Hospital Operations Management
This book is a part of the course by Jaipur National University, Jaipur.
This book contains the course content for Hospital Operations Management.

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<td>Architectural Barriers Act Accessibility Guidelines</td>
</tr>
<tr>
<td>ACCM</td>
<td>American College of Critical Care Medicine</td>
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<tr>
<td>ADA</td>
<td>Americans with Disability Act</td>
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<tr>
<td>AHU</td>
<td>Air Handling Unit</td>
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<tr>
<td>AIDS</td>
<td>Acquired Immune Deficiency Syndrome</td>
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<td>AM</td>
<td>Asset Management</td>
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<tr>
<td>BARC</td>
<td>Bhabha Atomic Research Centre</td>
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<tr>
<td>BER</td>
<td>Beyond Economical Repairs</td>
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<tr>
<td>BME</td>
<td>Bio Medical Engineering</td>
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<td>BMES</td>
<td>Biomedical Engineering Society</td>
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<tr>
<td>BMW</td>
<td>Bio Medical Waste</td>
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<tr>
<td>BPI</td>
<td>Building Performance Indicator</td>
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<tr>
<td>BSN</td>
<td>Bachelor of Science in Nursing</td>
</tr>
<tr>
<td>CABG</td>
<td>Coronary Artery Bypass Grafting</td>
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<tr>
<td>CPCB</td>
<td>Central Pollution Control Board</td>
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<tr>
<td>CPR</td>
<td>Cardio-Pulmonary Resuscitation</td>
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<tr>
<td>CT</td>
<td>Chemotherapy</td>
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<tr>
<td>DEM</td>
<td>Department of Emergency Medicine</td>
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<tr>
<td>DG</td>
<td>Diesel Generator</td>
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<td>ERCP</td>
<td>Endoscopic Retrograde Cholangio Pancreatography</td>
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<tr>
<td>FCCS</td>
<td>Fundamental Critical Care Support</td>
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<td>FGI</td>
<td>The Fungal Genome Initiative</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>GSA</td>
<td>General Services Administration</td>
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<td>HDU</td>
<td>High Dependency Unit</td>
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<tr>
<td>HEPA</td>
<td>High Efficiency Particulate Air</td>
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<tr>
<td>HIPPA</td>
<td>Health Insurance Portability and Accountability Act</td>
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<tr>
<td>HIV</td>
<td>Human Immunodeficiency Virus</td>
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<tr>
<td>HOD</td>
<td>Head of Department</td>
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<tr>
<td>HT</td>
<td>High Tension</td>
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<tr>
<td>HTC</td>
<td>Hospital treatment Capacity</td>
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<tr>
<td>HVAC</td>
<td>Heating, Ventilation and Air-Conditioning</td>
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<tr>
<td>IBC</td>
<td>International Building Code</td>
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<tr>
<td>ICT</td>
<td>Immunoreactive Chemo Therapy</td>
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<td>ICU</td>
<td>Intensive Care Unit</td>
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<tr>
<td>IEQ</td>
<td>Indoor Environmental Quality</td>
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<tr>
<td>JCAHO</td>
<td>Joint Commission on the Accreditation of Healthcare Organisations</td>
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<tr>
<td>JCI</td>
<td>Joint Commission International</td>
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<tr>
<td>KPI</td>
<td>Key Performance Indicators</td>
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<tr>
<td>LPN</td>
<td>Licensed Practical Nurse</td>
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<td>LT</td>
<td>Low Tension</td>
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<td>MCI</td>
<td>Mass Casualty Incident</td>
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<td>MEI</td>
<td>Maintenance Efficiency Indicator</td>
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<td>MRI</td>
<td>Magnetic Resonance Imaging</td>
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<td>MSC</td>
<td>Manpower Sources Diagram</td>
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<td>NABH</td>
<td>National Accreditation Board for Hospitals and Healthcare Providers</td>
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<td>NAFTA</td>
<td>North American Free Trade Agreement</td>
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<tr>
<td>NFPA</td>
<td>National Fire Protection Association</td>
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<tr>
<td>NIC</td>
<td>Newly Industrialised Country</td>
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<tr>
<td>NPP</td>
<td>Nurse Practitioner in Psychiatry</td>
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<td>ODP</td>
<td>Operating Department Practitioners</td>
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<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
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<td>OM</td>
<td>Operation Management</td>
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<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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<tr>
<td>OTS</td>
<td>Outsourced Software Development</td>
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<td>POE</td>
<td>Post-Occupancy Evaluation</td>
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<td>PPM</td>
<td>Periodic Preventive Maintenance</td>
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<td>PPS</td>
<td>Medicare's Prospective Payment System</td>
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<td>PSI</td>
<td>Property Standard Index</td>
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<td>RN</td>
<td>Registered Nurse</td>
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<td>ROI</td>
<td>Return on Investment</td>
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<tr>
<td>RPM</td>
<td>Respiration, Perfusion, and Mental Status</td>
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<td>START</td>
<td>Simple Triage and Rapid Treatment</td>
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<tr>
<td>STAT</td>
<td>Signal Transducer and Activator of Transcription</td>
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<td>UPS</td>
<td>Universal Power Supply</td>
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<td>WHO</td>
<td>World Health Organisation</td>
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Chapter I
Overview of Hospital Operations Management

Aim
The aim of this chapter is to:

• introduce the concept of operation hospital management
• explain the operational strategy of a hospital
• elucidate cleanliness and hospital waste management

Objectives
The objectives of this chapter are to:

• explain various hospital operations
• elucidate the concept of operation management
• describe the cleanliness and hospital waste management

Learning outcome
At the end of this chapter, you will be able to:

• understand hospital operational activities
• identify the importance of operation management in hospitals
• describe hospital accounting system
1.1 Introduction to Operations Management

Many of you reading this book may think that you don’t know what operations management (OM) is or that it is not something you are interested in. However, after reading this chapter you will realise that you already know quite a bit about operations management. You may even be working in an operations management capacity and have used certain operations management techniques. You will also realise that operations management is probably the most critical business function today. If you want to be on the frontier of business competition, you want to be in operations management.

Today companies are competing in a very different environment than they were only a few years ago. To survive they must focus on quality, time-based competition, efficiency, international perspectives, and customer relationships. Global competition, e-business, the Internet, and advances in technology require flexibility and responsiveness. This new focus has placed operations management in the limelight of business, because it is the function through which companies can achieve this type of competitiveness.

Consider some of today’s most successful companies, such as Wal-Mart, Southwest Airlines, General Electric, Starbucks, Toyota, FedEx, and Procter & Gamble. These companies have achieved world-class status in large part due to a strong focus on operations management. In this book you will learn specific tools and techniques of operations management that have helped these, and other companies, achieve their success.

The purpose of this book is to help prepare you to be successful in this new business environment. Operations management will give you an understanding of how to help your organisation gain a competitive advantage in the marketplace. Regardless of whether your area of expertise is marketing, finance, MIS, or operations, the techniques and concepts in this book will help you in your business career. The material in this book will teach you how your company can offer products and services cheaper, better, and faster. You will also learn that operations management concepts are far reaching, affecting every aspect of the organisation and even everyday life.

Every business is managed through three major functions: finance, marketing, and operations management. Other business functions — such as accounting, purchasing, human resources, and engineering — support these three major functions. Finance is the function responsible for managing cash flow, current assets, and capital investments. Marketing is responsible for sales, generating customer demand, and understanding customer wants and needs. Most of us have some idea of what finance and marketing are about, but what does operations management do? Operations management the business function responsible for planning, coordinating, and controlling the resources needed to produce a company’s goods and services.

1.2 Role of Operations Management

Operations management (OM) is the business function that plans, organises, coordinates, and controls the resources needed to produce a company’s goods and services. Operations management is a management function. It involves managing people, equipment, technology, information, and many other resources. Operations management is the central core function of every company. This is true whether the company is large or small, provides a physical good or a service, is for profit or not for profit. Every company has an operations management function. Actually, all the other organisational functions are there primarily to support the operations function. Without operations, there would be no goods or services to sell. Consider a retailer such as Gap that sells casual apparel. The marketing function provides promotions for the merchandise, and the finance function provides the needed capital. It is the operations function, however, that plans and coordinates all the resources needed to design, produce, and deliver the merchandise to the various retail locations. Without operations, there would be no goods or services to sell to customers. The role of operations management is to transform a company’s inputs into the finished goods or services. Inputs include human resources (such as workers and managers), facilities and processes (such as buildings and equipment), as well as materials, technology, and information. Outputs are the goods and services a company produces.

1.3 Introduction to Hospital Operation Management

Hospitals are large and complex organisations, yet they function largely without sophistication and technology inherent in other large businesses. In a time when well over half of all hospitals report negative operating margins,
driving down costs by achieving operational excellence is one of the most important yet overlooked areas. Healthcare operations management is the emerging discipline that integrates quantitative and qualitative aspects of management to determine the most efficient and optimal methods of supporting patient care delivery. Operations management helps hospitals and health systems understand and improve labour productivity, reduce waiting lines, shorten cycle times, and generally improve the patient’s overall experience—all of which helps to improve the organisation’s financial health.

Hospital operations management covers fairly large range of functions in a hospital as compared to well-known boundaries of operations management function in business. Harnessing full potential of hospital operations management is desirable in order for the hospital to stay cost-competitive, profitable and of immense service to the society at large. In any systems improvement exercise, it is important for a hospital to map out its own flows and interrelationships as only then some specific initiatives for efficiency enhancement, productivity improvement, quality control, etc. can be initiated, which all come within the realm of hospital operations management. Hospital operations management is concerned with applying traditional managerial functions (planning, organising, directing and control) to hospital daily services, namely, outpatient services, inpatient services, emergency services and diagnostic services, and management of other activities such as hospital pharmacy, vendor managed and co-managed inventory control, supply chain management, warehouse management, pharmacy management, etc.

Hospital operation management includes all day-to-day activities that it is busy all throughout the day but functions particularly marketing, accounting and finance, and HR, but no less important are usually kept out of its scope. This is because unlike outpatient or inpatient services; marketing, finance and accounting, and HR are not daily routine activities. However, at the same time addressing all major activities within the realm of hospital operations management is more important than narrowly limiting its scope on academic angle as real objective of hospital operations management is rendering more effective, efficient and productive services of world class quality than excluding some really vital activities from its fold on academic reasoning. Hospital management can be defined as entire hospital operations management plus HR, marketing and finance, and a few other hospital clinical and administrative functions.

A patient visit to a hospital creates flurry of activities in the warehouse, pharmacy and dispensing counters, which keeps associated hospital vendor-managed or co-managed inventory systems including the supply chain in active mode throughout the day. Hospital warehouse, pharmacy, vendor-managed or co-managed inventory control, and supply chain management are thus viewed as daily activities on the ground that no patient normally leaves hospital without taking some medicine along with him or her.

1.4 Different Functional Department of Hospital

Though HR, finance and marketing are not regarded part of hospital operations management on grounds of their being not as frequent activity as hospital outpatient or inpatient services but there can counter arguments to consider them as belonging to hospital operations management. While defining boundaries for hospital operations management, some professionals argue to keep HR or finance within its scope, on simple reasoning that no hospital activity can be carried out without involving hospital staff or financial transactions taking place almost daily. This can be supported on the ground that HR, finance and marketing also make their inadvertent presence almost daily while dealing with issues such as economics of outsourcing diagnostic services or medical staff scheduling. Furthermore, selection of medical, paramedical or support staff cannot be done in isolation, but with active concurrence by hospital operations managers only.

1.4.1 Hospital Finance System

Hospital finance system is concerned with continuous money supply to the hospital operation management system. All major hospital projects are funded by the hospital finance managers based on budgetary estimates prepared by the operation managers. It is a two way process. While hospital finance system ensures return on investment for capital intensive projects, the operation system communicates its funding needs to the finance system for diverse hospital services covered within its broad umbrella.
1.4.2 Hospital Accounting System
Provides feedback to the operations system on how well it performs with regard to effectiveness, cost, efficiency, productivity, and profitability measures. In many hospitals accounting is also responsible for the data processing function, which interfaces with all hospital functions including hospital operation system, HR, marketing and finance.

1.4.3 Hospital Operations Management
Hospital operations management also interfaces with hospital marketing function for eliciting critical information regarding impending elective surgeries, projections of outpatients and inpatients, targeted population’s perception about the quality of hospital’s service delivery, etc. In return, the hospital operation management system provides hospital marketing system feedback relating to effectiveness, efficiency, quality and productivity of the hospital service delivery.

1.5 Operational Management of the Hospital
The hospital administration has to run the hospital on a day to day basis to render patient care, which is their primary objective of the hospital, with the personnel, finance, accounts, technical and supportive services. In order to do this the hospital administration has to create a functional organisation that will be effective and efficient in order to achieve the hospital objective. The structure of the hospital need not follow any stereotyped fashion but must be responsive to the needs and demands of the situation. Expectation of the society, concepts, and philosophies, accepted and time-tested principles must be taken into consideration and adapted to the prevailing environmental conditions to determine the organisational structure of the hospital. The organisational structure must also take into account the ethical aspects and standards that is expected of the hospital. Many of the hospital’s functions are repetitive in nature. The hospital administration must lay down certain directives to guide the various functionaries regarding the activities to be carried out by them. When to deal with a situation an employee must know, what he should do, How he should do it and what he ought to do or ought not to do. The hospital administrator has to carry out his day to day activities efficiently and effectively managing the hospital by laying down the policies, procedures and rules.

1.6 Health Scene in India
Health services provided by government agencies, which can be accessed free or for a nominal free, are grossly inadequate in India. The private sector brings with it bed capacity, skilled human resources and some degree of efficiency. However, even with private healthcare that is a problem that good quality healthcare is not available even in private sector particularly in rural and other remote parts of the country. Private practitioners are hesitant to reach rural areas and hence end up catering to only a small section of the population. In rural areas, private sector accounts for 58 per cent of all hospitals, beds (29 per cent), doctors (81 per cent), and outpatient cases (77 per cent). The corresponding figure for the urban areas is 80 per cent. Both public and private sectors need coordinate their investments and growth in the health sector for larger public interest.

Years of prolonged under funding of the public health system and dependence on the private sector has pushed the cost of healthcare, and has also affected access. There is more than Rs. 3,000 expenditure in government hospitals in rural areas during every hospitalisation, which is met out of pocket. The out-of-pocket expenditure in the urban areas and in private hospitals is two to three times higher, public spending on health was 0.94 per cent of the gross domestic product (GDP) in 2004-05, which was among the lowest in the world. Private expenditure on health in India is about 78 per cent as compared to 14 per cent in the Maldives, 29 per cent in Bhutan, 53 per cent in Sri Lanka, 31 per cent in Thailand and 61 per cent in China. GOI now plans to increase its allocation for health to 2-3 per cent of its GDP during the Twelfth Plan.

National Rural Health Mission (NRHM) is by far most important strategic healthcare management initiative in India. NRHM unifies several rural health schemes promoted by the Ministry of Health and Family Welfare (GOI). NRHM aims to improve sanitation, hygiene, safe drinking water, and nutrition levels through the network of primary health centers (PHCs), community health centers (CHCs) and district hospitals. This is important considering that healthcare has direct linkage with several areas such as safe drinking water supply, nutrition, sanitation, female
literacy, and women empowerment. This national programme aims to improve access of quality healthcare to poor by ensuring availability of improved clinical technology in rural hospitals, drugs at low cost for common ailments, timely immunisation of newly born babies, and adequate health infrastructure and nutritional security for individuals in place. Around 30 per cent in rural India did not go for any treatment for financial constraints in 2004 – up from 15 per cent in 1995.

Similarly, in urban areas, 20 per cent of ailments were untreated for monetary problems in 2004 – up from 10 per cent in 1995. Loans and sale of assets helped in financing 47 per cent and 31 per cent of hospital admissions in rural and urban areas, respectively. Between 1986 and 2004, the average expenditure per hospital admission increased three times in government and private hospitals. The sharp rise in prices of drugs has been the main reasons for the growing cost of medical care, which more than tripled between 1993-94 and 2006-07. GOI plans to train 22,000 nurses annually. Acute shortage of trained medical manpower is a major problem. GOI envisages availability of 50,000 MBBS seats (as against 35,250 seats currently available) and 25,000 post-graduate seats (as against 20,000 at present) within the next three years.

### 1.7 Harmony in Medical Teams

Hospital activities are interdependent. An operation cannot be carried out unless an anaesthetist first administers anaesthesia. Nobel Prize-winning physicist Albert Einstein (1879-1955) once said (Byme, 2010), “A hundred times every day I remind myself that my inner and outer life depend on the labours of other men, living and dead, and that I must exert myself in order to give in the same measure as I have received and am still receiving.” Thus, cooperation from others is vital for human existence and any task we accomplish. There are situations, when some persons in a team might offend someone. For the success of the work on hand to which team members are committed, it becomes necessary to maintain interpersonal harmony. It will be most apt to remember what Rene Descartes (1596-1650), ancient mathematician and philosopher, advised (Byme, 2010), “Whenever anyone has offended me, I try to my soul so high that the offense cannot reach it”. Gautam Buddha always highlighted power of positivity in life, who advised (Byme, 2010), “If a man speaks or acts with an evil thought, pain follows him. If a man speaks or acts with a pure thought, happiness follows him, like a shadow that never leaves him”.

Similar views were expressed by the Chinese philosopher, Mozi, who visualised group harmony (Byme, 2010), as when “When all the people in the world love one another, then the strong will not overpower the weak, the many will not oppress the few, the wealthy will not mock the poor, the honoured will not disdain the humble, and the cunning will not deceive the simple”. A related example in hospital services, for the success of surgical operation harmonious relationship between anaesthetist and doctors is very essential. A quote by Gandhiji shall be apt to highlight the point, “No organisation can run smoothly when it is divided into camps, each growling at the other and each determined to have its own way by hook or by crook” (Young India, November 9, 1929). Service and love are helpful in building harmony in work teams. This is also reflected in Bapu’s such views, “Real affection is not shown through praise, but through service” (Young India, March 14, 1929).

### 1.8 Hospital Communications

Communication is a process by which a leader or a manager transfers and receives information in managing business. In fact, communication is the nervous system of a hospital. Communication processes within a hospital are vital for achieving healthcare goals. They are the processes that link different departments – outpatient services, inpatient services, emergency services and laboratory services, and other hospital functions, which are relevant at all levels, connecting all hospital staff in some capacity or the other. The effectiveness of the communication system – the way in which it is managed – has a significant impact on the ultimate effectiveness of the hospital.
Information is power which is conducive for problem solving, decision making, change management, and building trust and relationship. In a hospital typically a message from the chief medical officer or medical superintendent may be a directive to complete a pending surgery on priority; it may be an advice to perform a medical procedure in different manner to suit patient conditions; it may be an approval or disapproval of the hospital expansion proposal submitted; it may be new hospital policy to be in force, or a feedback about the hospital performance from the community. In hospitals medical staff deal with superiors, equals and subordinates at regular intervals through verbal and written communication, involving horizontal and vertical communication. Horizontal communication is as important as vertical communication in hospital systems.

In hospitals unless communication is essential for clinical reasons, silence is otherwise rewarding as patients heal more in silence than in noise. Hospitals should maintain utmost calm. In hospitals, these noises are simply maddening. They are made in total disregard of the feelings of other patients. Many patients and their relatives indulge in loud talks which they can easily carry on in gentle tones.

1.9 Cleanliness and Hospital Waste Management

Hospital should maintain surroundings very clean and no waste should leave hospital complex without first undergoing incineration. This is important in order to keep hospital environment free from infections. The reason is obvious that a hospital is visited by patients of all sorts and from any area, and hence chances of infections being spread are enormous when cleanliness levels are low. Hospital waste management has emerged as a distinct branch of hospital administration and in India there exists an independent professional society that addresses wide range of subjects relating to hospital waste management.

Cleanliness is important in any organisation but its need is much more overriding in hospitals than anywhere else. It will be very appropriate to reproduce one of his quotes on cleanliness which makes perfect sense in the hospital context. “A meticulous sense of cleanliness, not only personal but also in regard to one’s surroundings, is the alpha and omega of corporate life” (Harjijan, June 16, 1946).

1.10 Medical Ethics and Hospital Operations Management

A hospital is a service provider which is visited in moments of distress and not by one’s choice and thus it is unethical to cash on patients’ crisis moments. Furthermore, when an organisation is over flowing with money it may generate by earning illegitimate profits and losing its ethical behaviour or spiritual conduct in the process. This is because when a corporate hospital generates surplus funds at its disposal it may slip into money centric behaviour losing faith in God. A quote of Mahatma Gandhi very aptly explains this process, “I have always felt that when a religion organisation has more money than it requires, it is in peril of losing its faith in God and pinning its faith on money. The fact is the moment financial stability is assured, spiritual bankruptcy is also assured” (Harijan, December 10, 1938). According to Father of the Nation (Gandhi, 1922), ‘The science of Ethics is still in its rudimentary stage. Men have been interested so far in the investigation of the phenomena of the external world. We have not had till now any fearless explorers into the moral world. The true laws of morality can be ascertained and systematised only when men are prepared to devote themselves to their investigation with the same disinterested zeal as in the case of the positive sciences. Hospital authorities should always try to run hospital as a ‘not-for-profit’ organisation except when it becomes very necessary to earn some legitimate profits for maintaining the standards of hospital services.

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A private hospital can charge some nominal profits on its operations only when it needs money to make further investments on medical technology. While there can be some debate on degree of profitability hospitals should work at there can be absolutely no reason for overcharging hospital fees or indulging in violations of medical ethics. A hospital without medical ethics is a hospital at risk. According to Gandhiji, “it is wrong to think that business is incompatible with ethics. I know that it is perfectly possible to carry on one’s business profitably, and yet honestly and truthfully” (Harijan, May 4, 1935). According to him, honesty is the best policy in such matters. He noted, “It is difficult but not impossible to conduct strictly honest business. The fact is that the honester a business, the more successful it is.
1.11 Managing Hospital Staff

You might be impressed when you visit a modern hospital by its imposing buildings and the plethora of gadgets. But in spite of the highly technical environment of the hospital, human element still remains the sheet anchor of success of any hospital. A hospital employs a large number of people of different categories with widely varying educational and technical background. Some of them are highly skilled professionals while some others are of moderate education and without possession of any specific skill. This calls for a very efficient degree of personnel management.

Personnel management in essence involves the following elements of function by the hospital administration. The Managing Two Worlds Together project aims to add to existing knowledge of what works well and what needs improvement in the system of care for Aboriginal patients from rural and remote areas of South Australia (and parts of the Northern Territory). It explores their complex patient journeys and what happens when they come to Adelaide for hospital care. The relationship between patients and health care providers is the foundation of care and requires communication across cultures, geography and life experiences.

The very nature of medical staff scheduling demands the utmost efficiency when it comes to managing scheduling for staff and physicians at medical offices, hospitals, home health services, medical centers and other medical care facilities. While some medical facilities focus exclusively on certain types of medical care, others deal with ad hoc emergencies as part of their normal operations. Some medical practices and institutions engage in community awareness and prevention programs to help educate the public on various medical concerns, and all of these activities have their own scheduling demands.

With so many positions and skill requirements to meet, there is no room for anything less than total staff organisation, especially when the staff count reaches into the dozens, hundreds and even thousands, operating 24/7 and covering hundreds of shifts. Shift Planning’s custom installation and set-up allows every medical staffing demand to be met. Whether there are two or three shifts to cover in each 24-hour cycle, and taking into account the individual needs and preferences of each staff member, Shift Planning provides the powerful scheduling tools you need to cover a multitude of shifts, needs and expectations every day, efficiently and easily.

Shift Planning’s medical and hospital staff scheduling program puts real time data at the scheduler’s fingertips. Managers always know the availability of qualified personnel, staff preferences for particular days, shifts and units, and union and regulatory requirements. Shift Planning provides the tools necessary to keep track of staffing reports, regulated ratios and all of the demands that medical services must meet.

1.12 Benefits of Managing Staff

Following are the benefits of managing staff:

- Helps to accommodate safety and response time by keeping adequate staff on call hand at all times.
- Complies with union and governmental regulations automatically.
- Allows staff and workers consideration in their individual shift preferences.
- Provides the ability to reach any staff member within moments electronically, even if they are off-shift.
- Shift Planning allows you to manage the medical facility’s labour force and field services simultaneously, crucial to maximising the standards of operation.
- Shift Planning will provide powerful scheduling tools to prepare for everyday medical needs as well as emergency response to unexpected events within virtually any scenario that can arise.

1.13 Importance of OM

The importance of operations management was not always recognised by business. In fact, following World War II American corporations were dominated by marketing and finance functions. The United States had just emerged from the war as the undisputed global manufacturing leader due in large part to efficient operations. At the same time Japan and Europe were in ruins with their businesses and factories destroyed. U.S. companies were left to fill these markets: the post-World War II period of the 1950s and 1960s represented the golden era for U.S. business.
The primary opportunities were in the areas of marketing, to develop the large potential markets for new products, and in finance, to support the growth. Since there were no significantly competitors, the operations function became of secondary importance, because companies could sell what they produced. Even the distinguished economist John Kenneth Galbraith was noted as saying: “the production problem has been solved.” Then in the 1970s and 1980s things changed. American company’s experienced large declines in productivity growth, and international competition began to be a challenge in many markets.

In some markets such as the auto industry, American corporations were being pushed out. It appeared that U.S. firms had become lax with the lack of competition in the 1950s and 1960s. They had forgotten about improving their methods and processes, partly due to the lack of competitive challenge. In the meantime, foreign firms were rebuilding their facilities and designing new production methods. By the time foreign firms had recovered, many U.S. firms found themselves unable to compete. To regain their competitiveness companies turned to operations management, a function they had overlooked and almost forgotten about. The new focus on operations and competitiveness has been responsible for the recovery of many corporations, and U.S. businesses experienced resurgence in the 1980s and 1990s. Operations became the function at the core of organisational competitiveness. Although U.S. firms have rebounded, they are fully aware of continued global competition. Companies have learned that to achieve long-run success they must place much importance on their operations.
Summary

- Operations management helps hospitals and health systems understand and improve labour productivity, reduce waiting lines, shorten cycle times, and generally improve the patient’s overall experience—all of which helps to improve the organisation’s financial health.

- Hospital operation management includes all day-to-day activities that it is busy all throughout the day but functions particularly marketing, accounting and finance, and HR, but no less important are usually kept out of its scope.

- Hospital management can be defined as entire hospital operations management plus HR, marketing and finance, and a few other hospital clinical and administrative functions.

- The hospital administration has to run the hospital on a day to day basis to render patient Care, which is their primary objective of the hospital, with the personnel, finance, accounts, technical and supportive services.

- Communication processes within a hospital are vital for achieving healthcare goals. They are the processes that link different departments—outpatient services, inpatient services, emergency services and laboratory services, and other hospital functions, which are relevant at all levels, connecting all hospital staff in some capacity or the other.

- Hospital should maintain surroundings very clean and no waste should leave hospital complex without first undergoing incineration. This is important in order to keep hospital environment free from infections.

- The reason is obvious that a hospital is visited by patients of all sorts and from any area, and hence chances of infections being spread are enormous when cleanliness levels are low.

- Hospital waste management has emerged as a distinct branch of hospital administration and in India there exists an independent professional society that addresses wide range of subjects relating to hospital waste management.

- A hospital without medical ethics is a hospital at risk. According to Gandhiji, “it is wrong to think that business is incompatible with ethics. I know that it is perfectly possible to carry on one’s business profitably, and yet honestly and truthfully”.

- A hospital employs a large number of people of different categories with widely varying educational and technical background. Some of them are highly skilled professionals while some others are of moderate education and without possession of any specific skill.

- Operations management is the business function that is responsible for managing and coordinating the resources needed to produce a company’s products and services. Without operations management there would be no products or services to sell.

- The role of operations management is to transform organisational inputs — human resources, facilities, materials, technology, and information — into a company’s finished goods or services.

- Operations management is responsible for a wide range of decisions. They range from strategic decisions, such as designing the unique features of a product and process, to tactical decisions, such as planning worker schedules.

- Organisations can be divided into manufacturing and service operations, which differ in the tangibility of the product and the degree of customer contact. Manufacturing and service operations have very different operational requirements.

- A number of historical milestones have shaped operations management into what it is today. Some of the more significantly of these are the Industrial Revolution, scientific management, the human relations movement, management science, and the computer age.

- OM is a highly important function in today’s dynamic business environment. Among the trends that have had a significantly impact on business are just-in time, total quality management, reengineering, flexibility, time-based competition, supply chain management, a global marketplace, and environmental issues.

- Operations managers need to work closely with all other business functions in a team format. Marketing needs to provide information about customer expectations. Finance needs to provide information about budget constraints. In turn, OM must communicate its needs and capabilities to the other functions.
References


Recommended Reading

Self Assessment

1. Healthcare operations management is the emerging discipline that integrates __________ aspects of management to determine the most efficient and optimal methods of supporting patient care delivery.
   a. Quantitative and Qualitative
   b. Primary
   c. Secondary
   d. Tertiary

2. Hospital operation management includes all __________ activities that it is busy all throughout the day but functions particularly marketing, accounting and finance, and HR, but no less important are usually kept out of its scope.
   a. day-to-day
   b. single
   c. multiple
   d. secondary

3. All the money matters of hospital come under which department?
   a. HR
   b. Account
   c. Sales
   d. Finance

4. Which department provides feedback to the operations system on how well it performs with regard to effectiveness, cost, efficiency, productivity, and profitability measures?
   a. Finance
   b. Account
   c. HR
   d. Marketing

5. Hospital operations management also interfaces with hospital __________ function for eliciting critical information regarding impending elective surgeries, projections of outpatients and inpatients, targeted population’s perception about the quality of hospital’s service delivery.
   a. marketing
   b. HR
   c. operation
   d. finance

6. Which of the following is the primary objective of the hospital?
   a. Run the hospital on ongoing basis
   b. To render patient care
   c. To earn profit
   d. To open multiple branches
7. Communication is a process by which a leader or a manager transfers and receives _____ in managing business.
   a. information
   b. message
   c. signals
   d. knowledge

8. Information is power which is conducive for _________________
   a. problem solving and decision making
   b. loss
   c. hospital management
   d. profit

9. In hospitals unless communication is essential for clinical reasons, silence is otherwise rewarding as patients heal more in _______ than in noise.
   a. silence
   b. care
   c. noise
   d. ICU

10. A hospital employs a large number of people of different categories with widely varying _______ background.
    a. technical and educational
    b. hospitality
    c. logical
    d. science
Chapter II
Hospital Operation Strategy

Aim
The aim of this chapter is to:

• introduce the concept of operations strategy and its various components
• illustrate how operations strategy pertains to adding value for the customer
• identify the different ways in which operations strategy can provide an organisation with a competitive advantage

Objectives
The objectives of this chapter are to:

• introduce the concept of trade-offs between different strategies and the need for a firm to align its operations strategy
• explain the importance of operation strategy in hospitals
• explicate operations strategy

Learning outcome
At the end of this chapter, you will be able to:

• understand about hospital operational activities and its various components
• identify the importance of operation strategy in hospitals
• describe the hospital layout and location
2.1 Introduction

In the period following World War II, corporate strategy in North America was usually developed by the marketing and finance functions within a company. With the high demand for consumer products that had built up during the war years, companies could sell virtually everything they made at comparatively high prices. In addition, there was very little international competition. They could not even satisfy their own markets, let alone export globally. The main industrial competition to North America at that time, Europe, was devastated by the war. Within the business environment that existed at that time, the manufacturing or operations function was assigned the responsibility of producing large quantities of standard products at minimum costs, regardless of the overall goals of the firm.

To accomplish this, the operations function focused on obtaining low-cost, unskilled labour and installing highly automated assembly-line-type facilities. With no global competition and continued high demand, the role of operations management (that is, to minimise costs) remained virtually unchanged throughout the 1950s and early 1960s. By the late 1960s however, Wick Skinner of the Harvard Business School, who is often referred to as the grandfather of operations strategy, recognised this weakness among U.S. manufacturers. He suggested that companies develop an operations strategy that would complement the existing marketing and finance strategies. In one of his early articles on the subject, Skinner referred to manufacturing as the missing link in corporate strategy. Subsequent work in this area by researchers at the Harvard Business School, including Abernathy, Clark, Hayes, and Wheelwright, continued to emphasise the importance of using the strengths of a firm's manufacturing facilities and people as a competitive weapon in the marketplace, as well as taking a longer-term view of how to deploy them.

2.2 Operations Strategy Means Adding Value for the Customer

Value for the Customer: How often have we heard the expression “customers want their money’s worth”? Unfortunately, from a manager’s point of view, it’s not that easy. Customers want more than their money’s worth, and the more they receive for their money, the more value they see in the goods and services they are purchasing. In determining the value of a product, is it a good or a service, customers take into consideration all of the benefits derived from the product and compare it with all of the costs of that product. If, in the opinion of the customer, the benefits exceed the costs, then customers perceive value in the product. The more the benefits exceed the costs, the more value the product provides. In other words, Perceived customer value = Total benefits/Total costs

2.3 Trends Affecting Operations Strategy Decisions

Two major trends that have significantly impacted the role of operations strategy within an organisation are an increasing trend towards the globalisation of business and advances in technology, especially information technology.

