the safety precautions especially against needle stick injuries.

c) Training to be given to the nurses on BLS (CPR) at regular intervals and mock drills to be conducted.

d) Infection control practices need to be followed strictly as per guidelines. Hospital Infection Control Committee needs to be earmarked and need to brief all concerned regularly.

e) Mock drills with respect to fire fighting and disaster management need to be periodically conducted and documented.

f) Training to improve soft skills of the staff should be regularly given.

3.2.4 Medical Stores/ Pharmacy

a. At the dispensary/Medical Stores, there is a need to introduce an automated system which could give real time details of medicines available in the pharmacy to the Consultants and assist the pharmacy to monitor stock and expiry details. . At least basic Pharmacy Management System software needs to be procured and installed for smooth running/ functioning of Medical Stores.

Requisite training for the pharmacists on the use of the software should be given from time to time.

a) Proper receiving, segregation and storing area needs to be demarcated in the Pharmacy.
b) Items need to be labelled and stored alphabetically.
c) Inventory control practices need to be followed stringently (ABC, VED, FIFO).
d) Drugs and therapeutics committee needs to be formed.
a. Hospital Drug Formulary should be readily available & regularly updated**.**

3.2.5 Administration

a) The CMO has several responsibilities but no administrative powers hence functioning becomes difficult. The staff of the CGH know that the powers rest with the CEO in the DCB & the CMO would not approach the CEO for each problem , in day to day functioning.
b) The CMO has no/ very limited financial powers, Financial powers rest with the CEO for expenditures upto Rupees One Lakh, so all procurement has to be done on file through DCB office only. Procurement of items follow GFR,& is put to the 15 members of the DCB which functions like a Municipal body.
c) The clerk dealing with procurement of consumables as well as non consumables for CGH, in DCB office, is also responsible for many other institutions run by the DCB (Eight schools, Chitrakoot Guest House etc) hence is overworked & becomes the bottleneck. This adds to the delay in procurement of items.
d) DCB is a self financing body. The DCB works under the Ministry of Defence. The budget allotted is limited. Many times procurement gets stalled for want of funds.

e) Stock out of routine medicines do occur on & off. Approved Vendors under rate contract have been issued show cause notices & also have been blacklisted at times by the DCB. The Pharmacy /CGH at most can issue reminders only.

f) Registration of births & deaths is also a major responsibility for the CMO, as he is the Registrar of births & deaths for the entire cantonment area including civilians, defence personnel & their dependents. Public dealing for the same is a major concern which is an impediment for the smooth functioning for the CMO's office, as nobody can be denied entry for preparation of document/seeking queries during working hours.

SECTION 2 : PROJECT REPORT

CHAPTER 4

4.1 INTRODUCTION

Much of the present day improved status of health care is due to the contribution made by the pharmaceutical sciences. In developing countries, the basic essential drugs remain out of reach of millions of people because of financial constraints. As in these countries, payment is made out of pocket resulting in huge expenditure. Had the basic resources been made available to the poor, many deaths could have been avoided (3).

The term pharmacy has been derived from the Greek word 'pharmakeia' meaning use of drugs and 'pharmakon' meaning drug. Pharmacy is the health profession that links the health sciences with the chemical sciences. Pharmaceutical sciences ensure safe and effective use of medications. The traditional role of pharmacy is compounding and dispensing medications(4).

The President, Indian Pharmacy Graduates Association (IPGA) while dealing with the changing role of pharmacists: Indian scenario writes, "Pharmacists play a crucial role in any health system as they are responsible for providing solution related to medication. The rapid growth and diversification of the pharmaceutical industry, coupled with growth of the health sector has thrown open a sea of opportunities for the pharmacists. Over a period of time, the pharmacy profession has greatly changed from being focused on managing the production and dispensing of drugs, to being primarily concerned with safe, effective and appropriate use of medication and enhanced pharmacy services to patients. High technological advancement and information explosion have significantly raised the knowledge and quality level" (5).

The WHO (6) has revised the earlier role of the pharmacists and now envisages a much wider role for them commensurate with the development in healthcare technologies and information management systems. These roles of the pharmacists are now possible to be

performed, besides the explosion in the information technology, on the development of the pharmaceutical sciences and better training facilities. The modern roles of the Pharmacists are:

a) **Care Giver**: The pharmacist provides caring services. Whether these services are clinical, analytical, technological or regulatory, the pharmacist must be comfortable interacting with individuals and populations. The pharmacist must view his or her practice as integrated and continuous with those of the healthcare system and other pharmacists. Services must be of highest quality. This integration of pharmacy service with the health care system has been made possible because of development and adoption of automation in pharmacy Services.

b) Decision Maker: The appropriate, efficacious and cost effective use of resources(eg: personnel, medicines, chemicals, equipment, procedures and practices) should be the foundation of the pharmacist's work. Achieving this goal requires the ability to evaluate, synthesize and decide upon the most appropriate course of action. Quality decision making needs quality information. This is provided by the modern information technology.

c) Communicator: The pharmacist is in an ideal position between the physician and the patient, he or she must be knowledgeable and confident while interacting with other health professionals and the public. Communication involves verbal, non- verbal, listening and writing skills. The confidence can come from readily available quality information. This is provided by the modern information technology.

d) Leader: The pharmacist may be a part of the multidisciplinary care giver team where other healthcare professionals may not be present. Under such circumstances, the pharmacist has to assume a leadership role. Leadership

involves taking decision, communication and direction. All these components of leadership needs availability of information, besides the pharmacist's grooming as a leader , to play this role effectively.

e) **Manager:** The pharmacist when performing a managerial role as to effectively manage resources and information. More and more information, information and its related technology will provide challenges to the pharmacist as he/she assumes greater responsibility for sharing information about medicines and related products.

f) **Lifelong learner:** The pharmacist has to grow in the profession and therefore, keep himself abreast with the developments in both pharmaceutical sciences as well as health sciences. The information technology comes as a great boon to the pharmacists.

g) **Teacher**: A senior pharmacist has to undertake a role of teaching the future generation of pharmacists. It also helps the pharmacist to gain new knowledge. This acquiring and dissemination of knowledge is facilitated by the modern information technology.

It will thus be seen that the modern role of pharmacists needs the help of information technology to a great extent. The pharmacy therefore must provide these facilities to perform these roles.

In developing countries like India, the pharmacies have not yet adopted the modern role of pharmaceutical care and is confined to its traditional role of procurement, storage and distribution. Even these roles cannot be performed efficiently in absence of adaptation of modern technology of automation and use of software for its inventory management role.

4.2 The Study Setting : The study has been carried out at Cantonment General Hospital, New Delhi, which is a Government Hospital. The hospital is a 100 bedded facility at present, providing General Medical and Primary Emergency Care Services including Laboratory, X-ray and Delivery services. The hospital is located in Sadar Bazaar, Delhi Cantt.

CHAPTER 5

REVIEW OF LITERATURE

The available literature in the form of internet, Medline, books and Journals have been searched in order to obtain information on technological innovations and intensity of use of information technology in modern day pharmacy. Literature for the traditional role of pharmacy in materials management and inventory control has also been studied.

5.1 History of Pharmacy : The earliest known compilation of medicinal substances was the *Sushruta Samhita.* This was an Indian Ayurvedic treatise attributed to Sushruta in the 6th century BC. The great ancient Indian treatise on medicine (Ayurveda) was Sushruta Samhita, Charaka Samhita and Sharnagadhara Samhita (7).

Arabic pharmacy made a considerable stride since antiquity in the development of the pharmaceutical profession. In the 9th century, many privately owned pharmacy shops were opened at Baghdad and its vicinity (8).

In the Greek legend, Asclepius, the God of the healing art, delegated to Hygieia his daughter, the duty of compounding his remedies. She was his apothecary or pharmacist. In ancient Greece and Rome, separation of roles of physician and that of herbalist was recognized. The trend toward specialization was reinforced by a law enacted by the City Council of Bruges(Northwest Belgium) in 1963. The law forbade the physician to prepare medications for their patients (9).

The earliest known Chinese manual on materia medica is the "Shennong Bencao Jing" dating back to the 1st century BC. It was compiled during the Han dynasty. The title 'materia medica' was coined in the Latin translation "De Materia" which was used as a basis for many medieval texts, and was built upon by many Middle Eastern scientists

during the Islamic Golden Age. Japan made significant contribution in the development of pharmaceutical sciences (10).

5.2 Present Day Role of the Pharmacy

5.2.1 To Err is Human : Building a Safer Health System A landmark report published in the year 2000 by the Institute of Medicine has shown that at least 44,000 and perhaps as many as 98,000 Americans die each year in the US hospitals as a result of preventable adverse medical events. The death due to preventable adverse events exceed the deaths attributable to motor vehicle accidents (43,458), breast cancer (42,297), and AIDS (16,516) (11).

5.2.2 Patient Safety and Medication Error : Though patient safety was always a great concern in the minds of the health care professionals, this report has glaringly exposed the stark reality of the situation and brought it from the background to the forefront. The whole medical world took serious note of the situation and was galvanised into action. The role of every healthcare provider, every health care process, every piece of medical equipment and every infrastructure was being reassessed from the point of view of patient safety. In the context of this development, the pharmacists got an impetus to redefine their role as scientifically trained members of the medical team who are called upon to make contribution in the area of medication safety.

5.3 Economic Burden of Adverse Drug Reaction(ADR) : The Context

5.3.1 Inpatient Setting : Apart from the aspects of patient safety, the economic aspects are also overwhelming. The same report also shows the magnitude of the economic cost of such adverse medication events. Medication related errors occur frequently in hospitals. All do not result in harm but they do entail considerable amount of cost. A study conducted in two prestigious teaching hospitals in the US has found

that almost two percent of admissions experienced a preventable adverse drug event. This resulted in average increased hospital costs of $ 4700 per admission or about $ 2.8 million annually for a 700 bed teaching hospital. If these findings can be generalised, the increased hospital costs alone of preventable adverse drug events affecting inpatients are about $ 2 billion as a whole.

5.3.2 Ambulatory Care Setting : Hospital patients represent only a fraction of the total population at risk of experiencing a medication related error. In 1998 in the US, nearly 2.5 million prescriptions were dispensed by U.S pharmacies at a cost of about $ 92 billion. Numerous studies document errors in prescribed medication dispensing by pharmacists and unintentional non adherence on the part of the patient. Medication errors have the potential to increase as a major contributor to avoidable morbidity and mortality as new medications are introduced for a wider range of indications.

5.4 Conditions in India

Without any reliable available data, one can only surmise what happens in India. With the conditions prevalent in India where quality of medical care services cannot be claimed as at its best, the adverse drug events and the associated cost in terms of human suffering, death and individual and national cost must be mind boggling.

A study from a teaching hospital in India has shown that approximately 34% cases had at least one medication error. The medication errors were classified according to the types of errors, their severity and the medication class (es) involved. The Drug- Drug interactions were noted in 68.2 % of the patients making it the top most medication error. This was followed by incorrect dosing interval in 12.1 % cases, overdosing in 7 %, incomplete prescription in 5%, under dosing and monitoring error in 2.65 %, incorrect medication and allergy occurred in 1.3 % of cases. All the prescriptions were checked for drug-drug interaction errors by the Micromedex Drug- Reax database (12).

Out of the total errors identified, approximately 25 % were severe, 62 % were moderate and 13 % were minor. Out of the class of medication prescribed, antimicrobial agents contributed the maximum (29.4%). This was followed by cardiovascular agents (15.4%), GI agents (8.6 %) and the CNS agents (8.2 %) (13).

5.5 New Paradigm of Pharmacy Service

In a review of Pharmaceutical care, European developments in concepts, implementation, and research, the new and emerging roles of pharmacists have been enunciated as under:

"The pharmacists should move from behind the counter and start serving the public by providing care, instead of pills only. There is no future in the mere act of dispensing. That activity can and will be taken over by the internet, machines, and /or hardly trained technicians. The fact that pharmacists have an academic training and act as health care professionals puts a burden upon them to serve better the community, than they currently do."

The trend is now to move away from its original focus on medicine supply towards a more inclusive focus on patient care. The role of a pharmacist has evolved from that of a compounder and supplier of pharmaceutical products towards that of a provider of services and information and ultimately that of a provider of patient care. Pharmacists are being called upon to be increasingly responsible to ensure that a patient's drug therapy is appropriately indicated, the most effective available, the safest possible and convenient for the patient.

The role was being performed by the physicians till now, but with the increasing complexity of drug therapy, multiplicity of products to choose from, increasing recognition of drug-drug and drug-food interactions, patient's allergies, titration of

dosing requirements and being saddled with more exacting patient care responsibilities, it becomes well-nigh impossible for a physician to do justice to the whole gamut of medication management.

Technology has made an inroad in the arena of pharmacy in a great way. To handle this technology, specialised training is needed for safety of medication management. Therefore the concept of pharmaceutical care has been evolved with the objective of better outcome of drug therapy and making a positive contribution towards patient's quality of life. The concept of pharmaceutical care is evolving as is exemplified in the varieties of definitions that have been put forward to delineate the concept of pharmaceutical care. A definition provided by the American Society of Health System Pharmacists(ASHP) is as under:

"The mission of the pharmacist is to provide pharmaceutical care. Pharmaceutical care is the direct, responsible provision of medication – related care for the purpose of achieving definite outcomes that improve a patient's quality of life" . (14)

5.6 Paradigm Shift

There is an ongoing profound change in health care delivery system. Commensurate with this change, the pharmacy practice is also changing and adapting itself to support the health care delivery system. The changes for accessible, sustainable, affordable and equitable health care are manifested in:

a) Public health interventions
b) Pharmaceutical care
c) Rational medicine use
d) Effective medicine supply management

5.7 New Dimension of Pharmacy Service

The pharmacists have now started moving from behind the counter to its expanded active role in patient care. The new dimensions of pharmacy care are:

a) Pharmaceutical Care
b) Evidence based pharmacy
c) Meeting patient's needs
d) Chronic patient care- HIV/AIDS
e) Self medication- provides guidance to pharmacists, patients and the industry regarding the safe and effective use of non-prescription medicines.
f) Quality assurance of pharmaceutical care services
g) Clinical pharmacy
h) Pharmaco-vigilance

5.8 The Pharmacist as a Member of the Health Care Team

The health care team consists of the patient and all the health care professionals who have responsibility for patient care. Pharmacists have an important role to play in this team. The team needs to be well delineated and the members have to collaborate among themselves. Pharmacists have to adapt their knowledge, skills and attitudes to this new role. This role envisages integration of traditional pharmaceutical science with clinical aspects of patient care, clinical skills, management and communication skills, active collaboration of medical teams and solving of medicine related problems.

Collaborations between different components of health care team have become a necessity in the complex environment of health care delivery. In this context the World Health Professions Alliance(WHPA) was established in 1999 to facilitate close collaboration between Federation of International Pharmacists, the World Medical Association, International Council of Nurses and World Dental Federation. The

objectives of the alliance are to support governments, policy makers and WHO for better delivery of cost effective, quality health care, worldwide.

5.8.1 Pharmaceutical Care : The systematic approach to the delivery of pharmaceutical care has the following four steps:

a) **Step 1:** Assess the patient's drug therapy needs and identify actual and potential drug therapy problems.
b) **Step 2:** Develop a care plan to resolve and /or prevent the drug therapy problems.
c) **Step 3:** Implement the plan.
d) **Step 4:** Evaluate and review the care plan.

5.9 Information Management and Use of Evidence : To be able to perform their modern role effectively, the profession of pharmacy has to cross many barriers. Some of these barriers are:

a) Competence development.
b) Acquiring better knowledge and skill.
c) Use of Information Technology effectively.
d) Superior communication skill.
e) Practice of evidence based pharmacy service.
f) Acceptance by other members of medical care team that services of the pharmacists are needed for better and safer patient care.

