CHAPTER 6

(A) Other Dimensions Of Marketing-Mix
Product Mix:

In the service generating organisations, services mix occupies a place of outstanding significance; the high level of sensitivity and unfavourable conditions virtually prove to be an acid test of your expertise or professionalism. We are well aware of the fact that modern hospitals offer a number of services, such as core services, supportive, peripheral and the preventive services. In the figure mentioned below, we find the service mix/product mix of hospitals or healthcare organisations. It is an important functional responsibility of a healthcare manager to ensure that whatever the services profile/product profile is determined by the emerging trends in the medical sciences through the advancement in communications. Since formulation of a sound product-mix is a managerial process of mixing different types of services in the profile, it is quite natural that the process is substantially influenced by the scientific inventions and innovations.

Where Research gets due weightage in healthcare sector, a basic change in the diagnostic and treatment process cannot be denied. It is in this context that we find a technology driven diagnostic and treatment processes gaining popularity the world over. For generating world class core services, you need the same quality of supportive services because unless the infrastructural facilities are of world class, it is meaningless to think about the generation of quality services. The mounting intensity of competition makes it essential that you establish an edge over the strategic decisions of your competitors and it is against this background that the peripheral services draw the attention of a manager around the world. We agree with this view that if the core services help you in protecting your existence with the peripheral sources you succeed in increasing the market share. Since by enriching the quality of peripheral services, you create product uniqueness, the users are impressed. With this process, you succeed in establishing leadership.

In the figure given below, we find the service/product profile of healthcare organisations which is a combination of different types of services. The services have been classified into four parts, viz., line services, supportive services, auxiliary services and the preventive services.

It is your professional excellence to gauge the changing healthcare requirements of a particular catchment area and develop the mix accordingly so that the users experience uniqueness. Of course, it is important that you assign an overriding priority to the core and supportive services and assign due weightage to the auxiliary services but at the same it is also necessary that you promote the communication services, specially focusing on the creation of mass awareness related to the healthy living conditions. It is really
surprising that a majority of the healthcare organisations do not attach any significance to preventive services which aggravates the pressure on hospitals.

In the Indian perspective, it is of prime importance that creativity is made possible in the preventive services so that the public come to know about healthy living conditions and develop an awareness regarding food and water-borne, pollution related, vector-borne and communicable diseases. It is right to remind you that professional excellence of a hospital or healthcare manager is the essence of minimizing the pressure on the hospitals which would not be possible unless we make the preventive measures creative.

Of late, we find modern healthcare organisations also innovating the peripheral services which focus our attention on a number of services making the stay and visit of patients and attendants comfortable and convenient. The seating arrangements, potable water, sanitation, power, transportation and communications, entertainment facilities, shopping complex, restaurants and cafeteria are to mention a few playing a big role in making the stay of patients and attendants comfortable. Of course, you bear the responsibility of innovating the core services but at the same time you also need to innovate the peripheral services because in the healthcare organisations we find patients and attendants facing a number of problems very much instrumental in generating tension. It is your prime responsibility that you by the innovative peripheral services of your organisation instrumentalise the process of diffusing their tension.

The secondary, tertiary and other leading medical institutes not only generate different types of services but also products, various categories of personnel. We talk a lot about the quality of doctors, para-medical staff and the nursing staff but keep their development plans at the bottom of health manpower development programme. This has caused degeneration in the quality of hospital personnel of almost all the categories. It is against this background that the hospitals and the healthcare organisations also need to take into consideration the quality of educational aid to be made available to the medical students. The training institutes for nurses occupy an important place because they play a leading role in improving the quality of services offered by you. The syllabi at all the levels and for all the hospitals offering educational aid and training facilities are to be updated according to emerging trends in the environmental conditions. In this context, it is also important to mention that we find educational institutions in general concentrating on developing the professional excellence of medical students. They do not understand that in addition to professional excellence, personal commitment also is to be given due weightage in the process of educating and training the medical students. It is due to mainly our neglected efforts and a negative attitude towards
the development of ethics, human value, and humanity that we find doctors becoming inhuman and indecent. Even the unfair practices promoted by the hospital personnel are the result of the irrational educational policy. It is against this background that we make a strong advocacy for promoting medical ethics, which should be included in the curriculum to ensure that our products are not only professionally sound and personally-committed but also value-based.

The formulation of a product mix or development of a product profile for hospitals and healthcare organisations thus makes it essential that you optimally blend the different dimensions. Accreditation carries no meaning, professional excellence is of no use, if the patients and the attendants feel that the doctors or other para-medical staff are playing the role of a blood sucker. Thus the formulation of a sound product profile is your functional responsibility and you are supposed to perform excellently. Like other organisations, you also are responsible for satisfying the customers/users/patients; and this makes your product profile of world class. Of course, you need more frequency in the innovation process, and in the process the services should become affordable so that even the poor can afford.
Fig: Product Profile of Hospitals
Price-Mix:

In the Indian perspective, where a number of persons are below the poverty line, formulation of a price mix is a challenging task. A hospital manager on the one hand bears the responsibility of making the healthcare services affordable while, on the other, they are also expected to open new vistas for the development of hospitals and healthcare organisations. Striking a balance between the two opposite considerations requires world class professional excellence. It is against this background that we study the problem of formulating a sound price mix for the healthcare services. Quality services need expensive inputs for which a hospital should be financially sound. Of late costs of inputs used in the process are found increasing very fast. The Government hospitals in general are facing financial crunch because they are neither given a free hand while formulating a fee strategy nor adequate financial grants are made available from the state exchequer. They are expected to improve the quality but at the same time also to bring down the costs. Thus a hospital manager requires professional excellence so that hospitals/healthcare organisations can thrive significantly to cater to the increasing healthcare requirements of the society. It is in this context that we study the problem of formulating a sound price mix.

The defined principles of Social Marketing make it essential that hospitals and healthcare organisations are given an opportunity to thrive so that they enrich their potentials of bearing the social costs on account of free services to the poorest of the poor. It is against this background that modern hospitals need an innovative pricing strategy. The fee strategy for hospitals, private or public should be income-based. The quality of services would remain the same but the fee structure would be linked to the income-structure. For this purpose, we need to classify the society into four subheads, viz., high-income group, medium-income group, low-income group and no-income group. For a social institution like a hospital, it is pertinent that we promote discriminatory pricing strategy, or what the traffic will bear or a pocket-friendly strategy. In the Indian context, we find it judicious because a majority of our population find it difficult to avail of the expensive services of private hospitals. We don’t find any logic in regulating the pricing strategy of government hospitals more so when we are not in a position to provide to them the financial support they need to cater to the increasing healthcare requirements of the society.
At the very outset, we go through the problem of non-income group because specially in the Indian setting; we find this segment not harnessing the benefits of development in almost all the areas. They are not in a Position to pay because whatever they earn is inadequate even to meet their family requirements of food and shelter. Hence it is judicious that all of us who can afford partially or substantially contribute to the process by paying more proportionate to our incomes. The government hospitals as well as the private hospitals need a fresh look specially to subserve the interests of that segment. However, if we find a few of them even in that segment interested in contributing to the process of social transformation, we do not need to discourage them.

This would be positive in two ways, first there would be a very nominal increase in the revenue of hospitals and more important that a sense of participation will not demoralise them on this account they are living or surviving at the cost of others. Of course there would not be any limit to the same and the psychological and situational factors would guide them.

These facts make it clear that even from the internal sources, we find hospitals successful in making up the losses on account of concessional and subsidised services. So far as the development, expansion and modernisation programmes and in a few cases meeting the deficits are concerned, grants, charity, donations would be helpful.

We find rationale behind adopting such a strategy because even at the cost of all of us, the hospitals/healthcare organisations, private or government are required to be made available an opportunity to thrive and prosper so that qualitative and quantitative developments are possible to cater to the increasing healthcare requirements of the society. We cannot move forward with the present strategy adopted by the Government Hospitals.
Fig: Pricing Strategy for Hospitals

FREE

SUBSIDISED

COST-BASED

COST PLUS SUBSIDY

PUBLIC HOSPITALS

PRIVATE HOSPITALS
Place- Mix :
In the healthcare services, place mix draws our attention on two important issues, viz., first, the location point for hospitals and secondly the process of offering the services. The location point for hospitals assumes a great significance because it is related to the time-honoured availability of services and the task is more complicated, if we find hospitals not located conveniently. Since the hospitals/emergency services are to be made available round-the-clock, it is important that the conveyance facilities are easily available so that emergency or even general patients and attendants or visitors do not face problem. In addition to the convenient location, it is also important that hospitals are not located at places that are found hazardous to health. If we find hospitals located close to the big industries or population not having a civic sense; a number of problems can crop up. In addition to the pollution problem, anti-social elements may create different types of problems. Of course, the hospital planners, architects and consultants will help you in arriving at a right conclusion but one thing that you need to remember is trouble-free location. Since the patients and attendants are also expected to stay for a long time, if hospitals do not make available the facilities of shopping complex, and if the locations are very far the towns and cities, they may face complications.

Processing :
Another dimension of marketing-mix is related to the offering of healthcare services in a decent way. This has drawn our attention to the behavioural profile of the personnel in general and the front-line personnel in particular.

Being a manager you bear the responsibility of satisfying the users and if the personnel start misbehaving, there will be a gap between the services expected and services-offered. The personnel serving hospitals/healthcare organisations need not forget that in addition to the quality of services, their behavioural patterns is also an important part of quality healthcare services. While offering or processing the services, they need to remember processing.

A degeneration in the behavioural profile of hospital personnel requires the formulation of a separate mix for the processing of time-honoured services and decent behaviour.

In the government hospitals we find the problem we find the problem of misbehaviour by almost all the categories of personnel and it is against this background that the management experts feel the need to give due weightage to the processing of services. This draws our attention on the knowledge of behavioural management to the different echelons of management or other personnel. It is of course, necessary that you
offer to the patients the promised quality of services but it does not mean that you are not aware of the terminologies, like "sympathy", "empathy ", "humanity" etc. It is felt that an in depth knowledge of behavioural management to the hospital personnel will lead to decent behaviour. To be more specific the front-line staff like receptionists, nurses, paramedical staff need to know about the proper behaviour. This is due mainly to the fact that a number of services involve different categories of personnel and these are the points from where the process of service-degeneration starts. Of course, almost all categories of doctors are required to know about behavioural management but we need to ensure that front-line personnel working in the hospitals are decent. Particularly the personnel serving the government hospitals need to remember it because a large number of complaints are received against the behavioural profile of hospital personnel. This necessitates due weightage to the behavioural profile of the personnel and medical superintendent serving the government hospitals is given to educate and train them in the changing perspective. There are different points where we need attention, such as the cash counter, admission, registration, investigation reports and reception. It is important that the patients or attendants at the sensitive counters are given due treatment so that any distortion in the process of offering the services is removed. A hospital manager/superintendent is required to bridge the gap between the services promised or expected and the services offered and this is not possible unless a full team of hospital personnel co-ordinate with each other to provide a good-patient care.

Thus, while going through the place mix, it is important that a hospital manager devotes his/her attention on ensuring that the services reach the patients. He/she bears the responsibility of ensuring that different departments and personnel working there are careful, and in addition to the professional excellence, they also have the potentials to understand the changing behavioural profile of patients and attendants. Right processing, time- honoured processing, decent processing are some of the small things throwing significant impact on the level of efficiency of the personnel and satisfaction to the users and attendants. Here we need a fresh look on the processing of services.

In the large-sized hospitals where local and outstation patients and attendants visit, it is essential that a hospital manager is particular about the influx of patients and the pressure on the outdoor and emergency services are minimised. In the specialised hospitals of excellence, patients from different parts of the country or even from abroad arrive and so it is essential that overcrowding problem is taken care of intelligently. Increasing pressure on special category of hospitals makes it clear that there is a gap in the
demand and supply positions of the hospital because the available facilities in the hospitals are not enough to cater to the increasing demand position. It is in this context that a hospital manager, while dealing with the problem of delivering the services to the ultimate users requires the support of a full team without which the services degenerate both at the micro and the macro levels.

There are cases where the location point for a particular hospital assumes significance. In addition to the comforts of patients and attendants, a hospital manager is also required to study the constraints and difficulties before the hospital personnel specially while processing the services. There are a number of cases to prove that in the government hospitals, we find the problem of quality services and therefore a manager requires to ensure that quality is the most important aspect in the management of hospitals. But even if you improve the quality, and neglect the personnel, other constraints would influence the process. It is against this background that this mix of the marketing mix becomes significant.

In view of this, it is right to conclude that place mix requires due care of a hospital manager. He/she requires right processing of services so that the patients are satisfied. It is your professional excellence that would again determine the magnitude of your success.

People-Mix:

Of late we find people-mix is of special significance in almost all the organisations. In the healthcare services, we find people playing a leading role. There is no doubt in it that despite innovative bio-medical equipment, apparatus, instruments, machines and robot, the techni-culture becomes ineffective in establishing work culture if the people working there lack professionalism. It is against this background that we find developing the excellence of people an important task before the management of almost all the organisations. In the formulation of a marketing mix, the role of people mix has gained significance because the top-level managers and the boardrooms based on their experiences have come to this conclusion that people serving an organisation need top priority attention on your development agenda. We need to educate, train and develop people in such a way that they are not only professionally-sound but even personally-committed because professional excellence carries no meaning, if we lack personal care in services. This is substantiated by the fact that despite doctors having the world class excellence, technocrats extraordinarily efficient, administrators exceptionally proficient, teachers well qualified and experienced, the results are almost all dismal, the level of efficiency coming down and the rate of productivity
consistently declining due mainly to the fact that all of them lack personal commitment, ethics, values. This necessitates a fresh look, a new vision and an innovative strategy for the development of people. It is in this context that the concept of New People Management needs priority attention of the management experts. It is the time-cycle that influences the nature and character of the developments and an individual or an institution not interested in conceptualising the same, suffers a lot. Change is a natural phenomenon. No one can stop the flow and change its directions. Hence it is wise that we keep our minds active, eyes open and do our best to foresee the developments to take place and innovative strategic decisions accordingly. We have a sophisticated world class technologies, supporting infrastructural facilities, comforts-based buildings but the lowest level of efficiency.

Like other organisations, we find hospitals and healthcare organisations also facing the identical problems. If we divert our attention on the level of performance of government hospitals, except a very few by and large almost all of them present a disappointing result. The ultimate sufferers are the patients belonging to the poor segment because the private hospitals have been sub-serving the interests of those who can afford. Of course we appreciate the contributions of medical scientists who have made possible significant developments in the disciplines but their mission would remain unfulfilled if we find the poorest of the poor not harvesting the benefits of development in the world of medical sciences. Hospitals or healthcare organisations do not have a legitimate right of making profits and therefore the boardrooms or the policy makers are mainly influenced by the social considerations. The government as well as the private hospitals need to serve the patients with the same idea. Both of them need to find an equilibrium where time-honoured developments of hospitals and interests of stakeholders are given due weightage.

The formulation of a sound people-mix particularly for hospitals or healthcare organisations make it essential that they have professionally-sound, personally-committed and value-based people who not only play a commanding role in accomplishing the organisational objectives but also contribute significantly to the fulfillment of organisational mission.

The most important task before a hospital manager is to develop a healthy and harmonious relationship with the employees to create a family and friendly feeling, a sense of belonging in the minds of employees, a feeling that employees and managers share the same ideals. Thus in the face of degenerating level of efficiency in the hospitals and healthcare organisations, it is necessary that an organisation has people with special attributes who fulfil the organisational as well as the social interests.
Since we face the problem of marketing the healthcare services, it is necessary that we make sincere and honest efforts to make available to the hospitals quality people and for this it is significant that a fair synchronisation of the social and organisational goals is made possible. This would help or inspire the hospital personnel to show personal-touch in service in addition to the professional excellence. We talk about world class excellence but it is not possible unless we find our incentive plans competitive. A self-motivated manager bears the efficacy of making it a success.

The hospitals or healthcare organisations have been facing numerous problems. They need to make possible good-patient care. They need to bear a considerable amount of social costs. They need to achieve world class excellence. They need to assign an over-riding priority to the satisfaction of patients and attendants. This makes it necessary that a self-motivated manager accepts the responsibility of building friendly, harmonious, valued-based and inter and intra-departmental relationships. By doing that, he/she succeeds in making the environment at the work place instrumental in generating the level of efficiency. It is in this context that we strongly advocate in favour of developing quality hospital personnel who play a leading role in increasing the number of satisfied group of patients/users.

A hospital manager faces a challenging task of making the process of generating and processing the cost-effective healthcare services so that the services are affordable even to the weaker sections of the society. Not only this, he/she also needs to make hospitals and healthcare organisations a centre of excellence which is very effective in promoting research and innovating the diagnostic and treatment measures to meet the multi-faceted challenges before the healthcare sector. So, in the changing social condition it is necessary that an innovative fee/pricing strategy is practiced so that the hospitals or healthcare organisations are in a position to enrich their potential of bearing the social costs. Of course, he/she bears the responsibility of enriching the quality of biomedical equipment, apparatus, instruments, machines and infrastructural facilities but the important of all is the people that focus their attention on a priority basis. Unless we motivate people as per the international standards, it is difficult to achieve the world class excellence and unless we are globally competitive, our dream of becoming a leader would remain just remain a dream.
In view of this, it is right to conclude that people mix of organisations in general and hospitals or healthcare organisations in particular need an overriding priority and in addition to a healthcare manager, the boardrooms or the policy makers also need an attitudinal change. Here management experts promoting the new perception of “Quality People” require a flair blending of professional excellence and personal commitments.

Physical Attractions:
There is nothing more appealing than a man with a sense of wit and fun. There is nothing more paying than an aesthete. With the growing influence of corporate culture in the process of socio-economic emancipation, there is a basic change in the perception of personality development. Of late the leading global organisations have been assigning due weightage to physical attractions. The subjective knowledge, no doubt, plays an important role in almost all the organisations but at the same time, the organisations also expect that their employees have a classic look, an attractive look. A look that generates a positive image; a look that magnifies optimism and a look that conveys elegance. In a true sense, we find the appearance of employees conveying the image of the organisation where they work. Poor, repulsive and pessimism generating appearance creates a negative attitude about both the employees and the organisation. It is against this background that physical attractions occupy significant place in the marketing mix of modern organisations either producing goods or generating services; either working with the aim of generating profits or working to subserve social interests. Like other organisations, the healthcare organisations also give due weightage to this submix of the marketing mix.

While going through the problem of hospitals or healthcare organisations, it is relevant that we view the problem differently. Of course, the dresses used by the hospital personnel indicate the culture of that institution. The professional requirements, situational limitations, circumstantial compulsion, cultural barriers are some of the important considerations influencing the nature and types of dresses used by them.

It is quite natural that technocrats, corporate executives, cine artists, singers, doctors and others are not supposed to have an identical dress code and therefore the dresses used by them would have an apparent variation. The main thing in the process is to look smart and active and influencing the attitudes of users/customers/patients/attendants in a positive manner. In a majority of the hospitals, we find uniform culture not getting due significance. Of course, we find a very few of the healthcare organisations considering it significant. Of course, we find a very few of the healthcare organisations considering it
significant. This makes it essential that the policy makers, boardrooms, top-level managers, senior doctors assign an overriding priority to the uniform-culture.

Of late, we promote techni-culture, develop human resources in the face of evolving technologies but overlook or ignore uniform culture. The Industrial Psychologists are of the opinion that there is a close relation between dresses used by us and participation expected from us. Where the Security, Police, Air Hostess, Hotel Personnel wearing the uniform/dresses made available to them here; a sense of participation is created and he/she finds himself/herself on duty and in action. Similarly, if we find doctors wearing uniform, nurses and other hospital personnel wearing dresses the look they have reminds us of their profession. Not only this, it is also significant that they are able to impress the patients attendants and others too. The behavioural profile of patients and attendants witness a dramatic change the moment they find doctors and nurses in uniform. So, it is essential that hospitals or healthcare organisations irrespective of gender, age, or sectoral variation promote uniform culture to activate work culture. The hospital personnel on duty should attach great importance of the uniform culture because a sense of responsibility is automatically conveyed to the users.

While promoting uniform code or culture, the main thing that should be taken care of is that the dresses(uniforms) used by the personnel are neat and clean, well-pressed and infection-free. A hospital or a healthcare manager is responsible to ensure that the linen used at different places should not cause any infection. It is in this context that laundry management gets an important place in hospital management. It is quite natural that the uniform supplied to the different categories of people should not create inconveniences rather should make the professional conditions proactive. Since you serve an organisation in which patients from diverse sections, groups, regions, cultural and family background come and stay for treatment, it is necessary that they form a positive opinion about the hospitals. It is not incorrect to mention that in a majority of the hospitals, uniform culture is neglected and presently except nurses a very few of the other staff wear uniform. Even if they use, we find them not well maintained. The laundry section of the hospital is ill-maintained and deficiently managed and a medical superintendent finds it difficult to improve the working conditions. The patients coming to the hospitals develop a negative attitude that the hospitals are financially insolvent and they have no funds to supply uniform’s and maintain them. In addition, the patients and attendants find it difficult to identify the hospital personnel. So it is necessary that particularly
in the government hospitals, an attitudinal change is significant. The Private hospitals have been giving due weightage to the uniform culture.

Since you serve an organization promoting healthcare, educating and informing the public; it is essential that different categories of employees working there do not provoke to comment adversely about the different dimensions of physical attractions. Your dresses, physique, hair style, facial expression has significant impact on the behavioural profile of the patients, attendants and visitors. So it is essential that you are particular for the management of physical attraction and in promoting the same in the hospitals.

These facts make it clear that a hospital manager needs to treat Physical Attractions as a sub-mix of the marketing-mix where attractions carry some sensible meaning. Of course your core services generate attractions; your peripheral services create additional attractions but we find physical attractions linked to both. We talk about the high performer, a super performer and this makes it necessary that all the dimensions are given a fresh look, a new vision, and an innovative treatment so that the uniqueness proposition leads to establishment of distinction in almost all the areas. It is against this background that we feel the need for including this sub-mix of the marketing-mix even in the hospitals and healthcare organisations. Unless you generate additional attractions, and unless you differentiate yourself, and your hospitals, the customers/patients would not be encouraged. Of course, we find quality of healthcare service motivating them significantly but when you offer quality healthcare services and in addition also make sincere efforts to generate additional attractions, the task of excelling competition; and of establishing leadership would be fulfilled satisfactorily. These facts make it clear that physical attractions need to be incorporated in the marketing mix of hospitals.
(B) Overview of Diversified Services in Hospital Management
Financial Management Unit:
There was a time when non-profit hospitals, particularly church-related and other voluntary hospitals in our Country set their priorities in health care programmes by responding solely to the health needs of the community without any regard for their financial implications. What was worse, these hospitals, operating under the style of charitable hospitals, did not pay heed to the necessity of running their hospitals in a business-like manner. Many of them have now been forced to sing a requiem as it were to these compulsions. In order to stay in business, they realized that they should pay attention to economic imperatives. Every decision made within the hospital should be evaluated in terms of its financial implications. Public opinion and priorities of the trustees also have changed. The effectiveness and performance of hospitals are no longer measured by their response to community needs alone but by their ability to maintain a strong, viable financial position that commands the respect of the people. When the hospital is financially sound, it can meet the needs of the community any way. An out of business or a financially unsound hospital does not look after anybody. Hence the importance of financial management is there in hospitals.

The three main components of the financial management unit—business, accounting, and financial service—are often wrongly used interchangeably to refer to the whole department. The business office performs the day-to-day business procedures, primarily dealing with the patient accounts, accounts payable and pay-roll; the accounting office deals with budgeting, auditing and monitoring functions; and the financial service deals with planning, forecasting, reporting, advising and evaluating.

Functions:
The following are some of the important functions of the unit:

- Maintains extensive accounting and statistical records.
- Establishes patients' accounts—a unique number is assigned and a file opened for each patient.
- Posts charges for hospital services to patients' accounts.
- Compiles all charges, and issues bills; also collects cash and unpaid bills.
- Records all financial transactions, including control of cash, recording of purchases, estimate of cost of free service rendered to indigent patients etc.
- Develops pay-roll records managing and maintaining time cards, absenteeism, leave on loss of pay, payment of salaries, benefits at cessation or termination of service, etc.
Assists in the preparation of the hospitals budget, estimating the needs of various departments and anticipating patient load and income.

Prepares costing of departments and services, departmental income and expenditure and comparative statements. The costs of services help in setting fee schedules.

Handles accounts payable largely on account of purchase of goods, supplies and services. Coordinates with the purchasing department for the purpose of verifying payments for the goods and services received.

Coordinates legal matters such as statutory reporting of births and deaths, accident claims, free care, etc.

In some hospitals, the admitting department is under the financial management unit. The unit then supervises and coordinates functions relating to admitting and discharge.

In some hospitals, the data processing unit is under the financial management unit because originally the data processing was created to automate financial and accounting functions.

Location:
The unit generates heavy traffic and many transactions occur. Because the department relates directly with the administrative departments and must have a convenient access to the general public and staff of various departments, it must be located on the administrative corridor adjacent to the administrative block from the main lobby. Nevertheless, much of its work requires a level of concentration demanding privacy and freedom from frequent interruptions. One way of providing this is to have a front office for functions like billing, cashiering, etc. and a back office for work demanding concentration and privacy.

Design:
Computers are being increasingly used in hospitals. Because of this and the need for adaptation of space as warranted by changing accounting practices and changes in personnel requirements, it is recommended that the unit is designed with maximum flexibility with the use of open landscaped areas and minimum use of contained modules except where they are absolutely necessary.
Organization:
The head of the financial management unit is a controller or vice-president or director of Financial Services who reports directly to the CEO. In small hospitals, the CEO or one of his associates like the director of administrative services or assistant administrator may assume this office and perform the functions pertaining to it. The actual configuration of the department will vary depending on the size of the department and who the top officer is.

Financial operations of the hospitals are being increasingly computerized. Computer sophistication may range from automatic posting on mini-computers to complete financial systems. Where an in-house computer network is available, virtually every hospital department interacts with the computer system.

Some of the common activities of the business office in which computers can be used are:
- Open and maintain patient accounts, assign numbers, enter into ledger, etc.
- Post charges to patient accounts using charge codes for specific services. Data can be entered automatically and instantaneously as and when service is rendered.
- Generate bills on discharge of patients in a matter of minutes.
- Perform accounting and auditing function

Space Requirements:
Space is required for the following:
- Director of financial services;
- Senior associates or assistant directors, business manager, chief accounts officer;
- Secretarial and clerical area;
- Chief cashiers work area and cashiers booths. Cashiers must be conveniently located in major areas/departments where cash transactions occur;
- Central accounting work area;
- Billing section with adjunct cashier’s booth. Waiting area for patients and their families waiting to pay bills. Billing area should be adjacent to credit and collection area;
- Pay-roll section. Because the work is of a confidential nature, a separate room is recommended;
- Credit and collection area;
- Internal auditors room and space for external auditors;
- Storage room for supplies, etc.;
- Archives storage area for patient records, purchase invoices and other records; and a conference room for departmental meetings. Can also be used by the auditors.

Other Requirements:
- The chief cashier’s office should have a safe for keeping cash until it is sent to the bank.
- There should be a safe or locker for patient valuables given for safe custody during admission if this is not provided in the admitting office.
- A fireproof vault or cabinet for storing valuables records, documents and disks.

Problem Situations:
The following are some of the problem situations which the financial department must tackle:
- High accounts receivables.
- Poor cash flow.
- Late charges from ancillary and supportive service departments like X-ray, Laboratory and dietary especially if the functions are not fully computerized;
- A good percentage of missing bills and lost charges;
- Difficulty in obtaining correct information about patients. Many patients give wrong or fictitious addresses. Follow up and recovery of unpaid bills become almost impossible; and
- Embezzlement of funds, fraud and theft in various operations of the unit.

Internal Control:
The need for a system of internal control in any organization, especially a hospital is immediately apparent. It is impossible for the CEO to exercise direct and personal supervision over all employees and their activities. He must, therefore, depend on policies and regulations and a built-in-system of the internal control for the efficient running of the hospital.

Internal control provides a mechanism by which the work of one employee acts as a check on the work of another. For example, the store keeper does not have control over inventory records, employees handling cash do not have access to accounting records, purchasing functions are segregated from accounting, and receiving functions from issuing functions.
It has been estimated that up to one hospital employee in every ten steals habitually. It is incredible in how many different ways people embezzle money and commit fraud. In every organization, some employees are placed in certain strategic positions that makes it easy for them to embezzle money. The accounts clerks may keep two sets of books, write cheques to fictitious suppliers, enter fictitious names in the salary register, give refunds for materials that are not returned, collude with suppliers in obtaining quotations and supplies, tamper with accounts by changing amounts in invoices and cheques after payment have been made – examples can be multiple. The only way to check these malpractices is by instituting effective control measures. Any measures taken after the fraud is committed is like locking the stable door after the horse is stolen.

Hospital Information System (HIS):

The information system department, also called the electronic data processing department (EDP), is one of the newest and the most dynamic departments in the hospitals. Originally applied to automate the financial and accounting areas, computer technology has now pervaded almost every activity and has revolutionized the flow of information within the hospital. The daily flow of information in a hospital is overwhelming. An endless stream of data begins with the outpatient and admitting departments and emanates from every department throughout the hospital. Some of the information is vital to the care and well-being of the patients, while other data enhances the efficiency of the hospital itself. The way the hospital responds to the challenges of the information resource management, determines the quality of patient care and success or failure of the institution. Crucial decisions must be based upon facts established through management's use of the current information.

In the early days of computerization, when fragmentation was the norm there was no way hospitals could utilize data as a consolidated resource pool. The outpatient department and admitting separately collected specific patient information, and the laboratory stored appropriate data. Many separate systems functioned with little or no sharing among them. Sometimes, subsystems did not agree. We now have a system that puts together all departmental data into a comprehensive database that can be shared on a hospital-wide basis.
Hospitals consists of many diverse groups performing highly specialized functions. It is imperative that these functions be carried out in a well co-ordinated manner. This gigantic and seemingly impossible task is being performed as a matter of daily routine in many hospitals which have been Computerized. The individual systems work as a unified whole that fulfills the needs of both the departments and the hospital.

Today's state-of-the-art computer has a comprehensive clinical and financial database and an advanced database management handling technology. Designed to capture, edit and store information on line and in detail, it delivers maximum responsiveness to on line users. It has capabilities for extensive management reporting for all departments without affecting the simultaneous responsiveness for on line users. It can handle a wide spectrum of hospitals requirements from abstracting of medical records and historical reporting to retroactive processing of a patients complete financial data to producing a bill.

**Some Benefits of the Unified System:**

- One time data Capture is sufficient. This makes repeat entries and duplication of information redundant, and saves effort, time and expense. It reduces the possibility of human error.
- Since the system is event driven, it can function independently and notify other departments needing the information automatically.
- The information resource is accurate and up-to-date. One common database makes a powerful information resource available to the entire hospital.
- The existing applications, forming islands of computerization of departments, can be integrated into a unified system.
- The system offers information management for the entire hospital while allowing smooth functioning of departmental systems independently.
What to Look for in Computerization:

Hospitals will do well to bear the following points in mind while selecting a system:

- **Integrated System:**
  A system that links all the computerized systems of the hospital so that when complete, there will be an information network that allows online access to the database which ensures hospital-wide utilization of all features and functions except where security considerations and confidentiality on Information prohibits their use. Data should flow smoothly from one system to another without the need for cumbersome interface programs to forcibly fit in unrelated systems.

- **An On-line, Real time System:**
  In the high-tech health care system, patient records, patient information, etc should be on line permitting direct, immediate access through terminals and real time processing in which the computer system records each change and updates all the necessary files, etc. immediately. Example: a computerized on line appointment system or the intensive care computers that monitor patients heart functions, breathing, etc. are real time.

- **A Patient-oriented System:**
  Hospital transactions and activities revolve around the patient. The computer System is event-driven which means that each "event" or patient encounter is captured and processed as it occurs. Thus, any time a patient is provided service, the integrated database is updated accordingly.