2.3.1 Globalisation

As we saw in the first chapter, the world is quickly becoming a global village, caused in large part by technology. As a result, competition in most industries has intensified significantly in recent years, and this trend towards hyper-competition is expected to continue. At the same time, globalisation provides new opportunities for companies in the form of new, previously untapped markets, for their products as well as new sources for raw materials and components at significantly lower costs. This movement towards a single world economy has occurred for several reasons, including continued advances in information technology that facilitate the rapid transfer of data across vast distances. The growing trend to lower trade barriers is evidenced by NAFTA and the formation of the European Union. The trend toward lower transportation costs and the emergence of high-growth markets with associated high profit margins in newly industrialised countries (NIC).

These new markets can be compared to the saturated markets and shrinking profit margins that are being experienced in the more highly developed countries. For example, Jack Smith, the former chairman of General Motors, expects the growing Asian market, especially China, to be key to the company’s future. China had a passenger vehicle growth rate of 56 percent in 2002. New vehicle sales in Canada in 2002, in comparison, increased by 8.5 percent. As a result of this globalisation of business, managers must extend their vision beyond their own national borders when developing operations strategies. This includes the location of manufacturing plants in Southeast Asia because of low labour rates, or the establishment of call centres in Ireland because of a combination of inexpensive labour,
an educated workforce, and the necessary technology infrastructure that exists. In addition to structural strategy
decisions, such as where to locate a new plant, infrastructural issues also must be evaluated when looking to expand
a company’s operations strategy globally.

Here the education level of the workforce, the language, and the impact of local laws and customs must be taken
into consideration. For example, a major attraction for locating in Ireland is its highly educated workforce. As an
another illustration, employees in Germany can work up to 70 hours in some weeks without being paid overtime,
and then work as little as 30 hours or less in other weeks, as long as the total hours worked over a given time period
(such as 6 or 12 months) meets an agreed-upon amount.

2.3.2 Technology
Stan Davis and Chris Meyer, in their book entitled Blur, identify three factors that are significantly affecting the way
in which business is being conducted: Connectivity, Speed and Intangibility. They suggest that the combination of
all three is causing changes to occur in business at such a rate that managers can only view business today as a blur,
 hence the title of the book. All three factors are directly related to advances in technology. Connectivity refers to
the fact that virtually everyone is now connected electronically, be it through e-mail, the Internet, the telephone, or the fax.
At the same time, staff with these connected networks, in many cases, provide services that are now available 24/7
(24 hours a day, seven days a week) in place of the more traditional hours of nine to five, Monday through Friday.

Examples here include banking services, stock exchange transactions, and airline and hotel reservations. As a result
of this connectivity, information is transmitted in a matter of seconds or minutes, instead of hours or days (or even
weeks), which was the previous norm. The combination of connectivity and speed suggests that firms are now focusing
on the intangible aspects of their business to gain a competitive advantage in the market place, which translates into
providing better and more innovative services. As we shall see shortly, technology has also dramatically affected
one of the basic concepts in operations strategy: that of making trade-offs between priorities. With advances in
technology, managers no longer have to make pure trade-offs between competitive priorities as they once did.

2.4 Competitive Priorities
The key to developing an effective operations strategy lies in understanding how to create or add value for customers.
Specifically, value is added through the competitive priority or priorities that are selected to support a given strategy.
Skinner and others initially identified four basic competitive priorities. These were cost, quality, delivery, and
flexibility. These four priorities translate directly into characteristics that are used to describe various processes by
which a company can add value to the products it provides. There now exist a fifth competitive priority—service—and
it was the primary way in which companies began to differentiate themselves in the 1990s.

2.4.1 Cost
Within every industry, there is usually a segment of the market that buys strictly on the basis of low cost. To
successfully compete in this niche, a firm must necessarily, therefore, be the low-cost producer. But, as noted earlier,
even doing this doesn’t always guarantee profitability and success. Products sold strictly on the basis of cost are
typically commodity-like. (Examples of commodities include flour, petroleum, and sugar.) In other words, customers
cannot easily distinguish between the products made by one firm and another. As a result, customers use cost as the
primary determinant in making a purchase.

However, this segment of the market is frequently very large and many companies are lured by the potential for
significant profits, which are associated with large unit volumes of product. As a consequence, the competition in
this segment is exceedingly fierce—and so is the failure rate. After all, there can only be one low-cost producer,
and that firm usually establishes the selling price in the market. As an example, Zellers, a unit of Hudson’s Bay
Company, has found itself under increasing pressure since Wal-Mart entered Canadian 1994. It is estimated that on
a sales per square metre basis (a key measure of retail efficiency), Zellers lags well behind Wal-Mart. Thus Zellers
will have to improve its efficiency or differentiate itself from Wal-Mart to survive.
2.4.2 Quality
Quality can be divided into two categories: product quality and process quality. The level of quality in a product’s design will vary as to the particular market that it is aimed to serve. Obviously, a child’s first two-wheel bicycle is of significantly different quality than the bicycle of a world-class cyclist. The use of thicker sheet metal and the application of extra coats of paint are some of the product quality characteristics that differentiate a Mercedes-Benz from a Hyundai. One advantage of offering higher-quality products is that they command higher prices in the marketplace. The goal in establishing the “proper level” of product quality is to focus on the requirements of the customer. Overdesigned products with too much quality will be viewed as being prohibitively expensive. Underdesigned products on the other hand, will lose customers to products that cost a little more but are perceived by the customers as offering much greater benefits.

Process quality is critical in every market segment. Regardless of whether the product is a child’s first two-wheeler or a bicycle for an international cyclist, or whether it is a Mercedes-Benz or a Hyundai, customers want products without defects. Thus, the goal of process quality is to produce error-free products.

2.4.3 Delivery
Another market niche considers speed of delivery to be an important determinant in its purchasing decision. Here, the ability of a firm to provide consistent and fast delivery allows it to charge a premium price for its products. George Stalk Jr., of the Boston Consulting Group, has demonstrated that both profits and market share are directly linked to the speed with which a company can deliver its products relative to its competition. In addition to fast delivery, the reliability of the delivery is also important. In other words, products should be delivered to customers with minimum variance in delivery times.

2.4.4 Flexibility
From a strategic perspective, in terms of how a company competes, flexibility consists of two dimensions, both of which relate directly to how the firm’s processes are designed. One element of processes is the firm’s ability to offer its customers a wide variety of products. The greatest flexibility along this dimension is achieved when every product is customised to meet the specific requirements of each individual customer. This is often referred to as mass customisation. Examples of fit a that have achieved this level of flexibility include Dell Computers and the National Bicycle Industrial Company in Japan.

2.5 Developing Operations Strategy - Facility Location and Layout
As the hospital industry in the US continues to consolidate, decisions are made daily to close, merge, acquire, and sell. Some of the stress experienced by hospitals is well understood. For example, the tremendous pressure on hospital operations from third party payors to shorten patient hospital stays and to perform procedures on an outpatient basis resulted in excess capacity throughout the industry.

But there are other factors in this industry that are not clearly understood. What causes some hospitals to struggle and which management responses are most appropriate in particular settings? Organisations in all industries, including hospitals, develop strategies to respond to environmental factors and competitive challenges. Those strategies drive operational decisions regarding investments in new or updated technologies. The downstream effects of strategic choices and operational decisions on organisational performance are difficult to measure, but are a topic of great interest.

In general, this research suggests that industries behave differently with respect to how external environment and internal business decisions influence business performance. The hospital industry is unique in that it includes for-profit, non-profit, and government-owned facilities, sometimes competing for the same patients. Only 5% of revenue in the health care industry is self-funded by patients. Government funding (Medicare and Medicaid) accounts for 54% of revenue and private insurers provide 34% (7% is from other sources). The idiosyncratic nature of the environment in the hospital industry suggests the need to develop models that are specific to this industry.
Empirical evidence suggests that some environmental dimensions normally considered in analysing organisations are not germane in analysing hospitals while others explain a great deal. For example, unemployment rate and per capita income of the local population are significant predictors of hospital closure. Other environmental factors such as munificence and hostility have little effect on hospital performance. Similar arguments can be made about organisational structure, where high levels of regulation circumscribe the structural variation in hospital organisations.

For example, there are specific requirements for licensing of physicians, nurses, and technicians that preclude non-compliant task assignments, thus affecting hospitals’ choices with respect to role specialisation. We develop a model based on hospitals’ responses to being in an urban or rural location through their choices of strategies and operational decisions on technology investments. Location is an important factor in high contact service industries such as health care when services cannot be delivered remotely.

We investigate hospital strategies to determine if they moderate any apparent advantage or disadvantage directly attributable to urban or rural location. In addition, urban and rural location, strategy, and technology investments are analysed together to assess their influence on hospital performance. Operational definitions of the studied variables are provided next, and the analysis and results are presented and discussed. Insurers provide 34% (7% is from other sources). The idiosyncratic nature of the environment in the hospital industry suggests the need to develop models that are specific to this industry. Empirical evidence suggests that some environmental dimensions normally considered in analysing organisations are not germane in analysing hospitals while others explain a great deal.

For example, unemployment rate and per capita income of the local population are significant predictors of hospital closure. Other environmental factors such as munificence and hostility have little effect on hospital performance. Similar arguments can be made about organisational operational decisions, and performance. In contrast, these variables have frequently been used in studies of manufacturing operations.

### 2.6 Site Selection

The selection of a site involves both location and site selection, in other words, identifying the general area for the business and identifying a specific site within the area. Location refers to a general area within a city, while the site is a specific piece of property. A common approach to site evaluation is to first develop a checklist to ensure that all relevant factors are considered. Essentially, it involves an evaluation of various factors that are likely to impact upon sales and costs at a site. A judgment about the desirability of the site is made based on this evaluation.

Several standard checklists have been published to aid the evaluation process. These checklists commonly include information on the socioeconomic and demographic composition of the neighbourhood, level of competition, and existing retail outlets in the area. Site-specific factors such as traffic count, parking facilities, ease of ingress and egress, and visibility are also considered. While some of the data may be quite subjective, the use of checklists allows standardisation of the data-collection procedure and some comparison of information on different potential sites.

### 2.7 Location Analysis

According to Nelson (1958), the value of a location depends upon four factors:

- Its accessibility to the resident population
- Its accessibility to people moving about or gathering together on errands other than shopping
- Its physical desirability from the standpoint of grade or level, appearance, size, shape, neighbourhood or district environment, and other amenities
- Its reputation
Location analysis should begin with a general area analysis including economic conditions, population, potential competition, and growth. It also requires the definition of a trading area, roadway and transportation system, and traffic patterns and the volume of traffic. Mercurio (1984) highlighted the major topics that must be addressed in a location strategy as follows:

**Internal factors (The company):** Type of retail business, type of markets, sales expectations, market coverage requirements, operating policies, merchandising approaches, pricing, and advertising

**External factors (The market):** Physical environment, economic base, population base, demographic characteristics, expenditure potential, retail environment, and available existing facilities.

The location decision is important because opening a business costs a lot of money, the retailer is committed to the location for a long period of time even with a lease, competition is getting tougher and a good location is one way to beat the competition, and problems such as store saturation, an uncertain economy, and tough zoning laws are making good locations harder to find. Simply estimating probable sales is not enough in a location decision. The types of customers who are candidates for the merchandise sold by the firm, the prospects for future growth in the trading area, customer lifestyles, and probable future competition should be considered.

### 2.8 Site Analysis

Whatever the occasion or motive for locating a restaurant, there are eight principles which must be observed in applying selection criteria to each specific site as follows: adequacy of present trading area potential, accessibility of site to trading area, growth potential, business interception, cumulative attraction, compatibility, minimising of competitive hazard, and site economic. Specific site selection involves the study of a trading area, traffic, complementary and competing outlets, and vulnerability, parking surroundings, area changes, and cost. It also considers ease of entrance and exit from the site, the site’s visibility, nearby land use, the size of the site, and its cost. Evaluating a specific site is important. Choosing a specific site involves assessing the adequacy and potential of vehicular or passenger traffic passing a site, the ability of the site to intercept traffic en route from one place to another, the nature of adjacent stores, type of goods sold, and adequacy of parking identified several criteria applicable to competent site selection, depending on the location’s ability to capitalise on the franchise trademark. Those criteria are demographics, accessibility, and market range, residential vs. commercial mix, visibility signage, longevity, direct and indirect competition, and tenant combinations. Factors to be considered in site analysis are zoning, area characteristics, physical characteristics, cost consideration, utilities, access, position of site, traffic information, availability of services, visibility, competition, market, and type of restaurant and service.

### 2.9 Hospital Urban/Rural location, Strategy, and Technology

There has been little research that develops models of the relationships between hospital location, strategy, S.M. Goldstein et al. / Journal of Operations Management 20 (2002) 63–75 65 operational decisions, and performance. In contrast, these variables have frequently been used in studies of manufacturing operations. For example, Swamidass and Newell (1987) use environmental uncertainty to predict elements of operations strategy which in turn are used to predict business performance. Similarly, Ward et al. (1995) show that environmental factors can be used to predict the operations strategy used by successful manufacturing firms.

They find that high and low performing firms use different strategies in the same environment, supporting their hypothesis that high performers develop strategies that are more responsive to environmental demands. Little work of this type has been done in the service sector. Many authors provide insight into the development of strategy in service organisations, but they do not address the links between environment and strategy or between strategy and operational decisions.

### 2.10 Hospital Urban and Rural Location

Location and proximity to markets are important factors for service organisations generally and hospitals in particular. Specifically, having an urban or rural location is an important environmental factor for hospitals. Hospitals in rural locations have struggled in recent years and their survival may depend on developing strategies that are appropriate for their location. Hospital location is important because the largest segment of a hospital’s market share comes from
an area of proximity to the hospital. Rural hospitals some times have no competition in their immediate region, so it is not clear that rural location by itself is an inherent disadvantage.

Although a majority of hospital closures in the past occurred in rural hospitals, rural hospitals have increasingly become targets for purchase by hospital chains because they are often inexpensive and have little competition in their immediate region, reducing certain types of risk to investors. The literature generally regards rural location as a disadvantage for hospitals but provides limited empirical evidence that this is true. The size of potential markets in rural areas may be an impediment because some hospitals are located near limited populations. It is also plausible that while market size may be adequate, lack of investment in medical technologies severely limits the services that are offered. This research investigates the dichotomy of urban and rural location in the context of strategy development and technology investments.

2.11 Hospital Strategy

In this study, we investigate how hospital management uses strategy to respond to the environmental factor of urban or rural location. While hospital strategies have been studied extensively, as reported in the literature, few studies address the linkage between environmental issues, such as location, and strategic decisions. In one such study, Lamont et al. (1993) evaluate the performance effects of hospital strategies in response to the environmental change in the health care industry introduced by Medicare’s prospective payment system (PPS) in the mid-1980s.

In contrast to the study reported here in which the environmental factor of hospital location is dichotomous (urban or rural), Lamont et al.’s environmental factor of the introduction of a PPS is the same for all of the studied hospitals. Their results indicate that hospitals with ‘proper’ fit between environment and strategy (the hypothesised ‘best’ strategy is Miles and Snow’s (1978) differentiator strategy) have the best performance. Financial and operations performance measures, including occupancy rate, are used to assess hospital strategy. Lamont et al. (1993) also found that hospitals can improve their performance by changing their strategy to achieve better fit with the environment. These results are important because they show that hospitals can use their strategies to respond to environmental conditions.

In the study reported here, we evaluate how hospitals use strategy to respond to their urban or rural location. Nath and Sudharshan (1994) addressed location relative to other hospitals as part of a hospital’s business strategy rather than an environmental factor. They use location relative to other hospitals as a proxy for convenience, as a source of competitive advantage, but do not consider the long-term nature of location decisions. In the study reported here, we consider location as an environmental variable that, once made, cannot be changed. Nath and Sudharshan identify five strategic groups based on business strategies and marketing, finance, human resources, and operations factors. While there are no significant differences in the performance of the five strategy groups, hospitals with “coherent” strategies have better performance, as measured by occupancy rate, than hospitals with incoherent strategies. Coherent strategies are defined as those with the most appropriate combinations (as defined by the authors’ industry experience) of the factors defining the groups. In determining how to measure and classify hospital strategies, it is important to note that hospitals often use multiple strategies simultaneously. This empirical finding suggests that hospitals’ behaviour deviates from the adoption of a single set of consistent activities that focus on a single strategy, as advocated in the management literature. Based on suggestions by Ashmos et al. and others on the use of multiple strategies, we seek to identify the most prevalent hospital strategies and how strongly hospitals pursue these strategies rather than to identify a single strategy for each study hospital. The hospital strategy data used in the study reported here are gathered using items similar to those used by Goes and Meyer (1990) who base their items on Miles and Snow’s (1978) strategic types and Porter’s (1980) generic strategies. Goes and Meyer (1990) report a longitudinal study showing that changes in hospital strategy tend to be infrequent, especially among high performers.

Hospitals with few strategy changes have better efficiency than those with many changes. Efficiency is operationalised using measures of occupancy rate, assets per patient day, and average length of stay, and occupancy rate shows the largest negative effect of frequent changes in strategy. There is little difference between the performance of hospitals with frequent and infrequent strategy changes in terms of profitability. While the literature provides several other strategy classification schemes, the current trends of hospital closures, mergers, and contracts with other health care...
providers make it difficult to study the implementation and performance of various strategies. The continual changes in environment and technology in this industry result in the development of new variations of existing strategies.

### 2.12 Hospital Technology

In this study, we identify management responses that urban and rural hospitals use to improve their performance in their given environment. One of these responses is investment in medical technologies. While it is unclear from the literature whether urban and rural hospitals have different reasons for investing in technology, it is clear that they use these investments to support their strategies.

For example, Hartley (1996) reports that rural hospitals purchase computerised tomography (CT) equipment because they believe that access to this medical technology improve either their economies of scale or economies of scope. There are many reasons that hospitals acquire medical technologies, including maximisation of profit, clinical excellence, and technological pre-eminence. Investing in technologies to increase clinical excellence means a hospital is focused on providing the medical services that require use of certain technologies. Technological preeminence means being the first to market with new technologies.

Morrisey (1994) finds that the best performing rural hospitals (based on eight financial, operational, and clinical performance measures) have capital asset investments 67% higher than the median investment for rural hospitals. Similar contrasts show the best performing small urban hospitals and major teaching hospitals have capital asset investments 66 and 53% higher than their groups’ medians, respectively. Morrisey does not evaluate whether higher investment in assets improves hospital performance or, conversely, hospitals which are better performers have more capital to invest.

However, capital asset investment is associated with not only financial performance measures (e.g. profitability), but also clinical (e.g. mortality rates) and operational (e.g. expenses per discharge) performance measures. This seems to indicate that asset acquisition is not merely driven by fi, but a success, but rather is associated with other types of performance that are important to hospitals. Research on non-profit Catholic hospitals report that these hospitals are falling behind on equipment and technology investments and show a significant correlation between investments in medical technology and net patient revenue.

However, net patient revenue may not adequately measure performance in these non-profit organisations. Finding S.M. Goldstein et al. Journal of Operations Management 20 (2002) 63–75 67 an appropriate performance measure in this industry which includes for-profit and non-profit organisations is a challenge for researchers. There is no evidence from the literature that for-profit and non-profit hospitals or urban and rural hospitals have different competitive reasons for acquiring medical technologies. In the study presented here, we measure the number of medical technologies used by each of the study hospitals. Decisions to invest in medical technologies are presumed to support these hospitals’ strategies.

### 2.13 Hospital Performance

Hospital performance can be difficult to assess because for-profit, non-profit, and government-owned organisations compete in this industry. Finding performance measures appropriate for all of these types of organisations is challenging. Occupancy rate is an industry-specific measure that has been used frequently in health care research as a indicator of performance.

Occupancy rate is the average utilisation rate of hospital beds, and previous research shows this measure is a significant indicator of hospital viability. Burda (1989) reports hospitals that close have an average occupancy rate of 27% versus 47% for hospitals that remain open. Lynch and Ozcan (1994) also found occupancy rate to be a significant predictor of hospital closure. Additionally, Nath and Sudharshan (1994) show that having a coherent strategy is correlated with higher occupancy, and Goes and Meyer (1990) show higher occupancy rates are associated with consistent strategies. For these reasons, we adopt occupancy rate as the primary performance measure for this study.
We validate our findings using an additional operational measure, efficiency (ratio of total expenses, adjusted for medical case mix and local wages, to total number of discharges, adjusted for numbers of inpatients and outpatients), and a financing measure, leverage (ratio of long-term debt to assets). Other hospital performance measures that have been used in the literature include clinical measures such as adjusted length of patient stay in the hospital and adjusted mortality rate and financial measures such as operating costs and operating margin.

In short, the literature identifies strategic groups in the hospital industry and begins to link strategies to decision-making and performance. More empirical evidence is needed to determine the environmental or organisational factors that prompt these strategies. In addition, the role of technology investments in strategic decision-making needs to be evaluated. Finally, assessment of strategies should be tied to hospital performance.

### 2.14 Hospital Layout and Design

Hospitals are the most complex of building types. Each hospital is comprised of a wide range of services and functional units. These include diagnostic and treatment functions, such as clinical laboratories, imaging, emergency rooms, and surgery; hospitality functions, such as food service and housekeeping; and the fundamental inpatient care or bed-related function. This diversity is reflected in the breadth and specificity of regulations, codes, and oversight that govern hospital construction and operations.

![Fig. 2.1 General hospital relationship](http://www.wbdg.org/design/hospital.php)

Each of the wide-ranging and constantly evolving functions of a hospital, including highly complicated mechanical, electrical, and telecommunications systems, requires specialised knowledge and expertise. No one person can reasonably have complete knowledge, which is why specialised consultants play an important role in hospital planning and design. The functional units within the hospital can have competing needs and priorities. Idealised scenarios and strongly-held individual preferences must be balanced against mandatory requirements, actual functional needs (internal traffic and relationship to other departments), and the financial status of the organisation. In addition to the wide range of services that must be accommodated, hospitals must serve and support many different users and stakeholders. Ideally, the design process incorporates direct input from the owner and from key hospital staff early on in the process. The designer also has to be an advocate for the patients, visitors, support staff, volunteers, and suppliers who do not generally have direct input into the design.

Good hospital design integrates functional requirements with the human needs of its varied users. The basic form of a hospital is, ideally, based on its functions:

- Bed-related inpatient functions
- Outpatient-related functions
- Diagnostic and treatment functions
- Administrative functions
• Service functions (food, supply)
• Research and teaching functions

Physical relationships between these functions determine the configuration of the hospital. Certain relationships between the various functions are required—as in the following flow diagrams.

![Flow diagram of hospital operations](http://www.wbdg.org/design/hospital.php)

Fig. 2.2 Major clinical relationship
(Source: http://www.wbdg.org/design/hospital.php)

These flow diagrams show the movement and communication of people, materials, and waste. Thus the physical configuration of a hospital and its transportation and logistic systems are inextricably intertwined. The transportation systems are influenced by the building configuration, and the configuration is heavily dependent on the transportation systems. The hospital configuration is also influenced by site restraints and opportunities, climate, surrounding facilities, budget, and available technology. New alternatives are generated by new medical needs and new technology. In a large hospital, the form of the typical nursing unit, since it may be repeated many times, is a principal element of the overall configuration. Nursing units today tend to be more compact shapes than the elongated rectangles of the past. Compact rectangles, modified triangles, or even circles have been used in an attempt to shorten the distance between the nurse station and the patient’s bed. The chosen solution is heavily dependent on program issues such as organisation of the nursing program, number of beds to a nursing unit, and number of beds to a patient room. (The trend, recently reinforced by HIPAA, is to all private rooms.)

2.15 Building Attributes

Regardless of their location, size, or budget, all hospitals should have certain common attributes. An efficient hospital layout should follow the points given below:

• Promote staff efficiency by minimising distance of necessary travel between frequently used spaces
• Allow easy visual supervision of patients by limited staff
• Include all needed spaces, but no redundant ones. This requires careful pre-design programming.
• Provide an efficient logistics system, which might include elevators, pneumatic tubes, box conveyors, manual or automated carts, and gravity or pneumatic chutes, for the efficient handling of food and clean supplies and the removal of waste, recyclables, and soiled material
• Make efficient use of space by locating support spaces so that they may be shared by adjacent functional areas, and by making prudent use of multi-purpose space
• Consolidate outpatient functions for more efficient operation—on first floor, if possible—for direct access by outpatients
• Group or combine functional areas with similar system requirements
• Provide optimal functional adjacencies, such as locating the surgical intensive care unit adjacent to the operating suite. These adjacencies should be based on a detailed functional program which describes the hospital’s intended operations from the standpoint of patients, staff, and supplies

2.16 Flexibility and Expandability for Hospital
Since medical needs and modes of treatment will continue to change, hospitals should:
Follow modular concepts of space planning and layout
• Use generic room sizes and plans as much as possible, rather than highly specific ones
• Be served by modular, easily accessed, and easily modified mechanical and electrical systems
• This system also uses walk-through interstitial space between occupied floors for mechanical, electrical, and plumbing distribution. For large projects, this provides continuing adaptability to changing programs and needs, with no first-cost premium, if properly planned, designed, and bid
• Be open-ended, with well planned directions for future expansion; for instance positioning “soft spaces” such as administrative departments, adjacent to “hard spaces” such as clinical laboratories

2.17 Therapeutic Environment of Hospital
Hospital patients are often fearful and confused and these feelings may impede recovery. Every effort should be made to make the hospital stay as unthreatening, comfortable, and stress-free as possible. The interior designer plays a major role in this effort to create a therapeutic environment. A hospital’s interior design should be based on a comprehensive understanding of the facility’s mission and its patient profile. The characteristics of the patient profile will determine the degree to which the interior design should address aging, loss of visual acuity, other physical and mental disabilities, and abusiveness. Some important aspects of creating a therapeutic interior are:
• Using familiar and culturally relevant materials wherever consistent with sanitation and other functional needs
• Using cheerful and varied colours and textures, keeping in mind that some colours are inappropriate and can interfere with provider assessments of patients’ pallor and skin tones, disorient older or impaired patients, or agitate patients and staff, particularly some psychiatric patients
• Admitting ample natural light wherever feasible and using colour-corrected lighting in interior spaces which closely approximates natural day light
• Providing views of the outdoors from every patient bed, and elsewhere wherever possible; photo murals of nature scenes are helpful where outdoor views are not available
• Designing a “way-finding” process into every project. Patients, visitors, and staff all need to know where they are, what their destination is, and how to get there and return. A patient’s sense of competence is encouraged by making spaces easy to find, identify, and use without asking for help. Building elements, colour, texture, and pattern should all give cues, as well as artwork and signage
2.18 Cleanliness and Sanitation for Hospital

Hospitals must be easy to clean and maintain. This is facilitated by:

- Appropriate, durable finishes for each functional space
- Careful detailing of such features as doorframes, casework, and finish transitions to avoid dirt-catching and hard-to-clean crevices and joints
- Adequate and appropriately located housekeeping spaces
- Special materials, finishes, and details for spaces which are to be kept sterile, such as integral cove base. The new antimicrobial surfaces might be considered for appropriate locations
- Incorporating O&M practices that stress indoor environmental quality (IEQ)

2.19 Accessibility in Hospital

All areas, both inside and out, should meet following guidelines:

- Comply with the minimum requirements of the Americans with Disability Act (ADA) and, if federally funded or owned, the GSA’s ABA Accessibility Standards
- In addition to meeting minimum requirements of ADA and/or GSA’s ABA Accessibility Standards, be designed so as to be easy to use by the many patients with temporary or permanent handicaps
- Ensuring grades are flat enough to allow easy movement and sidewalks and corridors are wide enough for two wheelchairs to pass easily
- Ensuring entrance areas are designed to accommodate patients with slower adaptation rates to dark and light; marking glass walls and doors to make their presence obvious

2.20 Controlled Circulation

A hospital is a complex system of interrelated functions requiring constant movement of people and goods. Much of this circulation should be controlled.

- Outpatients visiting diagnostic and treatment areas should not travel through inpatient functional areas nor encounter severely ill inpatients.
- Typical outpatient routes should be simple and clearly defined.
- Visitors should have a simple and direct route to each patient nursing unit without penetrating other functional areas.
- Separate patients and visitors from industrial/logistical areas or floors.
- Outflow of trash, recyclables, and soiled materials should be separated from movement of food and clean supplies, and both should be separated from routes of patients and visitors.
- Transfer of cadavers to and from the morgue should be out of the sight of patients and visitors.
- Dedicated service elevators for deliveries, food and building maintenance services.

2.21 Aesthetics for Hospitals

Aesthetics is closely related to creating a therapeutic environment (homelike, attractive.) It is important in enhancing the hospital’s public image and is thus an important marketing tool. A better environment also contributes to better staff morale and patient care. Aesthetic considerations include:

- Increased use of natural light, natural materials, and textures.
- Use of artwork.
- Attention to proportions, colour, scale, and detail
- Bright, open, generously-scaled public spaces.
- Homelike and intimate scale in patient rooms, day rooms, consultation rooms, and offices.
- Compatibility of exterior design with its physical surroundings.
2.22 Security and Safety of Hospital

In addition to the general safety concerns of all buildings, hospitals have several particular security concerns:

- Protection of hospital property and assets, including drugs.
- Protection of patients, including incapacitated patients, and staff.
- Safe control of violent or unstable patients.
- Vulnerability to damage from terrorism because of proximity to high-vulnerability targets, or because they may be highly visible public buildings with an important role in the public health system.

2.23 Emerging Issues in Hospitals Design

Among the many new developments and trends influencing hospital design are:

- The decreasing numbers of general practitioners along with the increased use of emergency facilities for primary care.
- The increasing introduction of highly sophisticated diagnostic and treatment technology.
- State laws requiring earthquake resistance, both in designing new buildings and retrofitting existing structures.
- Preventative care versus sickness care; designing hospitals as all-inclusive “wellness centers”.
- Use of hand-held computers and portable diagnostic equipment to allow more mobile, decentralised patient care, and a general shift to computerised patient information of all kinds. This might require computer alcoves and data ports in corridors outside patient bedrooms.
- Need to balance increasing attention to building security with openness to patients and visitors.
- Emergence of palliative care as a specialty in many major medical centers.
- A growing interest in more holistic, patient-centered treatment and environments such as promoted by plane tree. This might include providing mini-medical libraries and computer terminals so patients can research their conditions and treatments, and locating kitchens and dining areas on inpatient units so family members can prepare food for patients and families to eat together.

2.24 Relevant Codes and Standards for Layout of Hospitals

Hospitals are among the most regulated of all building types. Like other buildings, they must follow the local and/or state general building codes. However, federal facilities on federal property generally need not comply with state and local codes, but follow federal regulations. To be licensed by the state, design must comply with the individual state licensing regulations. Many states adopt the FGI Guidelines for Design and Construction of Hospitals and Health Care Facilities, listed below as a resource, and thus that volume often has regulatory status.

State and local building codes are based on the model International Building Code (IBC). Federal agencies are usually in compliance with the IBC except NFPA 101 (Life Safety Code), NFPA 70 (National Electric Code), and Architectural Barriers Act Accessibility Guidelines (ABAAG) or GSA’s ABA Accessibility Standards takes precedence.

Since hospitals treat patients who are reimbursed under Medicare, they must also meet federal standards, and to be accredited, they must meet standards of the Joint Commission on the Accreditation of Healthcare Organisations (JCAHO). Generally, the federal government and JCAHO refer to the National Fire Protection Association (NFPA) model fire codes, including Standards for Health Care Facilities (NFPA 99) and the Life Safety Code (NFPA 101).

The American with Disabilities Act (ADA) applies to all public facilities and greatly the building design with its general and specific accessibility requirements. The Architectural Barriers Act Accessibility Guidelines (ABAAAG) or GSA’s ABA Accessibility Standards apply to federal and federally funded facilities. The technical requirements do not differ greatly from the ADA requirements.
Summary

- The key to developing an effective operations strategy lies in understanding how to create or add value for customers. Specifically, value is added through the competitive priority or priorities that are selected to support a given strategy.

- Two major trends that have significantly impacted the role of operations strategy within an organisation are an increasing trend towards the globalisation of business and advances in technology, especially information technology.

- Globalisation provides new opportunities for companies in the form of new, previously untapped markets, for their products as well as new sources for raw materials and components at significantly lower costs.

- Skinner and others initially identified four basic competitive priorities. These were cost, quality, delivery, and flexibility.

- Within every industry, there is usually a segment of the market that buys strictly on the basis of low cost. To successfully compete in this niche, a firm must necessarily, therefore, be the low-cost producer.