Unless the pharmacists can demonstrate effectively that their role in patient care is complimentary to that of the physicians, their acceptance as the medical care team member would not materialize. A physician as the leader of the team may consider the

role of the pharmacists as only that of undue interference and meddling in the physician's arena of activity.

A study by Hynniman and Lamy & Williamson and Kabat found that, although a majority of physicians are receptive to an expandable role for pharmacists as drug information experts, most physicians believed that very few pharmacists were performing this service in any meaningful way. The expectations of pharmacists were therefore quite limited.

Although physicians are receptive to the consultative and educational services provided by pharmacists in an inpatient setting, the receptivity by individual physicians to those services is related to the value, the physician attaches to the service and the physician's perception of the pharmacist's competence. (15)

The pharmacists in their emerging role of care givers and for improving patient's quality of life must remain abreast with the current knowledge in the fast changing scenario. The fields of pharmacy and pharmacotherapy are changing at a rapid rate. New techniques, new products and new information about old products are constantly being introduced. All health care professional, including pharmacists, are faced with constant challenge of new information. They are required to filter, assimilate and use it to improve the delivery of patient care. The pharmacists in order to establish themselves in their new role and for gaining acceptance by the physicians have to strive harder and remain at least one step ahead of the physicians in acquiring and using the newer knowledge regarding pharmaceuticals. The use of modern information technology can help the pharmacists to achieve these objectives and also to practice evidence based medicine.

5.10 Evidence based Medicine : A definition of evidence based medicine is as under:-

It is the conscious, explicit and judicious use of current best evidence in making decisions about the care of individual patients. (16).

Evidence based medicine depends on the best possible evidence for practice and prescribing medication. The evidence is provided by the research in the field. The research studies that are published in the scientific journal can be accessed and critically evaluated. The research evidence is integrated with knowledge and experience of the practitioners to form the basis of practice. Information technology contributes to a great extent in accessing the evidences.

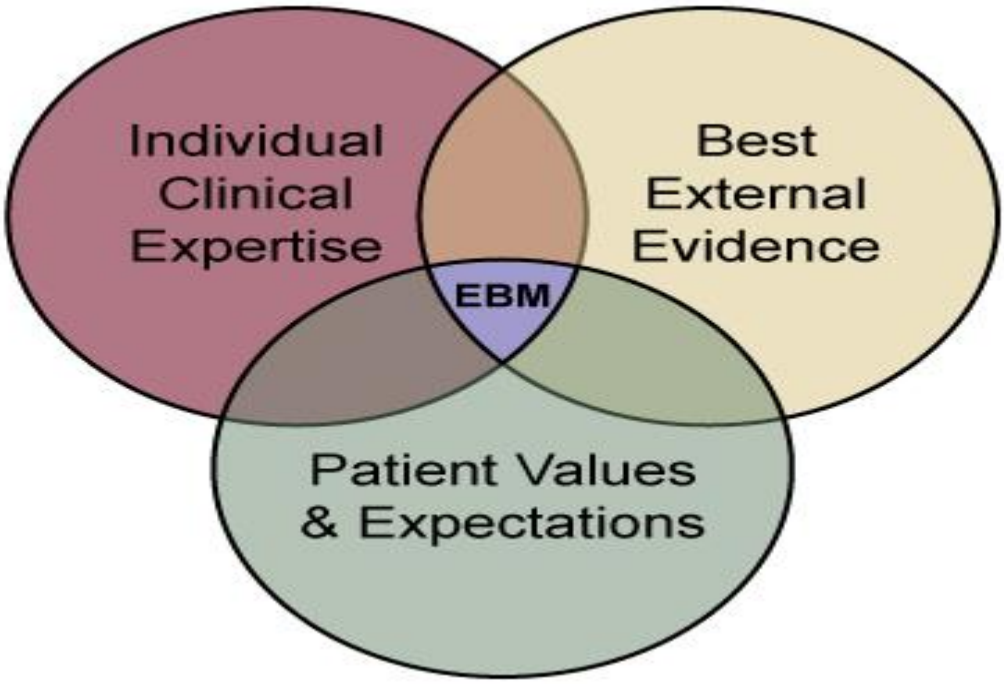


FIGURE: 5.1 EBM

5.11 Sources of medicines information

There are many resources from where medicines information can be obtained. These are

5.11.1 Reference books

a) Goodman and Gilman's The Pharmacological basis of Therapeutics.

b) Clinical Pharmacology by Laurence and Bennett.

c) Pharmacotherapy:A Pathophysiologic Approach. Ed.DePiro et al.

d) Hansten and Hom's Drug Interactions Analysis and Management – This is a primary source of information for drug interactions.

e) Martindale's The Complete Drug Reference.

f) AHFS Drug Information 2016.(American Hospital Formulary Service)

g) Indian Pharmacopeia, 2014 Addendum 2016.

h) National Formulary of India, 2016 (5^{th} edition). (17)

5.11.2 Drug compendia: Compendia usually include generic and brand names, chemical composition, indications and contraindications, warnings, precautions and interactions, side-effects, administration and dosing guidelines. Some of these compendia are commercially sponsored. E.g. Monthly Index of Medical Specialities (MIMS). The United States Pharmacopeia Dispensing Information(USPDI) and the British National Formulary(BNF) (http://www.bnf.org) are comprehensive and objective compendia & provide criteria for choice within well- defined therapeutic categories.

5.11.3 National medicines lists : India has an updated National List of Essential Medicines 2015.(NLEM) There are 376 medicines included in this list. Under the Hon'ble Supreme Court order, the prices of these drugs have been fixed. The list is available online.

5.11.4 Essential medicines and treatment guidelines

a) WHO model list of Essential Medicines, 2015. This list is revised every two years. (18)

b) Standard Treatment Guidelines for Medical Officers, Government of Chhattisgarh. (19)

5.11.5 Drug Formularies.

5.11.6 Medical Journals.

5.11.7 Drug information centres.

5.11.8 Computerised information.

5.11.9 The Pharmaceutical industries.

5.12 How to retrieve and evaluate medicines information online?

Many medical articles are indexed in Medline database. These are usually available in medical libraries. Free access is available through the internet. (20) The data accessed must be reliable. The following points may be useful in determining whether the published article is authentic:

a) Author's qualification and expertise in writing the article.

b) Authors organisation – is it reputable?

c) Is the article's source from a major university or institute specialising in that area?

d) Is the website publishing it, reliable?

e) Has the author followed the appropriate protocol of writing a research paper?

The World Wide Web has a lot to offer, but not all sources are equally valuable or reliable. It must be properly evaluated. (21)

5.13 The Cochrane Collaboration

The Cochrane Collaboration is an international network of individuals and institutions that review and analyse the best clinical trials available on various subjects, and synthesize them into regularly updated systematic reviews. The information found in Cochrane is considered by many to be the Gold Standard, or the final word in medical conversation on a topic. (22)

5.14 Pharmacoeconomic Analysis (23)

There are four main criteria to be considered in the selection and use of a medicine. These are:

a) Efficacy.

b) Safety.

c) Quality.

d) Economic evaluation.

5.14.1 Four methods of economic analysis are commonly used. These are:

a) Cost minimization analysis.

b) Cost effectiveness analysis.

c) Cost-utility analysis.

d) Cost benefit analysis.

The expanded role of the pharmacists in providing pharmaceutical care as a member of the healthcare delivery team requires the pharmacists to be competent, skillful, knowledgeable and confident. Today's patient care is largely technology oriented. The technology has made an inroad in modern pharmacies in a big way. The technology has contributed towards efficiency of pharmacy service, in logistics, and in patient safety. The information technology has contributed to a great extent in practicing evidence-based medication management, in pharmacoeconomics and pharmacovigilance.

5.15 Automation and Information Technology Integration with Pharmaceutical Care

Pharmacists started using computers much more than what they used to three decades ago. (24) The use of the computer in the early days was for dispensing, billing and reimbursement purposes. Since then, applications have extended to a wide range of clerical and medication management functions. Use of computer in patient care

services started only recently. The three categories of computer applications in patient care services in pharmacy practice can be divided as under:

5.15.1 Electronic Health Recording including,

a) Electronic prescribing and

b) Clinical Decision Support

5.15.2 Health Information Technology in Medical Management

5.15.3 Additional Pharmacy applications, including

a) Internet Pharmacies

b) Use of social media in communication on medicines

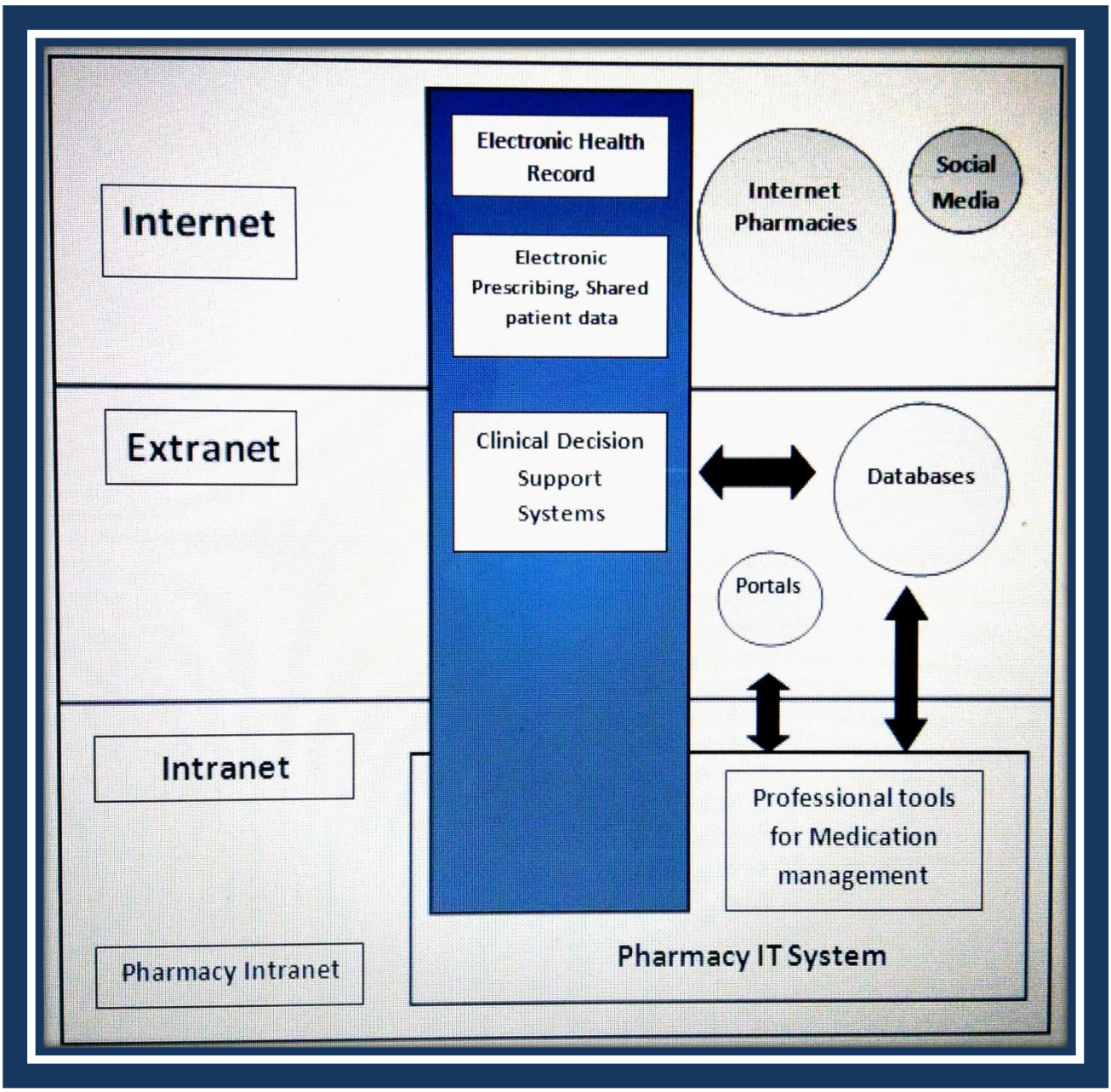


FIGURE: 5.2 THE PHARMACY INFORMATION TECHNOLOGY SYSTEM

5.16 ELECTRONIC HEALTH RECORDS

There are many definitions of Electronic Health Records (EHR). Some of these are:

a) EHR as a concept is for collecting longitudinal health information about individual patients and populations, in order to improve quality of care.

b) EHR is an individual patient's medical record including patient's demographics, medical history, drug history, allergies, progress notes, current medications, laboratory test results, radiology images and advanced directives.

In the US, the Office of the National Coordinator (ONC) for Health Information Technology has recommended that EHR system should have four core functions:

a) Electronic documentation of providers' notes.

b) Results Management.

c) Electronic prescribing known as Computerised Provider Order Entry (CPOE)

d) Clinical Decision Support Systems (CDSS)

The EHR is a standard based system usually managed by the National Government. Health related data from various sources form a pathway and are integrated for access. The sources of data are pharmacy IT system, hospital IT systems and physician's Electronic Medication Records (EMRs). The standardised system is necessary to ensure patient safety and productivity benefits using IT in health record management.

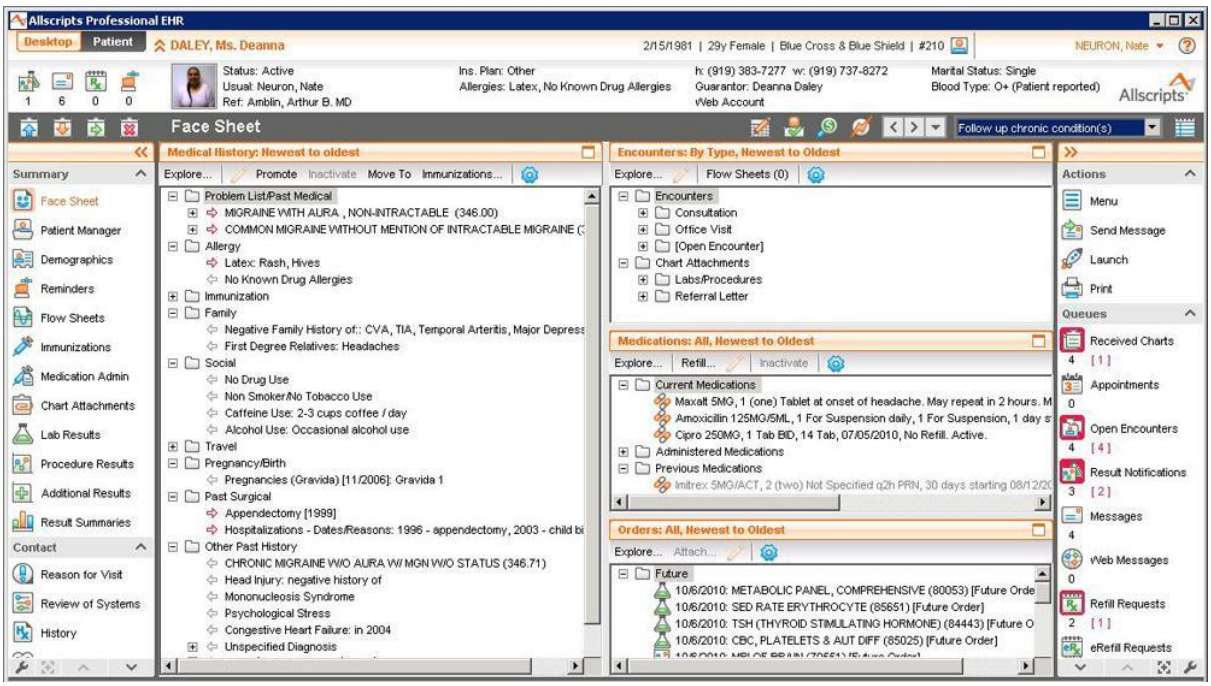


FIGURE: 5.3 SAMPLE ELECTRONIC HEALTH RECORD

The Royal College of General Practitioners in their report "The Good Practice Guidelines for GP electronic patient records" mentions about shared electronic patient records as under:

5.16.1 Background – Shared Electronic Patient Record

Even in the setting of the general practice, care is now rendered by multiple care givers. It is, therefore, crucial to maintain and improving health, particularly those with chronic illness, rehabilitation and palliative care needs. Developing models of information sharing and record systems to support these requirements has been patchy and was not conforming to the principles of clinical communication and governance. Against this background, the Royal College of General Practitioners, commissioned by the NHS, UK published its Shared Record Professional Guidance (SRPG) report in 2009. The report recommends that the Electronic Patient Record should be shared. The EMR should be patient- centred, secure electronic patient record, linked and accessible across (health) organisational boundaries. In this the patient is able to make choices about

sharing some or all of the content of their detailed (care) records with health professional involved in their care.