- **A Future-oriented System:**
  The computer System should be dynamic and designed to meet the challenges of today's healthcare needs as well as the requirements of the future. The healthcare system and the hardware and software technology changes so fast that systems become obsolete fast. The system should be capable of being easily upgraded to include future requirements.
• **Comprehensive But Modular, and implemented in Phases:**
Probably no hospital can computerize its entire operations at one stretch, and yet no hospital should create independent islands of computerization that are not integrated into a common database. The design must be modular so that functional modules can be implemented separately as add ons. The system should provide flexibility to first implement those modules most crucial to its environment and to meet the immediate needs, and after mastering them add on other modules. This way the cost can be spread over a planned span of time in a phased manner. The software modularity should be complemented by and integrated with hardware modularity.

Every computerized area representing one module should be complete and no part of it should be left to be handled manually. This will lead to a duplication of efforts.

• **The System should be Reliable:**
Any failure in the system will paralyse the whole hospital operation. The hardware should be capable of 24-hour non-stop functioning. The software should be time tested with a good track record.

• **The System Should be User Friendly:**
Almost everyone in the hospital including receptionists, clerk, cashiers, nurses, etc. will need to work on the computer. Almost every work is done on it so that this has become a routine operation. The system should be user friendly and simple without needing high computer literacy and in-depth training.

• **The System should be Cost Effective:**
Both the initial cost of installation, etc. and the cost of maintaining the system should be cost effective.

➢ **Applications:**
Limitations of space do not permit a more detailed discussion of myriads of application and functions that can be handled through the computer. Without being exhaustive, some of the more important ones are listed here:
Patient Management:

- Allows a wide variety of interactive enquiries into patient data with the data provided on line and updated in real time.
- Allows monitoring of clinical and financial information flowing into patient database and checks completeness and status of data.
- Provides more efficient registration of outpatients and inpatients. Patient index allows retrieval on line the most current basic patient identification and demographic data.
- Streamlines the admitting process and makes pre-admission bed reservation, provides access to pre-admission data, etc.
- Patients in emergency room, same day surgery, labour room, and ICUs can be registered on line using previous case data which are available on line and admitted directly without going through the admitting department.
- Provides complete, fully integrated, on line real time admission, transfer and discharge processing with immediate and automatic notification of departments involved. Generates and routes all necessary documents.
- Maximizes ability to handle high volume of outpatients. Gives clear picture of outpatient activities and assigns classifications, diagnoses, procedures, and other information.
- Provides daily census and bed occupancy, identifies and maintains on line bed availability and automatically notifies departments concerned.

Medical Records:

- Authorized personnel can have access to all current and historical data. On line abstracting can be done using screens and conditional editing. All editing is done in real time.
- On line master patient index gives immediate access to essential, episodic patient information. Records can be tracked down and located. Notices can be generated and issued to physicians to return records.
- Medical records reporting gives optimal access to information in the desired format. Reports can be sorted and sequenced in a variety of ways. They can be generated on a daily, monthly, quarterly, semi-annual basis.
Department level care: Service order entry:

- This subsystem has comprehensive, on line order processing capabilities. Fully integrated, it saves much time by automatically routing orders to appropriate departments and then automatically capturing charge data for billing.
- It allows to monitor the processing of orders, to see on line if that order has been placed after being approved by the authorized person, received at the concerned department, and if the processing has been completed and charged to the patient concerned. Order status and results of the test can be viewed.
- There is no need for re-entering recurring orders. Enter only once, for example for physical therapy treatment for 20 days. Order requisitions will automatically print the days scheduled for each course of treatment. Single order for any future date can also be placed.
- Orders can be revised. A record of the revised order together with the old order can be retained in the patients file.
- Allows to view on line any preparatory instruction or other standards of care when the order is placed. For example, when a certain procedure is ordered, preparatory instruction can be displayed to be followed by the nurse or the technician.
- Allows to enquire into entire order history file to see all current and completed orders for any patient.
- Database stores history of all order details used in reporting.

Patient Accounting:

- Fully automated, reliable inpatient billing/accounts receivable functions.
- Can enter patient information and charges for pre-admission testing and procedures in advance. The information is automatically entered upon admission so that accurate and current billing is effected. Bills can be generated for pre-admitted patients.
- A wide variety of both one-time and recurring charges (for example, bed charges) can be automatically posted upon admission, or at any other time.
- Charges for groups of services, package for a special service (for example, bypass surgery or accommodation package such as daily charges for room, heart monitor, nursing care), physician's visiting fee, medical and surgical supplies, etc.
- On line receivable management, on line cash posting, on line financial patient index enquiry, on-line account history, detailed trial balance, bad debt management and write-off, interface with general ledger, bad debt deletion, revenue and statistics reporting and a host of other functions.

**General Accounting :**
- General and patient accounting functions are integrated with the general ledger. It gives on-line access to the hospitals data and timely reporting.
- Generates a wide range of financial reports, including balance sheet, operating statements and budget projection.

**Payroll :**
- On line enquiry access to payroll and related information and management or reports. Payroll automation significantly decreases manual work. In addition to standard payroll functions, other capabilities are automatically calculating benefit accruals with ability to post them to general ledger, integration of payroll and personal data.
- Provides a wide variety of tools from wage and salary administration to management of employee relations and unions besides all standard personnel functions.

**Human Resources :**
- Information can be used for managing and utilizing personnel more productively and cost effectively. Total enquiry access to employee’s data.
- Helps to plan career development and professional growth of employees, to see skills and proficiency levels of employees, levels of formal education, degrees, study leave programmes, in-service training, etc.
- Information on employees current and previous jobs with details like salary, experience, etc.
- Details of performance evaluations – dates, performance ratings, deficiencies, development programme arranged, etc.
- Salary expense analysis with automatically updated historical payroll data.
**Business Office:**
- Helps to analyse unpaid bills, to detect what is not billed, why it was not billed, and the age of unbilled receivables.
- Define the period of time to hold bills.
- Information on occupancy trends, extent to utilization of hospital facilities, revenue trends, monitor receivables, manage cash, etc.

**Collection:**
- Accurate analysis of aging of receivables.
- Collection letters can be generated automatically when needed. These are fully integrated with accounts receivables.

**Nursing Service:**
- Complete, accurate, up-to-date and integrated data, on line, which enhances nursing capabilities for effective patient care.
- Easy access to information, historical retention of data, real time data entry and enquiry and password security to protect patients data from unauthorized access.
- On line data entry helps to collect key patient information for use in patient care activities.
- Helps to create and maintain patient care plans for each patient. Standard checklists of patient education plans or self-care instructions can be accessed for preparing patient care plans.
- Provides summary of patients at a glance. Derives and combines information from assessment, care plans, etc.
- Assess a patient’s need for nursing care based on degree of acuity.
- Creates personnel schedules with variable shifts, rosters, employees and nurse station reports, etc.

**Results Reporting:**
- On-line enquiry will allow instant access to results of tests, investigations and procedures that have been captured and stored only moments before in other automated systems such as laboratory, x-ray, etc. Test results are automatically routed to concerned locations. Results may be viewed on line, or printed for inclusion in the patients chart. Results can be revised as needed.
Materials Management:

- Processes departmental requisitions interactively, determines purchase requirements, identifies the best vendor, generates purchase order, and monitors the status of the order. Can marry receipts and purchase orders, update on-hand stock, check status of the stock, adjust inventory levels, etc.
- Producing purchase orders is a complex task requiring a comprehensive data base of all the stock and non-stock items, a quick cross-reference to a vendor file and a purchase contract file. A department look-up capability is required to check department codes, and an open order capability with a receipts function to close out files.
- Inventory stock status maintained in real time.

PHARMACY

► OVERVIEW

Pharmacy is one of the most extensively used therapeutic facilities of the hospital and one of the few areas where large amounts of money are spent on purchases on a recurring basis. It is also one of the highest revenue generating centres. A fairly high percentage of the total expenditure of the hospital goes for the pharmacy services. This emphasizes the need for planning and designing the pharmacy in a manner that results in efficient clinical and administrative services. Frequently the pharmacy is not organized and managed as its importance warrants.

A good pharmacy is a blend of several things: qualified personnel, modern facilities, efficient organization and operations, sound budgeting and the support and cooperation of the medical, nursing and administrative staff of the hospital. A modern and progressive pharmacy calls for new methods of operations, new production approaches and new distribution techniques to achieve reduced costs and increased efficiency. Automation, prepackaging, unit dose drug distribution, decentralization are some of the methods that are being increasingly used these days in addition to computer-based ordering system, computer assisted pricing, billing, cashiering and checking of reorder level, stock, out-of-stock and overstock positions, expiry dates, etc and a host of other functions.

Keeping in mind this picture of the pharmacy of the future, it is imperative that planners include enough flexibility and expansion potential in initial planning of the pharmacy itself so that expansion programmes can be carried out with minimum disruption to its physical location or without having to move it to an entirely new location.
Pharmacy is a specialized area. Its operation calls for intimate knowledge of drugs and drug therapy. Because of this and the amount of drugs and supplies involved, pharmacists usually handle their own purchases and stocking of drugs rather than let the purchasing department perform these functions for them. In large hospitals, there is a pharmacy and therapeutics committee of which the chief pharmacist is a member, to oversee the activities of the pharmacy.

> FUNCTIONS

The following are the primary functions of the pharmacy some of which are performed directly by its chief.

1. Purchase, receive, score, compound, package, label and dispense pharmaceutical items.
2. Serve as a source of drug information to physicians, pharmacists and other health care professionals, and the patients; This involves compiling, storing, retrieving and disseminating drug information and providing pharmaceutical advice and consultation regarding drug therapy.
3. Participate in the hospital's educational programmes.
4. Plan and organize pharmacy department, establish policies and procedures, and implement them in accordance with the policies of the hospital.
5. Serve as a member of the pharmacy and therapeutics committee, be actively involved in its functions and activities, and implement its decisions.
6. Carry out research and participate in the evaluation of new drugs.
7. Participate in performing therapeutic assessment of drugs and in the preparation of a hospital formulary so that equally effective but less expensive drugs may be put on the formulary. (A formulary is a list of drugs approved by the medical staff and the pharmacy committee for hospital use and kept in the inventory.)
8. Keep track of drugs and formulations or combinations banned in the country and elsewhere, and keep abreast of WHO's revision of "essential list of drugs" and other notifications.
9. Carry out quality assurance programs to ensure quality when in doubt of the efficacy or potency of a drug by sampling and analyzing it either in the hospital or through the drug inspectorate.

10. Comply with statutory regulations, initiating licenses to be obtained, and maintaining records as legally required.

11. Many hospitals are recognized to provide pharmacy students practical training which is in partial fulfillment of their course requirements.

► LOCATION

In determining the most suitable location for the pharmacy, the following factors should be considered.

- Flow of outpatient traffic through the hospital.
- Flow of drugs and other raw materials into the pharmacy.
- Flow of drugs and services from the pharmacy to the inpatient areas and other departments.
- Needs for future expansion.

These factors make it evident that pharmacy should be conveniently accessible from the outpatient department; central receiving (or pharmacy bulk) store and the inpatient areas, a ground floor location close to the outpatient department and to elevators servicing the inpatient areas is ideal.

It is assumed that the outpatient and inpatient dispensing activities are combined. Many hospitals may, however, find that when the outpatient department is the overriding consideration in determining the location of the pharmacy, the result is a less than optimal location for the inpatient dispensing activities. They may soon find that a separate inpatient pharmacy facility needs to be established. In many of our hospitals, inpatients are required to buy their requirements of medicines directly from the pharmacy on a cash 'n' carry basis. Medicines are not supplied and billed. Every hospital sooner than later and much to its consternation discovers that its pharmacy facility has become woefully inadequate. Keeping this in mind, the pharmacy should have at least one outside wall to allow for expansion, and must be located adjacent to an area, for example, a storeroom which can be relocated easily.
DESIGN

Since there is no such thing as a typical hospital, there cannot be a typical hospital pharmacy. Each hospital must therefore pattern its own pharmacy and solve its individual pharmacy-programming problems, and at the same time adhere to the accepted norms of good pharmacy practice and the legal requirements (Fig. 6.4).

Broadly speaking, the pharmacy has four main functional areas: the dispensing area, the production or preparation area, the administrative area and the storage area (Fig. 6.4). These areas must be designed and located for convenient access, staff control and security. Facilities required in these areas are discussed later in this section.

ORGANIZATION

The head of the pharmacy services is usually a chief pharmacist who may possess a B Pharm. or M Pharm. degree and adequate experience. He is normally responsible to the medical director or the medical superintendent. In larger hospitals, he may be required to work in conjunction with the pharmacy and therapeutics committee. Every pharmacist requires registration with the pharmacy council without which he cannot practice.

Other personnel in the pharmacy department are the registered staff pharmacists, pharmacy aides or helpers, pharmacy storekeeper and the pharmacy clerks.

Normal working hours of a pharmacy in most hospitals are from 7 a.m. to 11 p.m., seven days a week. Between 11 p.m. and 7 a.m., coverage is normally by the staff on an on-call basis.

FACILITIES AND SPACE REQUIREMENTS:

The pharmacy department requires space for the following facilities.

Dispensing Area

1. Patient waiting area.
2. Patient dispensing counter, preferably glass paneled, with space for computer-assisted pricing, billing and cashiering on one side and for dispensing on the other.

3. Active storage. Adequate space for a large number of active drugs stored in routine shelves laid out efficiently (Picture 6).

PICTURE 60 Dispensing Pharmacy

4. Pick up and receiving counter and space for temporary storage of carts.
5. Area for review and recording of drug orders.
6. Extemporaneous compounding area.
7. Work counters and cabinets for pharmacy activities.
8. Refrigerated storage,
9. Storage for narcotics and other controlled drugs (secured storage).
10. Storage for alcohol and for volatile and flammable substances.
11. Space for maintaining patient medication profiles and cross-checking of medication, for providing drug information, and a room for pharmacist to meet with the patient who requires extensive consultation, instructions or counseling, if these functions are performed.

Manufacturing Area

- Bulk compounding area.
- Provision for packaging and labelling.
- Provision for quality assurance.
- Clinical sinks and hand washing facilities.

The preparation of parenteral fluids comes under the mandatory regulations of the drug control act, which has now been made stricter and more comprehensive. Hospitals wanting to manufacture these fluids are advised to thoroughly study the regulations and procedures.

Administrative Area

1. Reception and the clerk-typist's area for office functions including filing, communications, references, etc.
2. Chief pharmacist's office, and office space for assistant chief pharmacist and clinical pharmacist (if there is one).

3. Waiting area for visitors, medical representatives and salesmen.


5. Staff facilities like lockers, toilets, lounge, duty room for on-call duty pharmacist(s), etc. Some or all of these can be offsite.

Storage Area

For convenience, some of the storage requirements already mentioned in other sections are repeated below.

- Bulk storage
- Active storage
- Refrigerated storage
- Volatile and alcohol storage
- Secured storage for narcotics and controlled drugs
- Storage for general supplies, equipment, files, stationery, etc.

► OTHER CONSIDERATIONS

The traditional pharmacy services are rapidly undergoing a change all over the world, especially in the dispensing and distribution systems, and many innovative approaches and methods have been introduced in recent years. Though not all the hospitals can implement these changes, it is our hope

That some of the larger and progressive hospitals in our country would introduce and test these newer systems and be pace setters for other hospitals to follow. Some of these changes are described here.

Clinical Pharmacy

In most of our hospitals, pharmacy is engaged in its traditional activities such as drug ordering, preparation, distribution and dispensing. Of these, dispensing prescriptions as ordered by physicians is
the most important. Except for monitoring drug incompatibilities occasionally, pharmacists have no role in determining what to order. But hospital pharmacists are now increasingly becoming involved in what is called "clinical pharmacy" which includes activities like taking medication history, monitoring drug use, drug selection, patient counselling and surveillance of adverse reaction of drugs. In other words, they are becoming involved in determining what to order and thus become a part of the team effort in determining treatment.

Unit Dose Dispensing System

Another important change that has taken place in the field of pharmacy is in the medication dispensing system — from the traditional pharmacy system to the unit dose system. In the traditional system, the pharmacy sends to each patient in the nursing unit, a supply of medication which may be for several days. The nursing unit then prepares the individual dose from the supply. In the unit dose system, the doses are premeasured by the pharmacy so that the nurse has only to administer the medication. The system uses a cassette mechanism which designates one drawer for each patient in the medication cart (Picture 47) or cabinet. The nurse rolls the unit dose cart to each individual patient room, removes the dose of medication to be given from the respective patient drawer in the cart, and administers it to the patient. In the emergency cart maintained in the nursing units, certain drugs are kept in single dose packages which are ready and convenient to administer.

While the unit dose system is expensive — initial one-time cost largely involves the purchase of unit dose carts and packaging equipment and increased pharmacy personnel — there are also several advantages. It reduces nursing time for pouring, counting and dispensing, reduces medication errors, and increases control and recording of medications by the pharmacy.

IV Additive System

The concept of unit dose system can be extended to intravenous (IV) solutions, for which there are two methods: the traditional method and the IV additive method. The activity relates to mixing of medications with IV solutions. In the traditional system, IV solutions are stocked in the nursing unit. Medications are sent to the unit by the pharmacy, and the nurse mixes or adds medications to the IV solution. In the additive system, the medications and the IV solutions are mixed in the pharmacy itself. The pre-mixed bottles are then sent to the nursing unit and the nurse merely administers the solution.
As in the case of unit dose system, the advantages are reduction in nurses' time as well as in wastage and medication errors.

**Pharmacy and Therapeutics Committee**

Every hospital should have a pharmacy and therapeutics committee consisting of physicians representing the various divisions of medical staff, pharmacist(s) and representatives of administration, to oversee the work of the pharmacy. More specifically, the following are some of the duties and responsibilities of this committee.

1. Develop a formulary of accepted drugs for use in the hospital.
2. Serve the medical staff, pharmacists and hospital administration in an advisory capacity in all matters pertaining to the use of drugs and in the selection of drugs to be stocked.
3. Evaluate clinical data concerning new drugs requested to be included in the formulary and for use in the hospital.
4. Add or delete specific drugs from the formulary.
5. Prevent unnecessary duplication of the same basic drugs to be stocked.
6. Recommend drugs to be stocked in the nursing units and other areas.
7. Study problems or reported adverse reactions to the administration of drugs.
8. Issue communication(s) to physicians, pharmacists, nurses and administrative staff regarding proposed changes in the formulary such as additions to and deletions from the list, changes in the working of the system and in the contents of the formulary.
9. Adoption of a policy that the inclusion of drugs in the formulary should be by their non-proprietary names.
10. Ensure that the labelling of medication containers be by the non-proprietary names of the contents.
11. Issue written communication to the nursing and pharmacy staff regarding the existence of a formulary in the hospital and the policies and procedures governing its operation.
12. Issue guidelines for the control, appraisal and use of drugs not included in the formulary, investigational drugs and non-formulary drugs.
Hospital Formulary

One of the major responsibilities of the pharmacy and therapeutics committee is to develop or adopt a suitable formulary of selected medications. A formulary is the official compilation of drug products that have been selected and approved for use within the hospital. The two main objectives of the formulary are: (a) it promotes rational therapeutics, and (b) it prevents unnecessary duplication, waste and confusion and thus promotes economy for both the hospital and the patient. When many brands of the same drug are stocked and prescribed, it results in a loss to the patient as well as to the hospital. However, economy in medication should not be construed to mean prescribing inferior remedies.

It should be remembered that a mere list of medications placed on the pharmacy shelves does not constitute a formulary. The drug list should be expanded to include specifications about how a medication should be used. Formularies should also include recommended daily dosage and cautions, warnings, restrictions, pharmacology and similar other information to facilitate correct use of the drugs.

A detailed discussion of the formulary system is outside the scope of this book. However, a brief mention of the administrative procedures pertaining to the development of a formulary would be in order. The following are some of the steps involved in this process.

1. Appointment of a pharmacy and therapeutics committee by the medical staff composed of physicians, pharmacist(s) and representatives of the administration.
2. Outlining the purpose, organization, functions and scope of the committee, and an organized method for this committee to evaluate the therapeutic claims of competing or suggested drug products.
3. Periodic publication of the authorized drugs.
4. Procedures for revising the list.

▶ PROBLEM SITUATIONS

Theft in Pharmacy

Pharmacy is one of the most theft-prone places in the hospital and, what is worse, pharmacy thefts can be costly, difficult to check, and may go unnoticed. Theft is usually by the employees themselves
or in collusion with them. The most common points where thefts take place are the dispensing area, stores, purchasing process, receiving and invoice payment and the nursing units.

Substantial losses may take place in the dispensing and purchasing areas and continue for a long time without being discovered. The chief pharmacist or the person responsible for purchasing may, in collusion with the vendors, manipulate supply or bills, and divert part of the supply to privately owned drug stores. With an incredibly large number of items kept mostly in open shelves of the dispensing pharmacy, the task of exercising any meaningful control over the drugs is a formidable one even with all the checks and balances and control measures. The problem becomes serious during evening and night shifts when there may be only one pharmacist on duty, and even more serious when, in smaller hospital, the pharmacist doubles the duties of the cashier as well.

Every hospital must recognize that it has a moral obligation to make theft and fraud as difficult as possible, if not altogether impossible, by instituting proper control systems. Too often the general climate in the hospital is such as to provide ample scope and temptation for employees to indulge in such activities without anybody taking cognizance of such offenses or punishing the offenders. A sound system of controls acts as a deterrent and creates fear in the employees that frauds and thefts will be detected and punished.

MATERIALS MANAGEMENT

► OVERVIEW

Materials management encompasses acquisition, shipping, receiving, evaluation, warehousing and distributing of all goods, supplies and equipment for an organization. Acquisition may be through purchase, lease or rent; warehousing is storage of goods, supplies and equipment, and inventory control; and distribution is delivery or pick up of goods and supplies. Traditionally nursing units, laboratory, x-ray and certain other departments performed their own purchasing functions, negotiated prices and maintained their own inventory. There is unnecessary duplication of personnel, facilities and efforts in this system, and the best possible prices cannot be negotiated. The current trend is thus increasingly towards centralizing materials management functions. Nevertheless, we have many hospitals
where pharmacy, food service, maintenance and certain ancillary services like laboratory and radiology perform their own materials management. The argument is that their purchases require a high level of technical competence or knowledge, which the purchase department normally does not have. In most cases, it may be so.

Computers are now increasingly used in materials management in the areas of purchase, inventory, reorder and invoice production, and a number of other functions.

► **TEN GOLDEN RULES OF MATERIALS MANAGEMENT**

There are certain cardinal rules that every materials manager should know and practice.

**Rule One** Successful materials management is built upon effective management system and good supervision.

**Rule Two** Purchase order is often called the umbilical cord of the purchasing process. For internal control and a smooth flow of goods, the receiving store, the accounts and the requesting department should receive copies of the purchase order. The original goes to the vendor and a copy of it to the purchasing file. The procedure and documents should be simple. Initiation of every purchase order costs money. It should, therefore, be cost effective. Consider this: if the cost of initiating a purchase order is Rs 5 or 75, and the cost of the ordered commodities is Rs 1, it will not be economical.

**Rule Three** Centralize the purchasing system. Decentralized purchasing is contrary to all the underlying principles of good materials management. Centralized purchasing eliminates uncontrolled purchases by departments, secures a reduction in prices through improved purchasing methods and quantity buying and shipping, results in improved allocation of space, and reduces inventory costs and staff. It saves staff time.

**Rule Four** Negotiations is the key to sound purchasing. Every purchase officer should learn the art of hard-nosed but ethical negotiation. Here are some tips for good and successful negotiation.

- Never purchase at list price.
- Negotiate for bulk price or price for the quantity the hospital would need for the whole year, and then get the price for any quantity you want to purchase.
- Regardless of how much you buy, always ask for a discount.
• Always get a price protection on the agreed price. Start negotiating price protection for two years. Even if you end up with a short period, it is worthwhile.

• Try to get at least a month's time to pay the invoice. Whichever way you look at it, it is a positive gain.

• Remember, even at a good bargain price, the supplier makes a profit. So don't feel sorry for him.

• Always keep in mind that there are tougher negotiators than you. They may be getting a better price than you do.

• Remember, it is the quality and determination of the negotiator, which always get a good price in buying and not merely the reputation, and size of the hospital.

Rule Five There should be an effective receiving programme with responsibility, accountability and internal control built into the system. The fundamental rule is that the three functions of purchasing, receiving and paying of invoices should be handled by three different persons. Receiving is one of the most important functions of materials management, which should be carried out professionally and ethically.

Rule Six Establish an optimum level of inventory, and a simple but effective inventory control programme. The inventory should not be so large that you can replenish it only with the aid of a computer. Remember the dictum: the secret to managing an inventory is to control it, not count it.

Rule Seven Establish effective and result-oriented requisition and distribution systems. The goal of the distribution system is: the right item to the right place at the right time in the right quantity and at the least total cost.

Rule Eight Establish written policies and procedures. Internal control in materials management starts with them.

Rule Nine If you want to buy the right supply in the right quantity at the right place and time, and simultaneously effect cost containment, standardization and evaluation of all products and services is a good place to start with.

Rule Ten Wherever possible, go for contract purchasing through prime vendors i.e., buy the entire categories of supplies from a single source on negotiated terms of quantity, quality, price and time. By being innovative in their purchasing approaches, hospitals can create a buyer's market instead of competing with each other in a seller's market. Since contract purchase encompasses all supplies of a certain category, hospitals can get the best deal in a fraction of time and effort they
spend on traditional purchase. A host of items, from medical-surgical to dietary items, can be purchased through prime vendors.

► RECEIVING

The receiving area is the entry point for all materials coming to the hospital. It is here that a careful check should be made and errors detected. Some of the most common receiving errors are: supplies not ordered are shipped; items are changed or substituted without the prior approval of the purchase department; outdated or defective materials are sent, or they are damaged, and there are shortages in the supply.

The cost of correcting any mistake committed by the purchase department, the vendor or the shipping agency after the supplies have passed through the receiving section can be very high. So great care should be taken to thoroughly check them at the entry point itself.

The receiving person should do the following:

• Check quantity — number of packages and weights against shipping or packing slip.
• Check quality — inspect the materials and condition of containers, and record any damage.
• Verify receipt of materials against the supplier's packing slip and the purchase order.
• Record in the receiving report all discrepancies between the materials ordered and the materials received, like shortages, surplus, incorrect or damaged materials, incomplete supply, etc. The unit of measure used in the receiving report should be the same as that in the purchase order. The report should carry the signature of the receiver and the date. It should state that the order received is complete.
• Enter the serial number of equipment items in the receiving report to enable the accounts department to maintain an accurate and complete assets register. There may be several pieces of equipment of the same model.
• Distribute the materials to the appropriate departments or stores, as the case may be, and obtain their signatures.
INVENTORY CONTROL

The central store is responsible for receiving, unpacking, storing and distributing supplies used in the hospital. Inventory control is one of its primary responsibilities.

The store generally stocks all items that have not been delivered to departments upon receipt, but have been stored for distribution and use at a later date. The most common materials that are stored are: medical-surgical items, dressings, housekeeping items, office supplies and stationery and forms. Materials usually kept in their respective departments are: drugs, other pharmaceuticals, intravenous solutions and sets, laboratory supplies, x-ray supplies, all processed sterile supplies, food items, and china and tableware. Linen may be kept in a separate linen store.

The inventory serves two important purposes: 1. It provides maximum efficiency and optimum inventory and 2. It provides a cushion between the forecast and actual demand for materials.

To achieve the primary goal of patient care, stores should carry on optimum inventory. This should not, however, be taken to mean a minimum inventory. Inventories are a protection against unforeseen failures in supply, sudden increases in demand, or unforeseen delays in delivery.

Among the criteria for inventory control is the availability of space; Prepackaged and disposable goods, packed by similarity of service or use, are available in plenty and are being increasingly used in hospitals. But they require more floor space and general circulation area. Another criterion is that it must be more economical to maintain an item in inventory than to purchase it on demand. Among the questions hospitals should ask are:

- What are the consequences of not having an item available from the patient care point of view, both in real and perceived terms?
- What are the economic consequences if any individual department is allowed to stock this item?
- For what use is the item intended?
- Is the item used by more than one department?
**DISTRIBUTION**

From the store to the user points, the hospital distribution is an intricate system. An effective distribution should ensure the provision of the right item to the right place at the right time. It is generally found that for every rupee spent to purchase an item, another rupee or a major part of it is spent on storing and delivering it. This makes it imperative for the stores and distribution system to be efficiently organized.

There are at least two methods of distribution in hospitals: (a) requisition system, and (b) par-level system. A third method, cart exchange system, which is rated highly, particularly from the point of view of management control, is not practiced in India.

The requisition system is the most widely used method in the Indian hospitals. Each user department maintains and keeps track of its inventories. Periodically or when inventory levels are low; a requisition is prepared and sent to stores, which delivers the requisitioned items to the user department.

In the par-level method, each user department stores a certain amount of supplies in the department. The levels of stock for each department are pre-determined based on the usage rate and on how frequently the stock was being replenished. At pre-determined intervals, the supply personnel check the stock and bring up stock to the par level.

In the requisition system, space utilization and management control are almost negligible, whereas in the par-level system, they are good. We, therefore, recommend the par-level system.

The type of distribution system should be decided early in the planning stage. This decision is crucial to the materials handling system. It should be based on cost consideration, but attention should also be paid to reduced employee travel time, reduced steps in material flow, and the number of employees needed for different activities of the distribution system.

Elevators are essential for the movement of goods. Large hospitals designate a separate elevator, called a "service elevator" for distribution of goods among other purposes.
LOCATION

Ideally, the major divisions of materials management should be located in one area of the building. But this may not be possible or practicable. The department generates moderate traffic of hospital personnel and vendors to and from outside the hospital.

For vendor traffic, the purchase office should have a sub waiting area with a receptionist and seating and an outside entrance to avoid routing it through the main lobby and the administrative corridor (Fig. 3.1). The department should have easy access to a multi-purpose room that can be used for product display and demonstration.

The central stores should be on the ground level and as far away as possible from other traffic areas. It should be close or conveniently accessible to an unloading dock, which should have a covered area big enough to handle trucks bringing in the goods and supplies. The receiving office, equipped with a platform scale, and the unpacking area should be adjacent to the unloading dock.

ORGANIZATION

Purchase, stores, receiving and distribution may all be integrated in one department, called materials management, under a materials manager or an assistant administrator. Or, these major functions, especially purchasing and central stores, may be informally linked but function independently under separate managers. Consolidation of all functions may produce savings.

There are professionally trained materials managers. Many universities offer graduate and postgraduate courses in materials management. Others acquire skill in the department by beginning at entry level in various posts and advancing as they gain experience.

FACILITIES AND SPACE REQUIREMENTS

The following offices and facilities are required for the materials management department.

- Materials director/manager’s office
- Secretarial and clerical area
- Office for assistant director (if there is one)
- Materials management clerical work area
• Office(s) for purchase officers
• Vendors/visitors' waiting area
• Receiving and unpacking area
• Central stores
• Unloading dock (common area)
• Multipurpose room for product display and demonstration. Can be a common area shared with other departments.
• Catalogue library. Space for filing product data, catalogues, specification sheets, brochures and samples.

► PROBLEM SITUATIONS

Theft, Fraud and Kickback

Large-scale theft and fraud can take place in the purchasing process, stores and at the receiving point, resulting in fictitious bills, overpriced purchases, inflated invoices, fraudulent payments and downright theft. Following are some examples of these fraudulent practices.

• Frequently, rules require merely the countersignature of purchasing department on the purchase order. This allows departments to carry on corrupt practices while the purchasing officer exercises little or no control over the purchase.

• Ancillary departments often stipulate specific manufacturer or supplier along with the price while submitting purchase requisitions. This leaves the purchase officer with no option to negotiate prices. Quite often, the purchase officer will be too happy if someone else does the preparatory work for him. Such practices provide ample scope for receiving a commission or kickback.

• Sometimes a staff member in departments like x-ray or dietary which have the privilege of making autonomous purchases places purchase orders, sometimes over the phone, and certifies that the goods have been received regardless of their quantity or whether they have actually been received or not.
• A single person performs the functions of purchasing, receiving and passing of bills for payment making it easy for him to accept a commission or kickback.

• Purchase of large-scale stores items is contracted on a yearly basis by one individual without committee sanction or approval of an administrative officer.

• There is lack of attention to and control over the receiving function, which is one of the most vulnerable areas. Often packing slip is not scrutinized against the purchase order and documents, quantity and quality are not checked.

• General stores and the receiving area may be adjacent to each other, and stores personnel may double as receiving personnel and vice versa making manipulation of records easy.