- One advantage of offering higher-quality products is that they command higher prices in the marketplace. The goal in establishing the “proper level” of product quality is to focus on the requirements of the customer.

- The hospital industry is unique in that it includes for-profit, non-profit, and government-owned facilities, sometimes competing for the same patients.

- Empirical evidence suggests that some environmental dimensions normally considered in analysing organisations are not germane in analysing hospitals while others explain a great deal.

- The selection of a site involves both location and site selection, in other words, identifying the general area for the business and identifying a specific site within the area.

- A common approach to site evaluation is to first develop a checklist to ensure that all relevant factors are considered. Essentially, it involves an evaluation of various factors that are likely to impact upon sales and costs at a site. A judgment about the desirability of the site is made based on this evaluation.

- Hospital location is important because the largest segment of a hospital’s market share comes from an area of proximity to the hospital.

- Although a majority of hospital closures in the past occurred in rural hospitals (Cleverly, 1991), rural hospitals have increasingly become targets for purchase by hospital chains because they are often inexpensive and have little competition in their immediate region, reducing certain types of risk to investors (Campbell, 1997).

References


Recommended Reading

Self Assessment

1. What is the goal of a quality process?
   a. To make costlier product
   b. To produce error-free products
   c. To produce low cost product
   d. To focus on process

2. Which of the factors does not significantly affect the way in which business is being conducted?
   a. Connectivity
   b. Speed
   c. Intangibility
   d. Heterogeneity

3. Quality can be divided into which of the two categories?
   a. Product and process
   b. Superior and inferior
   c. Primary and secondary
   d. Cost and profit

4. A hospital’s interior design should be based on a comprehensive understanding of the facility’s mission and its__________ profile
   a. patient
   b. doctor
   c. director
   d. HOD

5. What is mass customisation?
   a. Every product is customised to meet the specific requirements of each individual customer.
   b. Every product is customised to meet the specific requirements of each producer.
   c. Every product is customised to meet the specific requirements of each competitor.
   d. Every product is customised to meet the specific requirements of each retailer.

6. ____________ is the percentage of revenue in the health care industry is self-funded by patients.
   a. 10
   b. 5
   c. 7
   d. 12

7. The basic form of a hospital is, ideally, not based on which of the functions?
   a. Bed-related inpatient functions
   b. Production-related functions
   c. Diagnostic and treatment functions
   d. Administrative functions
8. Which indicator is used for health care research to measure performance?
   a. Occupancy rate
   b. Periodic rate
   c. Patient turnover rate
   d. Mortality rate

9. Match the following.

<table>
<thead>
<tr>
<th>1. Mechanical and Electrical System</th>
<th>A. For mechanical, electrical, and plumbing distribution.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. soft spaces</td>
<td>B. Such as clinical laboratories</td>
</tr>
<tr>
<td>3. Interstitial space</td>
<td>C. Such as administrative departments.</td>
</tr>
</tbody>
</table>

a. 1-D, 2-C, 3-A, 4-B
b. 1-A, 2-B, 3-C, 4-D
c. 1-C, 2-B, 3-D, 4-A
d. 1-D, 2-C, 3-B, 4-A

10. Which of the following statements is false?
   a. A hospital has security concern for their patients.
   b. A hospital has security concern for their property and assets.
   c. A hospital has vulnerability to damage from terrorism.
   d. A hospital has security concern for, colour, scale of buildings interior.
Chapter III
Hospital Maintenance Management

Aim

The aim of this chapter is to:

- introduce the concept of maintenance management for hospital
- determine the unfunded maintenance backlog for the service
- monitor and document corrective actions and project expenditures, for hospital maintenance

Objectives

The objectives of this chapter are to:

- explain maintenance management system for hospital
- identify maintenance needs and deficiencies and capital improvement needs for hospital
- describe the various unfunded maintenance backlogs for hospital

Learning outcome

At the end of this chapter, you will be able to:

- understand hospital maintenance management
- identify the importance of maintenance management in hospitals
- describe the backlogs for maintenance services of hospital
3.1 Introduction

The performance of hospital buildings and their components depends to a large degree on continuous and planned periodical maintenance, which challenges owners and facility managers to institute precise planning based on a well-structured maintenance programme. Despite the ever-growing need for lower operational costs, facilities managers must ensure that facilities are constructed and maintained efficiently without compromising safety. The performance of hospital buildings depends to a large degree on the efficiency of maintenance execution. The research objectives were to examine the efficiency of maintenance under alternative maintenance policies and alternative sources of labour (outsourcing vs. in-house). The research focused on maintenance of hospital buildings as a model for multi-system buildings operating in dynamic environments. The research used a systematic field survey followed by an in-depth statistical analysis.

Four key performance indicators (KPIs) were developed. The first, the building performance indicator (BPI), indicates the physical-functional condition of buildings. The second, the manpower sources diagram (MSD), reflects the efficiency of using in-house labour vs. the outsourcing of labour. The third, the maintenance efficiency indicator (MEI), is based on the annual costs of maintenance, the building age coefficient and the building occupancy coefficient. This indicator reflects the efficiency of usage of the resources (labour, outsourcing, materials and spare parts) in maintenance. The fourth indicator deals with the organisational structure of the maintenance division. The proposed KPIs integrate four aspects of hospital facilities management: performance management, composition of labour, efficiency of maintenance operations and organisational effectiveness. Efficient execution of maintenance management of hospital buildings may be obtained by the simultaneous implementation of the aforementioned KPIs.

The proposed indicators may be adapted to other types of facilities, such as office buildings, industrial plants and infrastructure. Further more, decision-makers concerned with the maintenance of hospital buildings are frequently called upon to decide whether maintenance tasks are to be executed by permanent internal personnel (in-house provision) or by external contractors (outsourcing). This chapter describes a preliminary development of key performance indicators of performance and maintenance management for the examination of the efficiency of maintenance departments. We discuss the effectiveness of the proposed indicators for the management of large hospital facilities, and their potential implementation in other types of facilities.

3.2 Hospital Departments

Hospitals vary widely in the services they offer and therefore, in the departments they have Hospitals may have acute services such as an emergency department or specialist trauma centre, burn unit, surgery, or urgent care. These may then be backed up by more specialist units such as cardiology or coronary care unit, intensive care unit, neurology, cancer center, and obstetrics and gynaecology.

Some hospitals will also have outpatient departments and whilst others may have chronic treatment units such as behavioural health services, dentistry, dermatology, psychiatric ward, rehabilitation services (Rehab), and physical therapy. Common hospital support units include a dispensary or pharmacy, pathology, and radiology, and on the non-medical side, there often are medical records departments and/or a release of information department.

3.2.1 The Main, and Most Common, Hospital Departments

All the departments in Hospital are important. They have different functions and duties to perform. Some of the important departments and their duties are given below.

- Accident and emergency (A&E): also called Casualty Department, where you’re likely to be taken if you have arrived in an ambulance or emergency situation.
- Admissions: At the Admitting Department, the patient will be required to provide personal information and sign consent forms before being taken to the hospital unit or ward. If the individual is critically ill, then, this information is usually obtained from a family member.
- Anaesthetics: Doctors in this department give anaesthetic for operations and procedures. An anaesthetic is a drug or agent that produces a complete or partial loss of feeling. There are three kinds of anaesthetic: general, regional and local.
Breast screening: Screens women for breast cancer and is usually linked to the X-ray or radiology department.
Cardiology: Provides medical care to patients who have problems with their heart or circulation.
Critical care: Also called intensive care; this department is for seriously ill patients.
Diagnostic imaging: also known as X-Ray Department and/or Radiology Department.
Elderly services: Covers and assists with a wide range of issues associated with seniors.
Gastroenterology: This department investigates and treats digestive and upper and lower gastrointestinal diseases.
General services: Support Services include services provided by Departments such as Portering, Catering, Housekeeping, Security, Health and Safety, Switch, Laundry and the management of facilities such as parking, baby tagging, access control, CCTV etc.
Gynaecology: Investigates and treats problems relating to the female urinary tract and reproductive organs, such as endometritis, infertility and incontinence.
Haematology: These hospital services work with the laboratory. In addition doctors treat blood diseases and malignancies related to the blood.
Human resources: role is to provide a professional, efficient and customer focused service to managers and staff and in turn facilitates the delivery of a professional, efficient and customer focused service to patients.
Infection control: Primarily responsible for conducting surveillance of hospital-acquired infections and investigating and controlling outbreaks or infection clusters among patients and health care personnel. The department calculates rates of hospital-acquired infections, collates antibiotic susceptibility data, performs analysis of aggregated infection data and provides comparative data to national benchmarks over time.
Information management: Meaningful information can be used in quality management, continuous quality improvement and peer review. By improving the quality of information, core data can be provided for randomised clinical trials, outcomes research and many studies.
Maternity: wards provide antenatal care, delivery of babies and care during childbirth, and postnatal support.
Microbiology: The microbiology department provides an extensive clinical service, including mycology, parasitology, mycobacteriology, a high security pathology unit, and a healthcare associated infection investigation unit, as well as routine bacteriology and an expanding molecular diagnostic repertoire.

3.3 System Maintenance

The results obtained from the evaluation process help the organisation to determine whether its information systems are effective and efficient or otherwise. The process of monitoring, evaluating, and modifying of existing information systems to make required or desirable improvements may be termed as System Maintenance. System maintenance is an ongoing activity, which covers a wide variety of activities, including removing program and design errors, updating documentation and test data and updating user support. For the purpose of convenience, maintenance may be categorised into three classes, namely: Corrective, Adaptive and Perfective.

Corrective maintenance: This type of maintenance implies removing errors in a program which might have crept in the system due to faulty design or wrong assumptions. Thus, in corrective maintenance, processing or performance failures are repaired.

Adaptive maintenance: In adaptive maintenance, program functions are changed to enable the information system to satisfy the information needs of the user. This type of maintenance may become necessary because of organisational changes which may include:
- Change in the organisational procedures,
- Change in organisational objectives, goals, policies, etc
- Change in forms
- Change in information needs of managers,
- Change in system controls and security needs, etc
Perfective maintenance: Perfective maintenance means adding new programs or modifying the existing programs to enhance the performance of the information system. This type of maintenance undertaken to respond to user’s additional needs which may be due to the changes within or outside of the organisation. Outside changes are primarily environmental changes, which may in the absence of system maintenance; render the information system ineffective and inefficient. These environmental changes include: changes in governmental policies, laws, etc., economic and competitive conditions, and new technology.

3.4 Overview of Maintenance Management of Hospital

Maintenance has become a principal phase in the life cycle of built assets. The high performance of hospital buildings requires that maintenance considerations be taken into account at early stages of design. Maintenance management issues play a major role in the performance of constructed facilities Outsourcing of one or more maintenance services may entail various difficulties, such as various employee related issues, loss of skills, lack of internal expertise to manage outsourcing contracts, potential loss of control, etc. On the other hand, outsourcing may result in cost savings, improved quality, the transfer of knowledge from outside specialists to internal personnel, etc., Neely and Neathammer’s (1991) research focused on American defence facilities, subdividing them into 34 building types (hospital buildings being one of the 34 subcategories).

They found that the majority of the maintenance budget in hospitals was spent on interior finishing and interior construction (32%), and on heating, ventilation and air-conditioning (HVAC) (29%). The rest of the budget (39%) was spent on electricity (13%), exterior envelope (13%), water and plumbing (10%), and other electricity systems, such as communications and low-voltage systems (3%). One method used to assess the efficiency of maintenance proposes seven key performance indicators (KPIs) that provide benchmarks for the asset management (AM) of medical facilities. Most of these indicators deal with business and financial performance, and thus are applicable mainly to private-sector medical facilities.

These indicators neglect factors such as building performance, intensity of use, sources of personnel, etc. McDougall and Hinks (2000) recognised the fact that it is now generally acknowledged that the financial measures used in practice are inadequate for demonstrating the effectiveness of a workplace. This is the reason this chapter emphasised the functionality (performance) and cost effectiveness in the KPIs, compared with customer satisfaction, revenue/profit and business growth in the business KPIs. While developing the Property Standard Index (PSI), O’shea et al. (2000) specified the building’s age as one of the factors affecting performance.

They concluded with a recommendation to thoroughly investigate the effects of this factor. Barrett (1995) supports the evaluation of user-needs in order to attain better conditions for them. He suggests using a post-occupancy evaluation (POE) process as a management aid. Hospital Maintenance is responsible for the operation and maintenance of lighting, plumbing, electrical distribution, air conditioning/heating systems, and finishes of all Hospital buildings. The Hospital Maintenance Department is responsible for the following:

- operation and maintenance of lighting
- plumbing, electrical distribution
- air conditioning/heating systems
- finishes of all hospital buildings
- preventive maintenance program
3.5 Hospital Equipment Preventive Maintenance Manual

It provides hospital engineers and other health care professionals involved with the operation and maintenance of hospital physical plant equipment comprehensive, technical maintenance information. This material is useful for both the user and the hospital administration because it is prepared in a simple way. This generic approach in hospital equipment preventive maintenance is unique to preventive maintenance in medical facilities with this approach it is possible to assess different manufacturers’ systems and products, while emphasising general procedures for preventive maintenance. Of necessity, the material is technical in many categories for technically oriented hospital engineers, equipment users and maintenance personnel who must evaluate the performance capabilities of different systems and equipment against basic technical data and applications indigenous to the generic category. It allows users to compare systems and equipment against specifications.

3.6 Hospital Equipment Categories

Different hospital has different equipment categories. Some of the common types of equipments are given below.

- Automatic fire detectors and sprinkler systems
- Auxiliary power generators
- Ethylene oxide sterilizers and aerators
- Floor buffers
- Floor scrubbing machines
- Food cart
- Microwave ovens
- Vacuum cleaners
- Hot water generators
- Sanitizers and sterilizers
- Steam driven sterilizers
- Vacuum pumps and air compressors
- Wheelchairs
- Electric and mechanical beds
- Physical therapy equipment
- Respiratory therapy equipment

3.7 Provision for Maintenance in Hospital

The equipment management cycle: Maintenance of healthcare equipment is not just a question of repairing broken things. It is an integral part of managing the whole lifecycle of equipment: It can be seen that maintenance and repair is just one element. To make the whole cycle work properly, a number of different inputs are required. All groups of staff will have a role at some point: Management Policy makers Procurement Stores Portering Finance Clinical Technical Maintenance Administration Patients Suppliers The equipment user should be involved or consulted in each and every one of these stages. Medical Equipment Maintenance Manual First line maintenance for end users recommended resources The user should not be left on their own.

Once a piece of equipment is installed, commissioned and accepted and once the user has been fully trained in operation, they will need these resources to carry out the use and maintenance of the equipment well: Manuals in fluent language Operator manuals are essential and should be specified at time of purchase. It is often also possible to obtain service or technical manuals, which should be held by the maintenance department. Maintenance schedule of regular visits by qualified maintenance personnel will be needed. This might be managed by the maintenance department or senior hospital management. Whether the maintenance is in-house or outsourced, a system of reminders to prompt the work will be needed.
It is a well known fact that a good Hospital management System must result into cost cutting and efficient management and has to be very precise too. Moreover, it should provide relevant information across the hospital to support effective decision making for patient care, hospital administration and critical financial accounting, in a seamless flow. Furthermore, while going for a Hospital Management System, the technology used should be secure, interoperable, manageable, scalable and reliable. Therefore, it is very necessary to keep a balanced solution in mind.

![Hospital management system](http://www.otssolutions.com/hospital-management-software.html)

OTS provides end to end Hospital Management software Solutions for single and multispecialty hospitals, to cover a wide range of hospital administration and management processes. HMS solutions are designed and developed keeping in mind today’s complex processing requirements and stipulations.

We first understand your Healthcare Organisation’s process and legacy systems to suggest an ideal solution to our clients. We take special care while devising a HMS so that our clients get a reliable, scalable and the best throughput from the solution. Most importantly, our cost effective solution facilitates early return on investment (ROI), through integrating your different process, thus reducing processing time and manpower required for completing any task. This of course, makes our health care software solutions suitable for small organisations such as clinics to large organisations like corporate hospitals.

The user will need to be able to call on a repair team when things break. Smaller items of equipment will be serviceable by the hospital team, whereas large scanners etc will require specialist outside services. Contract Management The purchase contract should have details of what warranty services are available and contact details to call in these services. Either stores or administration should monitor performance against these contracts and plan for cover on expiry of any agreement. Consumables supply the needs for consumables should have been specified during the procurement process, so that necessary supplies are available from the start of equipment use. A schedule of restocking will need to be developed, so that there is never a gap in services.
Technical advice will be required to decide which spares should be stocked on site and which should only be purchased when needed. As a general rule, it is recommended to keep spares likely to be needed for two years of operation on site and to have these supplied with new equipment. As a guide to technical personnel requirements, the How to Manage Guide suggests the following number of posts:

- **100 BED HOSPITAL**
- **16 50 BED in HOSPITAL**
- Biomedical Engineer 1-5
- Biomedical Technician 2-5
- Assistant Technician / Artisan 3 2 1
- Medical Equipment Maintenance Manual First line maintenance for end users

### 3.8 Effective Maintenance Strategy

It is essential that we plan the resources required for maintenance. Planning will need to be made for both repair work and also for planned preventive maintenance. The following will also promote effective maintenance.

Types and approaches to Maintenance of Medical Equipment: There are two types of maintenance:

Corrective Maintenance (or Repair): This is done to take corrective action in the event of a breakdown of the equipment. The equipment is returned repaired and calibrated. Preventive Maintenance: This work is done in a planned way before repair is required and the scheduled time for the work circulated well in advance. It involves cleaning, regular function, safety tests and makes sure that any problems are picked up while they are still small. The choice of approach for preventive and corrective maintenance depends on the complexity of equipment. Maintenance by in-house trained technicians the majority of the problems are relatively simple and can be corrected by a trained technician. Vendors should provide training to in-house technicians at the time of installation and commissioning.

Maintenance by manufacturer or third party for specialised and advanced equipment, the vendor should provide maintenance services through a combination of on-call services and a maintenance contract negotiated at the time of the purchase. It will rarely be economical to provide this level of service in-house.

### 3.9 Levels of Maintenance

There are three levels of maintenance commonly identified:

**Level 1, User (or first-line):** The user or technician will clean the filters, check fuses, check power supplies etc. without opening the unit and without moving it away from the point of use. Level 2: It is recommended to call the local technician when first-line maintenance cannot rectify a fault or when a six monthly check is due.

**Level 3:** Specialised Equipment such as CT Scanners, MRIs etc. will need specialised engineers and technicians trained in this specific equipment. They are normally employed by third party or vendor companies. For maintenance of medical equipments it is necessary to follow the steps given below:

- Provide training to technicians and operators.
- Provide user/operating manuals to every employee of maintenance department
- provide service/maintenance manuals
- Incoming equipment should be carefully checked for possible shipment damages; compliance with specifications in the purchase order; and delivery of accessories, spare parts and operating and service manuals.
- Inventory documentation should be maintain in a proper format

A proper entry should be made in the inventory register. The inventory record should contain the serial number and date of receipt as well as date of completed inspection. Installation and final acceptance Installation should be done by the vendor and training should be provided at this stage to the user as well as to the maintenance technicians.
Equipment history record there should be an equipment history record sheet to track the performance of the equipment. This sheet should note down the date of installation and commissioning, preventive as well as corrective maintenance records. Maintenance Proper maintenance of medical equipment is essential to obtain sustained benefits and to preserve capital investment. Medical equipment must be maintained in working order and periodically calibrated for effectiveness and accuracy.

The life cycle of medical equipment will vary from 5-10 years. If the equipment is declared obsolete by the vendor it may not be possible to get spare parts. Even if the parts are available it can become too expensive to obtain them and the equipment is no longer economical to repair. Condemnation of equipment should be well planned and the necessary steps should be taken in advance to arrange replacement. Medical Equipment Maintenance Manual First line maintenance for end users

### 3.10 Planned Maintenance of Medical Equipment

Planned preventive maintenance is regular, repetitive work done at scheduled intervals to keep equipment in good working condition. The activities under preventive maintenance involve routine cleaning, calibrating and adjusting, checking for wear and tear and lubricating to optimise working efficiency and to avoid breakdown. Also consumables replacement like the fitting of new filters, etc., is done as part of this work. Effective planning for preventive maintenance involves proper selection of the equipment to be included in the plan. Decisions must be made on what to include in order reducing costs. Inexpensive units can be replaced or repaired if they break down, so need not always be included. The overriding consideration is cost effectiveness.

#### 3.10.1 Setting up a Complete System

When many items of equipment are under the care of a single biomedical department, it is better to keep the planned preventive maintenance computerised with a programmed schedule. This will require an equipment inventory all equipment in the hospital should be recorded on cards or in the computerised database. All relevant information about the equipment must be entered, including its location, records of repair and maintenance and manufacturer details. A reference number is written on each item. Definition of maintenance tasks these tasks can normally be established by consulting the manufacturer’s literature establishing intervals of maintenance the frequency of these tasks must be decided. A heavily used item must be cleaned and checked more frequently than one which is used less often; however, minimum standards must be set. The frequency suggested in the manufacturer’s manual can be used as a guide, but the amount of actual usage should determine the maintenance procedure required. A complete system for maintenance of a hospital requires:

- Personnel: The biomedical team will normally monitor the Preventive Maintenance Programme.
- Reminder system: It will be necessary to develop a reminder system, so that staffs are prompted to carry out tasks when they are due. A card index/calendar system or a computer programme can be used.
- Special test equipment: A biomedical team should have a range of test equipment to check the correct functioning of equipment and its compliance with electrical and other safety standards.
- Technical library: A full technical library should be available. Surveillance After the programme has been set up, periodic surveillance must be carried out to ensure that records are legible and that all entries are being made.
- Surveillance: After the programme has been set up, periodic surveillance must be carried out to ensure that records are legible and that all entries are being made.

### 3.11 Disposal of Equipment

Healthcare institutions must ensure that there are proper procedures in place for condemnation and disposal of equipment that is unserviceable or that is no longer required. This will take old and potentially unsafe equipment out of service, make sure hazardous materials are properly treated and make storage space available. Procedure for condemnation and disposal of medical and allied equipment is given below:

- Equipment may be declared surplus, obsolete or unserviceable if it is: Surplus to requirement where a surplus piece of equipment remains serviceable, management should be informed. It may be decided to store the equipment, auction it or use it elsewhere.
• Unserviceable or unreliable if equipment cannot be repaired (either no parts available or not economical to repair) or it cannot be maintained properly it should be scrapped and replaced.
• Obsolete when equipment is not usable because parts are out of date or the clinical technique is no longer recommended it should be scrapped.

### 3.12 User Responsibilities in Equipment Disposal

To ensure that equipment is disposed of in a timely and safe manner, users are advised to: Keep management informed of equipment status e.g. report when parts are replaced, report when equipment is unreliable. Be aware of hazards involved when equipment is disposed, for example, warn of the presence of mercury, asbestos, etc. Assist in planning for replacements, for example, comment on helpful or unhelpful features or suppliers. Keep the asset register up to date e.g. report when equipment arrives new or is replaced. Request regular maintenance work if it is delayed, for example, send reminders to service/maintenance group when work is due. Inform maintenance dept of any issue as soon as possible, for example, report promptly any work done or spares required. Medical Equipment Maintenance Manual First line maintenance for end users.

Damaged through negligence or abuse where abuse of equipment is suspected, this should be reported to management and the equipment taken out of use beyond its prescribed life period such equipment should be reported to management and the condemnation committee. They should take into account any period of storage in addition to use, examine the condition of the equipment to see whether the item could be put to further use and if not they will declaring the item obsolete/surplus or unserviceable as appropriate.

### 3.13 Basics of Electrical Safety

If it is misused or poorly maintained, electrical equipment can be the cause of injury, death or fire. If it is well maintained, electrical equipment can save lives, improve the quality of lives and reduce capital expenditure. Electrical equipment and the electrical connections that supply power to it should always therefore be treated with respect and care. Careful consideration should always be given to the placing of equipment. Damp conditions should be avoided and equipment should be positioned in a dry, clean, well ventilated area on a solid, level base. Equipment should be as near as possible to the electrical supply and extension leads should be discouraged. Since most problems in this area occur with the plugs, sockets and cables supplying electrical power, this chapter mainly focuses on safe use and maintenance of these.

#### 3.13.1 Socket Outlets and Plugs

A convenient and safe socket outlet should be available. Socket outlets should be at least 2 m from a sink or wash basin. The socket outlet should be adequate for the electrical capacity for the equipment. There should be proper grounding in the sockets. Plugs should match the socket outlets.

#### 3.13.2 Wiring of Sockets and Plugs

The wiring of a plug is colour coded to help guard against electrical accidents. The colour codes in India as per Indian Electricity Rules are as follows: Phase (or Live) Red, Blue or Yellow, this carries the electrical drive current from the supplier to the equipment. It is the most dangerous line. Only qualified staff should work with this.

#### 3.13.3 Neutral Black

This returns the current to the supplier. It should not be connected to Earth. This is used for safety and protection. If equipment is housed in a metal case, the earth line will generally be connected to the case. The earth line in a socket is connected to a pipe or plate buried in the ground.

#### 3.13.4 Notes on Earthing

The earthing will depend upon the type of equipment being used: If there are only two wires in the power cable, no earth connection is required. If the cable fitted has three conductors then equipment needs to be earthed properly. Always make sure that the earth wire is longer than the other two so that if the cable is accidentally pulled out of the plug, the earth wire is the last wire to become disconnected. Medical Equipment Maintenance Manual First line maintenance for end users.
3.13.5 Sizes and Types of Sockets and Plug

The current rating (i.e. the amount and size of equipment they can supply) is measured in Amperes, written A. The rating and size of normally found plugs and sockets are: For low power operations 5 Amperes small size For large power applications 15 Amperes large size Mains electricity comes at a specified voltage and is measured in Volts, written V. The voltage in India is 220-240 V for single phase and 440 V for three phase operations.

It also is delivered at a specific frequency, measured in Hertz, written Hz. Mains electricity in India is at 50 Hz. A variety of electrical plugs are found throughout India, so an adaptor plug set is recommended. Type D is most common, which is also known as the Old British Plug. It has three large round pins in a triangular configuration. Type D Plug and Socket Type C Plug and Socket. The type C European 2-pin plug and electrical outlet is also very popular connector for common medical equipment which does not require earthing. Popularly known as the Europlug, it is used throughout continental Europe, parts of the Middle East, much of Africa, South America, central Asia, and the former Soviet republics.

3.13.6 Mains Cables Electricity

It is carried to the equipment through the mains cable. Points to be aware of are: No bare metal or internal coloured wire should be visible the plastic insulation is there for safety Cable should not be repaired with insulating tape water can still get inside Long flexible leads are dangerous leads should be as short as possible The cable, plug and socket should never be allowed to get wet water can conduct electricity.

3.13.7 Fuses

Fuses are used as protection. If the current through them is greater than their specified rating, they blow. This breaks the circuit and stops the current, making the equipment safe. Points of safety regarding fuses are: Always use the correct rating of fuse voltage V (volts) and current A (amperes). Always use the correct size of fuse keep the old one to check against never replace the fuse with bare wire it will not be safe Circuit breakers are fuses that have buttons or switches for reset they do not normally need replacing Medical Equipment Maintenance Manual First line maintenance for end users

3.14 Troubleshooting Electrical Safety

Fault possible cause solution equipment is not running No power from mains socket, Electrical cable fault, internal problem Check power switch is on, Replace fuse with correct voltage and current rating if blown. Check mains power is present at socket using equipment known to be working. Contact electrician for rewiring if power not present. Try cable on another piece of equipment. Contact electrician for repair if required. Refer to biomedical technician

• Fuse or circuit breaker blows a second time after replacement Internal equipment fault Refer to electrician or biomedical technician
• Coloured or metal wire visible in cable, socket or plug Insulation damaged Remove item and refer to electrician for repair. DO NOT cover with tape.
• Cracks visible in socket or plug damaged cover Remove item and refer to electrician for repair. DO NOT cover with tape.
• Electrical shocks Wiring fault Refer to electrician

3.15 Electrical Safety Issues in Hospital

Medical equipment maintenance manual should be continuously upgraded for safety purpose.

• Weekly department checklist cleaning clean dust and liquid off with a dry cloth
• Remove tape, oil and dirt from all cables, plugs and sockets
• Visual checks Remove any cracked connectors or cables from service
• Check for and report any damaged room wiring or fittings
• Check for and report any signs of burning, melting or sparks
• Untangle all cables and store carefully
• Report any sockets that are loosely fitted or not working
• Check for and report broken fans or lights Example of simple Socket Tester to check an electrical socket
  Plug the Socket Tester into a live socket and switch the socket on.
• Indicator lamps across the front of the unit provide a clear indication of a correctly wired socket.
• Fault indications are quickly identified using the label.
• Line neutral reverse, No earth neutral fault, live earth reverse
Summary

- The performance of hospital buildings and their components depends to a large degree on continuous and planned periodical maintenance, which challenges owners and facility managers to institute precise planning based on a well-structured maintenance programme.

- Hospitals may have acute services such as an emergency department or specialist trauma centre, burn unit, surgery, or urgent care. These may then be backed up by more specialist units such as cardiology or coronary care unit, intensive care unit, neurology, cancer center, and obstetrics and gynaecology.

- System maintenance is an ongoing activity, which covers a wide variety of activities, including removing program and design errors, updating documentation and test data and updating user support.

- Maintenance management issues play a major role in the performance of constructed facilities. Outsourcing of one or more maintenance services may entail various difficulties, such as various employee related issues, loss of skills, lack of internal expertise to manage outsourcing contracts, potential loss of control, etc.

- Planned preventive maintenance is regular, repetitive work done at scheduled intervals to keep equipment in good working condition. The activities under preventive maintenance involve routine cleaning, calibrating and adjusting, checking for wear and tear and lubricating to optimise working efficiency and to avoid breakdown.

- Healthcare institutions must ensure that there are proper procedures in place for condemnation and disposal of equipment that is unserviceable or that is no longer required.

- Healthcare institutions must ensure that there are proper procedures in place for condemnation and disposal of equipment that is unserviceable or that is no longer required. This will take old and potentially unsafe equipment out of service, make sure hazardous materials are properly treated and make storage space available.

- A number of historical milestones have shaped operations management into what it is today. Some of the more significantly of these are the Industrial Revolution, scientific management, the human relations movement, management science, and the computer age.

- OM is a highly important function in today’s dynamic business environment. Among the trends that have had a significantly impact on business are just-in-time, total quality management, reengineering, flexibility, time-based competition, supply chain management, a global marketplace, and environmental issues.

- Operations managers need to work closely with all other business functions in a team format. Marketing needs to provide information about customer expectations. Finance needs to provide information about budget constraints. In turn, OM must communicate its needs and capabilities to the other functions.

References


- Hospital Management System, [Video Online] Available at: <https://www.youtube.com/watch?v=4qYAG6sMRaI> [Accessed 12 December 2012].

Recommended Reading

Self Assessment

1. Removing errors in a program which might have crept in the system due to faulty design or wrong assumptions is known as__________
   a. Adaptive maintenance
   b. Corrective maintenance.
   c. Preventive maintenance
   d. Absorptive maintenance

2. KPIs stand for__________
   a. Key performance indicator
   b. Knowledge process indicator
   c. Key performance indicator
   d. Key part indicator

3. Which of the following are not the four aspects of hospital facilities management (According to KPIs indicators.)?
   a. Performance management
   b. Composition of labour
   c. Efficiency of maintenance operations
   d. Organisational ineffectiveness

4. An integral part of managing the whole lifecycle of equipment is known as?
   a. Maintenance of healthcare equipment
   b. Maintenance of healthcare
   c. Maintenance of hospitals
   d. Maintenance of hospitals

5. While going for a Hospital Management System, the technology used should not be__________.
   a. insecure
   b. interoperable
   c. scalable
   d. reliable

6. The high performance of hospital buildings requires that maintenance considerations be taken into account at ____________ stages of design.
   a. primary
   b. secondary
   c. late
   d. early

7. What is the maintenance budget in hospital that is spent on interior finishing and interior construction?
   a. 35%.
   b. 65%.
   c. 32%.
   d. 50%.
8. What is the percentage of budget in hospital that is spent on electricity?
   a. 45
   b. 59
   c. 30
   d. 39

9. Match the following
   | 1. BPI      | A. Reflects the efficiency of using in-house labour vs. the outsourcing of labour. |
   | 2. MSD labour | B. Indicates the physical functional condition of buildings                |
   | 3. Fourth indicator | C. Indicates reflects the efficiency of usage of the resources.             |
   | 4. MEI      | D. Deals with the organisational structure of the maintenance division.     |
   a. 1-B, 2-A, 3-D, 4-C
   b. 1-A, 2-B, 3-C, 4-D
   c. 1-C, 2-B, 3-D, 4-A
   d. 1-D, 2-C, 3-B, 4-A

10. Which of the following statements is false?
   a. Perfective maintenance means adding new programs or modifying the existing programs to enhance the performance of the information system.
   b. Perfective maintenance undertaken to respond to user’s additional needs which may be due to the changes within or outside of the organisation.
   c. In system maintenance outside changes are primarily environmental changes, which may in the absence of system maintenance; render the information system ineffective and inefficient.
   d. In perfective maintenance program functions are changed to enable the information system to satisfy the information needs of the user.
Chapter IV
Meaning and Scope of Patient Care Services

Aim
The aim of this chapter is to:

• introduce the concept of patient care services for hospital
• determine the need of patient care service
• elucidate the scope of patient care services

Objectives
The objectives of this chapter are to:

• explain provision for patient care service
• define different types of patient care service for hospital
• explicate the emergency department of hospital

Learning outcome
At the end of this chapter, you will be able to:

• understand patient care services for hospital
• identify the importance of nursing in hospital
• describe best practises for patient care
4.1 Introduction

The hospital’s plan for providing patient care was developed by collaboration with organisational leaders and department directors. The organisation’s plan for providing patient care will be reviewed at least annually, and, as necessary, revised. Significant changes in patient care needs or the findings from performance improvement activities may necessitate review and revision of the plan. The plan will be integrated with the organisation’s budget process. Development of the plan involved consideration of the following:

- The units, areas, or departments of the organisation in which care is provided to patients
- The mechanism(s) used in each unit, area, or department to identify patient’s care needs
- The required number and mix of staff members in each unit, area, or department to provide for patient’s needs
- The process used for assisting and acting on positive and negative staffing variances; and
- The plan for improving the quality of care in the unit, area, or department.

