ALAGAPPA UNIVERSITY

(Accredited with 'A' Grade by NAAC)
Karaikudi 630 003

DIRECTORATE OF DISTANCE EDUCATION

MBA (HM   663

Paper - 1.4

Hospital Planning and Designing

Copyright Reserved   for Private Use Only

ALAGAPPA UNIVERSITY

(Accredited with 'A' Grade by NAAC)
KARAIKUDI - 630 003 TAMIL NADU

DIRECTORATE OF DISTANCE EDUCATION

M.B.A (Hospital Management)

Paper-1.4

HOSPITAL PLANNING AND DESIGNING

Copy Right Reserved

For Private use only

HOSPITAL PLANNING & DESIG

Unit – I Introduction

Introduction to Hospital – Classification – Changing role of hospitals – Role of Hospital Administrator - Hospital as a System.Hospital and community.

Unit – II Planning

Principles of planning – egionalisation -Hospital planning team -Planning process – Size of the Hospital – Site selection – Hospital architect – Architect report -Equipping a Hospital – Interiors and Graphics- Construction and Commissioning

Unit – III Technical analysis

Assessment the extent need for the hospital services – Demand and need – Factors influencing hospital utilization – Bed planning –Land requirements - Project cost – Space Requirements - Hospital drawings and documents.

Unit – IV Hospital Design

Building requirement - Entrance and Ambulatory zone – Diagnostic zone – Intermediate zone – Critical zone – Service zone – Administrative zone.

Unit – V Facilities Planning

Transport –Communication - Food services – Mortuary - Information system - Minor facilities – Others

Unit – VI Standard in Hospital

Voluntary and Mandatory standards - General standards - Mechanical standards – Electrical Standards –Standard for centralized medical gas system -Standards for Biomedical waste .

Books for reference

G.D.Kunders, Designing for Total Quality in Health Care
Ervin Putseps, Modern Hospital
Macaulary HMC and Liewelyn – Davis , Hospital Planning and Admin...ion
Dr.Ashok Sahni – Hospital Planning
Frank E.Fischer – How to Achieve Effective Communication
BM Sakharkar – Principles of Hospital Administration and Planning

Prepared byParveen Sultana
Masters in Hospital Administration (MHA)

AU / DDE / D5 / Printing / 06 / 2016 date: 11-03-2016 ; Copies - 1000
Printed at Powerfull Printers Pvt. Ltd., Chennai - 29. Ph: 23743502

33334: HOSPITAL PLANNING AND DESIGNING

Objective:

- To Know the basic Concept of Hospital Planning and designing
- To identify the standards in Hospital

BLOCK I: BASICS OF HOSPITAL PLANNING AND DESIGNING

UNIT 1 Introduction :Introduction to Hospital – meaning – definition – concept – types nature – scope - Classification – Changing role of hospitals

UNIT 2 role of hospital administration – hospital as a system – hospital and community

UNIT 3 Planning :Principles of planning – regionalization – Hospital planning team – Planning process

UNIT 4 Size of the hospital – Site selection – tactic – strategic – problems – accommodations

BLOCK II: FACTORS OF HOSPITAL UTILIZATION

UNIT 5 Hospital architect – Architect report – Equipping a hospital – Interiors and Graphics – Construction and Commissioning.

UNIT 6 Technical Analysis : Assessment the extent need for the hospital services – Demand and need

UNIT 7 Factors influencing hospital utilization – Bed planning –Land requirements – Project cost

UNIT 8 Space requirements – Hospital drawings and documents – layout – designing – budget estimate – approval.

BLOCK III: FACILITIES PLANNING

UNIT 9 Hospital Design : Building requirement – Entrance and ambulatory zone – Diagnostic zone – Intermediate zone

UNIT 10 Critical zone – Service zone – Administrative zone.

UNIT 11 Facilities Planning : Transport – Communication –Food services

BLOCK IV: STANDARDS IN HOSPITAL

UNIT 12 Mortuary - Information system – Minor facilities – others.

UNIT 13 Standard in Hospital : Voluntary and mandatory standards – General standards –Mechanical standards

UNIT 14 Electrical standards – Standard for centralised medical gas system – Standards Biomedical waste.

REFERENCE

1. G.D. Kunders, Designing for Total Quality in Health Care.
2. Ervin Putseps, ModernHospital
3. Macaulary HMC and Liewelyn – Davis, Hospital Planning and Administration
4. Dr.AshokSahni – Hospital Planning.
5. Frank E-Fischer – How to Achieve Effective Communication
6. BM Sakharkar – Principles of Hospital Administration and Planning

UNIT – I
INTRODUCTION

DEFINITION OF HOSPITAL

The word hospital is derived from the latin word hospice in fact this word hospital, hotel, and hostel all derive from the common latin root hospice .the place or establishment where a guest is received was called the hospitium or hospitale. The term hospital has at different times been used to refer to an institution for the care of the sick.and wounded. lodging for the pilgrim and the wayfarer was also one of the primary functions of the hospital . in its earliest form the hospital was aimed at the care of the poor and the destitute, giving the aura of a "almshouse".
A hospital was no longer a place where people went to die. the advances in medical science brought about by antibiotics ,radiation, blood transfusion ,improvement in anesthetic techniques and medical electronics have all brought about tremendous growth and improvement in hospital services.

Today hospital means an institution in which sick or injured persons are treated.

A hospital in Steadman's Medical Dictionary defines a hospital as
an institution for the care, cure and treatment of the sick and wounded, for the study of diseases and for the training of doctors and nurses.

A hospital is an integral part of social and medical organisation, the function of which is to provide for the population complete health care ,both curative and preventive, and whose outpatient services reach out to the family and its home environment: the hospital is also a centre for the training of health workers and bio- social research.
- WHO defination of hospital.

Hospitals in India

Early indian rulers considered the provision of institutional care to the sick as their spiritual and temporal responsibility. The forerunners of the present hospitals can be traced to the times of Buddah, followed by Ashoka.India could boast of a very well organised hospital and medical care system even in the ancient times. the writings of sushruta and Charaka the famous surgeon and physician respectively were considerd the standard wors for many centuries with instructions for creation of hospitals, for provisions of lying-in and children rooms, maintenance and sterilisation of bed linen with steam and fumigation, and use of syringes and other medical appliances .medine based on the indian system was taught in the ancient university of taxilla.charaka was written around 600 AD and Sushruta samitha, a treatise of surgical knowledge , was compiled during 400 AD

The most notable of the early hospitals were those built by King ashoka .there was rituals laid down for the attendants and physicians who were enjoined to wear white clothes and promise to keep the confidence of the patients.

However the age of indian medicine started its decline from the Mohammedan invasions in the tenth century . the Mohammedans brought with them their Hakims who followed the greek system of medicine which came to be known as " Yunani" .This system and its physicians started to prosper at the expense of ayurveda and its vaidyas. however the influence of ayurveda continued in the south .

The modern system of medicine in india was introduced in the 17th century , the east india company – the forerunner of the british empire in india –established its first hospital in 1664 at chennai for its soldiers and in 1668 for civilian population. European doctors started getting popular and during the later part of 18th and early 19th century , there was a steady growth of modern system of medical practice and hospitals, pushing the indigenous system to the background .organised medical training was started with the first medical college opening at calcutta in 1835, followed by mumbai in 1845 and chennai 1850.

As the british spread their political control over the country many hospitals and dispensaries originally started to treat the army personnel were handed over to the civil administrative authorities for treating civil population.Local and local self government bodies were encouraged to start dispensaries at the tehsil and

district level in 1885 there were 1250 hospitals and dispensaries in india .But the medical care scarcely reached 10 percent of population.

Essential Services provided by a modern hospital:

A modern hospital is an institution which possesses adequate accommodation and well-qualified and experienced personnel to provide services of curative, restorative and preventive character of the highest quality possible to all people regardless of race, colour, creed or economic status; which conducts educational and training programs for the personnel particularly required for efficacious medical care and hospital services; which conducts research assisting the advancement of medical services and hospital services which conducts programmes in health education

Modern hospitals are open 24 hours a day. Their personnel render services for the cure and comfort of patient. In the operation theater, skilled surgeons perform life-saving surgery. In the nursery, new-born receive the tender care of trained nurses. In the laboratory, expert technicians conduct urine, stool, and blood tests, vital to the battle against diseases. In the kitchen, cooks and dietician prepare balanced meals that contribute to the patient's speedy recovery.

A hospital aims at the speedy recovery of patients. That is why its rooms are equipped with air-conditioners, call-bells and other devices. Several hospitals have libraries which provide books for them. The telephone keeps the sick in touch with their friends and relatives. In most of the hospitals today, patients have newspaper and barber services in their rooms. Many hospitals, keeping in view the recreation needs of their patients, have provided televisions and radio sets in their rooms/ wards. To save the precious time of the medical staff, secondary duties, like explaining the diagnosis and line of treatments and their attendants, are entrusted to another section of the staff called ' medical social workers'. In hospitals, therefore, the endeavor is to provide the best possible facilities to the patients within the hospital's resources.

Classification Of Hospitals

Hospital in general can be divided into two categories depending upon the agencies which finance them.

Government or public hospitals are those that are managed by government services, either central or state or public, municipal or departmental bodies that are financed from the overall budget for public services.

Non- government hospitals, on the other hand, are those that are managed by individuals, charitable organizations, religious groups, philanthropic bodies, cooperative societies, industrial undertakings or individuals. Many are operated on noncommercial, nonprofit (and some times no-profit no-loss) basic. Its modern variant is the private hospital run on commercial basis, funded and managed as a commercial enterprise by corporate groups or individuals. On the basis of following factors hospitals are classified as

Government

- Community Hospitals
- Rural Hospitals (PHC's , SC's)
- Taluq Hospitals
- District Hospitals

Private based on ownership patterns

- Private(Personal)
- Partnership
- Private (Family) trust
- Public charitable trust
- Cooperative society
- Private limited company
- Public limited company

Changing Role Of Hospitals

From its gradual evolution through the 18th and 19th centuries, the hospital both in the eastern and the western world –has come of age recently during the past 50 years or so, the concept of today's hospital contrasting fundamentally from the old idea of a hospital as no more than a place for the treatment of the sick. With the wide coverage of the every aspect of human welfare as part of healthcare – *viz* Physical, Mental and social wellbeing, a reach out to the community ,training of health workers, biosocial research etc.- the healthcare services have undergone a study metamorphosis , and the role of hospital has changed, with the emphasis shifting from:

- Acute to chronic illness
- Curative to Preventive Medicine
- Restorative to Comprehensive medicine
- Inpatients care to Outpatient &Homecare
- Individual orientation to community orientation
- Isolated function to Area wise or regional function
- Teritary and secondary to Primary health care
- Episodic care to Total care

Impediments to Medical Care Delivery and Role Perception of Hospitals

In spite of the phenomenal growth in the number of hospitals and medical manpower, it is a paradox that medical services have remained inaccessible to many. Geographical barriers, climatic features, insufficiency of resources and inability to provide finances, the conditional nature of the right to services under social security institutions, poverty and illiteracy are some of the causes that make medical services inaccessible to a grate proportion of the population.

In a society well protected against epidemics, each individual seeks medical advice 3 to 4 times a year either for protection of his or her health or because of illness or injury. In the 50s and 60s, the frequency of hospital admissions in such a society was between 150 and 200 per 1000 population per year, with each

admitted patient spending as an average of 1.5 to 2 days a year in the hospital. The cost of an average hospitalisation episode was about 4 to 5 times the average per capita daily income, the overall expenditure on hospitals being 2 to 3 percent of the GNP. Although health promotion and disease prevention has the greatest impact on health, diagnostic and therapeutic factors, i.e. physician and hospital services receive primary attention when health problems are encountered.

Many authorities point an accusing finger at the complacency of hospitals, which have developed as highly sectionalised segments of medical care and which have drifted further away from their true role as community institutions that should assume a larger role than just caring for the sick and "relieving often".

To fulfil its role a hospital need not be content with bidding goodbye to cured patients at its gates and expressing sympathies for the dead and non-cured. It is useful only if it is in tune with the economic limits of the people it has to serve, and patients and family members coming to the hospitals should be able to go back home after being educated on the present disease, its prevention and their personal role in prevention of disease and promotion of health in general.

Informed non-medical opinion considers that medical and hospital services are "crisis care"- concerned with illness, not health. Sociologists believe the reason for this is that it is concerned with personal attitudes – people respond only when they have to. A shift in the emphasis of medicine is therefore needed, that from "cure" to "care". Although medicine can claim many effective cures, it must confront the task of caring for the sick with greater zeal and effectiveness. Caring necessitates concern with the quality of life of the ill and reduction in any handicap consequent to disease.

The important factors which have led to Changing Role of the Hospitals

1. Expansion of the clientele from the dying,the destitute, the poor and needy to all classes of the people.
2. Improved economic and social status of the community
3. Control of communicable diseases and increase in chronic degenerative diseases

4. Progress in the means of communications and transportation
5. Political obligation of the government to provide comprehensive health care
6. Increasing health awareness
7. Rising standards of the living
8. Control and promotion quality of care by statutory and professional associations
9. Increase in specialisation where need for team approach to health and disease now required Rapid advance in medical science and technology
10. Increase in population requiring more number of hospital beds
11. Sophisticated instrumentation, equipment and better diagnostic and therapeutic tools.
12. Advances in the administrative procedure and management techniques
13. Reorientation of the health care delivery system with emphasis on delivery of Primary health care
14. Awareness of the community

Role Of Hospital Administrator

Hospital administrators oversee the various activities conducted in hospitals. This includes hiring staff and coordinating the hospital's business and support functions. In a small hospital, the administrator may directly coordinate most functions. In a larger organization, a chief administrator may supervise several assistants or other managers who in turn administer various specific departments or functions.

Responsibilities of hospital administrators and related managers are varied and may include:

- Submitting for approval a plan of organization for the conduct of hospital operation and recommending changes when necessary.
- Preparing plan for the achievement of the hospital specific objectives and periodical reviewing and evaluating it .

- Selecting, employing, controlling, and discharging all employees.
- Submitting for approval of annual budget showing expected receipts and expenditures.
- Recommending the rates to be charged for the hospital services
- Having charge and custody of and being responsible for all operating funds of the cooperation
- Representing the hospital in its relationships with other health agencies
- Serving as a liaison and channel of communication s between the governing board or its committees and the medical staff.
- Assisting the medical staff with its organizational and medical-administrative problems and responsibilities
- Submitting to the governing board reports showing the professional service and financial experience of the hospital, and submitting such special reports as may be requested by the governing board.
- Advising the governing board on matters of policy formulation

In addition, the AHA says in a potoscript to this catalog of responsibilities, the chief executive or his delegate is expected to attend all meetings of the governingboard and its committees, and to advise and keep the government board currently informed on significant trends which enable it to carry out its function of policy formulation including information on and explanation of

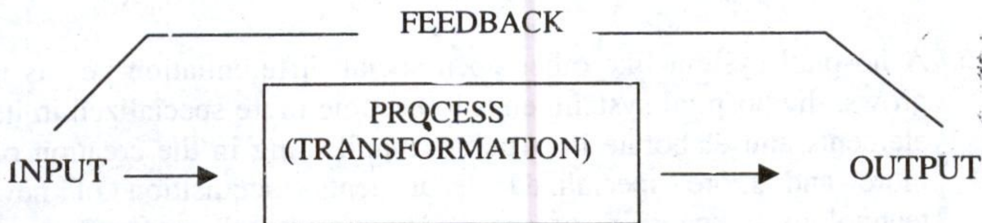
1. Significant economic, legislative, and social factors, which influence the hospitalfield in general and this hospital in particular.
2. Activities of local , state, and national organizations which are related to the hospitals program of services
3. Conditions within the hospital which may require action by the governing board. And
4. Technical and scientific advances in the health field.

Hospital As A System

A hospital can be variously described as a factory, an office building, a hotel an eating establishment, a medical care agency, social service institution and a business institution. In fact it is all of these in one, and more. Sometimes it is run by business means but not necessity for business ends. This complex character of the hospital has fascinated social scientists as well as lay people.

Management science defines a system as ' a collection of component subsystem which, operating together, perform a set operation in a accomplishment of defined objectives. A system is viewed as anything formed of parts placed together or adjusted into a cohesive whole. Every system is therefore a part of a large system and has its own subsystem.

A system is constructed as having inputs which undergo certain processing and get transformed into output the output itself in turn sending feedback to the input and the process, which can be altered to achieve still better output. A system is therefore a continuous and dynamic phenomenon.



Conceptual representation of a system

Transformation of matter, energy, or information produce the output by two processes, viz, decision process, i.e the process of deciding what to do how best to do it, when to do it and so on, and action process, i.e the process of putting the above decisions in action.

Peculiarities Of A Hospital System

In spite of the simple definition of a system, a hospital system is more than the sum of its parts. The peculiarities of the hospital system are as follows:

1. A hospital is a open system which interacts with its environment
2. Although a system generally has boundary the boundaries separating the hospital Systems from other social systems are not clear but rather fuzzy.
3. A system must produce enough outputs through use of inputs. But the output of a hospital system is not clearly measurable.
4. A hospital system has to be in a dynamic equilibrium with the wider social system.
5. A hospital system is not an end in itself. It must function, as a part of the larger health care system.
6. A hospital system like other open social differentiation i.e as it grows, the hospital system tends to become more specialized in its elements and elaborate in structure manifesting in the creation of more and more specialized departments, acquisition of new technology, expansion of the " Product lines" and scope of services.

Hospital As A Social System

Sociologists have considered hospital as a social system based on bureaucracy, hierarchy and super ordination-subordination. A hospital manifests characteristics of a bureaucratic organization with dual lines of authority, viz. Administrative and professional. In teaching hospitals and in some others, many professionals at the lower and middle level (items, junior resident, senior residents registrar) are transitory, while as in others, all medical

professionals are permanent with tenured positions and non transferable jobs. In order to continue in a orderly fashion, every social system has to full the functional needs of that system, viz, the need for pattern maintenance, the need for adaptation, for goal attainment and integration.

In a hospital system, the patients needs determine the interactions within the system. When a patient is cured and discharged, in his or her place a new patient is admitted. This new patient also demands all the attention and skills of doctors, nurses and others, thus forcing the essential and separate components into immediate action, repeatedly as each patient is admitted. Free upward and lateral communication is an important characteristic of any system.

So far as communication within the hospital system is concerned, in fact there is considerable restriction in communication among people in the hospital. Doctors communicate freely with doctors. Nurses with nurses and patients with each other (if not too ill) and with their relatives, but there is little communication between these groups at the non formal level.

In the course of interaction among the various units of a hospital social system, tensions and conflicts emerge. These strains have to be dealt with effectively if the system is to function properly. The system has to develop mechanisms of tension management to cope with such strains.

Integration deals with the problem of morale and solidarity in the hospital social system. Morale is necessary both for integration as well as pattern maintenance. Integration has to be achieved at the microlevel. It involves the development of loyalty to the system, to its other members and the values for which the system stands.

Need for pattern maintenance acts as a barrier to upward or lateral mobility of the staff. One occupational group cannot be promoted to the other group, e.g. laboratory technician cannot become nurse and nurses cannot become doctors.

In general, there is a trend in bureaucratization of hospitals, in which hospitals are seen to work towards achieving their goals through reliance upon such structural devices as systems of division of labour, an elaborate hierarchy

of authority, formal channels of communication, and sets of policies, rules and regulations.

The two lines of authority (viz administrative and professional) come into conflict, because each group has a different set of values. One is concerned with the maintenance of organization and the other with providing medical expertise. This leads to interpersonal stress. A system that operates through multiple sub ordination sub ordinates to multiple orders which are often inconsistent with one another.

A hospital is more than the sum of its parts . The major components of a hospital system are depicted.

Input		*Process –Transformation*	*output*
People		**Communication**	
A	Staff	Between	E F F
	Physician	Physicians and patients	I
	Nurses	Physicians and nurses/ paramedicalstaff	C
	Paramedical	Physicians and administrator	I
	Supportive	Administrator and nurses / paramedicalstaff	E
		Nursing / paramedical staff and patients	N T
B	Patients,their attendants And relatives	**Decision Making**	P A T
Material		For	I
	Drugs and chemicals	Cure: Diagnosis,treatment	E
	Equipment	Care : Creature Comforts of patients diet	N
	Diet		T

Money

To maintain staff Facilities and procure Material	Procurement of materials in right place at the right time	C A R E

Action

Putting decision into
Practise
Balanced mix of communication,
decision making and action

Hospital as a System

As a component part of health system, the first task of the hospital is to reach all people all the time at a cost the community can afford. The concept of hospital as the center of home care service and as a center of preventive medicine has enlarged its role enormously. The primary task of the hospitals is the provision of medical care to a community. However, the hospital has two other important roles to fulfill-to be a center for the education of all types of health workers, doctors, nurses, midwives and technicians and for the health education of the people.

The growing realization of the thin line of distinction between health and disease, the important relationship between social and material environment, its effects on the individual's physical and mental well being, the increasing demands for a better standard of living and health awareness of the people have all had a significant effect on hospital system and the trend of services provided by hospitals.

HOSPITAL AND COMMUNITY

The ultimate purpose of the health services is to meet effectively total health needs of the community.