• The stores supervisor may be too busy to supervise the work of stores clerks who are left to carry on the work of issuing and distribution as they please.

It is difficult to comprehend in how many inscrutable and uncanny ways people embezzle money and commit fraud. In every institution, some employees hold strategic positions where they can easily embezzle money. The accounts clerks may keep two sets of books, write cheques to fictitious suppliers, give refunds to materials that are not returned and collude with suppliers in obtaining quotations and supplies. Examples can be multiplied.

Wastage

Most managers recognize the enormous loss they suffer on account of fraud, defalcation and theft, and the imperative need for internal control to prevent such losses. But what they fail to realize is that losses due to wastage are considerably greater.

Wastage may occur in almost any area. In the area of human resources, it may be due to loss of time on the job, tardiness and absenteeism, unnecessary overtime, superfluous personnel, lack of skill, inefficiency, poor morale and turnover, etc. Material wastage occurs when materials drawn from the stores lie unused till they become unfit for use, or a bigger quantity than is necessary is indented for and the unused materials are thrown away. Other items most prone to wastage and theft are the stationery and office supplies. Efforts to control office supplies often cause resentment. Hospitals may do well to study this problem.
FOOD SERVICE DEPARTMENT

> OVERVIEW

Good food is important in the treatment of the patient and is a part of his total care. The food service department in today's modern hospitals ranks as one of the major departments. It is headed by a specialist who is either a professional manager or a chief dietitian.

Most people readily accept the professional service of their doctors with minimum criticism. They do, however, tend to pass judgments on the cleanliness of the hospital, the personal care and attention given to them as patients and visitors and on the quality of food. The coffee shop is one of the places where a visitor often stops by on entering the hospital, and it sets the overall impression of the hospital for the first time visitor. The decor and the service here, as in other parts of the hospital, should be consistent with the image the hospital wishes to project. An irritated customer here may give vent to his feelings at the patient's bedside, and look for faults in patient care. Hospitals have long recognized the public relations value of the food service department. Unfortunately, criticism of the food is one of the most frequently heard complaints in any hospital. A properly planned, designed and administered food department can avoid the major share of this criticism.

> FUNCTIONS

The functions of the food service department are as follows.

- Provide the best possible food at a cost consistent with the policy of the hospital.
- Buy to specifications, receive supplies, check their quantity and quality, and store, produce, portion, assemble and distribute food.
- Establish standards for planning menus, preparing and serving food, and controlling meals. Standards should be established before setting up food purchase specifications.
- Establish policies, plan layouts and equipment requirements.
- Plan and implement patient therapy, education and counseling, advise patients and their families on special dietetic problems prior to their discharge from the hospital or as referred from the outpatient clinics.
• Train dietetic interns.
• Impart instructions to nurses, medical and dental students, interns and residents about principles of nutrition and diet therapy.
• Cooperate with medical staff in planning, preparing and serving experimental or metabolic research diets.

► LOCATION

In the earlier times, hospital kitchens were generally allocated space unusable for any other purpose. Food service department located below the ground level is certain to have a deleterious effect on the quality of food and efficiency of the department. A kitchen in the basement, for example, is likely to be dingy, dark and poorly ventilated. A ground floor location is preferable, and is also convenient for delivery of supplies.

The department should be close to the materials management department. The storage area should be in close proximity to the unloading dock. Easy access to vertical transportation system serving patient care units is important to facilitate delivery of patient meals and return of used trays and utensils. The cafeteria and dining room(s) should be close to food preparation and production area, and within convenient access to the hospital staff.

► DESIGN

The design and physical facilities of the food service department have an important bearing on the standard of food service, labour costs and the morale of the employees. For example, storage rooms far removed from the work area, poor arrangement of the preparation and production area for work flow, and long traveling distance for prepared food lower the level of efficiency and increase unnecessary steps for employees resulting in increased costs.

In the general layout, the most important factor to be borne in mind is the logical work flow, that is, receiving supplies, storing and refrigerating them, preparing and serving food, returning trays
and washing dishes (Fig. 6.5). There should be adequate space and facilities for performing the work in each of these functional areas.

► FUNCTIONAL AREAS

The major functional areas (Fig. 6.5, 6.6) of the food service department, following the sequence in the workflow, are described below.

**Receiving Area and Control Station**

The food service department requires a substantial amount of supplies and materials. The receiving area which may be common to all other hospital supplies should be large enough for handling bulk supplies. The receiving clerk inspects and checks all the supplies both for quantity and quality. In the case of dietary supplies, the dietitian or a staff member of the food service department personally checks the supplies. The receiving area should be equipped with scales for weighing materials and supplies. All internal control measures described under materials management apply to this area too.

**Storage and Refrigeration Room(s)**

The storage area which comprises dry and refrigerated storage should be adjacent or close to the receiving area. Dry storage is for staples and refrigerated storage, for perishables. Hospitals generally store several days' supplies to meet any eventuality. Some dry foods are bought and stored in bulk. Wooden or steel racks and platforms are used for storage. Large hospitals have walk-in coolers and refrigerators with varying degrees of temperature for meat, meat products and poultry, dairy products and eggs, and fruits and vegetables. As in restaurants it is common practice in such hospitals to freeze all leftover food for later use. The refrigerators should have a thermometer in each unit for daily temperature check. The walk-in refrigerator should also have an alarm connected to a place with a 24-hour personnel coverage in case someone accidentally gets locked up inside.

**Preparation and Production Areas**

Some hospitals prefer to have a separate pre-production preparation area where sorting, peeling, slicing, chopping and washing of materials can be done prior to cooking. A double sink with
draining boards, worktops, peelers, and grinders are the necessary equipment. There should be efficient arrangements in the production area so as to permit best possible workflow and minimum cross traffic.

Special attention should be paid to the size of the production area. Early in the planning stage, it should be decided whether the hospital will serve only vegetarian food or non-vegetarian food as well, and if the latter also, whether there should be separate kitchens for these. Some raw foods when cooked may produce disagreeable odors and also taint other food. It may thus be necessary to handle them separately.

Food in hospitals is prepared in batches using the progressive approach. In progressive cooking, food is prepared in small batches at regular intervals during the serving time. This provides freshness and palatability, and the food remains hot.

The essentials of good production are:

- Good physical layout which ensures easy flow of work.
- Use of standardized recipes.
- Correct techniques of preparing each kind of food, which preserve natural flavour and nutritional value.
- Progressive cooking and preparation in the shortest possible time.
- Good management and supervisions.

**Serving Room**

The serving room is a place where patient food trays are assembled. It receives prepared food in bulk from the kitchen and the refrigerators. After the trays are assembled, they are loaded on to tray carts or food trolleys and sent to the patient floors. It is imperative that the serving area be close to the elevators.

The equipment and facilities in the serving room include refrigerators, tabletops, cupboards for storing trays, dishes, cutlery, and other articles necessary for assembling trays.

The dietitian has overall responsibility for the inpatient food service. She has the last immediate duty of checking the trays for proper identification, accuracy and temperature of foods, and ensuring that the food is palatable and served attractively.
Food Delivery

Food trolleys that can be plugged into an electrical outlet to keep the food hot are now available. An airline truck is a tray truck with separate heated and refrigerated sections for hot and cold foods, and bulk thermal containers for liquids. The hot bulk cart contains hot food in bulk, which is dished on to the patient trays on the patient floors (Pictures 62, 63). Some hospitals distribute foods in individual hot food containers carried in open food carts. Smaller hospitals may serve them in ordinary tiffin carriers. Beverages like coffee and tea are poured into cups in the patient rooms. Whichever method of distribution is used, the patient serving should not take more than forty-five minutes; if it does, the system should be evaluated.

Special Diet Kitchen

The special diet kitchen is an integral part of the hospital kitchen. The special diets should be prepared under the supervision of a qualified dietitian, the actual preparation being done by student dietitians or interns as part of their training. Since special diets are usually modifications of the basic menu and since the special diet kitchen derives its supplies from the main kitchen and transports the trays through the same tray carts, it should be located in the main kitchen or in close proximity to it. The diet kitchen also requires pots, pans, vessels, etc. like the main kitchen but on a much smaller scale. In addition, it requires scales for weighed diets.

Dishwashing Area

Dishwashing, an otherwise noisy job, is made easy with large modern dishwashing machines. In these, a continuous stream of soiled dishes are loaded at one end and clean dishes unloaded at the other. Wire baskets may be used to place glasses and cups in individual compartments.

An abundant supply of hot and cold water should be piped to the dishwashers and sinks. Drainage and plumbing should be well engineered.

Soiled dishes are brought to the dishwashing area and scraped and waste collected in a garbage receptacle. Dishes are then checked and placed in dishwashing trays, and loaded for washing. After this, they are stacked in appropriate places for reuse.
Potwashing Area

Washing of pots, pans and utensils is normally done by hand. It is a dirty and noisy work best done in a separate room. The place must have deep sinks, abundant supply of hot and cold water, and drying racks. Pots and utensils should be identifiable so that they can be returned to their respective user units.

Cafeteria

While accepting the proper nutritional care of patients as the primary responsibility of the food service department, most hospitals also provide food to non-patients and non-patient areas, such as hospital staff, visitors and patient bystanders, functions and meetings through the cafeteria (Plate 1: Picture 64), coffee shop and the snack bar.

In planning the cafeteria, the following factors should be considered.

- The number and kind of groups to be served — day staff, resident medical and nursing staff, visitors, patient attendants and bystanders; whether there should be separate dining rooms for medical staff, officers, VIPs, and other staff.
- Types and extent of food selection — vegetarian or non-vegetarian, number of food items, a complete meal for a fixed price or items by selection a la carte.
- Kind of service — self service at the counter or table service; whether separate counter for doctors, etc.
- Size of the dining room and number of shifts — whether all persons can be accommodated in two or three sittings during one or one-and-a-half-hour meal period.
- Method of clearing table. If self-service, whether personnel will be required to return their trays to a designated area, e.g. a trolley or a cart, and if they will also be required to dump garbage in the garbage bin before depositing the trays.
- The hospital cafeteria works like a fast food business operation — cash and carry. The customers buy coupons at the counter, pick up food items in exchange for them, carry their trays to the tables, and eat. The hospital cafeteria should be designed for this kind of operation.

A customer-oriented menu is the key to successful management of hospital cafeteria. The chief of food service must recognize certain fundamental principles, which ensure an efficient and profitable running of the cafeteria. They are:

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· Satisfaction of the customers who enjoy good food. In the case of hospitals, they are more of a semi-captive customers.
· Variety in food. Patients may or may not be accustomed to luxury but most of them are used to variety in their diets at home. If it is not provided, they may quickly develop distaste for the food.
· Purchase of high quality food at economical prices.
· Receiving and storing food supplies properly.
· Exercising effective control on supplies at the points of receiving, storing and issuing.
· Preparing foods according to standard recipes and standard quality and serving them attractively in standard portions.
· Accounting for the sale of food.

Coffee Shop and Snack Bar

The coffee shop-cum-snack bar should preferably be away from the main kitchen and dining rooms to cater largely in-between-the-meals coffee, tea and snacks to mostly outpatients, visitors, and personnel. This way, the main cafeteria can remain closed except for breakfast, lunch and dinner as keeping the whole cafeteria open over two shifts is costly. The coffee shop should be easily accessible to outpatients, particularly the emergency patients. This is important in the night when the cafeteria is closed and the patients need refreshments. It should be designed like a fast food restaurant for a quick turnover of patrons and not as a lounge where people settle down for an informal chat.

► ORGANIZATION

Traditionally, a dietitian has been the chief of the food service department, also called the dietary or nutrition department. But in larger hospitals, professional managers with degrees in management and specialty degrees in food service or hotel management are now becoming more common with the dietitian as the dietetic supervisor. In smaller hospitals, she may serve a dual role as both dietetic supervisor and department manager. The manager usually reports to one of the associate administrators.

The question is often raised as to whether the food service department should be placed under the management or the clinical services, and to whom should it be responsible — to the administrator, or the medical director. While mostly it is responsible to the administrator, the department also has a close relationship with the medical staff in professional matters.
The department has two main functional divisions: one relating to the administration of the department and food production, and the other relating to therapeutic food service and instructions to patients, and their counseling.

Administrative duties ranging from purchases to planning of menus occupy most of the manager's time. The therapeutic and educational duties include diet therapy, planning patient menus and special diets, supplying special diet list to patients and counseling, educational activities and teaching students and training dietitian trainees.

Unskilled workers constitute the bulk of workers in the department. The trend in hospitals is to employ workers at the lowest salary level. This results in instability, lack of responsibility, and poor quality of work. The department is often a breeding place for unions. Many hospitals require those involved with food service to undergo physical examination to make sure that they are free of communicable diseases.

Dietary aides, if properly trained, can perform a variety of functions such as checking supplies, writing requisitions, checking and reporting census, making out time schedules, checking routine tray line, and making out charge slips.

Every hospital must develop a diet manual prepared by the food service department and approved by the medical staff, and make it available for use of medical and nursing staff.

Early in the planning and design stage, hospitals should decide as a matter of policy whether the hospital food is to be compulsory for all the patients or they have the option to bring food from home, perhaps with the exception of special diets. The size of the department and the concomitant facilities are dependent on this decision. Both these systems have their merits and demerits. In some hospitals, food is included in the charges for the room.

Meal planning is one of the primary functions of the department. It is the determination of meals that are to be served to the patients and the non-patients. Cycle menus that are commonly used consist of a series of skeleton menus to be served over the length of the cycle — weekly, biweekly, or monthly. Variations are sometimes made to take advantage of the seasonal foods.

Some progressive hospitals allow the patients to select their own meals using menu cards as in restaurants. Dietitians help patients in giving their orders.

Therapeutic nutrition requires a qualified dietitian to assist in patient therapy. In most cases, nutrition therapy, as ordered by a physician, requires modification of the normal diet in its content, consistency and preparation. It is necessary that a specially prepared diet is written for every
individual patient although customarily a master cycle menu may have been developed. Therapeutic and special diets and meals should be clearly marked, preferably by colour coded labels.

- FACILITIES AND SPACE REQUIREMENTS

The following facilities and space are required. Some of these have already been discussed in detail.

- Food service manager's office. It should offer an unobstructed view of all the parts of the department, and be well ventilated and preferably soundproofed.
- Secretarial, clerical office with space for file cabinets and other equipment, seating for visitors, vendors, etc.
- Office space for chief dietitian and staff dietitians. Some hospitals locate the office of therapeutic dietitians on the patient floors for making them quickly available to the medical staff and patients.
- Receiving area.
- Storage and refrigeration area with walk-in refrigerators, coolers and dry storage.
- Pre-production preparation area.
- Cooking or food production areas separate for vegetarian and non-vegetarian foods.
- Special diet kitchen.
- Serving or tray assembly area.
- Dishwashing area.
- Pot washing area.
- Trolley, cart washing and clean cart storage area.
- Deep sinks and handwashing facilities in various places.
- Garbage disposal facilities.
- Storage with racks and cabinets for clean trays, dishes, cutlery, etc.
- Storage with racks for clean pot, pans, vessels, etc.
- Employee facilities like lockers, staff toilet, etc.
- Janitor's closet.
• Dining hall with self-service counter, cashier's booth, clean tray storage area, seating for adequate number of people, used tray depositing area, hand washing facilities, drinking water fountains, etc.
• Special (private) dining rooms for officers, medical staff, special guests, meetings, etc.
• Coffee shop/snack bar, preferably off site.

► PROBLEM SITUATIONS

Conflicts

Conflicts often arise between the food service staff and the nursing and admitting staff when patient admission, discharge and transfer result in last minute requests, cancellations or changes in preparation and delivery of scheduled meals. Some times food also gets wasted. A degree of tolerance, understanding and effective communication will help reduce such conflicts. Another point of conflict between the food service and nursing department is as to who should pass and pick up the patient trays. This is an administrative decision.

It is hard to provide a menu that pleases everyone. Complaints against the food service department are common and frequent. The work of the department is rendered more difficult because of the need to contain costs. Dietitians can play an effective role in this regard both in the preparation of menu and in talking to patients, especially in the matter of special diets which may not always be palatable or pleasing to the eye.

Many hospitals provide subsidized food to personnel and charge a much lower rate to them than to visitors and patients. Some hospitals provide free food to employees of the food service department while on duty. Most hospitals like to continue this tradition, but if because of the rising cost they have to reduce or abolish the subsidy, it may breed resentment among employees.

Theft

Petty theft and pilferage are common in the food service department. These mostly involve food dishonestly consumed on the premises, stealing patient food, eating food left in patient trays, and pilfering food from the store room and pantries on the patient floors. The biggest offenders are the employees of the department, housekeeping, maintenance personnel and guards. An effective method to curtail this is to lock the place where food is stored. Good supervision is necessary.
Bigger frauds can take place at the materials management level, particularly in the purchasing process. AH safeguards discussed in the section on materials management should also be employed here.

**Commonly Used Kitchen Equipment**

A list of commonly used kitchen equipment is given below.

- Cooking vessels
- Bulk cooker
- Idli plant
- Bain marie
- Meat mincer
- Wet & dry grinder
- Chapathi plate cum puffer
- Dosa plate
- Toaster
- Juicer
- Potato peeler
- Dough kneader
- Water boiler
- Milk warmer
- Dish washing machine
- Cooking ranges
- Bulk cooking battery
- Walk-in cooler
- Refrigerators
- Water cooler
- Food trollies
- Shallow fryer
- Deep flat fryer
- Tea urns, Coffee dispenser
• Multipurpose ovens
• Baking ovens

LAUNDRY AND LINEN SERVICE

► OVERVIEW

When most people think of hospitals, they usually think in terms of doctors and nurses because of their high visibility, the kind of services they render and the close contact and relationship they have with the patients and their relatives. But those who are familiar with the day-to-day operations of hospitals realize that no hospital can operate without the less glamorous and not-so-conspicuous services such as housekeeping, laundry and kitchen that go by the name of supportive services. A great deal of space and money is allocated to them, which is naturally a major consideration in the planning, designing and construction of a hospital. Laundry and linen services is one such vital department of the hospital.

Criticism of linen service is one of the most frequently heard complaints in the hospital. Attention to patient's personal needs and comfort is as important as the physician's medication, the care rendered by the nurse and the appetizing food served promptly and attractively. An adequate supply of clean linen sufficient for the comfort and safety of the patient thus becomes imperative. Besides helping in maintaining a clean environment, which is aesthetically significant to patients, clean linen is a vital element in providing high quality medical care. The other aspect of this is the personal appearance of the staff who attend on patients. Pleasant, neatly dressed employees in fresh, neat uniforms go a long way in creating a positive image of the hospital.

A reliable laundry service is of the utmost importance to the hospital. In today's medical care facilities, patients expect daily linen changes. In some areas, linen has to be changed even more frequently. This rigorous schedule can be very exacting both on the laundry and the capacity of linen to withstand the repeated cycles of use and wash. To enable the laundry to meet such a demand, the hospital should have a sufficient quantity of linen for circulation and for providing a rest period in storage. This will not only minimize wear and tear of linen but also add to its life.
FUNCTIONS

The functions of the laundry and linen services are as follows.

• Collection of or receiving soiled and infected linen
• Processing soiled linen through laundry equipment. This includes sorting, sluicing and disinfecting, washing, extracting, conditioning, ironing, pressing and folding
• Inspection and repair of damaged articles, their condemnation and replacement
• Assembling and packing specialty items and linen packs for sterilization.
• Distributing finished linen to the respective user departments.
• Maintenance and control of active and back-up inventories and processed linen.

LOCATION

The laundry should be so located as to have ample daylight and natural ventilation. Ideally, it should be on the ground floor of an isolated building connected or adjacent to the power plant. This is because laundry is one of the largest users of power, steam and water. A location that allows movement of linen by the shortest route saves steps and time. The department should also be close to the service elevators. Some hospitals have linen chutes through which linen bags are dropped to a designated place from where they are picked up by laundry personnel. However, these are now becoming obsolete.

Every time a load of linen is handled, the cost of laundry services goes up. The location and physical plan layout are important in keeping the cost down. One way of doing this is to keep the traffic flow line as short as possible on vertical and horizontal transportation between the laundry and the user departments. This can be more easily accomplished in a vertical multi-storeyed building where the services are in the basement.
SOME PLANNING ELEMENTS

Size of Active Inventory

In planning and maintaining linen stock, a stratified inventory system is generally used. This means that for every piece of linen in use, there are four others either being processed or held in store. Therefore, the active inventory consists of items used daily multiplied by five. For example, for each hospital bed in use, one sheet or pillowcase will be found in the following places:

- A soiled one in use on the patient's bed.
- A clean one in the linen closet in the nursing unit.
- A soiled one in the hamper or dirty linen collection area.
- One piece being processed in the laundry.
- A clean one in the linen store or back-up store for replacing active store.

Laundry Capacity and Load

A final assessment of the plant and machinery required for a new laundry can be made only by compiling a list of types and quantity of articles to be laundered weekly. At the planning stage, however, using the following guidelines can project the information required.

American Standard: An average of 15 pounds per bed per day plus 25 pounds for each operation or delivery.

British Standard: Sixty articles per bed per week at .39 kg per article.

Indian Standard: The rule of thumb is five kgs per bed per day.

All soiled linen in hospitals can be classified into two categories: (a) ordinarily or normally soiled linen and (b) fouled or infected linen. The latter category comprises an estimated 1 per cent of the total load of work. All babies' soiled napkins should be treated as infected.

For arriving at the actual daily workload, the total load of seven days' soiled linen should be washed on six working days of the week. The laundry should have the capacity to process at least seven days' collection within the regular six-day work week.
Soiled and infected linen comprises large flats (sheets, etc.), small flats (pillow cases, etc.), tumble work (bath towel, bed spreads, blankets, etc.), press work (garments, etc.), operating room and obstetrical linen, nursing and paediatric linen, and isolation linen.

**DESIGN**

The laundry functions effectively only when it is planned in strict accordance with the work sequence, namely, receiving, processing and dispatching (Figs 6.7 and 6.8).

The activities of the hospital laundry are in many ways similar to those in hotels and other institutions. However, the hospital laundry also handles specialty items and tasks with the most important being disinfection and infection control. It should be designed for asepsis and for removal of bacterial contamination from linen. Many hospitals fail to see that the layout and system of processing in a hospital laundry should follow the principles involved in the central sterilization and supply department. There should be a strict barrier separation between the normally soiled linen and fouled or infected linen on the one hand, and between the soiled area and the clean processing area on the other. The latter can be accomplished by installing double-door, pass-through washing machines in the wall separating the soiled area and the clean processing area. Linen is loaded on the soiled side and unloaded on the clean side (Plate 1: Picture 65).

This physical separation of soiled and clean areas has an important bearing on the design of the laundry and infection control. Traditionally, the various steps involved in the processing of linen are carried out in the same room as, say, in a hotel laundry. This is contrary to the now well-established concept of complete separation of clean and soiled functions throughout the hospital. An enormous quantity of bacteria is released in the air of the processing area during sorting of linen before wash. This airborne contamination pervades the whole area and eventually settles down on the clean processed linen which is delivered to the patient care areas. This can be avoided by the separation of clean and soiled areas.

Ideally, the process of separating normally soiled linen from the infected linen should start from the time they are soiled or infected in the user departments. Infected linen should be bagged in linen bags that are distinguished by colour. There should be sufficient space left to make for complete closure of the bags. The bags should be temporarily deposited in- a well-ventilated holding area to await collection by the laundry personnel.
Disinfection Area

Fouled or infected linen and normally soiled linen should be separately handled and washed. Fouled and infected linen goes to one section of the reception-control area where it may be temporarily stored (in the bags themselves) and later sorted and loaded into washing machines. This area should be separated from the rest of the reception area and from the post-wash clean area of the laundry. This latter separation is best done by double-door, pass-through washer-extractor machines installed in the barrier wall. The infected linen is loaded on the disinfection side and unloaded on the clean side. Some laundries provide a separate sluicing machine for sluicing and disinfecting before they are loaded into regular washer-extractor machines. The normally soiled linen is sorted, classified and loaded into washing machines on the clean side of the reception-control areas.

Separate reception points for soiled linen and infected linen are not necessary. After they are unloaded on the clean side of the laundry, both streams of linen join the normal flow of work in the finishing section.

Utilities

Early in the planning and design state, a careful study and projection of the utilities and services needed for the laundry should be made. The important requirements are water, power, steam and compressed air. Laundry consumes a great deal of water. There should be a source sufficient to meet the entire need. Discharge of effluent should also be dealt with at the earliest stage. Adequate electric power must be available. Hundred percent of the normal power should be provided as standby power. Adequate quantity of steam and correct temperature are important. Steam should be delivered by the shortest route to minimize line losses and at the same time provide ample heat to flat work ironers (Picture 66) and presses. The laundry also needs compressed air for operating these flat work ironers and presses.

The maximum demand for all utilities must be projected. The correct way to compute it is by the simultaneous use of various types and sizes of equipment keeping in mind the future expansion and increase in workload.
► ORGANIZATION

The operational chief of the laundry is a laundry manager who may have been trained in laundry operation or has adequate experience in the field. He reports to one of the associate administrators. Many laundry managers come up through the ranks. However, with increased automation and better opportunities to train people in the technical schools, more and more hospitals are recruiting ITI-trained personnel to head their in-house laundries.

No formal training is required for the other personnel and most of them learn their responsibilities on the job. Hospitals will do well to recruit personnel who are able to read and understand simple instructions. This is necessary in a hospital laundry.

► FACILITIES AND SPACE REQUIREMENTS

The following facilities and space are required for the laundry aid linen services.

- Reception-control area with facilities for receiving, storing, sorting and washer loading of soiled linen.
- Sluicing and central disinfection area.
- Clean linen processing room.
- Laundry manager's office with provision for an unobstructed view of the laundry operation.
- Sewing, inspection and mending area. A light table is necessary for inspection.
- Staff facilities.
- Supply storage room.
- A lockable store to accommodate materials for reclothing calendars and presses.
- Solution preparation and storage room.
- Hand washing facilities in each room where clean and soiled linen is handled or processed.
- Provision for supply of water, power, steam and compressed air.
- Cart washing and cart storage area.
- Clean linen storage room.
- Clean linen issuing counter.
- Electrical distribution switchgear room.
• Water recovery and recycling plant, if necessary.
• Water softening plant, if necessary.
The following facilities are required off-site.
• A central clean linen storage and issuing room.
• Clean linen (lockable) storage in every nursing unit and user department.
• Separate room(s) for receiving and holding soiled linen from the wards and departments until ready for pick up by the laundry personnel.

► SELECTION OF EQUIPMENT

The last few years have witnessed a revolution in laundry machinery and processing system. Automatic machines and labour saving devices have resulted in economies in the number of personnel and operational time, increased productivity, better utilization of water, heat, power, steam and washing materials, and the maximum utilization of men and machines. Some of the features commonly found are automatic formula dispensers, automatic operation controls, sorting and counting devices, machines combining washing, rinsing and extraction, and flat work folding machines for automatic folding.

The selection of equipment of a proper size is of utmost importance for balanced and economical production. The laundry equipment should be carefully selected. The following factors should be kept in mind.

• Reasonable capital cost.
• Reliability of design and compliance with the Bureau of Indian Standards.
• Availability of spare parts and ease of maintenance.
• Efficiency in working under normal conditions.
• Economy in consumption of utilities like water, power, steam, etc. and in washing materials and other consumables.
• Continuity of workflow and reduction of manual effort.

List of Equipment

The following is a list of commonly used equipment in a typical laundry.
• Washer-extractor sluicing machine
• Double-door washing machine
• Hydro extractor (Machines combining washing, rinsing and extraction are also available.)
• Flat work ironer, also called rotary iron or calendar
• Tumble dryer
• Utility press
• Mushroom press
• Table trolley
• Ironing table
• Hand iron
• Dry linen trolley
• Wet linen trolley
• Linen hamper
• Hanger trolley
• Distribution trolley
• Motorized sewing machine
• Platform scale
• Air compressor

► PROBLEM SITUATIONS

Theft of Linen

Theft of linen in hospitals is common. Linen in good condition is a very marketable commodity. Besides, people use sheets and pillowcases in their homes and pilfered linen items become handy. Theft of linen takes place usually at night on the patient floors and departments. Interestingly, soiled linen is not a significant target of theft.

All linen should be kept under lock and key, and linen in stock should be made accessible only to those who need it as part of their duty.
The linen closet in the nursing unit should be located directly facing the nurses' station to deter pilferage. The supply level of linen in the wards should be kept low to correspond with the bed occupancy. Thefts are proportionately higher when a large quantity of linen is accessible to the employees, visitors and patients.

**HOUSEKEEPING**

► **OVERVIEW**

Housekeeping services, also called environmental services, are of paramount importance in providing a safe, clean, pleasant, orderly and functional environment for both patients and hospital personnel. A clean and hygienic environment has a tremendous psychological impact on the patients and visitors, which immediately sets for them the overall impression of the hospital. Since it is difficult for the lay people to judge the practice of medicine in any hospital because of their lack of medical knowledge, they often form their opinions about the hospital on the basis of its appearance and cleanliness. Good housekeeping is an asset and a powerful public and patient relations tool, which has a direct bearing on the prestige and reputation of the hospital.

Consider two scenarios. In the first, the patient or the visitor finds the floor and walls of the hospital refreshingly clean. He will naturally be pre-disposed to speak well of the hospital, thus adding to its good reputation. In the other scenario, a visitor finds the lobby dirty and untidy, and the wards smelling of offensive odours. He will immediately entertain doubts about the quality of care his loved ones may be receiving in the hospital. This is similar to the experience of a guest staying overnight in a dirty and untidy hotel. He will not return to it again, and may even tell others about the appalling conditions, thus discouraging them from going there.

Good housekeeping is far more important to patients than many of us are inclined to think, and for two good reasons. Firstly, the hospital is their temporary home for the duration of their stay. Secondly, knowingly or unknowingly, they are exposed to the risk of cross-contamination or hospital-acquired infections. Every patient has a right to be protected from the hospital-acquired infections and from germs brought into the environment by other patients, visitors and the hospital staff. The hospital may
have the best doctors on its staff and the most modern equipment, but if it's housekeeping is of poor quality, it will overshadow the effect of all other things.

Maintaining a clean, orderly and sanitary hospital is important from the point of view of economy as well. Properly maintained buildings have potentially longer and less-expensive life while poorly maintained ones deteriorate fast and consequently prove more expensive in the long run.

Although the housekeeping department constitutes, in a manner of speaking, an insignificant and the least glamorous department, its work sets the tone and contributes greatly to the overall efficiency of all other departments. A clean, attractive and orderly work environment enhances employee productivity, efficiency and morale. On the other hand, much work time may be lost in a storeroom, for example, which is disorganized, cluttered and chaotic.

► FUNCTIONS

Specialization of medical and paramedical services on the one hand and changes in building material and designs on the other have brought about revolutionary changes in housekeeping with new methods and gadgets, increased and more specialized service and changes in the overall functions operation and design. While many hospitals still continue to provide in-house services, some also contract the housekeeping services either totally or in part.

The department is responsible for performing a variety of tasks. The following are some of the common functions.

- Daily cleaning: This includes sweeping and mopping floors, dusting furniture, cleaning fixtures, walls, ceilings, windows and bathrooms, emptying trash cans, and defrosting refrigerators in nursing stations.

- Periodic cleaning: This includes washing windows, waxing floors, cleaning carpets, dusting high ceilings and changing draperies.

- Trash and garbage removal: This includes collecting trash and garbage from various points within the hospital and moving them to incinerator or dumpster.

- Discharge cleaning: This includes cleaning patient room after discharge or transfer of patient and readying it for another patient.
• Watering indoor plants, if required.
• Exterminating bugs and pests.
• Preventing spread of infection and ensuring conditions for good patient care by using proven infection control procedures and techniques.

In addition to the above, the housekeeping department has certain incidental responsibilities, as follows.
• Saving electricity by turning off lights, fans, etc. when not in use.
• Ensuring an economical use of supplies (which is one area where there is much waste).
• Developing goodwill by a courteous, helpful and caring attitude toward patients and visitors.
• Promoting safety rules and measures by observing them and reporting dangerous conditions.
• Maintaining a harmonious working relationship with the employees of other departments.
• Being actively involved in the plans and activities of the disaster committee, firefighting, simulated disaster and fire drills, etc.