The organisation’s plan for providing patient care will be reviewed at least annually, and, as necessary, revised. Significant changes in patient care needs or the findings from performance improvement activities may necessitate review and revision of the plan. The plan will be integrated with the organisation’s budget process. Health care (or healthcare) is the diagnosis, treatment, and prevention of disease, illness, injury, and other physical and mental impairments in humans. Health care is delivered by practitioners in medicine, chiropractic, dentistry, nursing, pharmacy, allied health, and other care providers. It refers to the work done in providing primary care, secondary care and tertiary care, as well as in public health.

Access to health care varies across countries, groups and individuals, largely influenced by social and economic conditions as well as the health policies in place. Countries and jurisdictions have different policies and plans in relation to the personal and population-based health care goals within their societies. Health care systems are organisations established to meet the health needs of target populations. Their exact configuration varies from country to country. In some countries and jurisdictions, health care planning is distributed among market participants, whereas in others planning is made more centrally among governments or other coordinating bodies. In all cases, according to the World Health Organisation (WHO), a well-functioning health care system requires a robust financing mechanism; a well-trained and adequately-paid workforce; reliable information on which to base decisions and policies; and well maintained facilities and logistics to deliver quality medicines and technologies. Health care can form a significant part of a country’s economy.

In 2008, the health care industry consumed an average of 9.0 percent of the gross domestic product (GDP) across the most developed OECD countries. The United States (16.0%), France (11.2%), and Switzerland (10.7%) were the top three spenders. Health care is conventionally regarded as an important determinant in promoting the general health and well-being of people around the world. An example of this is the worldwide eradication of smallpox in 1980—declared by the WHO as the first disease in human history to be completely eliminated by deliberate health care interventions.

4.2 Provision of Patient Care Services

Hospital is licensed for 247 beds. Planned services offered to the community include the following essential services.

- Anaesthesia Services
- Cardiac Rehabilitation Services
- Chaplaincy Services
- Chemotherapy Services
- Clinical Laboratory Services
- Dietary Services
- Emergency Care Services
- Heart Station Services (including echocardiography, EEG, and Holter monitoring)
- Haemodialysis Services
- Home Care Service
- Housekeeping and Linen Services
- Imaging Services
- Diagnostic Radiology
- Nuclear Medicine
- Magnetic Resonance Imaging (MRI)
- Mammography
- Computed Tomography (CT scanning)
- Ultrasound
- Lithotripsy
- Medical Services
- Neonatal and Pediatric Services
- Nursing Care
- Obstetrical/Gynaecological Services
- Personal Emergency Response Services
- Pharmaceutical Services
- Physical Rehabilitation Services
- Physical Therapy Services
- Occupational Therapy Services
- Speech Therapy Services
- Poison Information Services
- Primary Care Physician Office Services
- Radiation Oncology Services
- Respiratory Care Services
- Security Services
- Social Work Services
- Special Care Services
- Surgery

The above patient care services are provided directly or through referral, consultation, or contractual arrangements.

4.3 Hospital Departments: Scope of Services

The scope of services provided by each department is defined in writing. Each department’s scope of service statement is approved by leaders of hospital administration and/or the medical staff, as appropriate. Directors of departments have established written documents that reflect the goals of the patient services provided by their staff members. Policies and procedures have been established and implemented to meet the needs of the patients served. Department leaders have established and implemented orientation, training, and education activities for all staff members; based on an assessment of each individual’s learning needs. Competence assessment activities are implemented to determine the knowledge and skill levels of staff members providing care. Scope of service statements addresses the following:

- Any unique services offered
- Types and ages of patients served
4.3.1 Anaesthesia Services
Anaesthesia services are provided for both inpatient and outpatient services and for all age groups. Anaesthesia services are primarily provided in the surgical suite, labour and delivery care and in the intensive care/coronary care unit and radiology when invasive procedures and/or high-risk procedures such as bronchoscopy, cardioversions, and ERCPs are performed. Anaesthesia staff members also respond to codes and assist with intubation procedures, when needed. Other services include the assessment and treatment of patients referred for chronic pain management. Anaesthesia staff members include board-certified anaesthesiologists, certified nurse anaesthetists, a registered nurse, secretary, and an anaesthesia aide. Services should be provided 24 hours a day, 365 days a year.

Appropriate anaesthesia staff members perform preanesthesia evaluations, establish a plan for anaesthesia, administer anaesthesia; monitor the patient during the procedure as well as in the post procedure period.

4.3.2 Cardiac Catheterisation Laboratory
The cardiac catheterisation laboratory uses guidelines established by the American College of Cardiology and the American Heart Association. Services include the study of cardiac function and anatomy for the purposes of diagnosis and evaluation of patients as candidates for coronary artery bypass grafting (CABG), percutaneous transluminal coronary angioplasty (PTCA), and other nonsurgical catheter-based interventional treatment, as well as selection of devices for specific clinical problems in which pacing or defibrillation is indicated. These procedures are performed on adult and geriatric patients and include, but are not limited to:

- Left heart catheterisation
- Right heart catheterisation
- Intercoronary streptokinase infusion
- Vena cava filter placement
- Permanent and temporary pacemaker insertions
- Atrial overdrive pacing and cardioversion
- Aorta and left ventricular angiograms and
- Transesophageal echocardiograms

4.3.3 Cardiac Rehabilitation
Cardiac Rehabilitation services include exercise therapy, dietary consultation, psychological counselling, vocational rehabilitation counselling, and education. The population to be served includes patients recovering from angina, myocardial infarction, cardiac intervention, or those at high risk for heart disease. Participants in the Cardiac Rehabilitation Program must be referred by a physician and a physician’s order must be on file prior to participation. The Cardiac Rehabilitation staffs have monthly multidisciplinary meetings to discuss patient progress. The staffs also work closely with attending and referring physicians and other caregivers to provide the best possible care.

The Cardiac Rehabilitation services assist patients with cardiovascular disease in achieving and maintaining optimal health. The main goals include:

- Minimising the physical debility associated with cardiovascular diseases and subsequent prognosis for rehospitalisation.
- Decreasing the anxiety, fear, and depression associated with a myocardial infarction, cardiovascular surgery, or other cardiovascular intervention by a systematic progressive plan for return to productive living.
- A medically supervised and safe environment to ensure detection of problems and potential complications, and provide timely feedback to the referring physician in order to enhance effective medical management.
- Improve the cardiovascular system’s exercise tolerance through a carefully monitored and medically prescribed, progressive treatment program.
• Educate and assist the patient and family in understanding and accepting coronary disease, treatments, and etiology (i.e., risk factors); learning physical capabilities at various phases of the treatment program; knowing early warning signs and symptoms; developing confidence and learning skills for a successful return to the working environment and/or for activities of daily living.

4.3.4 Chaplaincy Services
The Chaplaincy Services offers spiritual care to all persons in the hospital regardless of their religious affiliation. The hospital chaplain is a full-time employee. Volunteer retired ministers also provide services. The scope of services offered includes:
• Response to staff referrals and patient requests for pastoral care
• Administration and coordination of the volunteer chaplaincy program
• Administration of and counselling for the employee assistance program
• Provision of Sunday worship services for patients, families, and staff
• Provision of Wednesday prayer services for patients, family and staff
• Facilitation of and participation in support groups for cancer, stroke, and HIV positive patients and/or family members; and
• Participation in discharge planning meetings for surgical, oncology, and cardiac patients.

4.3.5 Dietary Services
Nutritional and therapeutic services are provided to patients and employees ranging from newborns through children, adolescents, adults, and geriatric age group. Following are services provided:
• Floor Supply Schedule: The floors are supplied with adequate amounts of soda, crackers, peanut butter, juice, milk, and coffee. They are stocked by par levels established by nursing and dietary daily at lunch.
• Guest meals are served when ordered by nursing and usually are served with patient trays. Monitoring and improving, patients’ nutritional status through the use of screening criteria developed by dietary and implemented by nursing, pharmacy, dietary, and data processing improve the status while working with multidisciplinary teams.
• Provision of education to patients and/or their families in the purpose and practice of both normal and therapeutic nutrition.

Management for the dietary department includes two dieticians and two managers. Other staff members provide appropriate levels of staffing seven days a week during hours of operation to meet patient care needs. Dietary Services provide daily patient meal trays and nourishment along with a full spectrum of nutrition support, counselling, instruction, and consultation to patients and employees. These services are provided in cooperation with patients, families, physicians, pharmacists, social workers, nursing personnel, and other healthcare personnel. Screening criteria are used by patient care personnel and appropriate referrals are made to the dietician. A dietician participates in multi disciplinary rounds in the skilled nursing facility. A dietician also serves on the cancer committee, the pharmacy and therapeutics committee, and the quality coordinating council.

4.3.6 Imaging Services
Services provided by the department of imaging consist of diagnostic radiology, computed tomography, nuclear medicine, ultrasound, and magnetic resonance imaging. These services are provided for inpatients, outpatients, emergency room patients, and skilled nursing facility patients.
4.3.7 Emergency Department
The emergency/convenience health care center provides services whereby all ill or injured individuals who come to the hospital for emergency evaluation or initial treatment are assessed by qualified individuals and, as indicated, are either treated or referred to an appropriate organisation. The emergency department is a Level II emergency treatment facility which is open 24 hours a day, seven days a week. The emergency room is staffed with licensed physicians and registered nurses at all times. The department provide evaluation and treatment to patients of various ages and various levels of illness from minor to critical.

Emergency department patients are initially evaluated by the triage nurse who determines treatment urgency and placement within the emergency department. A complete assessment is performed by the assigned nurse and patient needs are identified. The emergency department physician or attending physician evaluates the patient and determines diagnostic testing and treatment required based on patient needs. Emergency patients are evaluated for response to treatment and are admitted to the hospital or discharged with follow-up instructions as appropriate.

4.6 Nursing
The nursing department’s plan for providing nursing care is designed to support improvement and innovation in nursing practice and is based on both the needs of the patients to be served and the hospital’s mission and vision. The plan contains the following six elements:

• The hospital’s definition of nursing care.
• The units, areas, or departments of the hospital in which nursing care, according to the hospital’s definition, is provided to patients.
• The mechanism(s) used in each unit, area, or department of the hospital to identify the nursing care needs of patients.
• The required number and mix of nursing staff members in each unit, area, or department to provide for the nursing care needs of patients.
• The process used for assessing and acting on staffing variances.
• The plan for assessing and improving the quality of nursing care in the unit, area, or department.

Registered nurses, by virtue of their license, hold professional accountability for the provision of nursing care to patients in the hospital. Job descriptions, privileges, contracts and policies and procedures provide written evidence that clearly identifies registered nurses’ responsibility and accountability for prescribing, delegating, and coordinating all nursing care as defined by, and provided throughout, the hospital. The nurse staffing plan for each unit, area, or department provides for a sufficient number of registered nurses to carry out at least the following three activities:

• Prescription of nursing care for patients based on:
  • assessment data and other relevant information
  • identified nursing diagnosis needs, or problems,
  • appropriate nursing interventions as specified in standards of nursing practice, policies and procedures, and/or established protocols, or as determined by the professional judgment of the registered nurse based on scientific knowledge, and
  • the patients’ response to nursing interventions.

• Delegation of nursing care activities to licensed practical nurses, nursing assistants and other appropriate nursing staff members, based on the registered nurse’s evaluation of the nursing staff members’ qualifications and competence to safely and effectively carry out the delegated responsibilities and to provide timely and adequate supervision, as required.
• Coordination of both the nursing care provided to patients and the nursing care provided in conjunction with therapies directed by other disciplines. This coordination involves establishing and maintaining communication mechanisms for the delivery of nursing care to each patient, assuring that nursing care interventions and activities are directed at the resolution of identified nursing diagnosis and/or patient problems or needs identified through the assessment process, and communicating with other clinical disciplines providing patient care.

Consistent standards for the provision of nursing care within the hospital are used to monitor and evaluate the quality of nursing care provided throughout the hospital. Patients that have the same nursing care needs are given a comparable level of nursing care throughout the hospital.

4.6.1 Definition of Nursing

Definition of nursing at the registered nurse level is the diagnosis and treatment of human response to actual or potential health problems through the utilisation of the nursing process by competent caregivers with the focus on patient-centred quality care under dynamic leadership. Our definition of nursing at the licensed practical nurse level is the giving of nursing care in accordance with the educational background, job description and policies and procedures of Your Hospital. The LPN works under the direction of the registered nurse and physician. Nursing practice at Your Hospital is also defined in accordance with the North Carolina State Board of Nursing Regulations and Standards as follows: “Nursing” is a dynamic discipline which includes the caring, counselling, teaching, referring and implementing of prescribed treatment in the prevention and management of illness, injury, disability or the achievement of a dignified death. It is ministering to, assisting, and sustained, vigilant, and continuous care of those acutely or chronically ill; supervising patients during convalescence and rehabilitation; the supportive and restorative care given to maintain the optimum health level of individuals and communities; the supervision, teaching and evaluation of those who perform or are preparing to perform these functions; and the administration of nursing programs and nursing services.”

4.7 Pharmacy

The pharmacy department provides pharmaceutical care to all patients and maintains correct and proper records in accordance with state and federal regulations. Pharmacy services are continually upgraded with emphasis on the rational, safe, and economic use of medications. The pharmacy department provides an appropriate supply of quality medications for all patients in an effective and efficient manner. Pharmacists assist in the education of patients, physicians, nurses, students, and other members of the health care team.

The pharmacy department is involved in the design, implementation, and oversight of medication use activities for all age groups of patients. The philosophy of pharmaceutical care centers on the concept that every aspect of pharmaceutical service has an impact on the outcome of all patients receiving medications. All aspects of this service impact patient care ranging from procurement, storage, control, compounding, dispensing, intervention, and quality measures to actual drug dosing and management. The following are included in the pharmacy scope of care/services:

• Dispensing drugs, intravenous solutions, and supplies
• Monitoring drug therapy (e.g., for drug interactions and contraindications)
• Providing drug information
• Generating medication administration records which are available to caregivers
• Monthly checks of emergency and stock drugs on patient units
• Pharmacokinetic services
• Adverse drug reaction monitoring
• Education of staff and patients as appropriate
• Skilled nursing facility drug regimen review
• Employee prescription service
• Admixing chemotherapy drugs for inpatients and outpatients
• Provision of admixture service
Drugs are dispensed to inpatients utilising a unit-dose system. The pharmacy is an integral part of the diabetes team and the community health programs. Staff members participate on the pharmacy and therapeutics, infection control, safety, and cancer committees. The provision of pharmaceutical care is a coordinated effort between the pharmacist, nurse, patient, physician, and other members of the health care team.

### 4.8 Radiation Oncology

The radiation therapy department provides radiation therapy services, available 24 hours a day to inpatients and outpatients. Patient services provided before, during, and after a course of radiation therapy include periodic physician evaluations, patient general health status monitoring through blood tests and measurements of body weight, routine checking of records, assessment of radiation exposure, side effects, and counselling patients on how to deal with cancer and/or side effects. Follow-up with the patient after therapy is individualised according to the plan of care.

### 4.9 Physical Therapy

Services include the evaluation, examination, and utilisation of exercises, rehabilitative procedures, massage, manipulations, and physical agents including, but not limited to, mechanical devises, heat, cold, air, light, water, electricity, and sound in the aid of diagnosis or treatment. Patients are referred to the physical therapy department by physicians. Primary groups seen include stroke, burns, decubitus ulcers, amputees, total joint replacements, musculoskeletal problems, and neuromuscular problems. Services are provided on both an inpatient and outpatient basis for patients throughout the life span.

### 4.10 Occupational Therapy

Occupational therapy services include the evaluation and treatment of disorders which limit purposeful functional activities such as grooming, dressing, and self-feeding, as well as perceptual and cognitive disorders interfering with thought processes to accomplish self-care tasks. Occupational therapy also evaluates for and fabricates splints and orthotic devices to prevent contractures and disabilities and to increase functional use of an extremity. Specific treatments may include: teaching of activities of daily living skills, developing perceptual motor skills, sensory training, selecting adaptive equipment to maximise independent function, coordination exercises, neuromuscular reeducation, and home assessment and recommendations for adaptations.

### 4.11 Speech and Language Pathology Services

Speech and language pathology services include the evaluation and treatment of language or aphasia disorders, cognitive dysfunction, voice disorders, dysphasia or swallowing disorders, and motor speech disorders. These services are provided for both inpatients and outpatients. Staffing includes one full-time speech language pathologist and PRN contract therapists as needed for high census demands. Upon physician referral for physical therapy, occupational therapy, and/or speech therapy services, inpatients are scheduled for therapy initiation via the hospital-wide order communications system. Outpatients can schedule services via telephone communication with the department secretary. A review of patients’ hospital chart and/or a verbal medical history will precede therapy treatments in an effort to ascertain the appropriateness, method, and plan of care. Rehabilitation services continuously collaborates with all appropriate healthcare professionals in maintaining an interdisciplinary approach to providing efficient, quality patient care.

### 4.12 Best Practices for Hospital for Patient Care

Hospitals can’t know where they want to go until they know where they are. They must have an ongoing, valid, and reliable system of measurement for determining how well they are satisfying their patients.
**Step one: Measurement**
The improvement process begins with a baseline of performance. The best managers know how to assimilate this baseline satisfaction measurement with other measurement systems. For instance, a best-practice emergency department director does not simply know that her patients are dissatisfied with waiting times. She also knows the current average wait times for various steps in the process at different times of day. Good lab managers know the average time it takes from the submission of an order to receipt of results by the ordering physician.

**Step two: Share Data**
It is not enough for the manager alone to be familiar with patient satisfaction results. All employees must know their current level of performance. One CEO that I met walked the halls of his hospital and asked the staff members how they were doing on patient satisfaction. The most frequent responses were “OK” or “I don’t know.” Managers must post patient satisfaction results for the entire staff to see and hold ongoing discussions on performance and expectations for improving scores.

**Step three: Prioritisation/Focus**
Hospital employees are busy. Nurses, for example, deal with increased patient volumes and staffing shortages at the same time. Developing 10 or 20 separate action plans for different areas of improvement is not feasible, so those areas must be prioritised and those that have the most impact must receive the lion’s share of focus.

**Step four: Action Plan**
Stepping on a scale every morning does not constitute a diet. The same goes for measuring patient satisfaction. One must measure and take action to achieve results. The actions taken to improve patient satisfaction must be specific, measurable, actionable, and timely. Simply saying “we will do a better job” is not enough. Staff members, as well as managers, should prioritise and develop action plans. Some behaviour that needs to be implemented may seem simple, such as asking patients if they need anything else before leaving the room. However, if such scripts, protocols, and procedures are imposed from above, rather than developed by staff members at the workgroup level, employees may be less likely to follow them.

**Step five: Implement**
Planning has no impact if it does not result in action. I once worked with a nursing manager with great action plans who complained that the plans were never successfully implemented. A quick review of the situation revealed the fatal flaw - the manager was responsible for implementing all the plans. Implementation is a task for the entire workgroup. If not everyone buys in and participates, the action plans are doomed to failure.

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Fig. 4.1 Best practises for hospitals to succeed
(Source: http://www.gallup.com/poll/12100/patient-satisfaction-only-seven-steps-away.aspx)
Step six: Stay the Course
Improvement that lasts for one week, one month, or even one quarter does not constitute true success. Success is long-term, sustainable improvement. Once they establish their priorities, workgroups need to maintain focus on them. A common factor in failures I have observed is tendency of workgroups to change priorities each time they receive new patient satisfaction results. Hence, no action plan is ever seen through to completion. Workgroups should pick their top priorities, maintain focus until they achieve success, and only then identify the next area for improvement.

Step seven: Measure and Adjust
How do workgroups know that they’ve succeeded? They must have specific, measurable objectives and ongoing measurement to determine if they are achieving these objectives over time. Continuous patient satisfaction measurement provides trended data showing change over time, which allows workgroups to modify their strategies as needed.

4.13 Support for Patient Care
A trusting relationship with patients and their families is built on open, honest communication. However, today’s health care environment makes good communication among patients, families, and caregivers harder and harder to achieve. Hospital stays are shorter, medical care is more technologically complex, resources are constrained, and there is a growing need for patients and families to have more information about, and involvement in, care decisions.

4.13.1 Human Resources
The Human Resources Department interacts with the patient care/services in the following manner:

- Works with departmental managers to help assure that adequate numbers of competent staff are available when and where needed
- Assures that employee performance is assessed on a regular basis
- Participates in the evaluation of recognition and reward mechanisms
- Consults with managers in the handling of unusual personnel issues; and
- Serves as a resource for managers and staff with pay and/or benefit questions.

4.13.2 Information Systems
Information Systems will assist patient care providers in the selection of software and related hardware that is to be used as a part of the patient care process. Information Systems will also provide or assist the patient care providers in arranging computer hardware and software support, and in maintaining properly functioning data communication systems. The department assists in planning for future applications and technologies that will enhance and significantly expand care providers’ use of these systems in order to improve efficiency of care provided.

4.13.3 Materials Management
The materials management department strives to meet the constant and ever changing demands for supplies and equipment in a cost effective and responsible manner. The functions covered under materials management include purchasing, inventory control, receiving, distribution, mail postage processing.

4.14 Medical Records
Requests by physicians for previous patient records are ordered via the computer by nursing personnel and the request is printed in the medical records department. Medical records personnel retrieve the medical record(s) requested, which are then picked up by patient care personnel, sent via messenger, or delivered by medical record personnel. The medical records department strives to provide both security of records and prompt access to them to enhance the quality of information available to patient care providers.
4.15 Patient Representative
A patient representative visits all patients admitted to the hospital and is available to respond to patients and/or family concerns. The representative provides feedback to appropriate caregivers and managers for the purpose of resolving problems and increasing customer satisfaction. A communications log is maintained. The patient representative also provides patients/families with information about advance directives and coordinates the hospital’s.

The department provides for the security and safety needs of all patients, visitors, and employees of your Hospital. The department’s mission is to protect and provide assistance for those involved in the process of receiving or providing care. Staffs are to notify security personnel of any persons or conditions that could pose a threat or hazard to any member of the staff, patients, or visitors. The staffs are composed of local off-duty law enforcement officers. Most of the time, day or night, two officers and a monitor watcher (civilian) are on duty; the rest of the time one officer and/or one monitor watcher are on duty.

4.16 Volunteer Services
The volunteer services department recruits, screens, interviews, orients, places, trains, monitors, and evaluates all volunteers and is administratively responsible for all volunteers. Ongoing and annual recognition of volunteers is coordinated by the department. Volunteer personnel files and service hour’s records are maintained by the department. The director of volunteer services handles volunteer personnel problems and provides counselling as needed.
Summary

- The organisation’s plan for providing patient care will be reviewed at least annually, and, as necessary, revised. Significant changes in patient care needs or the findings from performance improvement activities may necessitate review and revision of the plan.

- Health care systems are organisations established to meet the health needs of target populations. Their exact configuration varies from country to country.

- Anaesthesia services are primarily provided in the surgical suite, labour and delivery care and in the intensive care/coronary care unit and radiology.

- Nutritional and therapeutic services are provided to patients and employees ranging from newborns through children, adolescents, adults, and geriatric age group.

- The scope of services provided by each department is defined in writing. Each department’s scope of service statement is approved by leaders of hospital administration and/or the medical staff, as appropriate.

- Cardiac Rehabilitation services include exercise therapy, dietary consultation, psychological counselling, vocational rehabilitation counselling, and education. Cardiac Rehabilitation services assist patients with cardiovascular disease in achieving and maintaining optimal health.

- Registered nurses, by virtue of their license, hold professional accountability for the provision of nursing care to patients in the hospital.

- Definition of nursing at the registered nurse level is the diagnosis and treatment of human response to actual or potential health problems through the utilisation of the nursing process by competent caregivers with the focus on patient-centred quality care under dynamic leadership.

- A trusting relationship with patients and their families is built on open, honest communication. However, today’s health care environment makes good communication among patients, families, and caregivers harder and harder to achieve.

- Occupational therapy services include the evaluation and treatment of disorders which limit purposeful functional activities such as grooming, dressing, and self-feeding, as well as perceptual and cognitive disorders interfering with thought processes to accomplish self-care tasks.

- Speech and language pathology services include the evaluation and treatment of language or aphasia disorders, cognitive dysfunction, voice disorders, dysphasia or swallowing disorders, and motor speech disorders.

- The patient representative also provides patients/families with information about advance directives and coordinates the hospital’s

- The volunteer services department recruits, screens, interviews, orients, places, trains, monitors, and evaluates all volunteers and is administratively responsible for all volunteers. Ongoing and annual recognition of volunteers is coordinated by the department.

References


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- Patient Care Services, [Video Online] Available at: <http://www.youtube.com/watch?v=Ryu75NmXkF0> [Accessed 11 December 2012].

Recommended Reading

Self Assessment

1. The organisation’s plan for providing patient care will be reviewed at least__________.
   a. annually
   b. quarterly
   c. in two months
   d. daily

2. _____________ of departments have established written documents that reflect the goals of the patient services provided by their staff members.
   a. Director
   b. HOD
   c. Doctor
   d. Members

3. Which services include exercise therapy, dietary consultation, psychological counselling, vocational rehabilitation counselling, and education?
   a. Cardiac catheterisation
   b. Vardiac rehabilitation
   c. Anaesthesia
   d. Chaplaincy

4. The _____________ of volunteer services handles volunteer personnel problems and provides counselling as needed.
   a. manager
   b. employee
   c. director
   d. supervisor

5. Diagnostic radiology, computed tomography, nuclear medicine, ultrasound, and magnetic resonance imaging, comes under which services?
   a. Anaesthesia
   b. Nursing
   c. Chaplaincy
   d. Imaging

6. Which of the following is not a plan for nursing department?
   a. The mechanism used in each unit, area, or department of the hospital not to identify the nursing care needs of patients
   b. The required number and mix of nursing staff members in each unit, area, or department to provide for the nursing care needs of patients
   c. The process used for assessing and acting on staffing variances
   d. The plan for assessing and improving the quality of nursing care in the unit, area, or department.
7. The pharmacy department is involved in the design, implementation, and oversight of medication use activities for ___________age groups of patients.
   a. senior
   b. different
   c. adult
   d. younger

8. The radiation therapy department provides radiation therapy services, available __________ hours a day to inpatients and outpatients
   a. 6
   b. 12
   c. 18
   d. 24

9. Match the following

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>2. Physical Therapy</td>
<td>B. Available 24 hours a day to inpatients and outpatients</td>
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<tr>
<td>3. Occupational Therapy</td>
<td>C. Offers spiritual care to all persons in the hospital regardless of their religious affiliation.</td>
</tr>
<tr>
<td>4. Chaplaincy Therapy</td>
<td>D. Evaluation and treatment of disorders which limit purposeful functional activities such as grooming.</td>
</tr>
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   a. 1-B, 2-A, 3-D, 4-C
   b. 1-A, 2-B, 3-C, 4-D
   c. 1-C, 2-B, 3-D, 4-A
   d. 1-D, 2-C, 3-B, 4-A

10. Which of the following statements is false?
   a. Information systems will assist patient care providers in the selection of software and related hardware
   b. Information systems will also provide or assist the patient care providers in arranging computer hardware and software support.
   c. Information system department assists in planning for future applications and technologies that will enhance and significantly expand care providers’ use of these systems in order to improve efficiency of care provided.
   d. Information system department serves as a resource for managers and staff with pay and/or benefit questions.
Chapter V
Facility and Bio-Chemical Engineering in Hospital

Aim
The aim of this chapter is to:

- introduce the concept of hospital facility engineering
- illustrate how facility engineering affect hospital layout
- explain the concept of bio-chemical engineering in hospital

Objectives
The objectives of this chapter are to:

- elucidate the concept of quality of process for hospital
- explain the importance of layout of hospitals
- describe the role of biomedical engineering in a hospital

Learning outcome
At the end of this chapter, you will be able to:

- understand energy management policy
- identify the importance of facility engineering in hospitals
- describe biomedical engineering in a hospital
5.1 Introduction

Engineering Services are perhaps the most vital of the utility services in the hospital. The efficiency of entire patient care delivery system of the hospital depends on their efficiency. Even the slightest breakdown of power supply system, information system communication system or malfunctioning of vital equipment can have catastrophic effects. The scope of engineering services in a hospital comprises of civil assets, electricity supply, water supply including plumbing and fittings, steam supply, central medical gases, air and clinical vacuum delivery system, air conditioning and refrigeration, lifts and dumb waiters, public health services, lightening protection, structured cabling, communication system (public address system, telephones, paging system), TV and piped music system, non-conventional energy devices, horticulture, arboriculture and landscaping and last but not the least workshop facilities for repairs and maintenance.

The scope of services generally includes repair and maintenance of existing facilities to ensure optimum operational reliability, risk reduction and their safety for the patient, staff and public. Initial planning and building the civil assets is too included in the scope of services. Some of the functions of engineering services are:

- Planning and implementation of a program of planned preventive maintenance in t/o all the facilities/services under their responsibility.
- Ensuring that all the facilities, systems and services under the scope of engineering services are well maintained and kept in a state of optimum operational efficiency.
- Maintaining an up-to-date inventory of all the equipment available and their distribution on the hospital.
- Maintaining an up-to-date history sheet for each and every/equipment unit in the hospital.
- Anticipating the requirement of commonly required spares and arranging for their adequate stocking.
- Ensuring that break down maintenance is prompt enough to ensure uninterrupted services. This, however, does not include sophisticated electronic equipment that should be better handled under the arrangement by suppliers.
- Ensuring that the facilities services coming under their scope are safe and hazard free.
- Hospital engineering service ensures that the facilities/services under their scope are in compliance with the relevant legal provisions.
- Ensuring that the facilities/services provided under their scope of responsibility are conductive to efficient and high quality patient care.
- Ensuring timely action for renewal of maintenance contracts insurance cover of the facilities/equipment under their purview.
- Ensuring that the services under their scope are provided at the minimum possible operating costs.
- Playing an active role in successful planning and implementation of the equipment audit program.
- Advising the management about the most cost-effective ways of managing the facilities/services under their purview (saving of energy water, purchase of equipment with low life cycle cost and high efficiency).
- A program of continuous training of staff. Planning and implementing a program of quality management of engineering services department.

5.2 Assurance of Quality of Engineering Services

Engineering service is one single department on which depends the efficiency of each and every department and each and every member of the hospital staff. Even though it is a department that generally does not come in the lime light for any credits, in view of its crucial role it would be more appropriate to call it an “Enabling Service”. This is the department that is responsible for soundness and integrity of the buildings, power and water supply, air conditioning, communication, transportation, functioning of all the equipment, and prevention of most of the hazards. Any break in any of the services may spell a disaster of some kind or the other.
The volume of workload, maintenance efficiency and hence the quality of services of the engineering department depends a lot on the quality of infrastructure (buildings, equipments, cabling wiring, switches and sockets, MCBs, etc.) Installed and to be maintained. A lot of hazards and maintenance load can be reduced by proper planning of facility, fitments, fixtures in the initial stages and installation of equipments as per accepted norms, rules and regulations. If the infrastructure is of poor quality, the hazards, breakdowns and the repair liability would be far more than in case of high quality infrastructure.

### 5.3 Quality of Outcome

Let us think of the quality of engineering services in terms of their outcome and ability to satisfy the expectations of clientele, both internal (doctors/nurses/technicians/management) and external (the patients/their relatives as well as the regulatory authorities)

**Expectations of the patients**

There is a regular and uninterrupted power / water supply, the communication system and a comfortable environment (lighting, ventilation, humidity, and noise and odour level). Failure of these services is not the cause of any untoward effect, on their treatment chances of recovery. The service should be able to provide to them an atmosphere like their home atmosphere.