There are a lot of factors which determine the health needs of community and solutions to them. Some of the important factors are listed in Table

1. Demoraphic Factors
   - Age
   - Sex
   - Marital status
   - Family composition
   - Education
2. Enabling Factors
   - Family financial resources
   - Family relationships in the household
   - Availability and accessibility of services
   - Health insurance (compensation for illness changes health behaviour)
   - Attitude to health and disease
3. Internal or Health System Factors
   - Manpower availability
   - Physical facilities
   - Organisation and structure
   - Interface with users
4. External Factors
   - Political
   - Social
   - Administrative

Factors determining the health needs of community

A good hospital would build its services on the knowledge and understanding of the community it is to serve, its success will depend upon the involvement of many groups, both professional, within and out side the hospital.

The providers, support Group and Community

The hospital being a distinct, albeit integral, part of the health services, is influenced by all the above mentioned factors and the health services in turn influence those factors. It has to deal with three different groups which from the larger community.

1. The first group is the "providers" of medical care, viz. The doctors, nurses, technicians and paramedical personnel.

2. The second group is management, administrative and support group comprising of personnel dealing with non-clinical functions of the hospitals, such as diet, supplies, maintenance, accounts, housekeeping, water and ward, etc.

3. The third group and the most important one for whose benefit the first two groups exist in the first place, is that of the patients who seek hospital service and their attendants, relatives and associates who, along with patient come in close contact of the hospital. This group is broadly termed as the "community".

Hospital-Community Relationship

In a complex juxtaposition between the providers of care and intermediate support group on the one hand and the patient and the community on the other, it will not be unusual to expect conflicts between the two groups. The nature of the relationship between the two groups' influences community relationship, and on this relationship depends the image of the hospital. To better this image, hospitals have to reorientate themselves to the expectations of the community.

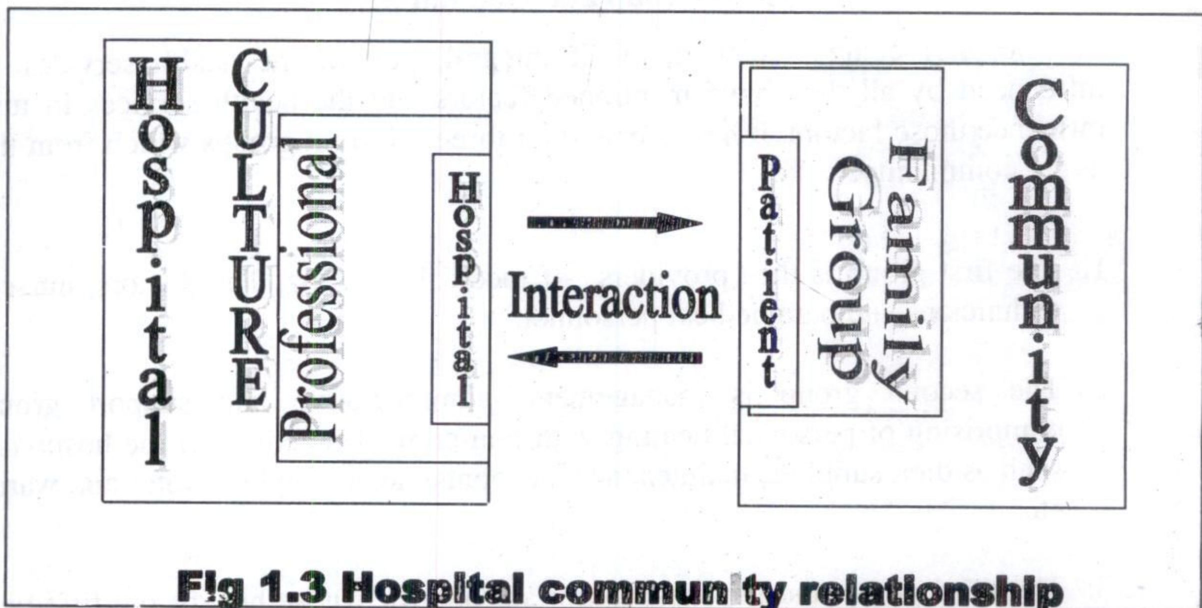


Fig 1.3 Hospital community relationship

Relevant communication and information must reach the user community in order to promote their participation and involvment. A community that is well informed and aware of its social responsibilities can become an effective instrument of cooperation and support.

However, the unpleasant fact that this community participation is being distorted by sectional interests trying to use the community as a pressure group tp mattain specific objectives which are not always compatible with the paramount aims of the hospital pragrammes need also to be remembered.

People go to the hospital with high expectations believing that every disease is fully and quickly curable. The average health consumer regards contemporary hospitals as the panacea to his health problems. They cannot appreciate the limitations of the hospital. There is an increasing demand for better care and quick cure. Besides giving care to every patient public expccts sympathetic understanding of the behaviour of the patient and his or her attendants and relatives. This shift has necessitated a new approach to doctor-patient and hosoital community relationship.

On the other hand, some questionable assumptions on wich the value system in hospital is based are still prevelant among medical personnel. These are that cure is more important then the care of patients, that the staff assume power over the patients, that every problem has a solution, and thatdeath is the worst thing that can happen to man.

Respect for the dignity of the patient is one of the most basic rights and needs of the patient. Concern for the care of the human being as a whole needs contribution from everyone working in the hospital. The hospital is like a federal system with several departments each enjoying considerable autonomy and discretion in its management of work. The greate challenges is one of coordination.

Whether it wishes to stress its links with the community and its human and personal character, or its power and glory as a temple of healing will depend upon the hospital itself. From starting as a work of charity, hospital care has developed into a science with many specialisations, to a high perfection industry, but still a social institution which yet remains to be integrated with society. There has to be a growing interest in the importance of human well-being, in the integration of health services provided.

Review Questions

1. Define hospital and Enumerate the Essential Services provided by a modern hospital
2. Explain the scenario of Hospitals in india
3. How the hospitals are classified
4. List the factors that have led to Changing Role of the Hospitals
5. Discuss the role of hospital administrator
6. Explain the concept "Hospital as a Social System"
7. Write the peculiarities of a hospital system
8. Explain the relationship of Hospital – community
9. List the factors that determine health needs of community

UN IT II
PLANNING

Principles Of Planning

Some guiding principles in planning and designing an efficient hospitals:

1. Early Employment of the Architect
2. Operational Plan and Functional Plan must Precede Architectural Plans
3. Planning Should no be Hurried
4. All details Should be Complete
5. Equipment Planning is done Early
6. Selection and Purchase of Site
7. Hospital must be Planned for the future

The following rules must be observed:

- Protection of the patient is the primary rule. Too much traffic will disturb the patients, affect the efficiency in patient care and increased the risk of infection, particularly in the case of surgical patients for whom aseptic condition is essential.
- The second rule is to plan for the shortest possible traffic routes. They assist in maintaining aseptic conditions and save steps for everybody- nurses, doctors, patients and hospital personnel's. A hospital is a place where everything should be done fast. Patients' lives often depend on it. Time wasted on unwanted steps costs money besides making people suffer from fatigue at the end of every working day.
- The third rule is the separation of dissimilar activities. Examples- separation of clean and dirty operations, quiet and noisy activities, different types of patients, different types of traffic both inside and outside the building, etc.
- Control is the fourth rule to follow. A certain amount of control is inherent when dissimilar activities are separated, but that is not enough. The nurses' station should be situated as to assist the nurses to exercise control over the visitors entering and leaving the unit. Infants must be

protected from being stolen and against germs brought in by visitors and hospital personnel. Patients in the ICUs must be guarded against infection. Operating rooms should be similarly protected.

NEED FOR SCIENTIFIC PLANNING

A hospital is responsible to render an essential service. In fulfilling their responsibility, hospital planning should be guided by certain universally acknowledged principles. The principles are useful irrespective of the level of planning, i.e whether in national level , state level or individual hospital.

Patient Care of a High Quality

Patient care of a high quality should be achieved by the hospital through adopting technical measures.

- Provision of appropriate technical equipment and facilities necessary to support the hospital's objectives.
- An organizational structure that assigns responsibility appropriately and requires accountability for the various functions within the institution.
- A continuous review of the adequacy of care provided by physicians, nursing staff and paramedical personnel and of the adequacy with which it is supported by other hospital activities.

Effective Community Orientation

Effective community orientation should be achieved by the hospital through adopting following measures.

- A governing board made up of persons who have demonstrated concern for the community and leadership ability.
- Policies that assure availability of services to all the people in the hospital's services areas.
- Participation of the hospital in community programmes to provide preventive care.
- A public information programme that keeps the community identified with the hospital's goals, objectives and plans.

Economic Viability

Economic viability should be achieved by the hospital through taking these measures.

- A corporate organization that accepts responsibility for sound financial management in keeping with desirable quality of care
- Patient care objectives that are consistent with projected services demands, availability of operating finances and adequate personnel and equipment.
- A planned programme of expansion based solely on demonstrated community need.
- A specific programme of funding that will assure replacement, improvement and expansion of facilities of facilities and equipment without imposing too much cost burden on patient charges.
- An annual budget plan that will permit the hospital to keep pace with times.

Orderly Planning

Orderly Planning should be achieved by the hospital through the following.

- Acceptance by the hospitals administrator of primary responsibility for short – and long-range planning, with support and assistance from competent financial organizational, functional and architectural advisors.
- Establishment of short- and long-range planning objectives with a list of priorities and target dates on which such objectives may be achieved..
- Preparation of a functional programme that describes the short-range objective and the equipment and staffing necessary to achieve them.

A Sound Architectural Plan

A sound architectural plan should be achieved by the hospital through the following.

- enough to provide for future expansion and accessibility of population.

- Recognition of the need of uncluttered traffic patterns within and without the hospital for movement of physicians, hospital staff, patients, and visitors and for efficient transportation of supplies.
- An architectural design that will permit efficient use of personnel, interchangeability of rooms and provide for flexibility.
- Adequate attention to important concepts such as infection control and disaster planning.

Regionalisation Of Hospital Service

Hospital and other health care institutions have traditionally remained individualistic entities independent of each other. On the contrary they should be coordinated in order to make up a system of medical and health care which provides services on areawise basis. Therefore, it would be ideal to plan the hospital services on a regional or areawiswe basis. However, this cannot become possible without active involvment of the Government. Apart from erstwhile USSR, Chile and Great Britain, where complete regionalisation of medical care has taken place, few other countries have reorganised the haospital system along these lines.

Understanding the concept of regionalisation is necessary because regional planning of health facilities and hospitals is something to which health planners have aspired for many years. Through its application, it is thought that construction of new hospitals and health centres can be tailored to the requirements of the users and that the necessary rational distribution of buildings and facilities will be obtained, enabling health services to be delivered according to a system in which different levels of competency adapted to the needs of the patients can be distinguished.

If regional planning is to become a functioning reality, it should be based on a full and detailed study of the objectives and functions of the health system. It will also be necessary to give a role in the planning process to give a role in the planning process to representatives of the groups that receive the services.

Although regionalisation of hospital services is theoretically possible to be enforced by law it has been implemented to full in a few countries only. There

are several obstacles such as multiplicity of ownership (Government, semigovernment, private, charitable etc.) difficulty in coordination between private and public institutions, problems of movement of personnel and staff, prestige, bureaucractic obstacles, and lack of continuous effort and team approach. Therefore, introduction of the concept is a complex process not easy to achieve.

A WHO working group had identified that in order to put into operation true regionalised system, it is essential that some prior conditions be met. It is easier to bring about in those countries which have a planned economy and a decentralised economic and social development administration. It is also very useful, when there exists a political and administrative body with executive and coordinating authority over the regional services, not only in health but also in the educational housing, welfare and other fields. Even when these ideal conditions do not exist, it is still possible for countries to establish a regionalalised health service provided a firm political decision is taken and is backed by legislation.

What is Regionalisation

Regionalisation is a system of technical and administrative decentralisation by establishment of "levels of care" which range from primary health centre at the community level, to general hospital and specialised polyclinics at the intermediate level, and culminating in higher medical centres where the practice of all specialities is carried out with teaching reasearch as major cancerns. The relationship between organisational scale on one hand and the effectiveness and efficiency on the other, influences indirectly their numbers and locations.

Regional planning envisages creating a hospital system on a three-tier basis. The rural community is served with local hospital (rural hospital) of say 30 to 100 beds, probably undifferentiated, providing general medical, surgical and maternity care. The intermediate hospitals (say district hospital) of several hundred beds serve as a local hospital for the population in its immediate vicinity and as a referral hospital for a group of rural hospitals in its region. Such a general hospital would provide medical, surgical, obstetrical and other specialised treatment. At the third tier, the regional hospital catering to the intermediate hospitals in a geographical region is designed to provide a complete range of treatment including such specialities as radiotherahy, neurosurgerv

thoracic surgery, oncology and so on. Usually, such a hospital would be associated with a medical college and postgraduate teaching centre. This hospital would be stategically located in the region so that patients in need of its highly specialised sevices could be readily reffered to it.

Regionalisational envisages a two-way flow of patients and services and also sharing of senior medical staff by holding consultant sessions at districrt hospitals, and *vice versa*, and regular visits to small local hospitals.

One more aspect of regionalisation which is not so frequently stressed is the aspect of quality and cost. It has been brought ou that the organisational sructure in regionalisation has a direct effect on quality and cost of medical services. The direct effect on costs is because large volumes reduce costs. However, adverse effects would result if the size of the organisational scale were to lead to frequent failures in communication, coordination and control.

Hospital Planning Team

One must realise in the very beginning that hospital project planning and execution is likely to be a difficult and frustrating task.

All the people involved in the delivery as well as utilisation of services are concerned with hospital planning. The people, patients, nursing, medical staff and the management all have their own peculiar requirements.

Technical requirements of a particular professional group in isolation have led to creation of physical forms limited in their utility. On the other hand, the interest of administrators is attracted by other than technical requirements of patients, community and owners. A critical understanding of these relationships is necessary to blend the differences of professional prestige, functional requirements and administrative considerations.

Suitably qualified and competent plannning staff are scarce to find. And they will need a long time to do the necessary work in a careful manner at each stage. It is a common practice, once the idea of a hospital has taken root, to go ahead

too hastily in the preparation of building plans without much delibration. The result is that when plans come under the scrutiny of the personnel who are going to work in the hospital, they are found to be all wrong. Therefore the key feature in planning of all good medical facilities should be the extensive participation of the medical staff in the process. In the initial stages, the time spent on spelling out clearly what the requirements would form the staff's standpoint will save both the money and time in the long run. Approximately 10 to 12 percent of the proposed outlay on construction can be saved if changes at the construction stage or with the short span of commissioning the hospital can be avoided.

The basic reason for the hospital's existence-the patient and his/her human needs seem to have been subordinated in design consideration. Hospitals which have been designed only to meet the health professional's needs have failed to develop an environment which meets patient's needs. The planning team's views must relate to this regard for the needsof patients, staff and visitors alike and not to the architect's and the cansultant's skill in selling their own plans.
The difference between an overall function and the activity components of that function is often confused. To that extent, there is a need to educate the planning group, especially the non-medical members of the group, in the description of spaces and activities. The design of a hospital must also meet patients needs as a human being- his/her social habits, privacy, need for sociability, food habits and so on.

Because the hospital building language is not understood by doctors, nurses and medical administrators, we have only been lapping up the ideas the architects and engineers thrust on hospitals. Even though the multidisciplinary nature of a hospital project involves participation by professional doctors, specialists, nurses, technical staff, architects, engineers and medical administrators, the lack of a common technical language needed for understanding of the common objective of this group tends to delay progress, because the language and semantics used by various participants of the group can confuse and create ambiguity. Therefore, medical men must first understand the language of hospital project planning before interacting with architects and engineers.

Hospital Consultant

Of utmost importance in planning a new hospital or addition of new facilities in an existing hospital, is the utilisation of a component hospital administrator-consultant. In Europe and USA, a class of professionals called the "hospital consultant" has emerged separate from the professional hospital administrator. It is a matter of debate whether such strict compartmentalisation is useful, or even necessary. A professional trained as a hospital administrator with adequate experience can profitably combine the job of hospital consultant and administrator. Such a professional is referred to here as a "hospital consultant".

An experienced hospital consultant would have had opportunities to study the operation of many hospitals and similar institutions, to work in different kinds of situations and to compare ideas and developments with others in the medical care field. He can approach a problem objectively and bring proper perspective both to problem solving and planning for the future. Only the specialised knowledge of alternative methods of doing things, and systematic approach can give the hospital project a fair chance of success on a functional basic consistent with economy.

The medical hospital consultant is able to provide experienced guidance in areas which cover:

(i) local and regional surveys of medical and health care,
(ii) analysis of the demand and need for hospital facilities,
(iii) assessment of the extent and range of services required,
(iv) equipment selection, and
(v) administrative and organisational relationships.

The first step in planning a hospital project is to assemble a planning team. The nucleus of the team can consist of a hospital consultant, one or two medical and lay administrators, a nursing administrator, and hospital architect. Nurse administrators feel that nurses tend to be brought in to react to plans drawn up by others, rather than to participate in their preparation. When she is associated from the beginning, the nurse in the planning team is better prepared to guide and support line nursing managers in determining departmental systems.

It has been suggested by some that a social scientist and even a health educationist should form part of the planning team. Whereas their usefulness at

the level of national health care planning cannot be denied their association with the planning team at the hospital level is unlikely to add to the effectiveness of the team.

The Core Group

The hospital consultant and one or two medical administrative personnel would work without other medical members in the early stages of the project. However, this core team will need to be enlarged gradually as the project develops by addition of a hospital engineer, a financial expert, and experts in the respective specially fields when clinical services are taken up for consideration.

As planning requires, understanding of the nature of activities and their impact on each other. It is desirable to funnel information through as small a group as possible, with one person assuming primary responsibility and providing the necessary leadership to keep the procession in motion.

Planning Process

Philosophy of the hospital. Laying down the philosophy of the hospital precedes the planning process. Normally the agencies sponsoring the hospital viz. Government or the agencies of the Govt., Philanthropic, voluntary or the private organizations lay down the philosophy of the hospital once the idea for the development of a hospital is mooted. Basic guidelines such as paying or free or both, type of hospital viz., purely service hospital, training institution or a research centre and so on world be laid down.

- Once the idea to construct a hospital is formulated, a multi-disciplinary planning team should be constituted. At the stage the planning team may consist of few members who at a later stage would from the core of the enlarged team. To start with, the team may consist of:

    - Owner or representative of Governing body/local body
    - Hospital Administrator
    - Financial expert
    - Hospital Architect
    - Health statisticians

- At a later stage specialists in different disciplines of medicine, nursing and allied services are co-opted for planning of different areas of the hospitals. In addition to this hospital consultants, engineers, landscape architects, interior designers of competence and reputation are added to the team.

The techniques adopted by the planning team are:

- Each member takes a lead in formulating a proposal. Each proposal is then reviewed and modified by the team either in the conferences or through written comments
- Model of temporary materials are constructed to test room size and arrangement discussed.
- Circulation of questionnaires to medical staff members.
- Visit to other hospital to inspect a specific unit or a piece of equipment.
- Review of plans in hospital and architectural periodicals and books.
- Discussion with other people involved in similar problems.
- Demographic pattern: Factors such as age, sex, occupational, characteristics, economic status and literacy status.
- Morbidity and mortality treads in the population .
- Need and demand of the population.
- Geographical characteristics such as terrain, soil structure, seismic data subsoil water level and rivers etc.
- Meteorological data consisting of temperature range, average annual rainfall, humidity, wind velocity and so on.
- Existing health care facilities data including use pattern of such facilities
- Means of communication: Tele communication, rail, road and air.
- Availability of land.
- Further plans for the development of the area including development of industries.

Size Of The Hospital

In developed countries it can be safely assumed that there is not any considerable volume of sickness that does not reach the notice of hospital authority. This assumption is not valid for developing counties where the actual need may be far greater than the over demand. The methods that can adapted for determining the size of hospitals are:

Bed death ratio: 0.5 General bed are needed per annual death for eg. If mortality id 10/1000 the beds needed will be 0.5 X 10 = 5 beds /1000 population. Expressed in terms of total death if we presume 200 death / year then 0.5 X 200 = 100 General Hospital beds will be needed for the given community(5)

b. Statistical Method

$$\text{(i). Bed / population ratio} = \frac{A \times S \times 100}{365 \times PO}$$

where A = Number of inpatient admission

S= Average length of stay

PO= Percentage occupancy

$$\left(\frac{\text{Average daily census} \times 100}{\text{Bed Complement}} \right)$$

c. If the statistics are not available the formula can be used on assumption from data of other regions.

Site Selection

While selecting the hospital site one has to keep in mind the growth of hospital in the near future say 10 years, 25 years or even up to 50 years. The site should therefore be large enough to enable the hospital to expand further. Keeping this in view the factors necessary for site selection are:

a. Area and land required : this depends on the proposed bed strength and the specialised scrvices to be provided. Have a rough demarcation of the service area from which a hospital draws the major share of its patients. Hospitals should be planned atleast five to ten years ahead.

