

Second Edition

Managing a Modern Hospital



Edited by
A. V. Srinivasan



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Response

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First published in 2008 by



Response Books

Business books from SAGE
B 1/I-1 Mohan Cooperative Industrial Area
Mathura Road, New Delhi 110 044, India
www.sagepub.in

SAGE Publications Inc
2455 Teller Road
Thousand Oaks, California 91320, USA

SAGE Publications Ltd
1 Oliver's Yard, 55 City Road
London EC1Y 1SP, United Kingdom

SAGE Publications Asia-Pacific Pte Ltd
33 Pekin Street
#02-01 Far East Square
Singapore 048763

Published by Vivek Mehra for SAGE Publications India Pvt Ltd, typeset in 10.5/13.5 pt ITC Bookman Light by Innovative Processors, New Delhi, and printed at Chaman Enterprises, New Delhi.

Library of Congress Cataloging-in-Publication Data

Managing a modern hospital/edited by A.V. Srinivasan. —2nd ed.
p. cm.

Includes bibliographical references and index.

1. Hospitals—India—Administration. I. Srinivasan, A.V., Dr.
[DNLM: 1. Hospital Administration—methods—India. 2. Certification—standards—India. 3. Medical Audit—organization & administration—India. WX 150 M2663 2008]

RA990.I37M36 362.110680954—dc22 2008 2008008930

ISBN: 978-0-7619-3629-9 (PB)

978-81-7829-793-4 (India-PB)

The SAGE Team: Sugata Ghosh, Neha Kohli and Anju Saxena

Cover design by Genesis

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Foreword

Health care is the world's largest industry. As such, India has to be prepared to meet the health care challenges of the new millennium.

Many modern disciplines have a long history but a short past. Health care management is one such discipline. Decades ago, the total body of literature on hospital administration was managed by a single doctor. Today, it is well recognised that the system requires a multi-pronged approach and total professionalisation to achieve quality and cost-effectiveness.

The past decade proved to be a difficult period for health care managers who were limited by the budgetary constraints in both public and private financing sectors, and an ever-increasing concern for the appropriate and optimum allocation of health care resources.

Hospitals today have to meet the needs of patients and the total focus has shifted to 'patient services' instead of only medical and surgical therapies.

The year 2000 may be characterised as the start of the 'decade of the administrator'. As we move into this era, the major problems that will be encountered and the issues that will have to be resolved will be clearly administrative in nature—the need for cost containment. The necessity of cost containment, while maintaining quality, is obvious. This concept highlights the society's medical resources and the concept of efficiency with cost.

There has been growing concern through this decade regarding access to hospitals and medical care for the 1 billion Indians who lack any form of health insurance. On the other hand, as the large majority of Indians are in villages, there is a need to provide them with access to quality care as is given to anyone in the cities. All these factors pose greater challenges for the modern hospital administrator.

This book is a well-planned and organised collection of essays. The selection offers a good balance of information on hospital structure and management methods which deal with general management principles, techniques of finance, operations and human resources that are of relevance today.

High quality of care is often equated with access to the newest technology, the most advanced medications and facilities, poised at the cutting edge of clinical care and research. This should go hand in hand with the efficient utilisation of health care resources by hospital professionals.

The Apollo Hospitals group, with its over one and a half decade of professionalised management, appreciates Dr A.V. Srinivasan's efforts to bring out this book for the benefit of a large number of beneficiaries.

Dr Prathap C. Reddy
Chairman
Apollo Hospitals Group and Apollo Hospital
Educational and Research Foundation

Acknowledgements

I am grateful for the resources and facilities provided by Apollo Hospital Educational and Research Foundation, Hyderabad.

I am grateful to Oxford University Press India for giving me permission for the extensive quotations on pp. 33–36 from Berman’s paper, ‘Health Care Expenditure in India’, published in *Health, Poverty and Development in India*.

I am grateful to the National Council of Applied Economic Research for giving me permission for the extensive quotations on pp. 36–38 from the paper, ‘Household Survey of Health Care Utilization and Expenditure’ published in their journal, *Margin*.

I have adapted selected findings from the report by Ernst & Young—*Healthcare: An Unprecedented Opportunity*, which appeared in the website of India Brand Equity Foundation, *Healthcare* page (www.ibef.org). I acknowledge this source for the text in Part 5 of Chapter 1.

AVS

Introduction

A quiet revolution is taking place in hospital administration in India. Private sector participation in health care is on the increase because entrepreneurs and technocrats see immense opportunity for earning in this sector. There is enough evidence to show that there is a willingness to pay for the services out of one's own savings or through organisational perquisites. It is no more the era of charity, either by a social organisation, or the government. This has earning potential, and there is a felt need to maximise the use of resources to build surplus to support the needy. The changing scenario of increasing demand, a variety of means to support the rendering of quality health care, and an entrepreneurial spirit, have given a boom to the health care industry in India. Many corporate hospitals and nursing homes have come up because large business houses have found this an area of opportunity; the supporting industries, such as equipments, instruments, software, indigenisation have multiplied and been strengthened. In general, everyone has found the need for sourcing of investment, resource optimisation, increasing productivity, maintaining high quality and service orientation to the customer-patient. Proper rate of return for investment, adopting high technology to hedge over competition, subtle marketing and application of analytical methods to improve efficiency are some of the management techniques which have been accepted by the industry consciously. Like in an engineering industry, hospital executives talk of marketing, promotion, retention of staff, payback period, quality improvement, and so on, which incidentally are typical management terminology. This has created the need for a new breed of hospital administrator, who is not necessarily a medical professional, but has studied management in depth. Until recently, the hospital administrator was, for most of the time, a medical professional who took to administration willingly, because of interest or for reasons of career growth, sometimes or rarely supported by a formal education in management.

Currently, there are very few schools in the country which are run on the lines of a management institution, where a high specialisation in hospital management is provided. These are the schools, where the entry qualification of the aspiring candidate can be any degree, including one in medicine; and which, like business schools, specialise in and offer a master's degree in hospital administration. The curriculum is oriented to running a hospital in the same way as an industrial organisation. Apart from classroom learning about management, these students learn about the activities in a hospital, through observation, project studies,

summer training and internship. Many times, these students are exposed to hospitals, for the first time perhaps, through these methods. Very few management books are available in the country to help them learn the basics of a hospital as an industrial organisation. *Managing a Modern Hospital* partially fills that void. The urge to publish this book came from my experience while establishing the Apollo Institute of Hospital Administration. For an entrepreneur-doctor, it provides the necessary management knowledge to create a hospital and run it as a viable economic unit. For an investor, this book provides enough information about some of the special features of the hospital as a business organisation. For an administrator in a hospital, it provides enough management material to ensure efficiency. For senior professionals, it provides the rationality for keeping *order* and *discipline* (Henry Fayol's *Principles of Management*) in any hospital, ensuring efficiency, productivity and creating a surplus for the use of the needy. This book will help the medical professional and administrator, irrespective of the ownership of the hospital—corporate, funded, charitable, religious, parochial or government, both large and small.

The selected topics cover a wide range of interest—from environmental issues to conventional management applied to managing a hospital. Every topic focusses on ensuring efficiency and order. The authors have shown the relevance of the use of computers, and where possible, taken a futuristic outlook. All chapters are practice-oriented and many are supported with case illustrations. Thus, this book will serve as a guide to help students of hospital management learn effectively and develop models for a given situation.

The opening chapter, 'Health Care in India—A Profile and the Future', contains five parts, and the first is an analysis of the official statistics on health care, leading to an estimate of number of hospital administrators that will be required in the country by the year 2001, to support the growing number of hospitals. The second and third parts present different vistas on the health care sector in India. It closes with normative and prescriptive long-term projections for the future, and an estimate of the size of the market. The author traces what has been taking place in the Indian health care sector, to prove its economic potential, the possibility of it becoming an engine for growth, and provides some suggestions for proactive decisions. This chapter contains the present developments in the country and sets the theme for private initiative to open up a segment which will bring health to more people and provide economic benefit to many more.

Dr (Col.) K.B. Subba Rao has given detailed information to an entrepreneur about the intricacies of creating a hospital, in his chapter, 'Planning a Modern Hospital'. He has used published standards to help aim at the ideal. Since many states do not impose stringent conditions to start and run a hospital, the condition

of many of them is abysmally low in India. His chapter will show the right way of doing it. In his chapter, Dr Srinivasan has indicated the utility, need and efficacy of small hospitals, which may be of the size of 30 to 100 beds. Dr Subba Rao's chapter helps to create such hospitals.

The chapter written by Dr S.F. Chandra Sekhar, 'Hospital Organisation Structure', is a blend of theoretical rationality and pragmatism. He traces various aspects of a structure which is applicable for any organisation, and applies them to four types of hospitals, classified by ownership—a large government-run hospital, a university teaching hospital, a trust hospital and a corporate hospital. He discusses their rationality and indicates the design for the future. He concludes that there is no one right structure that is appropriate for all hospitals, but the circumstances in which an organisation finds itself leads to its structure. He extols the current thinking regarding flat structures to increase efficiency, quicker decision-making and a close relationship.

From structure, we move on to finance in the next chapter, 'Financial Management for Hospitals' by Prof. P. Jangaiah. Many corporate and private-owned hospitals though technologically superior, are inefficient in managing finance. A proper management of finance will not only give a larger surplus, but will also help in cost control and minimisation, the gains of which can be passed on to the patients. He suggests sources for funding a hospital project, be it total creation or expansion, provides rationality for measuring its return, and works out various ratios to keep business operations in check. Many of the principles are supported with live data.

An important resource in a hospital is human resource. This should be particularly emphasised in the context of a hospital, since human relations plays an important role in providing a cure. In Chapter 5, 'Human Resource Management in Hospitals', Dr S.F. Chandra Sekhar applies the functions of general management—planning, organising, directing and controlling—to each one of the tasks of human resource management—procurement, development, compensation, integration, maintenance and separation—to give a holistic view. He gives a detailed working for manpower estimation and an illustrative instrument for selection. His theme is, 'from control perspective of personnel philosophy to commitment perspective of human resources philosophy'.

Classification of the materials used in any organisation will itself bring order and efficiency. This is known as Selective Management Principle. This classification can be made on different criteria. Mr V. Venkat Reddy has collected almost all classificatory systems in one place in the chapter, 'Hospital Materials Management'. He has illustrated each one of them, discussed when and how to use them, and where needed combined two systems in a matrix form for decision-making. For

the sake of clarity, he has provided a compare and contrast study between the materials managed in a hospital, and the ones in an engineering manufacturing organisation. Once the classificatory system is in operation, and the policies are stated, a computer programme will help automation by working out the inventory levels, order quantity and order date.

This is followed by two chapters which are case studies related to the same subject by Dr A.V. Srinivasan, 'Hospital Stores Organisation and Pharmacy' and 'Selective Systems of Materials Management in a Hospital—Case Illustration'. Making use of live data, he illustrates how pharmacy and hospital material stores are organised by structure and policy. All systems discussed by Mr V. Venkat Reddy are illustrated by item name and calculation in the second case study.

Mr K.P. Kumar has an interesting and novel approach to derive inventory policies for drugs in a hospital pharmacy. He extends the classificatory systems presented earlier, uses combinatorial analysis to reduce the classes, and put them into decision boxes, where the policy and the person in the hierarchy who is responsible for its implementation are clearly stated. The chapter titled 'MBASIC System for Effective Drug Management' by Kumar is a good example of decision-support system for drug inventory management. The availability of inventory management software, computer professionals and suitable hardware signal the application of this effective technique.

Customer Relations Management is now a hot topic in marketing and IT. Ms Pooja Elizabeth George has discussed it in easy language and applied to hospital management in the chapter, 'Customer Experience Management—A Marketing Initiative'. She has gone a step farther from image with and retention of customers of CRM to learning and adoption of their experience. Hospitals in private sector increasingly face competition and the customers (patients and referees) are getting more information from internet and are demanding. She has shown how to survive in such an environment by building competitive strength. She has supported the rationality with observation and a structure. This and the next chapter are valuable additions of latest knowledge to this edition.

A medical record is a compilation of pertinent facts about a patient's life and health history, including past and present illnesses and treatment given by health professionals contributing to the patient's care. It is the personal property of the patient and ensures continuity of treatment. The chapter, 'Medical Records', by Ms Mamta Edwards, covers the purpose, uses and value of medical records. The author indicates who is responsible for the construction, maintenance, administration of medical records and related legal issues. The formats in which the records are to be maintained, the types of data, and the retention principle

are also covered. This chapter concludes with future developments and computerisation of records.

Operations Research is a multidisciplinary approach for problem-solving and improving efficiency. It uses some of the proven mathematical models to a situation, whether it is simple or complex. This has been used very widely in industries and in Johns Hopkins Hospital, as early as the fifties. Its application has become easier now with the availability of powerful PCs and relevant software. Its utility is so high that it is a core subject in every management curriculum. Dr K.N. Gaur, in the chapter, 'Operations Research in Hospitals', traces the history of this approach to provide rationality, makes a listing of the major techniques included under this head, and describes how to build a model. In the second part of his paper, he shows how to apply selected Operations Research techniques to hospital situations. These are Allocation Methods, Queueing Models, Replacement Models and Network Techniques.

Dr Jeet Patwari has applied the concepts of expert system of decision science and developed a prototype for diagnosis. He has shown the intricacies of this powerful tool, which is difficult to apply. He has given an easy introduction to the concept, shown the steps of diagnosis by taking an example of a specific disease and takes the reader through a sequence of computer outputs of the procedure. This chapter, 'Computer Aided Diagnosis—Expert Systems', will show not only a method to develop computerized diagnosis using a database and computer but also create an interest and eagerness to build expert system models in health care. This chapter will be of special interest to IT developers and clinicians with research orientation.

A hospital produces a large amount of waste, some of them are pollutants and hazardous to health. In India, a large proportion of hospitals and beds are located in urban areas, where the civic conditions may not be at desirable level of efficiency. In the chapter titled 'Hospital Waste Management', Dr Homi Mehta presents readily implementable systems. He groups the wastes into different types, in terms of their end effect, and gives a classificatory scheme to segregate them, and eventually manage them in a manner so as to prevent unwanted after-effects. This chapter deals with the collection, disposal and treatment of waste. One aspect of waste management is prevention—how to minimise waste creation. This also forms a part of the chapter. Managing hospital wastes has not been getting the attention it requires from the civic authorities, and also from hospitals in the country. Dr Mehta presents a case study to illustrate the application of his scheme at the end of this chapter.

Dr U.V.N. Das looks at the need and advantage of keeping the patient comfortable, happy and contented. 'Patient Relations in Hospitals' is addressed

to all hospital staff, irrespective of their rank and location. He deals with each function in a hospital, and shows how a patient can be kept happy. This, and the following chapters are relevant and apt in today's world of consumerism.

While Dr Das touches upon creating a 'delighted customer (patient/ attendant)', Dr N. Rajaram and Ms Swati Pandey, in their well-researched paper on another aspect of consumerism, insist on the need and importance for 'Medical Audit and its Administration'. Starting from listing the acknowledged attributes of medical audit, they set up protocols for audit, identify its elements, discuss the audit types, methods and monitoring techniques. They discuss the constraints in auditing and difficulties in implementation. An informative part of the paper is their opinion survey of doctors on medical audit. They express the urgency, need and importance of this management process with the quotation: 'There is a time to end contemplation and a time to begin'.

The opening of the European Common Market to Indian industries brought along with it standardisation and third-party certification. Total Quality Management and Control of Variation were widely propagated among the industries—one more aspect of consumerism, 'the value for money'. One by one, many engineering industries in India went for ISO certification. Now it is the turn of the service industries, such as banking, education and hospitals, to control the variations in their output, and to attract customers through third-party certification of their quality of service. This will provide a competitive edge. A number of hospitals worked hard to obtain the ISO 9002 certification. K. Prabakar in the chapter 'ISO 9002 Certification for a Hospital—An illustrative Case', describes what this is all about, explains standard clauses in understandable terms to hospital administrators, and elucidates how Apollo Hospital obtained this certification. This is supported with a case illustration by Dr A.V. Srinivasan in the next chapter.

Compiling a book of this nature is quite a strenuous task, and is time-consuming. But I enjoyed it as I realised its value for the readers. The interest and continued support provided by Sangita Reddy and Dr Prathap C. Reddy enthused me in creating this collection. I wish to record my appreciation and thanks to them.

Archana Rajgopal, Ishrath Humairah, Kiranmaye Rao, Arundhati Mamidi and Dharma Tej, who were students of Apollo Institute of Hospital Administration, helped me a great deal in composing and editing the chapters. Their cheerfulness and willingness to share my work made the task a pleasure. Finally, Shaik Khasimbi, with her unlimited patience, supported me in this venture with secretarial assistance.

A.V. Srinivasan

Health Care in India— A Profile and the Future

1

A.V. Srinivasan

PART 1

HOSPITALS AND ADMINISTRATORS

Hospital Administrators—A New Class of Professionals

The hospitals can be classified into three categories based on the number of beds. *Category C* hospitals are located in many places for easy reach. They have 30 or fewer beds and provide primary care. These are clinics and nursing homes. *Category B* hospitals have 31–100 beds, provide some specialty-care, have few designated departments including some investigation facilities. They have arrangements to provide basic needs to patients and attendants. *Category A* hospitals have more than 100 beds, are multi-specialty, use better technology and attract superior qualified professionals.

In all categories, both public and private sector hospitals function. *Public sector hospitals* include those which are government managed, city administered and community supported. These typically provide service free of charge, operate on a budget, are controlled by external agencies (department officials) and are 'not for profit' earning. *Private sector hospitals* are run by trust, charity and religious organisations. Though they may charge for the services, the objective is 'not for profit' earning. In the private sector, there is one more class of hospitals that are large-sized, multi- or single-specialty and provide services that are relatively of higher technology. They are 'for profit' earning and run on the lines of corporate organisations. The private sector—for profit *Category A* and *B* hospitals—are management-oriented, have reached the critical-mass level in the resources to look for optimisation and are not controlled by external agencies. They have a felt-need for hospital administrators, who are trained in management principles but are not necessarily qualified medical professionals. This is a new class of

professionals coming out of management institutions such as Apollo Institute of Hospital Administration, Indian Institute of Hospital Management and Research, and Tata Institute of Social Sciences at an increasing rate. The author estimated the potential demand in India for such professionals—hospital administrators—as between 5,000 and 16,000 during this decade (Srinivasan 2000). Though more and more institutions are offering programmes to equip hospital administrators, the supply is falling short very much and the market has not matured enough to reach this level of demand. According to the author, various institutions in the country, which wholly or partially specialise in hospital administration, are hardly training 1,000 graduates in a year and most of them are employed in private sector.

MARKET DEVELOPMENT AND PRODUCT PROMOTION

Since this specific ‘managerial skill market’ does not yet exist at the critical-mass level, the industry should initiate a promotion programme to develop this market to its full potential among the health care and medical care institutions. Public sector hospitals are included in this consideration, though this change may occur only after a policy revision in the government and civic bodies, in terms of creating a position for them and acceptance of their role. Though the potential demand is expected to reach 16,000, the achievable demand will be determined by the size-composition of the hospitals in the future years, the promotion of this class of professionals in the health care industry, their acceptance by all private sector hospitals and their own professional contribution to efficient management of hospitals as economic and viable business organisations.

STRATEGIES FOR DEVELOPMENT

The industry is now in a situation for the development of this skill market. It has to make a careful analysis, formulate a suitable professional approach and evolve a plan based on marketing principles for new-product-promotion. The Category C hospitals will stand to gain a great deal, if they adopt the system of employing trained and qualified administrators to take care of the management aspects. Another strategy may be to create a development programme for the entrepreneur-manager, who may or may not have medical qualifications, to start this size hospital. Category C is an untapped market with high potential, which deserves nurturing and a long-term strategy for its development to be initiated by the industry. The gains will be more employment for graduates, efficient running of hospitals, the attendant lower cost to the patient, easy accessibility and advantages of market competition.

PART 2

THE PROFILE

SOME RATIOS

During the period 1981–2005, the number of hospitals and the number of beds increased at the rate of 5 and 2.6 per cent, per year, respectively. The growth of hospitals, beds and their number per lakh of persons are presented in Table 1.1 (Ministry of Health and Family Welfare, 2005).

Table 1.1 Number of All Hospitals and Beds with Ratio to One Lakh Persons

Year	Hospitals		Beds	
	Number of Hospitals	Number per Lakh Persons	Number of Beds	Number per Lakh Persons
1982	6,804	1.0	569,495	83
1986	7,474	1.0	656,850	88
1991	11,571	1.3	806,409	97
1996	15,097	1.6	870,161	93
2001	15,622	1.5	903,952	88
Annual Growth Rate per cent	5.0	–	2.6	–

The Private sector maintained 73 per cent of the total number of allopathic hospitals in the country, while they had only 38 per cent of the total number of beds. The distribution of hospitals and beds over the public and private sectors is presented in Table 1.2 (ibid: Table 8.02).

Table 1.2 Ownership of Hospitals and Beds in 2001

	Public Sector	Private Sector	Total	Per cent Private Sector
Hospitals	4,292	11,330	15,622	73
Beds	421,617	260,669	682,886	38

Urban areas command 66 per cent of hospitals and 73 per cent of beds in the country (ibid: Table 8.01). In India, health care is predominantly an urban phenomenon.