The workload of the housekeeping department fluctuates depending on the patient census. When the bed occupancy is high the workload increases. When it is low, empty rooms are generally kept locked making daily cleaning unnecessary. Discharges and transfers call for extra cleaning. They require extra staffing on certain days of the week and time of the day when most discharges occur, as for example, on Saturdays and around noon.

In some hospitals regular housekeeping personnel do not carry out housekeeping functions in certain specialty areas such as surgical and recovery rooms, labour and delivery suites, laundry, kitchen and maintenance department.

► LOCATION
Housekeeping serves all areas and departments of the hospital. Although it can be situated in a non-prime area, it should as far as possible be centrally located and close to the vertical transport system to facilitate easy movement of housekeeping materials and equipment.

**ORGANIZATION**

The head of the housekeeping department is called the executive housekeeper who is assisted in the administration of the department by an assistant executive housekeeper and floor supervisors. The training and qualification of the executive housekeeper are very important. She must have a degree in science and basic knowledge of health care sanitation including principles of bacteriology applicable to prevention and control of infection and communicable diseases. She must also have a working knowledge of medical terminology as applied to sanitation practices, and the ability to plan, administer and develop all phases of housekeeping. Good interpersonal skills and leadership qualities are essential.

In smaller hospitals, the director of nursing or nursing superintendent may be in charge of housekeeping operation as she is of the CSSD and laundry, but in larger institutions, the executive housekeeper is responsible to an associate administrator.

The importance of the position of executive housekeeper is evident by her placement as a member of the hospital infection control committee.

The assistant executive housekeeper and the floor supervisors must be well trained and fully conversant with the housekeeping procedures. They should be able to effectively manage the housekeeping employees who are a rather recalcitrant group difficult to handle. Good interpersonal relations are thus important.

Housekeeping employees are largely unskilled workers employed at the lowest salary level. They should receive a good orientation, in-service education and on-the-job training.

The importance of a sound selection programme in the hiring of housekeeping personnel cannot be overemphasized. In most hospitals the department is a hotbed of trade union activities and indiscipline. In the selection and development of personnel, the following principles should be kept in mind.
Good Selection: Check applicant as a person, his antecedents, ability to work with others and potential to do the required job.

Good Training: Give the employee the help and training he needs to perform the job.

Good Supervision: Provide guidance in performing work, correct poor work, and support him on the job.

Recognition: Recognize and praise good performance. Make the employee feel wanted and appreciated.

The key to efficient and effective functioning of the housekeeping department is good communications, particularly with the admitting department and nursing units — the two potential areas with which conflicts may arise. There should be cooperation and good working relationship between housekeeping and these two departments.

The admitting department should promptly notify the housekeeping of all admissions, transfers, and discharges, and the housekeeping in turn should get the rooms cleaned and ready without delay and notify that they are ready. This is particularly important when the occupancy rate is high. Otherwise the newly admitted patients will have to wait for their rooms. Computerized admission operations also speed up work.

Infection control is an important aspect of housekeeping activities. Many hospitals have an infection control committee of which the executive housekeeper is a member. Housekeeping staff should be aware of hospital-acquired infection and principles of infection control.

Standards are very important for the efficient and successful functioning of housekeeping. They equalize the workload of employees, ensure that each employee knows what is expected of him and in what amount of time, and maintain high quality service. Standards of quality, for example, define the required cleanliness of each object. Standards relating to frequency determine how often an employee is required to clean an area. Time standards allot the time required to complete each cleaning task. Performance standards provide a description of what is expected of an employee in various areas of work including attendance, punctuality, cooperation, etc.

► FACILITIES AND SPACE REQUIREMENTS

The following facilities and space are required for housekeeping.

- Office for executive housekeeper.

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• Clerical work area.

• Office for assistant executive housekeeper and desk or office space for supervisors. It is desirable that the floor supervisors are physically located in their assigned areas of supervision where the personnel under them work.

• Storage room for housekeeping equipment.

• Storage for housekeeping supplies.

• Housekeeping (janitor's) closets on all floors throughout the hospital, equipped with floor sinks, and space and shelves for housekeeping equipment, carts, buckets and supplies. As a matter of daily routine, supplies for daily use on the floors and departments should be delivered to their respective closets directly.

► PROBLEM SITUATIONS

Conflicts and Interruptions

The housekeeping work in certain areas of the hospital such as the patient rooms, operating rooms, ICUs, labour-delivery suites, emergency department and nurseries is constantly interrupted and its time severely restricted so much so the housekeeping personnel's time is often wasted in waiting. The timing of work of certain other departments precludes the economical and efficient functioning of the housekeeping department. Frequently, these departments consider housekeeping personnel as a nuisance and an interruption in their busy schedules. Conflicts are bound to arise in these areas. A more serious problem may arise in the patient care areas. Sick people who are generally sensitive to noise, odours and irritating bustle of activity around them may not cooperate with the housekeeping personnel in carrying out their work. The following are some other areas of conflict, which raise certain issues that should be resolved by administrative decisions.

• Who cleans up after a maintenance man has done his work?

• Who moves furniture and heavy equipment?

• Is it the responsibility of housekeeping personnel to notify the maintenance department of the need for repairs that they observe while cleaning?

• Whose duty is it to make the patient's bed when he is discharged?

• Who washes surgery and delivery room equipment?
Should housekeeping personnel help in moving patients from one room to another and a dead body to the mortuary?

One frequent complaint against housekeeping personnel is their attitude towards the nursing staff, that is, their lack of cooperation with and responsiveness to the nursing personnel’s requests. They either walk away when asked to do some chores, or do them grudgingly or raise their voice in open defiance. Suitable action should be taken to nip such cantankerous attitude in the bud.

The same problem arises when the floor supervisor fails to gain the cooperation of the cleaning staff. In larger hospitals where housekeeping personnel are widely spread out, supervision is a problem and employees tend to become lax in their work. Inadequate supervision results in poor performance, inefficiency and low employee morale so evident in many of our hospitals.

Theft and Waste

Theft in housekeeping is not a major cause for worry. Since most of the housekeeping supplies are centrally stored and supplies like cleaning fluids are issued on a daily basis, there can be only petty thefts. However, what should be a cause for concern is the waste of housekeeping supplies, which is often a far greater source of loss to the hospital. This problem of waste is compounded by the difficulty of supervising individual employees who are scattered throughout the hospital.

Bigger thefts of supplies and equipment are committed by housekeeping employees from the departments to which they are assigned to work. Theft can be of any material or equipment and from any department; every place affords an ample opportunity to the unscrupulous employee. Some are assigned to work in remote and deserted areas where there is not much supervision. Trash and garbage disposal provides an excellent means to conceal and take away stolen articles. If, however, trash is taken straight to the incinerator, chances of pilferage may be reduced.

VOLUNTEER DEPARTMENT

► OVERVIEW

One of the beautiful things that one sees in hospitals in the developed countries like the USA is the volunteer programme that permeates their whole social fabric and affects the economic health an
social progress of the people. In America, for example, hospitals of all sizes and scopes have well established volunteer programmes so much so the well being of the nation's economy is inextricably linked to that of the volunteer programme. Nearly forty million volunteers render several billion dollars' worth of free service to the hospitals.

Volunteers provide many extra services that supplement the essential functions of the professional staff — services that add to the quality of care as well as comfort and happiness of the patients. They assist in promoting understanding of the hospitals in the community. As established channels for community participation in hospital affairs, they provide a base on which to build an extended hospital-public relationship.

Volunteers fall into two general groups: hospital volunteers and auxiliaries or women's auxiliaries. Hospital volunteers work primarily in the functional areas of the hospital while the auxiliaries work largely outside the hospital in activities not directly related to the functions of the hospital. The hospital volunteers have entered all aspects of the functioning of the hospitals and provide free service to them.

Volunteers are public-spirited and service-minded people who are disciplined and have a high sense of commitment to the hospital. They derive satisfaction and joy that come from helping others. They comprise people of all ages, backgrounds and abilities: students, housewives, working people and retired people. To qualify, a volunteer must possess interest, dependability and the physical fitness necessary to perform the volunteer assignment. Each volunteer is required to participate in an orientation session to learn all about the volunteer programme as well as the hospital before starting his/her assignments. Some volunteer assignments require special training courses while others receive on-the-job training. There are special programmes for teenage volunteers tailor-made for summer holidays.

Volunteers subscribe to the philosophy of person-centred holistic health care and concern for wellness. They believe that an individual is more than a body that is hurt or broken. Each patient is an integrated whole with the physical, emotional, intellectual, social and spiritual aspects bound together. They, therefore, work to promote the wellness of the whole person.

Although auxiliaries are found in some of our hospitals, any organized hospital volunteer programme rarely exists in India. Hospitals should be encouraged to tap these valuable resources.
AVENUES OF SERVICE AND WHAT VOLUNTEERS DO

The services of volunteers can be utilized in a variety of ways and in almost every area of the hospital. Some of the more common areas where they can contribute their services are as follows.

• Gift shop
• Coffee shop/snack bar
• Information desk
• Admitting
• Sorting and delivering all incoming mail to staff and patients, and forwarding mail to the discharged patients.
• Recreational therapy
• Occupational therapy
• Book and magazine cart and patient library
• Delivering surgery schedules
• Clerical and secretarial work
• Visitor control and issuing passes
• Flower and newspaper delivery to patients
• Assisting as hostesses during hospital functions, conferences, and workshops.
• Conducting hospital tour to visitors, student groups, etc.
• Serving as interpreters for patients who do not know English or the regional language.
• Conducting free blood pressure screening clinic.
• Assisting in public relations programmes in writing human-interest stories, hospital publications, newsletters, etc.
• Organizing and assisting in hospital fund-raising programmes and events like entertainment, sale, fair, etc.

LOCATION

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The volunteers may work in almost every department. A central location is therefore desirable. The volunteer department should be easily accessible to the administrative services, particularly the public or community relations department. Because of the volunteer department's numerous contacts with the public and social and civic groups, it must be located to provide easy access to the representatives of these groups visiting the department.

➤ DESIGN

The enquiry desk, gift shop, bookshop and coffee shop are areas where volunteers often work, and where the visitors stop by before entering other areas of the hospital. The overall impression of the hospital is generally set for the visitors immediately upon entering the hospital facility. The service and decor in these areas should be consistent with the image the hospital wishes to project. If the coffee shop or bookshop is designed poorly, the volunteers may not be able to render proper service. It is the service and decor in these areas that often set the pace for family members who later visit the patient on the floor. The irritated or dissatisfied customer may complain about the unsatisfactory condition at the patient's bedside. They are likely to find fault with the care provided to the patient.

Coffee shop should not only be cheerfully decorated, but also designed to provide tasty food and for a rapid turnover of the guests. It should not be permitted to be used as a lounge area for hospital personnel who sometimes tend to take a long coffee break. The design should be counter-type with self-service and the seating on the pattern of the fast food restaurants. The low, wide, non-swivel type seating arrangement is convenient for the sick and the handicapped.

The design elements should extend to other areas where volunteers work, including the director of volunteers' office where she meets members of the public and also interviews applicants to join the volunteers. There should be a place near the reception-secretary for logging hours of volunteers. A place for shelves for books and magazines and for the patient book truck(s) is also necessary.

The gift and bookshop should have large display windows and adequate space to keep a large number of selling items.
**ORGANIZATION**

The volunteer department in the hospital is usually headed by a chief or director of volunteers who may be a full-time, salaried person. This person, generally a lady, reports either directly to the chief of the hospital or to one of his associates. She recruits, interviews and selects volunteers, organizes orientation and training programmes, and assigns them to various functional departments in the hospital. She maintains strong liaison with departments where volunteers are placed. It is her responsibility to keep the volunteers informed of hospital policies and procedures.

Volunteer department, like all other departments in the hospital, is organized by the authority of the governing board. Volunteers have their own bylaws governing their organization, work and relationship with the board, administration and other areas of the hospital. In its internal government, volunteer department is autonomous and self-governing. Outside its internal affairs, the department has no authority over other departments or personnel of the hospital, and should not attempt to exercise any.

**Planning and Designing Public Areas and Staff Facilities**

**CONTENTS**

- Entrance and Lobby Area
- Gift Shop, Book Shop, Florist's Shop
- Coffee Shop/Snack Bar
- Meditation/Prayer/Quiet Room
- Staff and Employee Facilities
- Bank Extension Counter

The public areas of a hospital serve as an important reference point in the context of space and traffic in the facility. In planning and designing a new facility, attention should be paid to the following.
ENTRANCE AND LOBBY AREA

The main lobby of the hospital is used primarily to accommodate patients and their families and friends. Unless a separate entrance is designated for them, the main lobby also serves as a convenient access route to the medical and other staff proceeding to administrative and other areas of the hospital. Patients usually enter the hospital through the main lobby and are also discharged there. Many patients may be tense and anxious. Some may be infirm and some in wheelchairs. It is important that they are courteously received and favourably impressed at this point. Staff should be caring and friendly. On the other hand, discharge is a happy occasion; nothing in the discharge process and in the activities that go on in the lobby at the time of discharge should mar this happiness.

The composite parts and adjacent areas of the lobby (Fig. 7.1) to which attention should be paid are the following.

- Parking area. It should be adequate with a separate space for medical staff and officers.
- Main public entrance. It should be at ground level, sheltered from weather and accessible to wheelchairs.
- Reception and information desk or counter. It should be conveniently located for people as they enter the lobby. In small hospitals, telephone switchboard and information are often combined in one area.
- Public waiting area.
- Public toilet facilities. Most visitors have difficulty in locating public toilets. These should not be hidden from view but should be easily accessible to people in the lobby.
- Water coolers or drinking water fountains.
- Circulation. Circulation area, which is an integral part of the net area of the main lobby should be generous.
- Direct access to horizontal and vertical circulation area. Elevators should be conveniently accessible from the lobby. They should not discharge people into the main lobby but into a recess.
- Alcoved space for wheelchairs and stretchers, out of traffic but easily accessible.
- Doorman's station and security post, if necessary.
- Easy to follow signage system (Plate 11: Pictures 68, 69). One of the most frustrating experiences for patients, particularly in large hospitals, is to find their way
through the complex maze of the hospital structure. A simple and effective programme of directional graphics and signage is therefore essential.

7.1 Main Entrance and Lobby Area of Hospital

- Programme board announcing seminars, conferences and other special events with proper location. It should be visible to the guests as they enter the lobby.
- Directory of floor plan and the building.
- Senior doctors' name board(s).
- Cashier's counter. It should be conveniently accessible to the main flow of lobby traffic.
- Coffee shop-cum-snack bar.
- Gift and book shop.
- Florist's shop.
- Retiring facility for anxious or bereaved relatives is desirable.

► MAIN WAITING AREA

The main waiting area should provide seating for the largest estimated number of people who may occupy it at a given time. The fact that all patients are usually accompanied by one or two relatives or attendants should be taken into account while planning. The main waiting area looks better organized, efficient and presentable if most of the patients and their relatives are dispersed to the appropriate sub-waiting areas. Some of the special sub-waiting areas are: room for expectant fathers or the obstetrical floor, waiting area for relatives of patients undergoing surgery, area adjacent to admitting for patients waiting to be admitted, sub-waiting areas in front of clinics and ICUs, and in administrative offices, for example, vendors in front of purchase office and job seekers in front of personnel office.
GIFT, BOOK AND FLORISTS SHOPS

Gift shop, book shop and florist's shop should be prominently located off the main lobby but visible from it. They should have plenty of display space with full glass walls in front and on sides. Gift shops are becoming increasingly popular and are a good source of income to the hospital. Often, they are run by volunteers. These shops occupy a prime area and serve a useful purpose. Nevertheless, they should not be larger than warranted for the simple reason that they are entirely secondary to patient care.

COFFEE SHOP-CUM-SNACK BAR

It is an essential facility for the outpatients and emergency patients, especially in the night, and so should be close to the outpatient and emergency services. It should also be in close proximity or adjacent to the food service department from where it should receive food items, as it is not economical to run two separate food establishments.

The coffee shop is another place which visitors and outpatients often have difficulty in locating and so it should be easily accessible. The design and organization of the coffee shop have been described elsewhere.

MEDITATION ROOM

Most Christian institutions have a chapel for worship for the staff and patients. They also have a chaplaincy department to cater specifically to the religious needs of the large number of nursing staff and nursing students who are resident on the campus. Other hospitals also have what may be variously called a meditation room, quiet room or prayer room where staff and patients can spend time in prayer and quiet.

STAFF FACILITIES
The staff facilities usually include locker rooms, staff toilets, staff lounges and library. Some hospitals also provide recreational facilities for the staff.

Many hospitals establish bank extension counters in their premises for the benefit of staff and the institution itself. Hospital collections are conveniently deposited in and salaries of staff disbursed through the bank where every staff member operates an account. One consolidated cheque for all staff is given to the bank which credits salaries to individual accounts of the staff. Arrangements may be made for outstation patients carrying a large amount of cash to temporarily deposit it in the bank.

Planning and Designing Engineering Services

CONTENTS

• Engineering Department
• Maintenance Management
• Clinical (Biomedical) Engineering
• Electrical System
• Air-Conditioning System
• Water Supply and Sanitary System
• Centralized Medical Gas System
• Telecommunication System
  • Telephone System
  • Nurse Call System
  • Dictation and Central Transcription System
  • Paging System
  • Public Address System and Piped Music
  • Television, Closed Circuit Television (CCTV)
• Environmental Control
• Solid Waste Management
• Safety and Security
• Safety in Hospitals
• Security and Loss Prevention Programme
In the last two decades or so, hospitals around the world have become a dynamic industry, which is expanding and becoming more complex with every passing year. Technological advances have permeated virtually through every hospital department. The unprecedented proliferation and sophistication of medical equipment pose a big challenge to those responsible for the installation and maintenance of the hospital plant and its equipment. This challenge, thrown by the specific needs of the hospital’s central plant, includes all aspects of design and space requirements for the generation, storage and distribution of steam, cold and hot water and for refrigeration, ventilation, air-conditioning and electricity. Besides adequate capacity, reliability is a major concern, primarily because of the many life saving services provided by the hospital. The activities of the engineering department include highly specialized services, which should be determined by specialist engineers, consultants and architects of the planning and design team.

Frequently, there is a tendency to minimize and underestimate the overall scope and requirements, particularly space needs, of the mechanical plant and other engineering services of the hospital during the planning and design stage. As a result, engineers are often compelled to fit equipment into inadequate space. This will seriously hamper the operation and maintenance of equipment throughout its operational life.
It is not difficult to see the importance of engineering department for the safety and smooth operation of the hospital if we consider that mechanical and electrical components represent 5 to 6 per cent of the total cost of construction of a hospital barring the cost of medical equipment.

The space requirements of engineering and maintenance department have increased greatly in recent years because of the development of more complex and sophisticated equipment which calls for more space and facilities and a greater number and variety of trained personnel. This includes facility for a complete, 24-hour monitoring system so essential to run an efficient modern hospital.

The engineering and maintenance department is charged with the responsibility for ensuring safe and economical operation and maintenance of hospital facilities and expensive equipment.

The department should be capable of providing technical and management support to the hospital. Organizing it into a professional, well-disciplined department responsive to the challenges of a rapidly changing modern hospital is a formidable task. The central figure charged with this task and putting together a capable and skilled team is the chief engineer. The hospital engineer of yesteryear who was more of a skilled mechanic has now given place to a highly educated professional possessing impressive academic qualifications and vast experience. In today's hospitals, he is a prominent member of the top management team.

► FUNCTIONS

The engineering department performs a wide range of functions, which may be assigned to various units of the department. It is responsible for the operation of all equipment, machinery and distribution lines, and preventive maintenance and repair. Specifically, the department performs the following functions.

- Plant operations (Picture 7).
- Building operations and maintenance.
- Mechanical and electrical maintenance.
- Preventive maintenance.
- Clinical engineering and biomedical! Equipment and electronics maintenance.
- Landscaping and grounds maintenance.
- Vehicle operation and maintenance.
• Elevator, lift and dumbwaiter maintenance.
• Plumbing, water supply and sanitary system.
• Contracted services.
• Carpentry, painting and sign shop.
• Solid waste disposal and incinerator.
• Electrical system including equipment, machinery, power, lighting, emergency generators, UPS and refrigerator maintenance.
• Communications system.
• Fire prevention, fire detection, firefighting methods and devices.
• Minor plant alterations, renovations and repairs.
• Equipment and instrumentation evaluation.
• Equipment control and pre-acceptance check.
• Condemnation and disposal.

► LOCATION

The ideal location for the engineering and maintenance department is on the ground floor in a non-prime area. Convenient access to elevators, unloading dock, mechanical areas, and the boiler plant is essential. The main shop area should preferably have an outside wall on one side for ventilation as well as future expansion. The storage area for grounds maintenance equipment should have an outside entrance.

► DESIGN

Engineering and maintenance department should be planned keeping in mind three important functional areas: the administrative area, the shop area and the mechanical equipment area. The administrative area should be similar to the other administrative areas of the hospital in decor, lighting and finishes. The shop area should be distinctly separate from the administrative area. It should have adequate space to accommodate various shops and the mechanical, electrical, plumbing, carpentry, painting and equipment repair activities. Large open spaces should be allocated to different
shops. Movable partitions may be used, if necessary. Adequate lighting is essential, and it is desirable that the place is soundproofed.

The chief engineer's office should be located between the entrance to the department and the main shop area. There should be a small waiting area and a clerical area so located as to control access to the offices. The assistant engineer's office should be adjacent to the clerical area.

The control monitor room should be adjacent to the chief engineer's room. This room, which houses equipment and control panels and is manned round the clock monitors mechanical and electrical systems. It locates and prevents potential breakdowns. However, at no time should this be considered a substitute for preventive maintenance programme and scheduled inspections and services.

The main shops are large work areas. Their locations with reference to one another are important. For example, mechanical and plumbing shops should be placed together or close together. Carpentry which produces much dust should be somewhat isolated from the other repair areas, and so also the paint booth which should be in an enclosed space but adjacent to the main shops. The paint shop should be large enough to accommodate equipment and furniture, largely hospital beds and lockers, sent for repainting from all parts of the hospital. The electric shop should be adjacent to equipment repair. A lockable room should be provided for the storage of supplies and materials required by the various work areas. A separate and distinct area should be provided for electronic and clinical engineering. This should be well ventilated and isolated in order to eliminate problems caused by dust. This is discussed in detail later.

The shops and other sections of the engineering department like the boiler plant come under the purview of various statutory and regulatory bodies.

► ORGANIZATION

The chief engineer is in-charge of the department. He is responsible to the chief executive officer or one of his associates. In large hospitals, he may be assisted by one or more assistant engineers who may be put in charge of major sections such as clinical engineering, electrical engineering, maintenance management and plant operations. A clinical (biomedical) engineer is usually placed in charge of clinical engineering unit. Other personnel in the department are: engineering supervisor, mechanic, skilled artisan, electrician, carpenter, HVAC mechanic, boiler operator, plumber, painter,
biomedical engineering technician, medical equipment repairman, helper, incinerator attender, secretary, clerical worker, stockroom clerk and storekeeper.

For an efficient organization and administration of the department, the chief engineer will do well to establish certain specific objectives to help him fulfil his responsibilities meaningfully.

His first objective should be to create an environment in the hospital that is conducive to the well-being of the patient and safe and attractive to the visitors and personnel. His second objective should be to ensure that the utilities like steam, electricity, air-conditioning, etc. are in a constant supply except for scheduled shutdowns for repairs and maintenance. His third objective should be to ensure economical operation and maintenance of the physical plant. Keeping things operating is important but even more important is keeping them operating economically.

The construction contract should include:

- Colour coding of all pipes and ducts so that supply and return conduits are easily identified.
- Provision of copies of as-built drawings to the hospital authorities and engineering department.

Colour coding of the piping system is more easily done and is relatively inexpensive at the time of installation. The drawings are also invaluable to the engineering department staff.

**FACILITIES AND SPACE REQUIREMENTS**

The following facilities and space are required for the engineering department.

- Chief engineer's office with space for storage of protected drawings, records, manuals, etc.
  - Clerical and waiting area.
  - Office(s) for assistant engineers.
  - Orifice or desk space for supervisors.
  - Separate building(s) or room(s) for boilers and for mechanical and electrical equipment.
  - General maintenance shops for repair and maintenance.
  - Central control room.
• Storage room for equipment and building repair and maintenance supplies and materials.
• Storage for inflammable liquids, diesel, oil, etc. A license may be required for this.
• Clinical engineering suite for storage, repair, and testing of electronic and other biomedical equipment with office room for the clinical engineer. It should be isolated, enclosed, dust-free and preferably air-conditioned. Supply of compressed air and nitrogen is necessary.
• Storage area for yard equipment and supplies. It should be off-site so that the equipment and supplies may be moved directly outside without interference to the other areas.
• Sanitary storage and disposal of solid waste, or its removal.
• Incinerator. This is discussed later in detail.

► PROBLEM SITUATIONS

Theft and Fraud in Engineering Department

Theft of tools and maintenance materials is very common in hospitals. Service personnel working in the evenings, nights, weekends and on holidays when fewer staff is on duty with little or no supervision easily manage to steal equipment and materials unnoticed. One effective way of preventing or reducing such thefts is by instituting a rigid system of documentation of all materials requisitioned and used, particularly those requisitioned and charged to individual work orders. There should also be an inventory of all equipment and instruments. Every worker should be responsible and accountable for the tools given to him.

Many large hospitals permit their engineering department to do its own materials management — purchasing, receiving and storing — which provides the greatest opportunity for employees to steal. More than what is needed for a work order may be requisitioned and the balance kept for personal use. Thefts also take place when materials are transferred from one building to another. Although thefts of this nature cannot be eliminated completely, they can be reduced drastically by effective supervision and instituting control measures and procedures for storage, inventory and issuing.

The engineering department, particularly its maintenance section, by the very nature of its work provides ample opportunities for theft and fraud. In this context, special attention should be paid to the following areas and activities.
- Maintenance workers often bring outside jobs to the hospital and engage themselves in their private repair work during the hospital working time. Electrical and electronic repair work easily lends itself to this practice, which may often go unnoticed. Weekends and holidays are the ideal time for staff to do private work.

- Maintenance workers are often assigned to work for prolonged periods of time in remote or outlying areas of the hospital where there is no supervision. As a result there is a constant risk of their idling away their time or disappearing from the place of work and engaging themselves in private work. Employees have been found moonlighting during their regular working hours.

- When workers do not finish their work because they have not put in a full day's work, overtime becomes necessary. Overtime is a financial burden, which can often be avoided.

- Work record should be maintained for all jobs. This will show how a worker spends his time. The concerned supervisor should carefully scrutinize the hours an employee spends on individual jobs.

- Another subtle loss to the hospital stems from the abuse of privileges and positions in the hospital by its staff and employees. Maintenance workers often oblige their supervisors by doing the work that they should not be doing. This may be some work in the department, which has not been sanctioned or approved. This practice does not stop there. Some of them do small repair jobs in the homes of their superiors, first in their free time and on holidays, and then during the regular hospital time using hospital tools and equipment. In large hospitals, these activities go unnoticed. Integrity of the staff apart, there should be internal control measures to check such malpractices.

MAINTENANCE MANAGEMENT

► OVERVIEW

Planned or scheduled maintenance is simply planning and scheduling the maintenance of equipment and facilities in order to extend their life, reduce costly breakdowns or failures, and attain maximum
operational efficiency. It includes such functions as preventive maintenance, functional testing, performance verification, calibration and safety testing. The goal of planned maintenance is to provide for a safe and functional environment by ensuring the proper maintenance of all equipment and facilities. Planned maintenance usually provides for one major procedure, which may include inspection, lubrication, calibration, safety testing and testing for wear for each piece of equipment at regular pre-determined intervals. This may be supplemented by as many minor procedures as necessary to keep the equipment performing at the desired level or standards.

The reasons for planned maintenance are many. The following are more important ones.

- The cost of equipment replacement is skyrocketing and hospitals find it difficult to bear this cost.
- There has been a proliferation of sophisticated hospital equipment and no clinical engineering department, however well equipped and staffed, can cope with the heavy demand of repairing it on an emergency basis.
- The indirect cost to the hospital and patient care of the non-availability of essential equipment and of lost opportunities due to equipment failure is high.
- Poorly maintained equipment is hazardous and expensive. It wastes electricity and power.
- The only way to handle a maintenance job is to do it in a systematic and planned manner.

▶ CLASSIFICATION OF HOSPITAL AREAS

For the efficient scheduling of a maintenance programme and securing the best results, the various areas of the hospital are classified as follows.

Non-Flammable Anaesthetizing Locations: Usually, these are areas designated for the administration of an inhalation anaesthetic agent. For example, operating rooms.

Critical Care Areas: These are areas where patients are subjected to invasive procedures or are directly connected to the line-operated medical devices. For example, operating rooms, ICUs and catheterization lab.
General Care Areas: These are patient care areas where patients come in contact with ordinary electrical appliances or are connected to medical devices. For example, patient rooms and wards.

Wet Location: It comprises patient care areas normally subject to wet conditions. For example, hydrotherapy room of the physical therapy department. It does not include areas rendered wet because of routine housekeeping procedures and incidental spillage.

Non-Patient Care Areas: These comprise administrative offices, laboratory, storage, etc.

Incorrect classification may result in inadequate or too much and unnecessary maintenance as in the case when a non-patient care area is classified as critical care area.

► ESSENTIAL EQUIPMENT

The type of equipment also has a bearing on the maintenance programme. An equipment is classified as "essential equipment" for the purposes of maintenance if it falls under one or more of the following groups.

- Equipment considered essential for life support. For example, monitors, emergency generators, etc.
- Equipment that is potentially risky and involved in incidents. For example, boiler, which has a high incident risk.
- Equipment needing a more intense maintenance schedule. The more mechanized a piece of equipment or the more often it is used, the more intense the maintenance.
- Equipment maintained by an external agency on contract service and not by the in-house personnel. It does not form a part of the scheduled maintenance.

► HOSPITAL EQUIPMENT CONTROL SYSTEM

One effective way of keeping the costs down is to manage the maintenance of hospital equipment through the establishment of what is called the equipment control system, which has been widely used with a high degree of success. This system provides for detailed information regarding every piece of equipment in the hospital: its location, date of purchase, description of equipment, date on
which the equipment was last serviced, due date for next service, etc. This information also helps in preparing the annual report for the maintenance programme in terms of total maintenance cost, total cost of spare parts, etc. during the year on every piece of equipment.

This topic is dealt with in greater detail in the section on clinical engineering.

► TYPES OF MAINTENANCE WORK

Typically, the hospital maintenance work falls into one of the following classes.

**Preventive Maintenance:** Maintenance work on a piece of equipment on a planned schedule to prevent breakdown. The work consists of inspection, adjustment, calibration, cleaning, repair, etc.

**Emergency Maintenance:** Immediate repair of a vital piece of equipment. Requests are usually made by phone demanding immediate attention.

**Routine Maintenance:** Maintenance on a routine basis. These are non-urgent repairs such as painting, replacing tiles, etc. which can wait until scheduling is possible.

**Contract Maintenance:** Repairs to equipment made through contracted labour and materials under annual maintenance agreements. This can be done either on a routine basis or when a piece of equipment under service contract breaks down.

**Project Work:** One-time-only work such as building renovation and tiling a roof. The department generally calls for quotations for this kind of work. Requests for projects are generally required to be submitted prior to the budget year so that approval may be accorded and budget allocation made. While establishing a preventive maintenance programme, the engineer should be clear in his mind of his priorities. Three significant factors should be borne in mind: (i) the importance of the piece of equipment to the functioning of the hospital or patient care; (ii) the direct cost of the failure of the equipment; and (iii) the indirect cost of failure and non-availability of an essential piece of equipment.

► PRIORITIES AND GUIDELINES
Some maintenance departments establish guidelines and a time frame for different types of maintenance work. They classify all types of work into the following categories on the basis of their priorities and criteria.