The usually accepted minimum space occupied by the bed itself and accessories is about 100 square feet.it will be seen that the total covered hospital area is eight to ten times above requirement.in other words the minimum covered area should be 60-80 square metre per bed.

b. Accessibility: The hospital should be within easy reach of the community. It has been quoted by National Institute of Health, New Delhi that members of the community should be able to reach the hospital within a travel time of 30 minutes.

c. Environment : The hospital should be written easy reach of the community. It has plenty of fresh air and sunlight. The site should be free from smoke and hazardous industrial emissions.

d. Availability of resources

(i) Water : 500 liters of water per patient/ day is required excluding the water for gardening. The water should be available 24 hrs and form two sources. Reserve water storage facility for 7 days should be planned in the form of underground or overhead tank. If the water is from the two sources, two days reserve capacity may be sufficient.

(ii.) Electricity (aa) The rule of thumb for planning energy requirement for a hospital with vertical transportation and no central air conditioning for the whole building was I KW/bed (6). In a super specialist hospital even 7 KW of electricity / bed may be required as all the equipment function on electricity (7).
(ab) +since t he present trend of electrical consumption and the energy will be required for light the area other than building ,it would ,it be fair to workout be energy requirement at 2kw/pt/day.

(ac) The power to hospital should be available from public utility atleast from two sources with sub-station in the vicinity of hospital. Arrangement for continuos power supply has to be made by provisionioning the generator for some areas of the hospital.

(iii) **waste Disposal** The centralised sewage system should be available near the site selected so that sewage system of the hospital can be connected to the central serwer.solid waste at the rate of 1 kg/bed/day is generated and liquid waste of 450ml/bed/day.Arrangement for the disposal is to be made in the plan.

Hospital Architect

The architect has to acquire an understanding of the comprehensive technical and administrative needs of the hospital. His responsibility is to translate clinical and administrative requirements into architectural and engineering realities which encompass site selection orientation of buildings, supervision of construction, utilities and electrical and mechanical installation. The requirements have to be understood in depth by the architect from the hospital consultant, from which should develop a programme in writing stating clearly all the requirements in comprehensive terms. Viz, number of beds, their distribution departmental needs, area requirements, major equipment, number and type of personnel to be employed, departmental functions and relationship.

An architect can be of value only if he has experience of hospital architecture and construction. There are specialist architects employed at the central and state government levels in the ministry/department of health for work in the government sector. During recent past, architects with hospital experience have also become available in the open market.

Therefore, it will be best to engage the services of architects who are specialists in hospital construction or with experience in hospital projects. As the project goes on, architects and engineers without previous experience in hospital building can be employed in an executive capacity without detriment to the project.

Architectural creativity is synthesizing all elements into appropriate solution patterns. For a hospital architect, to create a hospital which satisfies the functional requirements of the profession (medical nursing, administration), meets the cost limits set by the owners and yet retains some quality of architecture, is a task requiring imaginative approach, a high degree of professional skill and ingenuity.

PREPARATION OF DETAILED ARCHITECTURAL REPORT

The early employment of an architect is one of the first requirements for planning a successful building project. The architect brief is discussed with users and administration and if necessary modified. Then architect prepares a detailed report including:

- Architectural drawings/models.
- Cost estimates.
- Time frame for completion of project.
- Maintenance facilities.

The architect brief includes all the dimensions of the project.

A general hospital is likely to have the following major departments:

1. Administration
2. Out-patient Department
3. In-patient Department
4. Hospital Services:
   a. Sterilisation
   b. Dietary
   c. Laundry
   d. Transport
   e. Stores
5. Emergency Department
6. Engineering Services
   a. Civil Engineering
      i. Building Maintenance
      ii. Horticulture
      iii. Water Supply and Plumbing

b. Mechanical Engineering
    i. Air-conditioning
    ii. Refrigeration
c. Other Services

There may be other areas/activities as well. These may be planned in parts or together. Each identifiable space with a distinct function can be called as an activity. The flow diagram of a hospital building in terms of movement of doctors, patient's movements, food movement, services and other staff movement should be logical.

The contribution of engineers to the design is of crucial importance. Their help will be needed at an early stage. When the approximate demand for water, electricity fuel, gas and sewerage is being estimated. Their advice will be needed on the choice of site and on the master plan for the hospital.

Engineers will have to plan (before building construction) with the installation of all expensive mechanical equipments. Hospital authorities along with their engineers, should take advice of manufacture regarding installation of expensive and/or large equipment, during the designing stage of the building. A guaranteed installation and maintenance arrangements of any machinery or equipment should be taken from the manufacturers of from the concerned engineers. This avoids expensive demolitions, modifications, reconstructions or alterations at later date.

The master plan can develop in the form of a very concentrated building, making use where necessary, of multi-storey blocks; or it can be comparatively loose, occupying more areas on the ground and employing lower buildings. As far as possible the latter approach is preferable and for it sufficient land should be available.

In a vertical built or grown hospital, it is very much more economical and efficient to concentrate lifts at one place than to distribute them among different parts of the building. Four lifts booked together will give the same service as eight individual lifts distributed at separate points.

Equipping A Hospital

The mechanical and electrical installations and the plant and equipment component in a modern general hospital has been estimated to cost about40 % of the entire hospital project out of which about half is required for the medical equipment .

Hospital equipment covers a broad range of items necessary for functioning of all the services Various ways of classifying equipment in hospital can be used However universal application of the equipment in the hospital can be classified as

(i) Physical plant
(ii) Hospital furniture and appliances
(iii) General purpose furniture and appliances
(iv) Therapeutic and Diagnostic equipment

Plants and equipments required in a general hospital

Physical plant	Lifts Refrigeration and air conditioning Fixed sterillisers Incinerators Boilers Pumps Kitchen equipment Mechanical laundry Central oxygen, suction Generator
Hospital furniture and appliances	Beds Stretchers Trolleys Wheelchairs Bedside Lockers Dressing drums

	Kitchen utensils
	Bedside Lamps
	Movable screens
	Hand wash stands
	Operation tables
	Instrument Trolleys
	Bedpans
	Wastebins
	Hospital linen
General purpose Furniture Appliances	
Office machines	Intercom sets
	Typewriters
	Calculators
	Cash registers
	Filling systems
	Electronic exchange
	Computers
Office furniture	
Crockery and cutlery	
Therapeutic and Diagnostic equipment	
Equipment for general use	surgical instruments
	BP instruments
	Suction machines
	Rehabilitation Department equipment
	Physiotherapy Department equipment
	Sterilisers
	Equipment for clinical laboratory
	Glassware washers
	Voltage stabilizers
	Refrigerators
	Chemical analysers – microscope
Equipment interacting with patients During diagnostic and therapeutic	short – way diathermy machines electric cautery machine

Procedures	defibrillators
	X-ray machines
	Monitoring equipment
	Respirators
	Incubators
	ECG machines
	USG Machines

Identifying Equipment Needs

Equipment needs usually originate from the user departments. The need for the new equipment arises from the professional staff to improve quality of patient care, i.e., in both diagnostic and therapeutic services.

The need for equipment fall into three categories;

1. Acquiring new equipment
2. Addition of equipment
3. Replacement of old and obsolete equipment

1. **Acquiring New Equipment:** provision of efficient patient care services of an acceptable standard depends on the right sort of equipment available and maintained in good order. So careful planning must go into the equipping of any new hospital, whether it be a dispensary in a village or a referral hospital. The following fundamental principles should underline the choice of equipment for all new hospitals whether in developing countries.

    a. Reliance on mechanical or electrical should be kept to the absolute minimum.
    b. All equipment should be simplest which will carry out the functions for which it is required.
    c. The equipment chosen should be that which requires the locally available spares and maintenance facilities.

These principles are applicable to all the hospitals anywhere in the world, but particularity to those in developing countries where funds may be more limited, where there are very few skilled maintenance personnel. So once equipment planning is done, every effort should be made to ensure that the funds are spent wisely.

The following check points should be applied in the evaluation of the need for new equipment:

a. Does it suit the socio-economic environment of the community to which the hospital is providing health care?
b. Type of the services provided by the hospital.
c. Range of the services provided by the hospital.

So a defibrillator or a ventilator may not be of much use in a PHC, whereas an autoclave and routine surgical instruments will serve the purpose.

2. **Additional Equipment:** Expansion of patient care services require additional equipment. In this aspect the limiting factors are: (i) Limited resources. (ii) Limited availability of technical people to maintain the equipment.

The following questions should be answered before going to additional equipment:

a. Is there increased workload for the existing one?
b. Is the existing equipment time consuming?
c. Is it professionally best method of treatment?
d. Are there some better alternatives?
e. Is the extra expenditure justified?

3. Replacement of old and Obsolete Equipment: Replacement of old equipment with new one depends on the following factors:

Major Factors

(i) Economic Factor: Economic Analysis: In making economic analysis of a potential capital equipment purchases is to compare the proposed new equipment with the existing old one. The techniques involved in economic analysis are based on comparison of operating costs and income generation of the proposed equipment with operating costs and earnings of the existing equipment. This comparison is to determine the measure of profitability.

(ii) Technological and Engineering Factors: The technological and engineering features must be compatible with the buyers existing equipment, process and layout. They must also be in accordance with standards established by State and Central Governments such as occupational safety and environmental protection.

A few major considerations are given below:

(i) Physical Sizes and Mounting Dimensions: Will the equipment fit into existing available space satisfactory? Can it be tied into existing supporting structures without difficulty?

(ii) Flexibility: Can equipment be moved and relocated without excessive difficulty?

(iii) Power Requirements: Can existing power supplies be used?

(iv) Safety Features: Is the general safety level comparable with that of the existing equipment?

(v) Pollution Characteristics: Does the equipment perform in accordance with EPA (Environment Protection Agency) requirements concerning pollution and contamination discharge levels?

Calculation of Requirement of Equipment

Once the evaluation of the need for equipment is over, the next step is estimation of equipment requirement. There should be a realistic estimation of the requirement of equipments for different hospitals, and this estimation should

consider the future needs. The estimation of requirement of equipment depends on:

1. Type of equipment
2. Quantity required
3. Anticipated patient load in future years
4. Type and range of services provided by the hospital
5. Expansion plans of the hospital
6. Financial resources

Collection of Information

Once the needs and estimation of equipment is assessed the next step is to obtain information.

1. If there is a purchase department, it keeps a watch on the developments in major equipment industries.
2. The purchasing department regularly gives information about the new developments of equipment technology to the user department.
3. The purchasing department's responsibility to locate competent vendors and secure the information required by the user department.
4. It is the duty of the purchasing department to arrange the display and demonstration of new equipment so the user department can test and compare them.
5. The purchasing department arranges meeting between potential suppliers and user department to discuss the technical details.
6. They can also arrange user's trails.
7. Arranging visits to the other hospitals who are already using the proposed equipment, to know more operating and technical details.

Product Evaluation and Specification Audit

The fourth step is to produce evaluation and specification audit. The product evaluation involves numerous factors:

1. Evaluation of professional auditability of equipment.
2. Cost comparison and cost benefit analysis.

3. Compatibility with existing system.
4. Existing maintenance capability.
5. Utility and facility requirements like water, power, air-conditioning, sewage, hygiene, etc.

A good buyer of hospital equipment should functioning in the role of an auditor, in specification audit the following points should be cosidered:

1. All the technical specifications of the proposed equipment should be written as functionally as possible and clearly by the user department.
2. The nature of capital equipment requirement limits the number of possible suppliers. Most users hold bias for and against some specific brands. This bias again reduces the number of potential suppliers. So every effort should be made to exclude personal bias from the specifications.
3. The buyer or the hospital administrator should participate in most of the discussions between user departments and potential suppliers.
4. It is desirable for the hospital administrator to have basic understanding of the technical problems involved.
5. The hospital administrator must persuade the user departments that unbiased functional specification, serve the hospital's best interest.

Interiors and Graphics

What is interior Design?

We are in an era in which interior design has become an integral part of architectural process. Although man's propensity to create a pleasant environment for himself is as old as civilization itself, interior design as it is understood and practiced today, namely, the conscious planning and design of man-made spaces, is a relatively new field. In its true sense, interior design begins with the architectural concepts in the early design stage and ends with the owners occupying the completed space. But even in the present time when architecture has gone so far ahead, not much attention is paid to interior design

and furnishings of a new hospital until long after the building has been started. In the earlier days the supplier of equipment and furniture was usually asked to "decorate the hospital". If he could not provide this service, a local "decorator" was called in to advise the owners, largely on colour coordination. The term "interior decorator" is primarily used in connection with residential design and is not generally employed by a person who has received professional schooling and training in interior design.

Before interior design come to be practiced as a serious profession, it was interior decoration or decorator-design that was in currency. So loosely was the term used that anyone could print a card and call himself an interior decorator or decorator-designer. Decorators usually lacked comprehensive understanding of architecture, engineering, lighting, ventilation and air-conditioning. They were hired to do colour work and colour coordination, and in the selection of draperies, carpets and walls the term interior design indicates a broader area of activity. It is indeed a specialized branch of architecture or environmental design, so much so in some advanced where this profession is well established it is know as interior architecture. Having regard to the many elements that shape man-made environments, some would want to refer to the total field as environmental design.

Harmony among Elements

Interior design should not be considered in isolation. There are many elements that make up the totality. Interior and exterior spaces are interrelated and there should be harmony among the various elements such as structural aspects of the building, site planning, landscaping, furniture, graphics and interior details. Experts feel that "the best examples of design are those in which no visible difference exists between the interior and the exterior, between the building and its site, and between the many parts or spaces to each other, and the total building". Natural style of landscape architecture-I shall explain this in a little while-that became popular in England in the 19th century and continued into the 20th century is now widely used by modern architects in their attempts to unify interior and exterior spaces.

There are two styles of landscape architecture-the formal style and the natural style. A garden with its paths crossing at right angles, flowerpots laid out in geometric patterns and its balanced groups of trees and shrubs is a good

example of the normal style of landscape architecture. The natural style on the other hand seeks to imitate nature rather than impose artificial patterns upon it. This means that the trees, shrubs and flowers are allowed to grow in the natural way, that is, in their natural shapes and settings. This is the style we are concerned with in interior design.

By large, and architects do the designing too. If one looks into the directory of architects, one would observe that almost every one of them is listed as architect and interior designer. Interior designers are those who have undergone professional training in one or the other of the colleges or schools offering recognized cources, but unlike the architects and the engineers, they may not be required to hold a license to practice. Where an interior designer is hired for a project, the architect usually concerns himself with the overall design of buildings, and the interior designer is concerned with the more intimate aspects of design, and the specific aesthetic, functional and psychological questions as well as the individual character of spaces

Earlier we saw how important it is to satisfy the psychological and aesthetic needs of patients in addition to their physical needs. The interior designer addresses these issues.

Interior design has two basic categories-residential and non-residential interiors. Professional designers find less and less volume, need and challenge in the field of residential interiors. Some of them find greater challenge in the new and specialized areas such as space planning, office design, and designing of hotels, shopping complexes, hospitals and nursing homes.

Interior Design in Hospitals

It was not until recently that the need for interior design, much less the hiring of a professional interior designer, was considered important to the effective functioning of a hospital. Those were the days when it was common place to refer to a sterile, dull-looking space as "looking like a hospital". In the prevailing attitude toward interior design in health care institutions, engaging the services of an interior designer was out of the question. So, hospitals provided

their own interior design services. The administrator or some one else or a committee took on the responsibility of design services.

All this while, great changes were taking place in the field of building hospitals and in the attitudes of people toward health care. Advancements in medical technology, newer and sophisticated equipment and, more importantly, the realization that hospital should be built not only to cure mankind's physical and mental ills but also to meet patient's emotional and aesthetic needs brought about dramatic changes in building health care facilities. A growing efficiency was witnessed in constructing hospital buildings to meet these new challenges. It was rightly felt that a hospital couldn't build without highly skilled professional architects and engineers, nor should its interior be designed without skilled interior designers.

Certain areas of the hospital such as the operating rooms are strictly functional. However, the patients' rooms and many other facilities of the hospital are very much within the scope of interior design. Over the years, the influence of environment upon human behaviour has been increasingly recognized. This in turn brought about increased emphasis on interior design for all kinds of hospital's interiors. When it comes to aesthetic consideration in a hospital set-up, the most important thing to bear in mind is its appropriateness. The interior design of a club, for example, is hardly appropriate for a hospital or, for that matter, that of a hospital for a classroom. These are complex relationships involving psychological and aesthetic factors. Of all the component elements that form a completed interior, particularly in the hospital, the single most important element is the space. Space can speak; it can be exhilarating, serene, and cheerful. On the other hand it can be depressing, dreary or distasteful. The designer should consider the effect these will have on the emotional state of patients, patients' families, visitors and personnel. Other components are the ceilings, floors, walls, windows and doors, furniture and accessories, lighting and fabrics.

Graphic Art and Design

The one most important objective behind the massive marketing, public relations and promotional exercises that any hospital undertakes is to create and project a good image of the hospital. Every thing in a hospital, even the

seemingly small and inconsequential things, projects a good or a bad image to the outside world, correspondence, for example, forms a strong subliminal impression about hoe the executive runs his business or organization. It is also one of the most frequent opportunities he has for presenting himself to the outside world or the business community.
Of the hundred and one big and small things and the activities that go to build hospital's public image, the one that is relevant to our topic of interior design is the graphic art which is taking on increasing importance. The image of the hospital that patients and visitors carry with them out of the hospital depends on, among other things, the hospital graphics. Signs, directories, and room identification play an important visual part. Good architectural graphics have assumed great importance in the context of increasing size and complexity of our modern structures.

Directional Graphics, Safety Signs and Hospital Logo

Two types of graphics are of importance to the designer: the directional graphics or the signage system, and the printed matter including hospital logo.

A mass of information must be transmitted visually to patients, visitors and personnel so that time and motion are not wasted. A signing programme produces these directional signs both inside and outside the hospital.

Hospital way-finding system often confuses patients and visitors. The system is generally devoid of graphics and is written in physicians' language (for example, ophthalmology, diagnostic radiology, oncology, dermatology, etc.). Hospital administrators often think that a way finding system is just a matter of putting up sings. They do not realize that working out an effective signage system is an art; it takes concerted effort to select appropriate terminology which is supplemented by visual symbols, maps and directory of floors and rooms; the rooms should be numbered. The system should also produce a consistent lettering (style and size). Letter style and size are outlined with the design, placement and colour code of the entire hospital.

Apart from directional signs, there are other important signs such as safety signs that a hospital should be concerned with-signs relating to fire emergency, smoking, safety at work place in general and certain critical areas in particular, safety in places where oxygen is use or anesthesia is administrated. (see fig 15.2 for some these signs) Many of these are warning signs.

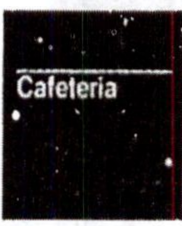
Of all the safety measures in the hospital;, safety against fire is of the utmost importance. Nowhere else is such a large number of helpless people concentrated in one place so utterly dependent on other people for their safety as in a hospital. Since the best form of protection from fire is prevention, warning signs are essential.

The printed matter is part of certain interior functions. The hospital interior designer should be as concerned with it as the designer in a five-star hotel is with napkins, menus, wine lists, etc. or the designer of a large departmental store is with shopping bags, advertising posters and signs.

Graphic design and the logo should be though early in the design stage. This will enable the graphic designer to participate in the total concept. Too often hospitals make the grievous mistake of putting off this important work to a later time, and realize that at the time the graphics and the logo are needed, it is too late to develop them.

Use of Decorative Colours in Hospitals

Colours have a definite influence on the mental and emotional state of patients. This fact should be kept uppermost in mind when deciding on colours to be used in the direction of various parts of the hospital. Everyone has personal preferences for some colours, but when it comes to selection of colours for the hospital, whoever is responsible for the selection should be willing to subordinate his personal preferences to what is good for patients, visitors and personnel.



PATIENT ROOMS

VISITOR REGULATIONS

VISITING HOURS

VISITING HOURS

EMERGENCY EXIT
TO FIRST FLOOR
ONLY

EMERGENCY EXIT
ONLY

REST PERIOD

NO VISITING

VISITING HOURS

PHYSICAL THERAPY

HOUSEKEEPING

FIRE EXIT
Please Keep Door Closed

In case of fire
do not use elevators

FIRE EXIT
KEEP CLOSED !

CAUTION
OXYGEN IN USE
NO SMOKING
NO OPEN FLAMES

NO
SMOKING

RADIATION
RESTRICTED
AREA

IF YOU
ARE PREGNANT
PLEASE
INFORM TECHNOLOGIST

DO NOT
CLOSE
VALVE

Prevent Back Injury...
Bend Knees to Lift

EMERGENCY
GUIDELINES

SAFETY TIP

IN CASE OF FIRE

PLEASE
HOLD
HANDRAIL

IN CASE OF FIRE

The question that should be asked is what is the effect of any colour on patients, visitors and employees? Take for example, the red colour, which is a highly stimulating and exciting colour-the degree of stimulation is dependent on its hue and intensity. Pink is that delicate tint of red is pleasant, enlivening and refreshing. But on the other hand is calming and subduing; it may even be depressing.