Table 1.3 Number of Allopathic Hospitals and Beds in Rural and Urban Areas in 2001

	<i>Rural</i>			<i>Urban</i>			<i>Total</i>
	<i>Number</i>	<i>Per cent to Total</i>	<i>Population Served by One</i>	<i>Number</i>	<i>Per cent to Total</i>	<i>Population Served by One</i>	
Hospitals	2,683	34	276,739	10,280	66	27,833	15,622
Beds	57,489	27	12,915	497,185	73	575	682,886

This has given rise to the National Rural Health Mission, which was launched by Government of India in 2005 (<http://mohfw.nic.in/NRHM.htm>). Even among the constituent states in the country, the availability of health care varies widely. Till the year 2000, about 51 per cent of the total number of hospitals were located in three states: Maharashtra, Kerala and Andhra Pradesh (Srinivasan 2000).

The population served per hospital and per bed in urban and rural areas in the year 2001 (latest available statistics) is given in Table 1.3 (Ministry of Health and Family Welfare, 2005). The number of doctors and nurses registered with Medical Council of India and with Nursing Council of India are presented along with nurse-doctor ratio and international rates in Table 1.4. (Ministry of Health and Family Welfare, 2005: Table 1.09)

Table 1.4 Registered Doctors and Nurses per One Lakh Persons

<i>Year</i>	<i>Allopathic Doctors with Medical Council of India</i>		<i>Nurses with Nursing Council of India (Diploma/Certificate)</i>		<i>Nurse to Doctor Ratio</i>
	<i>Number</i>	<i>Number per Lakh Persons</i>	<i>Number</i>	<i>Number per Lakh Persons</i>	
1981	2,687	39		21	0.54
1986	3,254	43	8,208	27	0.66
1991	3,936	47	10,753	40	0.85
1996	4,776	51	11,431		
2001	5,756	56	13,331		
			(1998)		
2005	7,675	70			
Less Developed Country*		14		22	
Developing Country*		84		96	
Developed Country*		252		742	

Note: * Comparative worldwide figures are sourced from Park, 1997.

The number of doctors per lakh of population was increasing at a sluggish rate and is lower than the annual population growth rate of 1.96 per cent per year. It may be noted that the ratio of nurses to doctors remained less than one. In the second part of Table 1.4, comparative worldwide figures are presented.

CAUSE OF DEATH

The cause of death among children, adults and old people are presented in Table 1.5 for selected killer diseases (Ministry of Health and Family Welfare, 2005: Table 11.03). It can be observed that there is a predictable pattern. Old people die of asthma, bronchitis and paralysis. Adults die of tuberculosis (TB) of the lungs, cancer and vehicular accidents. Children die of pneumonia, premature birth and gastroenteritis. Adults and old people have equal chance of death caused by heart attack. The number of deaths due to anaemia, is about the same for the three age groups.

Table 1.5 Percentage Distribution of Deaths by Ten Killer Diseases (1998)

<i>Disease</i>	<i>Up to 14 Years Age</i>	<i>15 to 59 Years Age</i>	<i>60+ Years Age</i>
Asthma, Bronchitis	2.3	14.8	82.9
Heart Attack	1.1	38.3	60.7
Pneumonia	85.3	7.1	7.6
TB of Lungs	3.6	64.0	32.4
Prematurity	100		
Cancer	4.0	50.7	45.5
Anaemia	28.4	23.7	48.0
Paralysis	1.9	20.1	77.9
Vehicular Accident	15.0	71.1	13.9
Suicide	2.5	86.1	11.4

DISTRIBUTION BY AGE

Persons over the age of 59 are less productive and more prone to diseases, seeking medical attention. Generally, this segment of the population is not fully capable of paying for the services received, unlike adults (15 to 59 years of age) who are likely to be engaged in productive occupation. Another way of looking at this situation is that there will be as many as 75 million people seeking medical attention by the end of this decade, which may have to be supported by the state. The positive side is that though there will be an additional 53 million persons, many of them will come into the fold of paying-patients in the near future (Srinivasan 2000). India is at a crossroads now: the increasing number of

productive adults demanding medical attention may have to be supported by corporate employers with the executive privilege of good health, opening-up of new kind of business opportunities in the form of medical insurance, hospital cooperatives, and hospitals and corporates joining hands for mutual benefit necessitating public policy in this area. The coming decade will bring into India a variety of innovations and initiatives in medical care.

EMERGING PROFILE

There is an uneven distribution of hospitals and beds between urban and rural areas. Private hospitals may consider effective and innovative outreach programmes to serve the rural areas, at least in the hinterland. This could give rise to a novel ripple effect, multitier operation and feeder systems. One-third of the total number of hospitals and beds in the rural areas are in one state, Kerala. Maharashtra and Gujarat account for over half the hospitals and one-fourth of the beds in urban areas. An intensive study of these three states will provide some lessons in expanding into the hinterland.

Smaller states have a better population-to-bed ratio. This may be because of administrative convenience or the economy of scale may be favourable in their case. An extension of this finding can be applied to large states, each of which has several regions. Intensive health care development in each region should result in favourable population-to-bed ratio. States may consider incentive packages to attract private sector hospitals in these regions.

Considering India as a developing country, the number of doctors per lakh of population is satisfactory. However, considering the rate of absorption of medical technology in this country, this ratio—48—is quite low, compared to 251 in developed countries. The situation with regard to nurses is still worse. There is not even one nurse for every doctor. The number of nurses per lakh of population—45—is no where near the average for a developing country. It is a well-known fact that nurses play a very important role—professional and emotional—in the recovery of patients. They can be quickly trained and the expenses incurred are cost-effective. From the social angle, this is a way to provide dignified employment for educated women, particularly belonging to lower economic class. A state policy, supported by social and health care organisations, is needed to create the right balance between nurses and doctors.

The disease pattern among different age groups suggests the feasibility of specialised services and an organisational strategy to create a niche market. The increasing number of old age patients indicates the need for a state policy and a new viable product—home health care. The health care industry can turn this into an opportunity by devising long-term financial and insurance schemes.

PART 3**HEALTH CARE SECTOR—FINANCIALS****ECONOMIC ENVIRONMENT**

The expenditure by Government of India on medical care and health services has been increasing over the years. The increase over the years is steady, from Rs 55 per capita in 1985–86 to Rs 83 in 1989–90 (Ministry of Health and Family Welfare 2005). These figures will come down when they are discounted for inflation and computed to a standard base. The increase is also larger than the annual population growth, which is 1.96 per cent. However, one should realise that a major part of the budget will be spent on salaries, leaving only a small amount for health care. An interesting feature is that expenditure, as percentage of the total budget, has been steadily falling. One interpretation of this situation may be that the annual expenditure is more for maintenance of assets and increase in salaries, than for expansion and new technologies. This indicates a state of stagnancy in the public sector. Hence, this is an opportunity for non-governmental agencies and the private sector to intervene to their own advantage.

The household sector Gross Domestic Saving as a per cent of Gross Domestic Product steadily increased from 6.2 per cent in 1951 to 23.5 per cent in 2004 (<http://indiabudget.nic.in>: Table 15). This is an indicator of the opportunity for private sector initiative in health care activities. A conducive economic environment exists for this industry to grow for the benefit of both supplier and buyer in the market, provided organised efforts are made, planned and channelled by the industry.

Based on the Pareto distribution of household consumption expenditure, the author has estimated the size of the affluent class of people in 2005 to be 1,100 lakh persons. This is the floor value for the size of the potential market for private sector initiative in the health care sector. A part of the next 10 per cent of the households will add to this market (Srinivasan 2000).

CONCLUSIONS FROM HEALTH EXPENDITURE

Over the years, the expenditure on medical care, at current prices, has been increasing. However, it remained a constant proportion of the budget. This gives an impression that the increase has been more for the maintenance expense of the system and only a marginal amount has been spent for development and innovation. It also shows that it never received any additional thrust in policies

and spending. The increased savings in absolute value, again at current prices, perhaps provided the thrust for the private sector initiative in the health care sector. Based on these analyses, a strategy for market development by private sector is stipulated in the next paragraph.

STRATEGY FOR MARKET DEVELOPMENT IN PRIVATE SECTOR

If the per capita consumption expenditure is an indicator of 'willingness to spend and affordable', the potential market for private sector operations in the health care market would be in the states of: Himachal Pradesh, Maharashtra, Punjab, Kerala, Gujarat, Assam and Haryana (Srinivasan 2000: 30). A rational market development strategy would be to set up health care entities in the four metros, the next six largest market-towns and the affluent cities of the states mentioned. The data regarding comparative picture of health care expenditure among the Asian countries shows that (a) there is willingness among Indians to spend on health care, and (b) through an innovative marketing strategy of backward flow, this service can be exported to other countries in Asia.

PART 4

TRENDS AND PREDICTIONS

HEALTH CARE EXPENDITURE

Berman (1996: Chapter 14), in 'Health Care Expenditure in India', states: 'At the most aggregate level all analysts agree that non-government sources of health expenditure far exceed the spending levels of government sources and that by far the largest part of non-government spending is the out of pocket expenditure of individuals and households.' The relative size of the different sources of funds for national health expenditure, as estimated by Berman, is presented in Table 1.6.

Table 1.6 Source of Funds for National Health Expenditure

<i>Source</i>	<i>Per cent</i>
Household	45
Private Sector	21
State Government	21
Central Government	10
Local Bodies	3

He supports this statement by referring to the small-scale household surveys report, where even poor households were found to be spending between 5 per cent and 10 per cent of their incomes on health. Private health expenditure is found to be relatively high as a proportion of income. Berman (1996: Chapter 14) interprets this phenomenon thus:

Within these high levels of spending, ambulatory illness care probably accounts for the largest part of the total, and expenditure on hospital services a smaller part. This aspect of the composition of household health spending reflects the structure of service provision in India, where approximately two-thirds of the hospital beds are in public sector facilities. In contrast, more than two-thirds of the qualified allopathic ambulatory care providers practise privately, along with an unknown, but probably even a larger number of other ambulatory care providers of other systems of medicine of lower levels of qualification....

It is also likely that this source of health expenditure has been growing more rapidly than government spending.

This finding has an interesting implication for private sector initiative in the field of health care in India, particularly when read with another statement in the same paper: 'A recent survey of the health benefits provided by private firms reported the high figure of Rs 1,339 per employee for the firms surveyed.'

POTENTIAL MARKET FOR HEALTH CARE IN INDIA

A prominent and potentially rich market for health care in India is the organised sector of corporates and affluent individuals. Berman explains the high level of private health expenditure by considering both supply and demand factors:

India's private health expenditure is unusual in its variety and scope. From frontline providers in rural villages to large hospitals, several systems of medicine coexist, with separate health care providers, facilities, and medical colleges. Studies show that many of these providers practise an 'eclectic' medicine, combining therapies from more than one system, and usually including some elements of allopathy. Studies in other countries have suggested that, in medical care, supply can create its own demand. Thus, it seems plausible that the existence of multiple recognised systems of medicine would substantially increase the amount of private care provided, and consequently private health expenditures. This situation is further stimulated by the almost complete absence of enforced regulation determining entry into medical practice, or quality control to affect the ability of unqualified providers to stay in practice....

India's poor health status might be expected to account at least in part for a high level of health care use and spending. In addition, micro-level studies of health care utilisation and expenditure suggest that Indians of all social classes are relatively heavy users of health care (Berman, 1996: Chapter 14).

To support this argument, Berman compares the data of Duggal and Amin's study of Jalgaon district, with a similar study in West Java in Indonesia:

The differences are suggestive. Illness incidence rates varied between the two country samples and expenditure classes. But the Indian respondents showed a higher propensity to use treatments, and spent much more per episode than the Indonesians. The result is significantly higher out of pocket spending in India, despite, in some cases, lower rates of illness reported. From my experience in both countries (India and Indonesia) I would suggest that these differences are not simply a function of greater health needs in India, but also reflect both the greater availability and access to private health care in India—the large number of practitioners of 'eclectic' treatment—as well as the greater propensity of Indians to seek formal health care.... (ibid.)

AGENDA FOR THE FUTURE

Some of Berman's other observations on 'Implications and Agenda for the Future' are:

1. India spends a higher proportion of its income on both government and non-government health care in comparison with other countries in the region.
2. In terms of spending better, one often hears the laments of poor motivation and management in the public sector. Certainly the efficiency and quality of public services could be improved by better management and administration.
3. While the national health policy laudably proposes specific targets for public services to meet, it gives only cursory attention to the development of the private health sector.
4. Public resources have not been sufficient to meet all of government's stated goals in health care, and they are not likely to increase immensely in the coming years.

The lack of basic information on India's private health sector is striking.

A system as a whole must be the development of better information on the private health care sector, ranging from the itinerant rural drug seller, to the

'five star' urban hospital. This information should include costs and expenditures, utilisation patterns, and descriptions of the size, composition and practices of different types of providers (Berman, 1996: Chapter 14).

NCAER SURVEY OF HEALTH CARE EXPENDITURE

The National Council of Applied Economic Research (NCAER) conducted the Household Survey of Health Care Utilisation and Expenditure in 1993. It covered all the states and union territories of India. The sample consisted 18,693 households spread over both rural and urban areas of the country. The following selective findings are taken from this report (Ramamani 1994:865–74).

Morbidity profile

In the case of the urban 60+ age group, the prevalence rates are as high as 220 and 216 per thousand for the male and female population, respectively. The high prevalence of illness among the elderly population has a very significant policy implication. It indicates that, with an ageing population, the disease burden on the society and state is going to increase in the coming years.

Nature of illness

With the rise in the economic status, the diseases of poverty and malnutrition are replaced by the diseases normally prevalent among the affluent in the Western world.

The reported hospitalisation cases (per thousand population) are 7.1 for the rural areas and 9.7 for the urban areas. For nearly 12 per cent of the illness episodes in the rural areas and about 8 per cent of the illness episodes in the urban areas, no treatment has been sought. The higher percentage of untreated illness in the rural areas probably reflects poor physical and financial access to health care in the rural parts of the country. The most important reason for not seeking any treatment turns out to be that the illness is not considered serious enough.

The dependence on private health facilities is fairly high for the business class, the salary earners/professionals of the urban areas and for the cultivators in the rural areas. The average distance travelled works out to 5.9 km for the rural areas and 2.2 km for the urban areas. The comparative data for urban and rural areas on the utilisation of health care services are shown in Table 1.7.

Table 1.7 Utilisation of Out-patient Health Care Services

<i>Rural</i>		<i>Urban</i>	
<i>Source of Treatment</i>	<i>Per cent</i>	<i>Source of Treatment</i>	<i>Per cent</i>
Government Hospital	17.4	Government Hospital	25.5
Primary/Community Health Centres	20.4	Government/Municipal Dispensaries	8.5
Auxiliary Nurse, Midwife, Primary Health Worker, Anganwadi	3.9	Private Hospital/Nursing Home	10.2
Private Hospital/Nursing Home	5.6	Private Practitioner	48.6
Private Practitioner	46.3	Charitable Trust	1.0
Charitable Trust	0.8	Medical Shop	5.2
Medical Shop	3.1	Faith Healer	0.2
Faith Healer	0.5	Home Remedy	0.8
Home Remedy	2.0		
All	100	All	100

VISION 2020

The Technology Information Forecasting Assessment Council (TIFAC) of the Department of Science and Technology of the Government of India constituted panels in 1994 to make long-term predictions for the year 2020 for several industrial sectors in India. One of the sectors was health care. Among other methods, the panel applied the Delphi technique to make this prediction. This was released as a document in the series VISION 2020 (Department of Science and Technology 1996). Selected predictions from this report are cited here, followed with a Desired Future Scenario, as interpreted by the author.

1. PREDICTION BY TIFAC

Among the infectious diseases, tuberculosis, AIDS, vector-borne diseases and diarrhoea will receive the highest priority in health care in the next 25 years. However, their incidence level will decline perceptibly. Among the non-communicable diseases, ischaemic heart diseases, strokes and female cancer will be the leading diseases attracting high priority. There will be an increase in accidents, suicides and homicides. Emotional and psychiatric problems may cause an increased disease burden in the future.

Desired future scenario*

Health care institutions will be geared to absorb this trend and demand. They will work closely with schools and social organisations for the prevention and early diagnosis of infectious diseases. Government and health care institutions will complement each other in working towards this goal.

2. PREDICTION BY TIFAC

Indigenous systems of medicine will help in identifying and synthesising new drugs, and will be useful in the treatment of chronic diseases. Clinical trials of new medicines and technologies developed overseas will be undertaken in India. Production of imaging equipment and others, hepatitis and anti-rabies vaccines and diagnostic kits will receive attention.

Desired future scenario*

Health care institutions will turn this into a business opportunity. A new kind of relationship will develop between health care institutions and drug research institutions, both Indian and foreign. This may turn into a backward integration opportunity for a Health Care Institution.

3. PREDICTION BY TIFAC

The status of the existing technologies to *prevent, diagnose and treat* the top ten diseases considered to be of high priority by the year 2000 are far from satisfactory for the following diseases (the diseases are listed in order of importance):

- **Technologies to *prevent***
AIDS, hepatitis, vector-borne diseases, neuro-psychiatric diseases, female cancer, cardiovascular diseases, diarrhoea, tuberculosis.
- **Technologies to *diagnose***
AIDS, hepatitis, neuro-psychiatric diseases.
- **Technologies to *treat***
AIDS, hepatitis, neuro-psychiatric diseases, female cancer.

Desired future scenario*

This is an opportunity for the health care institutions to bring appropriate technologies and adopt them to take care of this situation. Research institutions,

* Author's interpretation

pharmaceutical R&D units, and health care institutions will use the consortium approach with interested organisations outside the country, to achieve this goal.

4. PREDICTION BY TIFAC

Alternative systems of medicine will thrive and displace allopathy and modern medicine.

Desired future scenario *

Health care institutions will turn this threat into a business opportunity, which will result in further growth of alternative systems of medicine and this may result in a logical strategy to manage IPR regulations.

5. PREDICTION BY TIFAC

Medical professionals will get together to start cooperatives of clinics and nursing homes, with medical care receivers as participating members. The growth of nursing homes will be much higher than the growth of large-sized, multispecialty hospitals.

Desired future scenario *

Large and well-established health care institutions will use this opportunity and introduce institution-based services: a new relationship will be built between them, and the nursing homes and cooperatives. Information technology applications, particularly network communication, will be exploited effectively.

6. PREDICTION BY TIFAC

Two fast-growing segments will be health care institutions set up by groups of medical professional-entrepreneurs and large Indian industrial houses participating in the starting of hospitals as joint ventures. Hospitals will be run as commercial organisations giving importance to planning, cost-control, quality assurance, management efficiency and customer satisfaction.

Desired future scenario *

A new generation of hospital administrators, trained in management techniques and principles; project consultants who could construct hospitals on a turnkey

* Author's interpretation

basis; and non-banking financial institutions specialising in hospital creation and management, will spring up in the country.

7. PREDICTION BY TIFAC

Integrated health care networks will function widely and effectively, and bring health care at an affordable price to a large number of the population.

Desired future scenario*

This will change the mindset of medical professionals and institutions. The social mores of medical professionals and patients will change to a positive attitude. This will open up new avenues of employment and secured incomes. The old adage, 'prevention is better than cure', will be the new slogan adopted by health care institutions. Health care institutions and social organisations (NGOs) will provide education and training on a large scale, particularly in rural areas and urban slums, on preventive measures.

PART 5

TASK AHEAD

HOSPITAL ADMINISTRATOR

The private sector—corporate, trust or of the religious kind—need to be administered rationally and scientifically to be self-supporting, if not surplus producing. This can be achieved only if they apply management principles for planning, resource allocation, investment analysis, pricing and cost control in hospitals. They should behave like corporate bodies and be managed efficiently. In order to do this the country needs a special cadre of professionals trained in management principles applied to hospital administration. This specific 'managerial skill market' does not exist at a critical mass level in the country. Hence, the health care industry should initiate a well designed promotion programme to develop this market to its full potential. Government hospitals may soon follow them, once policy revision takes place within government and

* Author's interpretation

civic bodies. This is a totally untapped market, which deserves nurturing and developed through a long-term strategy. The gains will be: more employment for graduates, efficient running of hospitals, lower cost to the patient, easy accessibility and the advantages of market competition.

URBAN ORIENTATION

The uneven distribution of hospitals and beds between urban and rural areas needs to be attended to. Private hospitals could consider effective and innovative programmes to serve the rural areas, at least in their hinterland, which may give rise to a novel ripple effect leading to multi-tier operations and feeder systems. An intensive study of the states of Maharashtra, Gujarat and West Bengal could provide some clues in expanding into the hinterland. Smaller states have a better population-to-bed ratio. Applying this principle to regions in large states, health care development in each region may be brought about by attracting private sector hospitals to these regions.

DOCTORS AND NURSES

Considering the rate of absorption of medical technology by India, this ratio of number of doctors per lakh persons is quite low compared to that in developed countries. The situation with regard to nurses is still worse. There is not even one nurse for every doctor. Nurses play an important role, both professional and emotional, in the recovery of a patient. They can be trained in reasonably short time and the expenses incurred are cost-effective. From the social angle, this is an opportunity to provide dignified employment to educated women. A state policy supported by social and health care organisations is needed to create the right balance between nurses and doctors.

NICHE MARKETS

The disease pattern among different age groups suggests a possibility to develop several niche markets and offer specialised services. The increasing number of old-age patients indicates the need for a state policy to provide health support to them. The health care industry can turn this into an opportunity by devising long-term financial, social and insurance schemes.