Pharmacies as dispensing medications are included in these scenarios. The EHR as defined by the ONC, is quite broad in its scope. Two functions directly link the pharmacies with the EHR. These two functions are: electronic prescribing and Clinical Decision Support System.

5.17 Electronic prescribing

CPOE refers to a variety of computer-based systems of ordering medications, which share the common features of automating the medication ordering process. Basic CPOE ensures standardised legible, complete orders by accepting only typed orders in a standard and complete format. Almost all CPOE systems include or interface with CDSSs of varying sophistication. Basic clinical decision support may include suggestions or default values for drug doses, routes, and frequencies. More sophisticated CDSSs can perform drug allergy checks, drug-laboratory value checks, drug – drug interaction checks, in addition to providing reminders about corollary orders (e.g. prompting the user to order glucose checks after ordering insulin) or drug guidelines to the physician at the time of drug ordering. (25)

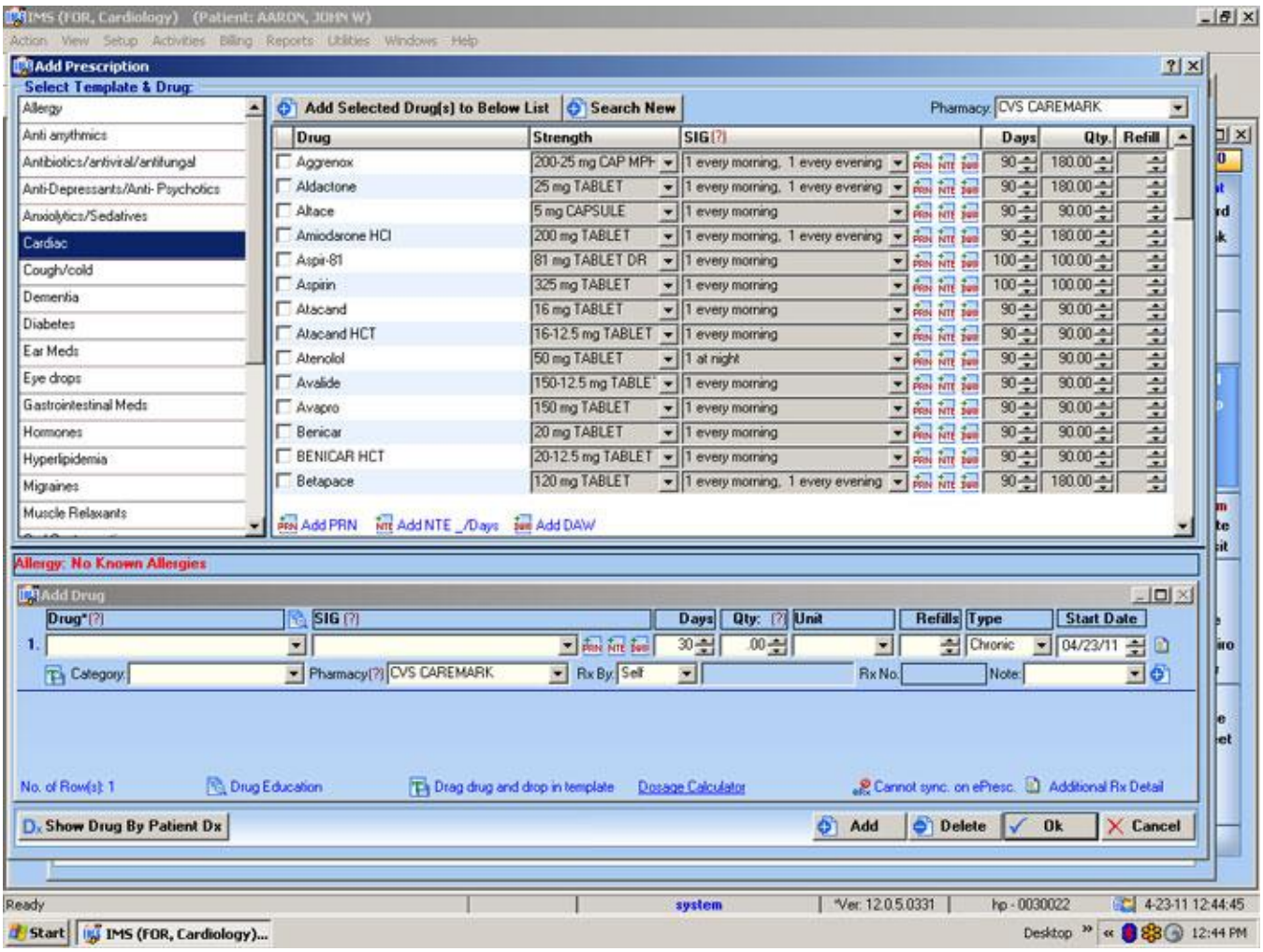


FIGURE: 5.4 SAMPLE OF E-PRESCRIPTION

Electronic prescribing is known in European countries as e-prescribing. In the US, the terms Computerised Physician Order Entry (CPOE) describing the physicians' systems has also been used. The physicians create the electronic prescription in their IT system from where it is transmitted through a secure network and accessed by the Pharmacy.

The CPOE is commonly a part of the larger health information technology (IT) plan or system implementation. Besides, CPOE, there are many healthcare technologies that impact patient care and pharmacy practice. CPOE includes all orders for patient care ,like Laboratory, nursing, respiratory and others. However, the pharmacy is concerned with medical ordering only.

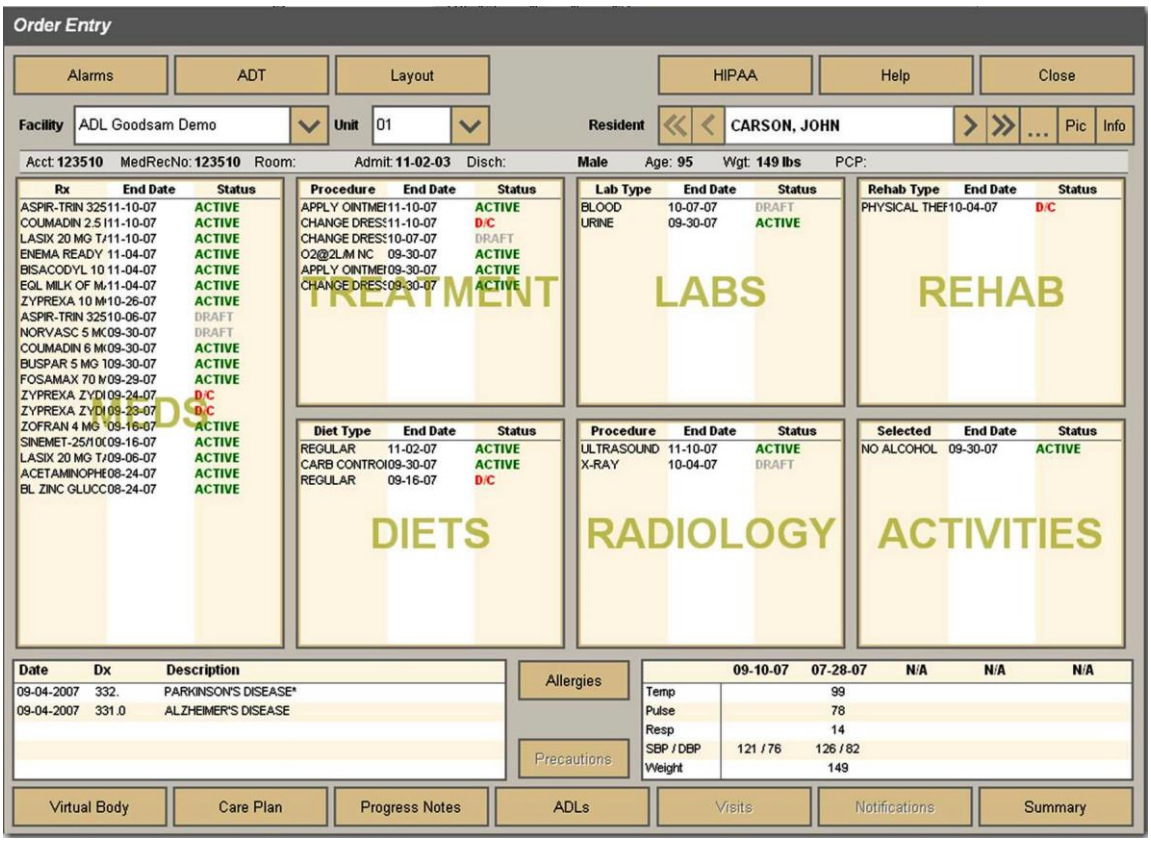


FIGURE: 5.5 SAMPLE CPOE SCREENSHOT

The impetus for CPOE came from the IOM (Institute Of Medicine) report where it was mentioned that between 44,000 to 98,000 patients die each year in US hospitals. Many such deaths are due to preventable medication errors such as Adverse Drug Events (ADEs). Most of these errors occur at the prescribing stage.

5.17.1 E-Prescribing in India

There are certain prerequisite for realizing the full potential of e-prescribing. Some of these are, EHR, Clinical Decision Support System, Pharmacy System, data network, capacity of the pharmacy to absorb the technology and so on. However, at a basic level, e-prescribing has already been initiated in certain health care settings. Some Indian software companies are already marketing the e-prescribing software.

Indian Medical Association (IMA) has already made a positive move towards adopting e-prescribing of medications on voluntary basis. (26) The IMA is in favour of electronic

prescriptions, mobile health care and e-health provided these measures are encouraged on voluntary basis, but not with legal enforcement.

Before implementation of e-prescribing as a national policy, certain legalities have to be looked into. Presently, the prescriptions for medication needs authorised doctors' signature on the prescription. In medication therapy, the prescription is a legal document. The relevant statutes for medication prescription are the following:

a) The Indian Medical Council Act, 1956
b) The Indian Medical Council (Professional Conduct, Etiquette & Ethics Regulations 2002)
c) The Drugs and Cosmetics Act, 1940 and Rules, 1945
d) The Pharmacy Act, 1948
e) The Narcotic Drugs and Psychotropic Substances Act 1985 and Rules 1987
f) Drugs (Price Control) order, 1995, and
g) The Drugs and Magic Remedies (Objectionable Advertisements) Act, 1854 and Rules, 1955.

Indian Trade is now offering a Prescription Pad Software with the following features:

a) It checks for drug interactions and duplications automatically along with checking of safety parameters like pregnancy, lactation, children, elderly, liver conditions, renal insufficiency and pulmonary inefficiency.
b) It also provides drugs and brand information.

In 2014, Dr Harshvardhan, Union Health Minister then, announced making E-prescriptions compulsory in India. On 30 Dec 2016, the new EHR standards, 2016 (27) have been notified by the Ministry of Health & Family Welfare. E-prescriptions in India are presently bound by the Pharmacy Practice Regulations, 2015 (28) notification No.14-148/2012 PCI as specified by Pharmacy Council of India.

5.17.2 Ways to achieve a unique signature

An article from Canada mentions about an electronic prescribing system whereby a physician uses a special pen to write a prescription. The pen is cradled on a wireless device which sends a "file" to a server at a remote location. When the physician uses the pen to sign his or her name, the image of that signature is captured and put into a file. This is digitized image file. That file is then sent to the server and is coupled with the unique prescription which the pen has also captured and sent to the server. Both files- signature and prescription are unique- and they must go together, the signature file cannot be used for another prescription.

Another way to create a unique signature is to sign the computer touch screen directly. In this way, the signature forms part of a particular prescription and because it is not located in a separate file, it can't be used by physician again. (29)

5.18 Clinical Decision Support System

Clinical Decision Support System (CDSS) is an approach that analyses data from the electronic health record to help health care providers make clinical decision. Pharmacist's awareness of decision support functionalities has recently been reported to be limited. (30) Pharmacy Clinical Decision Support (PCDS) software that contains drug-drug interaction (DDI) information may augment pharmacists' ability to detect clinically significant interactions. A study conducted indicate that many pharmacy clinical decision support systems perform less than optimally with respect to identifying well-known, clinically relevant interactions. Comprehensive system improvements regarding the manner in which pharmacy information systems identify potential DDIs are warranted. (31)

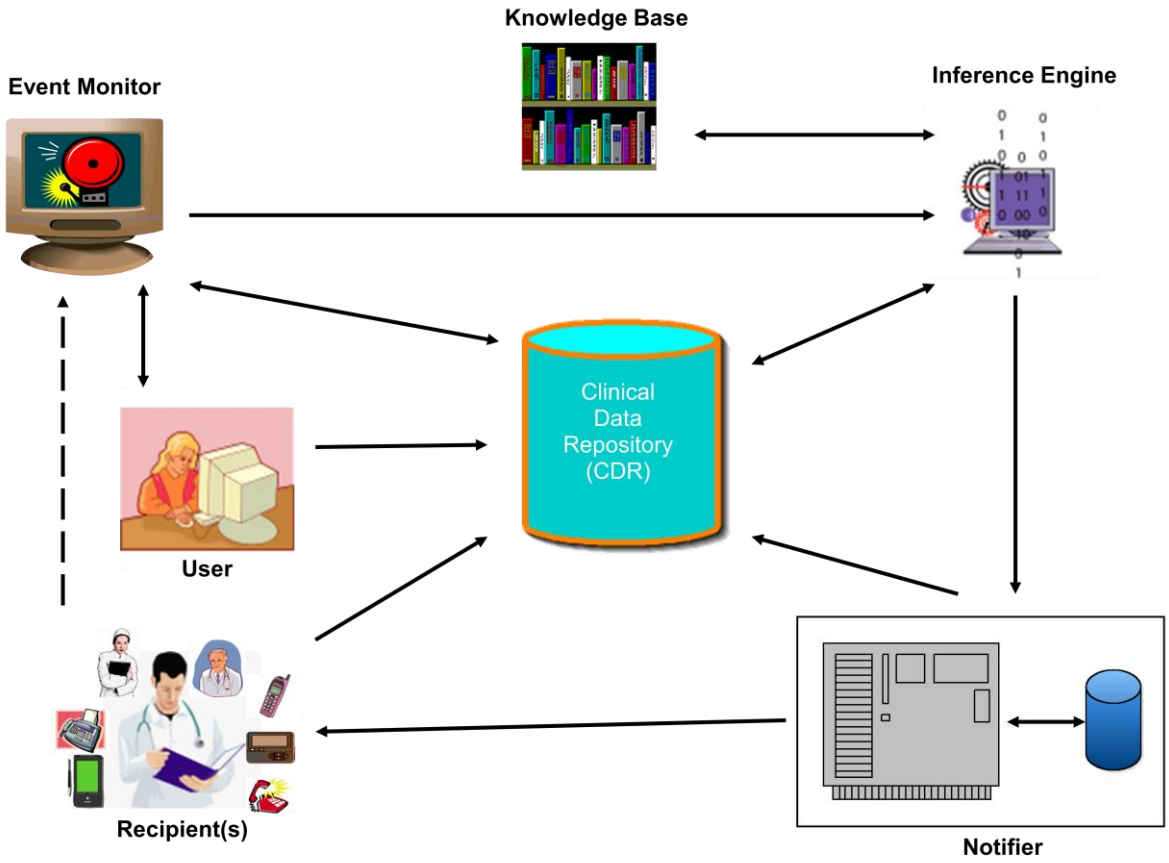


FIGURE: 5.6 CDSS FLOW CHART

5.19 Computerised Drug Utilisation Review in United States

In the United States, the first Drug Utilization Review (DUR) programs were initiated in the end of 1960. DUR is defined by the United State Pharmacopeia (USP) as: "A process to assess the appropriateness of drug therapy by engaging in the evaluation of data on drug use in a given health care environment against predetermined criteria and standards." The aim of the DUR is to prevent different kinds of drug related problems such as:

a) Drug- Drug interactions

b) Adverse drug reactions

c) Duplicate and misuse of medication

There are reasons why oversight of what is prescribed can be so vital. With thousands of potential drugs available, combinations of medications can quickly become lethal, or they

make people so sick that it dramatically increases medical costs. It is fair to state that people have died from prescribed medications that should not have been prescribed together or that were taken incorrectly. Having boards or private organisations that oversee potential interactions and make physicians and pharmacists are aware of them, is valuable.