Let us consider some of the important areas of the hospital and what colour schemes would be most appropriate for them.

The lobby for the most part is the first point of contact with the hospital patients and visitors. It sets the tone for their visit. It is here that they form their first opinion about the hospital. If they are depressed by the look of a cluttered, untidy lobby, they will be disposed to carry a negative impression about the kind of treatment they or their dear ones are going to receive in the hospital. The first impressions are, therefore, important-they may be decisive and lasting ones too. Therefore the lobby should not only be orderly and well appointed, it should also be bright and colourful-consistent, of course, with the architectural background. Experts say that the colours chosen for the lobby should be quite, restful and dignified such as rose tones or pecan gray.

The colour schemes of corridors walls should reflect light, and create atmosphere. Honey yellow, gray-green and light cedar rose are some of the choices.

Patients spend twenty-four hours of the day in their rooms-for them hospital is their temporary home. Since tastes are different and what one patient likes another may not, muted pastels are recommended. The colours that should be avoided in patient rooms are bright blues, soft purples, lavender tones, bright yellows or strong, definite colours of any kind. On the other hand, melon green, dusty rose, rose tone, aqua, pecan gray and honey yellow have been used with a great deal of success.

Since the patient in the lying position sees more of the ceiling than of any other place in the room, it is advisable that the ceiling is done in the same colour as the side walls.

Operating, delivery and workrooms should be done in colours that would be restful to the eyes. A colour that has been proved to be the ideal is gray-green.

Nurseries should be decorated in pink or blue, or a combination of these two. Pink and blue are the traditional colours of the infants.

A word about choosing curtains to go with the colour or colours of the rooms. The expert advice is to purchase curtains first and then select wall colours to harmonize with them. It is more difficult to find curtains to harmonize with colours of the walls that have already been determined.

The paramount purpose of including this section in this chapter is not so much to prescribe decorative colours to various areas of the hospital as to create an awareness in the architect, the planner and the whoever select these colours, how colours effect people, particularly, the patients. Earlier we saw, for example, that the interior design in the coronary care unit and intensive care units should be so planned as to avoid depressing effects or over-stimulation from certain colours and lighting. In the psychiatric ward too, the light, paint, décor should be thoughtfully chosen to provide a desirable therapeutic effect as these things can easily affect the mood and attitude of psychiatric patients.

The colours mentioned here may not be the answer to every situation-they should, therefore, be taken as suggestions that have been tried successfully in many hospitals, but then there may be equally or better colours that are conducive to the well being of the patients. It is for the planner to try them..

CONSTRUCTION AND COMMISSIONING

Construction

Working drawing and specifications are prepared by the architect to provide to the contractor a detail picture of the work to be done, materials and methods to be used and responsibilities to be assumed for the project. Based on these, the contract bidders prepare their proposals and estimates for the building and submit their tenders when invited to bid competitively. The award of contractor is made to the lowest bidder. Considering also his standing and experience in the building trade. The architect supervises the construction to

ensure that the work is carried out according to the contract, and those correct materials are used and specifications followed.

The agreement drawn between the owners and the contractor should lay down the time schedules. Method and periodicity of payment to contractor, sureties to be furnished by the contractor, penalties in case of default, inspection procedure and allied matters. The draft of this legal document is prepared with the help of the architect and consulting engineers and executed through a law firm.

The contractor usually subcontracts various parts of the work to other contractors, each a specialist in a particular line of work. Nevertheless, the overall responsibility for the construction lies with the main contractor as per the terms of the contract.

As clarified earlier once the work has started, any change in the construction plan at this stage is going to disrupt the project and cost a lot of money, however, modifications may become necessary due to unforeseen circumstances during the construction stage. In such a case, the drawing and the specifications, which have to be changed by the architect, will call for redrawing of the contract with the contractor.

Because planning invariably takes a considerable time, it is clear that by the time design and construction are complete, more modern ideas are being developed. The temptation to alter designs and construction are complete, more modern ideas are being developed. The temptation to alter designs, because ideas encorporated in planning earlier are no longer the latest fashion must be permissible if it can contained within the cost limit, but it may be cheaper to build the mistake-often mistakes may not be so serious when seen in retrospect. It is desirable to engage the services of a mechanical engineer to supervise the installation of mechanical equipment of complex nature, under the overall control of the architect. Arrangements for safe storage of all equipment at the site must be earmarked to uncrate, check, inspect, assemble and install each item of equipment in its appointed place. The hospital administrator-consultant should be available to guide the placement and installation of diagnostic and therapeutic equipment.

Phasing

Few projects can be taken tq the stage of completion without recourse to breaking it into phases. This is necessitated because of following factors.

1. The necessity to bring facilities into use as quickly as possible for operational reasons.

2. The necessity to spilt a major project into smaller units of building work as a contractual consideration.

3. The necessity of having certain departments ready before other

4. A local priority for introducing services.

5. Limitation on availability of capital funds.

Phasing requirements have a dominant effect on the future building shape depending on whether the phased development is on existing hospital site or a new site. The phased hospital on a new site has to provide the necessary basic services in the first phase, which takes a disproportional amount of capital, severely reducing the clinical content. On the other hand, having to build basic supportive departments smaller than their ultimate capacity necessitates defining how they can provide the increased services required in the later phases whilst still maintaining operational efficiency and optimal departmental relationships. The way in which the first phase departments will expand to serve later phases will have to be very carefully considered.

Commissioning

The hospital is ready to be commissioned when its building is ready, all equipment has been installed, and the staff and manpower engaged. The plant and machinery should have undergone many test runs before this, and the therapeutic and diagnostic equipment should have also been tested. The medical staff and other paramedical personnel should have been positioned a few weeks in advance.

The commissioning team would have started meeting much before the completion of the buildings and will comprise of key members who will be connected with the new hospital. It will have the hospital consultant, the hospital administrator and with him the chiefs of clinical services, senior nurses, personnel manager, supplies officer and a few others, in fact the chiefs or representatives of all the departments. The role of the hospital administrator, who should have been selected in advance, becomes crucial now. The team has the task to bring the hospital buildings. Plant and equipment to a state of the operational readiness, to develop operational systems, testing the equipment for use, to coordinate training of staff to ensure good communication with the public, to communicate with outside organisations affected by the hospital. Establishing a project room for this purpose will be advantageous, it acts as a communication centre for the team where maps, charts, drawings, data sheets, systems manuals, equipment schedules, etc.

Scheduling the Sequence of Services

Some services of the hospital will require to be ready while others have still ample time. For example CSSD requires lengthy trial runs and bacteriological checks installation and calibration of x-ray machinery is lengthy job. The sequence of opening the departments should be planned carefully. The following grouping of services into four categories is suggested

Categorisation of services

Group 1. Services required immediately
- Telephones
- A domestic services
- Central linen services
- Works department

Group 2. Requiring lengthy period of preparation
- CSSD (for trial runs)
- X-ray (")
- OT (")
- Pharmacy

Group 3. May be partially open before patients admitted

- Paramedical service
- OPD

Group 4. Will not be operational until all above departments are opened

- Wards

Shake-down Period

A well-planned hospital passes from the construction stage with a smooth transition if adequate thought has gone into aspect planning, equipment and staffing. After commissioning, a hospital's staff, patients, community, buildings, facilities and environment interact and adjust with one another until the hospital settles into its usual routine.

The period from the time of commissioning of the hospital till it settles down into a satisfactorily functioning entity is the "shake-down period". It is the period during which it experiences its teething troubles. In general, this period will be shorter it adequate time and thought have been devoted to planning and execution and can last from a few months to a few years. Any necessity for additions, alterations and modifications will become apparent during this period, as also the necessity to readjust staffing schedules.

Activity	1993 February	March	April	May	June	July	August	September	October	November		December		1994 January	February	March
Equipment and supplies :	Tenders Complete	Placing Orders				Handover	Delivery of goods easily available		Delivery period for items More difficult to obtain					First Patients		
Main contract / Install and test							Install, check and calibrate →							→		
Printing/ documents	List all requirements			Have printed			Gradual delivery into stores/departments									
Other consumables	List all requirements			Predict consumption			Gradual delivery into stores/departments									
Staff recruitment:																
Medical	15			4		5	—	—	5	18		14			20	
Technical	2			7		14	18	18	21		23		25		39	
Nursing	2			5		9	12	49	54	97					85	
Administrative	1			8		8	23	6	12			13	10		38	
Works	—			10		62	42	55	74	68			65		34	
Total	20			34		98	95	128	166	183	23	27	100		216	
Engineering and building				Pre-handover snagging			Engineering commissioning / Essential post-contract alterations									
Operational systems	Complete main dicussions and document policies			Department heads to draw up procedures and department systems										Review systems in operation		
Organisation	Draw up organisation and committee structure															
Training		Managerical					Commissionning orientation					Induction and		orientation		
Patient services														Open first admission	Phased increase	Fully operational
Public Relations										Site visits for Local Community					Official opening	

Fig. 2.6 : *Example of a commissioning timetable for a hospital*

Review Questions

1. List the guiding principles in hospital planning
2. What is the need for scientific planning
3. Explain the planning process
4. What is Regionalisation
5. Explain the size of hospital
6. List the factors necessary in the selection of site
7. Explain hospital architect
8. Pepare a detailed Architectural report
9. List the equipments required in a general hospital
10. Write the steps involved in equipment needs
11. Explain Graphic Art and Designing
12. What is interior designing? explain interior design in Hospitals
13. Write about (a) Phasing (b) Commissioning

UNIT III
TECHNICAL ANALYSIS

Assessment Of The Extent Of Need For The Hospital Services

One of the first task of the planning team is collection of data to assess the extent of need for the particular hospital and range of services required .such data should be available with the existing healthcare agencies in the government sector with local, district or state health authorities.
There are two methods of assessing the extent of functional need for a hospital.they are the emperical method which applies the norms of the past and rules of thumb to the problem,with appropriate modifications to suit local conditions, and the analytical method which makes a more fundamental ,systematic approach to the problem. the emperical method hinders a evolution of new solutions whileas the analytical method lacks the controlling elements of the norms use of such norms and rules of thumb also tend to perpetuate past faults.In practice ,therefore a combination of the two method will be usually be applied.

Relationship Between Demand And Need

Demand for hospital services can be estimated by studying statistical returns of current usage and morbidity statistics. Measurement of need for hospital services takes account of a more positive approach by aiming at a qualitative estimation of the amount of illness in the community which would require hospital services

The term demand is commonly used to denote "effective demand"and generally equated with utilization of service.However,demand should not be equated with need.It is often found that many. people who demand care hardly need medical care hardly need it(in medical terms),while many people who need medical care do not demand it for various reasons."Coverage"refers to the proportion of a target group which can utilise the facility or service.The three determinants of coverage are availability, accessibility and acceptability.In developed countries with high standards of medical care,the methods for surveying the need and

demand depend on the assumption that demands for care is reasonably close to the need.

When the bed:population ratio in a region is less than one per thousand for acute diseases,there is little chance of going wrong in extending the bed complement up to double.People will choose which facility to attend in an "open"system:private practitioners,private hospitals or government hospitals.However,two points need to be reiterated at this at this juncture. Firstly, there is a tendency for patients needing only primarily care to demand care at higher level. Secondly, "better service" attracts more patients ;given a choice,they will go to a facility providing better service even by spending more money. Because of better service,attendence is likely to increase, and this may further result in lowered quality of care.Notwithstanding what has been said above the elements that require consideration and analysis are summarised.

Elements That Require Consideration And Analysis Are

Morbidity statistics	
Prevalence of	Communicable diseasess Degenrative diseases Accident rates Specific diseases \disorders
Measurement of	Death rate Birth rate Maternal mortality rate Infant mortality rate
Demographic	Age and sex profile Population density Occupational characteristics Extent of urbanization Extent of migratory population Economic development of the area
Socio-economicstatistics	Economic status of the community Literacy and educational standards

	Social habits Housing conditions Styles of living Industrialisation
Hospital statistics	Type of existing hospital services Admission rate Disease specific admission rate Hospital beds in the region Utilization of existing hospital services

Factors Influencing Hospital Utilisation

Before proceeding further, it will be worthwhile to reflect upon the significance of the points considered so far.

Social, economic, educational and cultural characteristics of the people and the attitudes of the medical profession influence both the manner in which existing hospital facilities are utilized and the extent of utilization. However, where hospital facilities fall woe fully short of the bare minimum requirement, utilization statistics do not depict the correct picture.

There is no such thing as a standard population to be served by a hospital although a district general hospital usually serves 1,50,000 to 350,000 people. The exact size of a hospital's catchment area and of the population served depends on a variety of factors. The following factors affect the manner and extent of hospital bed utilization, a knowledge of which will be of help during the planning process.

1.Hospital bed availability As opposed to developed countries where utilization is high because of large availability of hospital beds, in developing countries because of low bed population ratio. A high available bed complement may lead to low bed occupancy rate

2.*Population coverage and bed distribution* since full coverage and bed distribution since full coverage of population depends equitable regional distribution rather than on total number of beds, an even distribution increases hospital utilization by wider coverage of population. People from scarcely populated areas generally find it necessary to travel to district hospitals or metropolitan towns for more sophisticated type of medical care.

3.*Age profile of population* A population with a high life expectancy (and consequently a higher proportion of aged persons) tends to raise the volume of hospitalization. The effect of age on utilization indices is reflected in an increase in the per person hospitalization rate and in average length of stay.

4.*Availability of medical services other than hospitals Availability* of well organized dispensaries, out patient clinics, mobile clinics and competent general practitioners reduce the load on hospital beds in an area.

5.*Customs and attitudes of medical profession* Doctors order admissions primarily for medical reasons. On the other hand, people themselves in - fluence the decision for admissions if a strong "hospital habit" is developed in them, or against admission because of fear of the hospital and unwillingness for separation from family. Physicians attitude on these matters and their philosophy on early ambulation and home care influence hospital bed utilization.

6.*Method of payment for hospital services* hospital services can be free, on payment by patient directly to the hospital, or by indirect payment through sickness insurance. Hospital utilisation is greatly influenced in the last case.

7.*Availability of qualified medical manpower* in areas with very small number of qualified doctors, much illness remains undetected and therefore admission rates are low. However the customs and attitudes of medical profession and pattern of services available influence hospital utilisation more than the number of doctors.

8.*Housing break up* of the joint family and a trend for nuclear families living in independent apartments result in increasing hospital admission be cause of inconveniences encountered in caring for the sick person at home. Shortage of home help in nuclear families and shortage of space in modern apartment dwellings are jointly responsible for demand for demand for hospital admissions in urban areas.

9.*Morbidity pattern* Acute communicable diseases result in a demand for short stay hospitals, whileas chronic infective and degenerative diseases create demand for long stay institutions. The former raises the admission rate and bed turnover, the later needs longer average length of stay.

10.*Hospital bottlenecks* The efficiency with which supportive services (radiography and laboratory, etc) support and reinforce the total hospital utilisation. Poor supportive services and cumbersome admission and discharge procedures act as " bottlenecks" and result in longer hospital stay.

11.*Internal organisation* A high degree of specialization where specialist departments function as watertight compartments result in segmentation within a hospital, resulting in lesser degree of utilisation due to tight compartmentalization of beds. This points out the need to provide the greatest flexibility in bed planning.

12.*Public attitudes* There are certain factors which are of considerable importance in determining where people will go to receive medical care, these are public attitudes. The category includes social and religious attitudes, local customs and traditions, beliefs and mores, and group preferences.

Bed Planning

It is unlikely that elaborate calculations to determine number of beds will be required in starting a new hospital anywhere because nowhere has the bed:

population ratio reached adequate levels. Even in cities where it has achieved such figures, more beds are required because of increasing urbanization.

Here, it should be realized that the hospital facilities in an area are not only utilised primarily by the population in the vicinity of the hospital – the direct population, but also by people who will constitute the indirect population in the larger catchment area. When these population factors are worked out, the calculation for total bed requirements can proceed as per guidelines of WHO.

Indices of direct and indirect admissions give the coverage hoped to be attained, the assumed average length of stay and the occupancy rate indicate efficiency in the use of services. About 85 per cent bed occupancy is considered optimum.

Example

Data

Direct population	-	600,000
Indirect population	-	800,000
Admission per year per 1000 Population : Direct population	-	165
Admission per year per 1000 Population : Indirect population	-	55
Average length of stay in days	-	10
Occupancy rate desired	-	85%

Procedure

Admission per year (direct population) 600,000 x 165/1000 = 99,000
Admission per year (indirect population) 800,000 x 55/100 = 44,000
Total admission per year - 143,000
Total bed days per year - 143,000 x 10 = 143,000
(Total admission x ALS)
Total beds required with 100% occupancy
(Total bed days per year / 365) - 143,000 / 365 = 3918
Total beds required with 85% occupancy
(Total beds with 100% occupancy / 85%)- 3918 x 100 / 85 = 4610

Land Requirement

It is difficult to lay down any yardstick for the land required. The parameters for the land required in the city of mumbai will be entirely different in comparison to a city where land is available freely. As a rough guide 10 acres of land per 100 bed is sufficient. Thus for 500 beds, 50 acres and for 1000 beds, 100 acres of land is sufficient. This areas of land is capable of easily accommodation future expansion.

Guidelines for the requirement of land are as under :

No. of Beds	Land Reqd (areas)	Type of construction
50 beds	10	Single storey
100 beds	15-20	Single storey
200 beds	20-25	Double storey
400 beds	45 -60	Multi storey 3-5
700 beds	65-80	Multi storey 4-6
1000 beds	65-85	Multi storey 6-9

where the land availability is at premium vertical spread of the hospital is to be planned. Even if land is available, to optimize the intramural circulation distance, building for a hospital above 100 beds should be planned in a multi storeyed complex.

Gross Space Requirements

A Major mistake in planning is to attempt to meet pressure for beds, which is a dominant requirement, without giving equal consideration to supporting facilities. Hence one simply moves from crisis to crisis. Some years ago from 500 to 600 net square feet per bed was relatively adequate. With development in the medical and administrative sciences, the minimum total has increase to 700 to 900 square feet per bed.

In some densely populated urban centers in advanced countries the average floor space per bed in hospitals constructed in the 60s was 55 to 60m2 (550-600 square feet). The current ratio of floor space occupied by wards,

outpatient department, diagnostic and therapeutic services, administrative services and services departments are

Distribution of floor space by wards and departments

Wards	OPD	Diagnostic and Therapeutic	ADM	Service Depts.
37-45%	12-18%	18-22%	8-12%	15-20%

Each unit must get essential space for the determined volume of service for the specified numbers and categories of workers, for working room, for placement of equipment and furniture and for storage of supplies.

Space requirements for various units and departments can be arrived at only when their functions, programmes and activities are clearly understood. For inpatients, functionally 100 square feet per bed in general hospitals has been accepted as area occupied per bed, with 75 square feet as minimum for beds located in rooms with four beds or more. The total hospital area works out to approximately ten times this.

Break Down of space requirements general hospitals.

Area	**Sq.ft.per bed**
Nursing units	250-280
Nursery	12-18
Delivery suite	15-20
Operation theatres	30-50
Physical medicine	12-18
Radiology	25-35
Laboratory	25-35
Pharmacy	4-6
CSSD	8-25
Dietary	25-35
Medical Records	8-15
Housing Keeping	4-5
Laundry	12-18

Mechanical installations	50-75
Stores	25-30
Public areas	8-10
Staff facilities	10-15
Administration	40-50
Total	567-751
Circulation	115-140
Total Net Area	682-891

Add walls partitions 95-125 sft.

Gross total area (Building gross) : 780 –1005 sft.

(72.50 to 93.46 sq.mtr)

A building gross square footage figure includes everything within a building's perimeter, viz. stairs, corridors ducts, wall thicknesses and mechanical area. Taking the liberal figures of 1000 sq.feet per bed the land requirement for a 500 bedded hospital would be as follows

At floor area ratio of 0.5 to 1: about 22 acres

At floor area ratio of 1.5 to 1 about 6 acres

At floor area ratio of 2 to 1: about 6 acres

Indian standards institution in their standard IS 10905 Part I have recommended an area of one hectare for every 25 beds.

Project cost

The most common method of estimating hospital construction costs has been the " per bed" method .if the total cost of a 100 bedded hospital has been Rs 400 lakhs, ost per bed is 4,00,000 .

The complexity of modern hospitals defies determining the cost by such a general method. Certain hospitals have extensive research functions,class-room and educational facilities may be required for some,there may be emphasis on extensive outpatient clinical facilities for others,and still others are exclusively inpatient hospitals .Not only the range of services provided by one hospital may be vastly different from that of another ,but also the gross areas per bed utilised by different hospitals will vary.General estimates based on comparison of costs are therefore, difficult to make on a per bed or per square foot basis.However in the absence of amore elaborate method ,the cost per bed methods is generally vogue.70 to 80% of the total cost is generally consumed for construction including fixed equipment,12 to 15 % for depreciable equipment of long life and 6 to 8 % for depreciable equipment of 5-10 year life

The building gross square footage represents an estimate of the total amount of the space that will actually be constructed, and includes all circulation mechanical and structural space.This total is multiplied by a per square foot cost factor prevalent at the point of time to arrive at the base cost of the building .To this is added the escalation factor, the site acquisition cost, and the working contingencies to arrive at the building project cost .