MARKET SIZE

The potential for private sector operations in the health care market is high in several states. A rational strategy for development of health care market could be implemented in the four metros, the next six large market towns and other affluent cities in the country. There is willingness among Indians to spend for health care. Through an innovative marketing strategy to create backward flow, this service can be exported to other countries in Asia.

The clientele for corporate hospitals will generally be at the upper end of income distribution, generally referred as 'The Very Rich' and 'The Consuming Class' and a fraction of 'Climbers'. The author estimates the potential market for health care in India to be around Rs 14,000 crore by 2010. This will still be an underestimation, since executive privileges are becoming more and more generous; the willingness to pay for a cure, as an attitude, is getting stronger; many medical insurance products are being introduced in the market; and the growth of corporate hospitals is an increasing trend leading to competition.

LAST WORD

The Indian health care sector has high economic potential and is at a turning point for growth. There is every possibility of it becoming an economic growth engine. In the last 10 years, a great deal of development has taken place in the health care industry in education, technology, availability of treatment, marketing, organisational structure, private initiative and policy changes.

To use terminology from physics, health care industry has moved out of inertia and gathered momentum, developing in all spheres at an accelerated phase. However, from a sociological point of view and on a comparative scale, the expenditure for treatment remains unaffordable and high for the common man. The large rural population continues to be deprived of the advances and the low quality of the clinical processes are not unquestionable.

In order to get a better idea on the latest developments in the health care sector—policy initiatives by Government of India on health care; telemedicine applications in the country; status of medical tourism; Joint ventures and business initiatives by Indian business leaders; projections on various resources used; Spending pattern of the clientele; and size of the health care market—the reader may look into, 'Healthcare, An Unprecedented Opportunity', on the website of India Brand Equity Foundation (www.ibef.org).

ANNEXURE

Health Care—Current State

<i>Attribute</i>	<i>1991</i>	<i>2001</i>	<i>2005/6</i>
Population (lakh)	8,464	10,286	
Annual Growth Rate (%)	2.07	1.96	
Urban to Total Population (%)	25.70	27.82	
Age Distribution (%)			
0–14	37.8	35.4	
15–59	55.5	56.9	
60+	06.7	07.7	
Expectation: Life at Birth (years)	58.6		64.8
Number of Medical Colleges	146		242
Number of Dental Colleges	57		205
Number of Colleges of Indian System of Medicine and Homeopathy		431 (2003)	440 (2005)
Number of Government Allopathic Hospitals	6,804 (1982)		7,008 (2005)
Number of beds in Government Allopathic Hospitals	569,495 (1982)		469,672 (2005)
Number of Community Health Centres	2,070		3222 (2005)
Number of Allopathic Doctors Registered with MCI	3,936		7,675 (2005)
Number of Doctors per Lakh Population	47		70 (2005)
Number of Dentists Registered with Dental Council of India	10,751		55,344 (2005)
Number of Dentists per Lakh Population	1.3		4.5 (2004)
Number of Registered General Nursing Midwife with Nursing Council of India	340,208		865,135 (2004)
Per capita Expenditure on Health and Family Welfare, Water Supply and Sanitation (Rs)	83.03 (1990)		

Source: Key Health Indicators, Central Bureau of Health Intelligence, Government of India; <http://www.cbhidghs.nic.in>.

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Planning a Modern Hospital **2**

K.B. Subba Rao

Planning a New Hospital

Planning is the most important aspect of establishing a hospital. If the plan is good all may go well. If the plan is not thought out carefully the work may never be completed. Planning a new hospital starts with setting goals for the hospital, without which the organisation cannot have a definite direction or focus. This is followed by the study of the external environment of the organisation, and the internal and external resources with which the goals set are to be achieved. This exercise facilitates selection of the means by which to achieve goals within a reasonable cost. It is much more than planning to buy a piece of equipment here or arrange for recruitment of a specific doctor there. In India, as all over the world, hospitals are key health care delivery institutions. At the time of independence, the country had 1,13,000 beds. The bed-to-population ratio was 0.24 beds per 1,000 population, which was grossly inadequate. There is one bed per 1,447 population in India now, while it is one to 171 in the USA. This inadequacy in India has to be rectified soon to provide health for all. The Government alone cannot meet this gap. A significant role for voluntary health institutions, private nursing homes and private hospitals has to be envisaged. Thus, there is ample scope for an entrepreneur to establish a private hospital. Dr Prathap C. Reddy, the pioneer in corporate hospitals in India, has shown the way by establishing the first corporate hospital in Chennai in 1983. Since then, a large number of corporate hospitals have come up and these well-managed institutions are flourishing. Modern management concepts and techniques are essential for their success, and planning is the first and foremost factor.

In planning, construction, equipping and providing services in a hospital, the patient is the central focus, and all facilities should be provided with a view towards best patient care. The hospital management should be cost-conscious and generate as much financing as possible for running the institution. While providing quality care, the institution should not only meet operational costs, but also generate surplus for expansion and adequate returns for the investors.

Planning a new hospital, or adding facilities in an existing one, starts with setting goals for the hospital as a whole. Without goals, the organisation cannot have direction. The hospital planning exercise covers the study of the section of the population it proposes to serve, the geographical area to be covered, variety of services to be provided, quality standards to be met, equipment to be provided and manpower to be recruited and trained. While planning, these factors should be taken into account. The steps involved in planning the facility are considered serially.

PROMOTER'S OBJECTIVE

The promoter needs to determine the objectives of the project with clarity. These include the type of services to be provided:

- Secondary care/tertiary care.
- Sophistication in the building plan and equipments.
- The investments and returns the promoter is looking for.

To rationally determine the above, a feasibility report based on a market survey is essential.

Feasibility report

The study should clearly bring out the following:

- The potential of the planned institution.
- The medical facilities that are lacking and need to be made available.
- The migration pattern of patients.
- Competition from existing hospitals and new entrants.

Based on observations and findings from the market survey, a *detailed project report* should be prepared, with the following objectives:

- To recommend medical facilities in terms of departments and equipments.
- To determine manpower requirements.
- To project financial performance for the first 10 years of operation.
- To arrive at an implementation schedule for completing the project.
- To study the scope for future expansion of facilities.

The report should realistically discuss 'operational' feasibility, financial viability and the medical departments in heavy demand in thrust areas. It should also

analyse the location of the site, the hospital design, manpower planning, project cost, financial analysis, sensitivity analysis and implementation.

LOCATION

The following characteristics should be considered:

- The land size should be adequate for housing the institution and also have ample provision for future expansion. Areas ideal for various bed capacities should be indicated.
- Good infrastructural facilities, such as water, power, transportation and communication should be available.
- Proximity of the location to the different segments of the potential market is an important factor.

MARKET SURVEY

To determine the feasibility of the project, the first consideration in the survey is to study the character, needs and possibilities of the community which the hospital is going to serve. The existing medical facilities in the region should be studied in terms of:

- Quality and number of hospitals.
- The areas of specialisation—doctors/specialists/paramedical staff.
- Level of technology, latest medical equipment.
- Patient flow, disease pattern.
- Costs of investigation and treatment.

Public opinion regarding the existing facilities, the need for more departments, and the response from the medical community are vital to the study. It is on the basis of this information that a decision can be taken about where a hospital should be built and its type and size. Is the community a wealthy one; or is it made up of moderate wage earners; are the industrial workers indigent—these are the deciding factors in determining the kind of hospital should be planned for. For example, if the community largely constitutes wealthy individuals, one can plan to build a luxurious hospital, with deluxe rooms and sophisticated diagnostic and therapeutic equipment; if it is largely meant for indigent patients, a non-profit or charitable hospital is needed.

Apart from levels of income, characteristics such as occupation, age distribution, and so on must be studied. These determine the amount and kind of hospital

facilities the new location will need, and the amount the residents are willing to pay. For example, if there is a large population of senior citizens, more geriatric services will have to be provided. If it is an accident-prone industrial area, then the trauma care department needs to be strengthened. The general attitude of the people to the clinical services is equally important.

The next phase of the survey is to study all the existing hospital facilities on an area-wise basis. This study should be comprehensive, covering both short- and long-term needs. The most important part of the study is an inventory of the facilities, beds and services of every hospital. It should cover the following areas:

- Bed capacity of the institution
- Physical condition of facilities
- Hospital occupancy
- Bed ratio
- Volume and kind of hospital services provided
- Quality of facilities and services

The study should include an assessment of the required staff and services—doctors, nurses and other professional staff required for the proposed hospital, and the hospital's ability to initially provide them and subsequently support them.

Finding and retaining competent specialist doctors and nurses in adequate numbers is not an easy job at the best of times. This difficulty is particularly acute in towns and remote areas. It is not unusual to find hospitals, which otherwise have all facilities, but are unable to provide good service to the community due to lack of staff (though some of them may make temporary arrangements).

How many and what kind of specialists are required for a hospital to provide adequate care for the community's needs has to be carefully analysed and decided upon. It is generally agreed that in addition to traditional services, such as internal medicine, general surgery, paediatrics, obstetrics and gynaecology, specialists in the disciplines of eye, ear-nose-throat (ENT), dermatology, radiology, pathology, and so on, may also need to be provided. Not all small- and medium-size hospitals can support specialty and superspecialty services.

The main exercise is to acquire the services of trained nurses and other professional staff. Getting trained nurses is a serious problem in our country. Well-qualified laboratory technicians and pharmacists are freely available. However, the same is not true of physical therapists and specialised technologists.

AVERAGE COSTS

The cost computed per bed depends on various factors, such as the cost of the land in a particular place, the wage and salary rate, accessibility of materials, and so on. Similarly, sophisticated equipment and expensive construction material will significantly enhance the investment. However, indicative average costs for a typical hospital expressed as 'per bed', keeping the current level of costs, would approximately be:

- Primary care: Rs 8 lakh.
- Secondary care: Rs 12 lakh.
- Tertiary care: Rs 20 lakh.

The above are only reference figures, the actual costs will be subject to a high variation depending on a variety of considerations.

CONSIDERATIONS

Health care is essentially a service industry. Patients will look for quality service and expect compassion. These intangible factors must be manifested and be obvious at the planning stage itself.

- The physical setting of the hospital must connote a clean and cheerful environment.
- The consultants and staff in a hospital are its biggest assets. They are responsible for providing quality service to the patients.
- Training of the staff is the most important criterion and must be emphasised from the outset.

FINANCIAL PLANNING

Modern hospitals are cost-intensive. Financial planning is crucial. The parameters used by financial institutions for sanctioning term loans are well known. But seeking their approval needs a lot of documentation, and generally takes three months to one year. Providing incomplete information will result in delay, affect the cash flow for the project, and hamper the progress. Financial needs should be anticipated and planned for. This covers both operational needs as well as funds for acquisition of capital items. One should be ready with more than one projection, such as, what happens if,

- Income is lower by, say, 10 per cent.
- Expenses are higher by, say, 1 per cent.
- Bank sanctions loans for a smaller amount.

An exercise providing financial results under changing assumptions and their evaluation, called 'sensitivity analysis', should be carried out.

SOURCES OF FUNDS

The requirement of funds needs to be considered as under:

Long-term funds

Generally these long-term funds are not taken out of the business. Once invested, these are traditionally used for acquiring long-term assets and for the provision of working capital. Adequate provision for long-term funds must be made during the initial years when acquisition of major assets takes place, and it takes two to three years to reach a break-even level of income.

The sources of long-term funds are:

- Promoters' contribution.
- Operating profit plus depreciation.
- Long-term loans.
- Leasing companies.

Short-term funds

These funds are used to meet current expenses such as payments to staff, suppliers, for services, and for items of working capital.

Sources for acquiring finance

- Promoters who provide capital funds.
- State and local government authorities who give substantial grants.
- Banks and financial institutions, such as Industrial Development Bank of India (IDBI), ICICI Bank, for temporary and long-term loans.
- Disinvestment of non-performing assets.

Allocation of funds for conflicting demands needs careful planning and ingenuity, as optimum utilisation accelerates the project, and sub-optimum use

may stall the project. Assistance from a financial consultant is necessary for proper planning, management and control of finances.

Some Important Considerations

A hospital is a crucial organisation and stands unique and incomparable to any other organisation. It is unique and special because it deals with life and death. Patients are not just attracted by high-technology. The demand now is for devoted doctors, prompt and accurate diagnostic facilities, quality nursing and a good support service. Some of the considerations while planning a hospital are discussed in this section.

PROVISION FOR DISASTERS

In locations where there is a history of hurricanes, tornadoes, floods, earthquakes, or other natural disasters, planning and design should consider the need to protect the life and safety of all health care facility occupants, and the potential need for continuing services following such a disaster.

FUNCTIONAL REQUIREMENTS

When construction is complete, the facility should satisfy the functional requirement for the appropriate classification, such as general hospital, tertiary care, single-specialty centre, and so on.

SITING AND ORIENTATION

Siting and orientation is an important part of every project, not only for aesthetics and access, but also to utilise the potential to capture or avoid natural energy. Landscaping provides shade, siting provides protection from dusty wards, utilisation of the prevailing breeze, orientation effects and window arrangement for exposure to the sun's rays. Consideration of alternate sites might be appropriate where physical, infrastructural or other restrictions make effective orientation impractical.

THE ENVELOPE

The envelope or exterior enclosure, including configuration, fenestration, wall materials, colours, insulation, sealing, roofing and wall areas of exposures,

overhangs, and so on, as well as mass, will affect energy demands. Lavish airconditioning may result in a struggle to meet electricity bills.

CONSERVATION OF ENVIRONMENT AND INFECTION CONTROL

This must be well-planned and adequate measures for successful implementation need to be addressed from the very outset of the project.

ENVIRONMENTAL IMPACT ANALYSIS

No adverse effect (even a negligible one) on the environment of the neighbourhood and community must be ensured. For instance, noise, polluted air, traffic noise—including air traffic—and location of incinerators need attention.

SPONSOR'S OBLIGATION

The sponsor for the project should provide a programme for the functioning of the facility that describes space requirements, staffing patterns, departmental relationships, and other basic information relating to the fulfilment of the institution's objectives. This may be general or detailed, but should include a description of each function, the approximate operational space needed for each function, number of staff or other occupants of various spaces, types and sizes of beds and equipment, and interrelationships of various functions and spaces. It should include a description of those services necessary for the complete operation of the facility. Facilities which already exist in the community need not be duplicated.

FUTURE EXPANSION

The functional programme should also address the potential for future expansion of essential services, such as X-rays, laboratories, and upgradation by adding on Magnetic Resonance Imaging (MRI), Computerised Tomography (CT) Scan, and so on.

STANDARDS

The hospital should meet all standards that have to be statutorily complied with.

SIZE

Department size will depend on the programme requirements and organisation of services within the hospital. Some functions may be combined or shared, provided the layout does not compromise safety standards, medical and nursing practices.

Basic Minimum Requirements for a Hospital of 30 Beds

SECTION 1: FACILITIES

Scope

This standard covers the minimum basic requirements for 30-bedded hospitals, including physical space, staff and equipment.

Functions

A 30-bedded hospital should generally have the following facilities:

Group 1: Medical and Allied Disciplines

- Anaesthesiology
- Blood bank
- Dentistry (optional)
- Emergency medicine
- General medicine
- General surgery
- Obstetrics and Gynaecology
- Paediatrics

Group 2: Health and Allied Services

- Family welfare
- Health education
- Maternal and child health care
- Nutrition
- School health care

Group 3: Nursing, Paramedical and Allied Services

- Dental technology (optional): including dental hygiene
- Dietetics and Therapeutic catering (optional)
- Drugs and Pharmacy
- Electrocardiography (ECG) technology
- Laboratory technology
- Laundry technology (optional)
- Medical record technology
- Nursing services
- Operating theatre technology (optional) including anaesthesia technology
- Sterilisation and disinfection Central Sterile Services Department (CSSD) technology
- Ultrasound imaging
- X-ray imaging

Group 4: Engineering and Allied Services

- Electric supply, including power generation and stabilisation
- Horticulture, including landscaping
- Liquid Petroleum Gas (LPG) supply (optional)
- Mechanical transport, including ambulance service
- Medical gases supply and vacuum (optional)
- Refrigeration
- Sewage treatment and disposal (where required), including sanitation and drainage
- Solar energy (optional)
- Solid waste disposal, including incineration
- Telephone and communication, including paging
- Water treatment and supply (where required), including plumbing
- Workshop (optional)

Group 5: Administrative and Ancillary Services

- Audio-visual services, including field publicity
- General administration
- Housekeeping
- Materials management, including inventory control
- Medical social work (optional)
- Security

SECTION 2: BED DISTRIBUTION

Bed distribution

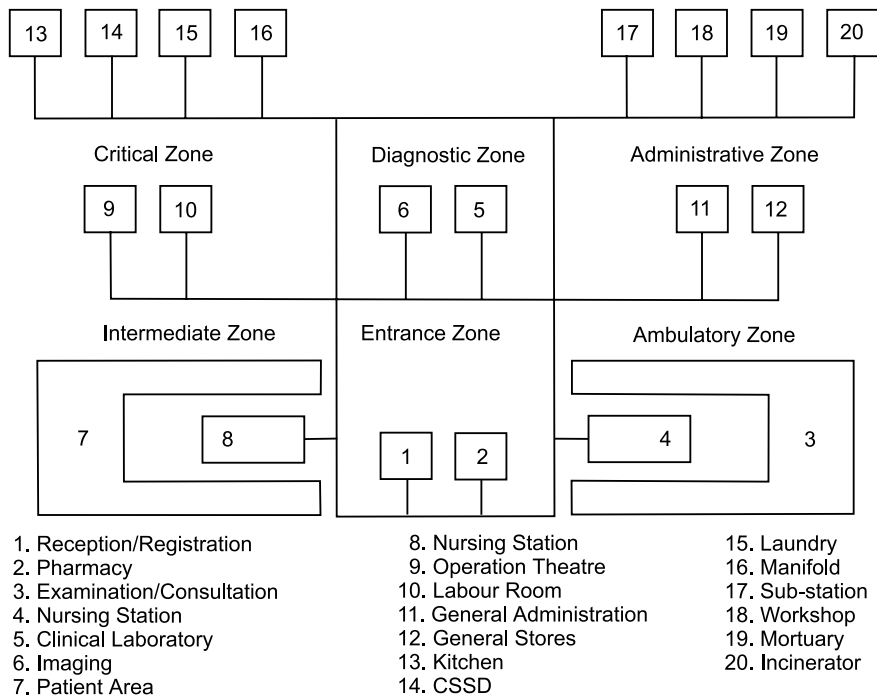
It is suggested that the allocation of beds for obstetrics, gynaecology and paediatrics could be 20, and rest of the 10 beds could be suitably divided between other specialties, such as Medicine, Surgery, Emergency, and so on. In case the need arises, beds meant for a particular department should be available for other departments.

SECTION 3: SPACE AND PHYSICAL REQUIREMENTS

General

This section covers space, physical and environmental requirements for a 30-bedded hospital. The building can be divided according to the functions described in Section 1. A typical work-flow analysis is given in Figure 2.1.

Figure 2.1 Work-flow Analysis



Total area

The total area to be provided for a hospital complex will depend on the availability of land. However, for guidance, an area of 1 hectare or more is recommended for a 30-bedded hospital.

Site planning

Hospital sites with a high degree of sensitivity to outside noise should be avoided, but may be compatible with other considerations, such as accessibility and availability of services. The buildings should be so planned that sensitive areas like wards, consulting and treatment rooms and operation theatres are placed away from external noise. While planning the hospital building, the importance of landscape elements such as open areas and horticulture to increase the comfort conditions inside the building and in the surrounding environment should be kept in view. Orientation of building should conform to provisions and recommendations contained in [IS: 7662 Part 1-1974].

Residential accommodation

If adequate land is not available, residential accommodation should be provided only for the essential staff, which should include the resident medical officer, nurses and Class IV staff. Residential accommodation for a major portion of the nursing staff should be provided close to the hospital block in the form of a hostel.

Functional and area analysis

The recommended standard rates and total area are given in Table 2.1.