DUR programmes use professional medical protocols and computer technology and data processing to assist in the management of data regarding the prescribing of medicines and dispensing of prescriptions over periods of time. (32)

5.20 Internet pharmacies

Social media is also providing pharmacy services particularly in community setting. Consumers want individual services. They also want to save time and money. Internet pharmacy provides the consumer with such opportunities. Pharmacists have responded to provide services on the internet. There is, however, a great concern for patient safety. Drugs may come from other countries, the pharmacies may not be licensed and drugs are provided without a prescription. Even the counselling by the pharmacists is missing. As per WHO estimates about ten percent of medicines are counterfeit.

Hospital pharmaceutical practices, however, are not exposed to the social media. (33)

5.21 Guidelines on Documenting Pharmaceutical Care in Patient Medical Record.

Pharmacists are gradually gaining more and more acceptance as a member of the health care team by their clinical colleagues. The pharmacists are accountable for the pharmaceutical services they provide for the safe and effective use of drugs that may affect patient outcome. In this context, the professional actions by the pharmacists need to be documented in the patients' medical records. The standards for accreditation of hospitals (NABH and others) require that assessment care plan by all the team members need to be documented in the

patients' medical records. (34) The hospital needs to provide authorisation to the hospital pharmacists for documentation in patient's medical records.

Examples of information, pharmacists need to document are: (35)

a) A summary of the patient's medication history on admission, including medication allergies and their manifestations.
b) Oral and written consultations provided to other health care professionals regarding the patient's drug therapy selection and management.
c) Physician's oral orders received directly by the pharmacists.
d) Clarification of drug order.
e) Adjustments made to drug dosage, dosage frequency, dosage form, or route of administration.
f) Drugs, including investigational drugs, administered.
g) Actual and potential drug-related problems that warrant surveillance.
h) Drug therapy monitoring findings, including
    i. The therapeutic appropriateness of the patient's drug regimen, including the route and method of administration.
    ii. Therapeutic duplication in the patients' drug regimen.
    iii. The degree of patient compliance with the prescribed drug regimen.
    iv. Actual and potential drug-drug, drug-food, drug-laboratory test, drug-disease interactions.
    v. Clinical and pharmaceutical laboratory data pertinent to the drug regimen.
    vi. Actual and potential drug toxicity and adverse effects.
    vii. Physical signs and clinical symptoms relevant to the patient's drug therapy.
i) Drug related patient education and counselling provided.

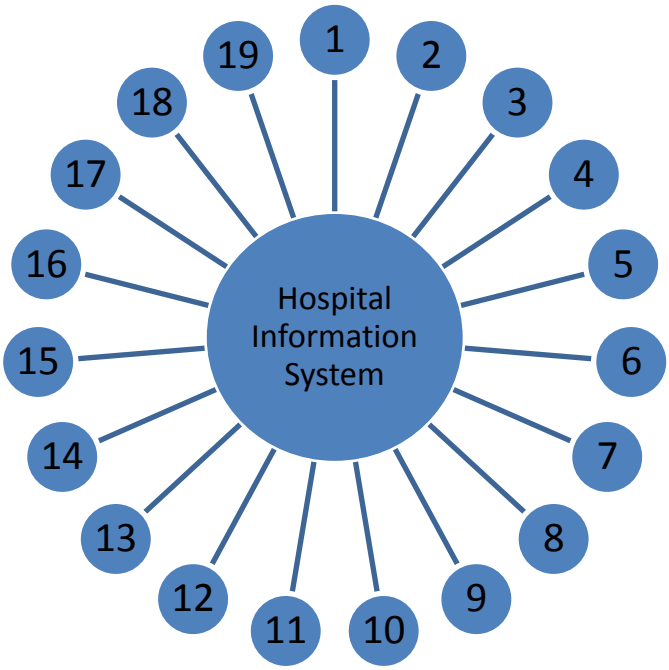
5.22 Expectation of Benefits from the Health Information Technology In summary, the modern role of the pharmacy enabled to use HIT is expected to provide integrated electronic health care with interactive exchange among patients, providers, government agencies and insurers. This will result in an increase in the overall quality, safety and efficiency of health care delivery. It is also expected that there will be fewer medication errors, increase in administrative efficiency, decreased health care costs, and expanded patient access to affordable health care. Government needs to provide incentives to expedite the nationwide implementation of HIT. (36)

5.22.1 Risks associated with HIT : Though the implementation of HIT can bring in considerable benefit to healthcare, it needs to be implemented and monitored closely till it functions as intended. The Joint Commission in the US has issued certain suggestions to help prevent patient harm related to the implementation and use of covering technologies.

5.23 Traditional Role of Pharmacy

One of the problems in health care in developing countries is the poor accessibility of medicines in pharmacies for patients. This is mainly due to lack of organisation and information. It should be possible to improve the situation by introducing information and communication technologies. (37)

In its traditional role, the pharmacy is required to perform the functions pertaining to materials management and inventory control.



1. Trauma and Emergency	8. Medical Records	15. Eqpt. Mgmt
2. Ward Management	9. HRD	16. Departments
3. Blood Bank	10. CSSD	17. Billing
4. CCU	11. Pharmacy	18. Dietary
5. Regis Adm. Dis. Transfer	12. General Stores	19. IT
6. Appointments	13. Operation Theatre	
7. Radiology	14. Accounting & Finance	

FIGURE: 5.7 HOSPITAL INFORMATION SYSTEM MODULES

Patient safety, improving quality of patient outcome, being accountable for pharmaceutical care as a member of the health care delivery team, improving efficiency of pharmaceutical services by using modern management techniques and harnessing the methods of information technology, automation, logistical innovation and cost control have been the increasingly growing concern for today's hospital pharmacy.

5.24 Automation in Hospital Pharmacy

Like any other field of human endeavour, hospital pharmacy also has seen the growth in the use of automation and information technology. These technological innovations have been able to free the pharmacists from the drudgery of routine repetitive jobs. The

monotonous jobs coupled with fatigue leads to commission of errors and compromising on patient safety. Many hospitals in the advanced countries have adopted Unit Dose Distribution System (UDDS). This has improved patient safety but at the same time increased the workload of the pharmacists. The UDDS works as below:

5.25 Unit Dose Drug Distribution System

There are many varieties of UDDS depending on the need of the organisation and its infrastructure development. It is a pharmacist controlled system for distribution and control of medication in an organised setting. This system is practiced in the USA. In the UK, ward pharmacy system is in use. Unit dose distribution system has been defined as:

"Those medications which are ordered, packaged, handled, administered and charged in multiples of single dose units containing a predetermined amount of drugs or supply sufficient for one regular dose application or use". (38)

The medicines are contained in single unit packages. They are dispensed in, as ready-to-administer form as possible and mostly for only 24 hours of supply of doses. These are delivered to the patient care area. In long term care, however, supply for 48 to 72 hours is acceptable.

The UDDS was introduced in 1980's. Since then various studies have been made about its efficacy and patient safety. It has been shown that the UDDS, in comparison to other drug distribution system, is:

a) Safer for the patient.

b) More efficient and economical for the organisation, and

c) A more effective method of utilising professional resources.

FIGURE: 5.8 UNIT DOSE DRUG DISTRIBUTION SYSTEM

The major advantages of UDDS are:

a) Reduction in medication error.

b) Decrease in total cost of medicine related activity.

c) More efficient use of pharmacy and nursing personnel.

d) Improved overall drug control and drug use monitoring.

e) More accurate billing for patients for drugs.

f) Reduction in inventory of drugs in patient care areas.

g) Greater adaptability to computerised and automated procedures.

Because of these benefits the American Society of Hospital Pharmacists considers the UDDS as an essential part of drug distribution and control in organised health-care settings. (39)

Availability of technology and computerisation has ushered in an era of automation in hospital pharmacy. Various processes including drug distribution system can now be automated. This automation process include: storage, packaging, dispensing, pick up, delivery and distribution of drugs along with electronic data transfer and saving transaction details. (40)

5.26 Bar- Code Enabled Medical Administration Technology

Medication errors occur at several stages of medication management. Though majority of errors occur at the prescribing stage, errors in administration is also not uncommon. The American society of Health-system Pharmacists encourages use of bar-code-enabled medication administration (BCMA) technology to improve patient safety and the accuracy of medication administration and documentation.

When implemented, the bar-code system must follow an accepted standard. GS1 is the world's most widely adopted supply chain standard for goods, services, assets and location identification since 1977. (41)

FIGURE: 5.9 USE OF BARCODE TECHNOLOGY IN MEDICATION ADMINISTRATION

5.27 Automated Medicine Dispensing Device

Robotics is now being used in many hospital pharmacies in developed countries for drug distribution particularly for UDDS. Automated packaging and dispensing systems for filling patient orders are becoming common in US hospitals. The origin for impetus for introducing automation and information technology in pharmacy is the concern for medication safety.

Bar-coding initiative has the potential to dramatically reduce medication error. It can help doctors, nurses and hospitals make sure that they give their patients the right drugs at the appropriate doses. UDDS was introduced in response to this need.

There are many automated systems available for use in the pharmacy. The PillPick system of Swisslog's Automated Drug Management System (ADMS) (42) is one such system. This system is widely used all over the world. It is a modular system enabling hospitals to choose a feature most needed for their pharmacy operations. The PillPick system first packages the bulk pharmaceutical items. These are bar-coded and labelled into individual unit doses. The unit doses are then automatically placed into buffer storage for future retrieval and dispensing to patient floors, tagged for individual patient administration.

FIGURE: 5.10 PILL PICK SYSTEM

The Pillpick Manager Software receives the electronic patient orders, sorts them by priority, and separates them into two groups:

a) Automatic dispensing
b) Manual picks

Once a physician has ordered a drug for a patient, it goes to the pharmacy for verification before the dispensing process begins.

5.28 Challenges in Pharmacy Automation

The major challenge is the cost. Technology, though it has its economies of scale for chain operations, can be an expensive affair for individual pharmacies. (43)

Factors that affect adoption of IT in hospital pharmacy are similar to other organisation. (44) Some of these are:

a) Familiarity with computer
b) Attitude of the pharmacists
c) Attitude of the administrators
d) Availability of hardware
e) Availability of software
f) Lack of motivation

Modern technology like Unit Dose Dispensing System, Bar-coded medication management, Hand Held Personal Digital Assistant (PDA), Robotics, Clinical Decision Support System, CPOE and internet access to medical reference materials has not made its entry in the hospital retail pharmacy. Nearly half of serious medication errors have been found to result from the fact that clinicians have insufficient information about the patient and the drug. (45)

The corporate hospitals in India have adopted the inventory management system software driven by their requirements of accurate billing, inventory management, customer relationship management and maximization of profit. In public sector hospitals, these incentives are missing. However, patient safety is a concern for all hospitals, be it be in public or in private sector.

The greatest potential for reducing medication errors and improving patient safety rests with the implementation of Computerised Provider Order Entry (CPOE) and Clinical Decision Support Systems (CDSS).

5.29 Computerised Provider Order Entry (CPOE)

It was recognised that errors resulting in preventable Adverse Drug Events (ADEs) involved a wide range of drug classes and most commonly occurred at the prescribing stage. The Institute of Medicine (IOM), USA, in its report "Crossing the Quality Chasm: A New Health System for the 21st Century" called for IT, including CPOE, to take a central role in the redesigning of the health care system to improve quality, increasing efficiency, and reduce errors. (46) The central goal of a CPOE system typically includes improving medication safety and the quality of health care processes.

Computerised Provider Order Entry is a Health Information Technology (Health IT) system that is commonly used by hospitals and other health care providers to prevent medication related errors and increase efficiency in medication administration. (47)

CPOE enables the providers to enter medical order into a computer system located within the organisation. A fully implemented CPOE is integrated with the Electronic Health Record (EHR supplementary role), and Clinical Decision Support System. CPOE, besides medication orders also is capable of specifying all orders for patient care including orders for laboratory, admission, radiology, nursing, respiratory and procedure orders. The CPOE checks for drug-drug interactions, drug-food interaction, allergies to prescribed medication and dosing for disease related conditions like hepatic and renal disorders, age related dosing

and contraindications of the prescribed medication in certain conditions like pregnancy and lactation. The provider gets alerts, if necessary, on his/her smart phone. CPOE replaces traditional methods of prescribing including paper prescriptions, verbal or telephonic orders and orders transmitted through fax.

In spite of many potential benefits of adopting IT in pharmacy, its implementation is quite slow even in developed countries. In developing countries, the hospital pharmacies are still continuing with their traditional role of inventory management, dispensing and distributing. The IT even in this traditional pharmacy role which is apprehended to continue for some more years can bring in considerable improvement in materials management ensuring right medication at the right time for the right patient.

5.30 Traditional Functions of Hospital Pharmacy

The basic functions of pharmaceutical management are selection –procurement- distribution-use. These functions are supported and linked by management support.

Appropriate selection of essential medicines is the most cost-effective action that any health care system or health care provider can take to promote regular supply and rational use of medicines. India has an essential medicine list consisting of 376 items. In a tertiary care hospital, this list will not be sufficient to treat the varieties of illness that the hospital is called upon to treat. The drug and therapeutics committee (DTC) of the hospital will determine the types of medications that the hospital will require. The requirement will be included in the hospital formulary.

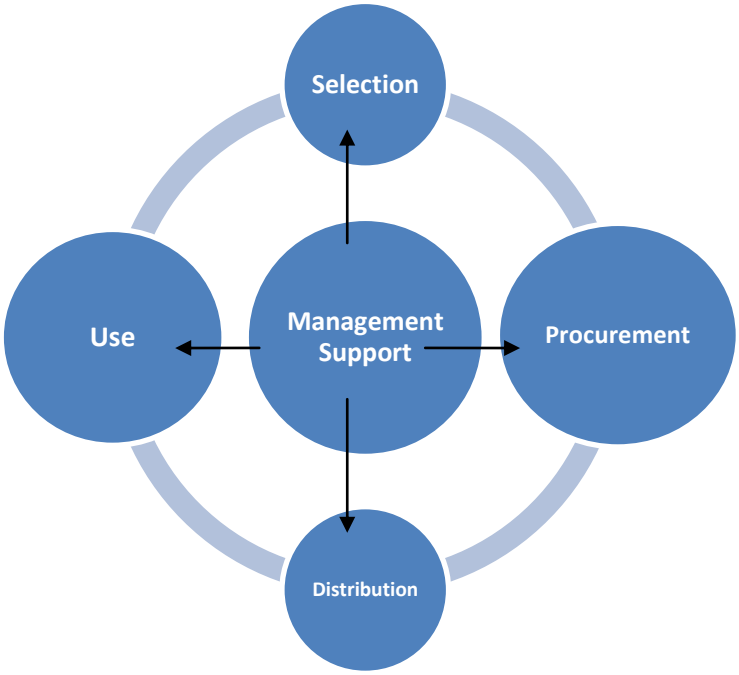


FIGURE: 5.11 MEDICATION SUPPLY MANAGEMENT

5.31 Materials Management

Most of the functions that a hospital pharmacy performs in India are concerned with only materials management.