<table>
<thead>
<tr>
<th>Priorities</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency</td>
<td>Life is threatened or endangered; hospital services will come to a standstill or curtailed, and an emergency situation may arise if not carried out.</td>
</tr>
<tr>
<td>Within 4 working hours</td>
<td>Normal repair in the patient areas.</td>
</tr>
<tr>
<td>Within 8 working hours</td>
<td>Normal repair in the support areas.</td>
</tr>
<tr>
<td>Routine</td>
<td>Minor tasks; some delay is of little consequence.</td>
</tr>
<tr>
<td>Long term</td>
<td>Requested and registered but not yet scheduled.</td>
</tr>
</tbody>
</table>

**GUIDELINES FOR SELECTION AND MAINTENANCE OF EQUIPMENT**

Hospitals can prolong the life of hospital equipment, reduce costly maintenance and attain greater operational efficiency by following certain rules and guidelines in the selection and maintenance of equipment. The following are some such rules.

- Avoid buying equipment that is expensive to repair and maintain and one that is not reliable.
- Involve technical personnel in the purchase of equipment and use their expertise.
- Make sure that the equipment; machinery and instruments that are planned to be purchased are not obsolete.
- Appoint qualified and experienced maintenance personnel. Unqualified and inexperienced persons may cause irreparable damage to expensive equipment and loss to the hospital.
- Provide necessary tools and test instruments to the maintenance personnel to work with. Although this may mean some initial investments, it will pay dividends later and offset the initial cost.
• Check if contract service for maintenance of certain key equipment works out cheaper. If it does, do not invest on costly tools and test instruments.
• Provide a thorough training to the maintenance personnel and operators of equipment and encourage them to update their knowledge through special programmes and field visits.
• Establish policies and procedures and ensure adequate records for all work and the materials used. Establish internal control measures for accounting, purchase, stores and issue.

► POLICIES AND PROCEDURES

Written policies and procedures should be formulated. The following are some of the procedures that should be established and enforced.
• All maintenance requests should be approved and signed by the head of the department or unit.
• Maintenance request form should be in duplicate and should give details regarding the name and title of the person making the request, location, date, requested action, etc.
• The repair or work order should be in duplicate giving instructions to the repairman regarding time, nature of the job, materials to be used, etc.
• Instructions should be issued to the maintenance personnel not to undertake any job without specific work order signed by the maintenance chief or his assistant.
• A procedure for emergency repair should be established with a clear definition of what constitutes an emergency.
  • There should be an effective system to sanction and control overtime.
  • There should be a comprehensive preventive maintenance programme for the entire hospital
Clinical or biomedical engineering is one of the latest and most dynamic programmes in hospitals. In today's high technology environment with a proliferation of advanced and complex medical equipment, clinical engineering has assumed great significance. This brief section has been included in this chapter to provide information about how to set-up and operate a clinical engineering programme as no hospital, which has invested a small fortune on costly equipment, can afford to remain without such a set-up.

The aim of clinical engineering programme is to provide technical expertise and management support to hospital administration, engineering department and the medical staff.

The following are some of the important functions of the unit.

- Writing specifications for all the new equipment and machinery.
- Evaluating equipment and machinery. Evaluation must include, among other things, not only the initial cost of the equipment but also its operating cost. Quite often, the high maintenance and operating cost of the equipment turns out to be many times the initial cost.
- Inspection of incoming equipment and machinery and performing pre-acceptance checks before official acceptance and payment.
- Setting standards and ensuring their compliance.
- Organizing in-service training programmes and training for personnel in the clinical engineering department as well as all the user departments to use the equipment properly.
- Evaluating the need for new or replacement equipment and for major repairs.
- Advising and providing expertise to medical staff and administration.
- Organizing a planned maintenance programme for all equipment and attending to emergency breakdowns and repairs.
• Instituting an effective equipment control system.
• Establishing equipment inventory of all existing and incoming equipment.
• Maintaining work record and maintenance history record.
• Active involvement in the activities of the hospital's safety committee and checking safety hazards.

► DESIGN, SPACE, FACILITIES AND UTILITIES

The productivity of the clinical engineering unit as a whole has a direct relationship with the quality of the facilities. When facilities are inadequate or poorly designed, much time is wasted in extra steps and in making makeshift arrangements. A congenial working environment influences the efficiency of employees. A pleasant and comfortable work area creates a favourable attitude and enhances productivity of personnel.

It is difficult to establish a standard space layout for a clinical engineering laboratory for all the hospitals. Many factors influence the space programme. Some of them are: the size of the hospital, the extent of sophistication of medical and other equipment, the size and training of personnel and the extent of contract service. Each hospital should tailor its structure and design to meet its individual needs. However, layouts are important and must meet the functional needs.

Generally, in a small hospital where there is only one biomedical technician, one room of 15 sq. ft. (15 ft. x 1 ft.) is adequate to perform the basic functions.

In a typically large layout, on one side of the room, there is a desk with wall-mounted cabinets or bookcases above it for reference books and catalogues, and adjacent to the desk, a file cabinet for manuals and records. Next to the cabinet is a lockable cabinet, shelves and drawers for storage of test instruments, spare parts and smaller instruments awaiting repair. Large instruments awaiting repair are stored at the end of the room on one side.

On the other side of the room, there are workbenches with storage drawers underneath for tools and more spare parts. This is the main work area. The bench is 12 ft. long so that the technician can work on more than one item at a time. A large laboratory type sink is provided at the end of the row for cleaning the instruments. The repair area is divided into mechanical repair area and electronics
repair area. These two are separated and provided with more cabinets for storage. There is a small-secured storeroom as well.

Irrespective of their size, all laboratories require the same facilities. The lab should be air-conditioned. Temperature control is necessary because electronic instruments and spate parts are temperature-sensitive and if they are not kept in an air-conditioned room, their operation may be affected. The lab also requires good lighting.

There should be adequate power supply for several equipment and instruments to be tested and operated at the same time. Both single and three-phase outlets are required for testing various types of instruments.

Provision must be made for both hot and cold water for cleaning the equipment. Some equipment on the mechanical side may require water for operation. Besides these facilities, the lab requires compressed air and vacuum system — either piped or furnished by a compressor and a vacuum pump — for cleaning equipment. Some equipment requires compressed air and others vacuum for operation. Certain instruments and equipment require moisture-free cleaning which is done by using nitrogen.

► ORGANIZATION

The head of the clinical engineering unit is a clinical or biomedical engineer with a degree in clinical engineering technology, electronic technology, or electromechanical technology along with many years of hands-on experience. He should also be competent in handling all the work of the unit. A professional engineer who is registered in his engineering speciality is not suitable for this position unless he possesses an additional degree or diploma in biomedical engineering. Various colleges offer specialized courses. The Coimbatore Institute of Technology, for example, offers a one-year postgraduate diploma course in medical instrumentation technology with a B.E. or A.M.I.E. degree being a prerequisite for admission. If clinical engineering is one of the units of the engineering services, its chief reports to the chief engineer. Other technical personnel in the unit are:

- Clinical or biomedical engineering technician who has a certificate or diploma in biomedical engineering or instrumentation. He is a highly skilled technician competent in doing the actual maintenance and repairs of most medical instrumentation.
• Medical equipment repairman who may be an electrician or a radio-TV repairman with some in-service training or hospital experience, or someone who has undergone some training specially designed for medical equipment. Although not an electronics technician, he has acquired skill and is capable of repairing many of the instruments or mechanical devices in the hospital.

▶ INSTRUMENTATION EVALUATION

One of the primary responsibilities of the clinical engineering unit is instrumentation evaluation, which involves documentation review as well as actual hardware inspection and testing. The unit plays a key role in assisting the administration and medical staff in selecting equipment and in determining the need for new or replacement equipment. When a new piece of equipment is received, the unit carries out the incoming inspection.

Incidence of operational failure or malfunctioning of newly received medical instruments is high in hospitals even in western countries. It ranges from 25 per cent to an alarming 5 per cent. It is no difficult to see the risk arising from placing expensive instruments in service without their proper inspection.

▶ INSTRUMENT CONTROL

Every hospital must develop an instrument control system, making the clinical engineering unit responsible for developing and implementing procedures. The steps involved are:

• The equipment control system starts when a new or a replacement equipment is to be selected. A review must be made concerning the age, condition and utilization of existing equipment, and whether there is any maintenance problem and also how many units exist similar to the one requested.

• When a new piece of equipment is received, the following steps should be gone through.
The equipment is received by the clinical engineering unit for a pre-acceptance check. The unit should check that the operator and maintenance manuals have been received, the equipment is of acceptable standards, and it meets the manufacturer's and purchase specifications.

- Calibration is checked for accuracy, and a calibration procedure and records are initiated.
- Tags and labels are affixed to the equipment.
- Necessary entries in the inventory (assets register) are made, and maintenance records started.
- The warranty card is filled and sent to the manufacturer. In some cases, warranty benefits may be forfeited if the warranty card is not signed and returned. The pre-acceptance inspection is the best time for the maintenance personnel to study the warranty conditions and to be aware of maintenance procedures and time, and to ensure that the equipment performs properly.
- The equipment is then taken to the user department and operators are shown how to use it properly. It is important to remember that most malfunctions with hospital instrumentation result from operator error; therefore, this initial training is very important.
- The warranty period is an important part of the instrument control system. During this time, hospital personnel should learn about the maintenance of the equipment. One month prior to the expiry of the warranty period, the equipment should be checked to make sure that it functions properly. If any repairs and adjustments are to be made, they should be done under the warranty.
- The equipment should then undergo safety checks, preventive maintenance, calibration and routine maintenance. This can be done either under a service contract or by hospital personnel. All checks and work should be entered in the proper records.
- Replacement of equipment is the final step in the instrument control system. The system evaluates and projects the need for equipment replacement so that a budget provision can be made for it. However, technology is changing so rapidly that quite often a new equipment becomes obsolete even before its normal life is over.

Tagging and Labelling: When a new piece of equipment is received, it should be identified with a tag. If this was not being done earlier, a programme should be started to tag every item in the inventory. The tag preferably with a metal plate affixed to it, should have the name of the
hospital and a unique identification number. The number is important because in a hospital there may be several items of the same model of an equipment.

Besides this tag, other labels concerning calibration, preventive maintenance and safety checks should be affixed to the equipment. There should be a separate label for each one of these functions because different checks may be due at different times.

Instruction or operation manual should be available for each piece of equipment.

**Equipment Inventory:** One of the first tasks of the clinical engineering unit is to establish an equipment inventory listing all the existing equipment, and their location. The inventory should record all details regarding every piece of equipment such as nomenclature, manufacturer, model number, serial number, date of acquisition, cost, location, and a unique number.

**Work Record:** In every hospital, especially in larger ones where employees are scattered all over and supervision is remote, workers waste time, either doing nothing or going slow at work. They spend a lot of time walking between jobs and the shop for reasons like fetching tools or parts. As a result, their productivity comes down to as low as 5 per cent. In order to maximize the efficiency of the personnel time and to see how they spend their time, a work record system should be established. The work record has other uses too, like determining to what department and equipment and to what extent the personnel time on a particular work should be charged, and also for studying the extent of instrument failure and the cost of down time.

**Maintenance History Record:** The maintenance history record is the historical record of all the work done on a given equipment, and is an important tool of the instrument control system. It is recommended that the record is not computerized but is kept on a 5-inch by 8-inch card.

A review of the maintenance history record show what has gone wrong with an instrument and what part of it has failed frequently so that timely repairs or trouble shooting can be done, and necessary stock of spare parts maintained. All these measures help in reducing down time.

**Preventive Maintenance Programme:** Preventive maintenance is the most effective method of ensuring that the instrumentation in a hospital functions reliably, accurately and safely. It is also the most economical way of maintaining the equipment. Pre-planned scheduling of maintenance work
and of the technician's time is far better than neglecting the equipment till it breaks down and becomes inoperative — often when it is most needed — and then arrange panic repair.

Under preventive maintenance, equipment is cleaned, lubricated, adjusted and checked for wear and tear at predetermined intervals, and components that might cause breakdown or serious impairment are replaced. This is done on a scheduled rather than a user-demand basis. The result is a clearly improved performance along with a major reduction in economic costs, which are certainly lower than the costs arising from demand repair work besides loss of revenue while the equipment is not functioning.

Calibration: The establishment of a calibration system is one important component of the preventive maintenance programme. The function of calibration is to control the accuracy of all equipment used in a hospital. As a rule, all instruments should be calibrated at intervals established on the basis of the extent of use of the equipment, accuracy, expected life span of trouble-free service and wear. Whenever an instrument malfunctions or is damaged, or does not meet the manufacturers specifications for accuracy, it should be serviced, repaired and/or calibrated. Most of the mechanical equipment requires calibration once in every six months.

Written calibration procedures should be prepared and used for calibrating all equipment in the hospital. Calibration of an instrument should be initiated during the week prior to its expiry date.

Safety: It is the responsibility of the hospital to provide a safe environment to the patients and personnel. There is no guarantee that they will not be injured even when all precautions and safety measures are taken including compliance with statutory regulations. However, such precautions and compliance ensure that everything possible has been done to provide a safe environment in the hospital. It should be remembered that a contract for equipment maintenance by an outside agency does not absolve the hospital of any kind of responsibility or liability.

A hospital has three major kinds of responsibility as far as handling of equipment is concerned. These are as follows.

Warn: It is the responsibility of the hospital and the manufacturer to identify equipment, which, if improperly used or maintained, may cause injury to the patients of the operator of the equipment. For example, an equipment operated in excess of safe limits.
Educate: The manufacturer should provide information on the proper use of equipment. Operators should then be properly trained in the correct use or operation of the equipment. This responsibility lies with the hospital.

Record: It is not enough simply to check or inspect an equipment, or make a check mark. A record should be kept of all the work. From the legal point of view also, documentation comes in handy during investigations or trial proceedings.

► OVERVIEW

Electrical energy is an essential source of power, the pivot around which almost every function of the hospital revolves, and the system is increasingly becoming more demanding, complex and crucial. This is partly because of the specialized medical and electronic equipment used for diagnosis, treatment and rehabilitation of the patients and partly because of the larger load of power needed in today's hospitals. In the electrical system, the main concern of the design team and the hospital engineer is the power distribution system, which, it is rightly said, is the electrical lifeline of the hospital. There are also other concerns like an adequate and dependable supply. No less important, which many owners do not take seriously, are the electrical equipment and fixtures, which should be of the best quality. They should conform to safety codes and regulations.

The highest dependability of electrical service, so essential for high quality patient care and functioning of the hospital on a 24-hour basis, is made possible by using high quality equipment, careful design, good construction and efficient operation in the hands of top quality engineers.

Emphasis should be on the design of an electrical system that will operate economically and provide for easy maintenance rather than the least possible installation cost.

Electrical system is one of the major costs of operation and many hospitals find themselves saddled with a heavy financial burden due to an inefficient system.

There should be an emergency generator to supply power to the essential and critical areas immediately if normal electrical service is interrupted. Under certain circumstances, even a ten-second power interruption may not be permissible. In such cases, an uninterruptible power supply (UPS) is the only answer.
In the design of a hospital electrical power system, the major elements that should receive serious consideration are: safety, reliability, cost, voltage quality and ease of maintenance.

**Safety:** Safety encompasses the protection of life and property, and continuity of hospital services. Protection of human life, both of patients and personnel, is of paramount importance. But safety of equipment is also essential. A faulty electrical system devoid of adequate safeguards may cause extensive damage to essential equipment and machinery, which in turn may cause loss of service, and a delayed return to normal operation because of repairs.

Designers often ignore the electrical residual current generation due to static electricity or earth leakage current which may endanger the lives of patients without even the doctors knowing about it.

**Economics:** It is necessary to consider the cost of the total system and not just of its components. Cost of installation and cost of operation must be balanced. So also, cost and reliability. Cost of equipment is a major percentage of the initial cost of installation. Cost of operation is frequently not given adequate consideration with all attention focused on equipment and installation.

**Voltage:** Stability of voltage is very important in the hospital power supply. It reflects the quality of electric power. With the increasing use of automated and electronic equipment in the hospital, voltage regulation under normal operation and abnormal changes in load merit special attention. Hospitals will do well to consider additional investment in the use of special devices in certain critical areas vulnerable to voltage fluctuations. This may prove more economical in the long run.

**Maintenance:** A proper maintenance of electrical system is necessary for its safety and reliability. The system should be designed and streamlined in such a way as to make maintenance work easy and safe, and to enable routine maintenance and inspection without shutting down the essential hospital supply. For this, the use of a circuit arrangement providing an alternate source of power should be arranged.
Some Design Elements

- Nature and magnitude of load.
- Source of power.
- Cost of electric power system.
- Voltage levels.
- Circuit arrangement, whether radial, ring main, etc.
- Most economical size of substation.
- Secondary distribution.
- Combined light and power systems. This is usually most economical, but flicker problems must be watched.
- Means of voltage regulation, if required.
- Short circuit protection.
- Grounding.
- Over current protection. Lightning protection.
- Proper metering of all circuits.
- Power factor correction.
- Antistatic electricity precautions.
- Isolation transformers for operation room complex.

► PLANNING

The hospital electrical system calls for careful planning. Consideration should be given not only to immediate requirements but also to future needs both in terms of expansion and increased workload. Early in the planning stage, the engineer, the consultant or whoever is in charge of planning should closely work with the architect on the one hand and the hospital administrator, the medical staff and the other hospital staff on the other.

The views of the hospital staff should be given due consideration because they are the ones who operate and maintain equipment and facilities of the system. The medical staff should be consulted on crucial, specialized medical areas and the administrative staff, on the other areas such as vertical
transportation and computer network. A third group whose views should be considered is the engineering and maintenance staff charged with keeping the system going.

The power distribution system should be adequate to meet the service reliability requirements of the hospital and yet it should be made as economical as possible. This requires that the power system engineer should plan the power distribution system on an all-inclusive basis. To do this effectively, he must constantly search for facts on which to base his decisions.

The right decisions in setting up the substation, electrical H.T. and L.T. panels, diesel generator room, load centres, etc. save not only installation but also the operational costs.

Finally, the engineer should be conversant with the various statutory regulations, codes and standards applicable to hospitals.

**Design Procedures**

In planning and designing an electrical system, the engineer should observe the following basic steps and procedures.

- Work out the actual connected load and the demand load for the present as well as the future.
- Develop a site plan of the hospital plant showing the size and location of the present and future loads.
- Work out the essential loads and then determine the capacity of diesel generator (D.G.) sets.
- Establish voltage levels throughout the hospital plant.
- Determine the size, number and location of power centres.
- Determine the service reliability, select circuit arrangements required in each hospital area, and design the circuits to provide the reliability.
- Provide adequate power supply points to the various pieces of equipment.
- Provide protection against lightning, earth leakage current, short circuit current, under voltage and over voltage.
- Observe special precautions required for the hospital safety.
- Consider special lighting design for patient rooms and other areas.
• Provide necessary specifications. Specifications supplement the working drawings and furnish the information not shown in them by describing equipment and its functions. They also prescribe qualities of materials and workmanship required under the contract. They tie the entire job together.

➤ **EMERGENCY GENERATORS**

The public utility electricity supply in our country being inadequate, hospitals must expect to go without normal source of power frequently. However, hospitals are especially vulnerable to even a short-term loss of electrical current because patient care depends on an uninterrupted power supply. Recognizing this, hospitals do provide for an alternate (emergency) source of power to serve essential portions of the hospital's distribution system. This emergency power should be reliable and is generally used for lighting and operating essential equipment.

The usual source of power used in hospitals for emergency purposes is the generator, which is driven by an internal combustion engine operating on diesel oil.

The components of the alternate electrical system are the same as those in the normal distribution system except for the alternate source of supply and transfer switches. The engineer must determine the load to be placed on the system.

The load can be transferred from the normal source of power to the emergency source either manually or automatically. The automatic transfer switch should be capable of transferring the load within ten seconds of the power failure. However, in normal practice it may take longer than that. Manual operation may take a few minutes depending on where the operator is and how long he takes to reach the generator site.

At the planning and design stage, the engineer should specify which loads have to be transferred automatically and which loads manually, depending on the urgency or how critical is the function of the areas. For example, all lights may be connected to the automatic transfer load because patients and visitors often panic in the dark.

➤ **UNINTERRUPTIBLE POWER SUPPLY (UPS)**
Under certain circumstances, even a 1-second interruption of power supply in hospitals may prove life threatening. In the operating rooms where an open heart surgery or kidney transplant is in progress, in the ICUs, cardiac catheterization lab or stress test laboratory, such interruptions may be fatal. In the non-medical areas, all computers depend on an uninterrupted supply of power. The engineer with the assistance of administrative and medical staff should identify critical areas that should be hooked on to the UPS.

Large hospitals often use advanced clinical and diagnostic equipment, sophisticated medical instruments and voltage-sensitive computers. These demand clean, computer grade power, which is totally free from the momentary interruptions, transients, sags, surges and brownouts that often occur in the utility power lines. With the actual and projected rapid deterioration in commercial power, power conditioning is becoming a standard requirement for reliable operation of EDP and clinical equipment and is no longer viewed as a luxury in the same way as air-conditioning has become more of a necessity for them now.

Several power-conditioning alternatives are available ranging from isolation transformers to the UPS. One of the choices is the motor-generator set which can protect the computer and other medical equipment from many power problems. However, it suffers from an inability to ride through longer commercial power outages.

UPS sets have over a period of time, established themselves as highly dependable pieces of equipment capable of supplying an output voltage of high quality (that expresses a degree of stability) and of harmonic neutralization (that implies total independence from the commercial supply source) and having a high rate of reliability.

Voltage sensitive medical equipment, computers and perhaps a small percentage of lighting are connected to UPS, which typically has a battery back-up of 3 minutes. Advanced models of some medical equipment have a built-in battery back-up which provides uninterrupted power supply to keep the equipment operational for some time.

Technical consideration pertaining to electrical system is beyond the scope of this book. But as stated earlier, hospitals should utilize the expertise of design and specialist engineers and consultants in the early stages of planning itself so as to provide optimum electrical system facilities in their hospitals.
AIR-CONDITIONING SYSTEM

► OVERVIEW

There is a need for conditioning air in particular areas of the hospital to achieve a certain level of temperature, humidity, filtration and circulation.

Operating rooms, labour-de livery suites, ICUs, nurseries, morgue and autopsy rooms are some of the areas, which require air-conditioning. Sophisticated medical equipment is sensitive to temperature and humidity, which affect its readings and performance. It should, therefore, be housed in air-conditioned rooms. The same applies to the central processing unit of the computer system.

Air-conditioning systems range from a battery of small self-contained window units to complex central air-conditioning systems. The type and selection of air-conditioning systems are a major consideration. The self-contained window units used in earlier times have now become obsolete and no longer serve the purpose. It has also become prohibitively expensive to use a battery of units, and thus a central air-conditioning system is now preferred for reasons of flexibility, application and maintenance.

The basic elements of most air-conditioning systems are air and water. Cooling can be achieved by utilizing chilled water, direct expansion refrigerant, or outside air when conditions are correct. The system of cooling using chilled water is discussed here.

The system components of controlled chilled water system are as follows.

• Compressor
• Condenser
• Chiller
• Chilled water pumps
• Condenser water pumps
• Cooling towers
• Expansion valves
• Chiller water pipes
• Air handling unit, cooling coil and its accessories such as ducting, prefilters, terminal filters, etc.
• Centrifugal fans for exhaust.

**DESIGN CRITERIA FOR CERTAIN SPECIALTY AREAS**

Planning and designing an air-conditioning system is best left to the AC engineers who are specialists in that field. But what is of particular significance to the facilities planning in hospitals and to the design team are the special air-conditioning needs of certain specialty areas of the hospital, which require special attention. The following are some such areas.

**Operating Rooms:** The main objectives of air-conditioning the operating rooms are to:

- Introduce fresh, uncontaminated, dehumidified and cool air into the operating rooms;
- Exhaust the air contaminated during surgery;
- Provide working comfort for the surgical team; and
- Prevent contamination from the adjacent areas.

Some of the design parameters considered for the operating rooms are:

- Temperature range should be between 23—24°C.
- Positive pressure to be maintained with respect to adjacent areas.

Special care should be taken to reduce air turbulence in the room by supplying air at velocity of no more than 2-25 fpm near the operating table. Low level exhaust air pick-up points should be placed at peripheral walls to have a scavenging effect.

It is recommended that individual air handling systems are provided for each operating room along with its changing rooms. This avoids cross contamination and has more flexibility. The relative humidity shall be maintained at 55 +/- 5%.

All items of equipment should be selected for low noise criterion. The noise levels should not exceed 52 dB at 125 Hz in occupied conditioned space.

**Labour-Delivery Suites:** Unlike surgery, the labour-delivery suites operate on a 24-hour schedule. These suites are air-conditioned at the same temperature as the operating rooms, usually 23°C. Even in hospitals, which are not centrally air-conditioned, labour delivery suites are one of the areas that are generally air-conditioned.
In the maternity department, nurseries are another area that requires air-conditioning. Full term nurseries are usually designed for 25°C temperature and 55-6 per cent relative humidity, and the premature nurseries for 28°C temperature and 65 per cent relative humidity.

**Morgue and Autopsy Rooms:** As the morgue is generally designed to hold bodies in refrigerated body boxes, it poses no particular problem. However, the autopsy rooms have odour problems. A large air supply and an exhaust system should be provided. The exhaust should be carried above the roof, if possible. The objective of air-conditioning the autopsy rooms is to provide comfortable working conditions for doctors and other personnel. The air pressure in the autopsy rooms should be negative compared to the adjacent areas to overcome odour problems.

**Central Sterilization and Supply Department:** The CSSD should be air-conditioned. In a modern CSSD, the decontamination (cleaning) area, the sterilizing area and the sterile storage room are physically separated. The sterilizing room generates a great amount of heat, and working in that condition is difficult. Special precautions should be taken regarding air-conditioning and ventilation if the sterilization work uses ethylene oxide.

In many hospitals, CSSD is either a part of the operating room (OR) complex or located adjacent to it, and if the OR complex is air-conditioned, in all probability, the CSSD too is. With washers, sterilizers and other equipment, the place always stays warm, and heat continues to be generated no matter how much air is removed from the area.

**Equipment Rooms:** Places such as radiology, catheterization lab, etc. which house sophisticated and sensitive equipment like CT Scan and MRI, should be air-conditioned. This should be done after evaluating the accurate data requirements of all medical equipment located in these areas. These pieces of medical equipment are very sensitive to large deflections in temperature and humidity. Thus, special care should be taken to control these two factors.

► **SUPPLY TO OPERATING ROOMS, ETC. AND RETURN AIR/EXHAUST AIR**
Air supply to operating rooms and labour-delivery suites should be from ceiling outlets near the centre of the work area. This will effectively control air movement. Exhaust or return air should be from near the floor level. Great care should be exercised in the design to ensure that turbulence and other factors of air movement do not cause particulates to fall into the wound site. Special procedures such as organ transplants may require "laminar air flow" or such other special designs.

Air supply to nurseries, birthing rooms, LDRP suites and rooms used for invasive procedures should be at or near the ceiling. Exhaust or return air inlets should be near the floor level.

The place used for administering inhalation anaesthesia should be provided with a scavenging system to vent waste gases. The gas collecting system should not interfere with the patient's respiratory system. Gases from scavenging should be exhausted directly to the outside atmosphere.

General Area
The corridors should have adequate ventilation. Individual private rooms should have independent fan coil units and thermostatic control for flexibility. All toilets should be exhausted for odour with a central exhaust system.

WATER SUPPLY AND SANITARY SYSTEM

► WATER SUPPLY

Water is one of the critically important utilities in a hospital, yet its supply is often taken for granted. Much of the hospital's engineering service is concerned with installing, repairing, and maintaining the systems that deliver utilities and services — water being one of them — in a functional, continuing and safe manner.

A hospital requires a copious supply of water. While the nation's population and the demand for water are increasing, its water supply is diminishing. This puts a tremendous pressure on the ability of administrators and hospital engineers to supply pure water to hospitals. Every effort should be made to conserve this precious but fast diminishing resource.
Hospitals should as far as possible rely on public water supply system for the necessary quantity and quality of their water supply. This may be supplemented by their own water supply. Some hospitals have on their premises private wells or bore wells which they can use to augment their water supply.

Designing a water supply and sanitary system for a hospital is a complex task which calls for the expertise of competent, experienced and specialist engineers. Since most of the service lines are concealed, faulty design and installation or any compromise in the quality of materials will lead to disastrous results difficult to rectify later. Therefore, planning and installation of this system are of the utmost importance. Defective installation would affect not only the functioning of the hospital but also its hygienic conditions.

Two important components of the system are:

- Water supply distribution network, and
- Sewage disposal.

The design should allow flexibility to recycle wastewater, if need be, for reuse as A.C. cooling tower make-up water or in gardening and toilet flushing.

► SOURCES OF WATER SUPPLY

The primary source of water supply to hospitals is generally the public utility supply system. Invariably water is in short supply in most cities. To meet the high and ever growing demand for water, the following alternative sources of water supply may be considered:

- Borewells.
- Tanker supply.
- Recycled water. The treated wastewater from wash basin, shower, laundry, etc. can be used in W.C flushing, landscaping, etc.

To ensure a continuous supply of water, adequate storage capacity of underground sumps and overhead tanks should be provided.

► DESIGN ELEMENTS

In designing the hospital water supply system, the major elements that merit attention are as follows.
Continuous and reliable supply of water
Quality of water
Proper distribution network
Cost
Ease of maintenance and operation

Continuous and Reliable Supply of Water
The designer should work out accurately the water requirements of the hospital for various purposes. Armed with this and the information regarding the sources and the quantum of water available from each of them, he should proceed with the design of underground and overhead water tanks of adequate capacities.

Reliability of water supply depends largely on: (a) incoming water supply, (b) equipment and system design, and (c) maintenance and operation.

Quality of Water
The quality of water supplied to the hospital affects virtually every aspect of hospital operations. It is, therefore, essential that suitable water of microbiological quality is provided for drinking, laboratory procedures and solutions used in medical and surgical treatment. Chemically acceptable water is essential for the operation of equipment, for laboratory tests and dietary purposes. A regular surveillance programme should be instituted. This normally includes evaluation of the source of supply, equipment and distribution system, and routine microbial and chemical analyses of water.

The engineer should have samples of water collected routinely and have them sent for analysis. In addition to potability, water should be tested for hardness and iron. Hard water is detrimental to equipment and increases operating costs.

Routine water processing programmes carried out in hospitals include chemical treatment of water, deionization, distillation, filtration and sterilization. The engineer should be familiar with hospital operations and know where specially treated, deionized or distilled water is used and when it is necessary to provide it. He should realize that deionizing process removes only the ionizable contaminants and not the bacteria or other organics and inorganics, and that the deionized water often becomes heavily contaminated with bacteria that grow on the resins. Distillation provides water of
the highest purity. However, distilled water is not sterile. Sterile water is produced by processing water in sterilizers or auroclaves. Hemodialysis requires specially treated water.

The quality of water depends largely on two factors:

1. The quality of raw water supplied to the hospital, and
2. Level of quality required for various purposes.

Since there are varied sources of raw water, it is generally not possible to control its quality. It is thus essential to first analyse the quality of water obtained from various sources and then recommend the treatment process before use.

Distribution Network

For the proper utilization of water, the distribution system should be designed taking into consideration the pressure and quantum of water required at various outlets. Due care must be taken while selecting distribution equipment and pipes because of the risk of contamination and corrosion. The water supply distribution system is often designed using the hydropneumatic system for achieving a uniform pressure at all the outlet points.

Great care should be exercised in protecting hospital's potable water against contamination, which can result from a poorly designed and installed plumbing system.

The potable water supply system should not be connected with other piping systems, nor should it be connected with fixtures having submerged inlets. This could cause contamination.

► PLANNING

The hospital water supply and sanitary system calls for a high degree of careful planning. The design should take into consideration not only the present needs but also the future requirements.

Adequate provision should be made for future expansion. The location and size of plant rooms, service ducts, etc. play a very important role in designing an economical and convenient system. Attention should be paid to the maintenance and operation of the system. In large hospitals, the service floor concept may be considered for running all sanitary and water supply lines horizontally below the toilets and terminate them in a common vertical duct. Careful interaction with the
architect and other service engineers is necessary before finalizing the layout for water supply and sanitary system.

► HOT WATER SYSTEM

Hot water supply is one of the prime requirements in any hospital. It is required in patient bathrooms, kitchen, laboratory, laundry, CSSD, etc. If the hospital is located in a cold climatic area, it is essential to provide hot water in all the toilets and washbasins. Hot water is supplied through the central distribution system and is usually generated using the oil-fired hot water (HSD) generators. The temperature of hot water ranges between 55-60°C, and stored in an insulated, closed pressure hot water mixing tank.