Table 2.1 Functional and Area Analysis for a 30-bedded Hospital

<i>Zone</i>	<i>Functions</i>	<i>Area/Bed (square metre)</i>	<i>Total Area (square metre)</i>
<i>Entrance Zone</i>	Reception and Registration — Reception Counter — Record Storage Pharmacy — Issue Counter — Formulations — Drugs Storage	2	60

Table 2.1 continued

Table 2.1 continued

<i>Zone</i>	<i>Functions</i>	<i>Area/Bed (square metre)</i>	<i>Total Area (square metre)</i>
<i>Ambulatory Zone Out-patient Department (OPD)</i>	Public Utilities		
	Circulation Space		
	Examination and Workup	10	300
	— Examination Rooms		
	— Sub-waiting		
	Consultation		
	— Consultation Rooms		
	— Toilets		
	— Sub-waiting		
	Nursing Station		
	— Nurses' Desk		
	— Clean Utility		
	— Dirty Utility		
	— Treatment Rooms		
	— Injection and Dressing		
— Sample Collection			
— ECG			
— Ultrasound			
— Sub-waiting			
<i>Diagnostic Zone</i>	Public Utilities		
	Circulation Space		
	Clinical Laboratory	6	180
	— Sample Collection		
	— Bleeding Room		
	— Laboratory		
	— Washing/Disinfection		
	— Storage		
	— Sub-waiting		
	Imaging		
	— Preparation		
	— Change		
	— Toilet		
	— Treatment Room		
	— Control		
— Dark Room			
— Sub-waiting			
Public Utilities			
Circulation Space			

Table 2.1 continued

Table 2.1 continued

Zone	Functions	Area/Bed (square metre)	Total Area (square metre)
<i>Intermediate Zone Ward</i>	Nursing Station	25	750
	— Nurses' Desk		
	— Clean Utility		
	— Dirty Utility		
	— Pantry		
	— Treatment Room		
	— Store		
	— Trolley Bay		
	Patient Area		
	— Bed Space		
	— Toilets		
	— Day Room		
	— Isolation		
	Ancillary Rooms		
	— Doctor's Rest Room		
— Nurse's Duty Room			
Public Utilities			
Circulation Space	8	240	
<i>Critical Zone</i>			Patient Area
			— Preparation
			— Pre-anaesthesia
			Staff Area
			— Changing
			— Resting
			OT/LR Area
			— Scrub and Gown
			— Preparation
			— Operation/Labour Room
			— Disposal
			Ancillary Area
			— Trolley Bay
			— Equipment Storage
	— Sterile Storage		
Public Utilities			
Circulation Space	7	210	
<i>Service Zone</i>			Kitchen
			— Dry Store
	— Day Store		

Table 2.1 continued

Zone	Functions	Area/Bed (square metre)	Total Area (square metre)
	— Preparation		
	— Cooking		
	— Delivery		
	— Pot Wash		
	— Utensil Wash		
	— Trolley Park		
	CSSD		
	— Receipt		
	— Wash		
	— Assembly		
	— Sterilisation		
	— Sterile Storage		
	— Issue		
	Laundry		
	— Receipt		
	— Weight		
	— Sluice-Wash		
	— Hydro-Extraction		
	— Tumble		
	— Calender		
	— Press		
	— Clean Storage		
	— Issue		
	Manifold		
	— Landing Bay		
	— Manifold		
	— Compressor		
	— Vacuum		
	Sub-station		
	— H.T. Panel		
	— Transformer		
	— LT Panel		
	— Generator Set		
	— Stabiliser		
	Pump House		
	Workshop		
	Incinerator		

Table 2.1 continued

Table 2.1 continued

<i>Zone</i>	<i>Functions</i>	<i>Area/Bed (square metre)</i>	<i>Total Area (square metre)</i>
<i>Administrative Zone</i>	Mortuary		
	— Receipt/Issue		
	— Body Store		
	Public Utilities		
	Circulation Space		
	General Administration	2	60
	General Stores		
	Public Utilities		
	Circulation Space		
<i>Total</i>		60	1800

Constructional requirements

Circulation areas

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

Floor height

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

The height of the operation theatres may be suitably increased if viewing galleries are provided.

Rooms should have, for the admission of light and air, one or more apertures, such as windows and fan lights, opening directly to the external air or into an open verandah. The minimum aggregate areas (if a window is partly fixed, the area which can be opened should be taken into account) of such openings, excluding doors but inclusive of frames, should not be less than 20 per cent of the floor area in case such apertures are located in one wall, and not less than 15 per cent of the floor area in case such apertures are located on two opposite walls at the same sill level.

The architectural finish in hospitals should be of high quality in view of maintenance of hygienic conditions, especially in sanitary blocks. Flooring in

sanitary blocks should preferably be done with marble or polished stone, and dado or glazed/ceramic tile finish given on wall.

The design of the building should ensure that noise caused by walking, movement of trolleys, banging of doors, and so on does not penetrate into other areas. Expansion joints should have a non-metallic beading finish.

Sanitary fitments

The requirements of the sanitary fitments should be in accordance with clause 17.1 of IS: 10905 Part 1-1984.

Out-patient department (OPD)

Physical facilities

The OPD of the hospital should have the following sections:

- Section A: General Facilities
- Section B: Clinics of Different Medical Disciplines
- Section C: Supporting Facilities such as Laboratory, Injection and Pharmacy.

Entrance hall

It serves as a waiting area for the patients before getting registered, and for the attendants who wait for the return of the patients. The size of the hall may be determined on the basis of the number of beds available to back up the OPD. Adequate toilet facilities should also be provided close to it.

Waiting spaces

Waiting spaces per clinic and subsidiary waiting spaces are required adjacent to each consultant's room and treatment rooms of the clinics. Waiting spaces in the paediatric clinic should provide recreation and play facilities for children, in addition to toilet facilities.

Medical records

It is desirable to maintain the medical records of the out-patient department, in continuation of registration area.

Clinics for various medical disciplines

These clinics include general medicine, general surgery, obstetrics, gynaecology and paediatrics. The cubicles for consultation and examination in all clinics should

provide for the doctor's table, chair, patient's stool, attendant's seat, wash basin, examination couch and equipment for examination. The treatment and dressing room should be spacious enough to accommodate a medicine shelf, sinks, dress tables with screen in between and a pedal-operated bin to hold soiled material. The medical clinic should have facilities for cardiographic examination.

Dental clinic (Optional)

Dental clinics may have facilities for dental hygiene, dental workshop and room for patient's recovery. The consultation-cum-examination room should serve as a multipurpose room for consultation, examination, dental surgery and treatment.

Obstetric and gynaecological clinic

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

Family welfare clinic

The clinic should provide educative, preventive, diagnostic and curative facilities for obstetric and gynaecological treatment, paediatric and health education. The importance of health education is being increasingly recognised as an effective tool of preventive medicine. People visiting hospitals should be informed about environmental hygiene, clean habits, need for taking preventive measures against epidemics, family planning, and other such issues. The treatment room in this clinic should act as the operation room for intra-uterine contraceptive device (IUCD) insertion and investigation, and so on.

Pharmacy (dispensary)

The dispensary should be located in an area conveniently accessible from all clinics. Its size should be adequate to accommodate 5 per cent of the total clinical visits to the OPD in one session, at the rate of 0.8 sq m per patient. The dispensary and compounding room should have multiple dispensing windows, counters and shelves. The plan according to which the counters and shelves are arranged will depend on the size of the room. Medicines that require cold storage must be kept in refrigerators.

Casualty/Emergency

Emergency cases should be attended by OPD during OPD hours and in wards afterwards.

Clinical laboratory

The clinical laboratory should be provided with a 60 cm to 80 cm high bench of about 2 m length per technician, and the full width of the room for the pathologist in charge of the laboratory. Each laboratory bench should have a laboratory sink with swan-neck fittings, reagent shelving, gas and power point and under-counter cabinet. The top of the laboratory bench should be of acid/alkali-proof material.

Imaging

General

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

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

Reception-cum-registration with waiting areas and toilet

An independent registration section should be provided where radiology is an independent department. The size of the counter should be sufficient to accommodate a clerk's seat and record chests. It may be interposed with the waiting area. Toilet facilities, separately for men and women patients, should be placed close to waiting areas.

Radiology and fluoroscopy room

The size of the room depends upon the type of equipment installed. The room should have a sub-waiting area with toilet facility and a change room facility, if required. The fluoroscopy room should be completely devoid of direct light by provision of air-lock. Radiography units should be operated from a separate control room, or behind a lead mobile protection screen of 105 mm lead equivalent, wherever necessary.

Film developing and processing room

Film developing and dark rooms should be provided in the department for loading, unloading, developing and processing of X-ray films. The room should be provided between a pair of radiography rooms, so that new and exposed X-ray films may be easily passed through the cassette pan with 20 mm lead backing installed in the wall in between. The room should be completely cut off from direct light through provision of airlock. For ventilation, exhaust fans should be provided. The room should have a loading bench (with acid and alkali resistant top), processing tank, washing tank and a sink. Flooring for the room should be acid and alkali proof.

Film drying

Provision of space should be made for drying films either by atmospheric drying, or by mechanical contrivances in the form of hot chambers.

Stores

The cupboards or built-in-cupboards required for storing films and chemicals may either be placed in the radiologist's room, or in a separate store. The unexposed films should be stored away from the radiography room. However, in case the unexposed films are to be stored in the darkroom adjacent to the radiography room for a temporary period, these may be stored in a 20 mm lead-lined box.

In-patient nursing units**General**

The In-patient Nursing Units (that is, wards) concept is fast changing due to the policy of early ambulation, and only a few patients really need to be on beds. The basic consideration in the placement of wards is to ensure sufficient nursing care, segregating patients according to three categories, locating them according to the needs of treatment with respect to medical discipline and checking and preventing cross infection. In this case, there should be two ward units, one for males and one for females.

Location

Wards should be relegated to the back to ensure silence and freedom from unwanted visitors.

Planning ward units

The ward units should be made at the rate of 7 sq m per bed and should be arranged with a minimum distance of 2.25 m between the centre of two beds, and a clearance of 70 cm between the bed and the wall. In wards, the width of the doors should not be less than 1.2 m, and all wards should have a dado (ceramic tile) to a height of 1.2 m. An isolation unit in the form of one single-bedded room per nursing unit should be provided to cater for certain cases requiring isolation from other patients. An area of 14 sq m for such rooms with a bed, bedside locker, easy chair for patient, a chair for visitors and a built-in cupboard for storing clothes is recommended. This isolation unit should have separate toilet facilities.

Type of ward

Wards may be either nightingale or rig type. In the former, beds are arranged at a right angle to the wall, with the feet towards the central corridor, and in the latter, 4 to 6 beds are arranged parallel to the longitudinal walls, facing each other. A rig type ward is recommended from the socio-environment standpoint.

General ward facilities and space requirements

Each ward unit should have a set of ward ancillaries as given below:

1. Nursing Station, 2. Treatment Room, 3. Ward Pantry, 4. Ward Store, 5. Sluice Room

Sanitary requirements

These are given in Table 2.2.

Table 2.2 Sanitary Requirements

<i>Item</i>	<i>Numbers Required</i>
Water closets	2 for male ward 3 for female ward
Ablution taps	1 for each water closet plus 1 water tap with drainage arrangement in the vicinity of water closets
Urinals	2 for male ward
Wash basins	2 for each ward
Bathrooms	2 for each ward
Cleaner's sinks and sinks/slab for cleaning mackintoshes	1 for each ward
Kitchen sinks and dishwashers	1 for each ward in ward pantry

Obstetrics and gynaecology department

Maternity service includes antenatal care, delivery and postnatal care. Before and after child birth, the patient should be attended at the out-patient clinic, and during labour the patient is confined to bed in the nursing unit. The out-patient clinic should also provide diagnostic facilities for gynaecology patients. Since these services are cyclic, it is recommended that the in-patient unit is located close to the out-patient clinic, making it easily accessible to the pregnant women.

The in-patient unit should comprise:

1. a delivery suite unit
2. a nursing unit
3. a neonatal unit

and they should be placed on the same floor. The neonatal unit should be close to the labour room, spacious and isolated from the main wards, to avoid infections. It should have the basic facilities of good illumination, elbow-operated wash basin, round-the-clock running water facilities, beam-type weighing machine, suction apparatus, oxygen cylinders and a phototherapy unit.

Water supply

Arrangements should be made to supply 10,000 litres of potable water per day to meet all requirements (including laundry) except fire fighting. Storage capacity for two days' requirements should be on the basis of the above given consumption. Round-the-clock water supply should be made available to all wards and departments of the hospital. A separate reserve emergency overhead tank should be provided for the operation theatre. Water storage overhead tanks with pumping/boosting arrangement should be installed. The laying and distribution of the water supply system should be according to the provisions of IS: 2065-1972. Cold and hot water supply piping should be installed in concealed form, embedded in wall, with full precaution to avoid any seepage.

Drainage and sanitation

The design, construction and maintenance of drains for waste water, surface water, sub-solid water and sewerage should be in accordance with IS: 1742-1983.

The selection, installation and maintenance of sanitary appliances should be in accordance with IS: 2064-1973. The design and installation of soil-waste and ventilating pipes should be as given in IS: 5329-1983.

Air-conditioning and room heating

Air-conditioning units should be provided only for the Operation and Neonatal Unit. However, air-coolers or hot air convectors may be provided for the comfort of the patients and the staff, depending on local needs.

Refrigeration

Hospitals should be provided with water coolers and refrigerators (IS: 1474–1959) in wards and departments, depending upon local needs.

Illumination

For requirements and methods for day lighting in hospital buildings, the standards are provided in IS: 2440–1975. The level of illumination for various visual tasks should be provided in accordance with IS: 4347–1967. General lighting of all hospital areas, except stores and the lavatory block should be fluorescent. In other areas, incandescent lamps are recommended. Electrical installations, except for artificial illumination, should be in accordance with IS: 732 (Part 2)–1983, IS: 732 (Part 3)–1982, IS: 8030–1976 and SP 30–1985.

Shadowless light

Shadowless lights (mountable type) should be provided in operation theatres and operating delivery rooms, whereas, in other areas, where operations of a minor nature are carried out, shadowless lights (portable type) should be provided.

Emergency lighting

Emergency portable light units should also be provided in the wards and departments to serve as an alternative source of light in case of power failure.

Call bells

Call bell (IS: 2268–1966) switches should be provided for all beds in all types of wards, with indicator light and location indicator situated in the nurses duty room.

Stand-by small generators

Stand-by small generators should be provided to generate electricity and power supply to operation theatre air-conditioners and shadowless lamps.

Lightning protection

The lightning protection system of hospital buildings should be in accordance with IS: 2309-1969.

Ventilation

Ventilation of hospital buildings should be achieved by either natural supply and natural exhaust of air, or mechanical supply and mechanical exhaust of air.

The following standards of general ventilation are recommended for various areas of the hospital building, based on maintenance of required oxygen, carbon dioxide and other air quality levels; and for the control of body odour when no products of combustion or other contaminants are present in the air, or when anaesthesia gases which are highly explosive, are present:

<i>Space to be Ventilated</i>	<i>Air Changes per Hour</i>
Bathroom/Toilets	6-12
Wards	8-12
Kitchens	6-9
Operation Theatres	15-20
Other Air-conditioned Spaces	8-10

The general principles of natural ventilation should be in accordance with IS: 3362-1977. Where adequate air changes cannot be obtained by natural ventilation, mechanical ventilation, either by exhaust of air or by positive ventilation (like fans and other equipment), or a combination of the two should be provided.

Fans and other equipments for mechanical ventilation should be located in convenient positions taking into consideration the intake of fresh air, accessibility for maintenance and noise control. Exhaust fans should be provided on walls on one side, or in the attic under the roof. The expelled air should not find entry back into the hospital.

Gas supply

Medical gas

Medical gases comprise mainly oxygen and nitrous oxide. Cylinders should be made available.

Cooking gas

For better hygiene, use of LPG cylinders is recommended. These should also be kept in a room from where a necessary pipeline with gas outlets, as required, may be provided to hospital kitchens and ward pantries.

Laboratory gas

LPG cylinders should be made available for the pathological lab. Alternatively, kerosene stoves should be made available where gas supply is not available.

Telephone and intercom

Wiring in conduits should be provided to give telephone outlet points in rooms, wards and departments, as desired by the authorities. An intercom system may also be provided in addition to the telephone. The communication system should be adequately designed in hospitals to alert all persons looking after patients and all employees of the hospital who are inside the building in the event of an emergency. The alarm system should be capable of being operated from intercoms, telephones and the administrative office.

Fire protection

Adequate first-aid and fire-fighting equipment should be provided and installed in accordance with IS: 2190-1979.

Manually operated fire alarm facilities should be provided in hospital buildings which sound an audible alarm in the administrative department, the engineering department, offices, fire office, and such other locations where gongs, sirens, whistles or bells do not disturb the patients. Distinctive visual and audible alarms should be installed at each nurse's duty room and duty station, and should be equipped with an automatic fire alarm system conforming to IS: 2189-1976.

Waste disposal system

The hospital should be provided with one incinerator, consisting of a burning chamber and chimney.

SECTION 4: STAFF REQUIREMENTS

The staffing pattern for a 30-bedded hospital is presented in this section. This requirement may be phased into three stages, as per convenience and demand build-up (see Table 2.3).

Table 2.3 Staff Requirements

	<i>Stage</i>			<i>Total</i>
	<i>I</i>	<i>II</i>	<i>III</i>	
<i>Medical Staff</i>				
General Medicine	1	–	1	2
General Surgery	1	–	1	2
Obstetrics & Gynae.	1	1	–	2
Paediatrics	1	–	–	1
Anaesthesiology	1	–	–	1
Dentist (optional)	1	–	–	1
Pathologist (optional)	–	1	–	1
Radiologist (optional)	–	–	1	1
<i>Health Staff</i>				
Female Health Assistant	1	–	–	1
Extension Educator	1	–	–	1
Nutritionist	–	1	–	1
Public Health Nurse	–	–	1	1
<i>Nursing Staff</i>				
Matron	1	–	–	1
Operation Theatre Nurse	1	–	1	2
Labour Room Nurse	1	1	–	2
General Nurse	7	1	1	9
Nursing Aides	7	1	1	9
<i>Paramedical Staff</i>				
Pharmacist/Asst. Pharmacist	1	1	–	2
Dietitian/Asst. Dietitian (optional)	–	1	–	1
Technologist/Technician ECG	1	–	1	2
Technologist/ Tech. Imaging	1	–	1	2
Technologist/Clinical Path	1	1	–	2
Haematology/Blood Bank	1	–	–	1
Technologist/Laundry (optional)	1	–	–	1
Technologist/Medical Records	1	–	–	1
Technologist/CSSD	5	1	1	7
<i>Engineering Staff</i>				
Technologist/Technician Electrical	1	1	–	2
Technologist/Mechanical/Plumbing	1	–	1	2
Engineering Aides	2	–	–	2

Table 2.3 continued

Table 2.3 continued

	Stage			Total
	I	II	III	
<i>Administrative and Ancillary Staff</i>				
Stenographer	1	–	–	1
Store Keeper	1	–	–	1
Admn. Assistant	1	–	1	2
Telephone Operator	1	–	–	1
Driver	1	1	–	2
General Attendants	2	1	–	3
Security Attendants	4	1	1	6
Sanitary Attendants	5	1	1	7
<i>Grand Total</i>	57	15	14	86

Conclusion

Establishment of a hospital requires careful planning. The human factor is very essential, unlike in other industries, since a hospital involves care of the physical, clinical and psychological aspects of patients. Facilities should be appropriate according to the needs and affordability of the community. The standards given in this book are for an ideal set-up. This may be stretched to a larger number of beds if the departments are fewer, and the personnel are more efficient. The viability of a corporate hospital, irrespective of its size, the level of care and sophistication is vital, and careful financial planning is very necessary. The doctors, nurses and technicians are more important than the equipment and buildings, in that order. Great care, therefore, should be taken to recruit proper staff, and there should be continuous training and motivation. Flexibility and future expansion plans are essential ingredients for meeting future needs.

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Hospital Organisation Structure

3

S.F. Chandra Sekhar

Introduction

A hospital as a health care organisation has been defined in varied terms as an institution involved in preventive, curative/ameliorative, palliative or rehabilitative services. However, the definition given by the World Health Organisation (WHO) is quite exhaustive and exclusive, in which a hospital is defined as 'an integral part of the medical and social organisation which is to provide for the population complete health care, both curative and preventive; and whose out-patient services reach out into the family in its home environment. The hospital is also a centre for the training of health workers and for bio-social research'.

Hospitals these days also provide bio-social research, teaching and training facilities for all members of the hospital, and a health team which includes not only doctors and nurses, but also para-professionals, paramedicals, pharmacists and others (Singh 1997). Operationally, a hospital could be viewed as consisting of service facilities for out-patients, in-patients, general wards, emergency, special wards, Intensive Care Units, operation theatre, delivery suite; and support services such as, pharmacy, radiology and imaging, Central Sterile Services Department (CSSD), blood bank and laboratory.

The emergence of corporate hospitals in the Indian health care sector is relatively recent. This trend has revolutionised the entire health care scenario in the country. Consequently, hospitals have been functioning in a very competitive environment. Most of these hospitals are professionally managed, with the objective of providing prompt, adequate, continuous and satisfactory services to the patient community because their prime consideration is providing quality health care, as well as earning profits. It is now a well-established fact that hospitals that are dynamic and growth-oriented and that survive are the ones that give priority to the quality of services provided and surplus-making. On the other hand, more and more corporate and trust hospitals are entering the market, further increasing the competition that had already been triggered by the earlier ones. Under the circumstances, hospitals need to design and redesign their strategies for providing quality health care and ensuring their own survival.

Unique Features of Hospitals and Health Care Organisations

Hospitals and health care organisations are often described as unique, or at least different from other types of organisations, in particular, industrial organisations. These differences are felt to be significant in the management of hospitals. Some of the most frequently mentioned differences are the following (Darr and Rakich 1992; Shukla 1996; Wieland 1981; Stephen and Arnold 1988; Massie 1995):

- Defining and measuring the output is difficult.
- The work involved is felt to be more highly variable and complex than in other organisations.
- Much of the work is of an urgent and non-deferrable nature.
- The work permits little tolerance for ambiguity or error.
- Activities are highly interdependent, requiring a high degree of coordination among diverse professional groups.
- The work involves an extremely high degree of specialisation.
- Hospital personnel are highly professionalised, and their primary loyalty belongs to the profession rather than to the organisation.
- There exists little effective organisational or managerial control over the group most responsible for generating work and expenditures: physicians and surgeons.
- In many hospital-organisations, there exists dual lines of authority, which create problems of coordination and accountability and confusion of roles.

Some of these points may be refuted with argument. However, the objective of this chapter is to develop a design of hospital organisations which will result in improving their effectiveness, efficiency, adaptability and will ensure their survival, structuring the position, roles and functions of the people in the organisation. Such structuring needs to take into account some of the pitfalls listed above.