International Federation of Purchasing and Materials Management have defined materials management as:

"Materials management is a total concept involving an organisational structure unifying into a single responsibility the systemic flow and control of material from identification of the need through customer delivery."

This concept of materials management includes the following functions:

a) Planning
b) Scheduling
c) Buying
d) Storing
e) Moving
f) Distributing

Like any other organisation, materials management is important for hospitals as well. This is not only from the cost point of view but also from the point of view of patient care.

Stock out of a vital medication may make the difference between life and death. Therefore, efficient materials management assumes greater importance in hospital pharmacy. Computerisation of inventory control functions can improve the efficiency of operation of the pharmacy.

5.32 Objectives of Materials Management

The major objectives of materials management are: (48)

a) To ensure continuous and uninterrupted operation by maintaining a steady flow of materials.
b) To ensure efficient operations in an economic manner.
c) To effect economies in the cost of materials by purchasing material of the right quality, in the right quantity, at the right time, from the right source, and at the right price.
d) To effect economies in the costs incurred on materials after they have been purchased, through storage, processing and warehousing, till the goods ultimately reach the user.
e) To reduce the working capital requirements through scientific inventory control.
f) To be alive to the changes in the market in respect of new products.

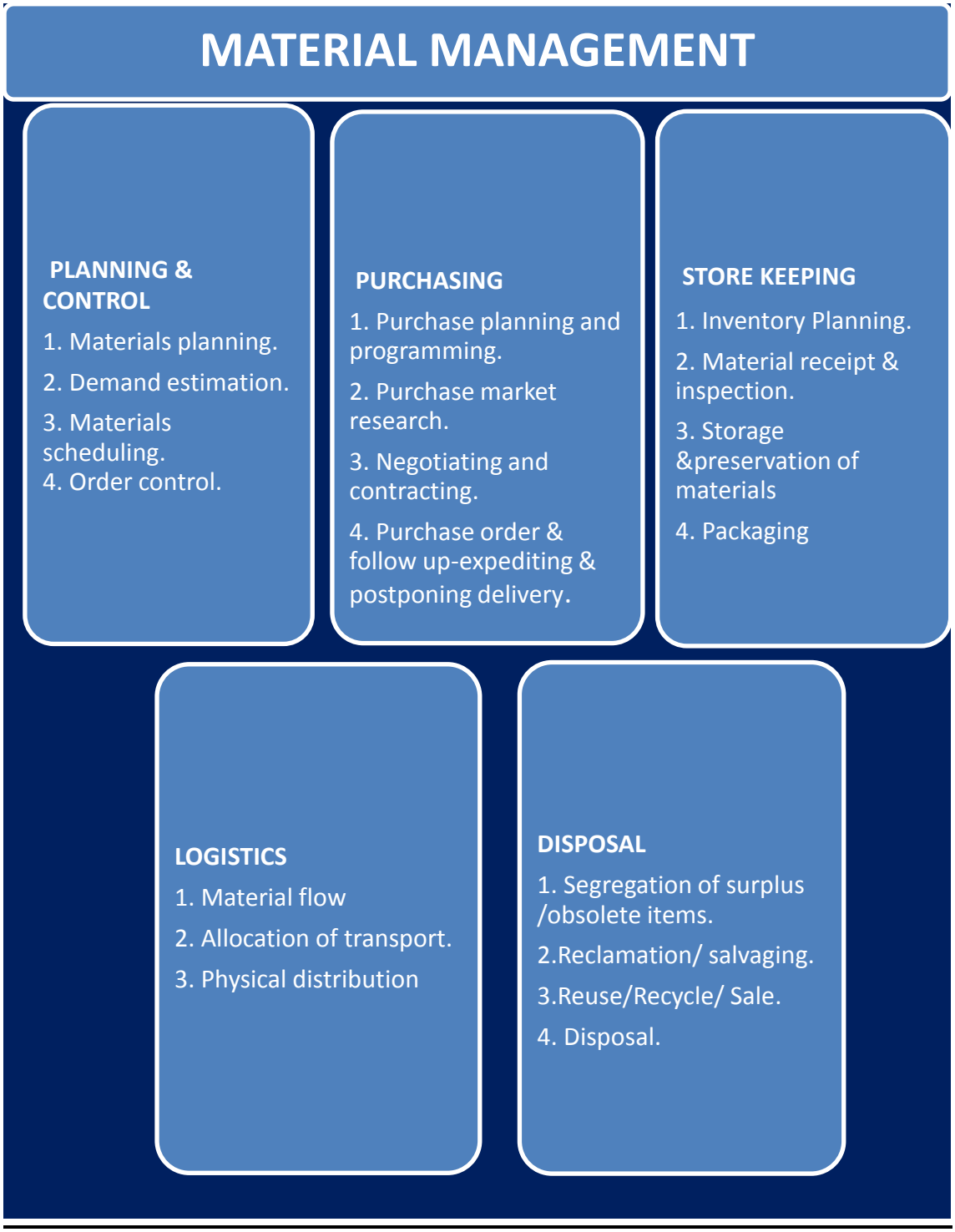


FIGURE: 5.12 ADAPTED FROM PURCHASING AND INVENTORY CONTROL (48)

5.33 Procurement

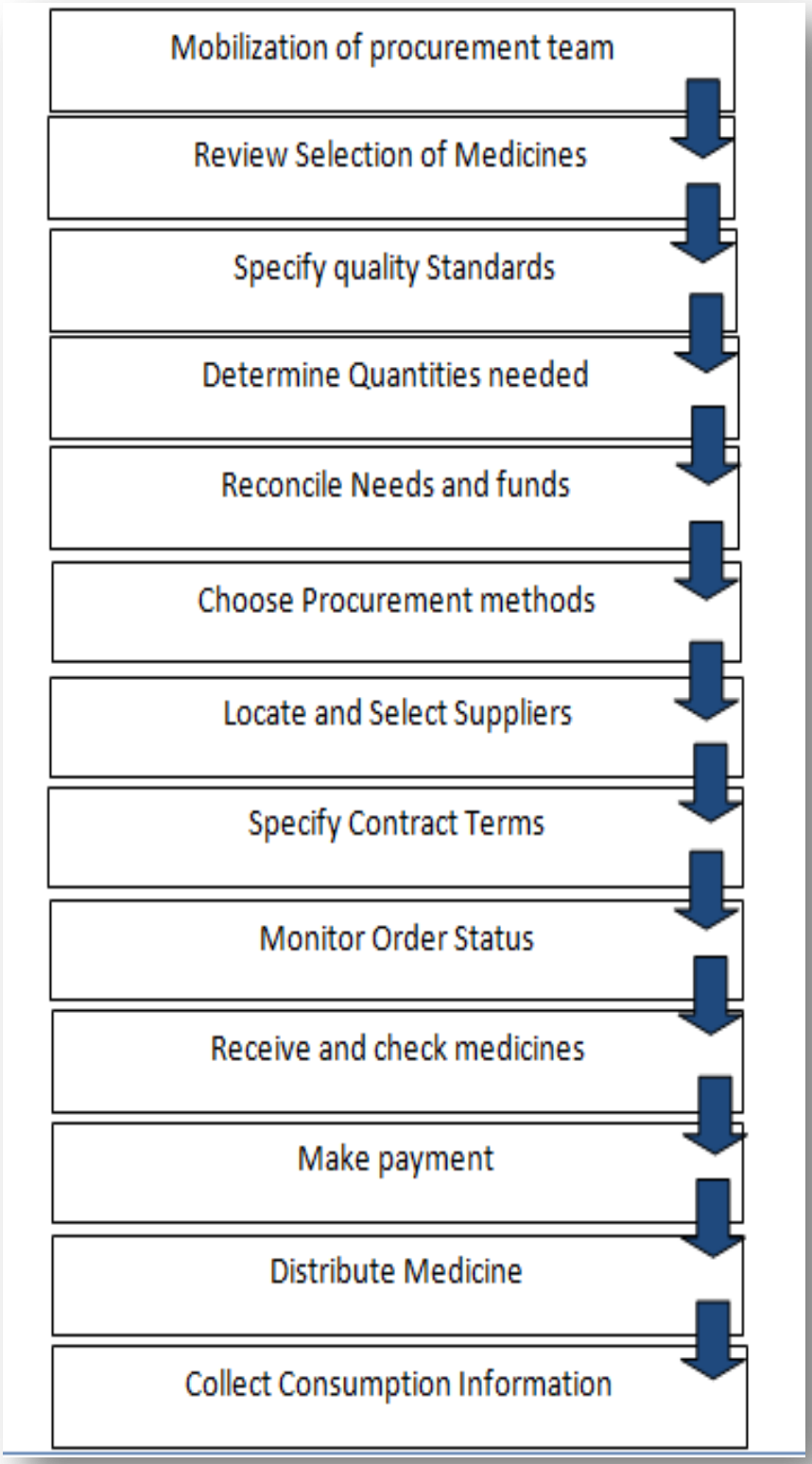


FIGURE: 5.13 STEPS OF PROCUREMENT CYCLE

Procurement is the most essential step in ensuring availability of the right medicines in the right quantities at reasonable prices and at recognised standards of quality. Pharmaceuticals may be acquired through purchase, donation or manufacture. The accompanying flowchart shows steps in procurement cycle.

The major procurement methods used by health systems are open tender, restricted tender, competitive negotiation and direct procurement. Many countries including India have resorted to e-procurement.

The Public hospitals in India are required to follow the General Financial Rules(GFR), (49) Fundamental Rules (FR) and Supplementary Rules (SR) of Government of India.

C-DAC has developed a Procurement Management System (PMS). In this system, integration of GFR with procurement system has been done. The system has been implemented at many Institutions. It is claimed that implementation of this Procurement Management System in these Institutions has resulted in considerable monetary benefits. (50)

5.33.1 The PMS system has six sub-modules. These are

a) Demand Planning sub-Module
b) Purchase planning sub-module
c) Tender Setup Sub-module
d) Order Management Sub-module
e) GFR Rule setup Sub-module
f) Reporting Sub-module. The various types of reports are:
    i. Purchasing details
    ii. Price Comparative Statement Detail
    iii. Supplier Performance Detail

iv. Earnest Money Deposit (EMD)

v. Performance Bank Guarantee (PBG) Detail and so on.

5.34 Inventory Management

Sound inventory management is essential for an efficient pharmaceutical supply system. Information technology can greatly improve the efficiency of the inventory management system. All the components of an inventory management system are amenable to computerisation.

The functions of inventory management, prima facie, sound easy. Simply put, these functions are:

a) Order the pharmaceutical items on a supplier
b) Receive the items when delivered by the supplier
c) Store the received items
d) Issue to the consumer departments, and then
e) Re-order to replenish the depleted stock

In actual practice, the task is not that easy. A poor inventory management will lead to wasted financial resources, stockouts, overstocking, expired drugs, poor accounting and pilferage. When the number of items in the pharmacy is large, the task of inventory management grows in complexity and becomes difficult to manage manually in a paper based system. The IT with a database management system can greatly improve the inventory performance.

5.34.1 There are seven basic steps in inventory management. (51) These are:

a) Definition of the context in which the inventory management system functions
b) Types of stock records to be maintained and the types of reports needed
c) Selection of items to be stocked

d) The level of service for different categories of items

e) Rule governing the ordering frequency and periodicity

f) Decision on ordering quantity

g) Use of cost minimizing techniques based on ABC and/or VED classification of items, level of use and other techniques.

These basic steps can very well be managed with use of information technology.

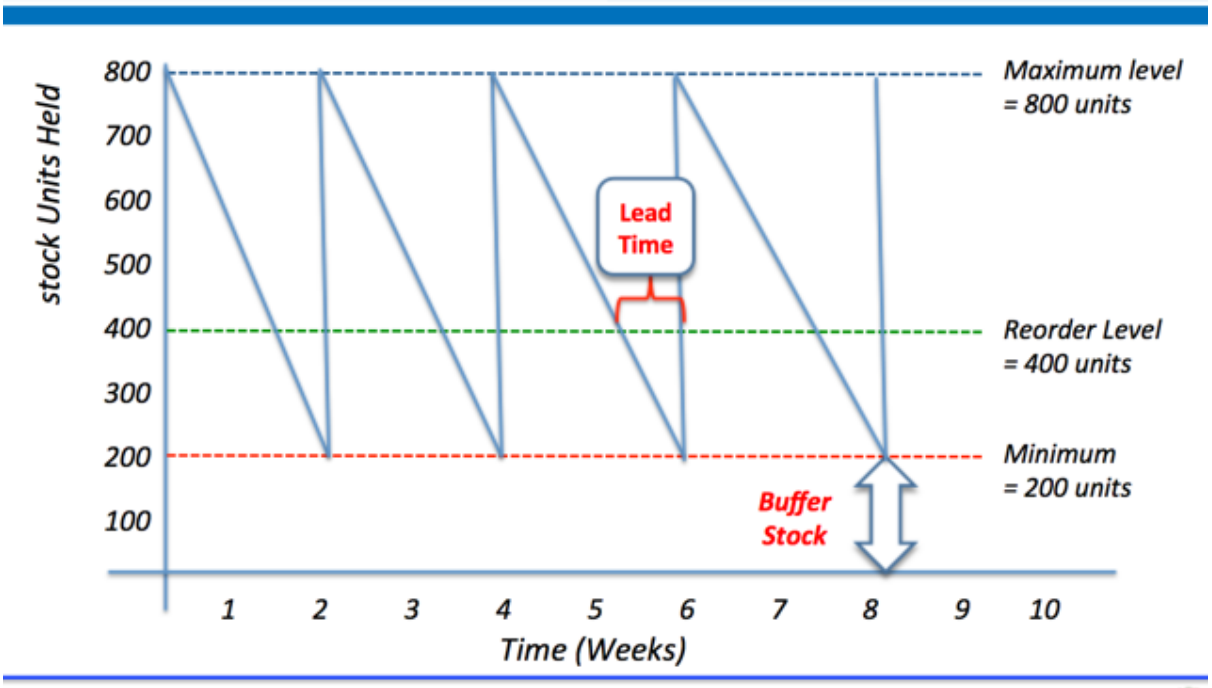


FIGURE: 5.14 IDEAL INVENTORY CONTROL MODEL

5.34.2 Stocks must be held in inventory:

a) To ensure uninterrupted availability

b) To maintain user confidence in the system

c) To reduce unit cost of medicines- purchasing in bulk will be cheaper

d) To avoid stockout cost – if items go out of stock, emergency purchase needs to be made. This will push up the price

e) To reduce ordering cost – if items are to be ordered frequently, cost goes up. Time of staff and other resources are required to prepare and dispatch orders, receiving items when supplied against the order and so on

f) To reduce transportation cost.

g) To allow for fluctuation in demand.

The crux of the problem is how much to stock. If the inventory level is high, the inventory carrying cost will be higher. If it is too low, stockout costs including inability to treat patients will occur. Therefore a balance has to be struck.