The ideal location for boilers, mixing tank and associated pumps and equipment is either the pump room or a separate room adjoining it. The exhaust flue &as from the hot water boiler should be taken above the building as per statutory regulations and discharged into the atmosphere. The complete hot water system should be distributed to various utility outlets using insulated G.I. pipes. To eliminate wastage and get immediate hot water when the tap is opened, a hot water circulation pump may be necessary. The hot water pressure in the pipe line should be maintained in the same way as in the cold water supply by connecting the hot water supply to the hydropneumatic system.

► STEAM

Steam is required in the kitchen, laundry, CSSD and other sterilization areas. It is generated at 8—1 kg/sq. cm pressure using the oil-fired steam boilers. The requirement of steam in the various areas will be at different pressure. Therefore, pressure-reducing stations with headers should be provided to tap the required steam. Provision has to be made to recover the condensate and conserve waste heat. The steam boilers should be located next to the hot water boilers. If the steam requirement is not much, it is possible to have only one combined steam boiler supplying both steam and hot water.

► DRAINAGE SYSTEM
The drainage system of the hospital should be simple, effective, economical and serviceable. It should be designed keeping in view the kind of septic and toxic waste envisaged which in turn needs to be effectively disposed off. It is advisable to adopt a double stack system in which separate stacks are provided for the collection of waste and soil from the toilets and other areas. Pipelines should run with sufficient slopes so that the sewage could be conveyed to inspection chambers by gravity.

Provision should also be made to terminate the collected sewage in the municipal sewer line via a battery of inspection chambers or manholes. Where it is not possible to do so, alternate arrangements like sewage treatment plants should be made. It should be ensured that the effluents from the treatment plants are further treated to acceptable standards before their utilization in landscaping or recirculation.

For sewage disposal, it is preferable to use PVC pipes, as they are easy to install and repair, and also allow for smooth flow of sewage.

► SEWAGE TREATMENT PLANT

The objective of the sewage treatment plant is to stabilize the decomposable organic matter present in sewage to produce effluents and sludge. These can then be disposed of in the environment without causing any health hazards or nuisance. The treated sewage water can also be reused for various purposes like gardening, landscaping, flushing of W.C.S, A.C. cooling towers, etc.

CENTRALIZED MEDICAL GAS SYSTEM

► OVERVIEW

Gases administered to patients are called medical gases. Centralized medical gas system is increasingly becoming an essential requirement in hospitals in the same way that other essential services and utilities such as electricity, water and air-conditioning are.
The centralized medical gas system provides an efficient, economic and dependable medical life support network that supplies medical gases (oxygen and nitrous oxide), vacuum (suction) and compressed air to the operating and special procedure rooms, ICUs and patient floors. The system makes for better patient care in all the areas of the hospital.

The following are the important components of the centralized medical gas system.

- Source of supply. It comprises the central supply room with control equipment or panel.
- Distribution system. It is a system of piping that extends to the points in the hospital where medical gases are required and used.
- Point-of-use delivery connections. These are suitable station outlet valves and pendants at the use points (Plate 11: Pictures 71,72).
- Monitoring and control equipment and alarms.

► CENTRAL SUPPLY ROOM: MANIFOLD ROOM

The central supply room usually consists of a cylinder manifold and a control panel. The manifold may be as small as two banks of two cylinders each, or as large as two banks of twenty cylinders each. The control panel consists of primary and secondary pressure regulators to ensure delivery of gas to the pipeline at the required pressure provided there is gas in the cylinders. When the cylinders become empty or gas is not delivered to pipeline due to any malfunctioning of the regulators, a warning lamp on the control panel illuminates. The control panel also has pressure gauges to indicate pressure in the cylinders.

The vacuum unit comprises of a vacuum pump with an electric motor. A cylindrical reservoir tank stabilizes the pressure of the pipeline system at all the outlet points. The motor has a negative pressure switch for automatic start and stop. Vacuum pumps are duplexed.

The compressed air unit consists of a compressor with electric motor, after cooler, air receiver and air dryer. The centralized compressed air system instantly provides compressed air through the pipeline wherever it is required. The compressors are also duplexed.

The primary supply is that part of the equipment which actually supplies the system. A secondary source automatically supplies the system when the primary supply becomes exhausted. The primary and
secondary equipment provide the normal operating supply. When the operating supply fails or is exhausted, a reserve supply automatically takes over.

In the event of the control panels of oxygen and nitrous oxide breaking down, an emergency kit ensures gas supply through the pipes. The emergency kit comprising a regulator and high-pressure tubing is connected to a bulk cylinder and the gas is fed directly to the pipeline through a service outlet. In case vacuum and air supply systems fail, a standby motor-cum-pump is used to provide uninterrupted supply.

Usually, half of the total daily consumption of oxygen and nitrous oxide is kept in the manifold room as reserve supply. In the case of vacuum and air, there is always a reserve capacity in the system itself, which lasts for a while.

Oxygen and nitrous oxide should be stored separately from flammable gases and liquids. The storage location should be free of combustible materials such as paper, plastic materials, cardboard, etc. When the quantity of gas stored exceeds 2,000 cubic feet, the storage area should ideally be outside the building. However, if it is situated inside, the room should have at least one-hour fire resistance construction. Additionally, there should be an automatic fire extinguishing system.

The size of the manifold room depends upon the systems it houses. The dimensions should be decided keeping in mind space for all equipment and for stocking full and empty bulk cylinders. Adequate space should be left around the equipment for servicing.

► ADVANTAGES OF CENTRALIZED MEDICAL GAS SYSTEM

The following are the advantages of centralized medical gas distribution system.

For the Patients

• No distressing sight of oxygen cylinders at the bedside.
• Elimination of the irritating noise from the movement of cylinders in and around the hospital.
• Protection of sterile areas from contamination caused by the use and movement of cylinders.
• Uninterrupted and clean supply at desired locations.

For Hospital Staff
• Instant availability of gas on taps.
• Clean, safe and reliable delivery of gases
• Continuous flow of gases whenever and wherever required.
• Minimal accident hazards due to mishandling of cylinders.

For the Hospital Administrator
• Easy purchase of gases in bulk quantities at favourable terms.
• Economy on purchases of cylinders.
• Fewer breakages.
• Rationalization in ordering, scoring, and transporting a wide variety and sizes of gas cylinders.
• Minimum damage to building due to handling of cylinders.

► OXYGEN AND NITROUS OXIDE

In view of the increased demand for oxygen in hospitals, centralized distribution has become necessary. Oxygen for hospital use may be supplied from a bulk tank or from cylinders, it may be stored as gas or a liquid; the oxygen containers may be stationary or moveable. The bulk oxygen system is defined as an assemblage of equipment such as oxygen storage containers, pressure regulators, safety devices, vaporizers, manifolds and interconnecting piping with a storage capacity of more than 20,000 cubic feet of oxygen including reserves. The system terminates at the point where oxygen first enters the supply line at service pressure.
Nitrous oxide is not as widely used as oxygen. The largest users are the operating and special
procedure rooms.

► VACUUM (SUCTION)

Piped medical-surgical vacuum system is used for patient draining, aspiration and suction. Vacuum is also used in the hospital laboratory. Like oxygen and nitrous oxide, the medical-surgical vacuum is distributed through a network of pipes. There is a central vacuum supply system with control equipment, an alarm signaling system and a network of piping extending to areas in the hospital where patient suction is required. The piping terminates with outlet valves at each user point.

The central vacuum system (Picture 74) consists of two (or more) vacuum pumps, which operate either simultaneously or alternately, depending on demand. Each pump should be capable of maintaining 75 per cent of the peak-calculated demand. The pumps should in normal course alternate automatically. This may be done by an additional circuit board. Also, if the first pump is incapable of maintaining the required minimum vacuum, the alternate pump should have a provision to get activated automatically. Normally, the pumps go on and off even if an automatic device is not incorporated.

The pumps should be equipped with motor starting device and overload protection. As a measure of protection, disconnect switches should be provided in the electrical circuit ahead of the motor starting devices. The failure or shut off of one vacuum pump should not affect the operation of others.

► COMPRESSED AIR

The demand for compressed air in hospitals has increased greatly. Air is used for both medical and non-medical purposes. The medical uses include laboratory work, inhalation therapy equipment and powering of surgical tools, for example, powering of pneumatic drills in orthopaedic surgery and in the dental department. A word of caution. Drills may require 90-120 psi pressure whereas the pressure in the piped system may be only 60 psi.
In the non-medical areas, compressed air is used for maintenance of tools and equipment, and also in the clinical engineering department. Compressed air used for medical-surgical purposes should be free of dust and moisture. This is done by means of oil filters, dust filters, moisture separator and the 'dryer' at the equipment level. A separate dryer equipment is provided to the air compressor system. This absorbs moisture in the air before delivering it to the pipeline. If the compressed air is not used properly, it can damage equipment and contaminate chemicals, foods and drugs.

In the compressed air system the standard items of equipment and accessories are: compressors, shutoff valves on tank outlets, valves on drains, pressure gauges, safety valves, check valves, pressure switches, inlet filter-mufflers, and automatic electrical controls.

All personnel should be warned that air under pressure, as from a hose line, should not be allowed to touch any part of the human body. Minute particles propelled by the airstream can cause painful puncture wounds. Lives have been lost when compressed air was used in practical jokes like when air under pressure is introduced to any body cavity like the anus.

► PIPES

Pipeline should be seamless type, of high quality copper tubing for medical use with Lloyd's approval. Embedded piping should be protected against physical damage and corrosion. Exposed oxygen pipelines should not be installed in such areas as kitchen, laundry and rooms where combustible materials are stored. The gas content of pipeline should be readily identifiable by colour of the tubing and by labels that bear the name of the gas.

Before they are erected, all pipes, tubes, valves, and fittings should be cleaned thoroughly and washed with tetra chloride, or a hot solution of sodium carbonate or trisodium phosphate mixed with water, and rinsed thoroughly with warm water to free them from oil, grease, dust or other combustible materials. After installation of the pipes but before the air line is connected to the compressor on the one hand and the outlets on the other, the pipes should be blown clear using oil-free air or nitrogen. When the whole system is in place, it should be subjected to a test pressure of 150 psi or one and a half times the working pressure for 24 hours by means of oil-free air or nitrogen to check if it could withstand the required pressure, and also for any leakage. This test called "pressure lock" is done section by section.
**PRECAUTIONS AND CONTROLS**

The following precautions and controls are necessary in various areas of the hospital served by centralized medical gas system.

- High quality regulators and other gas flow control devices approved by the Bureau of Indian Standards should be used to reduce the pressure of every cylinder used for medical purposes. All these devices should have connections designed for attachment only to the appropriate gas cylinders.

- The main supply line should be provided with a shutoff valve for use in an emergency. This should be located for easy access.

- Each riser from the main line should be provided with a shutoff valve adjacent to the riser connection.

- There should be a shutoff valve at each anaesthetizing location on each oxygen and nitrous oxide line. Valves should be readily accessible for use in an emergency. The valves should be safeguarded against physical damage and should bear a sign such as "Oxygen: Do Not Close." This will prevent tampering or inadvertent closing.

- Shutoff valves accessible to unauthorized personnel should be kept in boxes with view windows in a manner that can be operated manually. The box should be labelled: "Caution. Oxygen Valves. Do Not Close Except In Emergency. This Valve Controls Oxygen To...."

- Suitable flow meters, which can provide flow rate as per the desired user-settings, should be installed for direct use on the pipeline pressure. For suction, pressure controls should be used at each terminal outlet to adjust the suction pressure at the required level.

- Regulators of proper size should be installed in front of each piece of gas-using equipment to ensure proper control of pressure and flow.

- The manifold room should have at least one-hour fire resistant construction and door and an automatic fire extinguishing system.
• For routine maintenance and repair, each vacuum pump should be provided with shutoff valve to isolate it from the vacuum system.
• Wall outlets for vacuum, supplied by the manufacturers, should be legibly marked "Vacuum" or "Suction" so that they can be easily identified when they are disassembled for hooking up to the piping system.
• Compressed air should be compatible to be connected to ventilators. Oxygen and compressed air in the newborn nursery are to be attached to the ventilators.
• AH piping should be colour coded as per the international code for each gas. Additionally, the pipes should be labelled with metal tags or stencils.
• Colour and valve schedules should be given to the hospital authorities for permanent record and reference.
• A procedure manual must be provided to the hospital authorities both for the operation and maintenance of medical gas system and for the prevention of fire hazards.

► ALARM SYSTEM

Two kinds of alarm are usually incorporated in the centralized medical gas system. The more important one (Plate 12: Picture 75) monitors the pressure of various gases at different areas of the distribution system. If abnormal pressure is sensed, the system sets off an alarm: the normal green signal goes off and the red warning signal glows with audible alarm until line pressure returns to the normal. Alarms should be located in working areas of those who use and maintain the system.

However, it is quite possible that these areas, such as operating rooms, may not be manned all the time. Auxiliary alarm signals should thus be installed in additional places where there is a 24-hour personnel coverage, for example, in telephone operator's room, security office and emergency department.

The other alarm, called the remote signal lamp, should preferably be both visual and audible. This is generally not available in India. What is available is only visual: the lamp lights up when either of the banks of cylinders in the manifold room becomes empty. In this case also, there can be auxiliary signals outside the manifold room in places where there is 24-hour attendance.
The remote signal lamp provides a warning signal. No immediate action is necessary because when one bank is empty, the other bank takes over and delivers gas without interruption.

Table 8.1 shows various locations in the hospital and the number of outlets required for oxygen, suction and air.

<table>
<thead>
<tr>
<th>Location</th>
<th>Oxygen</th>
<th>Vacuum</th>
<th>Air</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient rooms in medical, surgical, obstetric and paediatric wards</td>
<td>x\textsuperscript{a}</td>
<td>x\textsuperscript{a}</td>
<td>d</td>
</tr>
<tr>
<td>Examination/treatment rooms in nursing units</td>
<td>X</td>
<td>X</td>
<td>—</td>
</tr>
<tr>
<td>Intensive care, coronary care unit</td>
<td>xx\textsuperscript{c}</td>
<td>xxx</td>
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<td>Nursing, nursery</td>
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<td>General operating room, emergency trauma room</td>
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<td>Cystoscopic and special procedure rooms</td>
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<td>Recovery room</td>
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<td>Labour room</td>
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<td>Delivery &amp; birthing room</td>
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<td>Emergency department</td>
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<td>Anaesthesia workroom.</td>
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<td>Anaesthesia workroom.</td>
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<tr>
<td>Autopsy</td>
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\textsuperscript{a} One outlet accessible to each bed (one outlet may serve two beds) Separate outlet for each bed.

\textsuperscript{b} One outlet for air is required in the paediatric unit only.

Nitrous oxide which is not shown here is required in operating and special procedure rooms.
SAFE HANDLING OF GASES

The following are some of the general practices recommended for the safe handling of gases. More specific rules relating to handling, use and storage should be provided by the supplier.

- Ensure that only experienced and properly instructed persons handle compressed gases.
- Observe all regulations and statutory requirements concerning storage of cylinders.
- Do not remove or deface labels provided by the supplier for the identification of the cylinder contents.
- Ascertain the identity of the gas before using it.
- Know the properties and hazards associated with each gas before using it.
- Establish and be familiar with plans to cover any emergency situation that might arise.
- Never lift a cylinder by the cap or guard; use a cylinder trolley for transporting.

TELECOMMUNICATION SYSTEM

Over the last few years, communication systems in hospitals have made great advances with a variety of new and sophisticated features being added every year leading to the fast obsolescence of existing ones. The communication system in hospitals encompasses intra- and inter-departmental intercom, telephone, paging (overhead and wireless), nurses' call, computerized visual display terminals, television, cable television and closed circuit television (CCTV), alarm system, central dictation, monitoring, and so on.

Instantaneous and reliable communication is crucial to hospitals. A slow response or missed communication can be life threatening. For example, a delay in issuing a cardiac emergency call or failure to reach a specialist on time may endanger the life of a patient. Poor communication can result in overall organizational inefficiency. A tardy response or unfriendly attitude of the telephone operator may establish a negative image in the minds of the public who may lose confidence in the hospital. Since the telephone operator is frequently the first contact of the caller with the hospital, how she responds to his calls sets the overall first impression of the hospital for him.
TELEPHONE SYSTEM

Advanced telecommunication technology of the present day offers vastly improved and sophisticated telephone equipment with never before features and capabilities. Advanced systems are now available in which a single instrument acts as a multi-button phone. Most telephone systems have flexible circuits that allow telephone calls to be transferred to another areas as, for example, to the admitting office. In smaller hospitals, this eliminates the need for a telephone operator during the night. Some other new features are: touchtone dialing, call pick up, call forwarding, conference capability, transferability of incoming and outgoing calls and direct dialing.

Interconnecting telephones should be provided for all departments and sections including operating rooms, ICUs, nurses' stations, offices, maintenance, housekeeping and elevators. A telephone service outlet should be provided midway in the elevator shaft for connecting the telephone in the elevator. All intercom telephones should be dial type which permit intercommunication without calling the hospital switchboard.

Many hospitals now provide telephones in the patient rooms. Patients can make long distance calls directly with the facility of remote metering or transmission to a computer so that automatic charging of the concerned patient is accomplished. The practice of installing jacks in all patient areas for use of plug-in telephones is now considered obsolete. As far as possible, telephones should be installed in patient rooms, especially in private and special rooms.

Public (pay) telephones should be provided at convenient locations for the outpatients, visitors and staff, particularly in the outpatient area, inpatient areas, emergency department, near the labour-delivery suites and in the fathers' waiting room, if there is one. Pay phones leave hospital switchboard free for patient care and official use. In addition to public telephones there should be a convenient room where visitors, outpatients and hospital personnel can make assisted STD and ISD calls. Conduits should be provided to facilitate installation of telephones, wherever necessary, keeping the future needs in mind.

The Integrated Service Digital Network (ISDN), which is poised to take the business world by storm, will revolutionize our lives. Digital switching system which is an advanced computer by itself will be able to handle voice, data, text and image transmission — all on the same telephone line. In other words, telephone, computer, printer, FAX and almost anything else that is electronic can be plugged into a single telephone line to provide an integrated communication system.
NURSE CALL SYSTEM

The nurse call system ranges from the simplest — a mere visual signal system — to the most complex and sophisticated computer controlled system with a visual and audio indicator, two-way voice communication and advanced facilities for management information. It can be linked to the panic button in the patient's bathroom, code blue alarm system and the fire alarm system.

The feature common to all the systems is the switch or button provided at the patient's bedside (Picture 76) which, when activated, registers the call at the nurses' station. In the traditional system, a push button with a flexible cord is provided to each bed. The signal can be switched off only at the bedside. A pilot light is placed over each bed if there are more than one bed in the room. There is a pilot light over the door of the room and a central light panel at the nurses' station.

A central monitoring panel is provided central monitoring panel is provided in the nurse director's office.

The following are the features of the advanced computerized nurse call system.

- Call is registered by the patient.
- Call is acknowledged by the nurse.
- Call is attended to by the nurse. (Nurse switches off the call signal in the room.)
- In the event of delay as programmed by the response time, the signal light flashes.
- When the delay becomes longer, the flash rate increases progressively.
- The signal is both audible and visible.
- There is a provision for two-way voice communication between the patient and the nurse station; this can be programmed in such a way that only the nurse can initiate the voice communication and not the patient.

The system has the following components.

- Panel in the patient room
- Patient room door panel
- Main nurse station panel
- Monitoring panel
- Computer interface
- Software
Remote dictation service is set up to allow the doctors to dictate reports from any part of the hospital where a dictating equipment is provided, usually from the operating rooms, ICUs, patient floors, emergency room and the doctors’ chart completion room in the medical record department. Modern telephone systems have the capability to be used for dictation as they can now be interconnected with centralized dictation where reports are recorded on tapes and later transcribed by medical secretaries. The system allows any phone in the hospital to dial a code and dictate to the central room. It enables the doctor to start, stop, play back and correct his dictation.

Two kinds of paging systems are generally used in hospitals: overhead or loudspeaker and radio paging. These two systems are used largely for different purposes.

The loudspeaker system normally includes a microphone feeding through an amplifier to a number of speakers located hospital wide. This is used for paging for doctors and other staff, announce code blue emergency, and for issuing instructions in case of fire, bomb threat, disaster or other catastrophes, and for announcing simulated fire, bomb and disaster drills.

Obtaining a license from the Government of India to operate a radio paging system was extremely difficult in the past, but things have changed now. Many leading companies, including international ones like Motorola and Hutchison, are in the field vying with each other for a share in what promises to be booming market.

Radio paging is the system largely used for locating individuals or for transmitting messages to them. The basic components of this system are: a microphone usually located at the telephone switchboard, radio transmitter placed at any suitable location, antenna system which radiates in all directions but usually in a loop around the area of desired coverage, and receivers which are small, lightweight, portable receivers tuned and set to receive messages on only one wave length. These are checked out to and carried by individuals — largely doctors and officers of the hospital who are on the
move. Both beep and vibration types are available. Some systems transmit audible signals only, while others transmit voice messages. In the earlier days, all systems in use transmitted messages one way only, that is, no talkback feature. However, the advanced models now have two-way voice transmission capabilities.

Paging transmissions are normally controlled by the telephone operator. In its simpler form, a code number or a telephone number is transmitted to an individual in a remote place. The individual uses a phone to contact the hospital or any other desired number.

There are now firms, which set up and sell paging services in larger cities. Hospitals may utilize their services instead of setting up their own infrastructure and systems, which are an investment many of them can ill afford.

As the radio paging system is in a state of flux and many new features and sophistication are in the pipeline, hospitals are advised to tread cautiously before they decide on the system.

► PUBLIC ADDRESS SYSTEM AND PIPED MUSIC

Public address system or wired or overhead paging is also meant as an emergency backup to the radio paging system in addition to the other functions described earlier. It is invaluable in making announcements to a large number of people in large assembly halls, and other strategic locations. The system should be designed for zone paging so that information can be transmitted to selected places without disturbing patients and hospital staff in other areas. Suitable background music can be piped throughout the hospital during selected hours. Many Christian institutions broadcast devotional songs and worship programmes over the public address system. Individual speakers in patient rooms give patients the option to switch the transmission off if they do not wish to listen. Where piped music, public address system and television systems are bundled together, a cut-in feature for announcements should be included. Announcements may be made from several places depending on the nature of announcements, the CEO's office being one of them.

► TELEVISION AND CLOSED CIRCUIT TELEVISION
Television, once considered a luxury, has now become commonplace as a source of news and as a means of entertainment in homes and other places. Many hospitals also provide for patients' entertainment, information and educational and health programmes by way of television, video and closed circuit television.

Star TV and cable TVs provide a variety of entertainment, sports and educational programmes. Many hospitals provide these avenues of entertainment to their patients.

A television system becomes a closed circuit television (CCTV) when the hospital generates its own video programmes and feeds it into the distribution system.

In some hospitals, closed circuit television is used in the operating rooms to transmit information to consulting doctors for advice and to residents and students for teaching purposes. It is also used in cardiac catheterization procedures for displaying x-ray image of the catheter position. In advanced countries, CCTV is used by the nurses to view children in isolation, and for visitor-patient two-way viewing. Inclusion of audio facility provides an opportunity for children to communicate with their parents when the latter are in isolation and children are not permitted to visit them.

When CCTV is used in the operating rooms on a permanent basis, a good quality camera is required, and it should be adapted for use with the surgical lights. Most modern surgical lights are adjustable for positioning and focusing the camera.

The CCTV is widely used in hospitals for security purposes.

ENVIRONMENTAL CONTROL

Hospitals have always considered it their responsibility to control their environment. This involves protection of the patients, staff, visitors and the surrounding community. The concept of environmental control is generally practiced through: (i) infection control, (ii) general environmental hygiene and pollution control, (iii) radiological health, (iv) accident and accidental injury protection, and (v) occupational health.

A detailed discussion of this vast subject is outside the scope of this book. We shall, however, highlight some of the important areas.

From the early times when hospital-acquired infections took a heavy toll of human life, efforts have been made to control infection through improved and scientific methods of disinfections and
sterilization procedures, better housekeeping system, strict application of basic environmental hygiene procedures, development of laminar airflow, etc. Even then, hospital-acquired infection continues to be a problem in our hospitals.

**INFECTION CONTROL**

Environmental control is based primarily on the science of engineering, microbiology and sanitation. All those who are concerned with environmental control — from the chief executive officer to the hospital engineer down to the housekeeping personnel — should become familiar with the basic facts about microbial growth and death and the transmission of disease.

Every hospital must establish an infection control committee to administer a hospital wide infection control programme, and formulate and enforce policies and procedures for infection control.

These policies and procedures should cover the following.

- Personnel. This includes employee health, dress code, in-service education, etc.
- Isolation procedures.
- Environment specimens like trash, garbage storage and collection, infectious waste, etc.
- Water supply.
- Maintenance of buildings, etc.
- Ventilation system including air intake and outlet, air filters on air-conditioner units, etc.
- Preventive maintenance.
- Rodent controls.
- Systems control, including evaluation of systems, etc.

**GENERAL ENVIRONMENTAL CONTROL**

General environmental control covers such areas as water supply, plumbing, liquid waste, solid waste, air quality and air pollution control, sterilization (autoclave, use of ethylene oxide), insect and rodent control, interior cleanliness and food service. Some of these subjects have been dealt with in detail elsewhere in this book.
▶ RADIOLOGICAL HEALTH

Radiation control and safety practices in hospitals come under the mandatory regulations of the Division of Radiological Protection (DRP) of the Bhabha Atomic Research Centre (BARC). Radiation sources are generally of two categories: ionizing and non-ionizing. Examples of hospital ionizing radiation are x-rays and radioactive isotopes. The most common non-ionizing sources are microwave and laser; the latter is sometimes used in hospitals for diagnostic and treatment procedures.

Radiation control measures are based on the factors of time, distance, shielding, containment, personnel protective and monitoring devices, and ventilation. Hospitals must appreciate the problems concerning radioactive waste disposal, both liquid and solid, and should strictly comply with the regulations.

▶ ACCIDENTAL INJURY PREVENTION

Few people appreciate, much less concern themselves with, the problems arising from accidental injuries in hospitals, largely among hospital patients, personnel and visitors, and the resultant financial loss and suffering. Too preoccupied with fulfilling their primary mission of patient care, hospital authorities and staff do not recognize hospital's responsibility in this regard and the fact that most accidental injuries can be prevented.

Causative factors leading to accidents are "environmental" or "human". Control of environmental factors through various means discussed earlier cannot by itself prevent accidents. The human factors are the cause of most accidents. On hospital's part, such seemingly minor considerations as elimination of electrical shock situations, provision of non-slip floor surfaces, handrails and grab bars, wherever necessary, and provision of structurally and mechanically sound equipment and furniture, to mention just a few, go a long way in making the hospital a safe place. The subject of safety in hospitals is discussed in detail later.

▶ OCCUPATIONAL HEALTH
Every employee has the right to work in a safe environment. Frequently, the work place is hazardous in spite of the mandatory safety regulations and requirements under the relevant laws. Hazards and dangers lurk in unsuspected places: in walking, working surfaces, means of egress, hazardous materials, compressed gas and air equipment, materials handling and storage — the list is endless. Hospitals have an obligation to do everything reasonably possible to make the hospital environment a safe place. However, safety is everybody's business. All employees should be made aware of it.

SOLID WASTE MANAGEMENT

Hospitals and civic bodies should share the responsibility for the management of hospital solid waste. However, neither of them seems to appreciate the magnitude and seriousness of the problem and the impact of hospitals' solid waste on the community. Quite often, the municipality is blissfully unaware of the types of waste generated by the hospital and refuses to cooperate with the hospital and be involved in the management of solid waste.

Hospitals need to know the local codes and regulations regarding the management and disposal of waste, for example, discharges to the sewer, discharges to the atmosphere via incinerator exhausts, and discharges on land via disposal trucks. In many respects, hospital's solid waste is not different from any other waste except that part of it has pathogenic organisms, and so the ultimate disposal method will have a different kind of effect on the environment.

A solid waste handling system has five basic components: handling waste at the point of production, transportation within the facility, internal storage, internal processing or treatment, and transportation to the point of final disposal.

Solid waste should be packaged at source, preferably in disposable plastic bags, or collected in containers or receptacles with lids. Separate puncture proof containers should be provided for syringes, needles and other sharp objects to prevent accidental injury to those handling them. As far as possible, pathogenic waste, including waste from patients in isolation and waste in specimens from the laboratory should be sterilized at or near the point of production and prior to removal from the place. Food service department generates an enormous amount of garbage and this may have to be
stored temporarily until picked up for final disposal. There should be a sufficient internal storage capacity; otherwise, the waste bags tend to be left in corridors, halls and other public areas.

Many hospitals have on-site incinerators for internal processing or treatment of waste. Careful attention should be given to the selection of the system of internal processing. Frequently, during the planning stage, there is a tendency to reject designs requiring high initial cost without any consideration to the operating costs because the initial cost is very perceptible compared to the future operating costs, which may later prove to be very high.

Within the hospital, solid waste is usually transported manually. This in India is the most economical method.

Two systems are available in our country for internal disposal of solid waste: oil or gas-fired incinerators and electric incinerators. These are discussed here briefly.

**INCINERATOR**

In the past, incinerator was a single-chambered unit, but now improved multiple-chambered versions with auxiliary burners, controlled firing, air washers and scrubbers are available. Technically advanced modern incinerators are designed in such a way that the emission of air and the regulation of chambered temperature are controlled automatically requiring no special operator.

**Advantages of the incinerator**

- Reduces the volume of solid waste by 85-90 per cent
- Can be installed within the hospital building meeting the statutory regulations. This minimizes transportation costs.
- Pathological and infectious waste can be conveniently disposed of within the premises without much preparation and effort.
- Some incinerators have special heat recovery feature.

**Disadvantages**

- Maintenance cost is high.
• Specially trained operator may be required to attend to it all the time.
• Fuel consumption is generally high.
• Aerosol cans, though not widely used in Indian hospitals, can create a serious hazard to the incinerator operator.

Incinerator can be a great source of energy. From the enormous amount of waste produced in hospitals, which has a high Btu content, hospitals can produce energy while simultaneously disposing of waste. The equipment now available can be used as a standby boiler that generates sufficient steam to operate laundry and kitchen. However, administrators should carefully study and analyze the initial and maintenance costs and the benefits accruing from the system by way of energy generation.

► PYROLYSIS

Pyrolysis is the thermal decomposition or degradation of a substance or organic compound to other compounds or free elements by the application of heat at high temperature, usually in the absence of oxygen. Waste pyrolysis is defined as the carbonization of organic substances without the air. Thereby, a combustible gas is created, and this is used in further processes as a high quality combustible fuel. Many modern industrial processes are based on pyrolysis. Through pyrolysis, soiled waste can be reduced to sterile, inert and odourless char with a greatly reduced volume.

Pyrolytic incinerators are classified as controlled air incinerators where the heat and air needed for combustion are regulated to first volatilize or gasify the waste in conditions of inadequate air, that is, below stoichiometric air-conditions and heat, and then totally destroy it in adequate heat and excess air.

These incinerators are twin chambered with refractory lined chambers mounted on top of each other. Volatization is achieved in the primary chamber with controlled air supply from one of the twin air ducts. Combustion air is supplied by a forced draught fan. An automatic ON/OFF fuel oil burner supplies the heat source. The volatized or gassified waste burner passes on to the secondary chamber through a specially designed opening to achieve sufficient velocity. There it is subjected to the above stoichiometric air. Again, the heat source is the auto-control fuel oil burner system.
Combustion is carefully regulated for minimum turbulence, thus avoiding emission of pollutants and making redundant the use of a dust collector or bag filter.

A specially designed educator system is incorporated at the outlet to bring down the temperature of the exit gases from 950°C to 300°C before releasing them in the atmosphere. This is a safe limit for emission conforming to strict pollution control norms. The mechanism keeps the entire system under a negative pressure, thus totally eliminating the risk of hot gases, flames and volatiles rushing out from the door or any other part.

The optimum balance of time, temperature and turbulence in these incinerators makes them the best technological solution for destroying solid waste.