Objectives

The objective of this chapter is three-fold:

- First, it wants to draw the reader's attention to how a hospital organisation is designed from the systems point of view while clarifying some widely-held misconceptions.
- Second, it will provide a few illustrative structural configurations (hierarchies

and organograms) of some select hospitals of differing ownership. These will be analysed from the standpoint of organisational theory.

- Third, factors for evolving effective organisational structures needed for future hospitals that will operate in a highly competitive environment will be highlighted.

Structure and Context Factors

A discussion or analysis about an organisation invariably begins with a description of its general context and an illustration of its organisational structure. Organisational context is defined conventionally as the social and economic setting in which an organisation chooses to operate (Pugh, et al. 1969). It also refers to all the conditions and factors external to the organisation under consideration (Van De Ven and Ferry 1980).

In the selection of a particular design to maximise performance in a corporate hospital, four aspects need to be mentioned. They are—external environment, organisational assessment, human resources and political processes.

EXTERNAL ENVIRONMENT

The environment presents constraints and opportunities that need to be analysed for designing organisations. Some of the questions that need to be answered in this context are:

1. What are the economic, political and legal conditions that may have the same or decreased impact upon the health care organisations?
2. What are the demographic and cultural conditions that may remain the same, or have a decreased impact upon the design of services to be rendered by the hospitals?
3. Will the new organisational forms, like multi-institutional arrangements (mergers, corporate structures, health insurance arrangements, and so on), influence the design of the hospitals?
4. What are the latest developments in medical technology that need to be acquired by the hospitals?

ORGANISATIONAL ASSESSMENT

This section deals with assessing the mission of the hospital and reconsiders it in relation to its future environment. It also deals with goals and specific strategies

developed by the organisation on one hand and the quantity, quality and type of services to be provided on the other. In this manner, problems related to the current structure and the internal processes of the hospital may be identified, for example, the inability to anticipate problems and take corrective action quickly, communication barriers, difficulties resulting from conflicting roles, employee turnover, and recruitment and selection problems.

HUMAN RESOURCES

This involves evaluating the capabilities and potential of key persons in the organisation. The quality of performance of senior- and middle-management professionals is important not only for meeting the goals of the organisation, but for implementing proposed changes in the organisational structure. The Human Resource Development (HRD) strategy also needs to be outlined in the assessment of human resources.

POLITICAL PROCESS

This involves a systematic assessment of the informal internal dynamics of the hospital. The informal groups and leaders who influence the programmes in the hospital need to be identified. This may help the management to allow these leaders to participate in the planning and decision-making process at an early stage.

With the help of the information that is generated from the assessment of these four contextual factors, the top management will become more knowledgeable, and will be able to take the right decision in selecting an appropriate structure for the hospital.

Organisational Structure

Organisational structure is defined in many ways. It is defined by Hodge and Anthony (1984) as:

the hierarchical pattern of authority, responsibility, and accountability relationships designed to provide coordination of the work of the organisation; the vertical arrangement of jobs in the organisation.

Pugh et al. (1969) refer to it as:

a formal system of interaction and coordination that links the tasks of individuals and groups to help achieve organisational goals.

Child (1972) defined structure as:

the formal allocation of work roles and the administrative mechanisms to control and integrate work activities, including those which cross formal organisational boundaries.

De Ven and Ferry (1980) defined

structure in terms of the skeletal organisation chart. Its underlying dimensions are the degree of vertical, horizontal, and spatial differentiation; the forms of departmentation; and the allocation of administrative overhead.

In a more elaborate form, Miles and Snow (1985) state that

the organisation chart, when supplemented with the perceptions of informants on the question, "Who makes what decisions, where?", provides an overall understanding of the structure of authority in an organisation.

The reason we focus on these structural dimensions is because they are basic to solving the organisational design exercise at the overall organisational level of analysis. The organisation design is principally concerned with:

- Division of labour in terms of degrees of differentiation and forms of departmentation.
- Interdependence and sub-optimisation among organisational components that division of labour creates.
- Structure of authority.

The Structural Dimensions of an Organisation

PURPOSE

One of the purposes of organisational structure is to channel information to the appropriate managers, so that their level of uncertainty is reduced when they make decisions. A second is to effectively distribute the authority to make decisions, so that members of the organisation can implement their plans smoothly and cohesively at every level. It is a managerial tool that aids in guiding the organisation toward its goals, and can be likened to the skeleton of the organisation-body (Hodge and Anthony 1984). Lastly, the organisational structure

defines and governs the relationships among the various work units, ensuring that all work is assigned and completed in an orderly fashion, which in turn, contributes to effective overall organisational performance (Duncan 1979).

In order to evolve a good organisational structure, there is a need to understand first the constituent elements of the structure. Hage and Aiken (1970) focussed on some variables that form the organisational structure. They are:

- Formalisation
- Centralisation
- Specialisation
- Complexity
- Configuration

Till recently, there was a misconception that organisational structure is merely an organisational hierarchy that depicts designations of and the relationships among people in the organisation, and nothing more. In this context, a brief description of all the dimensions of organisational structure will help to understand better the concept of configuration as an emergence of interrelationships among structure properties of organisation, and not merely the structure itself.

FORMALISATION

Formalisation represents the extent to which jobs are governed by rules and specific guidelines. It is the degree in which policies, procedures and rules are formally stated in written form (Hodge and Anthony 1984). This aspect of organisation is typical of bureaucracies. Measures of formalisation can be attempted in a number of ways. One can count the number of rules that apply to jobs, as these are found in formal job descriptions, rule manuals, or employee workbooks. There is some evidence that the greater the degree of formalisation, the lower is the rate of programme change. Rules and norms discourage a search for better ways of doing things.

CENTRALISATION

Centralisation is a measure of the distribution of power within the organisation. The fewer the people participating in decision-making, and the fewer the areas of decision-making in which they are involved, the more centralised is the organisation. It was also found that the higher the organisation's degree of centralisation, the lower is its rate of programme change (Hage and Aiken 1970).

In a decentralised organisation, where decision-making power is more widespread, a variety of different views will emerge from different occupational groups. This variety of opinions can lead to conflict, but also to a successful resolution of conflict, and to problem-solving. In any situation, decentralisation appears to foster the initiation of new programmes and techniques, which are proposed as solutions to various organisational problems. Further, it is likely that the decentralised organisation will experience more initiation of change and a greater number of actual programme changes than the centralised organisation.

SPECIALISATION

Specialisation refers to the extent to which an organisation favours division of labour. In hospitals, specialisation of roles and functions reach extremely high levels both in intensity and extent. People with extremely different skills and abilities, and diverse backgrounds, interact closely, within a work structure whose requirements of functional interdependence and close cooperation are unmatched when compared to the great majority of complex human organisations of similar size. Work in the system is highly specialised and divided among a great variety of roles and numerous members with heterogeneous attitudes, needs, orientations and values. A certain degree of specialisation among and within organisations, and professions and occupation, is indispensable for efficient role performance, individual adaptiveness and organisational effectiveness. In hospitals, it is understood that medical and nursing specialisation undoubtedly lead to improved patient care, just as administrative professionalisation leads to improved hospital functioning. A properly regulated specialisation in organisations with high internal social integration will eliminate the dysfunctional nature of the organisations.

COMPLEXITY

Complexity refers to the extent of knowledge and skill required of occupational roles and their diversity. Hodge and Anthony (1984) define it as the degree of sophistication and specialisation that results from the separation of work units for the purpose of establishing responsibility. Organisations employing different kinds of professionals are highly complex. Among the service organisations, the hospital is the most complex form of organisation. One way to measure complexity is to determine the number of different occupations within an organisation that require specialised knowledge and skills. An organisation is considered complex when it employs numerous kinds of knowledge and skills; and when these occupations require sophistication in their respective knowledge and skill areas.

In a hospital, typically, employees of different occupational groups will appear in the wards during the course of the day. One can find a variety of doctors, administrators, nurses, dietitians, X-ray technicians, laboratory technicians, occupational therapists, social workers, housekeepers, engineers and others. In organisations where there is greater complexity, the greater is the rate of programme change (Hage and Aiken 1970).

CONFIGURATION

Organisation structures occur in a limited number of configurations. On what basis are these structures formed? As mentioned earlier, Child's (1972) definition involves both division of work and means of integrating this differentiation. Thus, any structural configuration must include criteria by which various roles, activities and coordination mechanisms can be differentiated, as well as grouped together in the organisation (Shukla 1996). Thus the terms organisational structure, design, hierarchy, chart, model, organogram are interchangeably used, since they are understood in a similar way.

Mintzberg (1983) proposed a rational approach to the formation of structures. According to him, an organisation can be composed of five basic elements which are as follows:

1. *The Strategic Apex*

This includes top-level management, which is vested with ultimate responsibility for organisational effectiveness. The top management could be a team or a single individual.

2. *The Operating Core*

This includes employees who perform the basic work related to the production of goods or services of the organisation.

3. *The Middle Line*

This consists of people who connect the strategic apex to the operating core. These are intermediate managers who transmit, control and help in implementing the decision taken by the strategic apex.

4. *The Technostructure*

This includes staff functionaries and analysts who design systems for regulating and standardising the formal planning and control of the work. For instance,

this function is looked after by departments such as finance, production planning, human resources, and others.

5. *The Support Staff*

This includes people who provide indirect support to the work process and are not involved directly in it. Services like the cafeteria, mailing and transport are considered to be a part of it.

Mintzberg (1983) states that by putting all these elements together, we can get a complete picture of the whole organisation. However, all organisations are not identical; they differ in terms of the part which exercises greater control, and the manner in which the activities of the operating core are coordinated, and similarly with other elements of the organisation's structure. Mintzberg (1989) reported from the study of 129 organisations that only about half could neatly be fitted into certain categories. The others were hybrids, conforming to two or more configurations. This is likely since organisations are complex entities, with different parts facing different environmental demands, and therefore developing into different configurations.

Hospital organisations also followed some of the configurations that are similar to manufacturing organisations. However, during their evolution, they developed unique features. The most important is an arrangement called the triad, the foremost example of which is found in private and teaching hospitals. The triad includes the governing body, the chief executive officer and the medical staff (Darr and Rakich 1992). In theory, the triad permits sharing of power and authority among themselves. However, it is best characterised as an accommodation rather than sharing. The accommodation results from the *independent status of the physicians and consultants* who play a major role in treating patients in the hospital. Such accommodation will be much more effective when the governing body delegates responsibility to the Chief Executive Officer (CEO) and senior managers for the day-to-day operation of the hospital.

Organisational Designs

Common organisation designs seen in health service organisations are (Leat and Fred 1985):

- Functional design
- Divisional design
- Corporate design

- Matrix design
- Parallel design

These designs are briefly explained in the following sections.

FUNCTIONAL DESIGN

Most hospitals are familiar with a functional design where the workers are divided into specific functional departments, for example, finance, nursing, pharmacy, housekeeping, and so on. This arrangement is more prevalent in relatively small hospitals with fewer than 200 beds, offering single specialty services, and this design is most appropriate in small organisations which provide a limited range of services and with only one major goal. The primary advantages of the functional design are that it facilitates decision-making in a centralised and hierarchical manner, and the role of managers in the various departments is clearly demarcated. It is, however, inappropriate when an organisation is involved in major growth or diversification. At such times, lateral coordination and decentralised decision-making is required. It is also inappropriate for organisations operating in complex, dynamic environments, because it cannot accommodate and process the rapid information flow generated by the environment.

DIVISIONAL DESIGN

The divisional design is often found in large teaching hospitals and sometimes in a few private hospitals that operate under conditions of high environmental uncertainty and high technological complexity, because of intense research activities and exacerbated by relationships with the medical college. It is most appropriate for situations where clear divisions can be made within the organisation and semi-autonomous units can be created. Conventionally, in teaching hospitals, the way of grouping units has always been relatively clear cut; units are grouped according to accepted medical specialties, such as medicine, surgery, paediatrics, radiology and pathology.

Divisionalisation decentralises decision-making to the lowest level in the organisation where key expertise is available. Individual decisions have considerable autonomy for clinical and financial operations. Each division has its own internal management structure. Difficulties with the divisional design tend to occur in times of resource constraints, when priorities must be set at higher organisational levels. For example, a large teaching hospital may have difficulty in arriving at a consensus about which patient programmes should be given priority, if divisional managers do not have a proper perspective of the

whole organisation. In times of resource constraints, an obvious strategy will be for the divisions to share the resources. To achieve this, top management would impose new systems and procedures for cooperation between the units of the organisation at most of the horizontal levels of decision-making, taking care to keep the goals of the divisions undisturbed and maintain the overall mission and goals of the organisation.

CORPORATE DESIGN

There is an increasing use of the term 'corporate model' in hospitals these days. In business terms, it means any organisation which is legally incorporated (Leat and Fred 1985). The true structure envisages:

- A governing body
- Top management

With regard to the governing body, the board members include salaried corporate directors and executives. There is a full-time chairman of the board who functions as the executive of the corporation. The board members are elected and paid a fee for attending meetings.

With regard to top management, the chairman is a voting member of the board and the senior management is made up of general managers. There is a group of corporate staff who provide ongoing long-range support services to the general managers. Typically, they provide support in such functional areas as human resource, public relations, data processing, legal affairs and planning. Lastly, there is a great emphasis on team approach to management and decentralisation of decision-making.

This design is most useful in large, complex organisations which have several goals and which operate in changing environments. Corporate structures often develop where two or more hospitals merge. This design is less suitable for a small organisation where conversion to a corporate structure would simply mean a change in designation for the senior managers. The design is also inappropriate if the CEO is not prepared to delegate authority to other members of the senior management team, or if management team members do not possess the necessary skills to assume delegated authority.

MATRIX DESIGN

This design was developed initially in the aerospace industry, which is characterised by a dual authority system, where individuals have two or more

bosses (Davis and Lawrence 1978). This design is evolved to improve mechanisms of lateral coordination and information flow across the organisation (Shukla 1996). The structure is usually drawn in the form of a diamond, with functional heads and programme managers on the top edges of the diamond. This arrangement increases the opportunity for lateral coordination and communication, which frequently emerge as problems in other design configurations. Functional heads, for example, nursing, medical records, pharmacy and housekeeping are responsible for the standards of services provided by their department. Typically, functional heads bring stability and continuity to the organisation and sustain the professional status of staff. Programme managers for departments such as oncology, nephrology, paediatrics, neurology, and so on bear the responsibility for individual multidisciplinary programmes and coordinate team functioning. It is the responsibility of the CEO to maintain balance between both sides of the matrix.

This design is useful in highly specialised technological areas that focus on innovation. It allows programme managers to interact directly with the environment vis-à-vis technological developments. Usually, each programme requires a multidisciplinary team approach; the matrix structure facilitates the coordination of the team and allows team members to contribute their special expertise.

The disadvantages of this design are: (a) individual workers may find that having two bosses is untenable, since it creates conflicting expectations and ambiguity, (b) the matrix design may also prove to be expensive, since both functional heads and programme managers may spend a considerable amount of time in meetings, because of the frequent requirement for dual accounting, budgeting, control, performance evaluation and reward systems. Hospitals, however, are accustomed to working on multiple-authority lines; in fact, some experts suggest that many hospitals have a *de facto* informal matrix model.

PARALLEL DESIGN

This is a design which has been developed as a mechanism for promoting the quality of work in the organisations (Stein and Kanter 1980). The bureaucratic or functional organisation retains responsibility for routine activities in the organisation, while the parallel structure is responsible for complex problem-solving that requires participatory mechanisms. The parallel structure is a means of managing and responding to changing internal and external conditions. It also provides an opportunity for persons occupying positions at various hierarchical levels in the bureaucratic structure to participate in organisational decisions

(Kanter 1983). It is on this basis that the parallel organisation has potential for building a high quality of working life. Within the parallel organisation, a series of permanent committees are established, with representation from all levels in the formal hierarchy, as well as from all departments, depending on the problem or task at hand.

The parallel design is appropriate where organisations are faced with critical and complex problems with no easy solutions. This is useful when it is necessary to include a broad range of disciplines in the development of policies and procedures. The performance of the organisation can be improved not only by identifying solutions to difficult problems, but also by a cross-fertilisation of ideas which will result from the interdisciplinary approach.

Problems may arise with the parallel model if the parallel arm of the structure begins to assume decision-making responsibilities, which should remain with the functional arm. There may be differences in priorities set by each side of the structure. Also, individuals at lower levels in the organisation may end up spending a great deal of time at meetings, which interferes with their ability to do their job.

In reality, many hospitals have elements of a parallel design, particularly as a mechanism for involving physicians and other health professionals in forming organisational policies.

Configuration of Select Hospitals

There are specific design options that are available for health services managers. Keeping this in mind, the choices will depend on environmental demands and the organisation's strategies. Accordingly, the activities of the hospital can be grouped. In most health care organisations, decisions about the organisational structure traditionally have been made in an informal and somewhat *ad hoc* manner. Design is often a reactive process with minor changes made in the organisation chart, as individuals leave or enter the organisation. It is rare that a hospital engages in a systematic and proactive assessment of the total organisation, with consideration being given to the range of possible alternative organisational models. Yet such a fragmented approach to the organisation structure is likely to have an unanticipated effect on its other parts and frequently lead to incomplete organisational design, inefficiency and compromised performance. One other point to be borne in mind, since organisational design is a conscious and deliberate process, which is essential for all hospital organisations on an ongoing basis, is that it has many implications for the changing role of chief executive officers.

The organisational structure of hospitals has been referred to as a wobbly three-legged stool. The legs are the board of trustees, the medical staff and

administration. The board of trustees bears ultimate responsibility for the performance of the hospital—its medical and management staff. The board makes the overall governing policies and establishes the hospital's bye-laws. The difference between the boards of corporate business enterprises and the boards of trustees of most hospitals is based on the fact that industry is an economic enterprise with social overtones; whereas the hospital is a social enterprise with deepening economic overtones. A hospital's board is frequently composed of community and business leaders. They do not own or have a financial interest in the hospital and are accountable for the conduct of the institution, to the public, rather than to shareholders of the corporation. In non-profit hospitals, the fiscal concern may be that the surplus should be kept modest, in keeping with the public service nature of the hospital's goals (Evertt and Johnson 1982).

In several hospitals, the medical staff is the group of physicians to whom the board of trustees has granted privileges to admit patients. In some of the hospitals the medical staff is not paid by the hospital, is not responsible for making available the services of the hospital, and there is no direct reporting to administration. However, the medical staff is responsible for the quality of medical care given to the patients and for the conduct of its members, in accordance with the regulations established by the board. The medical staff is accountable to the board of trustees and has the responsibility of participating in the functioning of the hospital, by serving on hospital committees and directing technical and clinical services.

The administration is accountable to the board for the management of the hospital and the implementation of policies approved by the board. It is also responsible for the financial aspect, hotel service, the physical plant, and personnel functions of the hospital. All people who work in the hospital, aside from most of the physicians, formally report through administrative channels.

Models of Select Hospitals

The configuration of four select hospitals is presented in Figures 3.1 to 3.4 to help understand the rationality of their structure. The first, Figure 3.1, is a government hospital of 1,000 beds, with multispecialty treatment facilities offered free of charge to the patients. The second, Figure 3.2, is a university hospital, with 700 beds, which offers multispecialty services, with the primary aim of teaching and research. The third, Figure 3.3, is a trust hospital with 1,000 beds, equipped with multispecialty and multimodel treatment facilities. Figure 3.4 is a large corporate hospital with state-of-the-art technology, 250 beds, offering superspecialty services.

The organisation charts presented in Figures 3.1 to 3.4 depict the formal and hierarchical lines of authority and departmentalisation within the hospitals. The operating divisions may be grouped in a number of ways, but frequently are divided into nursing, food and beverage service, patient care, ancillary diagnostic/therapeutic support and finance. The hospital's medical departments are usually organised according to medical specialities—cardiology, oncology, paediatrics, and so forth. Patient care, however, is actually carried out through a matrix organisational structure, with the medical staff directing the specialised members of the medical care teams in each of the departments.

The government and the teaching hospital's structure, on several counts, are a divisional structure, where clear divisions can be seen within the organisation and semi-autonomous units are created. In their case, the way of grouping units is relatively clearcut—units have been grouped according to accepted medical specialties such as medicine, nephrology, neurology, pathology, radiology, and so on.