Direct Project Cost = Base cost of Building + Escalation Factor +Fees (Architect, consultant, Site engineer) + Site acquisition

it is estimated that the cost of constructing and equipping a general hospital is somewhere between Rs three and six lakhs per bed.

Breakdown of the Project Costs

The total cost of the project can be broken down broadly as under.

- Acquisition of site
- Site survey
- Landscaping
- Construction contract – Building with fixed equipment
- Supervision
- Equipping the hospital
- Movable equipment
- Architects fees
- Consultant's fees
- Site Engineers fees

DRAWINGS

Drawings represent the culmination of the architect's efforts in interpreting the information contained in the operational and functional plans , and translating it with all the clinical and administrative needs in to required building areas .the intended purpose of these drawings that are drawn to scale is to convey to the contractor and his workmen the necessary details pertaining to the construction of the building. A complete set of drawings consists of architectural drawings, Structural drawings , mechanical drawings, electrical drawings etc

Architectural drawings show plan of the site, location of the building ,existing and finished grade ,elevators and general sections ,roads and walkways, consecutive floor plans ,roofplan,schedules of doors,windows and finishes ,interior and exterior details,wall sections etc.

Structural drawings show the layout and size foundations, framing plans,structural sections and details ,columns, beams and slabs.

Mechanical drawings delineate a site utilities drawings showing incoming water supply service ,fire hydrant, underground water piping system ,storm water and sewer line networks plumbing drawings, medical gas system, ventilating and air conditioning system ,hot and cool water piping system ,equipment schedules ,and system and fixture schedules.

Electrical drawings show diagrams of electrical feeders , point of entry of incoming power in to the building ,locations of electric panels, plans of lighting ,power and special systems, fixtures, items of electrical equipment ,requirements of receptacles ,nurse call system ,intercommunication system ,static electricity shielding ,special grounding and fire alarms.

Documents

Tender Documents

These are the documents and forms by means of which the contractors bid on the building construction work ,that is the owners invite the tenders for construction work and the contractors make an offer to carry it out at a stated price .
The various sections of the tender documents are indexed and bound in a book form with a title page and a table of contents .they generally include notice inviting tenders ,special instructions to bidders articles of agreement ,tender for general and specific conditions f the contract ,technical specifications, bill of quantities, tender drawings and appendix .The appendix consists of subsections specifying the date of commencement ,date of completion , EMD ,mobilisation advance payable ,rate of recovery of mobilisation advance ,defects liablity period ,value of interim bills ,penalty and bonus clause ,retention amount and release of retention amount.
Contract Documents

- It legally binds the contractor to construct the building according to approved plans and specifications
- It sets a time by which the building should be completed and turned over the owners
- It provides for penalties for delay in construction beyond the stated time .it may also provide ,if the owners so desire ,for incentives or reward if the

work is completed before the specified time

- It places the contractor under the supervision of the architect as far as the construction of the building according to the plans and specifications is concerned
- It provides for payment of portions of contract money at specified stages f construction after the architect has certified the completion of the work
- It makes provision for conditions of insurance and specifically states the amount of insurance that the contractor must carry .the owners must however ensure the necessary insurance is carried at all times and not allowed to lapse.
- It provides for correction of works performed by the contractor such as substandard work, defective construction, deviations from the plans.
- It provides for the rectification of any defective work or defective material supplied by the contractor during the defect liability period. in the event of the contractor not responding during the specified period , it makes it possible for the owners to get the same done by another qualified contractor at the risk and cost of the original contractor
- It provides for conditions under which the owners or the contractor may legally terminate the contract before the project completed
- Finally the contract provides for the completion of the building and its being taken over by the owners.

Review Questions

1. Describe the Relationship between demand and Need
2. Enumerate the factors influencing hospital utilisation
3. Explain Bed Planning
4. Explain Land requirements
5. Discuss project cost
6. Explain the types of drawings
7. Discuss how the documents are useful in planning

UNIT IV
BUILDING REQUIREMENTS

Building Requirements

Circulation Areas – Circulation areas such as corridors, entrance halls, and staircases, in the hospital buildings should not be less than 30 per cent of the total floor area of the building.

Floor Height-The height of all the rooms in the hospital should not be less than 3.00m and not more than 3.65m, measured at any point from the surface of the floor to the lowest point of the ceiling. The minimum head room such as under the bottom or beams, fans and lights shall be 2.50m measured vertical under such beam, fan or light.

Room shall have for the admission of light and air, one or more apertures such as windows and fan; lights opening directly to the external air or into an open verandah. The minimum aggregate areas of such opening (if the window is partly fixed, the openable area should be counted), excluding doors inclusive of frames, shall be not less than 20 percent or the floor area in case such apertures are located in one wall and not less than 15 percent of the floor area in case such apertures are located in two opposite walls at the same still level.

The architectural finishes in hospitals shall be of high quality in view of maintenance of better hygienic conditions specially in sanitary blocks. Flooring in sanitary blocks should preferably be done with marble or polished stone or dado or glazed/ceramic finish given on wall.

The design of building shall ensure control of noise due to walking movement of trolleys and banging of doors, etc. Expression joint should have a non-metallic beading finish. The doors should be operable on both sides in operation theatre while inside at other places.

Sanitary fitments – The requirements of the sanitary fitments shall be in accordance with 17.1 of IS 10905 (part I) 1984 Recommendations for basic requirements of general hospital buildings: Part 1 Administrative and hospital services department buildings.

Entrance And Ambulatory Zone

Physical Facilities – The entrance and ambulatory zone of the hospital should have the following facilities:

- Reception and registration
- Clinics for various disciplines (examination and work up consultation)
- Pharmacy
- Nursing station
- Casualty/emergency
- Supporting facilities

Reception, Registration and Entrance – The area serves as waiting area for the patient before getting registered and for the attendants who wait for the return of the patients. Adequate toilet facilities may also be provided close to it.

Clinics for various Medical Disciplines – These clinics include general medicine, general surgery, denta (optional) obstetric and gynaecology, paediatrics and family welfare. The cubicles for consultation and examination in all clinics shold provide for doctor's table, chair, patient's stool, followers setat, wash basin, examination courch and equipment for examination. The medical clinic should have the facility for cardiographic examination.

Dental Clinic (Optional) – The dental clinic may have facilities for dental hygiene and room for patient's recovery. Consultation-cum examination room should serve as combined purpose room for consultation, examination, dental surgery and treatment.

Obstetric and Gynaecological Clinical – The clinic should include a separate reception and registration, consulting cum-examination, treatment and clinical laboratory. The clinic should be planned close to in patient ward units to enable them to make use of the clinics at times for ante and postnatal care. The clinic should also be at a convenient distance from other clinics in the OPD. Antenatal patients by the undergo certain formalities prior to examination by the doctors. Therefore, clinical laboratory for the purpose is essential. A toilet-cum changing room close to treatment should also be provided.

Paediatric Clinic – The clinic should provide medical care for infants (including newborn)·and children up to the age of 12 years. Owing to risk of infection it is essential to isolate the clinic from other clinics. The clinic shall be provided with a separate dressing, treatment and immunization.

Family Welfare Clinic- The clinic should provide educative preventive, diagnostic and curative facilities for maternal, child health, school health and health education. Importance of health education is being increasingly recognized as an effective tool of preventive treatment. People visiting hospital should be informed of environmental hygiene, clean habits need for taking preventive measures against epidemics, family planning, etc. Treatment room in this clinic should act as operating room for IUCD insertion and investigation)etc.

Pharmacy (Dispensary)-The dispensary should be located in an area conveniently accessible from all clinics. The size should be adequate to contain 5 percent of the total clinical visits to the OPD in one session at the rate of 0.8m3 per patient. The dispensary and compounding room should have multiple dispensing windows), compounding counters and shelves. The pattern of arranging the counters and shelves shall depend on the size of the room. The medicines which require cold storage and blood required for operations and emergencies may be kept in refrigerators.

Nursing Station for Ambulatory zone – The nursing station shall be centered in such a way that it serves all the clinics from that place. The nursing station should be spacious enough to accommodate a medicine chest, a work counter for preparing dressings, medicines, sinks, dress tables with screen in between and pedal operated bins to hold soiled material.

Casualty / Emergency – The emergency cases may be attended by OPD during OPD hours and in inpatient un its afterwards.

Supporting Facilities- Various clinics under OPD required supporting facilities which include waiting spaces, medical records and injection room. A social worker room to render service to patients may also be provided.

- Waiting Space – General waiting per clinic and subsidiary waiting spaces are required adjacent to each consultation and treatment room in all the clinics.
- Medical Records – It is desirable to maintain the medical records of the outpatients in continuation of registration area.
- Injection Room – For administering injections to patients a central injection room shall be provided in conjuction with the dispensary.

Diagnostic Zone

Clinical Laboratory – The clinical laboratory should be provided with 600 mm wide and 800mm high bench or length about 2m per technician and to full width or room for pathologist in-charge of the laboratory. Each laboratory bench shall have laboratory sink with swan neck fittings, reagent shelving, gas and power point and under counter cabinet. Top of the laboratory bench shall be of acid alkali proof material.

- Sample collection Room – for quick diagnosis of blood urine, etc. a small
  sample collection room facility may be provided
- Bleeding Room – Blood taking also requires a comfortable reception with toilet. Bleeding room should quiet and not a thoroughfare and should be divided into cubicles for privacy. A rest room shall also be provided for donors to rest and take light refreshment before returning home.

Imaging

General – The role of imaging department should be radio diagnosis. Radiology is a fast developing technique and the department should be designed keeping in view the future scope or expansion. The department should be located at a place which is easily accessible to both OPD and wards and also to operation theatre department.

As the department deals with the high voltage presence of moisture in the area should be avoided. Radiography is a device of making pictorial records by means of X-ray on sensitized film whereas fluoroscopy is direct visualization through the medium of X-ray.

Radiology Fluoroscopy Room – The size of the room shall depend upon the type of equipment installed. The room should have a sub waiting area with toilet facility and a changing room facility,if required. Fluoroscopy room shall be completely cut off from the direct light through provisions of air locks. The radiography units should be operated from separate control room or behind a lead mobile protection screen of 1.5 mm lead equivalent wherever necessary.

Film Developing and Processing Room – Film developing and dark rooms shall be provided in the department for loading, unloading, developing and processing of X-ray films. The room should be provided between a pair of radiography rooms so that new and exposed X-ray films. The room should be provided between a pair of a radiography rooms so that new and exposed X-ray films may be easily passed through the cassette pan with 2.0mm lead backing installed in the wall in between. The room should be completely cut off from direct light through provision of airlock. For ventilations, exhaust fans shall be provided. The room shall have a loading bench (with acid and alkali resistant top) processing tank, washing tank and a sink flooring for the room shall be acid and alkali proof.

Film Drying and storing – There shall be some space available for film drying and storing near the room of film developing.

Treatment Room – Treatment room of the department shall include space for the infra X-ray and contract thereby apparatus which is of simple character, occupies little space and may not need elaborate structural requirements.

Ultra sound – Ultra sound, a scanning device of imaging department also requires a small room for use mainly by gynaecology and obstetric clinic.

Intermediate Zone (Inpatient Nursing Units)

General – Inpatients Nursing Units, that is ward, concept is fast changing due to policy of early ambulation and in fact only few patients really need to be in the bed. The basic considerations in placement wards is to ensure sufficient nursing care locating them according to the needs of treatment in respective medical discipline and checking cross infection. In this case there should be two ward units, one for male and one for female.

Ward Unit – In planning a ward the aim should be to minimize the work of the nursing staff and provide basic amenities to the patients within the unit. The distances to be traveled by a nurse from bed areas to treatment room, pantry, etc. should be kept to be minimum. The ward unit may be made of desired number of beds at the rate of 7m2 per bed and should be arranged with a minimum distance of 2.25m between center of two beds and a clearance of 200mm between the bed and wall. In wards the width of doors shall not be less than 1.2m Isolation unit may be provided to cater for certain case requiring isolation from other patients. An area of 14m2 for such room to contain a bed, bedside locker, easy chair for patient, a chair for the visitor and a built in cupboard for storing clothes is recommended. This isolation unit should have separate toilet facilities.

Type of Ward – Wards may be either nightingale or rigs type. In the former, beds are arranged at right angle to the wall with the feet towards the central corridor, and in the latter 4 to 6 beds are arranged parallel to the longitudinal walls and each pair of beds facing each other. A rig type ward is recommended from socio environment stand point.
General Ward Facilities – Each Ward unit should have a set of ward ancillaries as given below:

- Nursing station
- Treatment room
- Ward pantry
- Ward store
- Sluice room
- Day space
- Sanitary

Nursing Station – It should be positioned in such a sway that the nurse can keep a continuous watch over the patients. The room shall contain a cupboard to hold material which might otherwise be placed in clean utility room; a drug cupboard sink, chair, small table and space for all system points and records. Separated toilet facilities for nurses shall be provided.

Treatment Room – Major dressing and complicated treatments should be carried out in the treatment room to avoid the risk of cross infection.

Ward Pantry – For collection and distribution of meals and preparation of beverages, a ward pantry shall be provided it should be fitted with a hot water supply geyser, refrigerator and a hot case and should have the facilities for storing cutlery etc.

Ward Store – A store shall be provided for storing the weekly requirements of clothes, bed sheets, and other ward equipment

Sluice Room – A room shall be provided for emptying and cleaning bed pans, urine bottles, and sputum mugs, disposing of used dressing and similar material, storage of stool and urine specimen etc.

Day space – For those patients who are allowed to sit and relax, a room shall be provided in the ward unit itself. It should afford an easy access to patients and supervision by the nursing staff and should be provided with easy chairs, book shelves and small tables. It may also serve as dining space.

Sanitary – The sanitary requirements of an Intermediate zone' are given below:

Item	Number Required
Water Closets	2 (for male ward) 3 (for female ward)
Ablution taps	1 for each water closet plus 1 Water tap with drainage arrangement in theVicinity of water closets.
Urinals	2 (for male ward)
Wash Basins	2 (each ward)
Baths	2 (for each ward)

Sinks/slab for cleaning Mcintoch	1 (for each ward)
Kitchen sinks anddishwashers	1 (for each ward in ward pantry)

Critical Zone (Operation Theatre/Labour Room Department)

General – Operating suite / labour room is technically a therapeutic aid in which a team of surgeons, anaesthesists, nurses and sometimes pathologist and radiologist operate upon or care for the patients. For optimum utilization of the operation/labour room units, this department, as a rule should not be reserved rigidly for use by a particular department.

Circulation – Normally there are three types of traffic flow, namely (a) patients (b) staff, and (c) supplies. All these should be properly channelized.

(a) Patients - Patients are brought from the ward and should not cross the transfer area in their ward clothing which is a gret source of infection. Changeover of trolleys should be effected at a place which will link up both preoperative and postoperative rooms.

Preparation Room (Tehatre Pack) – It should be a work room for arranging for stretchers, dressing and all other surgical items.
Preparative Room – Patients are transferred from respective ward to the room for pre medication before operation segregation of male and female patients is to be taken care of the room should have toilet facility separately for men and women.

Postoperation Resting – Immediately after the operation, the patients are kept in a room situated close to the operation theatre/labour room until such time they are found fit to be taken to their parent ward.

(b) Staff – The doctors, nurses, technicians and assisting staff should enter from a separate route and through a set of change rooms and an air lock. They should communicate through the sterile corridor. A shoe

change and gowning space near the air lock shall also be provided. Separate change rooms for doctors, nurses and technicians shall be provided with arrangements for lockers, bating and toilet facilities.

(c)Supplies – All sterile goods should have a separate entry point reaching the clean corridor independently, soiled material should be taken out by the exit only. Store rooms shall be provided for storing theatre supplies, such as stretcher, trolley, sterile material, medical gas cylinders, instruments and linen.

Operation Theatre / Labour Room – Operating room / labour room should be made dust proof moisture proof, corners and junctions of walls, floor and ceiling should be rounded to prevent accumulation of dust and to facilitate cleaning. Ali doors should be two leaf type with a minimum 1-5m width and shall have self-closing devices. Natural lighting shall be provided with large windows and general illumination by means or fluorescent tubes. The operating room/labour room should be normally arranged in pairs with scrub up and instrument sub sterilizing room.

Scrub up – In this room the operating team wash and scrub up their hands and arms, put on their sterile gown, gloves and other covers before entering the operation theatre/labour room. It should have a single leaf door with self closing device and viewing window to communicate with the operation theatre/labour room. A pair of surgeons sinks with elbow or knee operated taps are required.

Instrument Sterilization – It is sub sterilizing unit attached to the operation theatre/labour room. A pair of surgeons sinks with elbow or knee operated taps are required.Disposal Theatre refuse, such as dirty linen, used instruments and other disposable/non disposable items should be removed to a room after each operation. Non disposable instruments after initial wash is given back to instrument sterilization unit and rest of the disposable items are disposed and destroyed. Dirty linen is sent to laundry through a separate exit. The room should be provided with sink, slop sink, work bench and draining board.

Services Zone

Dietary service (optional) – The dietary service of a hospital is an important therapeutic tool and it is properly rendered. It shall be a clinical and administrative means of stimulating rapid recovery of patients hereby shortening patients, stay in he hospital. The aim in hospital catering, therefore, should be to produce well cooked, appetizing and nutritious food as economically as possible. The achievement of this objective shall depend on administrative efficiencies of the staff planning department, layout and equipment. The hospital kitchen alone could be responsible for spreading diseases if hygienic conditions are not maintained use of cooking gas and electricity will definitely improve the hygienic conditions of a hospital kitchen. Good natural light and ventilation is of great importance.

Central Sterlization and supply Department (CSSD) – Sterilization, being on of the most essential services in a hospital, requires the utmost consideration in planning. Centralization increases efficiency, results in economy in the use of equipment and ensures better supervision and control. The material and equipment dealt in CSSD should fall under three categories) a those related to the operation theatre department (b) common to operating and other departments, and (c) pertaining to other departments alone.

Laundry Services – Laundering or hospital linen shall satisfy two basic considerations, namely, cleanliness and disinfection. The hospital could be provided with necessary facilities for drying pressing and storage of soiled and cleaned linens.

Administrative Zone

General Administration – The administration department of hospital shall essentially look after organized group of people, patients and resources in order to accomplish the task of providing best patient care. It shall have two main sections, namely general and medical records.

General section shall deal with all matters relating to overall up keep of the hospital as well as welfare of its staff and patients. Medical records section shall function for professional work in diagnosis, treatment and care of patients.

General stores – Hospital stores comprise of stores need for various hospital functioning and should be grouped centrally in he service complex. The area for each type of stores should be utilized to the optimum by providing built in shelves at different heights according to the type of stores. Adequate ventilations and security arrangement shall be provided. Stores should also be provided with fire fighting arrangement.

Review Questions

1. List the Building Requirements
2. List the facilities required for the entrance and ambulatory zone of the hospital
3. Explain Diagnostic zone
4. Explain Ward Unit Of The Intermediate Zone
5. Explain the circulation of the critical zone
6. Enumerate the departments of service zone
7. List the requirements of Administrative zone

UNIT V
FACILITIES PLANNING

Transportation

Transportation within the health care industry is a function that is sometimes not considered as important as more clinically related functions. Health care professionals sometimes perceive that transportation is external involving trucks, vans, and so on or that movement within a facility is largely supportive service oriented and does not involve direct patient care however these perceptions are incorrect .the fact is that transportation is a visible and important function that can alter direct patient care in many ways.
The transportation function in a hospital is actually a utility available to many customers and users including patients ,nursing staff ,medical staff ,other hospital staff ,administration and so on.

Type of Transportation

Transportation can be defined in either an inter or intrafacility sense. Interfacility transportation refers to movement between facilities .generally conducted by vehicles (either over the road or via horizontal connections)examples

- Over the road trucks
- Monorail material handling system
- Guided material handling vehicles and systems
- Car-on- track systems

On the other hand, intrafacility transportation refers to movement within healthcare facilities ,usually through hospital corridors and vertical transportation utilities such as elevators

- Monorail material handling system
- Guided material handling vehicles and systems
- Car-on- track systems

- Manual systems inwhich hospital staff physically move vehicles(carts,pallets,wheelchairs,strechers)

Transportation workshop

Hospitals normally maintains a large number of vehicles ranging from cardiac and intensive care ambulance to a scooter for a dispatch rider for the maintenance of these vehicles a transport workshop is necessary. The size and the sophistication of the work shop will depend on the number of vehicles which in turn will depend on the size of the hospital

The transport workshop will be under the hospital engineering department .depending on the requirement, the hospital workshop will have adequate area for repairing of vehicles as for the surviving of the vehicles. It will also have provision of a small spare part store.
As head of the transport workshop, the hospital engineer will ensure that :

- The vehicles stay road worthy
- Issue petrol, oil and lubricants.
- Surprise checks of petrol consumption
- Nominate a driver who will bring to his notice, repairs that may be required
- Sanction the spare parts in accordance to the hospitals purchase and issue policy
- Will ensure that vehicles are suitably serviced at recommended intervals.