Advantages of pyrolysis
- No need to segregate waste.
- Needles, syringes and sharps are rendered harmless without any special treatment.
- A volume reduction of up to 90 per cent, and a weight reduction of up to 85 per cent can be achieved.
- With a substantial reduction in emissions, the environmental pollution is drastically reduced.
- The degree of operational comfort is high, particularly in the case of charging furnace.
- The system is mechanically simple and virtually maintenance free.

Disadvantages
- The system may need a large space for installation.
- Pyrolysis has not been time tested in the hospitals. Thus, the pros and cons of the system should be carefully studied before arriving at a decision.

► ELECTRIC INCINERATOR

Electric incinerators, as the name implies, use electrical energy as the source of heat, and are becoming increasingly popular in hospitals and research labs for the disposal of pathological waste.
They come fitted with special nichrome heaters and can be operated on standard voltages. They are energy efficient with low operating costs: reportedly 1/3 of those of oil or gas incinerators. There is no oil or gas pollution and the whole operation is neat and clean. No special igniter is required as in the case of oil or gas incinerators.

It is claimed by the manufacturers of electric incinerators that pathological waste, amputated bones, and highly wet material can be totally destroyed and that the residue by way of sterile ash is less than three per cent. These incinerators can also be designed for manual or semi-automatic charging.

The only disadvantage of these incinerators is that they need stand-by power in the event of a commercial power failure.

**Basic Considerations:** While selecting a solid waste disposal system, hospitals should consider the following factors.

- Cost of equipment.
- Cost of installation.
- Operating and maintenance costs including costs of utilities.
- Labour costs (excluding operating and maintenance costs).
- Cost of replacement parts and accessories like containers, carts and vehicle operation.
- If heat recovery is to be included, the heat recovery and energy-saving potential.

Other factors that should be considered

- Facilities for temporary storage of solid waste at the points of production and at the incinerator site when the incinerator is in operation.
- The method and the cost of final disposal of the residue and its estimated quantity.
- Local codes, the requirements of regulatory and waste collection bodies, and the cost involved in complying with them.
SAFETY AND SECURITY

► SAFETY IN HOSPITALS

Overview

The word safety in its purest sense means freedom from injury, risk or harm. The management of any hospital has a twofold responsibility regarding safety: (a) to make the work place and the environment safe by creating safe conditions and (b) establish, communicate and enforce the safety rules. Safety is everybody's business and no safety programme can succeed without the cooperation of the people. Everyone has to work as a team and share the responsibility of safeguarding the patients, visitors and the hospital personnel.

Safety awareness is of paramount importance for the success of the hospital's safety programme. Every task that we perform, whether at the work place or home, entails some risk of personal injury. Our ability to work safely is directly related to our knowledge of the hazards associated with the work. Therefore, a sufficient knowledge of the work-related risks is essential.

Some departments of the hospital are more risk-prone and hazardous than others. The laboratories, nursing floors, laundry and kitchen are areas, which call for special instructions and elaborate safety rules. Ignorance about the risks associated with the work place and negligence may endanger the lives of employees and turn them into a liability for the hospital and their families.

It is rightly said that a feeling of safety is, like happiness, a state of mind. It is necessary for the employees to incorporate this feeling into their work and lifestyle. For this they should develop a 'safe' attitude and a 'safe' behaviour.

Accidents do not just happen by themselves; they are caused. These causative factors are more human than environmental, and merely controlling the environmental factors does not by itself prevent accidents. The hidden causes of accidents should also be taken into account. For example, if one slips and falls over a banana peel or an oil spill resulting in an injury or fracture, the cause of that accident is apparent: an unsafe condition created by an unsafe attitude or behaviour on the part of someone.
Some General Safety Rules

The following are some of the basic safety rules and principles, which everyone should bear in mind and observe.

- The only correct way to do a job in the hospital is the safe way. Urgency is a poor excuse for neglecting safety.
- Know your job thoroughly. Do not indulge in any guess. If there is any doubt, ask the supervisor.
- Do not handle or operate machinery, tools and equipment without authorization.
- Be alert and observe keenly. Report immediately any faulty equipment, unsafe conditions or acts, and defective or broken equipment. Do not try amateur repairs.
- Stay physically and emotionally fit for your work by maintaining good health and a proper diet. Abstain from alcoholic drinks. Take sufficient rest andpractice cleanliness.
- Personal hygiene is important. Wash your hands often. In many areas of the hospital, this is absolutely necessary.
- Prevent the spread of infection and contagious diseases. Cooperate with the hospital infection control committee by observing the established procedures. When you are ill with an infectious disease, report to the doctor immediately and stay at home.
- Wear proper uniform or clothing for your job: neither too tight nor too loose. Tight clothing does not permit freedom of movement, while loose one runs the risk of getting entangled.
- Jewellery and high heel footwear may be hazardous.
- Walk, not run, particularly when you are carrying delicate, breakable articles or instruments. Be extra cautious at the corridor intersections, in front of swinging doors (particularly when they do not have view panels), at blind corners and in congested areas.
- If you see some foreign material, loose wire, oil spill, etc. on the floor, which may cause an accident, make sure it is removed at once.
- Never indulge in horseplay or practical jokes involving fire, acid, water, compressed air and other potentially dangerous things.
• Pay attention to all warning boards. These signs caution you about dangers and hazards that may cause injury or harm. For example, smoking in an area where oxygen cylinders are stored.

• Be familiar with your work procedure. All departments have written work procedures, which include safety practices at work and for handling equipment.

• Always remember to use handrails on stairways or ramps. They are there to ensure your safety and are meant to be used by all, not just the sick and the old.

• When you want to reach overhead objects, always use a good ladder; do not climb on chairs or boxes.

Apart from these general safety rules, there are other rules relating to particular areas like fire safety, electric instruments, traffic, patient care, toxic materials, and certain departments. These are discussed in Appendix B at the end of this book.

SECURITY AND LOSS-PREVENTION PROGRAM

► OVERVIEW

Three elements — motive, opportunity and means — are necessary to prompt someone to commit a criminal act. The hospital management can effectively curtail only the element of opportunity. The other two can only be constrained, not countered. For example, the element of motive can be countered to some extent by preaching and practicing a code of values, positive morale building, stressing loyalty to the institution and reminding employees of the consequences of theft and fraud. The means may be curtailed by instituting internal control measures like unannounced audits, formulating well-defined policies for the control of materials, cash and other assets, checking and questioning all expense accounts, and so on. Even then, employees are ingenious enough to devise new ways of committing fraud.

The element of opportunity can and should be controlled. The management has a moral obligation to safeguard the assets of the institution by making theft and fraud as difficult as possible, if
not downright impossible. Often, the general climate in the organization is such as to provide ample opportunity and temptation to the employees to indulge in fraudulent activities without anybody taking cognizance of those offences or punishing the offenders.

Fraud and theft combine to make a booming business in any society, and a hospital is no exception. It is estimated that one out of every ten hospital employees steals habitually. Another study suggests that 25 per cent of all employees will steal to some extent if they feel that only a small percentage of the offenders is likely to be caught and punished. The study further shows that within that 25 per cent, the management level culprit is responsible for over 60 per cent of the total thefts. Sometimes an employee who would not steal a rupee of hospital funds appropriates valuable articles of supplies for personal use.

Contrary to the popular belief, integrity of a person is not directly proportional to the salary he receives or the responsibility he carries. It is not true that most of the thefts and frauds in hospitals are committed by the lowest category of employees. In fact, the top management personnel engaged in such activities cause most harm to the organization, and are probably the most difficult to detect. What is worse, it is not easy to punish them.

The individuals who get most of the opportunities to steal and commit fraud are: supervisors vested with authority, guards, employees of the housekeeping and food service departments, employees on duty during night shifts, weekends and holidays, people with keys to sensitive areas, storekeepers, receiving clerks, purchase department staff, clerks handling cash, payments, payroll, financial and equipment records, etc. and the maintenance and other service personnel.

**Types of Frauds and Thefts**

We have discussed the subject of theft and fraud with reference to particular departments. Some of the general factors, which cause loss to the hospital, are as follows.

- Embezzlement.
- Pilferage (small scale theft).
- Kickbacks and collusion.
- Equipment theft.
- Personal property theft.
- Payroll fraud and theft including fraud in punching time clock.
- Cash theft involving main cashier, subsidiary cashier(s), cafeteria cashier, etc.
- Fraudulent practices in purchasing, receiving and storing.
- Fraud in registers, records and billing.
- Computer fraud.

**Some Methods of Internal Control**

There are two basic methods of exercising internal control, namely, physical security and procedural security. The following are some examples of these. Physical Security

- Guarding all means of ingress and egress. Protect the hospital against intrusion from without and illegal movement of goods from within.
- Control of the hospital’s perimeter. This is easy if the hospital is housed in a single building, but extremely difficult in a sprawling campus-type layout with several buildings spread across a wide area.
- Control of human traffic like employees, visitors, drivers, contractors, vendors, etc. Conduct body search, if necessary.
- Separate entry and exit points for (a) staff, (b) patients and visitors, and (c) vendors, sales persons, delivery people and contractors. The last category should not be allowed to mix with patients and visitors but instead routed through a permanently guarded entrance.

- Identifying, scrutinizing and properly guiding the non-patient and non-visitor traffic such as vendors at the controlled gates.
- Prohibit pedestrian traffic through receiving dock, receiving area, morgue exits, and truck gates.
- Control of vehicles like delivery trucks, etc. and checking outgoing vehicles.
- Electronic surveillance of strategic and sensitive areas through closed circuit television.
- Controlled or guarded gates at all the patient care areas.
• Install locking devices and alarm systems.
• Issue visitor passes.
• Procedure for and control over the issue of keys and sub master and master keys. Authorization necessary to issue keys and an effective, enforceable procedure for retrieving them.
• Lockers and lockable cabinets for staff against personal property theft.
• Provision of a safe for patients' valuables.
• Secured cabins for cashiers with a panic button or a silent foot or knee operated hold up alarm in their cabins.
• Provide roll-up shutters or grills at strategic places for nighttime protection.

Procedural Security

• Establish and communicate service rules for all staff members. Each employee should be given a printed copy the receipt of which he has to acknowledge.
• Establish policies and procedure manual for each department.
• Establish committees like general purchase committee, pharmacy and therapeutics committee, etc.
• Establish accountability and control over the flow of hospital supplies and materials, particularly the receiving functions, and regulating the operation of receiving and loading dock.
• Institute inventory control procedures.
• Establish well-formulated procedures for requisition, purchase, indenting, supply, and distribution.
• Adopt the policy of not allowing the cashier to have both the keys to operate the cash register. The first key unlocks the mechanism for register operation and gives total readings for money and number of transactions. The second key gives total either cashier-wise or by some other classification, and resets all totals back to zero. If the cashier has both the keys, the prospects of fraud increase.
• Institute perpetual inventory system.
- Conduct surprise checks of all the departmental inventories.

The above list is not exhaustive. The chief executive officer and his team, with sufficient imagination and insight, can devise methods suitable for their own individual system.

FIRE SAFETY

► OVERVIEW

Fire safety and protection are matters of vital importance concerning everyone in the hospital. The best form of protection from fire is its prevention. Although every possible measure may have been taken to make the hospital buildings as safe as possible, no place can be completely free from fire hazards. A careless employee, a thoughtless visitor, or a confused or disoriented patient can inadvertently set off a fire, and though initially it may appear to be insignificant, it is important to remember that every large fire starts from a small one.

An effective fire safety programme calls for an understanding of the hospital fire plan and the active participation of every employee at all times. There is no better protection against fire than constant vigil to detect fire hazards, prompt action to eliminate unsafe conditions and a high degree of preparedness to fight fire. Panic and confusion are the greatest hazards of fire. They can be countered only by sufficient preparedness.

General Fire Information

Every employee should know how a fire is caused, how it can be prevented, and where the alarm boxes and extinguishers are located. He or she should also have knowledge of the fire fighting procedure that should be learnt before a fire actually occurs.

For a fire to sustain itself, three elements — heat, fuel and oxygen — should be present. Fire is a chemical reaction, which occurs when a material (fuel) rapidly combines itself with oxygen in the

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presence of heat to produce a flame. If any of these three elements is taken away, the fire will fizzle out. This principle is the basis for fire extinguishment.

Most fires can be classified into three general types. Let us call them class A, class B, and class C.

Class A fire occurs in ordinary combustible materials such as wood, paper, cloth, etc. The best way to put out such a fire is by quenching it with water and thereby reducing the temperature of the burning material below its ignition point.

Class B fire occurs in flammable liquids and greases like oil, petrol, paint, alcohol, etc. It is best handled by the blanketing technique, which tends to keep oxygen away from the fire and thereby suppress combustion. Water should never be used. It will only spread this type of fire.

Class C fire occurs in electrical equipment such as motor, wiring, switches, panels, etc. This fire is a combination of the previous two types. Because of the hazards of electrical short circuit, a nonconducting extinguishing agent should be used to put out this type of fire. Again, water should never be used on an electrical fire. The person using water on an electric fire may receive an electric shock.

The fire protection system in hospitals basically consists of a static water supply source within the building. Connected to this are first aid hose reels and landing or hydrant valves with hoses at every floor level, preferably housed in an M.S. hose cabinet with glazed door and strategically placed. If the building is a high rise one, there should be a wet riser serving every 1000 sq. meters of the floor area to which the hose reels and hydrant valves are connected. The required pressure in the line should be provided with suitable capacity pumps. It is necessary to have one working pump and another as standby (diesel engine drive) in case of power failure during fire fighting operation.

In addition to the wet riser system, some unmanned areas require sprinklers. Portable fire fighting extinguishers of the type and capacity suitable for specific areas of application should also be provided in strategic locations.

Fire detection system consists mainly of smoke and heat detectors, which sense fire at an early stage and give off an alarm so that the fire could be controlled at the initial stage itself. Smoke and heat detection devices are wired in series and terminated in control panels, which are located in areas manned 24 hours of the day. Apart from these detectors, break-glass units and hooters are also provided at strategic areas. When there is a fire, the nearest break-glass unit should be activated by breaking the glass. This automatically sets off the alarm so that precautionary methods such as evacuation of the area can be undertaken.
Basic Responsibilities of Every Employee

Fire safety, fire prevention and, to some extent, fire fighting are everybody's business. Every employee has certain responsibilities in this regard. Specifically, he or she should:

- Be completely familiar with the hospital fire safety programme and the departmental fire plan.
- Be alert and observe the hospital with a critical eye, and report all fire hazards to the concerned authorities.
- Not smoke in the prohibited areas or anywhere if the entire hospital is declared a no-smoking area.
- Know the location of fire alarm boxes and be familiar with their operating instructions and use.
- Know the location of fire fighting equipment and be acquainted with its operating instructions and use.
- Know the location of fire exits and assist the supervisor or head of the department in keeping them clear at all times.
- Report to the supervisor if he (she) notices any defect in stairway doors, which should remain, closed and in operational condition at all times.
- Participate in all fire drills and other training or practice sessions as well as know his (her) assigned duties in the hospital's fire plan and evacuation.

What to Do in Case of Fire

If you discover a FIRE in your area, observe the following points.

Use Code: Do not PANIC, RUN, YELL, OR USE THE WORD "FIRE." Use the code DOCTOR RED (Plate 13: Picture 80).

Evacuate: Remove persons from immediate danger of smoke and fire. Only patients in immediate danger need be relocated in areas on the same floor but away from the fire. If the fire is in patient room(s), remove the patient(s) and close the door behind you.
**Sound Alarm:** Sound the fire alarm from the nearest fire alarm box. This will notify the telephone operator and fellow hospital employees of the situation. The alarm box will set off a series of sounds or hoots.

**Dial Telephone Operator:** Give the exact location — the floor, wing, area, etc — and the extent of fire. This is important because the telephone operator should be very sure of these details before calling up the fire department. The telephone operator will immediately write the location down.

The telephone operator will announce Doctor Red on the public address system followed by the location of the fire three times. This announcement will be repeated every 30 seconds for a period of two minutes.

To avoid panic among patients and visitors, emergencies in the hospital are announced using codes. For example, Doctor Red for fire. See Plate 13: Picture 81 for other codes.

The operator will also notify important officials like the CEO, nursing director, security chief, engineer and leader of the Doctor Red Alert team (explained later).

If the situation warrants and with the approval of the CEO or the person in charge at that time, the telephone operator will notify the fire department and summon help.

**Shut off Ventilating Fans, etc.:** On notification, the engineering department will shut off all ventilating fans, oxygen (after checking with the area supervisor), gas, electric power to the affected area and if necessary, to any adjoining areas threatened by fire.

**Prevent Smoke or Fire Gases from Spreading to Other Floors:** There is a great danger of people dying of suffocation even on the floors far removed from where the fire has broken out. Smoke and fire gases spread to other floors through air-conditioning ducts, pipe tunnels, etc. This can be avoided by closing all the dampers in the air-conditioning ducts.

**Avoid Using the Elevators:** Walk down the stairs.
Establish Control Centre: The CEO or a senior officer will take charge.

At the Scene of Fire

- Seal off the area of fire. Close windows and all patient room doors. Place wet blankets or towels along the door edges to prevent leakage of smoke. This is an effective fire fighting technique.

- Fight the fire with appropriate fire extinguishers. Use carbon dioxide type extinguisher on electrical and flammable liquid fires. Use fire extinguishers if the fire is small and fire hose if it is large.

  Warning: Do not operate the fire hose if you are not trained to do so. It is risky as you may be swept off your feet. Remember: two people are needed to operate a fire hose.

- Supervisor of the area will take charge.

- Doctor Red Alert team will go to the scene of fire. The team leader will direct operations as they pertain to the actual fire situation.

- When the fire department personnel arrive, they will be in complete charge.

- Personnel on general floor and other patient care areas will remain calm and reassure the patients. They will remain with their patients at all times until properly relieved.

- There should be written procedures for evacuation of patients and on who can make that decision.

- In case you are trapped and are unable to leave your room, do the following.

  1. Feel the door. If warm, do not open.
  2. Place wet towels, bedding or blankets under the door(s).
  3. Stay low on the floor where smoke and heat are the least and air clearer.
  4. Go to the window and open it.
  5. Attract the attention of fire fighters by hanging a sheet or blanket outside the window.
  6. Stay at the window for rescue.

    - All Clear signal should be given by a responsible person, and Code Green announced after the fire is controlled.
The Time to Know What to Do is Before a Fire Occurs, and Not After

Regardless of whether it comes under the purview of fire regulations or not, every hospital should be provided with a fire protection system considering the damage fire can cause to life and property. In addition, provision must be made for the following.

- There should be an effective fire safety programme for the hospital.
- There should be written policies as well as a procedure manual covering all contingencies arising from fire.
- Every department should have a departmental fire plan and a fire procedure manual outlining every employee's role in the plan.
- There should be a pre-appointed standing Doctor Red Alert team to direct all fire fighting operations.
- There should be written procedures for evacuation of patients in case the fire becomes widespread. The procedures should specify who could decide on evacuation as well as the procedures, methods and the order of precedence to be followed for evacuation.
- Simulated fire drills, which are an essential part of an effective fire prevention programme, should be conducted periodically. These drills help ensure that all personnel understand their roles in fire safety programme and perform their assigned tasks well. Practice makes them perfect. Fire drills should be conducted in a realistic manner.

Summary

If the fire is in your area

- Remove persons from immediate danger.
- Activate fire alarm.
- Alert personnel calmly. Never use the word Fire. Use the code Doctor Red or code Red.
- Dial the telephone operator. Give exact location and extent of fire.
- Seal off the affected area. Close all windows and room doors in the area. Use wet blankets to confine smoke.
- Unless lives are at stake, do not attempt to re-enter a room if the fire has gone out of control. Wait for help to arrive.
  - Shut off all equipment, gas, etc, which may compound the risk.
  - Fight the fire. Use a proper extinguisher.
  - Follow your department's specific fire plan and procedures.
  - Set up a fire control area.
  - Take head count of patients and staff.
  - Post staff at the elevator.
  - Prepare for evacuation of patients or other duties as prescribed in the department fire rules.
    - Establish contact with engineering, security, etc.
    - Establish and maintain communication with the control centre, and inform it about staffing needs.
    - Relinquish control when fire department personnel arrive at the scene.
    - When the fire is completely put off, send an All Clear message to the control centre. This should be agreed to by the fire department personnel if they are present.

If the fire is not in your area
- Stop what you are doing.
- Report to your department head or supervisor.
- Continue your duties within your department if instructed by your supervisor.
- Take head count of patients and staff.
- Shut off equipment, gas, etc. which might aggravate the risk. Check with the supervisor before shutting off the oxygen.
  - If you are in a patient care area, communicate with the patients and reassure them.
  - Send staff to control centre or the assignment area, if required.
  - Be prepared to assist in evacuation of patients, if necessary.
  - Post staff at the elevator.
  - Maintain a stand-by alert for any eventuality

Do not
• Panic.
• Run or shout in the corridors.
• Use the word Fire. Refer to it as Doctor Red.
• Use elevators (unless you are already on your way down).
• Leave your department unless permitted or directed by your supervisor.

Within a reasonable time after the fire is extinguished, head(s) of department(s) where fire had broken out should write a fire incident report and send it to the administration. The engineer should assess the damage caused by the fire, make an estimate of the loss suffered by the hospital and send a report to the CEO.

BOMB THREAT

► OVERVIEW

About 95-99 per cent of all bomb threats are found to be false. However, the implications of this kind of threat make it imperative that immediate action is taken to avoid personal injury or any loss of life and property as well as to arrest the spread of panic. The hospital, where such a large number of helpless people are concentrated and are utterly dependent on other people for their safety, should be alert to the dangers of a bomb threat and take all measures for its prevention. A bomb threat thus should not be dismissed lightly.

In most cases, telephone is used to communicate a bomb threat. The telephone operator is, therefore, the most likely person to receive the threat call. However, every employee should be familiar as to what to do after a bomb threat is received.

Upon Receiving a Bomb Threat

• Do not take the threat lightly.
• Be calm, do not panic. Do not display emotion or fear.
• Be courteous to the caller.
• Attempt to prolong the conversation with the caller and try to get as much information as possible.

• Ask the exact location of the bomb, how it looks like and at what time it is set to explode.
  o Be alert to the distinguishing background noises like street noises, aircraft, crockery, machinery, bells, etc., or anything that would help determine the location of the caller.
  o Note the distinguishing voice characteristics as well as the age, sex, mental condition of the caller, which may lead to his identification. (See the Bomb Threat Procedure Report Form at the end of the section.)
  o Note if the caller appears to have knowledge of the hospital by description of the location, departments, personnel, etc.

• Keep the caller on the lines as long as possible in an attempt to trace the call. Ask more questions to prolong the conversation. Some specimen questions to engage the caller are given below.

1. Where is the bomb right now?
2. When was it placed?
3. What does it look like?
4. Did you place the bomb? If so, why?
5. Do you represent any organization?

• Inform the caller that the hospital has a lot of helpless and sick patients and a bomb explosion could result in the death of or serious injury to many innocent people. He should help to avert this crisis.

• Immediately after the caller hangs up, the operator should notify the CEO, director of nursing, medical director, security officer and others concerned. She (the operator) will tell them, "There is a bomb threat situation at the hospital."

• Outside the regular working hours, she will notify these officials at their residences and notify simultaneously the person on duty in a supervisory position.

• Upon getting clearance from the CEO or his deputy or the person in charge of the hospital at that time, the telephone operator will notify the police and the fire department.
• In the night, the supervisor or the person on duty will take full charge of the situation until one of the senior executive officers arrives.

• After the top management has been informed, the operator will make announcements on the public address system informing hospital personnel of the bomb threat.

• Using a code, she will announce Code Black (Plate 13: Picture 80) three times. This announcement will be repeated every 30 seconds for a period of two minutes.

• If the bomb threat is received by anyone other than the telephone operator, details of the threatening phone call should immediately be conveyed to the telephone operator who in turn, will initiate the steps described above.

• If the caller has indicated the location of the bomb, the telephone operator will contact the CEO, director of nursing and others and inform them of the exact location. The security supervisor will seal off the area.

• If the caller has not indicated the exact location, a general search will be conducted in all work areas. There is no better or more qualified person to search a particular area of the hospital than the employee who works there. He or she can readily recognize any foreign or unusual object placed in the employee's work area.

**Warning**

It is important that the personnel involved in the search clearly understand that their only mission is to search for and report suspicious object(s). Under no circumstances should they touch, move or jar (give a sudden shock or jolt to) the object or anything attached to it.

Disposal of suspicious objects will be the specific responsibility of the bomb squad, which comprises specially trained police or fire department personnel.

• On hearing the Code Black announcement, each ward sister or head nurse will prepare an inventory of patients in her area and send copies to the nursing service and control centre, retaining the third copy in the nursing station.

• The office of the chief of the hospital will become the control centre for telephones and other forms of communication. Any report regarding the search or any unidentified or suspicious objects should be relayed to this office. The other senior officers will assist the
chief of the hospital. Secretaries will be in attendance. Only authorized personnel will be allowed entry in this area.

- All personnel should remain calm and reassure the patients. They should notify the control centre of any significant development in their areas.

  1. If an unexploded or suspected bomb is found, the following procedure should be followed.
  2. Close all doors in the immediate area. This will reduce the impact of the bomb.
  3. Prevent the suspected object from being moved, touched or jarred in any way.
  4. Report all details to the control centre, which, in turn, will inform the police and the fire department.

    When they arrive, police and fire department personnel should be met and escorted to the scene.
  5. Isolate the area.
  6. Evacuate patients, visitors and other personnel from the danger area in an orderly fashion.

- The decision to evacuate patients will be made by the chief of the hospital or the person in charge at that time, in consultation with other senior officers.

- Upon arrival of police and/or fire department personnel, complete authority will be given to them for search and investigation. If a suspected bomb is found, police will either defuse it or remove it from the hospital.

- As soon as possible after informing the people concerned, the person who received the bomb threat call will complete a pre-printed Bomb Threat Report form (see specimen form at the end) and send it over to the control centre.

- Upon a signal from the control centre that everything is clear, the telephone operator will announce the All Clear message. She will announce code Green three times, and repeat it in the next two minutes.

- The hospital personnel will then return to their respective places of work and resume their duties.

- Immediately after the All Clear message has been given, a critique will be held in the control centre. All senior officers will attend the meeting. The meeting will discuss the
established procedure, the difficulties encountered during the procedure, and the possibilities of using the experience gained to further improve the system.

The time to know what to do is before a bomb threat is received and not after. For this purpose:

- Hospitals must develop a procedure manual setting forth in detail the procedure to be followed in the event of a bomb threat.
- There should be periodical drills for all staff of the hospital so that they become familiar with the procedure.

### BOMB THREAT PROCEDURE

**REPORT OF PERSON WHO RECEIVES THE BOMB THREAT CALL**

Name of the person who received the call

<table>
<thead>
<tr>
<th>Title</th>
<th>Time</th>
<th>Date</th>
</tr>
</thead>
</table>

**EXACT WORDING OF THE THREAT**

<table>
<thead>
<tr>
<th>Sex of the Caller</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of Call</td>
<td></td>
</tr>
</tbody>
</table>

**CALLER'S VOICE**

<table>
<thead>
<tr>
<th>Calm</th>
<th>Slurred</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angry</td>
<td>Stutter/stammer</td>
</tr>
<tr>
<td>Excited</td>
<td>Deep</td>
</tr>
<tr>
<td>------------</td>
<td>---------</td>
</tr>
<tr>
<td>Slow</td>
<td>Harsh</td>
</tr>
<tr>
<td>Rapid</td>
<td>Clearing throat</td>
</tr>
<tr>
<td>Soft</td>
<td>Deep breathing</td>
</tr>
<tr>
<td>Loud</td>
<td>Cracking voice</td>
</tr>
<tr>
<td>Laughter</td>
<td>Disguised</td>
</tr>
<tr>
<td>Crying</td>
<td>Accent</td>
</tr>
<tr>
<td>Normal</td>
<td>Whispered</td>
</tr>
<tr>
<td>Distinct</td>
<td>Familiar</td>
</tr>
</tbody>
</table>
If voice is familiar, who did it sound like?

<table>
<thead>
<tr>
<th>BACKGROUND SOUNDS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Street noises</td>
<td>Factory machinery</td>
</tr>
<tr>
<td>Crockery</td>
<td>Animal noises</td>
</tr>
<tr>
<td>Voices</td>
<td>Clear</td>
</tr>
<tr>
<td>Music</td>
<td>Long distance</td>
</tr>
<tr>
<td>House noises</td>
<td>Other</td>
</tr>
<tr>
<td>Motor</td>
<td></td>
</tr>
<tr>
<td>Office machinery</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>THREAT LANGUAGE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Well spoken (educated)</td>
<td>Incoherent/not clear and logical</td>
</tr>
<tr>
<td>Foul</td>
<td>Taped</td>
</tr>
<tr>
<td>Irrational</td>
<td>Message read by threat maker</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>REMARKS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reported call immediately to:

Signature
ALARM SYSTEM

A hospital, more than any other institution, is exposed to emergencies and life threatening situations: from medical emergencies like cardiac arrest, accidents, casualties and disasters to dangers arising from fire and bomb threat. It has to be all the more alert to these situations because nowhere else are such a large number of helpless people concentrated in one place and are so utterly dependent on other people for their safety and health.

Built-in safeguards and preparedness are the essence of all safety programmes. The alarm system is one such programme. We discuss here some of the alarms that hospitals should have.

Fire Alarm

Every hospital must have a fire alarm system, which should be a part of the hospital’s electrical system. Wherever possible, it should be designed to transmit an alarm, signal directly to the telephone operator so that she can contact the fire department and notify the hospital personnel without any loss of time. The fire alarm system can be automatic or it can be operated manually.

Smoke and fire detection devices are installed in the patient rooms and other high-risk areas in the heating and ventilating ducts between the floors. These actuate the fire alarm system. On activation the system sounds audible alarms throughout the premises or zones, including distinctive visual and audible alarm signals at the respective nurses’ station. To indicate the location of fire, there is an indicator light outside every patient room. This is activated when there is a fire in the room.

In the automatic system, smoke detectors not only actuate the fire alarm signals, but also close smoke doors and simultaneously shut off fans in the central air handling system. If the fire alarm system is not automatic, then anyone noticing or hearing the fire signal should immediately inform the telephone operator who, in turn, will call the fire department and notify the hospital personnel.

Medical Gas Alarm
In the centralized medical gas system, oxygen and nitrous oxide, which are stored in bulk in the manifold room, are distributed to other areas of the hospital such as the operating rooms, ICUs and patient rooms through pipelines. Compressed air and vacuum (suction) are also supplied through pipes to certain areas.

Two kinds of alarm are incorporated into the medical gas system. One monitors the pressure of various gases at different areas of the distribution system. If abnormal pressure is sensed, the system sets off an alarm — the normal green signal goes off and the red warning signal glows with audible alarm until the line pressure returns to normal. The second alarm is called the remote signal lamp, which is generally only visible. The lamp lights up when either of the banks of cylinders becomes empty.

The remote signal lamp is only a warning signal. No immediate action is necessary because when one bank is empty, the other takes over and supplies the gas without interruption.

The alarm should be located in the medical gas user areas such as the operating rooms and patient floors as well as the main working area where medical gas system is maintained. However, these areas, especially the maintenance area, may not be manned all the time. Secondary signals should therefore be installed in places like the telephone operators' room, security office and the like where a 24-hour attendance is assured.

**Blood Bank Alarm**

Most hospitals use specially crafted refrigerators — a cold room or walk-in cooler is ideal — to store whole blood in the blood bank. These refrigerators are set to a particular temperature to maintain blood in good condition and are provided with an alarm. The alarm, which is both audible and visual, goes off whenever it senses high temperature or a drop in voltage. If the blood bank or the laboratory of which it is a part is not manned round the clock, the alarm signals should be located both in the blood bank and in a place having 24-hour attendance like the telephone operators' room or the security office.

**Narcotics Alarm**
Narcotics are stored in locked cabinets in the nurses’ stations as well as the pharmacy. These are restricted drugs, which are constantly stolen by persons addicted to them. Some hospitals install a signal system that illuminates a light bulb which is visible from the nurses' station and the corridors whenever the narcotics cabinet door is opened.

**Cold Room and Walk-in Cooler Alarm**

Many hospitals have walk-in cold rooms or coolers in their food service department and laboratory. There have been instances of the staff of the food service department getting accidentally (or even deliberately) locked up overnight inside the walk-in coolers. There should be an alarm button that can be used in such an emergency with a distinguishable audible and visual alarm indicator in a prominent area where there is 24-hour personnel coverage.