**Expectations of the doctors/nurses/technicians**

The services optimise the comfort level of the patient. That the services are adequate enough to support the timely performance of the diagnostic/therapeutic procedures. The communication system is efficient and fully reliable. The services do not, in any way, adversely affect the treatment of their patients.

**Expectations of the management**

No complaints from the patients, staff or the regulatory authorities. Safety of patients, public and staff from all possible hazards related to the facility management. There should be minimum possible cost for maintaining the facilities/equipment under the charge of the department.

**Expectations of the regulatory authorities**

There should be absolute compliance of all legal provisions and no incidence of violations of the laws. Complete safety of the patients, relatives, public and the staff. No complaints from the public about environmental nuisance. Since the quality of Outcome is supposed to be dependent upon the quality of infrastructure and processes in use, let us discuss those aspects.

### 5.4 Location, Space, Layout for Engineering Department in Hospital

The engineering department should be located at the rear of the building on the ground floor where all engineering services are clubbed together. It should have space for office, space for storage of spare parts, workshop areas for electrical, mechanical, plumbing repairs and maintenance. There should be a separate space for the biomedical electronic engineering section with a dust proof enclosure.

#### 5.4.1 Quality of Manpower

The department should be headed by a senior and well qualified electrical engineer with exposure to air conditioning, refrigeration, communication technology and some idea of mechanical/biomedical equipment besides, of course, the knowledge of civil works. He should be answerable directly to the medical superintendent. Adequate supervisory and other staff in all branches, including the civil, mechanical, electrical and plumbing section, should be available to attend to problems round the clock. Bio-medical Engineering section should have a qualified and experienced bio-medical engineer (diploma in biomedical engineering) as well as a technician to attend to the minor day-to-day problems and ensure maintenance of all the equipment, in house, as well as through annual maintenance contracts.

#### 5.4.2 Quality of Equipment

The department should have all the tools/equipment necessary for monitoring, maintenance and repair of all the services facility under their responsibility. Computer terminals should be provided on an as required basis for
efficient maintenance of records. Also, it is important that the equipment installed in the hospital is of high quality and low on maintenance. Maintenance of costly electronic equipment should be entrusted to the suppliers / their authorised agents under the maintenance contract. Of particular importance is the quality of cabling and provision of adequate number of sockets at every user point as per the requirement so as to avoid misuse overloading which can be quite hazardous.

5.4.3 Quality and Availability of Materials and Spare Parts
Often the delay in repairing/restoring the equipment is due to delay in purchasing spare parts. This delay can be eliminated by carefully planning and maintaining the inventory of spares. Whenever equipment is purchased, a list of commonly required spares should be prepared in consultation with the supplier and the spares should be added to the inventory. However, the quality of spares purchased must be ensured and a periodic check and updating of the inventory must be carried out.

5.5 Quality of Process for Hospital
Quality of process should be such as would ensure the following:

- Availability of a documented manual for quality assurance of engineering services with clearly defined role and scope of services and the policies procedures covering every aspect of their activities.
- A procedure for detection/reporting of defects and their repair maintenance with the minimum possible downtime.
- A documented system of planned preventive maintenance (and breakdown repairs) in r/o all civil assets as well as equipment installed.
- There is a documented check list of all the legal compliances and a mechanism for ensuring regular updating of licenses / registrations/certifications.
- There is a procedure for ensuring implementation of all legal provisions and the responsibility in each provision is clearly documented and known to all concerned.
- The organisation has a comprehensive equipment management program and a system of equipment audit and the engineering staff are involved in the program. The records of proceedings including the audit points and corrective actions are maintained.
- There is a documented, updated inventory of all the equipment available in the hospital and a comprehensive history sheet in respect of each and every equipment unit.
- There is a laid down policy about storing spare parts and the same is being implemented.
- There is a documented operational and maintenance plan for ensuring safety of environment and facilities for the patients, staff and public.
- A standardised system and format for registering complaints giving the detail of:
  - Ward/department
  - Detail of equipment
  - Detail of defects
  - Urgency involved (routine/urgent/immediate)
  - Date and time of complaint
  - Authentication by the complainant.
- The responsibility for maintenance has been specified in writing, the responsible staff are fully aware of their responsibility and the maintenance staff are available for emergency repairs, round the clock. A record of breakdown complaints and the response time for attending to complaints (restoration of operational status) is maintained and monitored.
- There is a procedure for periodic inspection and calibration of the equipment by the authorised agencies.
- There is a procedure for ensuring potable water supply round the clock with adequate reserve (three days requirement) or an alternate source identified and regularly tested for quality of water.
• Planned periodic cleaning of ac ducting and filters and inspection change of hepa filters wherever provided.
• There is a check list of actions to be taken by the departmental staff during fire other emergencies. It is ensured that up to date floor plans along with the escape routes are available, the escape routes are kept free of any obstacles and there is a documented plan for safe escape of patients public and staff during fire or other emergencies.
• The engineering service is represented in the hospital safety committee which regularly inspects the facilities at least twice a year. The reports of safety committee are documented, the corrective measures implemented and a record is maintained.
• There is a system of planned preventive (and breakdown) maintenance of centralised gas and vacuum supply to ensure uninterrupted and optimum service.
• There is a system of periodic inspection and planned preventive (and breakdown) maintenance of all fire safety equipment to ensure its optimum operational status.
• Identification and documentation of all possible hazards and the plan for prevention, monitoring and combating the hazards.
• There is a documented system of periodic inspection and planned preventive (and breakdown) maintenance and risk reduction in respect of each of the following services.
  • Building and environment for loose stones/plaster/slates, bricks.
  • Electric supply and distribution system including the diesel generator (dg) sets, ups systems and stabilisers. No loose hanging wires or temporary connections are allowed.
  • Water supply and distribution system including the supply of hot, cold, potable, ultra pure water and stream supply. There are no dripping taps, leaking pipes or blocked sewage lines.
  • Air conditioning and refrigeration facilities
  • Centralised gas and vacuum supply service
  • Communication system
  • Traction/transportation system
  • Lightening protection-periodic testing of patency of earthing.
  • Public health engineering system (waste storage/disposal, effluent treatment plant)
  • All electric equipments and their proper earthing.
  • All switches and sockets to ensure their adequacy and hazard free functioning.
• There is a documented program for continuous, on-job as well as formal training of the staff and a record is maintained.
• A check list for ensuring renewal of insurance cover and / or maintenance contracts for the buildings equipment installed in the hospital.

5.6 Structural Survey of a Hospital

There is a documented operational and maintenance plan with up to date drawing With detail of site layout, floor plans and fire escape plans. There is internal and external Sign ousting in the organisation in a language understood by patient, families and community. Provision of space shall be accordance with the available literature on good practice. There are Designed individuals responsible for the maintenance of all the facilities. The organisation has provisions for safe water, electricity, medical gases and vacuum systems.
• Potable water and electricity round the clock
• Alternate sources in care of failure.
• Regularly tests the alternate sources
• Maintenance plan for piped medical gas, vacuum installation
• The organisation has plans for fire and non fire emergencies within the Facilities:-
• Mock drills are held at least twice in a year.
• Staffs are trained for their role in case of such emergencies.
• Documented safe exit plan in case of fire and non fire emergencies.
• The organisation has a smoking limitation policy:
  • Organisation defined and implements to reduce or eliminate smoking.
  • The policy has provisions for granting exceptions for patients and families to smoke.
• The organisation has a plan for management for hazardous material:
  • Hazardous materials are identified within the organisation.
  • There is a plan for managing spills of hazardous materials.
  • Staff is educated and trained for handling such materials.
• Hospital implements processes for sorting, labelling, handling, storage, transporting and disposal of hazardous material.

The organisation has systems in place to provide a safe secure environment. The hospital has a safety committee to identify the potential safety and security risks. Patient safety devices are installed across the organisation and inspected periodically. There is a safety education programme for all staff.

### 5.7 Energy Management Policy

Promote energy saving and conservation of resources by using non-conventional sources of energy. Following points are used for energy management:

- Comply with the energy legislation and other regulations
- Promote use of energy efficient alternatives
- Communicate energy management policy to all employees and encourage their involvement through training and participation
- Create awareness amongst all employees for innovate ideas towards conservation of energy

![Fig. 5.1 Building your energy management program](http://www1.eere.energy.gov/buildings/energysmarthospitals/m/energy_mp.html)
Building systems are interdependent; improving hospital building design and operation depends on the development and coordination of energy-efficiency technologies across every major building system. Hospitals can proactively manage energy use by developing a comprehensive energy management program. Whether building or retrofitting, once an energy management program is in place, information on energy use will:

- Generate savings from reduced utility costs that can be redirected to mission-critical needs. Provide indicators to perform predictive maintenance and reduce equipment downtime. Create a basis for budgeting for future energy-efficiency and renewable energy improvements. Promote an energy-efficiency mindset that will contribute to a more comfortable environment, promote faster healing, and increase staff satisfaction.

When building a new hospital or adding on to an existing facility, once construction is completed and occupancy of the new space begins, emphasis will shift to a key group: the Energy Management Program Team. This group, reflecting wide representation from across the hospital (see Step 3 below), will be charged with primary responsibility for the long-term success of all energy-efficiency planning and operations.

In the case of retrofits, energy-efficiency upgrades considered together in sequence will ensure building systems are right-sized and optimally used, and will avoid wasted improvement efforts and unnecessary expenses.

### 5.7.1 Getting Started: Step-by-Step

**Step 1:** Create Awareness of the Opportunity: Make the commitment to energy efficiency known to staff and provide visible leadership support.

**Step 2:** Perform Baseline Mapping: Consolidate energy use data and cost figures from throughout the hospital system into a broad and integrated hospital energy map.

**Step 3:** Develop a Compelling Vision: Organise your Energy Management Program Team with wide representation from across the hospital (finance, maintenance and facilities, purchasing, quality assurance, government relations, clinical operations, medical personnel). Charge the committee with developing a strategic plan and setting goals in alignment with your hospital’s mission. Include retrofitting, new construction, and operation of existing facilities in scope. Incorporate relevant existing initiatives within the hospital system.

**Step 4:** Turn the Vision into Action: Establish metrics and implement a comprehensive “whole building” energy management program, addressing all building systems. Track, evaluate, and continue mapping and upgrading. To make an effort to reduce the cost continuously every year by adopting an effective energy for detailed engineering services focused should be on:

### 5.8 General Remarks and Recommendations for Hospital

General cleanliness and maintenance of all the buildings and surrounding structures needs to be scheduled and carried out. These shall include checking and correcting water spillages, seepages, provision of concealed wiring, Concealed water pipes and covered drains, giving clean and aesthetic looks to walls, ceilings, doors and windows by way of painting and polishing, upkeep and maintenance of faulty taps and sanitary appliances for proper functioning, cleaning and repairs replacement of window pans on regular basis, and proper repair of technical fitments and appliances. All clinical areas along with supportive services shall be interconnected through covered corridors. All isolated blocks used by patients need to be connected with min hospital building through all weather proof covered links. Dietary and Laundry services if so desired need to be re planned with requisite functional elements and flow. Proper covered food trolleys need be procured for transporting cooked meals to patient dining areas Toilet facility for inpatients, outpatients, staff and visitors attendants need to be re planned and provided at appropriate locations and their upkeep and maintenance shall be accorded priority.
Nursing units in all areas which are planned to be renovated shall be provided with safe environment, positive and negative isolation rooms. Placement of beds in the ward shall be of rig pattern i.e., beds arranged parallel to windows for affording better view to patients. All beds shall be provided with convenience electrical outlets, nurse call system. Provision of telephone facility in the nursing unit and TV facility on common basis to patients in a ward be considered. The Surgical suites, delivery suites needs to be re planned with due consideration of four well defined zones of varying degree of cleanliness. They are sterile, clean, protective and disposal zones.

Surgical suites shall be grouped between 8-10 OTs in one location for easy control and operational efficiency. Some of the OTs may be planned with individual AHU, HEPA filter and Laminar flow. The requirement of OT planning and internal facility to be provided in each OT was explained to the surgeon, nursing staff Material units available may be provided, so as to provide seamless interior. In the Imaging suites Radiology department, there is a need to create change rooms for male and female patients going in for plain X-ray. This will curtail the service time for X-ray as more than double number of patients can be imaged. It is advisable to locate the dark room automatic processor for easy access from all X-ray rooms.

It is further recommended that before planning a specialised facility the concerned planner shall visit better similar facility area in the region. Technical inputs (medical) shall also be provided by top medical management. For early implementation of proposals, PIU shall be so organised so that the procedural delays are curtailed. The Flooring, skirting and dado shall be provided as per the facility need. They shall be easily maintainable. The skirting and dado shall be kept flush with wall surface to avoid dust collection. At present the ambulances are parked near the entrance canopy near emergency. All ambulances need to be provided a covered parking bay with the emergency and ambulance control room. It shall have communication facility with the emergency and ambulance control room.

Medical store needs to be re planned with adequate space and ample shelving for storage of drugs and care needs to be taken to prevent dampness by proper maintenance. Locked areas for storage of high risk medicines with proper compliance need to be provided in the store, pharmacy dispensing unit and nursing stations. The present cold storage needs to be expanded for enhanced capacity. It is advisable to provide dedicated hospital engineering cells under the Medical Superintendents of Hospital Dean of Medical College. The engineering department [compact] shall comprise of civil engineer, electrical engineer, specialised hospital air-conditioning engineer, public health engineer and bio-medical engineer.

### 5.9 Important Points Related with Layout for Hospital

All patient care areas as well as staff areas need a proactive planned maintenance schedule and breakdown maintenance policy especially for electrical, sanitary and civil work. Provision of bilingual sign posting of all service, directions, instructions, study, and education material across the organisation shall be made. It is suggested that full and semi Fowler beds be provided in emergency area, ICUs, HDUs, Pre and post operative, observation areas and in some wards. Additional provision of wheeled beds need be considered in emergency, ICU, and post operative areas where the whole bed with patient and fitments can be moved rapidly to other areas by the management for certain valid reasons.

Provision of Crash Carts for CPR and other emergency managements is made across the whole of organisation. These may be controlled by the pharmacy services and cared for by the user units. The carts shall be kept sealed attending an emergency life threatening event and is meant for single use after which it is replenished and made ready for next patient. Water supply installations comprising of underground storage sumps, overhead storage tanks, and pump house shall be centrally grouped for easy control and maintainability. Stand by pump not available at present, shall be provided on urgent basis Total water requirement be assessed as per laid down norms. Water shall be checked and tested both at the source storage and point of consumption in respect of physical, chemical and biological tests as per laid down regulations. Electrical installations comprising of incomer, transformers, HT panel, LT panel, Generator sets, office and storage area shall provided and maintained as to have electricity round the clock. Total load of the hospital shall be assessed and shall match with transformer and generators provisions.
A well designed and excellently maintained stand by genet will take some time to come on load. In the present day situation of power supply which is full of aberrations, the UPS (uninterrupted power supply) system offers a viable solution. For such a health care institute, it is suggested to go in for the system as many sophisticated electronic equipments may need uninterrupted power. v. At present the Air-conditioning system is of split units, and window air conditioners. For such an establishment central Air-conditioning HVAC system is mandatorily required for surgical suites, Delivery suites, critical care units, imaging suites, laboratory services etc. Fire protection measures do not exist in this Hospital. This shall be planned in consultation with the local fire officer/authority. Horticulture and proper plantations need advance planning and execution.

### 5.10 Biomedical Engineering

Biomedical Engineering is the application of engineering principles and design concepts to medicine and biology. This field seeks to close the gap between engineering and medicine: It combines the design and problem solving skills of engineering with medical and biological sciences to advance healthcare treatment, including diagnosis, monitoring, treatment and therapy. Biomedical engineering has only recently emerged as its own discipline, compared to many other engineering fields. Such an evolution is common as a new field transitions from being an interdisciplinary specialisation among already-established fields, to being considered a field in itself. Much of the work in biomedical engineering consists of research and development, spanning a broad array of subfields. Prominent biomedical engineering applications include the development of biocompatible prostheses, various diagnostic and therapeutic medical devices ranging from clinical equipment to micro-implants, common imaging equipment such as MRIs and EEGs, regenerative tissue growth, pharmaceutical drugs and therapeutic biological.

### 5.11 Roles of a Biomedical Engineer in a Hospital

There are various roles a biomedical engineer has to perform. Some of them are given below:

- Advise and assist in the application of instrumentation in clinical environments.
- Provide leadership, guidance, support and supervision to the section staff and take responsibility in the day to day operation of the clinics.
- Evaluate the safety, efficiency, and effectiveness of biomedical equipment.
- Ensure that all medical equipment is properly maintained and documented.
- Provide engineering and technical expertise on all matters related to medical technology, especially in the process of planning, review, evaluation, and specification of medical equipment.
- Install, adjust, maintain, and/or repair biomedical equipment. Evaluate, negotiate and manage service contracts.
- Adapt or design computer hardware or software for medical science uses.
- Develop and provide a comprehensive in-service education program on the safe and effective use of medical equipment for both medical and nursing staff.
- Advise hospital administrators on the planning, acquisition, and use of medical equipment.
- Develop and implement short and long term strategies for the development and direction of the department to effectively manage medical equipment and technology in the clinics.
- Minimise, investigate and rectify hazard risks associated with medical equipment use.
- Perform other duties within the scope of the job and its technical capacity and expertise.

### 5.12 Bionics and Biomedical Engineer

Artificial body part replacement is just one of the things that bionics can do. Concerned with the intricate and thorough study of the properties and function of human body systems, bionics may be applied to solve some engineering problems. Careful study of the different function and processes of the eyes, ears, and other organs paved the way for improved cameras, television, radio transmitters and receivers, and many other useful tools. These developments have indeed made our lives better, but the best contribution that bionics has made is in the field of biomedical engineering.
Biomedical Engineering is the building of useful replacements for various parts of the human body. Modern hospitals now have available spare parts to replace a part of the body that is badly damaged by injury or disease. Biomedical engineers who work hand in hand with doctors build these artificial body parts. Biotechnology (see also relatedly bioengineering) can be a somewhat ambiguous term, sometimes loosely used interchangeably with BME in general; however, it more typically denotes specific products which use “biological systems, living organisms. Even some complex “medical devices” can reasonably be deemed “biotechnology” depending on the degree to which such elements are central to their principle of operation. Biologics/Biopharmaceuticals (for example, vaccines, stored blood product), genetic engineering, and various agricultural applications are some major classes of biotechnology. Pharmaceuticals are related to biotechnology in two indirect ways:

- Certain major types (for example, Biologics) fall under both categories, and
- Together they essentially comprise the “non-medical-device” set of BME applications. (The “Device - Bio/Chemical” spectrum is an imperfect dichotomy, but one regulators often use, at least as a starting point.)

5.13 Bio Medical Engineering-Support Services

The Role of Biomedical Engineering Department is not only multidimensional in its paramount importance from stand point of effective engineering support but also because of its direct bearing on the human being as it is linked with the most modern technological innovations related to the life saving diagnostic, curative and other healthcare branches. Biomedical discipline of engineering by the grace of God Almighty is commensurate with the high technology which has gone into most of the state of the art medical equipment.

The term management not only includes repair/maintenance of the biomedical equipment, but also reflects entire range of engineering support, which comprises of the following.

- Classification of specialties of medical equipment.
- Assessment/evaluation and recommendations for procurement of suitable equipment.
- Ensure periodic preventive maintenance (PPM) and calibration of equipment.
- Carry out life cycle cost evaluation of equipment.
- To develop and propose up-gradation/modernisation of engineering system from time to time to ensure minimum reliance upon foreign based repair organisations.
- Plan specialised equipment training to improve skill of staff and repair/maintenance techniques
- Arrange re-fresher training course for support personnel according to their levels of responsibilities.
- Propose specialised test equipment to support electro-medical engineering equipment.
- To assist in formulating workshop procedures in this discipline.
- Suggest standardisation of various types of equipment to reduce maintenance cost after the procurement.
- Suggest stocking of assemblies/sub assemblies of beyond economical repairs (BER) equipment subsequent use of spare parts for similar types of equipment.
- To determine / forecast future of technical stores.

5.14 Biomedical Engineering: Curing Life on Canvas of Engineering

Throughout the beginning of human history, engineering has driven the advancement in human civilisation. It has played a significant role for the development of our Civilisation. World is changing globally day by day and the modern era is having the applications of engineering in almost every field of medicine; so much so that the practice of medicine is now seems completely dependent on the work and support of engineers. ‘Yet 21st century has been labelled as the “Biological Century” with the anticipation of reflective implications to future technological breakthroughs both in the medical as well as industrial sectors. In particular, we are moving on the threshold of revolution in ‘biology and medicine’ with the completion of the sequencing of the human genome research to narrate sequence to expression and eventually to cell and organ function. These gigantic changes entail critical transformation for various segments of industry and for the profession of biomedical engineering.
Biomedical engineering is a new discipline of engineering which is curing health related life issues on canvas of engineering. It has been one of the fastest growing medical career fields in recent years. Biomedical engineering could be better defined as the application of the knowledge gained by a cross-fertilisation of engineering and the biological sciences so that both will be more utilised for the benefit of mankind. Biomedical Engineering with expertise in medicine, engineering and technology management playing a pivotal role in determining the potential for implementation and cost effectiveness of new medical technologies through technology assessment.

Biomedical Engineers use engineering principles to solve health related issues and medical problems. They develop techniques, materials, processes, and devices that help prevent or treat disease or rehabilitation of patients. They perform their duties in hospitals, universities, institutes, industry, and clinical research laboratories. They are responsible for the repair and maintenance of the hospital equipments; they investigate medical equipment failure, and advise hospitals about purchasing and installing of new equipments. While at hospitals they carry out safety checks and train practitioners to safely operate equipment.

Apart from that biomedical engineers are also engaged in biomedical research and in its applications for improving quality of life, and in implementing cost-effective solutions for delivery of health care. They perform a lot of research in conjunction with life scientists, technologists and chemists, medical and health care professionals to design medical devices like artificial limbs, hearts, pacemakers, ultrasound diagnostic equipments, dialysis machines, and surgical lasers. They conduct research on diverse biological processes and investigate new ways to modernise laboratory and clinical approaches.

According to the Biomedical Engineering Society (BMES), the areas of specialisation for biomedical engineers include biomaterials; bioinstrumentation; biomechanics; medical imaging; rehabilitation; and cellular, tissue, and genetic engineering. Biomedical engineers who specialise in biomaterials develop materials that can be safely implanted in the body. Engineers who pursue their career in biomechanics apply principles from physics to biological systems. They develop artificial organs, such as the artificial heart (pacemaker). Biomedical engineers who focus on bioinstrumentation utilise ICT applications or other electronic devices to diagnose or treat disease. A rehabilitation engineer helps to improve the quality of life for people with disabilities. Biomedical Engineers related with Tissue and cellular studies develop cells outside of the body to be implanted in the body and serve some function.

These are some evidences of biomedical engineering which can be found everywhere in modern medicine and complexities of human life. Hospitals are full of such equipments, devices, instruments and machines that have been designed and produced by biomedical engineers working in collaboration with health care professionals like doctors, nurses, biochemists, physicists, microbiologists, technologists and technicians. No any hospital can perform without having a biomedical engineering department, particularly hospitals which are into tertiary and secondary care. In a hospital or clinical area a biomedical engineer not only takes care of equipments and instruments being used there but also forms an integral part of the hospital’s management team.

In nutshell we must be aware that new trends in medical technologies are going to evolve in this century and that these technologies will be based on fundamental biological discoveries and engineering principles. It is clear that because of the projected increase in the health care sector there exists a tremendous potential in the health care sector, and there is a pressing requirement for biomedical engineers in near future. Hence there seems to be no edge to what engineering could achieve further to revolutionise medical practice. In fact, the next generation of biomedical engineers will probably develop things we can’t even yet imagine.
Summary

• Engineering services of a hospital are the key to conversion of all the inputs into a successful output.
• Quality assurance is outcome oriented and process driven. It is outcome, i.e. the patient improvement and satisfaction, which is the most important.
• Although some components like electric supply, communication and information technology (IT) are of crucial significance (without which patient care will come to a standstill), all components are important in the sense that any problem with any component is going to affect the outcome of patient care and satisfaction.
• For effective and optimum level of functioning, therefore, it is essential that the infrastructure be of high quality. Every hospital must have a proper well staffed and equipped department of engineering services and must implement the maintenance program in a well planned and efficient manner.
• Facility engineering is one department where one can say with certainty that a penny spent is worth a pound saved.
• Biomedical Engineering is the application of engineering principles and design concepts to medicine and biology.
• Prominent biomedical engineering applications include the development of biocompatible prostheses, various diagnostic and therapeutic medical devices ranging from clinical equipment to micro-implants, common imaging equipment such as MRIs and EEGs, regenerative tissue growth, pharmaceutical drugs and therapeutic biological.
• The Role of Biomedical Engineering Department is not only multidimensional in its paramount importance from stand point of effective engineering support but also because of its direct bearing on the human being as it is linked with the most modern technological innovations related to the life saving diagnostic, curative and other healthcare branches.
• Biomedical engineers use engineering principles to solve health related issues and medical problems. They develop techniques, materials, processes, and devices that help prevent or treat disease or rehabilitation of patients.
• According to the Biomedical Engineering Society (BMES), the areas of specialisation for biomedical engineers include biomaterials, bioinstrumentation, biomechanics, medical imaging, rehabilitation, and cellular, tissue, and genetic engineering.

References

• Biomedical Engineering, [Video Online] Available at: <http://www.youtube.com/watch?v=hV-Q4aDNaRo> [Accessed 11 December 2012].

Recommended Reading

Self Assessment

1. Engineering service is also known as ___________.
   a. enabling services
   b. facilities services
   c. construction services
   d. important services

2. Which of the following is not related with quality of process?
   a. It is a procedure for detection or reporting of defects and their repair maintenance with the minimum possible
downtime.
   b. There is a documented, updated inventory of all the equipment not available in the hospital and a
   comprehensive history sheet in respect of each and every equipment unit.
   c. There is a laid down policy about storing spare parts and the same is being implemented.
   d. There is a documented operational and maintenance plan for ensuring safety of environment and facilities
   for the patients, staff and public.

3. A standardised system and format for registering complaints do not give the detail of______________.
   a. Ward department
   b. Detail of defects
   c. Date and time of complain
   d. Doctors and nurses

4. A Mock drills in a hospital are held at least ____________ in a year.
   a. twice
   b. thrice
   c. one time
   d. six times

5. The hospital has a __________ committee to identify the potential safety and security risks.
   a. management
   b. board of directors
   c. safety
   d. doctors

6. Which of the following statements is false?
   a. Energy management comply with the energy legislation and other regulations.
   b. In energy management it is always good to promote use of energy inefficient alternatives
   c. Communication of energy management policy to all employees and encourage their involvement through
   training and participation
   d. Energy management programm create awareness amongst all employees for innovate ideas towards
   conservation of energy.
7. ______ night light fixture in each patient bed room is required.
   a. Ten
   b. Four
   c. One
   d. two

8. Each patient room have ______ grounded receptacles. One on each side of the head of each bed, one for
   TV, one on every other wall.
   a. triplex
   b. single
   c. multiple
   d. duplex

9. What is the meaning of rig pattern of bed?
   a. Beds arranged next to windows
   b. Beds arranged back to windows
   c. Beds arranged front to windows
   d. Beds arranged parallel to windows

10. Which of the following is not a role of bio-medical engineer?
    a. Advise and assist in the application of instrumentation in clinical environments.
    b. Provide leadership, guidance, support and supervision to the section staff and take responsibility in the day
to day operation of the clinics.
    c. Evaluate the safety, efficiency, and effectiveness of biomedical equipment.
    d. Examine the patient.
Chapter VI
Intensive or Critical Care Services

Aim
The aim of this chapter is to:

- introduce the concept of intensive or critical care services
- illustrate the importance of intensive care services
- identify the different ways in which these critical care services can provide a hospital with a competitive advantage

Objectives
The objectives of this chapter are to:

- describe ICU and its various components
- explain hospital resources for level I, II, and III critical care centres
- discuss three levels of hospital-based critical care centres to optimally match services and personnel with community needs

Learning outcome
At the end of this chapter, you will be able to:

- understand about coding requirement of hospital
- identify the importance of ICU policies and procedure
- recognise essential intensive care unit services and personnel for each critical care level
6.1 Introduction

Critical care is defined as the direct delivery by a physician(s) of medical care for a critically ill or critically injured patient. A critical illness or injury “acutely impairs one or more vital organ systems such that there is a high probability of imminent or life threatening deterioration in the patient’s condition”. Critical care services include the treatment of vital organ failure and/or the prevention of further life threatening deterioration in a patient’s condition. Delivering critical care in a moment of crisis, or upon being called to the patient’s bedside emergently, is not the only requirement for providing critical care service”. Treatment and management of a patient’s condition in the threat of imminent deterioration while not necessarily emergent, is also required. The presence of a patient in an ICU or CCU, or the patient’s use of a ventilator, is not sufficient to warrant billing critical care services. The service must be medically necessary and meet the definition of critical care. Medically reasonable and necessary services that do not meet all the criteria to report critical care should be reported with the appropriate evaluation and management code.

Critical Care Documentation: Full Attention of Physician Since critical care is a time-based service, the physician’s critical care note(s) must document the total time spent evaluating, managing and providing critical care services to a critically ill or injured patient. Critical care time may be continuous or intermittent in aggregated time increments. Time spent performing separately billable procedures/services cannot be used to support critical care time. The time spent providing critical care services must be spent at the immediate bedside or elsewhere on the floor or unit as long as the physician is immediately available to the patient. Therefore, the physician cannot provide services to any other patient during the same period of time.

Teaching Physician: In the teaching environment, the teaching physician must be present for the entire period of time for which the claim is submitted. Time spent teaching may not be counted towards critical care time. The teaching physician, in addition, cannot bill for time spent by the resident providing critical care services in their absence. Only time that the teaching physician spends with the patient, or that he/she and the resident spend together with the patient, can be counted toward critical care time.

6.2 Coding Requirements for Hospital

There are some requirements which should be full fill by every hospital. These requirements are:

- Only one physician may bill for critical care services during any one single period of time even if more than one physician is providing care to a critically ill/injured patient.
- Physicians assigned to a critical care unit (hospitalist/intensivist) may not report critical care based on a “per shift” basis.
- Services cannot be reported as a split/shared service when performed by a physician and a qualified npp of the same group practice.
- Physicians in the same group practice, with the same specialty, may not report to the same patient on the same calendar date.
- Concurrent care by more than one physician representative by different specialties is payable if the services meet critical care requirements, (i.e., must be medically necessary and non-duplicative.)
- Hospital emergency department services are not payable for the same date as critical care services when provided by the same physician or physicians of the same specialty.
- Critical care services will not be paid on the same calendar date that a physician reports an unbundled procedure with a global surgical period.

Intensive care units (ICUs) vary significantly from hospital to hospital with respect to structure, services provided, personnel and their level of expertise, and organisational characteristics. These variations are based on economic and political factors unique to each hospital’s internal dynamics and external environment. Accordingly, the characteristics of an ICU may depend on the population served; the services provided by the hospital the subspecialties of physicians on the hospital’s staff. In addition, a hospital may choose to segregate ICU patients into areas based on diagnosis, acuity of illness, prognosis, or age. Large medical centres frequently have multiple ICUs or critical care centres separated and defined by specialty or subspecialty practices.
Examples include cardiothoracic surgical ICUs, trauma ICUs, coronary care units, and neurologic/ neurosurgical ICUs. Small hospitals may have only one intensive care unit designed to care for a large variety of critically ill patients including adult and pediatric populations. The use of intermediate care or step-down units in some hospital settings may provide a more efficient distribution of resources for patients whose critical illness requires less use of monitoring equipment and staffing than a high-acuity ICU. Although the types and variety of ICUs may differ from hospital to hospital, all ICUs have the responsibility to provide services and personnel that ensure optimal care to critically ill patients. Recently, outside influence has been applied for hospitals to document their commitment to high-quality care.

This chapter describes the partitioning of critical care units or centres into levels determined by resources available to the hospital. It attempts to update similar guidelines written by the American College of Critical Care Medicine (ACCM) and published in Critical Care Medicine in 1999. An updated literature review and a consensus opinion of experts in the field of critical care medicine were used for this revision. Although some hospitals will be able to provide comprehensive care to a broad spectrum of patients and others to only limited populations of patients, the expectation is that care provided will be of high quality. It is also an expectation that hospitals within a region collaborate to avoid redundancy of highly specialised and costly services.

### 6.3 Definition of Levels of Care

It is recommended that all hospitals determine the level of critical care services offered in keeping with their mission and goals as well as regional needs for this service. Three levels of care are proposed to accommodate university medical centres, large community hospitals, and small hospitals with limited critical care capabilities.