Communication

Definition: Communication is mutual exchange of facts, thoughts and perception result in common understanding of all the parties or Communication is the creation or exchange of understanding between sender and receiver.

Importance of Hospital communication

- Effective Hospital Communication is important because it helps in
- Organing and coordinating, efficient and effective patient care.
- Establishing and disseminating the goals of the hospital.
- Developing plans for the achievement of the laid down goals
- Organising human and other resources required for achieving the objectives of the hospital in an effective way
- Clarifying tasks, responsibilities, identifying authority positions and producing accountability of performances
- Selecting, developing and appraising the hospital employees.
- Providing data necessary for decision making
- Organising and developing good public relations and building a good image in the community

In short effective communication is

The life line of the hospital

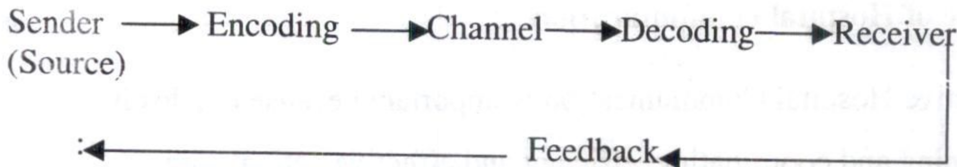
The source of good understanding

The vehicle for motivation and morale

The basis for good decision making

Communication process

Communication activity can be diagrammed easily as seen in the model presented



Communication Model

Source : The process of communication begins with the source. the source sender can be an individual ,a number of individuals or even a machine .the sender initiates communication because he has some need ,thought, idea or information that he wishes to convey, the quality of the message depends upon the nature of the idea generated.

Encoding : the idea is encoded into suitable words ,charts, or other symbols which would transmit the message in suitable fashion. Encoding of the idea produces a message which can be either verbal or non-verbal.

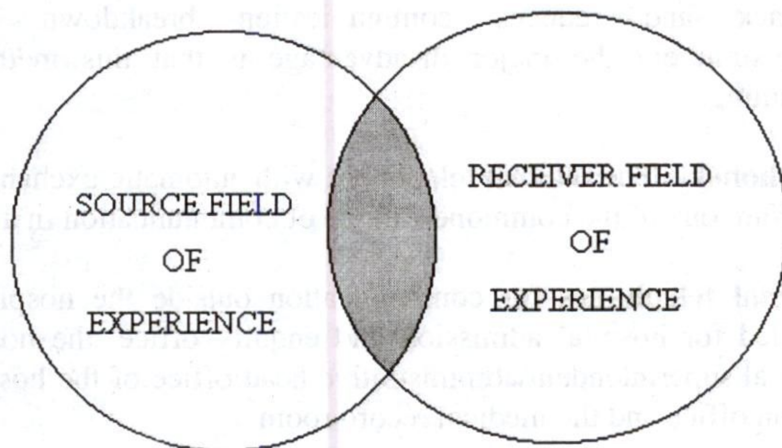
Channel : Once the message is ready ,it is then transmitted through a media or a chosen method .A chaanel is the link that joins the sender and the receiver.in the hospital setting the channel could take the form f face to face conversation ,written memos, telephones, group meetings, pagings, circulars, magzines, computers ,cctv, etc for effective hospital communication the channel used should be appropriate for the message aswell as the receiver.

Decoding: The receive has to decide the message so that its meaning is not destroyed and the message is understood. A successful communication can occur only when the receiver decodes the message and attaches the same meaning to it which was intended by the sender.

In order to ensure congruence between the encoded and decoded message, it is necessary to develop a greater degree of homogenity between the sender and the receiver, both of whom have their own fields of experience .the field of experience constitutes an individuals attitudes, experience, knowledge, environment and socio-cultural background .The greater the overlap of the fields of experience between the

sender and the receiver ,the greater will be the probability of effective communication.

the hospital setting ,where there is congiomeration of various number of individuals which differing fields of experience , it is the responsibility of the sender to adjust his field of experience to that of the receiver for achieving successful communication .



Illustrates The Field of Experience model

The greater the shaded area of the overlap the higher will be likelihood of successful communication.

Feedback: Is the return message which is transmitted in the opposite direction. It is the message which indicates the level of understanding or agreement between the sender and receiver.

Channels\Mode Of Commnication In Hospitals

The channels of communication are simply the means by which the message is conveyed.the choice of the channel depends upon the nature, importance and urgency of the message as well as the situation.

Various modes \channels of communication in the hospital are briefly described below

Verbal communication : It is a very effective mode of communication.it leads to better understanding and better team work.Verbal communication in hospital is generally effected through the following means.

Person to person - person to person communication provides immediate feedback and reduces communication breakdown of course, administratively the major disadvantage is that this method is time consuming.

Telephones – The internal telephones with automatic exchange or with a PABXare one of the commonest mode of communication in a hospital.

External telephones for communication outside the hospital must be provided for hospital admission and enquiry office ,the hospital stores ,medical superintendent\administrative head office of the hospital, public relation office and the medical record room.

Intercom for prompt communication certain hospital areas must be connected with the system of intercoms. Most vital areas should be grouped together like medical superintendents ofice,admission and enquiry office, hospital stores, nursing superintendent office etc.

Radio paging system new innovations in communication technology have brought about revolutionary change in hospital communication that make it possible to contact anyone.the typical radiopaging system configuration includes the following equipment
Encoder, Transmitter, Omni directional antenna, and pagers

Public Address System. Provision must be made for public address system in certain areas of the hospital especially in the outpatient departments and day care surgery units.such a system is handy in hospital parking lots.

Written communication: Written messages are the most formal communication means in that they inherently convey a degree of authority often not present in other forms. additionally the formality of a written communiqué often gives the message greater importance than if it were delivered verbally. Some examples of written communication in the hospital are

Sign posting : Within the hospital which direct and guide the public to the various areas of the hospital.

Hospital Bulletin :which is in the form of an inhouse comminique / newspaper that not only educates the employees but also the public bout the occurrence of events, research and the facilities available n the hospital from time to time.

Annual reports : Which summarise the operational highlights of the year just past, and enlightens the reader on the improvements, positive achievements as well as the set back and problems being faced.

Charts/Posters giving:
Do's and don't's
General information on facilities.
Health education message

Audio Visual Aids for communication within Hospital

Audio visual aids like CCTV can be generally utilize in the hospitals for

- Public Information
- Health education
- Teaching Purpose

These can be used to good effect in OPDs where patients have to wait for some time before being seen by the doctors .in Indian scenario CCTVs are more beneficial because more often than not each patient is accompanied by at least one or two relatives/friends .In operation theatre CCTV s can be used for

teaching/demonstrating surgical procedures to trainees/residents without their crowding around the patient to the table, and increasing the risks of incidents and infection .Audio visual aids accomplish the following

- They make learning more permanent
- They develop a continity of thought
- They have a high degee of interest
- They offer a reality of experience

Other channels of communication in Hospitals

- **Through Computers** : with the advent of information technology it is prudent to assume that future planning of hospital s will have to incorporate computers as one of the means of communication .the computer terminals has to be installed in a number of areas in a hospital. A local area network of computers will have to be set up in most of the large hospitals is not too distant a future. Computers serve as the means of easy and quick storage and retrieval of informations .all nursing stations,special care areas ,laboratories and departments can now easily commnicate with each other throgh the computers installed in their respective areas.

- **Self Example:** This is an effective and silet way of communicating to others .consider he case of the head nurse who announces to the other employees That because of a temporary shortage of personnel every one existing staff will have to pitch in and do more work.in setting the example she began showing up an hour early and going an hour late .once the employees became aware of this they rallied behind he and helped in that way as well .by setting the example herself the head nurse was able to communicate more effectively the need for extra effort.

Food Service Department

The mission of Food Service Department is to promote and maintain health through encouragement of adequate and appropriate nutrition intake of individuals and groups

Hospital food service is specialty and merits special consideration.it is unique and complex requiring trained personnel . the demands on a hospital kitchen or dietetics department are complex because of the type of clintele, the treatment regimens, medication, infection and type of service required .Hospital diets may be general or therapeutic but they are special in as such as they are served to individuals suffering changes in their physical conditions are placed under abnormal or extraordinary circumstances.

The Functions of a Department

- Preparation and service of adequate ,wholesome and appetizing food to patients and personnel.
- Planning, calculation, preparation and service of therapeutic diets
- Nutrition education and diet counseling

All areas of practice in hospital dietetics service include a management component .Management can be defined as the art of bringing together available resources including the abilities of different people and organizing them is scientific and orderly manner ,to achieve the desired goals of the organisation. the resources available to a hospital kitchen manager include money, personnel, food and physical facilities.

Resources are always limited and for an establishment to survive in its ever changing and competitive environment ,resources need to be utilized to their maximum.

Physical facilities

A Kitchen is designed as an area where food is received, stored, prepared and cooked prior to its presentation to the customer .it will also provide garbage

disposal, pot washing and dishwashing. good lighting and ventilation correct working heights and lighting sensible mechanical aids together with adequate Staff facilities will result in better efficiency .the sequence of operations to be carried out in a kitchen should proceeds forward in an orderly manner with the minimum of backtracking and cross traffic.the equipment and workers should be so related that the workers and the materials do not have to move over unnecessary distances. The overall kitchen area may be related to the number and type of meals to be prepared ,ranging from 2 to 6 sq.ft.per meal served.

The suggested space requirement for hospital dietaries are

200 or less

....

20 sq. ft. per bed

200-400

....

18 sq. ft. per bed

500 and above

....

15 sq. ft. per bed

Average recommended height for work areas are

Work surface 80-100cms
Sink top 90-100cms
Highest shelf for general use 180cms

Structure features of the kitchen are also important these include drainage, electricity, gas connection, water supply, and finish of walls, ceilings and work surfaces. the efficiency of drainage system determines the hygiene and sanitation of the kitchen to a large extent .all drainage inlets should be fitted with grease traps and should be atleast 10-15cms in diameter .schedules for kitchen maintenance should be drawn up by the food service manager for the efficient functioning.

In hospital kitchens, space must also be assigned for either preheating bulk food charts or for an assembly line where individual meal trays may be set up.

Food Resource Management

This is the function responsible for the coordination of planning, sourcing, purchasing, moving, storing and controlling food materials in an optimum manner so as to provide a predetermined service to the customer at the minimum cost. the ability to mange these activities smoothly and effectively is known as food management the process may looks simple but requires skill and initiative at every step. it also requires the knowledge of foods, market and customer. whatever type of form,in which ingredients are used,it is important to maintain the quality of food.
Quality not only includes palatability but also wholesomeness or food safe for consumption .standards must be set for each of the factors determining " acceptable quality" like quantitative , sensory and nutritional and this has to be controlled at every stage of the production cycle.
The 'MENU' is the blue print of operation in any catering establishment .the nutrition value of food and its suitability for the resident client group is determined by the menu. the main elements to be considered in good menu planning are your client and your situation .the menu must be reviewed regularly

A brilliantly planned menu is worthless if the food is stone cold or unpalatable when it arrives at the patient bed side.the kitchen manager needs to be in control of entire 'food chain'

Supplies > Stores > Kitchen > Distribution > Patient

Purchase and storage

Food purchase should be appropriate ,of acceptable quality, and within the food budget .Standards for each item should be specified to obtain maximum value for money spent. weight or volume should be as specified in the invoice or delivery challan.

The purchased food items have to be then stored appropriately .the management of stores is an important step in ensuring good quality, wholesome and nutritionally optimal food is available .secure inventory control is a key part of overall budget management.

Recommended storage temperatures

Dry provision	21° c (70° F)
Fresh fruits, salads, vegetables	4-6 ° c (39 ° -43 ° F)
Dairy products, vegetables	2 ° c (35 ° F)
Fats and oils	4 ° -7 ° c (29 ° -45 ° F)
Meat or fish	-2 ° c to 0° c (28 ° F)

Food service

The service of food is an art and represents the manner as well as the atmosphere in which food is presented to the customer. Good service represents clean serving, properly selected serving equipment , and well behaved neatly dressed and pleasart serving staff . in hospitals the type of service followed for patients is the tray service where meals with the necessary accompaniments in individual portions are served on trays and loaded on to delivery carts. the food service may be centralized or decentralized or a combination of the two . the type of service selected will depend on the type of hospital ,type of diets, clientele and budget .the ultimate objective is that the food be of good quality and attractively served of correct temperature , safe , and with in the food budget.

Hospital catering has its own problems which often make it very difficult to provide correctly served meals ward are sometimes spread over a wide area ,food may have to travel a long distance and meals are strictly timed .also patients must have a choice of food and that choice should be exercised as close to the time of service as possible .food must be distributed as quickly as possible. Hot holding of food has disastrous consequences for its nutritional values, its

appearance , and its taste, must be kept to a minimum. The timings and logistics of distribution must be carefully planned and monitored.

Dish washing

Management of food preparation is not complete without attention to the function of cleaning .adequate facilities and arrangements have to be made for waste disposal ,washing of cooking utensils, cleaning of equipments, and sanitizing of trays are utensils used for the patient service .all cleaning involves the use of hot and cold water adetergent or scoring powder , and something to scrub with .the nature of these equipments affect the quality of the wash .suggested temperatures of final wash water is 77 ° - 82 ° c (171 ° – 180 ° F) for 2 minutes.

Mortuary

Mortuary is a place where dead bodies are kept . in a hospital where there are indoor beds ,such a provision is essential because when deaths occurs it is the duty of the hospital to deal with it as per needs of the society and the law. Thus a hospital mortuary, dead bodies of persons dying in the hospital are kept and preserved properly, before being handed over to the relatives of the deceased usually dead bodies from the wards are sent to the mortuary together with death certificates and the relatives of the deceased contact mortuary to take charge of the dead body,.in certain cases there might be a considerable time lack between reaching of a dead body from ward to the mortuary and handing over the same to the relatives.it is the responsibility of the hospital concerned that such dead bodies are preserved properly and destroyed because of vagaries.of nature such a need of a proper storage in cold storage places arises.not only this hospital authorities have also to see that no mix-up occurs and a particular body is handed over to its rightful heir / relatives /organisations for a last rites.

Locations

The site of the mortuary should be selected mainly after taking an account of light ,air and isolation. Mortuary should be located at either at one end or slightly away from main hospital building, but never be around the refused dumping area

of the hospital . as could be seen in any hospital, lot of activities occur in a mortuary and relatives visit the area during their distress period ,it becomes imperative on us to give pleasant surroundings to this structure .thus a mortuary be located in pleasant surroundings having trees etc. for shade to the relatives visiting mortuary
It should be taken care of the mortuary block is not directly overlooked by the pavilions or balconies of the ward . in modern hospitals , it is the rule to have sub- terranean approaches to mortuary building. Which connect the dead hose with all the departments and with the ward, so that a corpse can be wheel into the post mortem without attracting attention

Functions

Mortuary is generally used for the folowing

- To keep deadbodies,till these are claimed by relatives.
- Viewing and identification of dead bodies by relatives and friends
- To keep unclaimed dead bodies , which may be later cremated or handed over for studies and research
- Dead bodies requiring pathological postmortem
- For keeping dead bodies of medicolegal cases for postmortem and handing over
- Demonstration of autopsy to medical students

Physical facilities

The space requirements and the provision of physical facilities will depend on the location and type of hospital. in general adequate space should be provided to accommodate the following areas

Space for keeping the dead bodies at one per cent of bed strength'
- Postmortem rooms as required, 40 sqm , 2 postmortem tables,15 sqm for each additional table
- Viscera rooms for preserving samples before sending to pathology laboratory.12sqm
- Doctors room 12sqm

- Staff room 12sqm
- Changing and dressing rooms with basin , WC, Shower facility 12sqm.
- Stores 12sqm
- Waiting halls for relatives 15sqm
- Conference room in teaching hospitals
- Drinking water, Toilets, benches etc.
- Police room

In addition in any mortuary structure , place for religious services be always provided. It is a wellknown fact that before taking away a dead body for cremation or burial, relatives perform certain religious rites with the dead body.

Size and spatial Requirements
Tnese depends upon the following

- Type of the hospital whether it is acute or chronic care and whether it is teaching or non-teaching.
- Total no of beds.
- Anticipated annual death rate which is generally taken to be around one death per bed per year.
- Autopsy percentage which should be minimum 25 % in a teaching hospital for teaching purposes.
- Recognisation of a hospital for postmortem purposes

The above factors will also determine the spatial requirements , but as a general rule BIS has laid down a standard of 0.70 sq.m / bed. whereas COPP suggests 0.86 sqm / bed.

Equipments

Like any other departments the normal functioning of department depends on provision of various specialised equipments, though the small hospitals may require only space and mortuary chambers with arrangements to keep the mortuary temperature regulated around 4 ° c- 6 ° c, while for a teaching hospitals additional equipments may be required to carry on postmortem and other works with in the mortuary i.e

- Postmortem table
- Autopsy table
- Mortuarychamber
- Bone and Meat cutting (saw)
- X-ray machine with dark room
- Thin layer Chromatography kit
- Gas liquid chromatography
- High pressure liquid chromatography
- Spectrophotometer(U.V)
- Histopathology auto
- Cold room

Hospital Information System

A hospital conducts a wide variety or range of activities in which an application of technology may be great use. computers can create new patterns of decision making or introduce new type of decisions that could never have been made before the advent of computers .by reducing redundancy of information while improving its accuracy and timeliness , computerization provides a tremendous opportunity for hospitals to improve operations at lower cost.

The introduction of information technology in the hospital environment has paralleled an increased need for timely and accurate data from various sources ,technological innovation , and a growing awareness of the need to integrate all information systems under a uniform umbrella of hospital information system .the sheer amount of data in hospital operations calls for a need to implement an administrative and patient related data retrieval and analysis system summarize data into reports and assists in medical and administrative audits and utilization reviews.the ability to store and retrieve accurate ,timely and consistent data ,effectively report those data, and allow transferability of data to other applications within a hospital environment is valuable for effective management of hospital and patient care.

Hospital Information system (HIS)

HIS provides the required information to each level of the management at the right time ,in the right form, and in the right place ,so that the decisions are made effectively and efficiently .HIS plays a vital role in planning ,initiating, organizing and controlling the operations of the subsystems of the hospital and thus provides a synergistic organization in the process .His can improve patient care by assessing data and making recommendations for care, and it can enable a hospital to move from a retrospective to a concurrent review of quality and appropriateness of care.

The Objectives of HIS

HIS aids a hospital in achieving a greater operational efficiency and control of information –oriented tasks in administrative and patient care areas .A well designed integrated HIS ,tailored to the specific needs of a hospital ,can improve the productivity of a hospitals staff ,allowing each department and service centre to control its own information processing and contribute to the quality of patient care.

Need for HIS

The need for HIS arises from the following factors

- Complexity of the hospital as an organization
- Scarcity of resources
- Prolific information generating organization
- Cost effectiveness of the services
- Increased quality of information and
- Medical research.

Description of a Hospital Information system in terms of the main information Entities

<table>
<tr><td colspan="3">Clinical Subsystems :Patient Central Patient Record</td></tr>
<tr><td>Medical Information</td><td colspan="2">Medical-administrative Information</td></tr>
<tr><td>Diagnostic
• Laboratory
• Radiology
• Nuclear Medicine
• EEG, ECG, EMG, respiratory

Therapeutical
• Operation History
• Radiotherapy
• Intensivecare
• Physiotherapy
• Nursing
• Medication</td><td>Admission data
• patient demographic data
• Orders
• Planning and appointment data
• Patient diets
• Material delievers</td><td>Real-Time -> Short-Term</td></tr>
<tr><td colspan="3">HOSPITAL: COMMUNICATION SYSTEM- RESPIRATORY SYSTEM</td></tr>
<tr><td>• General accounting
• Accounts receivable
• Accounts payable
• Personnel data
• Loans and salaries
• Inventories</td><td>• Case Mix
• Resource allocation data
• Simulations / Models
• Retrospective utilization data
• Cost / quality information</td><td>Mid to long term -> Future</td></tr>
<tr><td>Financial Information</td><td colspan="2">StrategicInformation</td></tr>
<tr><td colspan="3">Management subsystem : Hospital Central</td></tr>
</table>

Design Objectives of a hospital Information system

Functions of HIS

His acts as a transaction system , and a control reporting system, and helps in operational planning and strategic planning in a better way.

Applications of HIS

- External information system – demographic, mortality, morbidity data.
- Internal information – patient care systems (record keeping ,clinical laboratories,radiology,cardiology,nursing services, pharmacy services, Intensive care monitering,imaging,nuclear,medicine,clinical information monitering,clinical evaluation and research).
- Administrative and financial information system , including material management.
- Strategic management (budgeting,medical care evaluation , services utilization data).

STAGES OF COMPUTERIZATION

1. Initiation
    - Introduction of computers
    - Encouragement of users
    - Users' resentment.
    - Simple accounts type applications
    - Centralized data processing division
2. Contagion
    Enthusiastic users
    Development of applications required
    Free computing to users
    Expenses termed as overhead expenses
    xpansion of data processing , equipment , and staff
    Management , lack of planning and control.
3. Control

- The organization takes control

- Management becomes concerned about the level of benefits versus cost of data processing
- Data processing budget is either held constant or the growth rate is sharply reduced
- Focus on giving the department a professional look
    - Planning and control systems are initiated
    - Emphasis is on documenting existing applications
    - Attempt to make the user accountable.