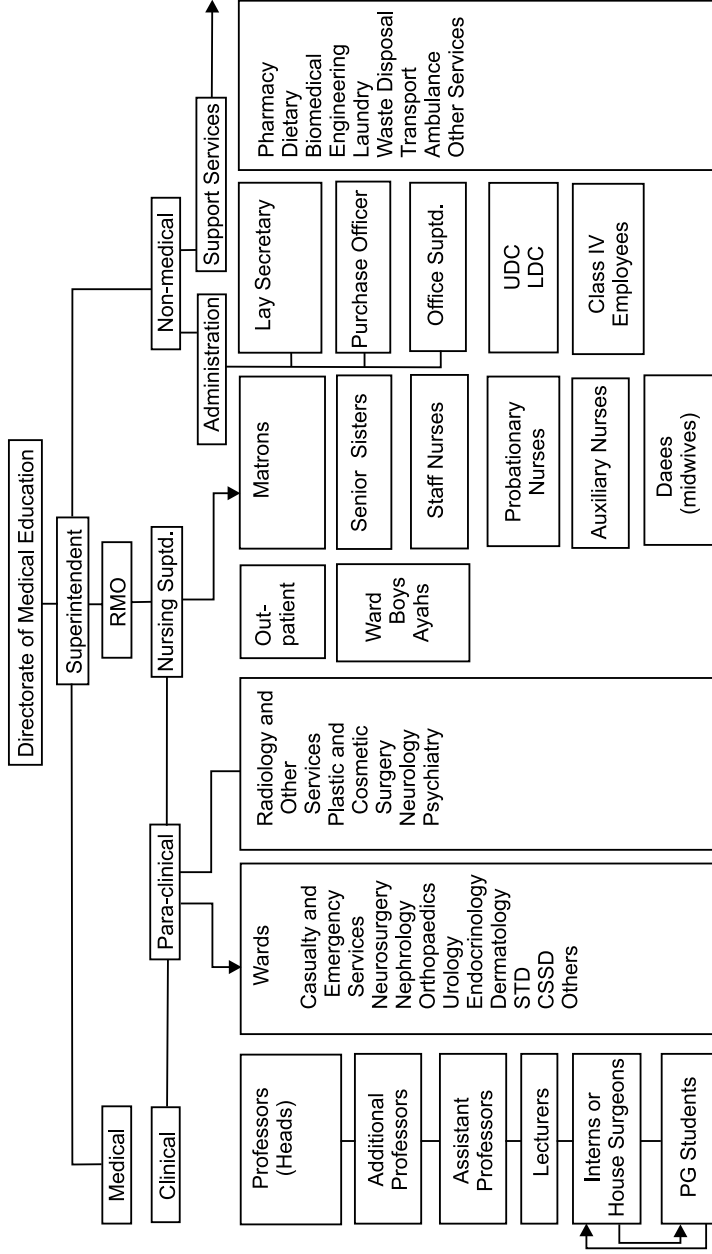
Figure 3.1 shows the physicians in charge of each clinical service, as the persons with direct overall authority for divisional operations. Each division has heads for nursing, medical and non-medical areas. They are accountable to the medical superintendent, who, in turn, reports to the Directorate of Medical and Health Services of the government.

Figure 3.2 shows the Dean, who is given the overall authority for the departmental medical services. The executive registrar is accountable for the accounts, establishment and planning activities of the hospital. The medical superintendent is accountable for the supportive services and paramedical services of the hospitals. All of these report directly to the Director or Vice-Chancellor.

Figure 3.3 depicts the organisational chart of a trust hospital. This structure is patterned on a functional design. Here, the basic hospital services such as finance, medical, diagnostic, nursing and supportive services are separated. Each service is headed by an assistant administrator. This design enables divisions to be made on a centralised and hierarchical basis. All these assistant administrators are accountable for their functions to the administrators, who, in turn, report to the Director.

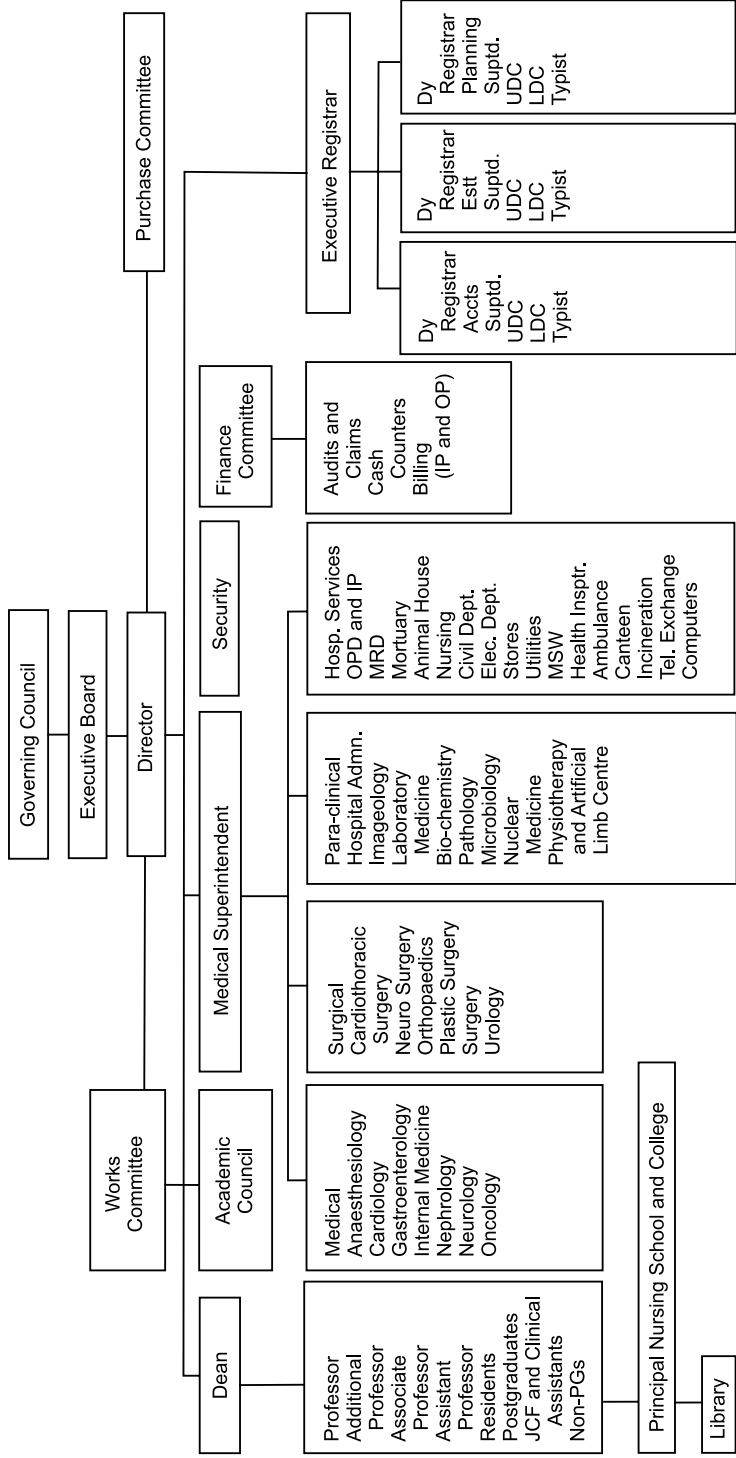
Figure 3.4 shows the separation of hospital services into administration and medical. The CEO has the overall authority for the administration, which includes several services, such as front office, billing, and so on, on the one hand, and a quality assurance programme, on the other. The CEO also has overall authority for Human Resource Management and Human Resource Development issues, and the fire and safety services of the hospital. The Director of Medical Services is accountable for the medical services of the hospital. All these report to the Managing Director, who, in turn, gives an account of the overall performance of the hospital to the Chairman and the board.

FIGURE 3.1 Configuration of a 1000-bedded Government Hospital



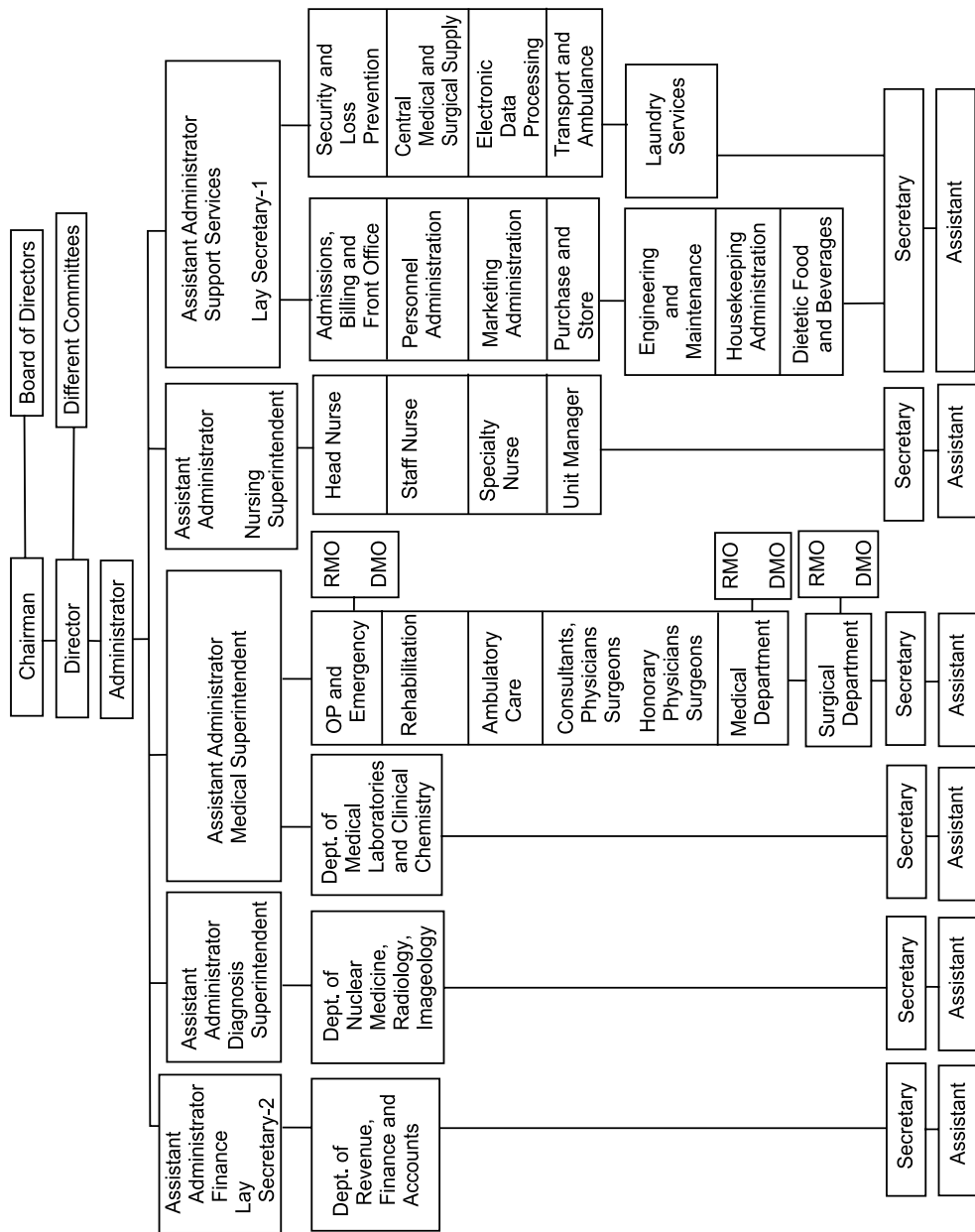
Note: **CSSD** Central Sterile Services Department; **LDC** Lower Division Clerk; **PG** Postgraduate; **RMO** Resident Medical Officer; **STD** Sexually Transmitted Disease; **UDC** Upper Division Clerk.

FIGURE 3.2 Configuration of a 700-bedded University Hospital



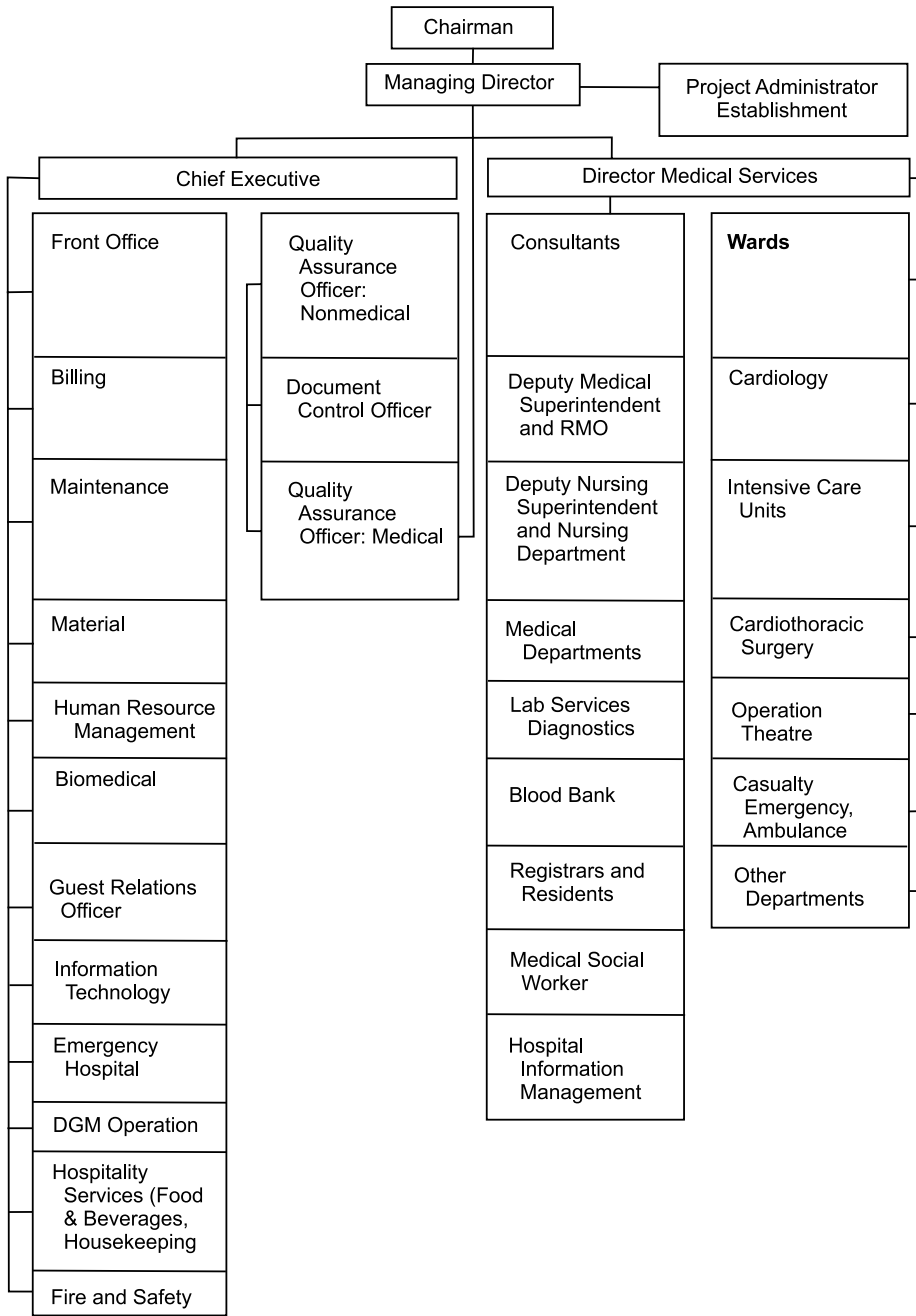
Note: **IP** In-patient; **JCF** Junior Clinical Fellow; **LDC** Lower Division Clerk; **MSW** Masters in Social Work; **MRD** Medical Records Department; **OP** Out-patient; **UDC** Upper Division Clerk.

Figure 3.3 Configuration of a 1000-bedded Trust Hospital



Note: **DMO** Duty Medical Officer; **RMO** Resident Medical Officer.

FIGURE 3.4 Configuration of a 250-bedded Corporate Hospital



Note: **DGM** Deputy General Manager.

Rationality of these Models

Consider the figures of the four hospitals. The lines connecting the various boxes in the figures are called 'lines of authority'. They show the hierarchical way in which responsibility is identified and authority is delegated. They also show the reporting relationships and the communication channels in the organisation. The figures also illustrate a variety of ways of grouping the activities in hospitals.

Some relevant factors relating to the theoretical concepts of the four figures presented are discussed in the following section. These concepts are: division of work, differentiation, line and staff functions, hierarchy of functions, span of control, work levels, delegation and authority, accountability, and responsibility.

DIVISION OF WORK

Every hospital arranges its activities into sub-activities in a proper sequence, with concern for efficiency. Thus, a larger number of people would be required if the same activities increase in volume. They would also be needed if different activities were initiated and were to be done simultaneously. From all the figures, it can be assumed that the objective of the hospital is to provide preventive and curative care. The activities involved are:

- Examining patients and treating them.
- Keeping records of patients, treatment prescribed and money collected.
- Keeping the hospital clean.
- Ordering, receiving, storing prescription medicines and other supplies.

A few people, depending on the volume of work, can perform these activities. Thus, it can be seen that these figures accommodate both the medical and administrative staff, according to their activities.

DIFFERENTIATION

Differentiation is the grouping of specific tasks that are similar, in contrast to other groups of tasks which gives rise to organisational divisions through task specialisation. Thus, what is evident from the figures is that every hospital is characterised by several service units/divisions according to its specialisation in providing patient care. For example, it is evident that departments like cardiology, Emergency Medical Department (EMD) nephrology and neurology are a part of differentiation. On the other hand, differentiation can also be seen in the

administrative functions, such as finance, marketing, human resources and operations. With regard to the splitting of work by the levels in the figures, there are two kinds of differentiations—vertical differentiation and horizontal differentiation. Vertical differentiation is the division of work by the level of authority, often referred to as the scalar process. For instance, the arrangement of authority is:

Figure 3.1:

Superintendent—RMO—Nursing Superintendent

Figure 3.2:

Director—Dean— Professors—Associate Professors—Assistant Professors

Figure 3.3:

Director—Administrator—Assistant Administrator—Lay secretary

Figure 3.4:

Managing Director—Director Medical Services—Heads of Departments

Horizontal differentiation is the division of work by specialisation. For instance, arrangement of the heads of the clinical, para clinical and non-medical functions can be called horizontal differentiation (Figures 3.1 to 3.4).

LINE AND STAFF FUNCTIONS

Line functions are those that include the performance of tasks which are directly involved in the provision of patient care, whereas staff function includes performance of those tasks that facilitate the operations of line functionaries. In a hospital, the line function is performed by doctors and nurses, whereas the staff includes the supportive and managerial functionaries who make recommendations and suggestions about the implementation of decisions. In the figures presented, the line and staff structure is quite evident, irrespective of the type, size, and ownership of the hospital.

SPAN OF CONTROL

It is defined as the number of immediate subordinates who report to a given superior. We see, in Figure 3.1, the span of control of the superintendent includes two people—the Medical Chief and the Resident Medical Officer (RMO). While for the RMO, it is the nursing superintendent and non-medical functionaries. In

Figure 3.2, the span of control for the director are the chiefs—the dean, the medical superintendent, the security chief, the academic council and the finance committee. In Figure 3.3, the administrator's span of control includes five functionaries, the assistant administrators—finance, diagnosis, medical, nursing and supportive services. Lastly, Figure 3.4 shows that the span of control of the managing director includes three functionaries—the CEO, the Director Medical Services and the Project Director.

WORK LEVELS

Every hospital categorises the groups of work positions into levels. Conventionally these are three—top, middle and the bottom or lower levels. These are also called primary, secondary and tertiary levels, from top to bottom. The secondary and tertiary levels in every organisation, including hospitals, exist so as to reduce the workload of the top levels, and so on.

According to the nature of activities, the number of levels is increased or decreased. Sometimes there may be four levels as a standard—top, senior, middle and bottom levels. From the figures it can be seen that there can be three, four or six work levels.

AUTHORITY, DELEGATION, RESPONSIBILITY, ACCOUNTABILITY

Yet another critical factor in deciding the organisational structure is the determination of how the organisation's authority is to be distributed among the various positions. Authority is power that has been legitimised by formal organisation. Delegation is the process by which a superior assigns a portion of his or her workload and authority to one or more subordinates. In the figures, it can be seen that authority is delegated to several levels of management in the hospitals. Therefore, each functionary of the respective level is responsible for the particular function. Responsibility is the obligation to perform a task as directed by a superior. Finally, the manager holds the subordinate accountable for the proper accomplishment of the task. From the figures it is quite evident that there is not a single structure that follows any one of the structural models that were mentioned earlier. Nevertheless, they exist as an amalgam of characteristics of two or three models. One of the distinct violations of the principles is related to the unity of command (every subordinate has only one supervisor-superior). Most of the employees receive instructions from a clinical boss and an administrative boss. This results in work-role and priority conflicts for the employees. Further, it causes anxiety among them, as a result of their prioritising the tasks assigned

to them by two different bosses, representing line and staff positions in the hospital. Since hospitals have been traditionally designed with a structure allowing employees to report to two or more superiors, in the course of delivering services to the patient community, the matrix structure would be more appropriate, where job descriptions provide role clarity for all employees.

Implications for Future Designs

From the preceding sections, we observe that there are five designs in the structure of an organisation—functional, divisional, corporate, matrix and parallel designs. However, in this chapter, only four hierarchies of select hospitals are presented, since the parallel model of organisational design is virtually non-existent in the hospitals that were selected. Are they exhaustive? Virtually no. Organisations are quite varied and distinct from each other. In fact, Mintzberg's (1989) study revealed that only about half of the 123 organisations studied could be neatly fitted into these five categories. The others were amalgamated, conforming to two or more configurations. This is quite possible, since the organisations are complex entities, with different parts facing different environmental demands, and, therefore, developing along the lines of a specific configuration. In the same organisation, for example, it is quite logical to expect that the configuration of the functional design of cardiology is quite different from that of a neurology department.

Designing Organisations for Long-term Growth and Stability

There is often a need to reassess the organisation's mission and review the strategic plan in the light of changes which occur as time passes. As organisations consider issues related to long-term growth and stability, accountability becomes particularly important. It may be necessary to change the organisation's design to make health professionals more accountable for their behaviour, especially when there are pressures from the external environment to control costs. This may involve decentralised structures or the creation of lateral relationships.

Management and clinical information systems, reward systems, and evaluation systems that are consistent with the new design must be created.