**Level I:** These critical care centres have ICUs that provide comprehensive care for a wide range of disorders requiring intensive care. They require the continuous availability of sophisticated equipment, specialised nurses, and physicians with critical care training. Support services including pharmacy services, respiratory therapy, nutritional services, pastoral care, and social services are comprehensive. Although most of these centres fullfill an academic mission in a teaching hospital setting, some may be community hospital based.

**Level II:** These critical care centres have the capability to provide comprehensive critical care but may not have resources to care for specific patient populations (e.g., cardiothoracic surgery, neurosurgery, and trauma). Although these centres may be able to deliver a high quality of care to most critically ill patients, transfer agreements must be established in advance for patients with specific problems. The intensive care units in level II centres may or may not have an academic mission.

**Level III:** Hospitals that have level III capabilities have the ability to provide initial stabilisation of critically ill patients but are limited in the ability to provide comprehensive critical care. These hospitals require written policies addressing the transfer of critically ill patients to critical care centres that are capable of providing the comprehensive critical care required (level I or level II).

These facilities may continue to admit and care for a limited number of ICU patients for who care is routine and consistent with hospital and community resources. Cooperation between hospitals and professionals within a given region is essential to ensure that appropriate numbers of level I, II, and III units are designated. A duplication of services may lead to underutilisation of resources and underdevelopment of skills by clinical personnel, and it may be costly. State and federal governments should be encouraged to enforce the appropriate distribution of critical care services within a region and to participate in the development of referral and transfer policies. Standards for interfacility transfers have been delineated in a collaborative publication by the Society of Critical Care Medicine and the American Association of Critical Care Nurses. In these standards, reference is made to federal and local laws.

### 6.4 Hospital Resources for Level I, II, and III Critical Care Centres

Critical care services are generally delivered by teams of health care professionals from a range of medical and surgical specialties. These may require a stay in a hospital emergency department, ambulatory surgery center, urgent care centre or other short-term stay facility, along with the assistance of diagnostic services, surgery, or follow-up outpatient care in the community. Hospital-based acute in patient care typically has the goal of discharging patients
as soon as they are deemed healthy and stable. Critical care settings include but are not limited to: emergency department, intensive care, coronary care, cardiology, neonatal intensive care, and many general areas where the patient could become acutely unwell and require stabilisation and transfer to another higher dependency unit for further treatment.

6.4.1 Medical Staff Organisation

A distinct critical care organisational entity (department, division, section, or service) exists:

- Privileges (both cognitive and procedural) for physicians practicing critical care medicine are approved by the Medical Staff Credentials Committee based on previous training and experience as defined by the medical staff.
- A section of the medical staff bylaws delineates the regulations governing the granting of critical care privileges and monitoring the critical care activities of privileged staff.
- Budgetary activities relating to unit function, quality assurance, and utilisation review are conducted jointly by members of the medical, nursing, pharmacy, and administrative staff.
- A critical care representative serves on the Medical Staff Executive Committee.
- The critical care services for the center are led by a critical care physician who meets the definition of an intensivist and who has the appropriate time, expertise, and commitment to oversee the care of critically ill patients within the hospital.
- ICU patient management is directed by a staff level physician who fullfill all of the following:
  - It is privileged by the medical staff to have clinical management responsibility for critically ill patients.
  - Has board certification in critical care medicine
  - Sees the patient as often as required by acuity but at least twice daily
  - Is either the patient’s attending physician or a consultant who provides direct management of critically ill patients?
  - ICU medical staff members should participate on the institution’s bioethical committee.

6.4.2 Organisation of ICUs

A physician director who meets guidelines for the definition of an intensivist is required. Specific requirements for the unit director include the following:

- Training, interest, and time availability to give clinical, administrative, and educational direction to the ICU
- Board certification in critical care medicine
- Time and commitment to maintain active and regular involvement in the care of patients in the unit
- Expertise necessary to oversee the administrative aspects of unit management including formation of policies and procedures, enforcement of unit policies, and education of unit staff
- The ability to ensure the quality, safety, and appropriateness of care in the ICU
- Availability (either the director or a similarly qualified surrogate) to the unit 24 hrs a day, 7 days a week for both clinical and administrative matters
- Active involvement in local and/or national critical care societies
- Participation in continuing education programs in the field of critical care medicine
- Hospital privileges to perform relevant invasive procedures
- Active involvement as an advisor and participant in organising
- Care of the critically ill patient in the community as a whole
- Active participation in the education of unit staff
- Active participation in the review of the appropriate use of ICU resources in the hospital
- A nurse manager is appointed to provide precise lines of authority, responsibility, and accountability for the delivery of high-quality patient care. Specific requirements for the nurse manager include the following:
An RN (registered nurse) with a BSN (Bachelor of Science in nursing) or preferably an MSN (Master of Science in nursing) degree.

Certification in critical care or equivalent graduate education

At least 2 yrs experience working in a critical care unit.

Experience with health information systems, quality improvement/risk management activities, and healthcare economics.

Ability to ensure that critical care nursing practice meets appropriate standards.

Preparation to participate in the on-site education of critical care unit nursing staff.

Ability to foster a cooperative atmosphere with regard to the training of nurses, physicians, pharmacists, respiratory therapists, and other personnel involved in the care of critical care unit patients.

Regular participation in ongoing continuing nursing education.

Knowledge about current advances in the field of critical care nursing.

Participation in strategic planning and redesign efforts.

6.4.3 Physician Availability

Several studies have suggested that a full-time hospital staff intensivist improves patient care and efficiency as summarised in a recent review. Ideally, 24-hr in-house coverage should be provided by intensivist who are dedicated to the care of ICU patients and do not have conflicting responsibilities. If this ideal situation is not possible 24-hr in-house coverage by experienced physicians (board-eligible/certified surgeons, internists, anaesthesiologists, or emergency medicine physicians) who are not intensivist is acceptable when there is appropriate backup and supervision. This arrangement requires an intensivist to be on call and physically present in the hospital within 30 mins for complex or unstable patients.

The intensivist should be able to return 95% of pages within 5 mins and ensure that a Fundamental Critical Care Support (FCCS) course-trained physician or physician extender reaches the ICU patient within 5 mins. Physicians (staff and/or fellows) or physician extenders covering the critical care units in-house should have advanced airway management skills and Advanced Cardiac Life Crit Care Med 2003 Vol. 31, No. 11 2679Support qualifications. Training in the FCCS course sponsored by the Society of Critical Care Medicine is highly desirable.

Ideal intensivist-to-patient ratios vary from ICU to ICU depending on the hospital’s unique patient population. Hospitals should have guidelines for these ratios based on acuity, complexity, and safety considerations.

The following physician subspecialists should be available and be able to provide bedside patient care within 30 mins:

- General surgeon or trauma surgeon
- Neurosurgeon
- Cardiovascular surgeon
- Obstetric-gynaecologic surgeon
- Urologist
- Thoracic surgeon
- Vascular surgeon
- Anaesthesiologist
- Cardiologist with interventional capabilities
- Pulmonologist
- Gastroenterologist
- Haematologist
- Infectious disease specialist
• Nephrologists
• Neuroradiologist (with interventional capability)
• Pathologist
• Radiologist (with interventional capability)
• Neurologist
• Orthopaedic surgeon

6.4.4 Nursing Availability
All patient care is carried out directly by or under supervision of a trained critical care nurse. All nurses working in critical care should complete a clinical/didactic critical care course before assuming full responsibility for patient care. Unit orientation is required before assuming responsibility for patient care. Nurse-to-patient ratios should be based on patient acuity according to written hospital policies. All critical care nurses must participate in continuing education. An appropriate number of nurses should be trained in highly specialised techniques such as renal replacement therapy, intra-aortic balloon pump monitoring, and intracranial pressure monitoring. All nurses should be familiar with the indications for and complications of renal replacement therapy.

6.4.5 Respiratory Care Personnel Requirements
Respiratory care services should be available 24 hrs a day, 7 days a week. An appropriate number of respiratory therapists with specialised training must be available to the unit at all times. Ideal levels of staffing should be based on acuity, using objective measures whenever possible. Therapists must undergo orientation to the unit before providing care to ICU patients. The therapist must have expertise in the use of mechanical ventilators including the various ventilator modes. Proficiency in the transport of critically ill patients is required. Respiratory therapists should participate in continuing education and quality improvement related to their unit activities.

6.4.6 Pharmacy Services Requirements
Critical care pharmacy and pharmacist services are essential in the ICU. A position paper on recommendations for these services have been published by the ACCM and the American College of Clinical Pharmacy.
• A “ready to administer” (unit dose) drug distribution system, intravenous admixture services and at a minimum a medication information system or computerised physician order entry are essential.
• The ability to supply immediate medications and admixtures in a timely fashion is essential. A critical care pharmacy satellite is desirable for at least part-time coverage, but full-time coverage is optimal.
• A medication use system that creates and maintains patient medication profiles, interfaces with patient laboratory data, and alerts users to drug allergies, maximum dose limits, and drug-drug and drug-food/ nutrient interactions is essential.
• Registered pharmacists, dedicated to the ICU, should be available to evaluate all drug therapy orders, review and maintain medication pro-files, monitor drug dosing and administration regimens, evaluate adverse reactions and drug/drug interactions, give drug and poison information, and provide recommendation on cost containment issues.
• Availability of a clinical pharmacist dedicated to the ICU with a specialised role in activities such as critical care therapeutics, nutritional support formulations, cardio respiratory resuscitation therapeutics, and clinical research projects is desirable.
• Pharmacists should participate regularly on rounds with the intensivist and the critical care team, provide drug therapy-related education to critical care team members, and take part in multidisciplinary quality activity committees.
• Pharmacists should implement and maintain policies and procedures related to safe and effective use of medications in the ICU.
• It is essential that the pharmacist have the qualifications and competence necessary to provide pharmaceutical care in the ICU. This may be achieved by a variety of means including advanced degrees, residencies, fellowships, or other specialised practice experience.
6.4.7 Laboratory Services
A clinical laboratory should be available on a 24-hr basis to provide basic hematologic, chemistry, blood gas, and toxicology analysis. Laboratory tests must be obtained in a timely manner, immediately in some instances. “STAT” or “bedside” laboratories adjacent to the ICU or rapid transport systems (e.g., pneumatic tubes) provide an optimum and cost-effective setting for obtaining selected laboratory tests in a timely manner. Point-of-care technology may be used to obtain rapid laboratory results.

6.4.8 Radiology and Imaging Services
Transport to distant non-ICU sites for radiologic procedures has been shown to be associated with changes in physiologic status that required corrective therapeutic intervention in 68% of patients. Therefore, guidelines for intrafacility transfer should be followed for radiologic procedures performed distant from the ICU bedside. The following diagnostic and therapeutic radiologic procedures should be immediately available to ICU patients, 24 hrs per day.

- Portable chest radiographs affect decision making in critically ill patients. They lead to therapeutic changes in 66% of intubated patients and 23% of non intubated patients.
- Interventional radiologic capabilities should be available including invasive arterial and venous diagnostic and therapeutic techniques, percutaneous access to the renal collecting system and biliary tract, percutaneous gastrostomy, and percutaneous drainage of fluid collections.
- Computed tomography and computed tomography angiography
- Duplex Doppler ultrasound
- Magnetic resonance imaging and magnetic resonance angiography
- Echocardiography (transthoracic and transesophageal)
- Fluoroscopy

6.4.9 Services Provided in Unit
An ICU has the capability of providing monitoring and support of the critically ill patient. To do, so the ICU is prepared to provide the following:

- Continuous monitoring of the electrocardiogram (with high/low alarms) for all patients.
- Continuous arterial pressure monitoring (invasive and non invasive).
- Central venous pressure monitoring.
- Transcutaneous oxygen monitoring or pulse oximetry for all patients receiving supplemental oxygen.
- Equipment to maintain the airway, including laryngoscopes and endotracheal tubes.
- Equipment to ventilate, including ambu bags, ventilators, oxygen, and compressed air.
- Emergency resuscitative equipment.
- Equipment to support hemodynamically unstable patients, including infusion pumps, blood warmer, pressure bags, and blood filters.
- Beds with removable headboard and adjustable position, specialty beds.

6.4.10 ICU Policies and Procedures:
The following must be available to all ICU personnel and must be updated yearly. Many of these areas have been addressed by Guidelines and Practice Parameters Committee of the ACCM

- Admission and discharge criteria and procedures.
- Policies for intra- and interfacility transport.
- A total quality management/continuous quality improvement program is required that addresses safety, effectiveness, patient-centeredness, timeliness, efficiency, and equity as outlined by the institute of medicine. Programs should specifically address appropriate agency for healthcare research and quality indicators.
- A list of hospital staff that are privileged for procedures/skills used in the ICU
6.5 Level II Critical Care Centres
Level II Centres are unable to provide critical care for specific areas of expertise. For example, level II centres may lack neurosurgical expertise, a cardiac surgical program, or a trauma program. Nevertheless, these centres provide comprehensive critical care for their unique patient population. Therefore, with exception of services and personnel in the areas of expertise that they lack, these centres have the same organisational structures as outlined for level I centres. These centres require policies and procedures that address transport to a level I centre when appropriate. Criteria for transfer should be specific and readily available to hospital personnel so that delays in definitive care are avoided.

6.6 Level III Critical Care Centres
Because level III centres are limited in their ability to provide comprehensive critical care, their usually small intensive care units focus on the stabilisation of patients before transfer to a comprehensive critical care centre (level I or II). As a result, the guidelines outlined previously for level I and II centres, although desirable, are not always applicable. Level III centres require an on-site physician 24 hrs/day who can manage emergencies, can secure the airway, can establish rapid intravenous access, is qualified in Advanced Cardiac Life Support, and, if not subspecialty trained in critical care medicine, has taken the FCCS course. It is desirable that level III centres address the frequency with which these educational activities are updated. It is common and acceptable for emergency physicians, anaesthesiologists, general internists, and general surgeons to fulfill this role. A critical care trained nurse and respiratory therapist should be available on site, 24 hrs per day. Essential pharmacy services should be provided. With the exception of highly specialised services, basic services for stabilising, monitoring, and treating critically ill patients should be available. Detailed transport policies and expertise in the transport of patients are essential for these centres. Although new and in need of additional validation, telemedicine-driven ICU care should be considered as a surrogate for on-site intensivist driven care.

6.7 Academic Vs. Non Academic Critical Care Centres
Level I and II centres may have an academic mission through affiliation with a medical school, nursing school, or other health services educational programs. The critical care physician and nursing leadership as well as pharmacists and respiratory therapists of these centres require sufficient protected time to participate in scholarly activity (clinical and/or basic research, case reports) and to foster an environment of critical thinking. They should have the appropriate knowledge and teaching skills to participate in on-site education of critical care nursing staff, physicians in training, and staff physicians. Non academic centres should maintain a commitment to remaining current with changes in the field of critical care. They should encourage and provide protected time for all critical care personnel to participate in continuing education activities and maintain current certification in appropriate areas of expertise.

6.8 Open Vs. Closed ICUs
Some critical care centres defined their ICUs as “open” or “closed” or a combination of both types of units. In the open system, although nursing, pharmacy, and respiratory therapy staff is ICU based, the physicians directing the care of the ICU patient may have obligations at a site distant from the ICU such as outpatient and inpatient areas and the operating room. They may or may not choose to consult an intensivist to assist in management. In some of these ICUs, critical care consultation is mandatory for all patients. In the closed system, care is provided by an ICU-based team of critical care physicians, nurses, pharmacists, respiratory therapists, and other health professionals. A variety of studies reported in the literature have documented more favourable outcomes when ICU patients are managed in a closed system compared with an open system.
Regardless of the type of system used, the ACCM recommends that the intensivist and the ICU patient’s primary care physician and consultants proactively collaborate in the care of all patients. In both systems, an intensivist must be given the authority to intervene and directly care for the critically ill patient in urgent and emergent situations. Ideally, all orders regarding an ICU’s patient’s care should be channelled through a unit based intensivist (and his or her physician or physician extender team if applicable) to ensure optimal care and to minimise redundant or conflicting approaches to care. If these principles are followed, the distinctions between open and closed units and the divisive implications associated with the use of these terms wither away.

### 6.9 Operating Rooms(OR)

Contemporary operating rooms are devoid of a theatre setting (though some in teaching hospitals may have small galleries), making the term “operating theatre” a misnomer for the modern facility. Operating rooms are spacious, easy to clean, and well-lit, typically with overhead surgical lights, and may have viewing screens and monitors. Operating rooms are generally windowless and feature controlled temperature and humidity. Special air handlers filter the air and maintain a slightly elevated pressure. Electricity support has backup systems in case of a black-out. Rooms are supplied with wall suction, oxygen, and possibly other, anesthetic gases. Key equipment consists of the operating table and the anesthesia cart. In addition, there are tables to set up instruments. There is storage space for common surgical supplies. There are containers for disposables. Outside the operating room is a dedicated scrubbing area that is used by surgeons, anesthetists, ODPs (operating department practitioners), and nurses prior to surgery. An operating room will have a map to enable the terminal cleaner to realign the operating table and equipment to the desired layout during cleaning. Several operating rooms are part of the operating suite that forms a distinct section within a health-care facility. Besides the operating rooms and their wash rooms, it contains rooms for personnel to change, wash, and rest, preparation and recovery rooms(s), storage and cleaning facilities, offices, dedicated corridors, and possibly other supportive units. In larger facilities, the operating suite is climate- and air-controlled, and separated from other departments so that only authorised personnel have access.

### 6.10 Streamlining OT

Today hospitals are utilising OTs better by streamlining key areas of OT manpower, scheduling, layout, designing and technology. In any hospital, the Operation Theatre (OT) is said to be the primary source of revenue generation with around 50-60 per cent of revenue earned just by this area. This is more so for surgical specialities. The OT complex in a hospital also represents an area of considerable expenditure in a hospital budget and requires maximum utilisation to ensure optimum cost-benefit. In the best of hospitals, some 30-35 per cent of weekday OT capacity is not utilised, say experts. However, the situation is changing slowly. Today hospitals are keen on utilising OTs better by streamlining key areas like manpower, scheduling, layout and designing. “Technological advances like minimally invasive surgery, which need costly equipment, payment based on diagnosis-related groups, captivated payment and discounted fee for service have all significantly reduced margins in the surgical business,” says Dr Shabeer Ahmed, Gastrointestinal and Minimal Access Surgeon, Wockhardt Hospitals, Bangalore.

### 6.11 Operating Room Equipment

The operating table in the centre of the room can be raised, lowered, and tilted in any direction. The operating room lights are over the table to provide bright light, without shadows, during surgery. The anaesthesia machine is at the head of the operating table. This machine has tubes that connect to the patient to assist him or her in breathing during surgery, and built-in monitors that help control the mixture of gases in the breathing circuit. The anaesthesia cart is next to the anaesthesia machine. It contains the medications, equipment, and other supplies that the anaesthesiologist may need. Sterile instruments to be used during surgery are arranged on a stainless steel table. An electronic monitor (which records the heart rate and respiratory rate by adhesive patches) is placed on patient’s chest. The pulse oxi meter machine attaches to the patient’s finger with an elastic band aid. It measures the amount of oxygen contained in the blood. Automated blood pressure measuring machine that automatically inflates the blood pressure cuff on patient’s arm. An electrocautery machine uses high frequency electrical signals to cauterise or seal off blood vessels and may also be used to cut through tissue with a minimal amount of bleeding. If surgery requires, a Heart-lung machine, or other specialised equipment, may be brought into the room. People in the operating room wear surgical clothes to help prevent germs from infecting the surgical incision. The surgical clothing includes the following:
• A protective cap covering their hair
• Masks over their lower face, covering their mouths and noses
• Shades or glasses over their eyes
• Vinyl gloves on their hands
• Long gowns
• Protective covers on their shoes

The surgeon may also wear special glasses that help him/her to see more clearly.

6.12 Equipment Requirements as Per Standardisation Norms

Considering the vast and explosive expansion in the field of technological innovations in the field of medicine, the attempts to list out the equipment for various levels of service provision becomes formidable. Making a comprehensive list not feasible because of the inherent danger of any equipment becoming obsolete at any point of time and necessity of adding newer equipment to the armamentarium of the service providers as and when they became available. Even in such a context one can’t afford not to have standardised lists of at least minimum/optimum equipment for various levels institutions. Though preparing such a list is a major task the committee, based on the consensus evolved in the meeting called by the Director of Health Services, in which specialist from various specialties took-part, we are presenting a list of equipment. This would have to be updated incorporating latest technological changes. Taking stock of the vast innovations occurring in the field of Medicine, it is recommended that the list have to be periodically updated at intervals of at least 2 years and not more than 3 years under any circumstances.

6.13 Newer Trends Used in Hospitals

Smart Operation Theatre Today the concept of Smart Operation Theatre is becoming popular, which promises to make operations faster and more efficient and dramatically increase productivity and reduce fatigue in the OT. Here the surgeon issues voice commands that are interpreted by an automatic speech recognition system, and control an integrated network of Smart OR devices. A voice controlled set of medical devices is being created so that the surgeon’s verbal commands can guide the activity of the OT. “The systems are being designed as open systems to enable working with a wide range of medical devices of different manufacturers and an industry standard is being established for communication between different devices.

Ultra-sterile OTs with laminar airflow and positive pressure ventilation combined with the use of HEPA filters has reduced infection rates drastically. The latest equipment is being used quite freely in the West. Many minor surgeries are done in the OPD itself to reduce congestion in the OTs.

Robotic surgical systems: They are used abroad as they reduce the complications of surgery. They involve three robotic arms placed at the operating table, a computer controller and an ergonomically-designed surgeon’s console. One robotic arm is used to position the endoscope and the other two devices manipulate surgical instruments. This technique results in precise, minimally invasive surgical procedures.

In the West, some hospitals adopt Time-Motion analysis of operation time to arrive at cost and bill patients accordingly. “Operating theatre information system is used in the West: This is designed to provide information on the workload, case type and medical personnel involvement applicable to theatre managers, anaesthetists and surgical staff,” shares Dr Bakthavathsalam. Day Care Surgery: The strategy of imparting good day care service to the patients generates revenue for a hospital. This is a cost saving technique as it gives quick turnover with low staff requirement and less OT cost. Therefore if the hospital has a separate day care centre, the patient comes in the morning, uses the facility and leaves by the afternoon.

6.14 Time, Cost and Technique Required

It is important to minimise the time between surgeries. According to Yeo Eng Lam, Business Development Director, Johnson Medical, going for multispecialities per OT will increase usage, as the turnaround will be faster. Standard equipment is fixed on ergonomically positioned pendants (boom arms) and only specialised equipment needs to be rearranged for each case. On the other hand, orthopaedic, cardiac, transplant and neuro cases may be most sensitive
to sharing of OT with others. These are also more equipment intensive, hence grouping their OT may be useful as they too take up longer hours. This will not hold up others. Normally every speciality needs specific equipment and by and large hospitals allot different OTs for different surgeries. But by making all our OTs ultra clean and the same in terms of lights, tables, environment and air conditioning we are not wasting operating room time for cleaning and shutting down machines. So, wherever the work is, we are able to accommodate all our OTs simultaneously.

Pre-operative clinics well in advance of surgery reduce unused operating room time resulting from cancellations. Initiating room clearance before the patient has left the room, or induction of anaesthesia during operating room setup can also help. “Induction rooms can be utilised that permit anaesthesia to be administered prior to arrival in the OT,” Dr J Damodharan, Medical Director, Sri Ramachandra Medical Centre, Chennai feels that timely pre-anaesthetic assessment of the patient the previous day by the anaesthetist will go a long way in improving the overall utilisation of the OT. “If the anaesthetist assesses the patient the previous day completely then that can avoid a lot of delays. The patient will be in the OT on time the next day with all the assessment issues clear,” he says.

Wockhardt Hospital, Bangalore has been following pack the OTs and shut down policy for many years. According to Dr Murali Chakravarthy, Chief of Anaesthesia, Critical Care and Pain Relief, Wockhardt Hospitals, Bangalore, it is a viable idea to conduct cases back-to-back and shut down the OTs. This results in decreased stress on the infrastructure such as electrical power, air conditioning and laminar flow system. Not following this method results in unnecessary running of this essential equipment, which increases the running costs. “Running all the available OTs to complete the list allows the staff to perform other duties such as preparing items for the cases during the week, get the maintenance department to attend to malfunctions and servicing of equipment. This reduces the ‘down time’ of the equipment, thus improving its efficiency. When the OTs are shut down, except the airflow in the laminar airflow system, all other electrically operated equipment is shut down,” shares Dr Chakravarthy.

Experts also suggest the use of cable management system to avoid time spent on disconnecting and reconnecting monitors. Adding personnel to the OT team will allow non-operative tasks to be accomplished more quickly. Acute pain service can reduce costs of surgical procedures significantly.

Newer technologies minimise surgery time and ensure precision, thereby reducing morbidity and mortality rates significantly. “It is also important to integrate information technology with theatre management applications which will assist the theatre manager, anaesthetist, surgeon, other OT personnel to schedule theatre session, collect pre and post operative data, generate OT/OR reports and statistics, and track and schedule theatre,” Dr Raghupathy avers. Modern Neuro monitoring can help to avoid unnecessarily deep levels of anaesthesia and to achieve rapid recovery from general anaesthesia. This saves money and theatre time. Fast-tracking procedures allow the patients to bypass the post-anaesthesia care unit. “Video recording of procedures helps in reviewing the procedure, and comes in handy for future reference. In addition, it goes a long way in teaching activities, telemedicine and video conferencing,” Dr Dhar adds.

**6.15 Challenging Path**

The emphasis especially in a country like India should be on providing a safe OT, especially in terms of reduced infection rate and avoidable morbidity and mortality. “Surgical skill wise we may be second to none but many of our OTs especially in rural and semi urban areas may not be really safe. The staff might not be well trained, the equipment may not function well and sterility principles may not be followed due to lack of proper training, documentation and monitoring,” warns Dr Chirayath. Accreditation bodies like NABH and JCI also stress the safety part of Indian hospitals. Minimally invasive surgery demands that high cost equipment be maintained in the OT and that the OT should be supported by a strong biomedical team to reduce the downtime of equipment. Misconceptions about infection control practices and sterility abound in most hospitals. A good infection control programme as advocated by accrediting authorities would go a long way in removing the misconceptions.

Some hospitals fumigate after each case, every day, every week. Using ultra clean surgical environment will give a constant air washing effect, maintain low bacteria count, and assure surgeons of clean environment and hence faster turnover of cases. A better maintained OT gives 20 per cent higher throughput due to faster turnaround time for the next case.
Critical care services include the treatment of vital organ failure and/or the prevention of further life threatening deterioration in a patient’s condition. The service must be medically necessary and meet the definition of critical care.

Medically reasonable and necessary services that do not meet all the criteria to report critical care should be reported with the appropriate evaluation and management code.

Intensive care units (ICUs) vary significantly from hospital to hospital with respect to structure, services provided, personnel and their level of expertise, and organisational characteristics.

It is recommended that all hospitals determine the level of critical care services offered in keeping with their mission and goals as well as regional needs for this service.

Three levels of care are proposed to accommodate university medical centres, large community hospitals, and small hospitals with limited critical care capabilities.

Cooperation between hospitals and professionals within a given region is essential to ensure that appropriate numbers of level I, II, and III units are designated.

Level I critical care centres have ICUs that provide comprehensive care for a wide range of disorders requiring intensive care.

Level I and II centres may have an academic mission through affiliation with a medical school, nursing school, or other health services educational programs.

Non academic centres should maintain a commitment to remaining current with changes in the field of critical care.

Regardless of the type of system used, the ACCM recommends that the intensivist and the ICU patient’s primary care physician and consultants proactively collaborate in the care of all patients.

Operating rooms are spacious, easy to clean, and well-lit, typically with overhead surgical lights, and may have viewing screens and monitors. Operating rooms are generally windowless and feature controlled temperature and humidity.

Besides the operating rooms and their wash rooms, it contains rooms for personnel to change, wash, and rest, preparation and recovery rooms(s), storage and cleaning facilities, offices, dedicated corridors, and possibly other supportive units.

The OT complex in a hospital also represents an area of considerable expenditure in a hospital budget and requires maximum utilisation to ensure optimum cost-benefit.

Establishment of operating room rules and regulations, strict adherence to and enforcement of approved policies and procedures along with continuous monitoring are said to be the essential ingredients for efficient OT management.

To more efficiently operate a surgical setting, managers may consider centralising scheduling to the OT suite itself. Ideally, holding patient and surgeon preferences constant, an operating facility can identify cases and appropriately place them into predetermined time slots, or blocks.

Experts stress allocating the right amount of OT time to each service on each day of the week so that rarely do services fill their allocated OT time and leave another case to schedule.

A smooth unidirectional flow of patients with nurses at each level to monitor the movement greatly helps. It works almost on the assembly line principle used in manufacturing units, ensuring a smooth and efficient flow of cases.
References

- Intensive Care (Part 1) [Video Online] Available at: <https://www.youtube.com/watch?v=2enNosCm5Yg> [Accessed 12 December 2012].
- Intensive Care (Part 2) [Video Online] Available at: <https://www.youtube.com/watch?v=2enNosCm5Yg> [Accessed 12 December 2012].

Recommended Reading

Self Assessment

1. Critical care services include the treatment of which of the following disfunction?
   a. Normal body disfunction
   b. Viral fever
   c. Tonsils
   d. Vital organ failure

2. Robotic _______ systems involve three robotic arms placed at the operating table, a computer controller and an ergonomically designed surgeon’s console.
   a. surgery
   b. surgical
   c. mechanical
   d. process

3. What is the full form of ACCM ______________ ?
   a. Adequate Care Council of Medicine
   b. African Care Council of Medicine
   c. American College of Critical Care Medicine
   d. American College of Care Medicine

4. An operating room will have a ___________ to enable the terminal cleaner to realign the operating table and equipment to the desired layout during cleaning.
   a. map
   b. brush
   c. signals
   d. process

5. Operation Theatre (OT) is said to be the primary source of revenue generation with around ___________ per cent of revenue earned just by this area..
   a. 20-30
   b. 40-60
   c. 70-80
   d. 50-60

6. Which of the following is not used for surgical clothing?
   a. A protective cap covering their hair
   b. Shades or glasses over their eyes
   c. Vinyl gloves on their hands
   d. A silk head ribbon

7. In Smart Operation theatre who issues the voice commands?
   a. Doctor
   b. Surgeon
   c. Nurse
   d. Administrator
   a. reduces
   b. increases
   c. change
   d. maintain

9. Match the following

<table>
<thead>
<tr>
<th>1. Unit director</th>
<th>A. Should be available 24 hrs a day, 7 days a week.</th>
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<tr>
<td>2. Nurse manager</td>
<td>B. Focus on the stabilisation of patients before transfer to a comprehensive critical care center</td>
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<tr>
<td>3. Respiratory care services</td>
<td>C. Provide precise lines of authority, responsibility, and accountability for the delivery of high-quality patient care.</td>
</tr>
<tr>
<td>4. Level III Critical Care</td>
<td>D. Board certification in critical care medicine.</td>
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   a. 1-D, 2-C, 3-A, 4-B
   b. 1-A, 2-B, 3-C, 4-D
   c. 1-C, 2-B, 3-D, 4-A
   d. 1-D, 2-C, 3-B, 4-A

10. Which of the following statements is false?
   a. ICU is privileged by the medical staff to have clinical management responsibility for critically ill patients.
   b. ICU must have board certification in critical care medicine.
   c. ICU patient management sees the patient as often as required by acuity but at least twice daily.
   d. ICU patient management protect hospital property and assets, including drugs.
Chapter VII

Bio-Medical Waste: Affecting Hospital Operations

Aim

The aim of this chapter is to:

- introduce the concept of bio-medical waste management
- illustrate the hazards of bio-medical waste management
- identify how bio-medical waste affects hospital operation

Objectives

The objectives of this chapter are to:

- describe responsibilities of hospital to manage bio medical waste
- explain segregation of bio-medical waste
- discuss bio-medical waste and its drawbacks

Learning outcome

At the end of this chapter, you will be able to:

- define bio-medical waste treatment system
- understand disposal of bio-medical waste
- describe the hazards of biomedical/health care waste
7.1 Introduction

Everything is made for a defined purpose “anything which is not intended for further use is termed as waste”. In the scientific and industrial era combined with increasing population and their demand, the turnover of products has gone very high resulting into increase in quantum of urban solid waste. With increasing need of Health Care in fast changing society the role of hospitals/nursing homes comes to the forefront. “Hospital is a residential establishment which provides short term and long term medical care consisting of observational, diagnostic, therapeutic and rehabilitative services for a person suffering or suspected to be suffering from disease or injury and for parturient. It may or may not also provide services for ambulatory patients on an outpatient basis”. Hospital Waste or Health care waste should include any type of material generated in Health Care Establishments including aqueous and other liquid waste. Hospital waste means “Any solid, fluid or liquid waste material including its container and any other intermediate product which is generated during short term and long term care consisting observational, diagnostic, therapeutic and rehabilitative services for a person suffering or suspected to be suffering from disease or injury and for parturients or during research pertaining to production and testing of biological during immunisation of human beings. Hospital waste includes garbage, refuse, rubbish and Bio Medical Waste”.