4. Integration
    - Integration of existing systems
    - Data processing utility functions for users are set up
5. Data administration
    - High utilization of database technology
    - Data administration functions created to plan and control the use of data
    - Users are accountable for computer resource use
    - Common integrated systems, sharing data among various functions
6. Maturity
    - Computers integrated into the management process
    - Data resources meshed with strategic planning process

HIS Design Objectives And Considerations

- Form a design team consisting of functional managers and MIS expert
- Analyze the information needs of hospital
- Set the objectives and desires characteristic for an integrated HIS
- Design the systems major characteristics.

Objectives

- Fuctionally, responsiveness, reliability, availability, flexibility, deployability, modularity, efficiency, security, ease of use , evolutionary growth and cost control.
- The selection of an appropriate design for a particular situation depends on organization characteristics ,such as hospital external and internal environment ,system objectives and design characteristics.

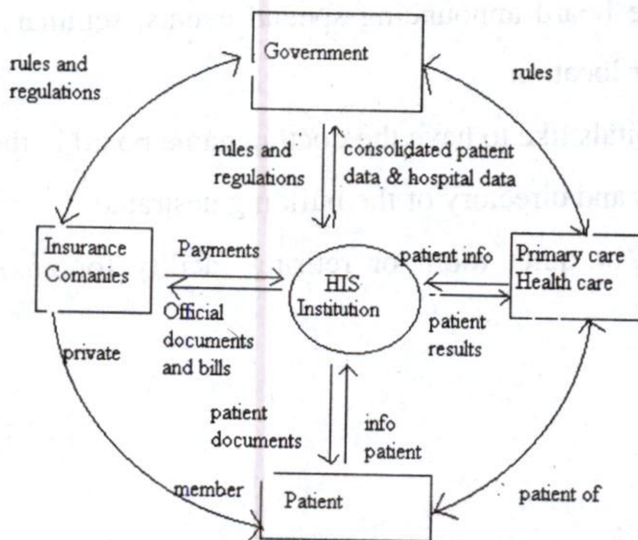
System development Life Cycle (Definition Phase)

Functional requirements and constraints are defined to reflect the specific information needs of an organization and based on these requirements, structured specifications for an integrated HIS. are set and its planned development demonstrated.

System Design (Second Phase)

Considering the diversity of needs amoung hospital departments and facilities on one hand , and the state of the art information technology on the other , disturbed architecture seems to better suit HIS environment disturbed system consists of a variety of system architecture and characteristics

Conceptual database Design
The basic need here is for a centralised database system to support co-ordinated patient care and administrative functions using combination of core data and disturbed specially oriented data at the node.



Representation of HIS and its External Links

Minor Facilities

Architects and planners generally do not fail to pay attention to major items in facilities planning what they do often miss,however are small items which escape their attention. Here's a checklist of some minor facilities

- Pay telephones in or near the emergency and outpatient departments as well as assisted STD, ISD call facilities in the lobby area or in its vicinity.
- Drinking water facilities – water cooler, aquaguard or other similar devices that provide potable drinking water should be installed.
- Alcoves for wheelchairs and stretchers.
- Doorman's post and security post if necessary
- An easy-to—follow way finding system. patients are often confronted with mazelike layouts and signs written in unfamiliar terminology. these bewildering array of signs confuse patients and visitors.
- Programme board announcing special events, seminars and conierences with proper location
- Many hospitals like to have the doctors name board in the lobby
- Floor plans and directory of the building desirable
- Meditation or quiet room or retiring facility for anxious or bereaved relatives.

Other Facilities

Admitting and Discharge Department: if there is an admitting department as such, it should be directly accessible from the main lobby. Many of the patients waiting to be admitted are physically incapacitated. The area must be designed for maximum comfort and for efficient and speed handling of patients.
Admitting and discharge should not be through the main lobby or in the midst of heavy traffic and noise. for this ,a subsidiary waiting area, a screened alcove or a sub-lounge off the main lobby adjacent to the admitting department is recommended. An alcove for wheel chairs and stretchers, out of the traffic line, is also recommended.

Main Vertical Circulation

Elevators should be easily accessible from the lobby. this is particularly important from the point of view of certain patients like emergency cases requiring surgery. Elevators should not discharge people into the main lobby but into a recess or an alcove off the lobby.

Gift shop, Book Shop and Floris's Shop

These serve useful purpose and are best located off the main lobby in a conspicuous place with adequate display space. The three shops can be combined however it is suggested to keep the florist shop separate but adjacent to the gift and book shop as it would require a sink and water connection

Review Questions

1) Describe transportation and types of transportation
2) Discuss the utility of transport workshop
3) Define communication And enumerate the uses of communication in a hospital
4) List the various channels of communication in a hospital
5) How will you plan a food service department in a hospital
6) Discuss other facilities of a hospital
7) Prepare the checklist of the minor facilities required in a hospital
8) Explain HIS and list the stages of computerization
9) What are the essential functions of a mortuary in hospital
10) What necessary physical facilities are required in mortuary of a teaching hospital

UNIT VI

SETTING STANDARDS

Standards for Hospitals

Introduction

Recognizing that the care of the sick is their first responsibility and a sacred trust, hospitals must at all time strive to provide the best possible care and treatment to all in need of hospitalization. "This clause tops the Hospital Administrators. Acceptance and application of this and other value and principles of other institutions seeking similar goals of service led to the development of definition of principles which conform to professional standards of conduct by some hospitals and comparing them with those of other institutions seeking similar goals of service led to the development of definition of principles responsibilities and standards in hospitals, ultimately encompassing almost every aspect of the hospital including hospital's design, construction, operation, maintenance and environmental safety. Standards are used to describe the broad bases and fundamental policies as well as specific details for levels of patient care.

Voluntary and Mandatory Standards

In the beginning all standards were voluntary standards which were those established without the authority of law. Imposed upon themselves of their own accord and acting in concert with other institutions which share common interest and have similar purposes, many hospitals established standards which represented a strong desire on their part to serve their patients to the best of their ability in a safe and efficient manner.

Mandatory standards are those established by the government, or by licensing or regulatory bodies under the authority of law a standard may be said

to be a measure of quality established on a voluntary basis by those who are subject to it or imposed upon them by a legal authority.

General Standards for Details and Finishes

The following are the standards for details and finishes. Some of them are recommendations, or those developed into standards over the years of people's own volition, or by convention, or by convention, not necessarily coming under one or the other of mandatory requirements. However, hospitals are urged to make every effort to attain them in the interest of good patient care.

The hospital in most sections should be so oriented as to allow a maximum of light to all parts of the building and the greatest possible exposure o prevailing winds.

- Main corridors should be 2,4384 metres (8 feet) in width with a finished ceiling height of a minimum of 2,4384 metres (8 feet). However, corridors in areas not commonly used for patient transportation in beds or stretchers may be reduced in width to 1.524 metres (5 feet). In general, corridors should be as straight as possible, but their long smooth walls should broken by projections for the sake of appearance as well as to prevent the reservation of sound.
- Where ramps are used, the slope should not exceed five per cent.
- Ceilings should be acoustically treated
- Walls should be smooth and easily washable
- Electrical outlets should be provided on the walls of the corridor for cleaning equipment, and for use of mobile e-ray. They should be spaced conveniently to reach every room without the need to use unduly long extension cords. Outlets may also be utilized for food trolleys that need to be plugged on to an electrical outlet to keep the food warm.
- It is desirable to place nurses signal lights in the corridor above the doors of the patient rooms.
- Telephone booths, drinking water facilities, vending machines and potable equipment should not be located on the corridors as they will restrict corridor traffic, or reduce their usable width.

- Floor should not be hard type. as much as employees of the hospital spend many hours on their feet, efficiency will be greatly impaired if the floor is hard. On the other hand, soft and smooth floor like that of vinyl or linoleum is resilient, at the same time makes walking easy, noiseless (which is desirable in a hospital) and non slippery.

- Stairways are hardly used but they are mandatory, and are necessary in case of a fire. There should be at least two stairways leading from the top floor to a ground level exit in two separate areas of the building. A minimum width of 1.2 meters (3'8") and wide landings are necessary to handle and negotiate stretchers in an emergency such as evacuation of patients or breakdown of elevators.
- Handrails at a height of approximately three feet should be provided on both sides of the stairways. These are one of the safety measures needed in the hospital even for normal people, not to mention the aged and the sick who cannot walk safely without them. Clearance of 3.81 cm (1.5") should be provided between the handrail an and the wall. Ends should be returned to the wall or otherwise arranged to minimize injury to people.
- On hardly sees a linen chute, much less a refuse/garbage chute, in the present days modern hospitals. It is recommended that they be not made part of the design for obvious reason. The author does not recommend them. However, if one is planned, the minimum cross sectional dimension of gravity chute should be two feet, and the chute should discharge directly into a collection room that is not used for other services.
- Elevator location should be determined by maximum concentration of traffic. there should be minimum of two elevators for any multi storeyed building, but hospitals with 150 to 200 beds will require three. Elevators are best utilized in a bank and not at separated locations. Safety devices such as dual controls, self leveling features, telephone and alarm should be provided Elevator call buttons and controls should be of the material that will not be activated by heat or smoke. Elevator doors should not open and unload passengers into the main lobby but preferably to an alcove or a side corridor.

- Toilets in the patient rooms should have doors and hardware that will permit emergency access from the outside. Similarly, doors should open

outwards so that they will not be pushed against a patient who may have collapsed in the toilet.

- The minimum width of doors to patient rooms should be 1.12 metres (3'8") preferably 1.16 metres (3'10"). However, any door that may admit a patient in a bed such as the doors of classrooms, elevators, treatment rooms, operating rooms, trauma rooms, radiology rooms, labour and delivery rooms should be 1.21 metres (4'0") and its height 2.13 metres (7'0") to facilitate Food services – clearance movement of beds along with people as well as equipment including traction frames. The wider width also reduces damage to doors and frames where frequent movement of beds and large equipment occurs.

- As a rule, doors of patient rooms should open outward into the corridor with an outside lock only and no inside hardward.

- Doors should not swing into corridors in a manner that will obstruct traffic flow or hurt passers by.

- Expansion joints and thresholds should be made flush with the floor to facilitate smooth movement of stretchers, wheelchairs and carts.

- Patient toilets should preferably be provided with grap bars and if possible, a panic button with a pull chord. These are particularly important in geriatric ward, ICU and CCU toilets. Bars should have strength and anchorage to sustain a load of about 110 to 120 kilograms.

- Wash basins should be firmly fixed to withstand a vertical load of about 100 to 120 kilograms on the front of the fixture.

- Mirrors should not be provided in places such as hand washing facilities in food preparation area, nurseries, clean and sterile supply areas, and scrub sinks where hair combing is likely to im pair asepsis control.

- Radiation protection of Bhabha Atomic Research Centre

  - The minimum ceiling height should be 2.43 metres (8"0"). Exceptions to this rule are:

- Radiographic operating and delivery rooms, and rooms that have ceiling mounted equipment (like the Hubbard Tank in the physical therapy department) or ceiling mounted surgical light fixtures. The height should however, be sufficient to accommodate the equipment fixtures and their normal movement and operation.

- Boiler rooms which would have ceiling clearance of not less than 6.35cm (2'6") above the main boiler header and connecting piping.
- Toilet rooms, storage rooms, corridor, and minor spaces that are normally unoccupied. In these the ceiling may be 2.13 metres (7' 0")

- Recreation rooms, exercise rooms (such as those in recreational and physical therapy departments), and equipment rooms and similar areas which generate impact noises should not be located directly over patient bed areas or operating and labour-delivery suites unless special provisions are made to eliminate or minimize such impacts and noises.

- Laundries, central sterile and supply department (CSSD) and boiler rooms which contain heat producing equipment should be insulated and ventilated to prevent areas above and adjacent to them from receiving or affected by excessive heat.

- Conductive flooring should be avoided in areas and rooms in which flammable anesthetic agents are stored and administered.

- Special attention should be paid to wall bases in kitchen, operating and delivery rooms, soiled workrooms that are subject to wet cleaning every day several times of the day. They should be made integral with the floor, tightly sealed and constructed without voids.

- Ceilings and walls in operating and delivery rooms, isolation rooms, nurseries and CSSD should be monolithic from wall to wall without open joints, crevices or fissures that may attract and retain dirt particles.

- Dark rooms in the x-ray department are often too small. A minimum inside dimension of 1.82 metres by (6 ft. by 6 ft.) is recommended.

- In the clinics area, toilets should always be provided within the clinics or they should be direcly accessible to them.

- Entering public toilet rooms directly from waiting areas should be avoided. Water closets should be separated from wash basin areas by stall partitions wherever possible.

- High window sills should be avoided in administrative offices and waiting areas for better ventilation and for visual contact outside.

- Acoustical treatment of ceilings is strongly recommended to reduce sound transmission, especially in clinic examination and interview rooms, and in conference rooms.

- If there is a dental clinic, it should be located close to the main lobby to minimize interference with other clinic. Experts say that in general hospitals, the dental clinic should be arranged as an optional area so that it can be readily omitted as the programme dictates.

General

Waiting area in the outpatient department: Standard space requirement is 0.74 to 0.92 sq. metres (8 to 10 sq.ft.) per patient visit. If there is a paediatric clinic in the general outpatient department, provision must be made for the separation of waiting spaces for paediatric and adult patients.

Mechanical Standards

1. Mechanical systems should be designed adopting recognized engineering practices without sacrificing patient care or safety. Well-established good engineering practices should be followed to achieve high overall efficiency, minimum life cycle cost, maximum savings and energy conservation.

2. Renovation of existing facilities may pose special problems. Existing insulation, weather stripping, etc. are to be brought up to standards to the extent possible to achieve maximum economic benefit and efficiency.
3. Hospitals should be designed considering the site, orientation, availability of natural daylight and such other considerations relative to passive and active energy systems.

4. Wherever possible, waste heat should be recovered

5. Design of the hospital should consider the use of natural ventilation if the conditions permit, variable air volume systems, ' load shedding'. And programmed control of unoccupied periods during nights weekends, etc. System should be designed with low operating and maintenance costs.

6. Special consideration should be given to 'sterile' areas such as operating and delivery rooms. Quantity and quality of suplly and exhaust air flow should be controlled to ensure movement of air from clean to less clean areas to maintain asepsis control.

7. All mechanical systems should be tested, load balanced and operated to the satisfaction of the designer/owner at the time of handling over of the installation to prove that the performance of the system meets with design specifications. Test results should be documented.

8. As part of the contract, the owner should be supplied with sufficient copies of operation and maintenance manuals, parts lists 'as built' drawings and procurement instructions. Information on energy ratings should also for future energy audit.

Thermal and Acoustical Insulation

Insulation within the building should be provided for hot water and steam pipes, exhaust pipes, chilled water and refrigerant piping, condensate return piping, air conditioning ducts etc. to maintain the efficiency of the system.

Asbestos should not be used in health care facilities. 'Soft type' spray on insulation should be avoided to prevent air or mechanical erosion when loose particles may create maintenance problems.

Steam and Hot Water Systems

Sizing of steam and hot water generators should be based on the recommendations of the National building code (NBC) and other national standards. Stand by generators of sufficient capacity to meet the needs of the hospital are to be preferably foreseen to take care of the requirement during periods of maintenance, breakdown, etc. of any one generator.
Generator auxillaries such as feed pumps, circulating water pumps, condensate return pumps and fuel oil pumps should be able to provide both normal and standby service.

Air Conditioning, Heating and Ventilation (HVAC) Systems

To the extent practicable, natural ventilation for non sensitive areas and patient wards should be utilized if weather permits. Mechanical Ventilation will be required for interior areas and during periods of temperature extremes. All rooms and areas in the hospital should have positive ventilation. Exhaust in should be installed at the discharge end and should be conveniently accessible for maintenance. Following energy conservation measures to reduce the system cost may be adopted by making use of the heat in the exhaust system:

- Waste heat recovery boilers
- Variable air volume
- Load shedding
- Shutting down the system or reducing ventilation of certain areas when unoccupied.

When outside air is used for mechanical ventilation, it has to be properly filtered. Ventilation system should be designed and balanced for comfort, asepsis and odour control. Guidelines for ventilation may be taken from American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) or Indian

Society of Heating, Refrigeration and Air Conditioning Engineers (ISHRAE). Specialized patient care areas including organ transplants, burn units, etc. should have provision for additional ventilation for air quality control laminar air flow or similar to properly meet the performance needs.
Each operating room and delivery room should have at least two return air inlets located as remotely from each other as practical. Air supply to operating and delivery rooms should be from ceiling outlets near the center of the work area for a better air movement control. Return air is from near the floor level. Similarly, air supply to nurseries, birthing rooms, room used for invasive procedures should be at or near the ceiling and return air inlets near the floor level.

Areas used for inhalation anaesthesia must be provided with scavenging systems to vent waste gases directly to the outside. Within the emergency suites, in rooms for routine dental work, etc., separagte scavenging systems are not required as gases are used only occasionally.

Following guidelines will be useful in designing the ventilation system

- Fresh air intake to be located at least 7.62 m from the exhaust outlet.
- Bottom of outdoor air intakes serving central systems to be located as high as possible but at least 1.83 m above ground level or 900m above roof level, if installed above the roof.
- Exhaust outlets from areas that may be contaminated to be located above the roof level so arranged as to minimize circulation of exhaust air into the building
- Bottom of ventalation (supply/return) opening to be at least 760mm above the floor.

Filters for central ventilation or air conditioning should have high efficiencies and should be durable and easily maintable.

Air handling duct systems must be provided with duct detectors and fire dampers hat are actuated by fire or smoke sensors, not by fan cut off alone.

Remote controlled reset devices may be provided for smoke dampers with provision for local manual control for reopening. Care should be taken while restarting the fans to ensure that the dampers are open to prevent possible damage to the system.

Laboratory hoods should be well ventilated/exhausted through a system separate from the building exhaust system. Ducts should be of non combustible, conosion-resistant material as needed for general requirements, and of acid resistant stainless steel for ducts serving hoods for radioactive material and strong oxidizing agents (e.g. perchloric acid)

Exhaust hoods in food preparation areas should comply with relevant standards and should have grease filters, fire extinguishing system and heat actuated fan controls.

Ventilation system for anaesthesis storage rooms should conform to relevant standards. Mechanically operated air systems may also be thought of in this room.

Gas sterilization (by ethylene oxide or similar gases) requires special safety precautions, such as aeration prior to use and special exhaust ventilation.

Boiler rooms should be provided with sufficient outside air for combustion and to limit workstation temperature to an effective value of not more than 32.5 deg.C.

Gravity exhaust may be used, where conditions permit, for non patient areas such as boiler room, central storage etc.

Non Flammable Medical Gas System

The installation of non flammable medical gas and air systems should conform to National Fire Prevention Association (NFPA) requirements. When any piping or supply of medical gases is installed, altered or augmented, the entire system should be tested and certified as to type and quantity of medical gas it each outlet and areas controlled by each valve station.

Clinical Vacuum (Suction)Systems

Clinical Vacuum system installations should comply with the requirements of NFPA and sufficient number of outlets at each bed for vacuum, oxygen and air systems should be provided.

Identification

All piping including steam, hot water, ventilation, air conditioning, gas and vacuum should be colour coded for easy identification all valves should be tagged. Colour and valve schedules should be displayed at important location and provided to the hospital maintenance department for permanent record and reference.

Sanitary and Plumbing System in Hospitals

1.Plumbing fixtures

- Non absorptive and acid resistant plumbing fixtures
- Water supply spouts in lavatories and sinks are to be so selected as to provide adequate clearances to fill carafes, utensils bottles etc. to avoid potential contamination with the contents of these containers.
- Photoelectric devices or infrared ensors should preferably be utilized in scrub sinks, wash basins, etc generally used by medical and nursing staff to avoid touching the fixtures by hand.
- Clinical sinks should have an integral trap in which upper portion of water trap provides a visible eal.
- Non slip surface or rubber mats with buttons should be provided in showers for patients.

4638

2. Potable Water Supply System

- System should be so designed as to provide sufficient pressure at all fixtures during periods of maximum demand
- Capacity of hot and cold water pipes should be so selected as to provide ample water at the showers. Wash basins and sinks
- Stop valves should be provided at each fixture.
- Back flow prevention devices specifically designed to prevent back flow or back siphonage should be installed on hose bibs, supply nozzles that may be used for connection of hoses or tubing as in laboratories, autopsy a tables and such other locations.
- Hot water at appropriate temperature (in any case not exceeding 49 deg. C) for comfortable use should be available at each hot water outlet.

Water Requirement of a Hospital

Minimum requirement of water supply for hospital shall be in accordance with the National Building code (NBC) Hospital (including laundry) Per bed.

a. Number of beds not exceeding 100 = 340 litres per head per day

b. Number of beds exceeding 100 = 450 litres per head per day

c. Nurses/medical staff quarters = 135 litres per head per day

4. Minimum hot water requirement = 45 litres per head per day

3. Hot Water System

Hot water may be generated either by all mounted electric water boilers in each patient bath room as in small hospitals or by a central hot water

generator (as in large hospitals) generally oil fired, of adequate capacity, installed in a convenient location in the basement. Care must be taken while sizing the hot water generator to include the hot water requirement of laundry kitchen, patient rooms, nurses stations and other areas of the hospital. A standby unit is necessary to meet the requirement of hot water during emergencies.