The compatibility between changes in job design, unit design and overall organisation design must be considered. For example, expanding into new service areas may require different administrative support and different patterns of linkages with other departments.

Conclusion

This chapter has presented some of the significant features of hospitals, distinguishing them from non-hospital entities. Organisational structures of select hospitals have been presented, while enumerating the distinct differences in the understanding that prevails with regard to the organisational structure and the attributes of such structures. A detailed discussion regarding preconditions for designing the organisational hierarchy is made, while providing explanations from the theoretical framework. Lastly, implications for future organisational design are drawn.

In conclusion, it should be added that there is no one right structure that is appropriate for all organisations. There are structures that are more appropriate for a particular organisation, given the circumstances in which that organisation finds itself. It is important to examine carefully the number of layers of hierarchies between the chief executive and the patient, on a regular basis. The flatter the structure, the closer is the decision-making to the patient, and the more efficient is the work process.

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Financial Management for Hospitals

4

P. Jangaiah

Introduction

The business of health care is becoming increasingly risky in terms of financial management. It is labour and capital intensive and the utilisation of some of the equipment and machinery rarely reaches the break-even level. The obsolescence rate is high. Cost of the equipment, land and building, personnel and other inputs spiral upwards constantly. The demand for service is unpredictable, while new hospitals are coming up at an incredible pace. They are growing in number in leaps and bounds and the existing hospitals are adding bed strength every year. The price war, which is a common feature of competition in consumer and similar industries, is crawling slowly into the health care industry in a subtle way in the form of discount cards. Health insurance is just round the corner, which opens up new opportunities for many hospitals, while it poses a threat to some of the existing hospitals. Hospitals established in joint venture with foreign participation seem to be imminent soon after the health insurance scheme takes off. This chapter makes an analysis of the current state of the health care industry, suggests the financial aspects to be taken into consideration before establishing a hospital, the sources for financing, and the financial control which should be exercised for the hospital to be commercially viable and efficient.

Current State of the Industry

The health care market in India, with a population of 1,030 million growing at an average rate of 1.96 per cent per annum (as of the 2001 Census), has the potential to become a huge market. Developed countries such as USA have a hospital bed for every 170 persons, whereas India has one bed for 1,120 persons. Thus, there is tremendous scope for establishing many hospitals in the years to come, if India wants to achieve standards of health care established by the developed countries. The promoters of the health care business are eager to establish more

hospitals or increase the number of beds in the existing ones. In this context, it will make sense to observe some related statistics at the national level in order to understand the reasons for the shortage of supply in the Indian health care industry. Our country, where the individual's paying capacity is low, was a controlled economy for a long period of time and the responsibility for providing health care to the community was assumed by the government—central, state and local. Private sector operations were present for a long time in India, though it was confined to non-government organisations, solo practice or a few partnership firms. The presence of the government was ubiquitous at all levels of care—primary, secondary and tertiary.

Though our population is large, economic development was slow and of a low order. India's GDP and per capita income, literacy level and awareness of health care were also low. As per the 2001 Census, the literacy rate was 65.5 per cent, and 26 per cent of the population was below the poverty line. This is in stark contrast to the indicators of the developed countries. As per a World Bank policy study, USA had one bed for 171 people, while India had one bed for 1,120 people. These contrasting observations of statistical ratios between the USA and India show some of the causes for the supply being short and there being limitations in the scope for growth in the health sector. In order to achieve the population to bed ratio of 171:1, India needs to have (as per the 2001 Census population statistics), a bed strength of 9 lakh at the national level. As against this, we have only 6.64 lakh, as shown in Table 4.1.

Table 4.1 Patterns of Health Sector Growth in India

<i>Attributes</i>	<i>Year</i>		
	1981	1991	2001
Number of Hospitals	6,805	11,571	15,622
Per cent in Private Sector	43	57	73
Number of Beds	504,538	806,409	903,952
Per cent in Private Sector	28	32	38

Source: Ministry of Health and Family Welfare, 2005.

If the current growth rates continue—1.96 per cent for the population, 1.2 per cent for bed strength and 3.5 per cent for hospitals, it is evident that the shortage in supply will continue for long, as shown in Tables 4.2 and 4.3.

Table 4.2 Trends of Growth in Hospitals

<i>Attributes</i>	<i>Year</i>		
	1981	1991	2001
Number of Hospitals	6,805	11,571	15,622
Decade Annual Growth Rate %		4.4	3.5
Private Sector	2,926	6,595	11,404
Decade Annual Growth Rate %		13.9	7.3
Public Sector	3,879	4,976	4218
Decade Annual Growth Rate %		2.8	(-)

Source: Ministry of Health and Family Welfare, 2005.

Table 4.3 Trends of Growth in Hospital Beds

<i>Attributes</i>	<i>Year</i>		
	1981	1991	2001
Number of Hospitals	504,538	806,409	903,952
Decade Annual Growth Rate %		6.0	1.2
Private Sector	141,271	258,051	343,501
Decade Annual Growth Rate %		8.2	3.3
Public Sector	363,267	548,358	560,451
Decade Annual Growth Rate %		5.1	0.2

Source: Ministry of Health and Family Welfare, 2005.

Thus, the opportunity for establishing new hospitals, or the addition of beds in existing hospitals is quite vast. The supply, very likely, will lag behind demand for another decade or even longer if we keep adding health care facilities at the current rate. Though the growth rate is encouraging, the pace is not enough to match not only the existing needs, but also to catch up with the growing demand. It may be observed that much of the growth during the past one and a half decades can be attributed to the growing participation of the private sector.

REASONS FOR SLOW GROWTH

- The government—a major provider even today—is not providing sufficient funds to spend on health care or to meet growing health needs, which creates an entrepreneurial opportunity for the private sector.
- The return on assets is quite low, investment is too large and gestation period long, which discourage new promoters.

- The break-even level of operations for some of the equipment is too high.
- The location choice of promoters is biased towards urban areas, leading to stiff competition, low occupancy and, consequently, unprofitable operations. Some are finding it difficult to stay afloat.
- The costs of operations, personnel, medicines and drugs also have an impact on the operating margin (profitability).
- Health care is seen more as a social service than a profit-oriented business proposition. Unlike other industries, health care does not enjoy the favour of financial institutions and the government has not given encouragement and support to this industry.

INDUSTRY CHARACTERISTICS

A puzzling characteristic of the health care industry today is unprofitable hospitals, even when there is a large demand and supply gap. Is it an inherent characteristic of the industry, or is this situation specific to how hospitals are promoted and operate in India? The answer seems to be both.

The average Indian patient's income is low; most cannot afford the high cost of the best health care in the private sector, and some, perhaps as a result of a cultural carryover, are not willing to spend though they can afford it. The industry resembles a mirage. But of late, market characteristics are undergoing a rapid change. The second part of the question raised in the beginning of this section is answered at length in the following paragraphs.

The *raison d'être* of an organisation is its objective. The existence, continuance and survival of a hospital are justified in terms of its ability to achieve the objective for which it was established. Every hospital is established with an ideal, a goal and a mission, or simply to achieve a set objective. The form and type of ownership of the hospital influences the objective.

To a great extent, the form of organisation is influenced by the size of the hospital in terms of bed capacity, the investment needed, or the managerial skill needed. We find different forms of organisations in the health care industry. From the ownership perspective, we can classify them as solo practitioners, partnership clinics/nursing homes, private limited companies, public limited companies, non-governmental voluntary organisations, missionary and trust hospitals and government hospitals of various kinds.

The type of ownership plays an important role in formulating the goals and objectives of a hospital. Corporate hospitals and private limited hospitals aim to operate for profit, while others such as government, trust and missionary hospitals operate to serve the sick free of cost, to mitigate the sufferings of the poor who

cannot afford the cost of medicare. They are 'not for profit' hospitals. An organisation, or for that matter a hospital, can have multiple objectives, but it must ultimately end up fulfilling the single objective: to make profit, or to serve the community. If a hospital is working for profit, it would like to maximise that profit in the long run; if it is operating to serve, and not to make profit, it would like to serve the maximum number of patients with the given resources because such resources are scarce in economic terms. The difference is that the first has the funds, while the other does not have facility to earn it when they render service to the community. Thus, it is essential to operate efficiently and effectively, irrespective of whether the hospital is working for profit or not. The rest of the chapter will discuss financial operations in hospitals that are established to earn profit.

END IS PROFIT

Profit is the end result of a long chain of the management process. Planning, as a function of management, has been understood as a continuous process comprising *ends, means, resources, implementation* and *control*. In this process, *ends* imply the setting of specific goals; *means* specify the selection of policies, programmes and procedures used to pursue the goals; *resources* mean the estimation of the firm's needs; and *control* pertains to the system of detecting, preventing and correcting deviations on a continuous basis. Hence, it is imperative for an organisation to start with a goal that is measurable, acceptable and clearly understood. Profit, or the rate of return, is one of the goals that is comprehensive and covers all other sub-goals. In a market economy, organisations that make a profit will become fit, and organisations that are fit only can survive by forcing the sick to the graveyard. Profit is the essence of many financial transactions. To be profitable, every financial transaction must be entered into and completed with great care.

An organisation, and hence a hospital, can operate profitably only if it can take care of three standard activities:

- Investment
- Financing
- Operations

Improper planning and inefficient execution and control in any one of these activities will have an impact on the profitability of a hospital. While inefficiency in 'operations' has a short-term effect and is correctable, in the other two, it will have a long-term effect and will be difficult to correct. The rest of the section is

devoted to a discussion about how to plan, organise and exercise control at each stage of these activities, so that the desired outcome is obtained.

Investment Activities

Before making a commitment to invest in a hospital, it would be wise to have a feasibility study of the project carried out by a professional. This study must address both the technical and financial feasibility and include the following issues:

1. *Where will the hospital be located? What is the catchment area it wants to cover? What is the size of the market—the population that needs the service?*

It should be a detailed study of the size of the population, age distribution, growth rate, morbidity statistics, income levels, literacy levels, industrialisation, employment rate and other demographic and economic data with relevant forecasts.

2. *What kind of service does the hospital want to offer and what specialties will it include?*

The promoters must address choices such as single specialty or multispecialty; if the latter, which specialties? This should be linked to the needs defined and studied above. This will also include information about competitors in the location, since hospitals compete in terms of the specialties they offer and not by bed strength alone.

3. *Who are the competitors in the area?*

Make an assessment of the size of their operation, expansion possibilities, market position, their current market share, their strengths and weaknesses vis-à-vis the promoters. This will give an idea about the market, which the promoters may have to target, and its size. The study should also assess and take into consideration the likely reaction of the competition to the current project, as and when it is undertaken.

4. *Technology is a major parameter which defines not only the size of the project, but also the process and the inputs required, and the need for technical know-how and consultancy.*

Technical feasibility should address issues such as whether the selected technology is superior to the ones existing in the locality, the competitive edge it offers over its competitors, its cost-effectiveness and maintenance.

For example, the use of X-knives or Gamma knives that replace traditional methods of surgery, with precision and less pain, are prohibitively expensive. Their use requires a large volume and a specific kind of clientele. If the market cannot provide the volume and the clientele, perhaps the choice of traditional techniques should be preferred, and are more acceptable. A case in point is MRI machines.

This item, along with the market size, the competitors' share, the specialty the promoter wants to offer, the target population, and the morbidity data, will help determine the size of the project.

5. *What is the size of the project, in terms of bed capacity and capital investment required?*

Generally the size of a hospital is measured in terms of bed capacity. But this does not help estimate the project cost. A 100-bedded maternity hospital does not require as much investment as a 100-bedded cardiothoracic hospital. Bed size is helpful for estimating the required plinth area of the building. It is better to use a compound measure such as beds-specialty-investment in order to determine the size of a hospital. Investment alone sometimes can measure the size of the project, but it is affected by price fluctuations.

6. *Is the manpower available locally?*

A hospital is a labour intensive industry. The manpower required is highly skilled, and generally patients are clients of the doctors and not of the hospital. Most of the time hospitals are located in urban areas, hence there may not be a problem of manpower availability. But if a project is planned in non-urban areas, this can be a limiting factor; the salaries have to be very high to attract the right people to join. The transportation cost of employees will also be more, which will escalate the recurring operational expenses. This factor can be used in forecasting future labour expenses.

7. *What is the cost of land and works in the area?*

It is generally observed that the investment in land and building works out to 32 to 38 per cent of the total investment in fixed assets. This asset, which does not directly contribute to the provision of health care, takes a lion's share in the

investment. This may be attributed to the increasing cost of real estate and the spiraling cost of civil works and construction material in urban areas. Leasing may be a better option to minimise the investment.

8. *Should the project be commissioned in phases or at one time?*

For a large project, such as a 1000-bed capacity hospital, beds-specialty-investment will determine the size of the hospital and is better executed in phases than at one go, for obvious reasons. It does not require all the investment at one time, precludes future competition, and gives flexibility for changing plans and adjusting to the growing demand without much difficulty. But, the phasing time has to be worked out suitably so that the project cost is somewhat evened out.

9. *What is the pattern of costs for the services offered by existing hospitals?*

This will help in deciding the prices; the hospital can charge the patients in the present and in future, for forecasting revenues, for preparing projected financial statements and for making a break-even analysis.

10. *What is the cost structure of the services rendered by the hospital?*

The cost structure constitutes the value of the material, salaries, supplies, administration and fixed costs, expressed as percentage of the sales, for the chosen size of the hospital and at a given level of operation. A cost structure with a high percentage of variable costs is advantageous to a new hospital in the short run and in the event of uncertainties in demand.

11. *As per the feasibility study, how long does it take to break-even, or what is the gestation period?*

Since the investment in fixed assets is quite high in hospital projects, depreciation costs are high, which add to the operational fixed costs. Therefore, fixed costs are proportionately high in the case of hospitals. Hence, it is very long before a hospital breaks even.

12. *How much time does it take to complete the project?*

In most projects, the investment cost increases because of time overruns. It is essential to plan the timing of the project meticulously and execute it accordingly, making use of project management techniques, so that the project cost is manageable and within the budget.

13. *Who will manage the hospital?*

Many doctors do not accept the fact that a professional manager in a modern hospital will contribute better to its efficient operation. They feel that a doctor can run a hospital as well as a manager running an industrial enterprise. This may be true in some exceptional cases, but a majority of successful business organisations are run by professionals who are educated and trained for that role. Slowly hospitals are accepting this reality and are employing trained management professionals to take care of the managerial side of the hospital, while doctors run the medical side. It is good for a hospital when they function together and complement each other.

14. *What incentives can the local government offer?*

Governments in certain areas may offer various benefits for a hospital if it provides service to poor patients. This may be in the form of subsidies, grants, and so forth. The benefits must be measured and weighed against the costs, before accepting or rejecting the offer, if there is a choice.

THE PROJECT REPORT

After all the points listed above have been covered, a proposal for the project can be formulated in the form of a document. This will give details of the amount and schedule of investment, the phasing details—revenues and operating costs for each year for a given capacity, until the total capacity is reached or at least for the next five years, the profit or loss in each year of operation, and cash flow estimates and break-even values. An estimate of the working capital needed to support the expected level of operation in each of the years should form part of the total project cost. A margin for contingencies can be estimated to meet unforeseen expenses and escalations in the forecasted expenses. This should be incorporated in the report.

Investment in a project is risky because resources are committed for a long-term in anticipation of uncertain future returns from an expected level of future operations. These decisions are by nature irreversible. They involve large sums of money. A single mistake at this stage may be suicidal for the project. The commitment has to be made based on a rational analysis of the information available and with a long-term perspective. The decision to invest in a project on the spur of the moment, on an irrational basis, for short-term benefit or for personal reasons, is likely to lead to difficult consequences resulting in wastage of scarce resources and disappointment to the investors. When the project cost is estimated, the next step is to determine the source of the required capital.

Financing Activities

STAGES OF PROJECT

Choice of the project, market study, project preparation and estimating the investment forms one wheel of the cart. The other wheel is procuring or gathering the capital or the money required for the investment. Financing requirements arise many times in the lifespan of a hospital. They may be classified into different periods:

- Gestation stage
- Operational stage
- Expansion stage

The gestation stage covers the period from the commencement of project construction to the commencement of operations. The operating stage includes the period during which the firm produces and sells the goods or services. The expansion stage is the period during which the hospital adds additional capacity in terms of beds, equipment or the establishment of another unit. Some of the stages may recur.

It is important to establish the goals at each of these stages. During the pre-operative period, the project cannot contribute directly to the long-term goal of the hospital, but it can contribute to profits at a later stage if the construction cost and project schedules are maintained as per the proposal. During this period, the management must be careful not to let the hospital be burdened by an excessive amount of debt capital, but ensure that it is kept to a minimum. The interest will add to the project cost and the payment will be made out of the capital. If used excessively, this will tell on the results of the operating period adversely.

During the operating period, the management's responsibility will be to ensure that the operating cycle—input, output, sale, collection and payment—goes on smoothly. The use of resources or inputs—material, cash, labour and other services—in the production or service process creates short-term liabilities. Current liabilities and the output, and its consequent sale, creates some claims—and current assets. Working capital management refers to the proper planning of current assets and arrangement of funds from various sources and their payments. At this stage, the management must maintain liquidity, while keeping costs low. This will ensure long-term success and the attainment of profit goal.

During the expansion period, two distinctive situations arise, one relating to the efficient operation of the existing capacity of the hospital, while the other is to

arrange and supervise the funds required for the expansion at a cheaper cost, and not to expose the hospital to further financial risk. Thus, the expansion period is a combination of gestation and operation periods.

FINANCIAL PLANNING

Financial planning of the hospital should lay down policies in respect of:

- The amount of capital required at each stage.
- The sources, in general and particular, to be used to raise the required capital.
- The mix of different sources in the total capital.
- The target cost of capital for the hospital.
- Appropriation of profit during the operating period.
- The policies relating to the grant of credit and collection of receivables.

The project proposal should give information regarding how much investment or funds are needed at each stage of the project. During the gestation period, funds are needed to meet the cost of land and buildings, improvements to the land, promotional expenses, cost of machinery and equipment, and salary expenses. During the operating period, the requirement of current assets and the arrangement of finance assume a prominent position. Current assets are estimated and monitored on a constant basis, keeping in mind the occupancy levels or capacity utilisation in the hospital. Though some current liabilities arise spontaneously, the rest should be planned in advance and procured on time. Investment is needed for keeping a certain level of materials in stock, for granting credit to patients or clients, and to pay some expenses in advance. The expansion period resembles the gestation period because it involves investment in fixed assets or taking up another new project, but it is done during the operational period of the existing hospital. Estimation of cost for the expansion of the project is similar to the first stage, but it must bear in mind the existing business and financial risk.

SOURCES OF FINANCE

Once the quantum of finance is determined, the next step is to plan and procure funds from various sources, at the minimum rate possible. The available sources will depend on the form of the hospital-organisation. Each form has some sources specific to it.

A (single) proprietor-owned hospital, or nursing home, has limited scope in terms of its sources. The capital available is also limited. The proprietor, his or her friends and relatives contribute the capital. Some commercial banks and state-level financial institutions also supply its capital requirements to a limited extent. This form is suitable for clinics, small nursing homes and some diagnostic centres.

Another form is partnership. Many nursing homes and small-size hospitals are run under this form. Its sources of finance are similar to the proprietor-form, but the size of the funds will be relatively larger, because the number of owners is many. According to Indian partnership law, the number of partners is limited to 20.

A private limited company is another form of organisation that is prevalent in some of the hospitals in the country. This form is much better than the earlier two. Its size can be big, but need not be as large as a public limited company. Again, the sources of its finance are limited, since the number of shareholders (owners) is limited to 50. This form is suitable for a medium-sized hospital with up to 200 beds.

The ultimate form of organisation is the public limited company. There is no limit on the number of shareholders and the liability of the owners is limited. This form of organisation is popular and is the form of many manufacturing firms. It offers unlimited scope in terms of ownership capital and is financially supported by many financial institutions of all-India status, for project financing, modernisation of equipment, and so on. Ever since the Apollo Hospitals Group adopted this corporate form of organisation, it has become popular in the health care industry. For large-sized hospital projects of above 200 beds, this form is suitable. It has the potential of pooling any amount of capital from various sources that are uniquely available to this form. Some major sources of finance for corporate hospitals are discussed below.

Sources of Finance

EQUITY SHARE CAPITAL

Owners' capital is relatively easy to come by. It is permanent in nature and remains with the company as long as it survives. An owner's investment shows their commitment to the project and their belief in the future profitability of operations. The firm never guarantees any specific rate of return. The returns depend on the fortunes of the business: in good times there is a good return, whereas in bad

times the return may even be nil. Sometimes capital can be lost if losses are heavy. It is the riskiest form of capital investment for the owner and the best source for the firm in bad times. The investors who contribute to this capital are called shareholders and are the owners of the company.

This capital may be raised through public issues. The quantum of minimum capital to be contributed in this form is not left to choice. Capital issue norms and debt equity ratios imposed by financial institutions will determine how much can be raised from this source. Debt-equity ratios range from 3:1 to 2:1—in other words, of the total finance requirement, the owners should bring in 25 to 33.3 per cent. Securities Exchange Board of India (SEBI) specifies that in a public issue of equity capital the promoters' contribution should be a minimum of 25 per cent of the issue size and not exceeding 40 per cent. Thus, the minimum amount is fixed by two factors—the project cost and the debt-equity ratio imposed by the lenders. The maximum is restricted by its authorised capital.