**Voltage Fluctuation Alarm**

In any hospital where crores of rupees worth of sensitive and expensive equipment is used, stabilized voltage is essential. Motors are usually designed to withstand only a 10 per cent fluctuation in voltage supply. Beyond this limit, the motor will get damaged unless it is disconnected.

Low voltage poses the biggest threat to electrical system and equipment. Diagnostic equipment often gives erroneous readings in low voltage conditions. There are certain areas and sensitive equipment that do not tolerate excessive low or high voltage. Such areas or equipment may be fitted with a simple voltage-sensitive alarm along with a voltmeter. The alarm can be set at any desired point.

**Elevator Alarm**

Many hospitals have more than one passenger and bed-cum-passenger elevators, which are in continuous operation. Whenever there is an electric power failure, elevators with their passengers get stranded, often in between the floors. In order to rescue the stranded passengers, a panic or emergency push button is provided in each elevator. When it is pressed, a battery operated alarm installed in the electric room or the security room, which is manned round the clock, is actuated to alert people about the rescue operation. Elevator operators or maintenance crew then manually winch down the elevator car from the machine room to the next lower floor to rescue the stranded passengers.
Modern elevators have an optional leveling feature which automatically takes the elevator car to the next floor level in case of power failure.

**Security Alarm**

Certain sensitive areas of the hospital like the cashier's office, the psychiatric ward, bank extension counter and pharmacy which are prone to theft and burglary or where patients suddenly become violent need to summon immediate help from the security personnel. Some hospitals provide alarm systems in these areas. The alarm may be of two kinds. One is an automatic alarm like the one used in strong rooms of banks or jewellery shops, which goes off when someone tries to break in. The other is similar to the one used by bank tellers. The device is activated by the employee to summon security or police help.

**Patient Emergency Alarm**

Various new features are now available that can be incorporated into the conventional nurse call system to meet emergency situations in the patient rooms. If the nurse does not respond to the patient's call immediately, the system makes the light outside the patient's room and on the nurse call panel in the nurses' station go blinking. If there is still no response, the blinking of lights and the bleeping signals from the beeper on the panel gradually keep on increasing in frequency.

An additional feature that can also be fitted into the nurse call system is the panic button in the patient toilet, which the patient can activate by a pull cord in case of an emergency.

**Code Blue Alarm**

Code blue is a term used in hospitals to announce or signal an emergency of a serious nature such as a cardiac arrest. In some hospitals, in all patient rooms and other strategic locations, there are independent buttons — not a part of the nurse call system — named Code Blue which when activated emit distinguishable emergency alarm signals both at the nurses' station and at the telephone operator's room. While the nurse attends to the patient instantly, the telephone operator goes on the public address system announcing code blue three times giving the location of the emergency. In such hospitals there is a written procedure to deal with such situations and a pre-
appointed code blue team, which responds to the call instantly. The members of the team are trained to deal with medical emergencies including cardiac arrest.

To avoid panic among patients and visitors, emergencies in hospitals are announced using codes: code blue for cardiac arrest, code (doctor) red for fire, code black for bomb threat, code white for security emergency, doctor major for disaster and code green for all clear (Plate 13: Picture 80).

**DISASTER PREPAREDNESS**

▶ **OVERVIEW**

Disasters are of two types: natural and man-made. Natural disasters include storms, heavy rains and floods, landslides, tidal waves, earthquakes, tornadoes and hurricanes. Examples of man-made disasters are riots, plane crashes, complex motor vehicle accidents, train accidents, building collapses, dam breaks and blackouts. In most of these accidents, fire may also break out.

Any hospital could be involved in a disaster. It may be an internal disaster such as a fire, bomb threat or a medical gas leak, or it could be an external disaster such as a complex automobile accident, train or airplane accident, explosion, tornado or other man-made disorders like riots.

Hospitals are concerned with the conservation of human life as well as the restoration of individuals to society. They are cognizant of their responsibility towards the hapless victims of a disaster. However, merely being cognizant or feeling a sense of responsibility is not enough. Hospitals should be properly prepared to effectively meet any eventuality. Too often, their preparedness to deal with disasters is grossly inadequate.

For a hospital to be properly prepared, there should be a well-documented and well-established disaster preparedness plan, which is the result of intelligent and cooperative thinking, and planning by all concerned. However this is only one step towards being prepared. No matter how well a plan has been conceived and written, it is of little value if filed away without implementation. To be effective, the plan must be clearly understood by every employee of the hospital. Personnel should know what
they have to do and how to do it. Rehearsal drills with conditions simulating the actual scene can provide basic training and practice that are so necessary for its successful implementation.

Drills should be scheduled for different shifts to get as many personnel trained as possible. To make them more realistic, some drills should be held without warning while others may be practice drills announced ahead of time. The importance of these drills, which ensure preparedness, cannot be overestimated. The disaster preparedness plan should be implemented as a "dry run" at least twice a year at approximately six-month intervals.

Inasmuch as the disasters cannot be forecast, it is necessary that the plan make provision for all possible types of them. It should also cover detailed assignments and specific tasks to be performed by each department. It is important to involve as many of the personnel as possible.

In dealing with an external disaster, especially of a large scale, it is not only necessary to involve other hospitals in the neighborhood but also the entire community in addition to the police and fire departments and other civic bodies. For this, it is desirable that occasionally disaster drills are conducted involving other hospitals and the community including the police and fire departments.

A detailed and comprehensive disaster plan is beyond the scope of this volume. However, the essential elements of such a plan relating to the steps that should be taken prior to and during the time when it is in operation are discussed here.

**Some Definitions**

**Disaster:** Any serious or unusual situation, which cannot be resolved by the personnel on duty in the hospital at the time.

**Doctor Major:** A code used to indicate a disaster of undetermined magnitude, which is likely to tax the hospital facilities.

**Triage:** The process of classifying the sick and the injured according to the urgency and type of conditions in order that each casualty receives treatment according to his or her immediate need.

**Information Team:** A team consisting of a medical person and others who reconnoiter the disaster site and report its estimate of the casualty situation to the disaster medical director or the
on-site medical director who may then decide if some of the cases have to be sent to other hospitals.

**All Clear:** The time when the acute phase of disaster terminates. This determination is made by the disaster chief, medical director, CEO or the nursing director of the hospital.

**Initial Steps Before the Disaster**

- Appointment of a disaster committee with the medical director as the permanent chairman and consisting of a representative of each department and service and significant others like chief residents of each service.
- Appointment of key personnel such as disaster medical director and/or on-site medical director, information team, etc. and identification of certain areas used during a disaster such as command post, control centre, triage area, medical aid station(s), etc.
- Formulation of a detailed disaster plan.
- All medical and hospital staff should be thoroughly familiar with individual and departmental responsibilities.
- Conduct simulated disaster drills for all employees periodically to establish proficiency in managing a disaster.

**When a Disaster Strikes**

1. Authorized individuals are called to declare a Doctor Major. Only the CEO, medical director, director of nursing or the senior physician in the emergency room are authorized to activate the disaster plan.
2. Police and fire departments are informed of the disaster.
3. An immediate announcement is made throughout the hospital, if necessary. The telephone operator announces Doctor Major three times and repeats the announcement every 30 seconds for a period of two minutes.
4. Depending on the seriousness and scale of the emergency, physicians and other hospital staff who are off duty are recalled. All departments activate their established procedure to provide immediate and necessary support.

5. Medical staff and house officers report to a designated staff holding room where they are given written instructions for manning important areas or performing crucial tasks. Specific instructions are given to: the disaster chief, chief of emergency room, chief of triage area, chief of emergency waiting room, chief of staff holding room, chief for emotionally disturbed patients' area, chief of waiting room for relatives of casualties, chief of admitting office, chiefs of x-ray department, blood bank and CSSD, etc.

6. "Chiefs" are assigned to key areas. Additional staff is assigned as needed.

7. Security and support personnel control the traffic in and around the hospital.

8. Triage is initiated adjacent to the ambulance entrance. The following instructions should be observed.

   (a) Do not allow casualties to accumulate.
   (b) Sort patients rapidly.
   (c) Tag them appropriately.
   (d) Route to appropriate treatment or other areas without delay according to the following:

      (i) Hyper acute conditions (life-threatening problems, hemorrhaging, etc.) to treatment area in the emergency room.
      (ii) Serious casualties to serious casualty centre or surgery area,
      (iii) Ambulatory care patients (non-life-threatening and observation cases) to emergency room waiting area.
      (iv) Emotionally disturbed to chapel or meditation room,
      (v) Dead on arrival to the morgue.

9. Definitive care is instituted at the above areas as soon as possible.

10. At each area, data is obtained, recorded and directed to business office, admitting office and public relations office for coordination and release.

11. Patients who may be discharged are directed to the admitting/discharge office.
12. Only the disaster chief, medical director, director of nursing or the CEO may authorize an All Clear announcement indicating the termination of the disaster status. Personnel may then return to their respective places of work.

13. The telephone operator will then make the All Clear announcement over the public address system. She will announce Code Green in the manner as explained earlier.

14. Public relations department
   (a) Releases information and messages to media, as necessary,
   (b) Acts as liaison between patients and relatives,
   (c) Centralizes information about casualties,
   (d) Controls all photographs, and
   (e) Prepares and posts updated casualty lists.

15. In the emergency department, personnel
   (a) Remain in their area unless specifically assigned to other disaster posts;
   (b) Defer all routine activities immediately including cast work;
   (c) Stand ready to receive and assist disaster casualties requiring urgent life-saving measures;
   (d) See that additional nurses are assigned from the floors, if necessary;
   (e) Are responsible that crash carts are brought to and kept in readiness in the triage area, and;
   (f) See that a portable x-ray machine is brought to and kept ready in the emergency department.

16. Following provisions shall be made in the morgue.
   (a) An admitting clerk takes charge,
   (b) Personal effects are not removed from the bodies,
   (c) A morgue register is kept. It lists bodies with their:
      (i) Identification,
      (ii) Date and time of arrival,
      (iii) Time of release and removal by proper person(s),
      (iv) List of personal effects,
      (v) Signature of person removing each body, witnessed by clerk, and
      (vi) Destination of the body.
17. Similar and appropriate written instructions are given to other areas and personnel, namely:

- House physician staff
- Housekeeping
- Linen services
- Nursing service
- Pastoral care, if there is one
- Pharmacy
- Hospital security and police department
- Radiology department
- Social work
- Surgery
- Volunteers
- Inpatient area
- Outpatient department
- Transportation

There is no one standard disaster plan that is tailor made to suit all hospitals. Hospitals vary in size, resources, facilities, type of staff they have and in their ability to render emergency treatment. Some of them may be able to provide only elementary first aid whereas others may have facilities and staff to provide advanced care. The place where hospitals are situated also makes a difference. A hospital located on a busy highway may get more accident cases, or an urban hospital more scab injuries than the ones in a quiet residential area. Each hospital should, therefore, formulate and develop its own disaster plan to suit its own conditions. However, regardless of the type and where it is located, every hospital should have a disaster preparedness plan that can be put into action in any eventuality.
CODE BLUE PROCEDURE

Code Blue procedure is a written procedure to announce, summon help and follow when there is a serious medical emergency such as a cardiac arrest anywhere in the hospital (Plate 13: Picture 80). In some hospitals there are call buttons marked Code Blue in patient rooms or in certain strategic areas of the hospital to summon help immediately. In the advanced computer assisted code blue system, information or announcements can be programmed to be automatic whereas in the manual system, the press of the code blue button will set off alarm signals both at the nurses' station and in the telephone operator's room. While the nurse will attend to the patient, the operator will go on the public address system announcing for the code blue team. It is a team trained to deal with all kinds of medical emergencies. It will respond to the call immediately.

There is a written procedure for code blue. As in the case of fire, bomb threat and disasters rehearsal drills should be conducted for all personnel. Every staff in the hospital must be given thorough training in cardiopulmonary resuscitation (CPR) procedure so that anyone who is readily available can resuscitate and revive the patient.

See under intensive care units and alarm system elsewhere in the book for more about the code blue procedure.

TRANSPORTATION

► OVERVIEW

Transportation is an essential function that is performed in every hospital regardless of its size, sophistication and means of transportation. It encompasses a wide range of activities and areas in any hospital. Some of them are as follows.

1. Inpatient escort service upon admission and discharge. Some hospitals make it mandatory for every patient upon discharge to be escorted in a wheelchair to the main entrance of the hospital.
2. Patient transportation to and from ancillary departments like x-ray, physical therapy and pulmonary medicine besides operating rooms, delivery suite, etc. for inpatients, emergency room patients and, on occasion, outpatients.

3. Movement of staff and visitors within the facility through elevator operator service.

4. Movement of supplies, materials and equipment within the hospital.

5. Movement of patient food, generally in trolleys or carts, from food service department to patient floors, and return of used trays, dishes, etc. to washing areas.

6. Ambulance service. Movement of patients from their homes, scene of accident, etc. to the hospital, and discharged patients to their homes.

Some hospitals may have a transportation department for the operation and maintenance of ambulances, vans and other vehicles. Some may have, in addition, what is called the patient transportation or escort service. Where there is no such centralized patient escort service, individual departments may arrange for transportation and escort service for their patients.

The usual means of transportation of people and materials include ambulance, elevators, wheelchairs, lifts, dumbwaiters, stairways, and ramps.

► Elevator, Lift and Dumbwaiter

Elevator

Elevators are a major part of the hospital's transportation system. They handle four types of traffic: patients, visitors, personnel and service. Movement of patient and visitor traffic should be quick. Patients may have to be moved quickly in an emergency, sometimes in their beds and stretchers, to the emergency rooms, operating rooms, ICUs, CCU or the labour-delivery suite. Patients are moved in wheelchairs to the ancillary services and other therapeutic treatment areas. Ideally, patient traffic should be separated from the visitor and service traffic. Some hospitals have separate service elevators for the service personnel and equipment for delivering supplies from outside and for such internal deliveries as food, linen, and materials.

Hospital elevators are of two types: (i) for passenger traffic including doctors, nurses, personnel and visitors, and (ii) for vehicular traffic including beds, stretchers, wheelchairs, portable machines, food carts and the accompanying personnel.
At least one hospital-type elevator should be installed when up to 59 patient beds are located on any floor other than the main entrance floor; at least two hospital-type elevators are needed when 60 to 200 patient beds are located on floors other than the main entrance floor; and at least three hospital-type elevators are needed when 201 to 350 patient beds are on floors other than the entrance floor.

Some Specifications

- The hospital-type elevator cars should have inside dimensions that will accommodate a patient bed, attendants, and necessary equipment. It should be at least 1.52 m (5' 0") wide by 2.29 m (7' 6") deep. The car door should have a clear opening of not less than 1.22 m (4' 0") wide and 2.13 m (7' 0") high. Additional elevators meant for visitors, personnel, and materials handling can be of a smaller size.

- All elevators should be equipped with automatic leveling devices.

- Some hospitals equip the patient transporting elevators with a two-way special services switch to permit cars to bypass all landing button calls and be dispatched directly to any floor.

- Every elevator should be equipped with a telephone and an alarm for use in an emergency.

- If there is a bank of elevators, at least one elevator should have dual control to obviate the necessity for an operator during the night or the hours when traffic is light. This is particularly useful in smaller hospitals.

- Elevator call button and controls should be of the type that will not be activated by heat or smoke.

As a rule, hospital elevators are slow. And there is a misconception that they should be so. This is not true. There is no reason why they should not move as fast as those in hotels or in commercial buildings.

- Elevators are one place where people panic in case of power failure. To obviate this, electric service and switching facilities should be arranged to permit operation of elevators from alternate (emergency) power source in case of interruption in normal electrical service.
it is not possible to connect all elevators to the alternate source of power, at least one elevator in each bank of elevators should be powered by alternate source.

- For their proper and efficient functioning, elevators require routine, maintenance and inspection by skilled elevator mechanics with special training and experience in this field. Elevator inspection and maintenance service should be contracted to the manufacturer or his authorized agent, and not undertaken by the in-house personnel as it is normally considered beyond their capabilities.

**Lift**

An elevator which is primarily used to move materials one or two floors is called a lift. In India, however, the term lift is used synonymously with elevator. In this context, lifts (elevators) are used to move all kinds of traffic and materials.

**Dumbwaiters**

Dumbwaiters are small lifts or elevators, which are used to deliver food trays, medicines and supplies. Before installing a dumbwaiter, the purpose for which it is going to be used should be decided. One purpose for which it is used is to deliver sterile supplies and instruments from the CSSD to the operating rooms when these two departments are located in different floors but directly one below the other so that the dumbwaiters open directly into the departments.

There are two types of dumbwaiters: the conventional waist-loading type and the floor-loading type. The latter permits a greater variety of use including transportation of small carts between upper and lower floors. The cart can be rolled directly onto the platform. This eliminates manual handling of items. This is not possible in the waist-loading type.

Dumbwaiters can be equipped with automatic loading and unloading devices. They are available in various sizes and capacities. One popular size is of 9 sq. feet of floor size and 4 feet in height.

Large dumbwaiters can be used to transport bulky equipment like food trucks or trolleys and laundry trucks.
When used for transporting sterile supplies from CSSD to the upper floor operating rooms, generally twin dumbwaiters are used: one to transport sterile instruments and supplies and the other to send dirty instruments and supplies to CSSD for reprocessing.

**STAIRWAYS AND RAMPS**

**Stairways**

Wherever there are elevators, stairways do not play a major role in handling normal traffic. However, they are required largely for use if the elevators break down and as a means of egress in case of fire. Therefore, they must be planned with considerable care. There should always be at least two stairways — in larger facilities, even more than two — leading from the top floor to a ground level exit. It is also necessary to locate them in different areas of the building. The fire department may require, as a measure of protection against fire, that there should be a complete enclosure in the entry to the stairways with self-closing doors and lighted exit signs over the door in the corridors. A minimum width of 3 ft. 8 in. and wide landings are necessary for handling stretchers in an emergency as, for example, when patients have to be evacuated during a fire. Continuous railings on both sides at a height of approximately 0.9 m. (3 ft.) are necessary for ease as well as safety of patients and personnel. Treads with grooves should be provided to make the surface of the steps non-slippery.

In smaller hospitals with only ground and first floors, there may not be any elevators. In that case, stairway in combination with a ramp becomes the major means of handling traffic of all kinds with ramps being used for transporting patients on stretchers and wheelchairs.

**Ramps**

Ramps are a common feature in many hospitals. They are largely used for transporting stretcher patients. Some features of the ramp are: gradient is 1:10, width is 2.5 m., width at landing at the U turn is 3.0 m., concrete railings are at a height of 0.9 m. and top of the railings with M.S. pipe or wooden railings have a diameter of 75 mm.
The flooring of the ramp should have grooves in perpendicular direction to the slope to avoid skidding. The floor may be of tiles, stone slabs or ribbed vinyl. When ramps are located in the periphery of the building, as they sometimes are, they should be sheltered from weather.

**CHECKLIST OF MINOR FACILITIES**

Planners and architects generally are not found wanting in their attention to major items of facilities planning. But more often than not, myriads of small items escape their attention. We present below some of the generally forgotten items as a checklist for hospital planners. The list is not in any particular order.

- Gift shop, bookshop and florist's shop.
- Coffee/snack bar.
- Pay telephones in the outpatient department, emergency department and the inpatient areas, particularly near labour-delivery suites, ICUs and CCU.
- Drinking water fountains.
- Assisted STD and ISD call facilities.
- Cashier's booth(s).
- Offices for night administrator and night nursing supervisor.
- Police and duty driver's posts near the emergency department.
- Doctors' lounge and medical staff facilities.
- Hospital mail sorting and delivery office.
- Medical library.
- Duty rooms, separate for male and female doctors, with sleeping accommodation and toilets and bathroom facilities for night duty residents and doctors, and for those who are or call duty, like surgeons, anesthesiologists, obstetricians, etc.
- Doctors' chart completion and chart review room adjacent to the medical records department with dictating facilities.
- Medical transcription area in the medical records department.
• Facilities from where in-house video programmes are telecast and music is broadcast.
• Room for copier, mimeographing. Also provision for FAX, TELEX, etc.
• Staff and employees' health clinic.
• Employees' locker rooms — separate for male and female employees — with toilet facilities.
• Boardroom.
• Conference hall.
• Special dining room for VIPs and medical staff.
• Place(s) near the staff entrance where employees can punch time cards. If the staff is large, more than one area may be needed. A separate place for nurses is recommended.
• Name boards of doctors in the main lobby.
• Directory/floor plan of building and floors.
• Covered car park for officials and senior medical staff.
• Covered park for hospital vehicles.
• Adequate number of staff toilets and public toilets.
• Place for security chief and change room for guards.
• Alcoves for wheelchairs, stretchers, etc. at the main entrance and at emergency.
• Quiet room/prayer room/chapel.
• Ramps at the main entrance and at the emergency room unless the ground floor is at grade level.
• Fireproof vault for important business records.
• Burglarproof safe or locker for patients' money and valuables either in the admitting office or in the business office.
• Solarium/vista lounge/sun rooms/day rooms.
• Janitor's closet(s) on every floor.
• Protective guards at wall corners against knocking of wheelchairs, carts, etc. as well as skirting.
• Doorman's station.
• Magazine stands for promotional work.
• Retiring facilities for anxious or bereaved relatives. Quiet room may be used.
• Electrical outlets on corridors for use of cleaning and polishing equipment, and for mobile x-ray, spaced to reach every room without having to use unduly long extension cords.
• Recessed spaces for fire extinguishers and hoses.
• Sleeping accommodation for on-call duty personnel like pharmacists, x-ray and lab technicians.
• Sleeping/living accommodation for kitchen employees who have to be resident to start work early.

► ESSENTIAL FACILITIES THAT SHOULD BE LOCATED CLOSE TO OUTPATIENT DEPARTMENT AND EMERGENCY SERVICES ON GROUND FLOOR

• Registration and enquiry or information desk.
• Medical records.
• Admitting office.
• Outpatient cashier.
• Pharmacy.
• Laboratory services.
• Radiology.
• Finance department, particularly billing and cashier.

These interrelated services are open round the clock and should be close to one another.

► OTHER FACILITIES THAT SHOULD BE IN THE VICINITY ON THE GROUND FLOOR

• Gift shop, bookshop, and florist's shop.
• Coffee shop and snack bar, preferably accessible to emergency patients as it is most needed in the night.
• Pay-telephones and water coolers drinking water fountains.
• Night administrator's room.
• Security post near emergency. It can also be used by the police summoned in connection with accident cases.

Note the following:

• Facilities should be organized in such a way that departments and areas that are not functioning in the night could remain closed at that time.

• In such areas and floors, there should not be a solitary section open or functioning, necessitating the entire facility to be kept open.

• Uneconomical use and waste of resources should be avoided. Unnecessary traffic will pose a security risk.

• The following areas must remain closed or kept locked allowing access only to personnel on duty and in emergency.

  • Outpatient department and clinics except adjunct services like medical records, admission, etc.

• All inpatient areas after visiting hours. Gates will be opened only to physicians, duty personnel and for admission of patients.

A single lockable gate should be provided for each ward for strict control.

► DEPARTMENTS AND FACILITIES FUNCTIONING IN THE NIGHT WHICH SHOULD REMAIN OPEN OR BE AVAILABLE

• Accident and emergency services
• Registration and enquiry
• Admitting
• Medical records.
• Pharmacy
• Radiology
• Laboratories
• Billing and night cashier
• Coffee or snack bar
• Pay Telephones and STD or ISD telephone booth(s)
• Night administrator and supervisor's office
• Security post
• Ambulance and the duty driver

APPENDIX B HOSPITAL SAFETY RULES

► PATIENT CARE

1. Prevent patients from falling from bed. It occurs frequently as they attempt to get on or off the bed unaided. Many of them may be feeble, disoriented or under sedation.

2. Make infirm patients feel at ease. Make them understand that they need to get assistance.

3. Provide for patients' personal belongings to be kept within their easy reach. Ask them to use nurses' call bell to get bedpan or urinal.

4. Use bedside rails on both sides wherever provided, particularly for elderly or restless patients, those coming out of anesthetic and whenever conditions warrant.

5. Check and double-check medications regarding instructions, labels and patient identity.

6. Label all bottles and containers. Keep the medicine supply locked. Keep caution, warning signs against toxic substances, isolation, etc.

7. Lift patients correctly with your leg power keeping your back straight. Use mechanical aids where available.

8. Know proper techniques for:
   • Turning a patient toward you
   • Turning a patient from you
   • Turning a helpless patient
   • Lifting a patient up in bed, and
• Lifting a helpless patient from sitting position or wheelchair.
Familiarize with and follow written procedures regarding proper techniques. These should be available in the nursing service department.

9. Return equipment and materials after use to the correct storage and containers.

► TRAFFIC

1. Secure wheelchair or stretcher in place by locking wheel brakes or by other means before loading or unloading a patient or when assisting a patient on or off the vehicle.
2. Always use safety belts or side rails on stretchers to protect patients from falling while transporting.
4. Push stretchers and beds from the end and not on the sides to avoid jamming your hand against something.
5. Control stretchers and wheelchairs from the lower side while going up or down a ramp. Get help if load or traffic is heavy.
6. Pull vehicles through swinging door. Do not ram through.
7. Before entering or leaving an elevator with wheelchair or stretchers, be sure floor is at level. Wheelchair is always back first.
9. When you have transferred the patient or have waited with the patient, park wheelchair or stretcher out of traffic at one side of the corridor.

► TRIPS AND FALLS

1. Trips and falls can cause serious injury. Pick up the little things on the floor such as banana or plantain peelings, flower petals, pencils, broken glass, etc.
2. A liquid spill can be risky. Clean it up immediately. Block off the area until cleaned.
3. Keep drawers and cabinet doors closed, particularly the doors of wall-mounted cabinets.
4. Never be too busy to look ahead when you are walking.
5. Beware of electric cords. You may easily trip. Place them out of the way. Remove them when not needed.
6. Take one stair at a time. Always use handrails when walking up or down the stairs.
7. Never use fingers to pick up broken glass. Use brush or pan instead.
8. Place objects carefully overhead. Carelessly kept objects may drop and hurt people.

**SAFETY IN ELECTRIC GOODS**

1. Prevent dampness near switches, wiring and appliances. Keep hands dry when you handle them.
2. Protect cords. Heat, oil and abuse will damage electric insulation.
3. Inspect cords, plugs, switches, sockets and outlets frequently to ensure that they are not damaged.
4. Report electrical faults immediately. A "small shock", overheating, sparking or noises are urgent warnings.
5. Report defective wiring such as worn out cords, loose or broken plugs or receptacles, blown fuse, etc. to the maintenance department.
6. Do not use an electrical outlet when a plug does not fit snugly. Get the outlet changed.
7. Be sure the equipment is properly grounded. Three-wire "ground" plugs are a good protection.
8. When connecting and disconnecting an electrical equipment, turn the on-off switch to the "off position,
9. Avoid using an adapter to fit a three-pinned plug in a two-pinned outlet.
10. Take particular care with electrical fittings in areas where it is difficult to keep the floor dry such as the laundry, kitchen, etc. because of spillage, steam condensation, melting
ice, etc. All items of equipment and machinery should be grounded. No brass electric light
sockets, handles, guards, etc. should be used. If they are currently being used, they should be
replaced
with non-conducting or rubber-covered-type material.

11. Never attach decorations of paper, cotton, cloth, etc. to electric light wires, fixtures
etc. nor keep them within 3 ft. of any open light.

12. Never hang or fasten electric cords with nails, staples or other metal supports.

13. Keep wires, lamps, etc. free from contact with curtains, furniture, packing materials,
etc.

14. Do not use any portable electric appliance until it has been checked by the
engineering department for safety.

► HEALTH HAZARDS — TOXICITY

1. Each work place is different. Check procedures with your supervisor.

2. Certain chemical, physical and biological exposures can be hazardous to your health.
Exposure may be through the eyes, ears, nose, mouth, skin contact, absorption and the nervous
system. A hazardous exposure or its effect may be immediate or spread over a long period.

3. Comply with all safety procedures, exposure limits (of radiation, for example), and
emergency aid.

4. Never store flammable liquids in your desk or cabinet.

► GOOD POSTURE IS IMPORTANT

Poor posture not only looks bad, it leads to serious health problems like muscle tension, stiffness,
fatigue, backache, neck pain, etc. and even a loss of self-confidence. Good standing posture and good
posture in motion, sitting, sleeping and turning are important. Good posture in motion is the safest
way to bend, reach and move throughout the day.
LOW BACK PAIN

Low back pain is one of mankind's most common ailments. It is estimated that eight out of ten persons have a back injury sometime during their lives. And yet, it can be prevented by learning good posture, correct techniques of lifting, etc. All of us tend to neglect our backs until one day we wince: "Oh, ouch, my aching back!" Poor posture is one of the greatest causes of back pain. Back injuries cost people and their employers a great deal of money, not to mention the loss on account of reduced production, absenteeism and high medical bills. Follow these simple rules to protect your back.

1. Standing: Rest one foot on a low stool to support your lower back. Do not bend forward with straight legs or stand in one position for a long time. If you are using a lectern (high reading desk), raise or lower the work surface so that your shoulders and neck stay relaxed.

2. Sitting: It is said that 40 hours of sitting can put more strain on the back of a workaholic than 40 hours of standing or even lifting. So if you have to sit for a long time, minimize damage to your back by practicing correct posture.

The chair must be low enough for you to place both feet on the floor and the knees slightly higher than your hips. Cross your legs or put your feet on a stool or footrest if you wish. Always sit firmly against the back of your chair. You may support your lower back with a cushion.

3. Walking: Walk with a good posture. Walk with your head high, chin tucked in, pull in your abdominal muscles lightly to support your lower back.

When properly performed, walking is the healthiest exercise (particularly recommended for those with high blood pressure). Keep the body loose. The proper position is to bend slightly forward with the toes pointed straight ahead. The knee should be lifted with every step, which activates the knee and hip joints.

4. Sleeping: A good night's sleep is necessary. Sleep on a firm mattress, which is good for your back. It will support the three natural curves of your backbone. The best way to sleep is on your back with a pillow under your knees.

Sleeping on your side is all right with hips and knees drawn up and arms extending below the shoulder line. Use no more than one pillow under your head. Do not sleep on your stomach. That may strain your back.
5. Bending: Keep your back straight. The back and neck should be in line as you bend over at the hips. Tighten your abdominal muscles to protect your lower back.

6. Reaching: If you have to reach across the bed in your work with the patient, rest one knee on the bed to support your lower back. Then bend forward with your back straight. Keep your shoulders down; do not hunch over (thus making your back and shoulders into a rounded shape).

7. Lifting: Use your head before you use your back while lifting objects. Avoid painful and costly injury.

Use the power of your legs and not your back to lift correctly and safely. Your legs are strong but your back is weak.

Follow these simple rules.

- Evaluate the load before lifting — whether it is too heavy or too bulky and whether it is within your lifting capacity.
- Inspect the route over which the object is to be carried, the distance to be covered and obstacles on the way like doors, traffic, etc.
- Stand close to the load or the object being lifted.
- Place the feet apart with one foot forward for a firm and balanced footing.
- Keep your back straight.
- Use your arm, thigh and leg muscles.
- Divide the weight between two hands.
- Take firm natural footing.
- Squat or bend the knees keeping your back in good alignment and erect.
- Extend your hands down to the object and grasp it firmly and in balance.
- Bring the object close to the body.
- Lift with your legs, straighten the ankles, knees, and hips to an upright position by applying a smooth steady pressure with the leg muscles.
- Avoid sudden jerking; do not twist while lifting.

While carrying the object
- Use leg muscles for all carrying movements.
• Keep weight of the load close to your body and at waist level.
• To counterbalance the load, shift part of your body in the opposite direction of the weight.
• Keep your back as straight as possible.
• Proceed by taking short steps.
• Keep a clear vision of the route.

Mistakes that cause back injuries
• Bending the back
• Reaching too far
• Lifting to one side
• Twisting with load
• Off-balance shifting
• Attempting too much

The above are general safety rules. In addition, there are rules specific to certain areas or departments such as housekeeping, laboratory, radiology, engineering and maintenance, food service, and laundry. Every department must formulate written rules specific to its area.