The following figure illustrates the concept:

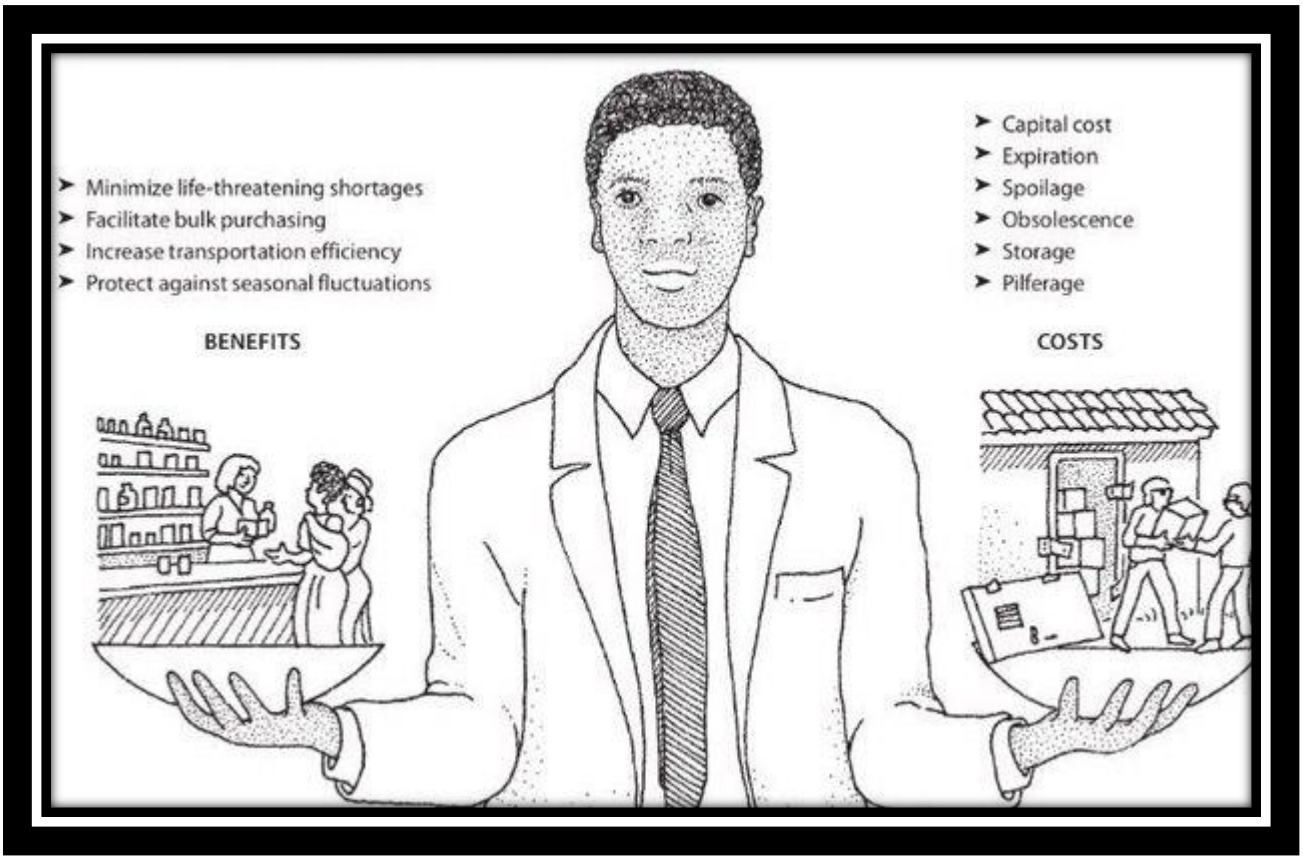


FIGURE: 5.15 BALANCING BENEFITS AND COSTS IN INVENTORY MANAGEMENT (52)

In a hospital, other considerations also influence the stocking of medications. If an item is vital and even if it is used infrequently, this has to be stocked.

5.35 Service level and Safety stock

After the items to be stocked have been identified, the decision now has to be made about how much quantity to be held in stock. Though different point of view may exist particularly amongst the clinicians, administrators and the finance department, a balance can be arrived at by determining the service level to be provided to the user and the safety stock. Service level is given by the formula:

Service Level = (No. of items issued/ No. of items indented) x 100

Example: If 20 items have been indented with 10 units for each item, then items on order = 200. Now, if only 170 items have been supplied, then the service level is 85%.

To determine the service level when a large number of items are involved, it becomes difficult to determine the service level manually. Computer software can easily determine this level very quickly. Usually, 95% service level is aimed at.

Service level is dependent on the average inventory level held and particularly on safety stock. A safety stock is the portion of inventory that is held to ward off uncertainties of either in consumption or in lead time for supply.

Relationship between safety stock and service level is not linear. As the service level rises above 80%, the amount of additional safety stock needed to satisfy increase in service level rises steeply. The amount of safety stock required to raise the service level from 95% to 99% may have to be raised two fold.

Safety stocks can be calculated using standard formula that takes into consideration the consumption pattern, inventory costs, stock out costs and some other factors.

Difficulty arises because of the facts that in a hospital the consumption pattern is not smooth and the lead time to obtain supply also varies. A mathematical approach is usually adopted to arrive at the optimum safety stock to cater to these variations in lead time as well as in consumption pattern.

Computerisation of these aspects of pharmacy management will lead to better inventory control.

5.36 Inventory Control Models and Reorder Frequency

The average inventory on hand is the safety stock plus the average working stock. The average working stock can be reduced by placing smaller orders more frequently. The average inventory can also be reduced by lowering the safety stock level. However, this will increase the probability of stock outs.

Any inventory control model has to take into account the following determinants:

a) Safety Stock – how much stock will be kept to prevent stock outs.
b) Reorder Frequency – this is the time between each order for an item.
c) Reorder Quantity – the number of units demanded when placing an order.

5.37 Factors to be considered for calculating reorder quantity

These factors are: (53)

a) **Average consumption** – the average consumption expected in the next procurement cycle. This is the key variable
b) **Lead time** – lead time is the time between initiation of a purchase order and receipt of the items at the store. Lead time has two components – one, is the time required to prepare the purchase order. This is internal lead time. The second is the supplier (or external) lead time. This is the time between placement of the order on the supplier and the receipt of the goods.

c) **Safety stock** – this is the stock that should be available to prevent stock outs. When lead time and consumption are predictable and stable, there is usually no need to include safety stock.

d) **Maximum stock level** – in most reordering formulas, this level is the target stock level. This is the stock needed to last till the next order after the current one is received.

e) **Stock position** – this is sum of stock on hand (working and safety stock) and stock on order (in the pipeline), minus any stock back-ordered to clients.

f) **Procurement period** – this is the period between now and when the next order will be placed.

5.37.1 There are various formulae for reordering.

In a computerised system this can be calculated by the software automatically with accuracy. Some of these are:

a) Minimum and maximum stock level formula

b) Consumption based reordering formula

c) Mathematical models for reordering. For example:

i. **Economic Order Quantity** - In this, the basic idea is that an ideal order quantity exists for any item, which strikes an optimum balance between inventory holding costs and incremental ordering costs. The formula has many variations. The most basic formula for EOQ is:

EOQ=$\sqrt{(2 \times U \times O/(H \times C)}$, where

U = annual use in units

O= incremental ordering cost

H = average holding cost (percentage of average inventory value)

C = projected net acquisition cost

5.38 Computerised Pharmacy Management System

Most corporate hospitals in India use Pharmacy Inventory Management System (PIMS). The system facilitates inventory management accurately and efficiently. The system keeps track of the purchases, stock, reorder levels, supplies, issues, returns, billing, and expiry of drugs. The PIMS generates various reports and outputs for operational control, business processes and other reports required by the hospital. It can automatically generate alerts for near expiry drugs, stocks reaching a critical level for initiating timely actions. (54)

5.39 The business benefits include:

a) Better planning, executing and controlling
b) Improves performance, speed, accuracy and efficiency
c) Reduces labour costs
d) Controls pilferage
e) Maximises productivity
f) Efficient control of inventory
g) Reduces inventory carrying cost

5.40 Functions of Pharmacy Inventory system

5.40.1 Purchase order

a) Issue purchase order
b) Purchase order approval
c) Purchase order closure
d) Purchase order cancellation
e) Purchase return – items returned to vendor can be recorded and tracked either for replacement or for refund of money.

5.40.2 Drug issue to outpatients and inpatients

5.40.3 Stocks issue for internal use to departments such as operating department, laboratory

5.40.4 Billing for issues of pharmaceuticals made to patients

5.40.5 Tracking, recording and updating of stock for drugs returned to the pharmacy

5.40.6 Supplier database maintenance

5.40.7 Vendor rating

5.40.8 Goods Receipt Note (GRN)

5.40.9 Drug expiry Management

a) Return of items nearing expiry
b) Stock transfer
c) Destruction of expired items

5.40.10 Reports

a) Stock availability report
b) Stock reorder status report
c) Drug expiry report
d) Billing report
e) Pending payments report
f) Balance sheet (Received/ Issued/Balance)

Many more modules may be added to the PIMS depending on the requirement of the hospital. The PIMS can grant selective access to the users depending on the privileges granted. The PIMS can be a standalone system or it can be integrated with the hospital Local Area Network.

5.41 Radio Frequency Identification (RFID) :

Radio Frequency Identification is used for identifying and tracking items or people. In an RFID system, a small memory-storage chip (tag) is placed on an item. RFID readers send out radio waves to detect tags and read their data.

RFID tags can store a range of information from a serial number to several pages. Readers may be mobile so that they can be carried by hand, or they can be mounted on a post or overhead. Readers system can also be built into the architecture of a cabinet room or building

5.41.1 Uses

Some examples of RFID use are as under:

a) Stores, warehouses and shipping areas for inventory control
b) Pharmacies or pharmaceutical distributors for pharmaceutical supply management
c) Work sites for employee identification
d) Transportation system for fare collection

RFID is a rapidly growing technology. It is now being used more widely, in settings such as hospitals and retail stores.

5.41.2 Risks/ Benefits

RFID has many applications in healthcare. RFID can potentially improve patient safety by

a) Identifying correct patient
b) Ensuring that correct medication is received by them
c) Preventing distribution of counterfeit drugs and medical devices
d) Facilitating device recalls

However, one should be aware of the potential interference with electronic medical devices such as pace makers and Implantable Cardioverter Defibrillators(ICD), though no such report has yet been received. (55)

Due to very high cost of RFID technology, not many pharmacies have adopted this technology.

5.42 Logistics

A pharmacy is also required to reach the medications to the point of use or to the user departments. In India, use of automation for transportation of small items is increasing in the form of Pneumatic Tube Technology, particularly in corporate hospitals.

FIGURE: 5.16 PNEUMATIC TUBE STATION – WALL MOUNTED AND COUNTER TOP SHOWING CARRIER CONTAINERS

The Pneumatic tube system of logistics for small items like medication can improve efficiency many folds. As the human factor is mostly eliminated, delay can be avoided totally. Besides this, there are many other benefits of this system.

In Delhi/NCR, this system is in use in several hospitals like Sir Ganga Ram Hospital, Artemis Health Institute Gurgaon, Dr. Lal's Path Lab, Dr B L Kapur Hospital, Medanta The Medicity,Gurgaon. The Pneumatic system uses IT to deliver the materials accurately to the destination station. The material is put into a carrier container. The carrier container is put into the receiving slot. The sender punches the identification code of the destination station at the dispatch station and the carrier container along with the material is transported via the network of pneumatic tube through transfer stations and delivered at the destination stations. The entire operation is automated.

CHAPTER 6

6.1 Objectives of the Study

The present study was undertaken with the following objectives:

a) To obtain information on the role of present day hospital pharmacies.

b) To obtain information on the level of automation and the degree of use of information technology in hospital pharmacies in India and other developed and developing countries in order to perform their present day role.

c) To study the organisation, functions and role of the medical stores (pharmacy) of the hospital under investigation.

d) To determine the level of automation and the degree of use of information technology in pharmacy of the hospital under study.

e) To investigate the feasibility of implementation of modern information technology in the hospital pharmacy with a view to improve efficiency, user satisfaction, economics of operation and patient safety.

f) To identify the barriers in implementation of automation and adoption of modern information technology in the hospital pharmacy.

g) To recommend strategies for adoption of modern information technology and automation in the hospital pharmacy.

CHAPTER 7

7.1 METHODOLOGY OF THE STUDY

The following methodology has been adopted for this study:

7.1.1 Review of Literature

Extensive review of literature was conducted through internet search, search of medline, pubmed, online journals, web published articles and books. This methodology was adopted for the objectives 1 and 2. This study yielded the information required to establish the penetration of information technology and automation in pharmacies vis-à-vis the modern role of hospital pharmacies.

7.1.2 Document Study

The documents maintained in the hospital pharmacy/medical stores were studied. The documents included in the study were:

a) **Ledgers of the consumable items-** This study was to yield information on stock out of drugs and the period of stock outs. The method of sampling was used for this study. This information was required to obtain an objective view on the efficiency of the pharmacy management system.

b) **Indent cum issue vouchers** – These were studied to determine the service level of the pharmacy to the consumers. A convenience sample of five such vouchers was scrutinised. (Convenience Sampling is a method in which, for convenience sake the study units that happen to be available at the time of data collection are selected in the sample).

c) **Indenting procedure** – This is a policy document issued by the DCB. This policy governs the indenting procedures and the stocking policy of the drugs. This document is held at the DCB office with the dealing clerk and was not made available.

d) **Standard Operating Procedure (SOP) for the local purchase of Consumables .** This SOP has been made by the DCB for purchase of drugs under the financial power of the Chief Executive Officer of the DCB.

e) **The reports and returns submitted to various authorities by the pharmacy.** No reports and returns are submitted by the pharmacy/medical stores. This aspect is dealt by the dealing clerk at the DCB, no data on the same was shared for this study. This information was to be collected to assess the efficiency of the present pharmacy management system.

7.1.3 Interview with the functionaries

A structured interview (with the help of a questionnaire, placed at Instrumentation 'A') was conducted with the functionaries in order to obtain data regarding the following:

a) Organisation of the pharmacy

b) Human Resources of the pharmacy

c) Education levels of the functionaries. This information was collected to ascertain if there is any human resource barrier in implementation of information technology. This included information regarding

   i. General education

   ii. Primary education

   iii. Computer education, skill and proficiency in use of computer.

d) Job description and role of the pharmacist with specific reference to their role in pharmaceutical care of the patients.

e) Whether the pharmacists are consulted by the doctors on any aspect of pharmaceutical care.

f) Availability of computer hardware and software.

g) Views of pharmacy functionaries regarding automation and adoption of modern information technology

h) Method used to check the accuracy of the indents from the departments.

i) Method of verification of WMF(Weekly Maintenance Figure) data submitted by the departments

7.1.4 Observation

a) Observation was carried out to see the method and procedure to carry out various functions in the pharmacy.

b) Number of computers/ printers available

c) Software availability

d) Networking with the hospital LAN system

e) Availability of automation equipment like:

   i. Bar code printing equipment

   ii. Bar code reader

   iii. Unit Dose Dispensing System

   iv. RFID technology

   v. Pharmacy Robot

   vi. Pharmacy logistics

f) Internet connection

7.2 SCOPE OF THE STUDY

The pharmacy deals with all types of medical stores , both consumables and non-consumables. The study is restricted to only consumable medical stores. Only the aspects of functioning of the medical stores that impacts the actual and potential use of information technology and automation have been studied.

7.3 CONSTRAINTS

Availability of time has been a constraint as this is a single investigator study. Most quantitative data have been collected on the basis of convenience sampling.