7.2 Present Scenario

Waste management is one of the important public health measures. If we go into the historical background, before discovery of bacteria as cause of disease, the principle focus of preventive medicine and public health has been on sanitation. The provision of potable water, disposal of odour from sewage and refuse were considered the important factors in Prevention of epidemics.

Coming back to modern age, on the eve of 21st century with increased use of disposable material and the presence of dreaded disease like Hepatitis – B and AIDS, it is utmost important to take care of the infected and hazardous waste to save the mankind from disaster. The Health care institutions or hospitals which are responsible for care of morbid population are emitting voluminous quantity of rubbish, garbage and Bio Medical Waste matter each day from wards, operation theatre and outpatient areas. Proper management of hospital waste is essential to maintain hygienic, aesthetics, cleanliness and control of environmental pollution.

The hospital waste like body parts, organs, tissues, blood and body fluids along with soiled linen, cotton, bandage and plaster casts from infected and contaminated areas along with used needles, syringes and other sharps are very essential to be properly collected, segregated, stored, transported, treated and disposed of in safe manner to prevent nosocomial or hospital acquired infection. Various communicable diseases, which spread through water, sweat, blood, body fluids and contaminated organs, are important to be prevented. The Bio Medical Waste scattered in and around the hospitals invites flies, insects, rodents, cats and dogs that are responsible for the spread of communication disease like plague and rabies. Rag pickers in the hospital, sorting out the garbage are at a risk of getting tetanus and HIV infections. The recycling of disposable syringes, needles, IV sets and other article like glass bottles without proper sterilisation may be responsible for Hepatitis, HIV, and other viral diseases. It becomes primary responsibility of Health administrators to manage hospital waste in most safe and eco-friendly manner.

With the proliferation of blood born diseases, more attention being focus on the issue of infectious medical waste and its disposal, Health care institutions must be aware of the potential risk in handling infectious waste, and adhere to the highest standards of disposal and transport. Education of the staff, patients and community about the management of the infectious waste is crucial in today’s health care arena.

7.3 Bio Medical Waste Management

Biomedical waste, (BMW), consists of solids, liquids, sharps, and laboratory waste that are potentially infectious or dangerous and are considered bio waste. It must be properly managed to protect the general public, specifically healthcare and sanitation workers who are regularly exposed to biomedical waste as an occupational hazard. Biomedical waste differs from other types of hazardous waste, such as industrial waste, in that it comes from biological sources or is used in the diagnosis, prevention, or treatment of diseases. Common producers of biomedical waste include hospitals, health clinics, nursing homes, medical research laboratories, offices of physicians, dentists, and veterinarians, home health care, and funeral homes.
Sorting of medical wastes in hospital at the site where it is generated, biomedical waste is placed in specially labelled bags and containers for removal by biomedical waste transporters. Other forms of waste should not be mixed with biomedical waste as different rules apply to the treatment of different types of waste. Household biomedical waste usually consists of needles and syringes from drugs administered at home (such as insulin), soiled wound dressings, disposable gloves, and bed sheets or other cloths that have come into contact with bodily fluids. Disposing of these materials with regular household garbage puts waste collectors at risk for injury and infection especially from sharps as they can easily puncture a standard household garbage bag. Many communities have programs in place for the disposal of household biomedical waste. Some waste treatment facilities also have mail-in disposal programs. Biomedical waste treatment facilities are licensed by the local governing body which maintains laws regarding the operation of these facilities. The laws ensure that the general public is protected from contamination of air, soil ground water, or municipal water supply.

The biomedical waste is the waste that is generated during the diagnosis, treatment or immunisation of human beings or animals or in research activities pertaining thereto, or in the production or testing of biological components. The different location or points of generation of waste in a health care establishment are:

- Operation theatres/wards/abour rooms
- Dressing rooms
- Injection rooms
- Intensive care units
- Dialysis room
- Laboratory
- Corridor
- Compound of hospital or nursing home

The Government of India as contemplated under Section 6, 8 and 25 of the Environment (Protection) Act, 1986, has made the Biomedical Wastes (Management and Handling) Rules, 1998. The rules are applicable to every institution generating biomedical waste which includes hospitals, nursing homes, clinic, dispensary, veterinary institutions, animal houses, pathological lab, blood bank; the rules are applicable to even handlers.

### 7.4 Hospital Waste Management

With increasing awareness in general population regarding hazards of hospital waste, public interest, litigations were filed against erring officials. Some landmark decisions to streamline hospital waste management have been made in the recent past. These are:

- **Supreme Court judgment dated 1st March 1996** in connection with safe disposal of hospital waste ordered that:
  - All hospitals with 50 beds and above should install either their own incinerator or an equally effective alternative method before 30th November 1996.
  - The incinerator or the alternative method should be installed with a necessary pollution control mechanism conforming to the standard laid down by Central Pollution Control Board (CPCB).
  - Hazardous medical waste should be segregated as source of disinfected before final disposal.

- **Ministry of Environment and Forest, Govt. of India** issued a notification for Biomedical Waste (Management and Handling) Rules 1998 in exercise of powers conferred by Section 6, 8 and 25 of the Environment (Protection) Act, 1986 that was published in The Gazette of India Extraordinary, Part-II, Section 3-Sub-Section (ii) New Delhi, July 27, 1998. These rules are further amended in 2000 and 2003. Under these rules:
  - The Delhi Pollution Control Committee has been designated as Prescribed Authority to implement these rules in the National Capital Territory of Delhi.
  - In exercise of the Powers conferred by Rule 9 of the Bio-Medical Waste (Management and Handling) Rules, 1998 the Lt. Governor of Delhi has constituted an Advisory Committee Vide No. F. 23 (322)/95/ EN/99 to act such authority under the said Rules. The composition of the Advisory Committee has 10 members with
Pr. Secretary (Health), Govt. of Delhi as Chairman and Director Health Services as Member Secretary / Convener. Under Chairmanship of Principal Secretary (Health and Family Welfare) this Committee meets from time to time to discuss and decide about various issues connected with these rules.

- It is primary responsibility of the government to implement the recommendations and directions of the Supreme Court and Biomedical Waste (Management and Handling) Rules 1998 in public interest, so that biomedical waste does not cause any harm to men, animal and environment.
- There is a big network of Health Care Institutions in Delhi. Although, these are not under one banner but these can be utilised by better coordination among different organisations. The organisation-wise Institutions are as follows:

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<td><strong>63</strong></td>
<td><strong>72</strong></td>
<td><strong>121</strong></td>
</tr>
</tbody>
</table>

Table 7.1 The agency wise distribution of institutions

These Health Care Institutions are inclusive of Allopathic, ISM and Homeopathic. The hospitals and dispensaries mainly under Delhi Government, Municipal Corporation of Delhi, New Delhi Municipal Council, Employees State Insurance Corporation and Central Government Health Scheme require special attention. Equally important is the private sector comprising of major hospitals, nursing homes, clinics, blood banks, diagnostic laboratories, and Unani, homeopathy and Siddha Dava-khanas. At present there are 606 registered nursing homes under this directorate in Delhi.

### 7.5 Responsibilities of Hospitals

It is mandatory for such institutions to:

- Set up requisite biomedical waste treatment facilities like incinerators, autoclave and microwave systems for treatment of the wastes, or ensure requisite treatment of the waste at a common waste treatment facility
- Make an application to the concerned authorities for grant of authorisation. A fee as prescribed shall accompany each application for grant of authorisation
- Submit a report to the prescribed authority by 31 January every year. The report should include information about the categories and quantities of bio-medical wastes handled during the preceding year.
- Maintain records about the generation, collection, reception, storage, transportation, treatment, disposal and / or any form of handling of bio-medical waste.
- Report of any accident to the prescribed authority.
7.6 Hazards of Biomedical/Health Care Waste

Hospital waste / health care waste includes all the waste generated by health care establishments, research facilities, and laboratories including minor or scattered source-such as care taken at home (Insulin Injection). About 75% to 90% of the waste produced by health care providers is non-hazardous “general waste” comparable to domestic waste. WHO has classified hazardous waste into different categories.

- Infectious waste (suspected to contain pathogens): For e.g., laboratory culture, waste from isolation wards, tissue-swabs, material in contact with infected patient, excreta
- Pathological waste (containing human tissue or fluids): For e.g., body parts blood and other body fluids, foetuses.
- Sharps (Sharp material): For e.g., needles; infusion sets; scalpels; knives; blades; broken glass.
- Pharmaceutical waste (containing pharmaceuticals): For e.g., expired drugs, contaminated bottles, and boxes.
- Genotoxic waste: For e.g., waste containing cytostatic drugs; genotoxic chemicals.
- Chemical waste: For e.g., laboratory reagents; film developer expired disinfectants, solvents.
- Waste with heavy metals: For e.g., batteries; broken thermometer
- Pressurised containers: For e.g., gas cylinders; gas cartridges; aerosol cans.
- Radioactive material: For e.g., unused liquid from radiotherapy; contaminated glass ware; urine excreta from patient treated with unsealed radio nucleotides.

7.6.1 Types of Hazards

The exposure to hazardous health care waste can result into:

- Infection
- Genotoxicity and Cytotoxicity
- Chemical toxicity
- Radioactivity hazards
- Physical injuries
- Public sensitivity

7.6.2 Infection

The infectious agents can enter in the body through a puncture, abrasion, or cut in the skin; through mucous membranes; by inhalation and ingestion. Commonest infections, which can result from mishandling of hospital/health care waste, are gastro enteric through faeces and/or vomit (Salmonella, Shigella spp., Vibrio Cholera, Helminthes; Hepatitis A), Respiratory through inhaled secretions; saliva (Mycobacterium tuberculosis; measles virus; streptococcus pneumoniae), Ocular infections through eye secretions (Herpes virus), Genital infections (Neisseria gonnorrhoeae; herpes virus), Skin infection through pus (Streptococcus spp.), meningitis through Cerebrospinal fluid (neisseria meningitides), AIDS through blood and sexual secretions (HIV), Haemorrhagic fevers through body fluids (Junin, Lassa, Ebola and Marburg viruses), Septicaemia and bacteraemia through blood (staphylococcus aureus, Enterococcus, enterobacter, klebsiella and streptococcus) and Viral Hepatitis B & C through blood and body fluids (hepatitis B and C viruses).

7.6.3 Genotoxicity and Cytotoxicity

Many cytotoxic drugs are extremely irritant and have harmful local effects after direct contact with skin and eyes (alkylating agents; Intercalating agents; vinca alkaloids and derivatives and epipodophyllotoxins). Many neoplastic drugs are carcinogenic and mutagenic; secondary neoplasia is known to be associated with chemotherapy.

7.6.4 Chemical Toxicity

Many of chemicals and pharmaceutical drugs used in health care establishments are hazardous (e.g. toxic, genotoxic, corrosive, flammable, reactive, explosive and shock-sensitive). They may cause intoxication by acute or chronic exposure, injuries including burns, poisoning.
7.6.5 Radioactivity Hazards
The radioactive waste exposure may cause headache, dizziness, vomiting, genotoxicity and tissue damage.

7.6.6 Physical Injuries
May result from sharps, chemicals and explosive agents

7.6.7 Public Sensitivity
The general public is very sensitive about visual impact of the anatomical waste, recognisable body parts including foetuses if handled improperly.

7.7 Segregation of Biomedical Waste
Creating a system for segregation of waste is the first step. Segregation at source of different types of biomedical wastes and their appropriate storage and/or disinfections sterilisation, etc. would ensure that infectious wastes do not get mixed with non-infectious wastes as this would infect the entire waste. Only a small fraction of waste generated by health care institutions is actually infectious or hazardous. It is estimated that 80-85 per cent is non-infectious, 10 per cent is infectious and 5 per cent is hazardous.

Segregation of waste into infected or contaminated waste and non-infected waste is mandatory and is a prerequisite for safe and hygienic waste management. Segregation at source makes it easier to prevent spread of infection, help it easier to choose among the options of disposal, and can reduce the load on the waste treatment system and prevent injuries. The rule has laid down certain directions regarding segregation and storage to ensure safe and hygienic handling of infectious and non-infectious waste. The segregation of biomedical waste into various categories and storage in four different coloured containers are taking into account the treatment and disposal facilities available.

The Biomedical waste shall be segregated into containers/bags at the point of generation in accordance with Schedule II prior to its storage, transportation, treatment and disposal. The containers shall be labelled according to the rule. Apart from the biomedical waste the general waste or the garbage generated in health care establishments such as office waste, food waste and garden waste is advisable to be stored in green coloured containers. The local bodies are duty bound to collect such general waste stored in green coloured containers.

The Rules recommend different colour codes for waste containers in which different types of wastes needs to be stored. Clinical and general wastes should be segregated at source and placed in colour coded plastic bags and containers of definite specifications prior to collection and disposal. The container should comprise of an inner plastic bag of varied colour depending on the type of waste. It should be of a minimum gauge of 55 micron (if of low density) or 25 micron (if of high density), leak proof and puncture proof, and should match the chosen outer container. The outer container is a plastic bin with handles, and of a size which will depend on the amount of waste generated. The inner polythene bag should fit into the container with one-fourth of the polythene bag turned over the rim.

Labelling has been recommended to indicate the type of waste, site of generation, name of generating hospital or facility. This will allow the waste to be traced from the point of generation to the disposal area. The containers are then to be transported in closed trolleys or wheeled containers that should be designed for easy cleaning and draining. If for any reasons, it becomes necessary to store the waste beyond such period, permission from the prescribed authority (established by the government of every State and Union Territory) must be taken, and it must be ensured that it does not adversely affect human health and the environment. Once collection occurs, then biomedical waste is stored in a proper place.

No untreated biomedical waste shall be stored beyond a period of 48 hours. Segregated wastes of different categories need to be collected in identifiable containers. The duration of storage should not exceed for 8-10 hours in big hospitals and 24 hours in other health care institutions. Each container may be clearly labelled to show the ward or room where it is kept. The reason for this labelling is that it may be necessary to trace the waste back to its source. Besides this, storage area should be marked with a caution sign.
Biomedical waste from the hospitals needs to be segregated prior to disposal.

- The plastic that is used in the hospitals is infected. It gets mixed with the other waste which lies exposed till it is collected by the municipality.
- The rag pickers come and collect it. In the process they handle this with bare hands, which is a hazardous practice.
- They sell this plastic material. This material is repackaged and sold. It is injurious to health.
- It is necessary to recycle this plastic. It should first be disinfected. Hence it must be segregated from non infectious waste.
- To make the process easier colour coded bags are provided by the organisation.

Black Bag: This bag is used for collecting dry waste material which is not infectious. Materials like paper, plastics, cardboard boxes, and other dry waste generated in hospital office or in the wards are disposed in this bag. This is not biomedical waste.

Red bag
This bag is used for the disposal of plastics collected from OTs, ICUs and wards.

Yellow Bag: This bag is used for highly infectious items like pathological waste, human anatomical waste such as body parts, amputated parts/organs, tumours, placentas, aborted or dead foetuses, blood soaked cotton bandages, animal tissues, organs, carcasses etc.

Blue or White Opaque Bag: This bag is used for collecting the segregated metal sharps such as needles, blades, saws, scalpels and glass pieces.

- These bags must be puncture proof.
- A metal box or a plastic canister should be used for collecting the metal sharps
- It is strongly recommend that even metal sharps and broken glass articles should be segregated.
- Broken glass sharps should be collected in blue/ white bags.
- Lead containers: These containers are used for collecting radioactive wastes. This waste is to be disposed as per the guidelines provided by Bhabha Atomic Research Centre (BARC), Mumbai.
- Radioactive wastes, especially cobalt needles used for brachy treatment must be returned to BARC.
- Cytotoxic waste can be stored in sturdy cardboard boxes and later can be incinerated.

<table>
<thead>
<tr>
<th>YELLOW BAGS</th>
<th>RED BAGS</th>
<th>BLUE BAGS</th>
<th>BLACK CARBOY</th>
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</thead>
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<tr>
<td>waste, bandage, s.gauzes, cotton or any other things in contact with body fluids, human body part, placenta.</td>
<td>Plastic waste such as catheters, injections, syringes, tubings, i.v. bottles,</td>
<td>all types of glass bottles and broken glass articles, outdated and discarded medicine.</td>
<td>Needle without syringes, blades, sharps and all medical articals</td>
</tr>
</tbody>
</table>

Fig. 7.1 Segregation of waste in color coded bags
(Source: http://www.envirovigil-bmwm.com/Management/Segregation.html.)
### Table 7.2 Segregation of waste in colour coded bags

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<th>Waste Category</th>
<th>Treatment option</th>
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<td>Incineration</td>
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<tr>
<td>Red</td>
<td>Plastic bag</td>
<td>Infected /Non-Infected Plastics</td>
<td>Shredding after Autoclaving</td>
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<tr>
<td>Blue</td>
<td>Plastic bag</td>
<td>Glass</td>
<td>Autoclaving /Destruction</td>
</tr>
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<td>Black</td>
<td>Carboy</td>
<td>Infected metal sharps</td>
<td>Autoclaving/ Destruction</td>
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### 7.9 Transportation of BMW

Untreated biomedical waste shall be transported only in specially designed vehicles. The waste should be transported for treatment either in trolleys or in covered wheelbarrows. Manual loading should be avoided as far as possible. The bags/container containing biomedical wastes should be tied/lidded before transportation. Before transporting the bag containing biomedical wastes, it should be accompanied with a signed document by Nurse/Doctor mentioning date, shift, quantity and destination. Special vehicles must be used so as to prevent access to, and direct contact with, the waste by the transportation operators, the scavengers and the public. The transport containers should be properly enclosed. The effects of traffic accidents should be considered in the design, and the driver must be trained in the procedures he must follow in case of an accidental spillage. It should also be possible to wash the interior of the containers thoroughly.

### 7.10 Personnel Safety Devices

The use of protective gears should be made mandatory for all the personnel handling waste.

- **Gloves:** Heavy-duty rubber gloves should be used for waste handling by the waste retrievers. This should be bright yellow in colour. After handling the waste, the gloves should be washed twice. The gloves should be washed after every use with carbolic soap and a disinfectant. The size should fit the operator.

- **Aprons, gowns, suits or other apparels:** Apparel is worn to prevent contamination of clothing and protect skin. It could be made of cloth or impermeable material such as plastic. People working in incinerator chambers should have gowns or suits made of non-inflammable material.

- **Masks:** Various types of masks, goggles, and face shields are worn alone or in combination, to provide a protective barrier. It is mandatory for personnel working in the incinerator chamber to wear a mask covering both nose and mouth, preferably a gas mask with filters.

- **Boots:** Leg coverings, boots or shoe-covers provide greater protection to the skin when splashes or large quantities of infected waste have to be handled. The boots should be rubber-soled and anti-skid type. They should cover the leg up to the ankle.

### 7.11 Biomedical Waste Treatment System

The Biomedical waste treatment and disposal are to be done very carefully, as it is infectious in nature. Considering the then level of information and knowledge, the Government of India has specifically laid down the treatment and disposal options. All health care institutions are required to follow this without fail. Any biomedical waste treatment system should comprise of segregation at source, storage in colour coded containers, systematic collection, transportation to treatment site, treatment considering the type of waste and disposal considering the type of waste. Segregation of biomedical waste is based on the category of waste. Storage and collection of waste in colour-coded containers is based on the treatment adopted. The treatment options for biomedical waste as per the rules are incineration, deep burial, autoclave, microwave, chemical treatment, destruction and shredding, and disposal in secured land fills. Disinfection refers to procedures, which reduce the number of microorganisms on an object or surface but not the complete destruction of all microorganisms or spores. Sterilisation on the other hand, refers to procedures, which would remove all microorganisms, including spores, from an object. Sterilisation is undertaken either by dry heat (for 2 hours at 170oC in an electric oven - method of choice for glass ware and sharps) or by various forms of moist heat (i.e. boiling in water for an effective contact time of 20 minutes or steam sterilisation in an autoclave at 15 lb/sq inch at 121oC for 20 minute)
7.12 Need of Biomedical Waste Management in Hospitals

The reasons due to which there is great need of management of hospitals waste such as:

- Injuries from sharps leading to infection to all categories of hospital personnel and waste handler.
- Nosocomial infections in patients from poor infection control practices and poor waste management.
- Risk of infection outside hospital for waste handlers and scavengers and at time general public living in the vicinity of hospitals.
- Risk associated with hazardous chemicals, drugs to persons handling wastes at all levels.
- “Disposable” being repacked and sold by unscrupulous elements without even being washed.
- Drugs which have been disposed of, being repacked and sold off to unsuspecting buyers.
- Risk of air, water and soil pollution directly due to waste, or due to defective incineration emissions and ash.

7.13 Operation Management Aspects for Managing BMW

From the planning stage to day to day execution of a proper waste management system in the health care establishments, management aspects are of crucial importance. The management of waste requires continuous involvement of a long chain of people, such as, doctors, nurses, ward boys, cleaning staff etc. Dereliction of duty and carelessness at any stage can affect or even spoil the whole system. Therefore, all staff should know about their precise role – what is expected of them and why it is important for them to act according to the directions given to them. According to a recent World Health Organisation (WHO) publication “Safe Management of Waste from Health-care activities”, apart from categorisation, assessment of current situation, the management of the hospital should develop and implement an effective Waste Management Programme.

The Head of the Hospital should form a Waste Management Team to develop and implement the Waste Management Programme. The team should have the following members:

- Head of hospital (as Chairperson)
- Head of hospital Departments
- Infection control officer
- Chief pharmacist
- Radiation officer
- Matron (or Senior Nursing Officer)
- Hospital manager
- Hospital engineer
- Financial controller
- Waste management officer (if already designated)

The Waste Management Committee should regularly meet at least once a month to review and make recommendations directly to the Hospital Director regarding any changes in the Management, Purchase Procedures, Training, Review and Remedial Measures for compliance of the Bio-medical Waste (Management and Handling) Rules, 1998 etc. All these recommendations should be duly documented.
7.14 Administration and Managerial Aspects

The management of the health care establishment should make an action plan to implement the recommendations of the rules framed by the Government of India (Ministry of Environment of Forests). This would include the following:

- Formation of a Waste Management Committee as outlined above.
- Clear indication of the role of each member of the committee.
- Action Plan for proper waste management in the particular health care establishment and its documentation. This plan should be reviewed once a year.
- Development of a format for reporting accidents and incidents relating to bio-medical waste management and its meticulous following.
- Assessment of all the survey results and their utilisation – once in every 6 months.
Summary

- Hospital Waste or Health care waste should include any type of material generated in Health Care Establishments including aqueous and other liquid waste.
- Hospital waste includes garbage, refuse, rubbish and Bio Medical Waste.
- Household biomedical waste usually consists of needles and syringes from drugs administered at home (such as insulin), soiled wound dressings, disposable gloves, and bed sheets or other cloths that have come into contact with bodily fluids.
- Biomedical waste differs from other types of hazardous waste, such as industrial waste, in that it comes from biological sources or is used in the diagnosis, prevention, or treatment of diseases.
- Many cytotoxic drugs are extremely irritant and have harmful local effects after direct contact with skin and eyes (alkylating agents; Intercalating agents; vinca alkaloids and derivatives and epipodophyllotoxins).
- Segregation of waste into infected or contaminated waste and non-infected waste is mandatory and is a prerequisite for safe and hygienic waste management.
- Segregation at source makes it easier to prevent spread of infection, help it easier to choose among the options of disposal, and can reduce the load on the waste treatment system and prevent injuries.
- Untreated biomedical waste shall be transported only in specially designed vehicles. The waste should be transported for treatment either in trolleys or in covered wheelbarrows.
- Special vehicles must be used so as to prevent access to, and direct contact with, the waste by the transportation operators, the scavengers and the public. The transport containers should be properly enclosed.
- Any biomedical waste treatment system should comprise of segregation at source, storage in colour coded containers, systematic collection, transportation to treatment site, treatment considering the type of waste and disposal considering the type of waste.
- The management of waste requires continuous involvement of a long chain of people, such as, doctors, nurses, ward boys, cleaning staff etc.
- The Head of the Hospital should form a Waste Management Team to develop and implement the Waste Management Programme.

References


Recommended Reading

Self Assessment

1. Biomedical waste differs from other types of hazardous waste, such as industrial waste, in that it comes from.__________
   a. pathological source
   b. biological sources
   c. ecological sources
   d. environmental sources

2. BMW stands for ________.
   a. Bio medical waste
   b. Bio waste management
   c. Biological waste management
   d. Bio waste management

3. Biomedical waste is placed in specially ________ bags and containers for removal by biomedical waste transporters.
   a. labelled
   b. plastic
   c. red
   d. blue

4. Which of the following is not used for treatment of bio-medical waste?
   a. Incinerators
   b. Autoclave
   c. Microwave
   d. Refrigerator

5. About__________ of the waste produced by health care providers is non-hazardous “general waste” comparable to domestic waste.
   a. 75% to 90%
   b. 65% to 75%
   c. 68% to 70%
   d. 70% to 80%

6. The infectious agents can enter in the body through a puncture, abrasion, or cut in the skin; through__________.
   a. skin
   b. plasma membrane
   c. mucous membranes
   d. air
7. Which of the following statements is false?
   a. The plastic that is used in the hospitals is infected. It gets mixed with the other waste which lies exposed till it is collected by the municipality.
   b. The rag pickers come and collect it. In the process they handle this with bare hands, which is a hazardous practice.
   c. The rag pickers sell this plastic material. This material is repackaged and sold. It is injurious to health.
   d. It is not necessary to recycle this plastic. It should first be disinfected. Hence it must be segregated from non infectious waste.

8. Match the following

| 1. Black Bag | A. This bag is used for highly infectious items like pathological waste, human anatomical waste. |
| 2. Red bag   | B. This bag is used for collecting the segregated metal sharps such as needles, blades, saws, scalpels and glass pieces. |
| 3. Yellow bag| C. This bag is used for the disposal of plastics collected from OTs, ICUs and wards. |
| 4. Blue bag  | D. Bag is used for collecting dry waste material which is not infectious. |

   a. 1-D, 2-C, 3-A, 4-B
   b. 1-A, 2-B, 3-C, 4-D
   c. 1-C, 2-B, 3-D, 4-A
   d. 1-D, 2-C, 3-B, 4-A

9. Secondary neoplasia is known to be associated with ___________.
   a. bio medical waste
   b. chemotherapy
   c. infection
   d. nano technology

10. No untreated biomedical waste shall be stored beyond a period of ________ hours.
    a. 48
    b. 24
    c. 12
    d. 72
Chapter VIII
Emergency Services for Hospital

Aim

The aim of this chapter is to:

- introduce the concept of emergency services for hospital
- determine the need of emergency services
- elucidate scope of code blue in a hospital

Objectives

The objectives of this chapter are to:

- explain role of a hospital in disaster
- define different types of emergency services for hospital
- describe hospital emergency plan

Learning outcome

At the end of this chapter, you will be able to:

- understand emergency services for hospital
- identify the importance of emergency service in hospital
- describe code blue in hospital
8.1 Introduction

India has been traditionally vulnerable to natural disasters on account of its unique geo-climatic conditions. Floods, droughts, cyclones, earthquakes and landslides are regular phenomena. India also witnessed a hitherto new natural calamity in the form of Indian Ocean Tsunami in 2004. Last few decades have witnessed an increased frequency in disasters causing tremendous human casualties, in terms of loss of life and disability in addition to huge economic losses. Equally important are the “peripheral emergencies” like road, rail and air accidents, fire, drowning and stampedes in mass gathering, industrial accidents, explosions and terrorist attacks that have an inherent potential to convert into a mass casualty incident (MCI).

The loss of life and disability are compounded by the lack of adequate medical preparedness both qualitatively and quantitatively across the country. Almost on daily basis there are reports of disasters around the world. So what do we understand? Are they accidents or something else? A disaster is defined as a serious disruption of the functioning of the society, causing wide spread human, material, or environmental losses which exceed the ability of the affected society to cope using its own resources.” A disaster occurs when a hazard (natural or man made) strikes a vulnerable society. Vulnerability is defined as “the extent to which a community, structure, service, or geographical area is likely to be damaged or disrupted by the impact of a particular hazard, on account of their nature, construction, or proximity to a hazard prone area”.

![Fig. 8.1 Factors affecting risk](http://www.in.undp.org/content/dam/india/docs/guidelines_hospital_emergency.pdf)

Almost on daily basis there are reports of disasters around the world. So what do we understand? Are they accidents or something else? A disaster is defined as a serious disruption of the functioning of the society, causing wide spread human, material, or environmental losses which exceed the ability of the affected society to cope using its own resources.” A disaster occurs when a hazard (natural or man made) strikes a vulnerable society. Vulnerability is defined as “the extent to which a community, structure, service, or geographical area is likely to be damaged or disrupted by the impact of a particular hazard, on account of their nature, construction, or proximity to a hazard prone area”.

8.2 Risk

Risk is a measure of the expected losses (deaths, injuries, property, economic losses, etc.) due to a hazard of a particular magnitude striking in a given area. The Fig. 8.1 illustrates the four factors that contribute to risk. They are:

- Hazards (natural such as earthquake, floods, landslides, cyclones, etc. Or manmade such as exposure to hazardous material, explosion, etc.)
- Location of hazard relative to the community at risk
- Exposure (the effect of hazard on infrastructure and lifeline systems serving the population such as water supply, communication, transportation network, etc.)
- Vulnerability of the exposed society, structure and systems to the hazard
Risk reduction can be done in two ways:

8.2.1 Preparedness
Preparedness encompasses all those measures taken before a disaster event which are aimed at minimising loss of life, disruption of critical services and damage when the disaster occurs. Thus, preparedness is a protective process which enables governments, communities and individuals to respond rapidly to disaster situation and cope with them effectively. Preparedness includes development of emergency response plans, effective warning systems, maintenance of inventories, training of manpower, etc.

8.2.2 Mitigation
Mitigation encompasses all measures taken to reduce both the effect of hazards itself and the vulnerable conditions in order to reduce the losses in a future disaster. Examples of mitigation measures include, making earthquake resistant buildings, water management in drought prone areas, management of rivers to prevent floods, etc.

8.3 Role of a Hospital in Disaster/Mass Causality Index
Hospitals play a critical role in health care infrastructure. Hospitals have a primary responsibility of saving lives, they also provide 24x7 emergency cares service and hence public perceive it as a vital resource for diagnosis, treatment and follow-up for both physical and psychological care. Hospitals are central to provide emergency care and hence when a disaster strike the society falls back upon the hospitals to provide immediate succor in the form of emergency medical care.

Whenever a hospital or a health care facility is confronted by a situation where it has to provide care to a large number of patients in limited time, which is beyond its normal capacity, constitute a disaster for the said hospital. In other words when the resources of the hospitals (infrastructure, trained manpower and organisation) are overwhelmed beyond its normal capacity and additional contingency measure are required to control the event, the hospital can be said to be in a disaster situation. This implies that a same event may have a disaster potential for a smaller hospital and not so for a bigger hospital. Therefore disaster for a hospital is “a temporary lack of resources which is caused due to sudden influx of unexpected patient load”. In order to find out what constitutes a disaster or unmanageable incident for the hospital, the hospital needs to calculate its normal capacity, beyond which it has to act according to the Disaster Plan.

8.3.1 Based on the Number of Causalities
Here the categorisation is based on the number of casualties coming to a hospital at a time and the ability of the hospital to cope with those casualties. Categorisation will differ from hospital to hospital and depend on several factors, such as the number of doctors and nurses available and the availability of supplies and support services. Assessment of the capacity of a hospital to respond to a given emergency situation can be assessed by the following two ways. Hospital treatment Capacity (HTC) is defined as the number of casualties that can be treated in the hospital in an hour and is usually calculated as 3% of total number of beds.

8.4 Hospital Emergency Plan
Hospital disaster management provides the opportunity to plan, prepare and when needed enables a rational response in case of disasters/mass casualty incidents (MCI). Disasters and mass casualties can cause great confusion and inefficiency in the hospitals. They can overwhelm the hospitals resources, staffs, space and or supplies. Lack of any tangible plan to fall back upon in times of disaster leads to a situation where there are many sources of command, many leaders, and no concerted effort to solve the problem. Everyone does his/her own work without effectively contributing to solving the larger problem of the hospital.