4. Drainage System

- Drain lines from sinks in which acid waste may be poured should be of acid resistant material

- To avoid possible undesirable chemical reaction/explosion, drain lines material serving some types of automatic blood cell counters must be carefully selected.

- Overhead drainage piping, whether exposed or in the ceiling, must be avoided as far as possible in sensitive area such as delivery and operating rooms, nurses, food preparation, serving and storage areas.

- Floor drains must be avoided in all operating and delivery rooms

- Back siphonage must be positively avoided in the design of drainage for autopsy rooms.

- Sewage from the hospital should be let into the municipal sewer after necessary treatment as prescribed by the local pollution control boards.

- Grease and oil traps for kitchens must be located in an easily accessible location without the need to enter the kitchen or food storage area.

Electrical Standards

1. Electrical supply to hospitals must be dependable and uninterruptible, as vital equipment cannot be without electrical power even for short periods.

SL-113:9

2. Electrical power supply to the hospitals may be at high voltage as in the case of large multidisciplinary hospitals or at low voltage as in the case of small hospitals, depending on the load demand. The supply may be on overhead lines or over underground cables. The latter is preferred, its higher cost not with standing, to reduce possibility of interruption of power.

3. In the case of high voltage supply is stepped down to distribution voltage level using mineral oil filled transformers or cast resin dry type transformers. The latter are preferred for indoor installation as the coils are non inflammable and are self extinguishing.

4. Draw out air circuit breakers or moulded case circuit breakers are used on the secondary of the transformers.

5. Power is generally distributed at 415/20V in the hospital using a separate protective conductor(TN-S System). With large motors being supplied at three phase 415 V and fractional horse power motors at 240 V single phase.

6. National Electrical code (NEC) envisages three types of power supply besides the normal power supply they are:

   - Standby supply
   - Safety supply
   - Special safety supply

Out of several options such as storage battery, duplicate feeder from E.B. generator, etc. available for supplying reliable standby and safety supply power, diesel engine driven AC generators have become popular to supply standby power. They supply required amount of lighting and power service that is considered essential for safety, life support and basic hospital operation during the time normal electrical service is interrupted. Emergency generators should be silent sets to prevent objectionable noise and should be located with adequate clearances for easy access and maintenance. They should be provided with appropriate ventilation for cooling and elimination of fumes.

National Electrical code (NEC) calls for a special safety supply system to be provided to automatically take over the load within 15 seconds after the failure of power supply at the medical establishment containing life supporting equipment.

Special safety system, classified into medium break and short break, should preferably be supplied by on line uninterruptible power supply (UPS) where life supporting equipment maintain important body functions (in particular breathing equipment and equipment for resuscitation), operation lamp etc. are involved.

7. Telephone cable should be brought into the building basement where practicable and it should be laid separately away from the power cables to prevent interference. Telephone cables should so laid that they would not be subject to mechanical damage, chemical action or heat.

8. Sheet metal enclosed dead front panel boards and switch boards with locable hinged doors should be installed in well ventilated rooms to prevent nuisance tripping of thermal devices in the panels. Adequate working space all around the panels and front, rear and side clearances should be as per relevant Indian standards (IS) and Indian Electricity rules.

   Distribution panel boards are to be located in corridors rather than in confined spaces. Lighting Distribution Boards (DBS) should be located on the same floor as the respective lighting outlets and are to be located so that the length of the branch circuit will not exceed about 30m.

9. Miniature circuit brakers (MCB) for power and lighting circuits are to be preferred to switch fuses. MCBs having combined magnetic and thermal release are better suited to protect small wires and flexible cords used on lighting and power circuits.

   Piano key type wall switches and door operated switches are recommended for patient areas and closets / wardrobes.

When the administration of flammable unaesthetic atmospheres or flammable anesthetics or flammable cleaning and / or dis infection agents with air, oxygen and nitrous oxide is indented, special measures such as the use of anti static flooring and use of switches approved for the hazard class are necessary. Alternatively, mains plug connections, switches, power distribution boxes and similar devices that may cause ignition should be kept outside the zone of risk.

10 Choice of the type of wiring and its insulation and method of installation depend on the locations, nature of the walls or other parts of the building supporting the wiring, voltage and electro mechanical stress likely to occur due to short circuits.

11 Rigid non metallic conducts of ample size are generally used for concealed wiring in hospitals to permit a reasonable amount of change with minimum amount of labour and structural changes. In the case of LT installation for loads in excess of a specified value, two cables of adequate size and capacity to meet the load should be laid to restore the supply expeditiously in case of failure of one of the cables.

12 Choice of lamps, luminaries and the general lighting design should be based on the recommended values of illumination and glare index by NEC and IS. Luminaries should selected considering durability, aesthetics, maintenance, case of relamping, energy conservation, light quality and quantity for effectiveness and efficiency.

- General illumination with provision for reduction to light levels at night in specific areas such as nursing unit corridors.
- Reading light for each patient
- Night light in the room, controllable from the room entrance.

A fourth service, doctors' examining light, may be a hand held portable lamp or a fixed ceiling examining light, ot produce about 750-1000 lux over: limited area, the being the preferred arrangement.

13. Levels of Illumination in recovery rooms, operating and delivery rooms, minor surgery and fracture rooms, laboratories etc. should be as per NEC

14. Human safety demands emergency lights to be provided for essential movement of staff and patients. Emergency lighting should be in operating and delivery rooms, exits, stairs, corridors, public waiting spaces, plant rooms, ambulance parking and unloading areas, etc. conforming to local regulations. External emergency lighting is normally restricted to accident and emergency entry areas.
Information desk, cashiers office and outpatient department should have adequate lighting and illuminated signs with conveniently located socket outlets.

    NEC recommends three grads of emergency lighting – A B and C for different areas in hospitals X-ray film illuminators should be provided in all consulting rooms and operating rooms.

15. Flame proof equipment of appropriate class and group should be used in hazardous areas such as anesthetic storage rooms, anaesthetizing spaces for administering anesthesia or disinfectants. Hazardous locations require conducting floors to interconnect people and equipment to prevent ignition of flammable gases or vapors due to electrostatic sparks. Comfort air conditioning will provide adequate cooling but the reduction in ambient humidity may result in an unacceptable build up of static electricity that can cause serious disruption and irreversible damage to sensitive electronic components and equipment. Hence it is important that the humidity be maintained at least at 50% to control static electricity.

16. Socket outlets should be provided in all areas where plug in service is required. Each patient bed should have at least three socket outlets with two outlets with two outlets near the head of the bed. Rooms having more than one patient should preferably have two outlets at the head of each bed. Or at least three outlets on the head wall for each two beds side by side.

Each operating and delivery room should have six outlets in addition to a distinctively marked outlet for mobile x ray. Critical outs (which may be shared) should be available so that each bed will have access to at least seven outlets. Intensive care units should in addition have two three phase 4 polo 30 A or larger outlets for motorized equipment or mobile x ray. Outlets in paediatric and psychiatric wards should be of the safety type.
In all wet areas having wet floors, grounding type sockets are to be provided. Special grounding type convenience outlets in corridors, spaced about 12m apart are desirable for portable x-ray food trolley and cleaning equipment.
All socket outlets in the following areas should be connected to the essential circuit, as recommended by NEC.

- All socket outlets in operating rooms for connections of x-ray equipment for fluoroscopy. Sterilizing equipment in operating theatre and CSSD.
- Treatment rooms and operating and operating rooms in the accident and emergency department
- Delivery rooms
- Post anaesthetic recovery rooms.
- Intensive therapy unit.
- Radiological diagnostic room
- Wards for patients depending on electrically driven equipment for example, respirators, rocking beds artificial kidney machines etc.
- Special baby care units.
- Pathology laboratories
- Wards where suction apparatus is used

It is recommended that all socket outlets supplied by emergency power supply be distinctively marked for eash identification.
The recommendation that all sockets be connected to the essential circuits provides the most convenient choice of socket outlets at any time and simplifies the installation.

17. Electrical call and signal systems such as nurse call and doctors' paging are necessarily be provided in hospitals.
The nurse call system may be a simple one way signal system which connects the bedside call system with a signal at the nurses station, utility room and floor pantry of the nursing unit. It simultaneously lights a dome light in the corridor over the door of the room from which the call originated. The signal at the nurses' station may be in the form of an annunciator with a buzzer or a single light with a buzzer.
For emergency call of nurse by the patient when he/she is inside a bath or water closet, suitable pull cord switches are to be provided. Call stations should be provided for nurse's use in nurseries, children's wards, operating and delivery rooms. Nurse call system may also be of the intercommunicating (two-way) type.

18. Doctor's paging system may be the wired or radio type. The wired system consists of loud speakers located throughout the hospital and a microphone to sound the doctor's number or the flasher type to indicate the doctor's number.

19 Interconnecting telephones should be provided for all heads of departments, assistants, operation and delivery suites, nurses stations, officers, housekeeping, doctor's rooms record rooms and diet kitchens. These may be connected on a dial system that will permit internal communication throughout the hospital switchboard without the assistance of an operator.

20 Overall dimensions of hospital lifts should conform to IS 3534. They should be designed to accommodate one bed/stretcher along its depth with sufficient space all around to carry a minimum of three attendants in addition to the lift operator. They are standardized in three sizes of 15 persons (1020 kg.) 20 persons (1360 kg) and 26 persons (1768 kg).

Hospitals 0.25 m/s normal travel 0.5 m/s and long travel lifts in general hospitals, 0.6 to 1.5 m/s.

In is convenient to place the passenger lifts near the staircase. Hospital bed lifts should be situated conveniently near the ward and operating theatre entrances.

In small and medium sized hospitals these hospital bed lifts are almost exclusively used because of the economic advantage of their "all purpose" characteristics. Automatic operation of these lifts without an attendant except during peak hours is quite common. In the case of large hospitals automatic lifts are key operated to enable the attendant to bypass any calls and travel directly to any desired station.
It is recommended that at least one of the hospital bed lifts is automatically connected to an alternative source of supply in an emergency. It is necessary to design the distribution system in such a way that it should be possible to bring any lift to the nearest landing in case it has been trapped between doors due to interruption of the normal power.

21 Guidelines given in the National Building Code (NBC) for fire detection and fire protection of buildings should be followed.
Fire ditection devices used in the detection system should conform to the relevant national/international standards. The system should be electrically monitored.

Wiring for fire detection and protection system should be segregated from other wiring to reduce the risk of damage to them in case of fire. For high-rise building, the fire fighting pumps are generally large and they draw heavy currents at the time of starting. Sufficient care should be taken to ensure that the supply to such to such motors is maintained properly.

Standards for Centralized Medical Gas System

- Following are some, not all, of the norms that should be adhered to; Pipeline should be seamless type, non ferrous, non-arsenic, of quality copper tubing for medical use and certified by Lloyd's or authorized agency.

- Exposed oxygen pipelines should not be installed in places like the kitchen, laundry and rooms where combustible materials are stored.

- Prior to erection, pipes, tubes valves and fittings should be cleaned thoroughly with proper ingredients and rinsed thoroughly with warm water to free them from oil, grease, dust and other combustible materials.

- After the installation, the pipes should be blown clear using oil free air or nitrogen.

- When the installation and cleaning process is complete and the system is in place and before put to use, it should be subjected to a test pressure in the prescribed manner for 24 hours to ensure that it would withstand the required pressure and that there is no leakage.

- Regulators and other gas flow control devices should be of high quality approved by the bureau of Indian standards or equivalent.

- The main supply line should be provided with a shutoff valve for use in an emergency. This should be easily accessible.

- Similarly, each riser from the main line should be provided with a shutoff valve adjacent to the riser connection; so also each anaesthetizing location on each oxygen and nitrous oxide. Valves riser connection; so also each anaesthetizing location on each oxygen and nitrous oxide. Valves should be readily accessible for use in an emergency. Sign (such as "Oxygen: Do not close") should be placed for each of them.
- Shutoff (isolation) valves should be kept in boxes with view windows with caution signs so that they are not accessible to unauthorized persons, and are not physically damaged or meddled with or shut off.

- A written procedure manual on prevention of fire and fire fighting should be developed and circulated among staff.

- There should be appropriate warning signs at places where medical gases are used or administered.

- Oxygen flow meters and suction units that provide requisite flow rates at the desired user settings should be installed for direct use on the pipeline pressure in required area as applicable.

- The manifold room should have a minimum one hour fire resistant construction and door, and an automatic fire extinguishing system.

- For routine maintenance and repair, vacuum, pumps should be provided with shut off valves so that they can be individually isolated from the vacuum system.

- There should be two kinds of alarm in the centralized medical gas system. One is to monitor the pressure of various gases at different areas of the distribution system. If abnormal pressure is sensed, the system sets off an alarm. Alarms should be located in working areas of personnel who use and maintain the system. The other alarm is generally the alarm located centrally in the manifold or central plant room. These are provided to moniror medical gas pressure and flow.

- An integrated control panel, preferably an automatic one, for oxygen manifold helps in auto changeover from left to right bank of cylinders or vice versa, should one of the banks in use becomes empty.

Standards for Biomedical Waste Handling and Management

Incineration for Biomedical waste

Hospitals by and large have twin objectives. The first objectives is to attend the patients to attend the patients to diagnose and administer the required medical treatment.The second is commercial or charitable consideration.Hospitals are increasingly coming under pressure that they should play role of "Healer"and not become a source of spreading diseases.The responsibility to ensure that the hospital's premises not only attend to the health needs of patients but also maintain acceptable hygienic conditions squarely rests on hospital authorities.

Scientists ever in search of new products for mankind have succeeded in making products of convenience.The entrepreneurs and industrialists in turn engage in mass production of these products.This process creates pollution.Even though hospitals do not manufacture such products their services produces considerable amount of waste that are toxic as well as non-toxic and more importantly could multiply diseases due to infection . By and large , the hospital waste is currently disposed conveniently along with the municipal waste , thus creating a dangerous situation that could imbalance the health of the society.

Conequent to public interest litigation filed in the supreme court regarding proper method of disposal of waste produced in hospitals , the supreme court took the initiative and entrusted the ministry of environment and forests to come out with suitable guidelines for proper disposal of medical waste.Consequently , the central pollution control board has framed rules to properly dispose the bio-medical wastes.Since July 1998,the directions of the CPCB regarding bio-medical waste disposal have become an act and all hospitals have to necessarily ensure that the bio-medical wastes are disposed as per the norms laid down therein.a summary of these rules published in the Gazette Notification is given

Standards for treatment and Disposal of Biomedical waste

Standards for Incinerators

A. Operating Standards

- Combustion efficiency atleat 99.99 %

- Primary chamber temperature $800^{0} \pm 50^{0}$ c
    - Secodary chamber :gas residents time atleast one second ; temperature at 1050 ± 50 : minimum 3 % oxygen in the stack gas

B. Emission standards

Parameters	Concentration (mg / Nm3)*
Particulate matter	100
Nitrogen Oxides	400
Hydrogen Chloride	50
Minimum Stack Height (in Metres)	30
Volatile organic compounds in ash shall be not more than 0.01 %	
* = at 12 % co2	

Standards for Microwaving

- The micro wave treatment shall not be used for the cytotoxic, hazardous or radioactive waste, contaminated animal carcases, body parts and large metal items.
- The micro wave system shall comply with efficacy test / routine test and a performance guarantee
- The microwave should completely and consistently kill the bacteria and other pathogenic organisms that are ensured by the biological indicators at the maximum design capacity of each microwave unit. biological indicators for the microwave shall be vials or spores with atleast 1 x 10 spores per milliliter

Standards for liquid wastes

Parameters	permissible limits
PH	6.5 to 9.0
Suspended solids	100mg
Oil and grease	10mg
BOD	30mg
COD	250mg
Bio assay test	90% survival fish after 96 hrs in 100% effluent

Standards for Deep Burial

- A pit of trench should be dug about two meters deep .it should be half filled with waste then covered with lime within 50cm of the surface ,before filling the rest of pit with soil .
- It must be ensured that all the animals do not have any access to burial sites .covers of galvanized iron / wire meshes may be used
  On each occasion ,when wastes are added to the pit . a layer of 10cm of soil shall be added to cover the wastes
- Burial must be performed under close and dedicated supervision
- The deep burial site should be relatively impermeable and no shallow well should be close to the site.
- The pits should be distant from habitation , and sited so as to ensure that no contamination occurs of any surface water or ground the area should not be prone to flooding or erosion
- The location of the deep burial site will be authorised by the prescribed authority
- The institution shall maintain a record of all pits for deep burial.

Standards for Autoclaving

The autoclave should be dedicated for the purpose of disinfecting and treating biomedical waste

When operating a gravity flow autoclave,medical waste shall be subject to

Temperature (in degree centigrade)	Pressure (pounds per square inch)	Residence Time (in minutes)
Not less than 121	15	Not less than 60
Not less than 135	31	Not less than 45
Not less than 149	52	Not less than 30

When Operating a Vaccum Autoclave

Temperature (in degree centigrade)	Pressure (pounds per square inch)	Residence Time (in minutes)
Not less than 121	15	Not less than 45
Not less than 135	31	Not less than 30

SITE SURVEY STANDARD

1) Site

Plan showing layout, boundaries with adjoining properties, access roads/paths, important landmarks, trees with more than one metre grith and wells. Accurate dimensions of sides and diagonals.

2) Levels

Spot levels at 3 metre grid and at prominent low/high spots and contours at 0.5 metre interval. For flat land, grid can be 6 metres.

3) Drainage

The area around the land to be shown with natural drainage as existing.

4) Ground Water Levels

The sub-soil level as indicated by the water in shallow wells if any on the site and as ascertained through boring.

5) Soil

The type of soil and its bearing capacity.

6) Services

Any main services like the overhead electric transmission lines, telephone line, water mains, sewers or drains closed or open, that may be passing through or near to the site with exact location.

7) Special Features

Any other special features peculiar to the site.

8) Site Orientation

North direction be clearly indicated in the site plan.

9) Scale of Site Plan

1:500 and in the case of sites more than five hectares 1:1000.

Review Questions

1. Explain theVoluntary and Mandatory standards
2. List the general standards for details and finishes
3. Mechanical Standards Steam and Hot Water Systems

   Explain the following

   (a)Air Conditioning

   (b) Heating and Ventilation (HVAC) Systems

   (c)Hot Water System ,

   (d)Drainage System

   (e)Non Flammable Medical Gas System

   What are the standards used for the electrical system in the hospital

   Give the Standards for Centralized Medical Gas System

   List the guidelines useful in designing the ventilation system

   Give the standards for treatment and disposal of Biomedical wastes

MODEL QUESTION PAPER
Hospital Planning And Designing
Time 3 hours Maximum Marks –100
PART – A (5 x 8 = 40)

Answer any Five Questions

1. Define Hospital and enumerate the essential services provided by a modern hospital.
2. List the factors that have led to changing role of the hospital
3. List the factors necessary in the selection of site
4. Explain the types of drawings
5. Explain Ward Unit Of The Intermediate Zone
6. List the various channels of communication in a hospital
7. Prepare the checklist of the minor facilities required in a hospital
8. Explain the following
   a) Heating and Ventilation (HVAC) Systems
   b) Non Flammable Medical Gas System

PART B (4 X 15 = 60)
Answer Any Four Questions

9. List the equipments required in a general hospital
10. Enumerate the factors influencing hospital utilisation
11. List the facilities required for the entrance and ambulatory zone of the hospital
12. How will you plan a food service department in a hospital
13. List the general standards for details and finishes
14. Explain the concept "Hospital as a Social System"
15. Discuss how the documents are useful in planning

Educate ⇨ Empower ⇨ Elevate

Alagappa University formed in 1985 has emerged from the galaxy of institutions initially founded by the munificent and multifaceted personality, Dr. RM . Alagappa Chettiar in his home town at Karaikudi. Groomed to prominence as yet another academic constellation in Tamil Nadu, it is located in a sprawling and ideally suited expanse of about 420 acres in Karaikudi.

Alagappa University was established in 1985 under an Act of the State Legislature. The University is recognised under Sec. 2(f) and Sec.12(B) of the University Grants Commission. It is a member of the Association of Commonwealth Universities and the Association of Indian Universities. The University is accredited with 'A' Grade by NAAC.

The Directorate of Distance Education offers various innovative, job-oriented and socially relevant academic programmes in the field of Arts, Science, IT, Education and Management at the graduate and post-graduate levels. It has an excellent network of Study Centres throughout the country for providing effective service to the student community.

The distance education programmes are also offered in South-East Asian countries such as Singapore and Malaysia; in Middle-East countries, viz., Bahrain, Qatar, Dubai; and also at Nepal and Sri Lanka. The programmes are well received in India and abroad.

ALAGAPPA UNIVERSITY

(Accredited with 'A' Grade by NAAC)

Karaikudi 630 003

DIRECTORATE OF DISTANCE EDUCATION

(Recognized by Distance Education Council, (DEC) New Delhi)