CHAPTER 8

8.1 FINDINGS

8.1.1 Organisation of the medical stores

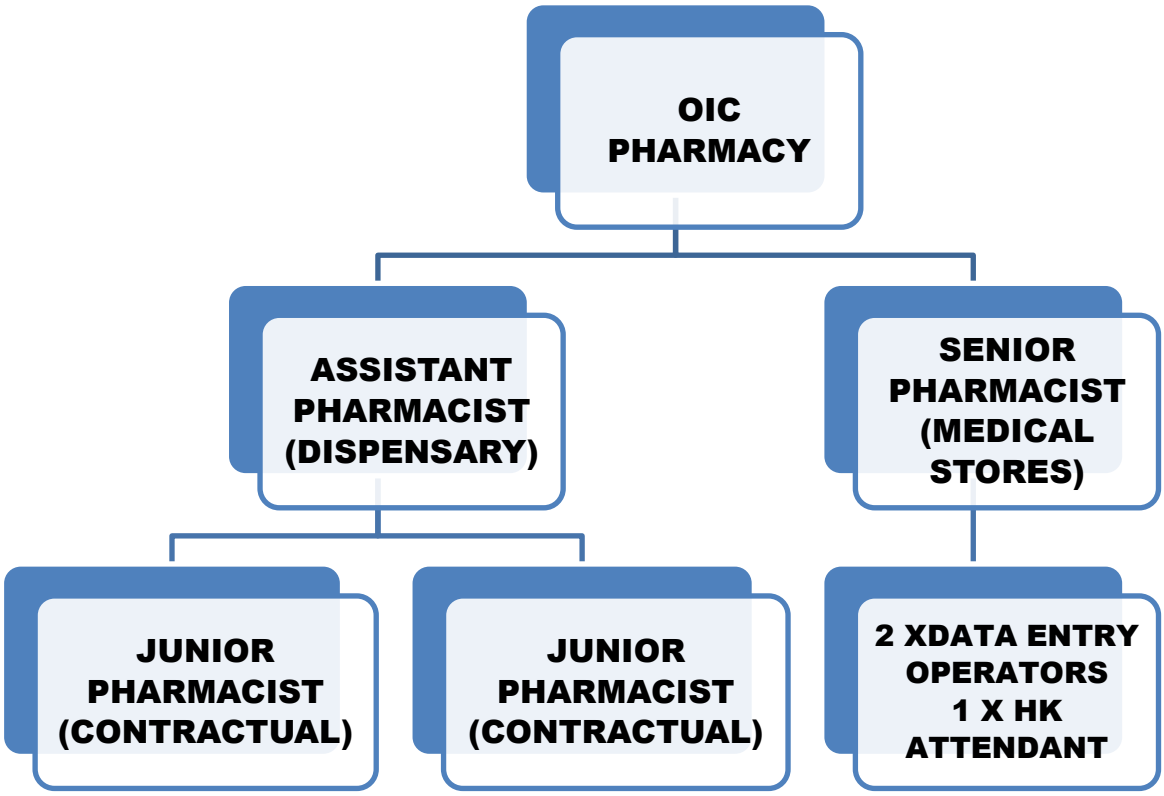


FIGURE: 8.1 ORGANISATION OF PHARMACY/MEDICAL STORES

8.2 Present Day Role of Pharmacists

The literature search has revealed the modern role of the pharmacists. The medication errors are one of the major causes of death in hospitals even in developed countries. In this context, the modern role of the pharmacists has changed. Present role is patient oriented care to produce better patient care. The role of the pharmacists is collectively known as pharmaceutical care. In essence, it consists of:

a) Assessment, such as taking a medication history and identifying real and potential drug-related problems.
b) Pharmacy care plan development, such as making and implementing recommendations and monitoring parameters to resolve and prevent drug related problem.
c) Evaluation, such as following up, to determine whether clinical outcome have been achieved.

The job description of the pharmacists does not mention that pharmaceutical care is one of the roles of the pharmacists of this hospital. This is also corroborated during the interview with the pharmacists. The pharmacists in the medical store of the hospital under study perform only the traditional role of product procurement, storage, distribution and record keeping. The pharmacists are not aware about the terminology of pharmaceutical care.

8.3 Information Technology use

It is seen from review of the literature that to discharge the modern role of pharmaceutical care, the pharmacies make use of the information technology in good measure. Electronic Health Record, Clinical Decision Support System, Computerised Physician Order Entry, e-prescribing integrated with Pharmacy Management System are increasingly being used in developed countries. This information technology is not widely used in India. Pharmacy in this hospital also, is not utilising such technology.

This hospital medical store does not use any pharmacy management software for their day-to-day functioning. At a very basic level MS Excel sheet, is being used only for certain functions especially for duplicating the data of the ledger on a monthly basis, to know the stock balance at the beginning & end of the month & also for preparation of indents. No real time data is available on computers, the same is required to be calculated manually.

Tremendous potential of information technology has not been harnessed by this medical store.

8.4 Automation

Automation in the form of Barcode Medication Administration, use of RFID technology, Unit Dose Medication Distribution system, Pharmacy Robotics and automation in logistics like use of pneumatic tube for transportation of small items are being increasingly used in the developed countries. Many corporate hospitals in India have started using barcode for patient and product identification. Pneumatic tube logistics systems are also being used in the corporate hospitals.

This hospital medical store uses only manual methods in all its operations. No modern technology for automation is being used in this hospital medical store.

8.5 Functioning of the Medical Store

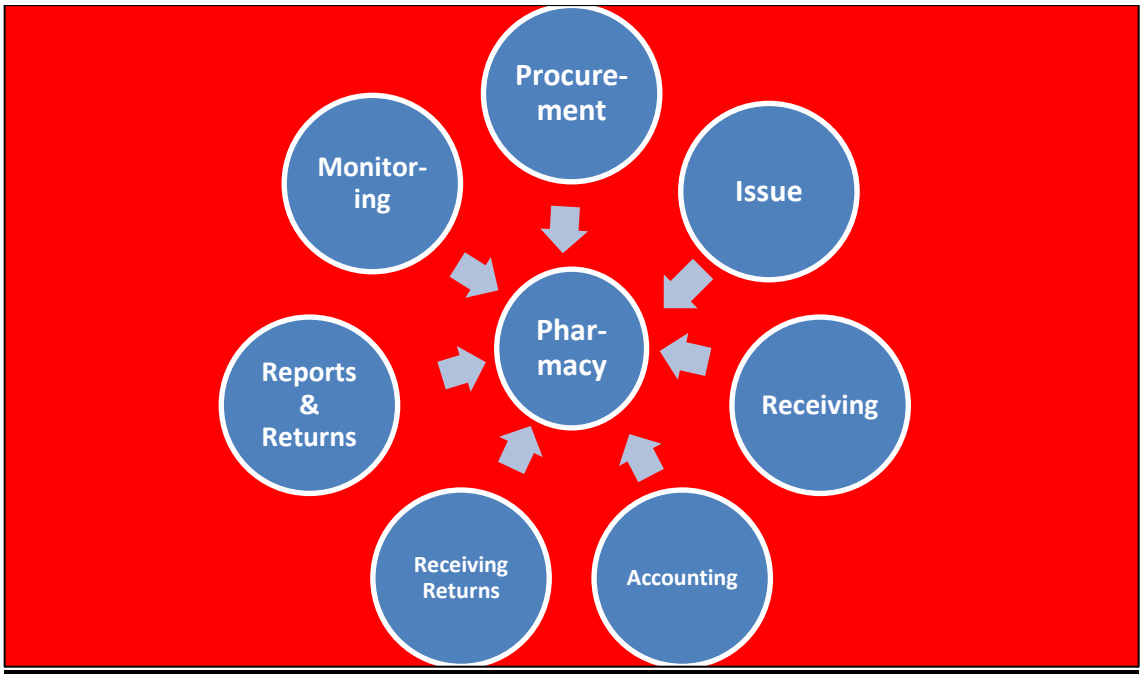


Figure : 8.2 Functions of the Medical Store

The medical stores perform the following functions:

a) Procurement of medicines through DCB.
b) Receiving
c) Accounting and maintaining ledgers
d) Issuing stores to the departments
e) Monitoring
f) Submitting reports and returns
g) Receiving returned stores

The medical stores function as per the guidelines issued by the DCB so far as the medical store functions pertaining to materials management are concerned.

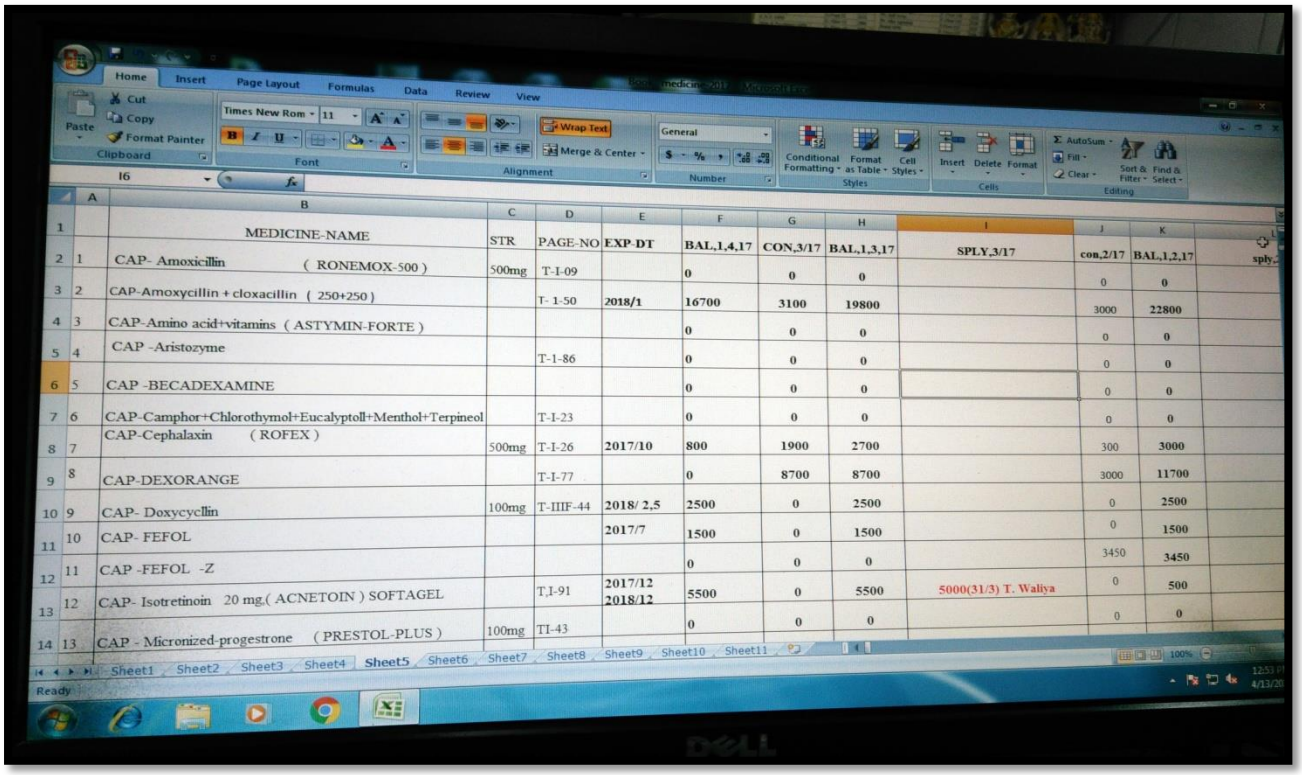
The DCB on behalf of the CGH, concludes rate contracts with the suppliers for supply of drugs and consumables. Formulary of drugs commonly used are called Priced Vocabulary of Medical Stores (PVMS). In addition, the new drugs which are used but not included in the PVMS are called Not in Vocabulary (NIV) items. The DCB through the process of rate contract, procures more than 800 listed drugs and over 100 NIV drugs every year from the L1 (lowest rate quoted) vendor. Previously some amount of drugs & consumables, used to be provided through the Armed Forces Medical Stores Depot (AFMSD) too, this channel of availability is no more in vogue.

Stock position in the store is monitored manually through the use of ledger balances. Demand is based on the WMF. Demand is triggered when stock balances reach four weeks WMF levels in case of routine items. WMF calculation is done manually by the consuming departments based on consumption as well as by the medical stores based on historical data of issue. Manual calculations are prone to errors.

Avoidance of stock expiry in store is controlled by not accepting items with less than 80% residual shelf lives as well as by physical monitoring and system of item replacement. This manual system is inherently prone to human oversight.

Expensive items are placed under a controlled category and monitored more stringently.

All functions in the medical stores are carried out manually except certain basic functions like duplication of data of the ledger on a monthly basis at the beginning and end of the month, for checking of stock. Computerised lists are used for preparation of WMF/demands.



	A	B	C	D	E	F	G	H	I	J	K
1		MEDICINE-NAME	STR	PAGE-NO	EXP-DT	BAL.1,4,17	CON,3/17	BAL.1,3,17	SPLY,3/17	con,2/17	BAL.1,2,17
2	1	CAP- Amoxicillin (RONEMOX-500)	500mg	T-I-09		0	0	0		0	0
3	2	CAP-Amoxycillin + cloxacillin (250+250)		T- 1-50	2018/1	16700	3100	19800		3000	22800
4	3	CAP-Amino acid+vitamins (ASTYMIN-FORTE)				0	0	0		0	0
5	4	CAP -Aristozyme		T-1-86		0	0	0		0	0
6	5	CAP -BECADEXAMINE				0	0	0		0	0
7	6	CAP-Camphor+Chlorothymol+Eucalyptoll+Menthol+Terpineol		T-I-23		0	0	0		0	0
8	7	CAP-Cephalaxin (ROFEX)	500mg	T-I-26	2017/10	800	1900	2700		300	3000
9	8	CAP-DEXORANGE		T-I-77		0	8700	8700		3000	11700
10	9	CAP- Doxycyclin	100mg	T-IIIF-44	2018/ 2,5	2500	0	2500		0	2500
11	10	CAP- FEFOL			2017/7	1500	0	1500		0	1500
12	11	CAP -FEFOL -Z				0	0	0		3450	3450
13	12	CAP- Isotretinoin 20 mg.(ACNETOIN) SOFTAGEL		T.I-91	2017/12 2018/12	5500	0	5500	5000(31/3) T. Waliya	0	500
14	13	CAP - Micronized-progestrone (PRESTOL-PLUS)	100mg	TI-43		0	0	0		0	0

FIGURE: 8.3 STOCK BALANCE BEING MANUALLY FED TO COMPUTER AT BEGINNING AND END OF THE MONTH

8.6 Local Purchase of drugs at Medical Stores

All items are procured through local purchase. There are two types of local purchase, one for the hospital in general for all patients. The other local purchase is exclusively for

medicines procured for staff of CGH & DCB only. Local purchase for hospital patients , follows tendering procedure, calling of quotations, rate contract procedure, L1 vendor ,as per GFR procedure. The LP for staff is done within financial powers of the CEO of the DCB. For this purpose, some of the functions are done by the use of computer. These functions pertain to maintenance of certain information like vendor database, items demanded on a vendor, vendor rating and so on. These data are held with the dealing hand at DCB and was not made accessible. None of this data is available at the pharmacy/medical store of the CGH. Only the Indents are made at the medical stores of the CGH, which is sent to the DCB after signature of the OIC, medical Stores & countersignatures of the CMO.

There is no Pharmacy Management System in use. There is no centralised Database Management System as a LAN based system. There is an SOP laid down for local purchase of drugs. The SOP basically lays down the financial powers of the Chief Executive Officer of the DCB, under different conditions like powers with open tender, propriety articles purchase, emergency purchase and so on. The purchase methods are specified in the SOP. The SOP was not made available for perusal. Procurement of consumable items is based on demand from clinical departments and the medical stores section where stock is held. If the procurement and associated inventory control is automated, the local purchase can also be taken care of. The computerised system can perform various evaluation parameters of inventory management.

FIGURE: 8.4 MEDICINES STOCKED AT THE MEDICAL STORES

The medical store holds an inventory of more than 800 items.