Therefore, it is essential that all Hospital Emergency Plans have the primary feature of defining the command structure in their hospital, and to extrapolate it to disaster scenario with clear cut job definitions once the disaster button is pushed. Chaos cannot be prevented during the first minutes of a major accident or disaster. But the main aim of Hospital Emergency Plan should be to keep this time as short as possible.
All hospitals should also have a realisation that in a sudden mass casualty incident their hospital is actually running on full capacity. Due to greater number of patients coming in there is a tendency and pressure to practice disaster medicine and thereby reducing the quality of medical care in the interest of greater number of surviving persons. But under all circumstances, even in a disaster planning should be done in a way that the quality of care to the serious critical patients is not compromised. The plan should aim at:

- the survival and recuperation of as many patients as possible
- a proportional distribution of patients to other health care facilities

Hospitals which provide full time emergency services on a 24-hour-per-day, 7 days a week basis meet the standard requirements of receiving mass casualty incident patients at all times. Hospital has sufficient number of personnel, including doctors and paramedical staff to meet the patient needs for emergency care. The Services are appropriate to patient needs. The emergency services provided are integrated with other departments of the hospital. Therefore it is imperative for these facilities to make a Hospital Emergency Plan.

The public health care infrastructure in India has been planned in a pyramidal fashion with primary and community health facilities at the base and tertiary health care facilities like medical college/University hospitals at the apex. In between there are many other hospitals like the district hospitals, municipal hospitals, etc., having a moderate bed strength of 100 to 200. Hospital planning in India has till now not focused on preparedness in case of disasters and MCI. Not only is there an urgent need to increase the preparedness of hospitals in mass casualties, but also the hospitals have to expand their focus to include both internal hospital planning as well as be a part of the regional plan for disasters and mass casualties.

Since the disasters do not strike at the vicinity of only bigger hospitals, it is imperative that all hospitals whether small or big providing emergency care have an emergency plan. The emergency plan for smaller hospitals such as community health center may actually only focus around providing either mobile emergency care on the site of incident or providing intermediate stabilisation and forward referral of serious patients to the nearest networked hospital. In most mass casualty incidents it has been observed that majority of the victims are not seriously injured and come in the walking wounded category. Such small centers can provide immense help in case of disasters/MCI by providing definitive care to such victims who are not seriously injured. The emergency plan of such small hospitals would largely depend upon the concept of hospital networking.

8.5 Organisation of Health Delivery System in Disaster/Emergency Solution

One of the important roles of the district medical authority would be to organise the overall health delivery system of the district according to the plan. The mass casualty medical preparedness plans should be dovetailed into the existing district disaster management plans. Health delivery system management plays an important role in reducing morbidities and mortalities. In times of disasters the health delivery systems, all of a sudden, have to provide medical facilities to an unusually large number of patients out of which many would require the first-aid treatment only. In order to provide medical facilities to the needy in time, it is necessary to screen out large number of minor injuries from the serious ones.

With the above intention, mass casualty management should be planned in two stages:

- **Pre-Hospital Management:** It includes the following measures:
  - First aid parties
  - First aid posts (static and mobile)
  - Ambulance service
  - Mobile surgical units.

- **Emergency-Hospital Organisation:** It includes the following measures:
  - Emergency hospital services (including critical care facilities)
  - Emergency surgical services
  - Emergency transfusion services
  - Emergency investigation facilities
8.6 Objective of a Hospital Emergency Plan

The main objective of a hospital emergency/disaster plan is to optimally prepare the staff and institutional resources of the hospital for effective performance in different disaster situations. The hospital disaster plans should address not only the mass casualties which may result from MCI that has occurred away from the hospital, but should also address the situation where the hospital itself has been affected by a disaster – fire, explosion, flooding or earthquake.

In case of MCI away from the hospital and not affecting the hospital the further goals are to control a large number of patients and manage the resulting problems in an organised manner:

- By enhancing the capacities of admission and treatment.
- By treating the patients based on the rules of individual management, despite there being a greater number of patients.
- By ensuring proper ongoing treatment for all patients who were already present in the hospital.
- By smooth handling of all additional tasks caused by such an incident.
- By providing medications, medical consultation, infusions, dressing material and any other necessary medical equipment.

In case of incidents affecting the hospital itself the further goals of the plan would be to protect life, environment and property inside the hospital from any further damage:

- By putting into effect the preparedness measures.
- By appropriate actions of the staff who have to know their tasks in such a situation.
- By soliciting help from outside in an optimal way.
- By re-establishing as quickly as possible an orderly situation in the hospital, enabling a return to normal work conditions.

8.7 Principles of Hospital Disaster Plan

The hospital plan should be always simple and easy to follow. Hospital plan should be:

- Predictable: The hospital disaster plan should have a predictable chain of management.
- Simple: The plan should be simple and operationally functional.
- Flexible: (Plan should have organisational charts) the plan should be executable for various forms and dimensions of different disasters.
- Concise (Clear definition of authority): The plan should specify various roles, responsibilities, work relationships of administrative and technical groups.
- Comprehensive (Compatible with various hospitals): It should be comprehensive enough to look at the network of various other health care facilities along with formulation of an inter-hospital transfer policy in the event of a disaster.
- Adaptable: Although the disaster plan is intended to provide standard procedures which may be followed with little thought, it is not complete if there is no space for adaptability.
- Anticipatory: All hospital plans should be made considering the worst case scenarios. Part of a Regional Health Plan in Disasters: A hospital cannot be a lone entity making its plans in isolation.

8.8 How to Proceed for making Emergency plan for your Hospital?

To make the proceedings easier it is recommended that the hospital administrators embark upon disaster planning using a phase plan. The hospital emergency planning can be divided into three phases:
### 8.8.1 Pre Disaster Phase

- Planning: Most of the assessment and planning is done in the pre disaster phase, the hospital plans are formulated and then discussed in a suitable forum for approval.
- The disaster manual: The hospital disaster plan should be written down in a document form and copies of the same should be available in all the areas of the hospital.
- Staff education and training: It is very important for the staff to know about and get trained in using the hospital disaster/emergency manual. Regular staff training by suitable drills should be undertaken in this phase.

### 8.8.2 Disaster Phase

- Phase of activation: Alter and notification of emergency.
- Activation of the chain of command in the hospital.
- Operational phase: This is the phase in which the actual tackling of mass casualties is performed according to the disaster/emergency plan.
- Phase of deactivation: An important phase of the hospital emergency plan when the administration/command of the hospital is satisfied that the influx of mass casualty victims is not continuing to overwhelm the hospital facilities.

### 8.8.3 Post Disaster Phase

This an important phase of disaster planning were the activities of the disaster/ emergency phase is discussed and the inadequacies are noted for future improvement.

### 8.9 Central Command Structure for Hospital

In order to ensure effective control and avoid duplication of action there should be a unified command system which should be based on the individual hospital hierarchical chain. The advantages of ICS are many. It has predictable chain of management; flexible organisation charts allowing flexible response to specific emergencies; prioritised response checklists; accountability of position function; improved documentation; a common language to promote communications and facilitate outside assistance; cost effective emergency planning within the hospital.

Although this sort of chain of command is ideal to avoid chaos in emergency situations, it is seen that there is a strong opposition to formation of any such hierarchical command system by the physicians and hospital personnel. Nevertheless all doctors including the administrator should emphasis that such a command system would come into affect only at the time of mass casualty incident and would close down on withdrawal of disaster alert. Therefore all hospital personnel including doctors should respect the command hierarchy during emergencies and disasters. Any command system may be used by the hospital but the most important rule is to make organisational chart. Each position on the chart should be function based and not position or individual based.

### 8.10 Plan Activation of different Areas of Hospital

The areas which should find a mention in a hospital emergency plan includes following points.
- Command centre
- Communications office/paging/hotline area/telephone exchange
- Security office/police picket (chowki)
- Reception and triage area
- Decontamination area (if needed)
- Minor treatment areas
- Acute care area (emergency department)
- Definitive care areas (OTs, wards)
- Intensive treatment area and activation of High Dependency Units (HDUs) Mortuary.
- Holding area for relatives/non-injured
• Area for holding media briefings (separate media/PRO/spokesperson room)
• Area for holding patients in case a part of the hospital is evacuated

All these areas should be mapped on the outlay map of the hospital. The normal capacities of the existing areas should be mentioned on these maps. Enhanced admission of patients requires an enlargement of suitable spots, if necessary even by changing their function.

8.11 How to Increase Bed Capacity in Emergencies?
The newly arriving patients would require admission for definitive treatment therefore plans should be there to increase the bed capacity when needed. This can be achieved by the following actions:
• Discharge elective cases
• Discharge stable recovering patients
• Stop admitting non emergency patients
• Convert waiting/non-patient care areas into makeshift wards

8.12 Planning for Security of Hospital in Emergency Situation
During emergency situation the hospital is the focus of not only the patients being brought in but a lot of other persons including relatives, by-standers, media, etc. They more often than not block the entrance and other areas hampering the smooth functioning of the hospital. It is therefore recommended that all hospitals should have some security arrangements even in non disaster phases. The hospital security should be operational at a very early stage of disaster. Some of the duties recommended are:
• Work in close coordination with local police
• Maintain order within and outside the hospital
• Direct traffic so as not block the free access of patient carrying vehicles to and outside the hospital
• Protect key installation of the hospital (emergency department, hospital working areas, power station/generators, water tanks/water supply, etc.)
• Restrict and strictly control access to the hospital
• Direct the entry for authorised persons to appropriate areas (ambulances to emergency, relatives to waiting area, media to media room, etc.)
• Protect hospital personnel and patients
• All hospital personnel should carry Identity cards

8.13 Hospital Emergency Plan Manual
The Hospital Emergency is a Plan written a document also known as “Disaster/ Emergency manual”. The reporting, recording, coordinating and evaluating activities associated with disaster management should be specified in this disaster manual. The disaster manual should incorporate the following:
• Medical Command Authority (Unified Incident command)
• Control center location
• Names and contact numbers of all members of the staff and their position according to the incident command structure.
• Disaster alert Codes
• Quick reaction teams formation, responsibilities and movement details
• Responsibilities of individuals and department
• Job action cards
• Chronological action plan
• Details of resource mobilisation for logistics and manpower
Details of Operational Areas (Patient Care Areas) this should include the existing patient care areas (Reception and Triage areas, Emergency and resuscitation areas, Definitive care areas, Intensive care areas, etc.) The plan should also label certain areas which are free in the hospital area which can be optionally used as patient care areas during the initial surge of patients.

- Standing orders and protocols for patient management
- Hospital triage criteria
- Documentation details
- Communications (Intra and Inter Hospital)
- Networking including capacities and capabilities of health facilities
- Pre-hospital transports
- Security arrangements
- Police networks
- Evacuation details
- Medico-legal responsibilities
- Disposal of the dead (role of mortuary services and forensic departments in identification, storage and disposal of the deceased)

8.14 Triage

The term “triage” comes from the French verb trier, which means to separate or sort. The concept is used in the medical field to simply and quickly identify the most severely injured people in a multi casualty situation. In other words, it is a principle of sorting casualties into categories of priority for treatment. The idea of triage was pioneered by French surgeon Dominique Jean Larrey to organise the care of wounded soldiers during the Napoleonic wars in the 1790s. Triage is used in hospital emergency rooms, on battlefields, and at disaster sites when limited medical resources must be allocated.

In the interdisciplinary trauma case procedures, due to the diversity of injuries, specialists of various medical disciplines are involved. These emergency and surgery doctors form a “trauma team”. Patients classified as trauma cases are characterised with a high degree of unpredictability and require immediate decisions, often according to suddenly changing diagnosis. External injuries are doubled with internal or neurological i.e. Selection of the most demanding patients (triage), sequence of the provision of care in each hospital section and the relevance undertaken steps, as well as time of reaction to injuries, are crucial for patients state in the future.

The ABCD concept

Triage of patients involves looking for signs of serious illness or injury. These emergency signs relate to the “ABCD”. Each letter refers to an emergency sign which, when positive, should alert you to a patient who is seriously ill and needs immediate assessment and treatment.

A - Airway
B - Breathing
C - Circulation
C - Coma
C - Convulsion
D - Dehydration (severe)

The Simple Triage and Rapid Treatment (START) system was developed to allow first responders to triage multiple victims in 30 seconds or less, based on three primary observations: Respiration, Perfusion, and Mental Status (RPM). The START system is designed to assist rescuers to find the most seriously injured patients. As more rescue personnel arrive on the scene, the patients will be re-triaged for further evaluation, treatment, stabilisation, and transportation. This system allows first responders to open blocked airways and stop severe bleeding quickly. Four colours of triage are used to prioritise casualties:
• Black (Expectant) which entails pain medication only until death
• Red (Immediate) which entails life threatening injuries
• Yellow (Delayed) which entails non-life threatening injuries
• Green (Minor) which entails minor injuries

8.14.1 Triage Guideline
Golden Hour - the period of time in which the treatment of the patient in shock or with traumatic injuries is most critical. The period of time is generally thought to be the first 60 minutes after the injury. One or more of the following triage locations may be established:
• Arts centre studio
• Cafeteria
• Gymnasium
• Carpentry shop
• Any classroom with large windows

8.14.2 Incident Commander
First person to arrive at scene becomes the Incident Commander. He performs following tasks:
• Assumes and announces command
• Ensure area is safe (ensure valves have been shut off)
• Identifies patient needs and resources three major components extricate, triage (treat) and transport
• Once campus manager arrives he will take over the role of incident commander designate an assistant or to triage officer and transport officer
• Ensures disaster response kits, first aid supplies and maps are obtained
• Facilitates with Fire Department and Ambulance

8.14.3 Triage Officer
The second person to arrive at the scene becomes the Triage Officer. He coordinates triage team (use fan out list to call first aiders) as members arrive he is prepared to sort and prioritise casualties using the universal 60 second assessment (consciousness, breathing, hemodynamic status) to aid 30-40 casualties. On-site first aid and emergency medical care will be supplemented by Ambulance Services.

Only the Triage Officer should have triage tags Ensure four collection areas are set up.
• Immediate transport (red)
• Secondary transport (yellow)
• Walking wounded (green)
• Morgue (black)

All casualties are colour-coded using triage tags:
• RED - high priority, most urgent
• YELLOW - medium priority
• GREEN - low priority, non urgent
• BLACK- lowest priority, dead (must be transported to hospital to determine need for autopsy)

8.14.4 RED: High Priority
High priority casualties are those who have serious injuries or medical problems. Their chance for survival depends on prompt and efficient medical care. This category includes the following:
• Cardiac arrest
• Airway and breathing problems (respirations are greater than 30 per minute)
• Deep shock - no radial pulse present, cold clammy skin, capillary refill greater than 2 seconds
• Uncontrollable bleeding or severe blood loss
• Open chest or abdominal wounds
• Severe head injuries
• Diabetic state (with complications)
• Poisoning
• Abnormal birth situation in which there is an arm or leg present
• Unconscious
• Burns involving respiratory track
• Several major fractures

8.14.5 YELLOW: Medium Priority
Second priority casualties are those for whom treatment and transportation can be delayed while more seriously injured persons are cared for. These injuries include can be any of the following:
• Fractures (as long as any associated serious bleeding can be controlled)
• Back injuries - even those with spinal cord damage - can be detained on the scene as long as they are carefully immobilised and protected against further injury
• Burns
• Spinal column injury
• Moderate blood lose
• Conscious with head injury

8.14.6 GREEN: Low Priority
Low priority casualties are those who should be cared for when all other persons have been treated and prepared for removal. In this group are:
• Minor fractures and wounds
• Contusions/abrasions
• Minor burns

8.14.7 BLACK: Lowest Priority
Deceased casualties - evidence of death is categorised as PRESUMPTIVE (an assumption based on available information) and POSITIVE (when no doubt exists as to the person’s death). Also in this category are:
• Persons already dead
• First Aiders will assess and treat all casualties within the scope of their training

8.14.8 Transportation Officer
Controls traffic and ensures traffic flow Directs ambulance movement and ensures paramedics wait in the vehicle All vehicles check in at Staging Area Delegate tasks as necessary and ensure casualties are tracked (triage tag numbers and destination including mode of transportation i.e. ambulance, taxi)

8.14.9 First Aiders
Meet at the Health Centre or Casualty Collection Centre, and report to the Occupational Health Nurse First Aiders will assess and treat all casualties within the scope of their training.
### 8.15 Code Blue

A message announced over a hospital’s public address system, indicating that a cardiac arrest or respiratory arrest requiring CPR is in progress; to be ‘coded’ is to undergo CPR. In some facilities, the term is confined to cardio respiratory emergencies in adults and children, in others, just for adults, also any adult emergency or tornado warning. Code Blue is one of the Emergency Procedure codes for Medical Emergencies and Arrests (including non-patient care areas) on the Herston Campus. A single telephone number 333’ is used for all Code Blue events at the Herston Campus. The call will automatically be directed to the Department of Emergency Medicine (DEM) who will dispatch a Code Blue Response Team.

#### 8.15.1 Purpose of Code Blue

Communicate and mobilise the immediate arrival of emergency equipment and specialised personnel to an adult or child whose heart or respiration has stopped. Reason blue was selected for heart or respiration stopping because it is commonly used among Oregon and Washington hospitals. It is also consistent with states that have already standardised emergency code calls.

#### 8.15.2 Supporting Information about Code Blue

It is for patients who do not have an advance health care directive indicating otherwise. It is initiated immediately when an adult or child is not breathing or heart has stopped. Other buildings of the medical center which are not part of the hospital itself will dial 911 for response. In some hospitals, they may say “pediatric” or “infant” to indicate a pediatric or infant emergency.

#### 8.15.3 Code Blue Response Team

Code Blue Response Team’ respond to both Medical Emergencies and Arrests. The foundations of this team are based on the ‘Medical Emergency Team’ concept. As the hospital comprises of clinical and non-clinical areas, the nominated Code Blue Response Team will respond to all areas. The Code Blue Response Team comprises of the following:

- Intensive Care Registrar
- Medical Registrar
- Treating Team
- Critical Care Nurse

**In all emergency situations, staff must:**

- Assess the situation quickly
- Ensure safety for staff, patient and bystanders
- Initiate a response from the patient
- Call for help - code blue emergency - ring ‘333’; and
- Commence appropriate treatment following the Basic Life Support flowchart.
Summary

- A disaster is defined as a serious disruption of the functioning of the society, causing wide spread human, material, or environmental losses which exceed the ability of the affected society to cope using its own resources.
- Risk is a measure of the expected losses (deaths, injuries, property, economic losses, etc.) due to a hazard of a particular magnitude striking in a given area.
- Hospitals play a critical role in health care infrastructure. Hospitals have a primary responsibility of saving lives, they also provide 24x7 emergency cares service and hence public perceive it as a vital resource for diagnosis, treatment and follow-up for both physical and psychological care.
- Hospital disaster management provides the opportunity to plan, prepare and when needed enables a rational response in case of disasters/ mass casualty incidents (MCI).
- Hospitals which provide full time emergency services on a 24hour-per-day, 7 days a week basis meet the standard requirements of receiving mass casualty incident patients at all times.
- Hospital has sufficient number of personnel, including doctors and paramedical staff to meet the patient needs for emergency care.
- The public health care infrastructure in India has been planned in a pyramidal fashion with primary and community health facilities at the base and tertiary health care facilities like medical college/University hospitals at the apex.
- Health delivery system management plays an important role in reducing morbidities and mortalities. In times of disasters the health delivery systems, all of a sudden, have to provide medical facilities to an unusually large number of patients out of which many would require the first-aid treatment only.
- The main objective of a hospital emergency/disaster plan is to optimally prepare the staff and institutional resources of the hospital for effective performance in different disaster situations.
- During emergency situation the hospital is the focus of not only the patients being brought in but a lot of other persons including relatives, by-standers, media, etc. They more often than not block the entrance and other areas hampering the smooth functioning of the hospital.
- The term “triage” comes from the French verb trier, which means to separate or sort. The concept is used in the medical field to simply and quickly identify the most severely injured people in a multi casualty situation.

References

- Dr. Das, N. C., Hospital Administration [Video Online] Available at: <http://www.youtube.com/watch?v=lejHMq4o8sw> [Accessed 7 December 2012].

Recommended Reading

Self Assessment

1. ___________ encompasses all those measures taken before a disaster event which are aimed at minimising loss of life, disruption of critical services and damage when the disaster occurs.
   a. Preparedness  
   b. Mitigation  
   c. Disaster  
   d. Risk

2. MCI stand for_________.  
   a. Mass Causality Item  
   b. Mass Causality Index  
   c. Mass Casual Index  
   d. Metric Causality Index

3. Which of the following is not an example of mitigation?  
   a. Making earthquake resistant buildings  
   b. Water management in drought prone areas  
   c. Development of emergency response plans  
   d. Management of rivers to prevent floods

4. What is HTC?  
   a. Hospital Total Capacity  
   b. Hospital Capacity Total  
   c. Hospital Treatment Causality  
   d. Hospital Treatment Capacity

5. Which of the following is not included in Pre Hospital Management?  
   a. Emergency hospital service  
   b. First aid posts  
   c. Ambulance service  
   d. Mobile surgical units

6. In which phase of hospital emergency plan planning is done?  
   a. Primary  
   b. Pre disaster  
   c. Late’  
   d. Early

7. Phase of deactivation comes under which phase?  
   a. Pre disaster  
   b. Disaster  
   c. Post-disaster  
   d. Planning phase
8. Which of the following not come under code blue response team?
   a. Intensive Care Registrar
   b. Medical Registrar
   c. Treating Tea
   d. Doctors

9. Match the following

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1. Red</td>
<td>A. Medium priority.</td>
<td></td>
</tr>
<tr>
<td>2. Yellow</td>
<td>B. High priority, most urgent</td>
<td></td>
</tr>
<tr>
<td>4. Black</td>
<td>D. Low priority, non urgent.</td>
<td></td>
</tr>
</tbody>
</table>

a. 1-B, 2-A, 3-D, 4-C
b. 1-A, 2-B, 3-C, 4-D
c. 1-C, 2-B, 3-D, 4-A
da. 1-D, 2-C, 3-B, 4-A

10. Which of the following statements is false?
   a. The Hospital Emergency is a Plan written a document also known as “Disaster/ Emergency manual.
   b. Low priority casualties are those for whom treatment and transportation can be delayed while more seriously injured persons are cared for.
   c. Triage of patients involves looking for signs of serious illness or injury.
   d. High priority casualties are those who have serious injuries or medical problems.
**Case Study I**

**Bio-medical Waste Management Lax in Jammu Hospitals**

One normally expects that health institutions be places where infections are cured. But these days that doesn’t seem to be the case in Jammu. Take for example, the Government Chest Diseases Hospital in Jammu, where biomedical waste including used syringes, is littered just on the hospital’s doorstep. Exposed syringes, which can carry infectious diseases like TB, are endangering the life of the inmates and the patients who visit the hospital.

In gross violation of the Bio-medical Waste Management and Handling Rules, most of the health institutions flout these norms, endangering the health of the very patients they are required to treat. More than 9000 kg of hazardous bio-medical waste is generated in the state every day, which hints at the amount of infectious waste that is out there. In Talab Tilloo area, when it rains and water from the mini canal spills over to the road, the bio-medical waste, thrown in to the mini canal, gets spread over the roads with the swelling waters, exposing the state of the health institutions with regard to their bio-medical waste handling. Similar is the situation of bio-medical waste handling at many places around the SMGS hospital too.

Sources said that even the worn out incinerators in Jammu’s Government Medical College don’t have pollution control devices like the soot filters, due to which the incineration of the bio-medical waste is adding to the pollution level in the city. The few incinerators in some of the government hospitals in Jammu are insufficient in dealing with the large amount of waste generated. Each bed generates a bio-medical waste of nearly 2 kg per day per patient. As Jammu has a collective bed capacity of more than 5800 and Kashmir more than 5000, one can imagine the quantum of bio-medical waste generated on a daily basis.

Medical experts have been stressing that a centralised facility, handled and monitored by one particular agency must be set up, where the type of waste requiring incineration can be destroyed collectively, but that has not materialised yet. According to Dr Yashpal Sharma, an expert on Bio-medical Waste management, in the absence of common Biomedical Waste treatment facility, even the State Pollution Control Board (SPCB) has given approval to a private agency in Pathankot for collecting Bio-medical waste from private health institutions in the state, but that hardly caters to the volume of the biomedical waste generated. He said that the SMGS hospital has an incinerator with capacity to just 5 kg per hour, while the GMC has a capacity of 50 kg per hour, which are outdated in the present context.

Even SPCB seems to have failed, despite taking up the issue with the health institutions saying that they must comply with the Bio-Medical waste Management rules. Recently even the SPCB chairman Dr C M Seth admitted during a workshop on Bio-medical waste that the hazardous Bio-medical waste continues to be dumped as the municipal waste in Jammu, endangering the health of the people here.

J&K initiated work on Bio-medical waste in June 2000 by documenting the ground realities of Health Care Establishments here through surveys, but still not much has been done. The surveys pointed out that either the hospitals dispose the waste by burning it in the open or they use double-chambered/single-chambered incinerators. Mostly, the incinerators are operating below the required temperature of 1000-1200°C, the study stated, adding that even plastic (chlorinated) which should not be incinerated, is also being incinerated along with other waste. Bio-medical Waste (Management and Handling) Rules, being now referred to as BMW, came into being on July, 20, 1998, with amendments of March 6 and June 2, 2000, respectively.

Questions

1. What comes under bio medical waste and what is its disadvantage?
   **Answer**
   Biomedical waste includes used syringes. Exposed syringes, which can carry infectious diseases like TB, are endangering the life of the inmates and the patients who visit the hospital.

2. Why Jammu and Kashmir hospital are not able to manage the bio medical wastes?
   **Answer**
   Jammu’s Government Medical College don’t have pollution control devices like the soot filters, due to which the incineration of the bio-medical waste is adding to the pollution level in the city. The few incinerators in some of the government hospitals in Jammu are insufficient in dealing with the large amount of waste generated.

3. Why J&K hospitals are not able to manage bio medical waste?
   **Answer**
   J&K hospitals are not able to manage bio medical waste because the hospitals dispose the waste by burning it in the open or they use double-chambered or single-chambered incinerators. Mostly, the incinerators are operating below the required temperature of 1000-1200ºC, adding that even plastic which should not be incinerated, is also being incinerated along with other waste.
Case Study II

Improve Patient Care and Experience

Virtua is the largest healthcare system in southern New Jersey, a fast-growing organisation with more than 8,400 employees, operating four hospitals, two nursing homes, two ambulatory-care centers, a home healthcare agency and 19 physician-services sites. Technology plays an important role at Virtua, and IT is viewed as the fundamental enabler of service capabilities. “An organisation can have the best strategy, the best processes, the best people,” says Ninfa Saunders, Virtua’s President and Chief Operation Officer. “But if they do not communicate and convert data into information for greater utility, nothing happens.”

To support its mission and growth, Virtua partnered with NEC to help enhance and integrate its voice and data infrastructures for quicker access to information, improved clinician communication and enhanced patient care. Virtua sought a partner whose Unified Communications (UC) solution could be integrated with data technologies and with nearly every aspect of Virtua’s buildings, back-office functions and healthcare delivery involving technology, the partner would need to be capable of implementing a large-scale project with minimal disruption to Virtua’s normal, 24/7 operations.

Alfred Campanella, Vice President and Chief Information Officer, and his team worked closely with a project manager from NEC to coordinate every step of the process as NEC designed a robust unified communications system and integrated it into Virtua’s IT infrastructure. “NEC understands the mission of healthcare and our unique needs,” says Campanella. “The people they brought to the table throughout the planning and implementation processes obviously understood what is important to us and were able to adapt to our particular needs.”

Virtua’s NEC UNIVERGE SV8500 Communications Server, wireless infrastructure, and NEC UNIVERGE Unified Communications for Enterprise form an integrated environment that supports more effective and safe patient care by providing patient data in real-time, while improving communication and collaboration. As Ninfa Saunders puts it: “We now have accurate, accessible and interoperable data for clinicians at the right time and place for the right patient.” Virtua’s physicians and nurses can now receive voice messages via email using wireless phones, and nurses can check lab results instantly via wireless phone before administering medication. “If a nurse is at the bedside and needs to check the patient’s lab results before administering medication, they can immediately access the information on their wireless phone,” says Kelly Beach, nursing director at Virtua’s hospital in Voorhees. “There is no wait – everything is at the nurses’ fingertips, so it closes the loop for patient care.”


Questions
1. What did Virtua done to support it mission and growth?
2. Explain why Virtua is one of the largest healthcare systems?
3. How do Virtua’s physicians and nurses receive messages before administering medication?)
Case Study III

Novia Strategies Hospital-Wide Staffing Assessment

Overview

The client facility had identified the need to significantly reduce their labour costs. They had been experiencing a decline in their general level of reimbursement, a significant reduction in their bottom line, and heightened competition in their immediate marketplace. Their goal was to achieve the needed savings while maintaining or improving their current level of patient care, and employee, physician and patient satisfaction. They also wanted to encourage volume growth in revenue-producing departments, particularly in the outpatient arena. Administration felt it was critical that mid- and upper-management not only understand, but also support, the recommended labour reductions/targets that would be set in all of their areas. Novia Strategies (formerly Sullivan Lakier Group) was engaged to perform this assessment, report its findings and recommendations, and develop realistic labour targets.

Assessment approach and activities

The consultants with the participation of hospital administration developed a comprehensive assessment work plan. Hospital administration set a three to four month target date for the completion of the staffing assessment. The assessment was commenced and consisted of the following activities. Interviews were conducted with key departmental leadership. The hospital’s overall financial situation was discussed, the purpose of the assessment was reviewed, and the assessment process was outlined. An in-depth analysis of each department’s operations was initiated. These analyses included: interviews with key department stakeholders, a review of existing department management reports and statistics, on-site observations and staff skill-level assessments. On each nursing unit, on each shift, on-site observations were conducted to assess staff skills, patient needs and inter/intradepartmental workflow and operations.

These departmental assessments were conducted by a core team of productivity consultants who were assisted by experts in certain specialties. Upon completion of the departmental assessments, each department was benchmarked against high performing peers using the leading national labour-benchmarking database. After the benchmarking was completed, the consultants worked with department management to establish conservative and aggressive labour targets in each of the cost centers.

The consultants developed a standard departmental summary which included a description of current departmental operations, a quantitative baseline of current labour and volume statistics, the benchmarking of the department according to 25th, 50th, and 75th percentile peer performers, a list of pertinent findings and observations, the conservative and aggressive labour targets for that department, and corresponding recommendations to achieve the conservative and aggressive targets.

During the course of the assessment, a bi-weekly productivity report was installed. These reports extracted payroll data from the payroll data system and volume data from the patient charging system and admit/discharge and transfer system. The volume statistics or units of service (UOS) in the productivity report were the same as those used in the benchmarking survey.

RESULT: 1

The projected savings at the conservative targets equated to 71 FTEs or $2.1 million salary without benefits. The aggressive target equated to 166 FTEs or $5.8 million in salary without benefits.

RESULT: 2

The findings, recommendations, benchmarking data and conservative targets were presented to administration by the consultant/manager team. Administration then selected the immediate target for each cost center, equating to $2.2 million in projected savings. The selected goal hours per UOS were entered into the productivity report.
RESULT: 3
The project was completed prior to the four-month deadline. The projected savings at the conservative and aggressive targets were within the hospital’s overall strategic labour goals.

RESULT: 4
The hospital achieved their short-term goal of $2.2 million savings within four months and within 14 months had achieved a savings of $5.2 million. They continue to work toward the more aggressive targets. The hospital’s bottom line has improved significantly as a result of this effort as well as other strategic initiatives undertaken by hospital administration, and they are currently in the midst of a major expansion project.


Questions
1. What are the strategies used by Novia for their staffing assessment?
2. How does departmental assessment take place in Novia?
3. What are the goals achieved after implementing a Hospital wide staffing assessment?)
Bibliography

Hospital Operations Management


**Recommended Reading**


• Jones, P. and Lockwood, A., 2002. The management of hotel operations: (an innovative approach to the study of hotel management), Cengage Learning EMEA.
• Quan, K., 2006. The Everything New Nurse Book: Gain Confidence, Manage Your Schedule, And Deal With the Unexpected, Everything Books.
## Self Assessment Answers

### Chapter I
1. a  
2. d  
3. b  
4. a  
5. b  
6. a  
7. a  
8. a  
9. a  
10. a

### Chapter II
1. b  
2. d  
3. a  
4. a  
5. a  
6. b  
7. b  
8. b  
9. a  
10. d

### Chapter III
1. b  
2. a  
3. d  
4. a  
5. a  
6. d  
7. c  
8. d  
9. a  
10. d

### Chapter IV
1. a  
2. a  
3. b  
4. c  
5. d  
6. a  
7. b  
8. d  
9. a  
10. d
Chapter V
1. a
2. b
3. d
4. a
5. c
6. b
7. c
8. d
9. d
10. d

Chapter VI
1. d
2. b
3. c
4. a
5. d
6. d
7. b
8. a
9. a
10. d

Chapter VII
1. b
2. a
3. a
4. d
5. a
6. c
7. d
8. a
9. b
10. a

Chapter VIII
1. a
2. b
3. c
4. d
5. a
6. b
7. c
8. d
9. a
10. b