8.7 Service Level

The table below shows the level of service provided to the users of medical stores

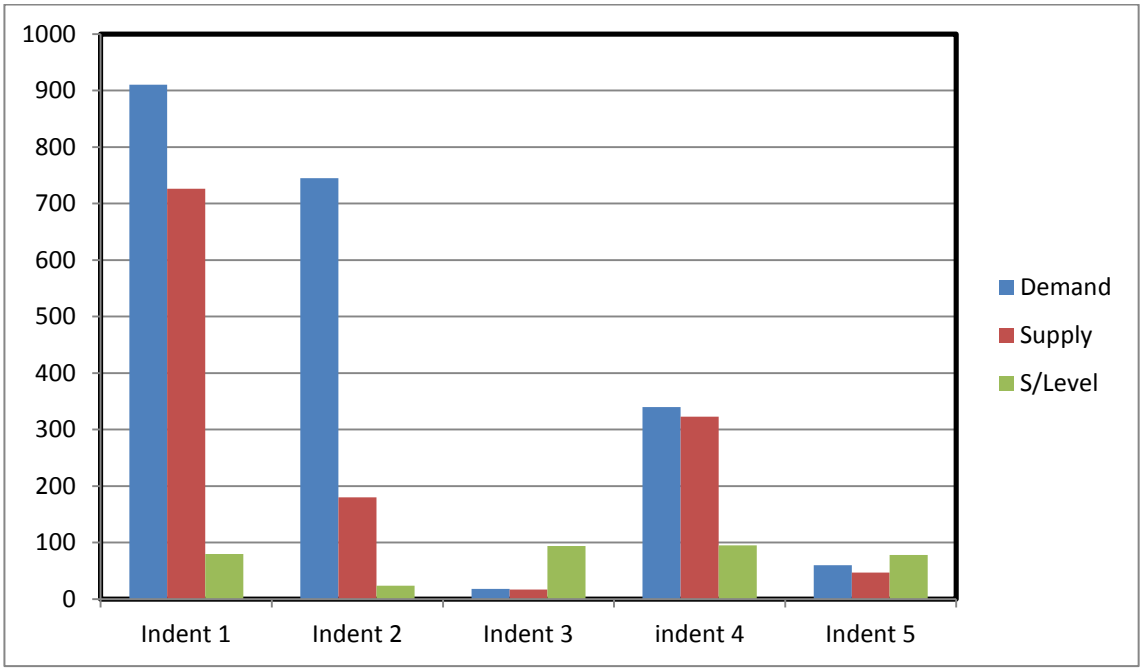
Service Level determination

No of indent cum issue voucher examined: 5

Table: 8. 1 Service level determination

Sr. No of Voucher	No. of Units demanded	No of units supplied	Service level
00515	18200	14520	80%
00516	14900	3600	24%
00517	356	336	94%
00518	6800	6450	95%
00519	1200	940	78%

TABLE: 8 2 SERVICE LEVEL DEPICTED IN GRAPHICAL FORM



Note : Items demanded & supplied in indents above, have been divided by 20, for realistic depiction, for preparation of graph.

8.8 Stock out of drugs

Stock out of common drugs do occur on & off. The medical stores sends reminders to the DCB for items not available due to stock out. The DCB in turn sends show cause notice to vendors for not supplying the requisite drugs despite the rate contract agreements. At times, vendors have been blacklisted too. Details of Stock out drugs was not made available for study. Stock out of drugs also occurs due to paucity of funds.

CHAPTER 9

9.1 DISCUSSION

9.1.1 Traditional Role

Information Technology is used for supporting functions of an organisation. The medical stores of the hospital under study perform only the very traditional role of product procurement and distribution. Even the compounding functions that were being performed by the pharmacists are no longer in vogue in most of the hospital pharmacies.

9.1.2 Situation in Developed Countries

In developed countries, the pharmacists are involved in patient care for a better patient outcome. The pharmacists are now members of the care delivery team. The modern role of the pharmacists is to provide pharmaceutical care. This is directly linked to patient safety through medication management. To discharge these functions and to practice evidence based medicine, access to information technology is essential.

9.2 Access to Information & Information Technology In the developed countries, the pharmacists have access to the Electronic Health Record. Computerised Physician Order Entry along with the Clinical Decision Support System is integrated with the Pharmacy Information Management System. When the pharmacists have full access to information, they can plan, advice and monitor the medication management aspect of the care.

9.3 Need for better Trained/Qualified Pharmacists

In order to perform their role and to gain confidence of the clinicians for their acceptability as a member of the patient care delivery team, the pharmacists have to be much better trained than what they are now. This need has been realised and accepted by the Pharmacy Council of India as well as the Government of India. Gazette Notification No.19 dated 10th May 2008 has been published in Part III Section 4 notifying the Pharm.D Regulations.(56) .This is

a 6 year integrated course after class 12th,dealing with clinical pharmacy & is different from the 4 year B.Pharma course/1 year Diploma in Pharmacy(D.Pharma).

9.4 Patient Safety/Medication Errors

The biggest patient safety concern is that of medication errors. A very large number of medical products are available in the market today. To remain updated on this for a busy physician, is a very difficult proposition. It is now known that most of the medication errors occur at the prescribing stage.

9.5 Pharmaceutical Care

A well trained pharmacist delivering pharmaceutical care will greatly contribute towards patient safety. In order that the pharmacists are assigned this role, a policy decision at the level of the Ministry of Health & Family Welfare/Pharmacy Council of India was taken, which led to enactment of the Pharmacy Practices Regulations, 2015. (28) (A total of 30 seats for Pharm.D & 10 seats for Pharm.D (Post Baccalaureate) per institution have been sanctioned). There are a total of 222 colleges/institutions spread over 13 states of the country, which have been approved by the PCI for running these courses as on date. This has to be followed by the development of training facilities and infrastructure development. In this infrastructure need, information technology will have a major share. This is a long term process. This will depend on simultaneous development of many other areas. Cost is also an important consideration. Human life is far more costly than anything else.

9.6 Pharmacy Automation

The next aspect of information technology that this hospital medical stores lack is the total absence of any Pharmacy automation. The developed countries have adopted various forms of pharmacy automation based on information technology. This improves patient safety, eliminates manual intervention which are prone to error and dependence on human memory which is again not always trustworthy.

9.7 Bar Coded Medication Administration

Use of Barcode is perhaps the least costly amongst the information technology based automation system for medication management. Many countries have adopted the Bar Code Medication Administration. This is also known as Bedside point of care. Use of Barcode medication can be extended to various points through which the medication passes, for identification of the correct item. Extending its use from the bedside to other areas, may add to safety but may be compromising with efficiency of operation. A word of caution needs to be given to the barcode users. Too much of dependence on barcode may be compromising with safety. A barcode reader emits beep. Good beep means only a right level. It does not always mean that it is the correct medicine for the patient.

9.8 RFID

The RFID technology though simple in concept, is costly to implement. Even in developed countries, adoption of this technology is slow. It has a great potential in inventory management.

9.9 UDDS

Unit Dose packaging and dispensing has a great role in reducing medication errors. This process has been automated in many hospitals in the United States. This is an information technology based system. The technology is based on robotics. European countries mostly rely on ward/floor stock of pharmaceuticals. Only some hospitals in India, like Aster Medcity, Kochi, Kerala have adopted this automated system of unit dose dispensing.

9.10 Pneumatic Tube Transportation System

Logistics is another area which can improve efficiency, considerably. Many corporate hospitals in India have adopted Pneumatic tube transportation system. Its operation and control is by using information technology.

9.11 Electronic Prescribing

For reduction of medication error, Electronic Prescribing (E-prescribing) has a salutary effect. Electronic prescribing can reduce medical errors, decrease pharmacy costs, improve both prescriber and pharmacy administrative efficiency, eliminate handwriting interpretation errors and reduce phone calls between pharmacists and physicians, reduce data entry, create electronic records to ensure that prescription information is retained and expedites prescription refill requests.

The electronic prescribing can be implemented in hospitals without much of a problem. This would need some system and cultural change in the hospitals particularly among physicians for its adoption. Initially more time will be required to write a prescription and transmit to the pharmacy. As the clinicians use it for some time, they will become more conversant in its use.

In this hospital, however, a policy change will be required from ward based dispensing to pharmacy based dispensing of drugs.

Indian Medical Association has chalked out a plan for e-prescribing of medicines on voluntary basis.

9.12 Pharmacy Management System

Medical stores is one of the most important support department for efficient delivery of patient care. Most corporate hospitals in India have introduced pharmacy management system and this is integrated with their hospital management information system. This level of computerisation improves the efficiency of operation.

9.13 EHR Standards, 2016 (27)

Though, Electronic Health Record Standards,2016 have been published by Ministry of Health & Family Welfare, Govt of India, it will take time to be fully implemented and become operational in all hospitals of the country. A research paper on Roadmap for

implementation of EHR Standards, 2016 in India, has been published by Dr Sunil Kumar Srivastava on 31 Oct 2016 and can be accessed online. (57)

9.14 Inventory Management

The medical stores of this hospital are doing only inventory management function for medical stores management. Most of the functions are being done manually. Standalone computers are used for certain very basic functions of inventory management. The medical stores of this hospital suffer from drawbacks of a manual inventory management.

9.15 Service Levels

Service levels are not always high. The optimum service level aimed at is 95%. Too high a service level will increase the inventory holding and consequently increasing the inventory carrying cost. Low service levels erode the confidence of consumers and they tend to inflate their demand of supplies. This inflated demand has a chain reaction. Inflated demand will result in receipt of more stock of items that can be consumed within their residual life period. Pharmacy will tend to push, issue of these drugs to the user departments to prevent writing off the items/or return them to the vendor for replacement.

9.16 Advantages of Automation

Almost all functions of inventory management can be automated. This would improve efficiency, reduce wastage, lower inventory carrying cost, improve consumer satisfaction and ultimately lead to better patient care.

9.17 Feasibility of Implementation of I.T

To examine the feasibility of implementation of the information technology in this hospital, to bridge the gap between what presently exists and what should be, a system review needs to be done. The hospital does not function in isolation. It is a part of the much bigger system. Both internal as well as external environment, have their influence on the feasibility of implementation of information technology in the medical stores of this hospital.

9.18 External Environment

The external environment that can influence the feasibility aspects are: the technological system, the socio- economic system, the education system, the legal system and so on.

9.19 Internal Environment

The internal environments that have influence on the feasibility of implementation are: acceptance of need, priority in patient safety, availability of finance, availability of expertise and competence, need for cultural change in doing a thing in a different way than hither-to-fore being done and the availability of support services external to this organisation.

9.20 Acceptance of Need at Decision Making Level

Some bigger and radical measures for implementation will need support at a higher level. The less costly implementation needing less education and training and short time line can be implemented within the hospital level itself, provided the need is accepted at the decision making level.

CHAPTER 10

RECOMMENDATIONS AND CONCLUSION

For bridging the gap in Information Technology use in the medical stores of this hospital, two types of strategic decision needs to be taken – the short term and the long term strategies.

10.1 Short Term Strategy

10.1.1 Inventory Management : In the short term strategy, the inventory management system can be implemented without any major cost effect. Training need required for this type of software use is very small. First the idea and the implications and the benefits need to be sold to the user of the proposed system.

10.1.2 BCMA : Similarly, barcode medication management system can be implemented without much of cost effect. Training need is also very little.

10.1.3 Electronic Prescribing : Electronic prescribing is easy to implement at the basic level. At the initial level, there need not be any assessment of drug-drug interaction, drug-food interaction, drug- disease interaction, dosing of medication particularly in geriatric and paediatric patients, pregnant and lactating mothers, and in patients with renal and hepatic disorders.

10.1.4 Policy Change : The above mentioned aspects can be gradually introduced as the system matures and the users gain confidence in the system. This, however, entails change in some policy decision to dispense medication from the pharmacy and not the Ward Store.

10.2 Long Term Strategy

In the long term strategy, the assessment needs to be made about the availability of the technology in the Indian market along with its support facilities, cost implications, training needs, to use the technology.

10.2.1 Adoption of Pharmaceutical Care : For adoption of pharmaceutical care, major initiative has been taken by the Government of India by introduction of Pharm.D courses since 2008 and inclusion of "Pharmaceutical care aspect" by the Pharmacists trained in Pharm.D/ Pharm.D(Post Baccalaureate) vide Pharmacy Practice Regulations,2015.(28) Major change effort will be needed at the implementation level on ground. This will involve recruiting these doctors of Pharmacy trained in clinical pharmacy aspects, availability of systems like Electronic Health Record, Clinical Decision Support System and Computer Physician Order Entry and so on.

10.2.2 Acceptance by the Physician : The greatest barrier may be the acceptance by the Physician who is the leader of the patient care team, of the new role of the pharmacists/doctors of pharmacy and their being a member of the Care Delivery Team.

INSTRUMENTATION- A

Questionnaire

Questionnaire for eliciting response from the pharmacists regarding their role, method of functioning, level of computerisation and attitude of the pharmacists.

	Designation	Qualification		
		General	Technical	Computer
1)	Senior Pharmacist IC, Medical Stores	Intermediate	D.Pharma (1year)	Basic Working knowledge (No formal training)
2)	Assistant Pharmacist IC, Dispensary	Intermediate	D. Pharma (1year)	Basic Working knowledge (No formal training)
3)	Junior Pharmacist, Dispensary (Contractual) x 02	10+2	D. Pharma (1year)	Working Knowledge
4)	Data Entry Operators x 02	-	-	Data Entry
5)	House Keeping Attendant(1)	-	-	-

Sr.No	Question	Answer
1)	What is the organisational structure of this Medical Stores/Pharmacy ?	Organisation as given in page 84
2)	Who is the Officer in-charge of the Pharmacy?	The Officer-in-charge of Medical Stores & Dispensary is Dr PP Singh (Physician)
3)	How many people are working in the pharmacy beside the Officer-in-charge	7
4)	Is the appointment of the Pharmacists transferable	No
5)	Does the pharmacy provide pharmaceutical care of patients ?	No
6)	Does the pharmacy check the drug-drug, drug-food, drug-disease interactions of the prescribed drugs	No
7)	Does the pharmacy check the correctness of doses prescribed?	No
8)	Does the pharmacy check the lab result and advice the care providers about the correctness of the drug and dosing?	No
9)	Does the pharmacy check the correctness of the route and frequency of the administration of the drug?	No
10)	Do the physician consult the pharmacists on pharmaceutical care of patients?	No
11)	Does the pharmacists themselves prepare indent for supplying depot?	All drugs are procured through DCB. Indents are made by the Pharmacists, rest all paper work is done by the clerical staff of DCB.
12)	Is the demand estimation done through computer or manually?	Done manually
13)	How is the WMF checked, manually or by computer?	Manually, checked by a Board of Doctors
14)	Are the pharmacists conversant in the use of computer	They have basic working knowledge, can operate computer and the younger contractual pharmacists know some of the packages of MS Office.
15)	Do the pharmacists themselves issue drugs or does the pharmacy have pharmacy technicians?	Pharmacists only issue the drugs
16)	Do the pharmacists maintain ledgers, files, vouchers in paper form or as computer files?	Mainly in paper form, computers are used to cross check .

17)	Do the pharmacists prepare report and returns manually or by computers?	Reports are prepared manually but typed in computer by the clerk at the DCB.
18)	How many computers are there in the pharmacy ?	3 (2+1)
19)	How many printers are there in the pharmacy?	2
20)	Are the computers connected with the hospital local area network	No.
21)	Does the pharmacy have internet connectivity?	Yes, in one of the PC's.
22)	Would you like that the following work is done through computer software	
	a) Checking of accuracy of WMF	Yes
	b) Preparation of estimation of demand	Yes
	c) Preparation of receipt voucher	Yes
	d) Automatic warning for near expiry drugs	Yes
	e) Accounting for returned drugs	Yes
	f) Automatic generation of periodic reports	Yes
23)	Do you believe that computers can do the above job accurately?	Yes
24)	If facilities are provided, would you like to upgrade your knowledge about computer use ?	Yes
25)	Is there any automatic system of drug distribution?	No
26)	Do the pharmacists have any role in inventory management of dispensary or the ward store?	No role in ward inventory.
27)	In the in-patient ward, controlled drug register is maintained. Is there any system of accounting of other drugs?	Done manually in the ward. Checked by MO I/C.

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