RETENTION OF EARNINGS

For an existing organisation (hospital), the profits made will be an internal source of finance, and it is a cheaper option compared to the public issue. This source will be of great use during the expansion period. But the size of the profits may be small, and it may affect the shareholders' expectations.

PREFERENCE SHARE CAPITAL

This source of capital is almost extinct. It is advantageous neither to the investor nor to the company. It is an instrument with the characteristics of a debenture and also that of an equity share.

DEBT CAPITAL

Lenders' capital is very difficult to get. It is a long-term source, but rarely a permanent one. It is also called loan capital or debt. The lenders are promised a fixed rate of return on their funds, irrespective of the profits or losses made by the hospital. During bad times, this capital worsens the financial condition of the company because of interest payments and principal repayments. But in good times, it more than offsets the risk of having this capital. In the case of liquidation, these levels get priority in terms of claims against the property of the company.

DEBENTURES AND BONDS

This source of finance is the most popular and commonly used by corporate India, and is well known and understood by the investing community. These are debt instruments, such as promissory notes, issued by companies to the investors for the amount of funds borrowed. They are in common denominations of Rs 100, Rs 500 or Rs 1,000. This capital will cost about 18 per cent per annum to the company on a pretax basis. This is a long-term source of finance. While the rate of interest is indicative, it really depends on the going rate at the time of the debenture issue.

There are basically two types of debentures—non-convertible and convertible. A convertible debenture is a combination of debenture and equity share. Until the time of conversion, it has all the features of a non-convertible debenture and from the time of conversion it is an equity share.

LONG-TERM LOANS FROM INDIAN FINANCIAL INSTITUTIONS

The following institutions offer long-term loans to the corporate sector:

- Industrial Development Bank of India (IDBI).
- Industrial Credit and Investment Corporation of India (ICICI).
- Industrial Finance Corporation of India (IFCI).

IFCI has been operating a scheme under which projects to set up new hospitals and multidisciplinary health centres, or to modernise existing facilities that are financially viable propositions undertaken by corporate hospitals, are eligible for financial assistance. The assistance may be in the form of:

- Rupee loan.
- Foreign currencies.
- Underwriting and/or direct subscription to the share capital and debentures of public limited companies.
- Guaranteeing of deferred payments for imported equipment and foreign currency loans.
- Assistance from IFCI in the form of financing, procurement and leasing of equipment and suppliers' credit from existing hospitals with a proven track record of profitability.

Eligibility

Hospitals that use modern equipment or the latest technology to provide service to patients will be given due weightage and projects promoted by medical professionals and non-resident Indians will be accorded priority.

Norms of debt-equity ratio and promoter's contribution

The minimum contribution from the promoters has to be 17.5 to 22.5 per cent of the project capital cost. More investment by the promoters will encourage the financial institutions in general. The debt-equity ratio must be within the limits of 2:1.

Terms and conditions of the loan

- Security must be provided for the loan.
- Repayment of the loan can be between three and five years.
- The rate of interest will be charged on par with other industrial organisations, but for modernisation of existing hospitals a lower rate is possible.
- Nominee directors will be appointed on the board of directors of the company.

Risk capital assistance

In case the promoters are not able to bring in the required minimum of promoters' contribution to the cost of the project, they can approach Risk Capital and Technology Corporation Limited (RCTC). RCTC will give assistance of up to 50 per cent of the promoters' contribution, as fixed by the financial institutions.

Other institutions offering long-term loans

- Industrial Reconstruction Bank of India (IBIM)
- Unit Trust of India (UTI)
- General Insurance Corporation of India (GIC)
- Life Insurance Corporation of India (LIC)
- Small Industries Development Bank of India (SIDBI)
- State Industrial Development Corporations (SIDCs)
- State Financial Corporations (SFCs)
- Commercial banks

Conditions to decide the amount of loan approval and sanction

- Debt-Equity ratio of 3:1 to 2:1.
- Promoters contribution in the total equity, 25 to 50 per cent.
- Whether the company is public limited or private limited.
- Location of the project, backward area or non-backward area.
- Security margin and the project cost, 80 to 85 per cent of tangible assets.
- Debt service coverage ratio, minimum of 1.5.

Ways and means of getting assistance from the above institutions

- Participation in equity—if the organisation (hospital) is a public limited company, the financial institutions will contribute to the capital of the company.
- Seed capital scheme—intended to create a new generation of entrepreneurs whose financial resources are limited, but who have all other traits of entrepreneurship. SFCs and SIDCs operate the scheme under the aegis of IDBI.
- Foreign exchange loans.
- Foreign currency refinance scheme—under this scheme IDBI helps hospitals to import the required capital equipment and services through SIDCs.
- Assistance for modernisation—operated by the SFCs and SIDCs to finance the modernisation needs of small- and medium-size units which have been in existence at least for five years and the equipment to be replaced has been in use for the previous five years.
- Refinance for rehabilitation—helps small and medium industrial units which are classified as sick. This is also operated by IDBI.
- Suppliers' line of credit.
- Leasing.
- Deferred payments for fixed asset purchase.
- Subsidies from governments.

Operations Activities

A hospital's operation constitutes its service to the patients. Typical hospital services include outpatient consultation, diagnostics, therapeutics, surgeries, counselling, admission, transfer of patient within the hospital and discharge. Financial management during the operational period generally ensures smooth functioning in terms of its day-to-day activities. Proper planning requires sales or demand forecasts, budgets for different departments about what resources they require, their quantity and timing. This also fixes individual responsibilities for receiving, spending and achieving. A hospital must formulate policies about:

- The credit period allowed to its patients, credit standards and collection policies.
- Vendor selection, payment terms, delivery schedules and quality of supplies.
- Inventory and stores management in terms of order quantities, buffer stocks, material budgets, inventory checking and control.

Requirement of personnel, recruitment, compensation, benefits and working rules must be prepared carefully so that salary costs can be estimated correctly.

Generally a hospital takes about five years to start making profits, if managed well. The reasons for this are inherent and unique to this industry. Bed occupancy grows gradually. Some of its equipment rarely reaches full capacity, though some of them may cost as much as five crores. For strategic and competitive reasons, such equipment is bought and installed for quality care. Some pieces of equipment never reach a break-even level of volume.

Efficiency of operations is measured by the following equation:

$$\text{Net Profit} = \text{Revenues} - \text{Expenses} - \text{Taxes}$$

The result of operations is net profit (or loss). As stated earlier, the profit is the end result of a long chain of management processes, which are affected by many factors. Not only current costs and revenues affect profit, but also past capital expenditure that is written off and interest paid on past financial transactions. Thus, inefficiencies in the form of capital expenditure and financial transactions that crept into the system in the past affect profits during the current period of a hospital. Unfortunately, these inefficiencies are not controllable once committed.

A hospital can improve its profits in many ways:

1. INCREASE REVENUE

It can increase its revenue—which is the product of the quantity of services sold and rates charged (price). By changing one of these variables the revenue can be increased. Most of the times, the rate set by hospitals is not based on cost plus method. They take what the nearest competitor is charging and add or deduct a given percentage to or from it, to set the rate. This method is similar to target pricing. Hence, profit is the result of price minus costs, but not the result of cost plus profit equals price. This relationship calls for efficient operations in terms of cost control.

2. REDUCE THE EXPENSES

The expenses include spending on items such as medicines, consumables, salaries and wages, supplies, rents and rates, depreciation, administration and marketing. Some of these expenses are the result of the activities of the current period, while some are due to past actions and decisions. Depreciation, write-off of preoperative expenses and interest payments are some examples of the latter.

Materials constitute about 30 per cent of the expenses, while salaries and wages constitute 40 per cent. Thus, by controlling these two items of expenses,

applying the Pareto Principle, a hospital can bring about a sizeable reduction in its costs. Cost containment is an ongoing process starting from the inception of the project.

Some of the expenses are incurred consciously, while others just happen. For example, inventory accumulated in the stores and its carrying cost, mounting receivables and resulting bad debts, collection costs, and cost of investment in these and other idle assets are examples of the second kind. If the managers are not alert and knowledgeable, expenses of this nature will wipe off the profits flowing from other actions and liquidity will be in danger. Therefore, it is imperative for managers to pay constant attention to the management of current assets and current liabilities.

3. MANAGING CURRENT ASSETS

Managing current assets involves determining policies regarding the size of each current asset and maintaining their quality. Receivables, inventory and cash are the current assets in any organisation.

Receivables

Receivables are the amount of credit sales that are yet to be realised from patients. The size of this asset is the product of the number of days, and the amount of credit granted to the customer. The number of days of credit are specified by the industry practice and are unique to each industry. Its size can be controlled in terms of the amount of credit granted and to whom it is granted. To whom credit is granted is the crucial factor in credit policy. In fact the identity of this debtor is the factor that decides whether to grant credit, and if yes, how much. Most bad debt costs and collection costs are due to the wrong choice of these customers.

Some hospitals may follow a liberal credit policy so that they can sell more volume, and, therefore, increase their profit. A hospital can be liberal only to the point where the cost of credit is lower than the profit on such sales.

Inventory

Inventory is another current asset that needs constant monitoring. Inventory experts say that an organisation must keep inventory in order to avoid production stoppages and stock-out losses. Stocks must cover the lead and lag times in the supply chain. Inventory has some invisible costs, such as carrying costs, cost associated with loss, investment costs and cost of obsolescence.

Most of the hospital-inventory are medicines and drugs which are of a perishable nature, having an expiry date. If the supplier does not replace the expired stock, it is necessary to plan such stocks as meticulously as possible.

Cash

Cash is another important current asset. Cash includes bank balances too. It is the common denominator with which all transactions are settled. If hospitals can synchronise collections and payments of cash, there is no need for any cash balance. But they never match each other, and hence, the need for a cash balance. Balance of cash maintained results in loss of interest earned. In order to hedge risk, in general, organisations tend to have a larger cash balance, resulting in a larger interest cost. Setting an optimum balance of cash is a tricky procedure. One has to suitably blend managerial experience with the tools and techniques of cash management.

4. MANAGING CURRENT LIABILITIES

Current liabilities are short-term obligations that mature within an accounting year. These include items such as creditors for supplies, outstanding expenses and any short-term loans from banks and other sources.

Suppliers' credit and outstanding expenses arise spontaneously and are relatively less costly. Loans from banks and other sources must be negotiated, and these are in the form of loans for working capital. The cost of a working capital loan is cheaper compared to long-term loans.

There is an accounting theory which states that one should not finance all current assets with current liabilities, as this will lead to liquidity problems. The part of current assets that has to be maintained, irrespective of the size of operations—called permanent working capital—has to be financed through long-term loans.

Measurement of the Efficiency of Hospitals

Management of the previous three activities will lead to the achievement of the objective of increasing profit in a hospital. However, to monitor the efficiency of a hospital, it is necessary to decide the factor that will serve as a measure for efficiency, and the yard-stick/benchmark/standard. These are discussed in this section.

AVERAGE LENGTH OF STAY (ALS)

A hospital's revenue is proportionate to the average number of days a patient stays in it. The revenue may not be equal on every day of the stay of the patient; it will be high during the first few days and will wane gradually to a minimum equal to the basic room rent towards the last day. Modern hospitals aim to reduce

the ALS to a minimum of six days or less. Since the revenue is higher during the first few days, reducing the ALS to such a target may result in the effective utilisation of resources—the hospital can achieve higher occupancy levels with a reduced number of beds, collecting more revenue per patient per day than before.

AGE OF THE PLANT

In economies where inflation is of high order, hospitals that have old equipment are supposed to have lower operating costs, as their depreciation will be low, and higher profitability compared to a newly established hospital of a similar nature. It will be able to dominate the market because of its low-cost structure. But very old equipment that is awaiting replacement or major repair is a threat to hospital operations, since it involves an increasingly heavy investment in the future and the hospital will suffer from problems of breakdown, low efficiency and increasing maintenance cost.

BAD DEBTS

Hospitals that have a sound credit policy and an efficient system for monitoring it will not suffer an investment-cost of funds tied up in the 'mounting and overdue' accounts receivable. On the other hand, hospitals that are lax in their standards incur loss due to bad debts, investment costs and collection costs. The ratio of bad debts to credit sales is a good measure of this situation. The average age of accounts receivable and the ageing schedule of debtors will help analyse the quality of receivables the hospital is facing. The shorter the average age of receivables, the better is the financial position.

CASE MIX INDEX

A hospital is a conglomerate in more than one sense. It has innumerable services to offer. The average revenue per patient day, or per bed day, of a cardiac hospital is much higher, when compared with, say, a maternity hospital. Of course, the cost also will be different. Thus, profitability per patient day, or bed day, will be different for differing case mixes. A hospital with a large volume of patient days from high value cases and a small volume of low value cases will have a better bottom-line vis-à-vis a hospital with a low volume of patient days from high value cases and a large volume from low value cases. When occupancy level and ALS studies fail to explain the differences, the Case Mix Index will help. Thus, ALS, occupancy rate and Case Mix Index should be used in conjunction for comparison

of the financial results of the same hospital over a period of time, or different hospitals over the same period of time.

FREE-PATIENT RATIO

From the profitability angle, the lower the ratio of free patients to the total number of patients, the higher will be the profitability.

COMPETITION

Competition has direct bearing on the hospital's profitability. If a hospital is operating at its full capacity, it means that it is operating in a profit zone and it can take some steps to beat the competition before it turns red. On the other hand, if it is operating within view of break-even point, it will be very sensitive to the competitor's actions and it may not take long for it to go into the red. The thumb rule should be that a new hospital should not be started in a location where existing and comparable hospitals are operating below the break-even point, as it will be detrimental to all hospitals in the location.

DEBT UTILISATION

The higher the debt in relation to equity, the more will be the risk for the hospital. Even though debt capital improves earnings for the owners, it must be used with caution. Younger hospitals should not use debt, because it increases their costs in the initial years when occupancy is low and depreciation and other write-offs are very high. Debt is suitable for a hospital when it is operating above the break-even point and wants to expand.

INTENSIVE CARE INDEX

Since higher utilisation of intensive care units leads to higher revenues, it is necessary to calculate the ratio of intensive care patient days to the total in-patient days during a standard calendar period. A high value of this ratio may signify better utilisation of facilities.

OWNERSHIP

Type of ownership influences a hospital's operational efficiency. It has been observed that most proprietorship organisations are successful compared to other

forms of organisations. It could be due to personal attention, centralised decision-making and a high level of control over operations.

LABOUR YIELD

Almost 40 per cent of hospital expenses go towards labour cost. A hospital employs personnel with a variety of skills. Within each category of job, various skill levels are required, and salaries are proportionate to skills. The yield can be measured in terms of sales revenue per employee, patient days per employee, or profit per employee. If the ratios are high, it may mean that manpower is employed efficiently and there is no excess staffing. Low ratios mean that the hospital is over-staffed, or that the manpower management is not at a desirable level.

IN-AND OUT-PATIENT MIX

It is a well-established fact that most of the hospital revenue is generated from in-patient service. Many of the in-patients may have been the hospital's out-patients. While it may be desirable to have a high in-patient ratio, a value beyond a specific level may indicate that it is an exclusive referral centre, which calls for management's consideration with regard to competition.

OCCUPANCY

Occupancy is an indicator of a hospital's capacity utilisation of its beds. This ratio is calculated using the number of patient-bed days served in relation to the number of patient-bed days available in a calendar period. Higher occupancy means more in-patients, and more revenue to the hospital. In a relative sense, higher occupancy may not produce more revenue, because revenue is the result of occupancy and case mix variables. Other things remaining equal, the higher the occupancy rates, the better is the hospital's revenue-earning capability.

DAYS SALES OUTSTANDING

This is a measure to control and check the quality of its accounts receivables. A higher ratio is a cause for concern, as it implies overdue accounts. Overdue accounts lead to bad debt losses, collection expenses and tied-up funds. It may land the hospital in a short-term liquidity problem.

INVENTORY TURNOVER

Since the second major element of hospital cost is 'material', it has to be closely monitored and controlled. The hospital must ensure the availability of materials of various kinds, while at the same time, the stocks are kept to a minimum. More stock results in unnecessary investment of funds, incurring of carrying costs, and incurring of losses inherent in the storage of material and pilferage. Lower stock means less costs to the hospital. The ratio of sales to inventory is a good measure to ensure efficiency in this area. A higher ratio will mean efficient material management in the hospital.

CURRENT RATIO

In the ratio of current assets to current liabilities, traditional belief is that 2:1 is good. It only implies that current liabilities can be met, even though half of the current assets are not turned into cash before current liabilities mature. But a 2:1 ratio alone never ensures fulfilment of this objective. This ratio, along with the day's sales outstanding, inventory turnover ratio, and amount of cash in total current assets, determine the liquidity position of the hospital. Too high a ratio leads to more financial costs and too low a ratio means risking technical insolvency.

PROFITABILITY RATIO

Profitability of a hospital may be measured in many ways. The two preferred ratios are pre-tax profit to sales and pre-tax profit to investment.

Pre-tax profit to sales

This expresses how well an organisation has managed its costs and generated revenues. Revenue is exogenous and market determined, the costs are endogenous and can be controlled by the management. A higher ratio implies good performance of the management.

Pre-tax profit to investment

This measures how well an organisation has utilised its facilities and investment during a given period. In a 'for profit' hospital, the profit should justify the investment made. This ratio can be studied in association with occupancy rates and the case mix index. They all tend to be higher in a profitable organisation.

Conclusion

This chapter traces the state of the health care industry in India and makes an attempt to identify reasons for its slow growth and its inability to match supply with demand in the market. The preparatory work that should be done before setting up a hospital is discussed in great detail. This is followed with a discussion of sources of funding, the need to run a hospital as a business organisation and the efficiency measures that should be monitored.

The choice of the form of a hospital, preparation of the project proposal, determining the sources of finance, deciding upon measures of operational efficiencies and its management are major concerns for new entrepreneurs in the health care industry.

The salient features of the Indian health care industry are discussed in detail. The tremendous market potential for health care services and the existing ones show that there is a great need for establishing many more new hospitals in the country. For new entrepreneurs, it is necessary to understand that a hospital is not an industry to invest in if they want to get quick returns. Low returns and high business risk characterise the industry. Proper planning of the project, procurement of finances from sources that are risk-free and relatively inexpensive and selection of efficient personnel and execution of the project in time hold the key to success.

The importance of having different sources of finance at different stages of the project and management of current assets and current liabilities is as important as the management of long-term assets and liabilities. To have operational efficiencies, one must avoid accumulating inventories, control the average age of receivables, and keep only necessary cash balances. Short-term sources of finance must be used with caution, because they might lead to liquidity problems. It is desirable to maintain a fine balance between the quantum of current assets and current liabilities.

It takes longer time for hospitals to start making profits as compared to other industries. Profit is the difference between the revenue from billing and cost incurred to render the service. A hospital's revenue and costs are affected by various factors, such as average length of stay, occupancy level, in-patient and out-patient mix, efficiency of personnel and others explained in this chapter. It is a good management practice to clearly state realistic profit plans well in advance so that operating managers aim to achieve them.

Great vision, perfect planning, efficient execution and well-coordinated effort are essential for the survival and growth of a hospital.

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Human Resource Management in Hospitals

5

S.F. Chandra Sekhar

Introduction

The simple and familiar word 'hospital' represents much, but is not always understood in its entirety and complexity. A hospital cares for patients of all ages and backgrounds, some appreciative and some disgruntled, some happy and some sad. It houses cooks and doctors, cleaners and nurses, technicians and therapists, ambulance drivers and administrators of different kinds, plumbers and clerks, all interacting with each other. It experiences love and hate, hope and despair, sympathy and indifference. It is a place which never closes complex equipment, has a wide variety of supplies, imposes policies and rules, has budgets and debts, experiments and learns, and plans for the future (William 1990).

The central theme conspicuous in a hospital is that it gives prominence to the people who deliver services to the wider constituents of a hospital. A human asset, in modern times, is considered to be a treasure rather than a mere resource in progressive business organisations. This is because it is the people who shape the destiny of the business, rather than the structures, systems and processes effectively formulated in the organisations. Many a time, managers comment, 'I wish I had a highly competent, motivated and committed staff working for me', while setting aside the structures and processes of their organisations. Hospitals are becoming large and complex, with the increase in modern health facilities, increased health awareness among people, and the advent of new technologies in medicine. Government intervention in recognising the hospital as an industry, and regulating their purpose and performance, has also increased in India.

There have been many success stories documented in the management literature about companies whose human resources have turned them around from failure. In contrast, there are also stories of some companies that are extinct because of poor human resource management (HRM) practices. Thus, it is evident that effectiveness of a hospital is, to a large extent, dependent on the quality of services delivered, and the work effort expended by its employees. Therefore, HRM function is critically important and cardinal for the efficient and effective operation of a

hospital as an organisation. Due to this fact, the recurring changes taking place in the health care industry, which affects health services, have also influenced the HRM function considerably. As aptly pointed out by Armstrong (1987), the fundamental belief underpinning HRM is that sustainable competitive advantage is achieved through people. They should therefore, be regarded not as variable costs, but as valued assets in which to invest, thus adding to their inherent value.

This chapter has five objectives. First, it presents the evolution of hospital HRM in India. Second, the objectives of HRM systems in the hospitals is explained. Third, the distinction between personnel management and HRM, and its objectives in hospitals are dealt with. Fourth, it enlists and elaborates each of the sub-functions of HRM vis-à-vis general management functions. Figure 5.1 presents the framework for such a relationship. The last objective, in brief, suggests how to put HRM into practice, followed by the future of HRM in hospitals in the new millennium.

Evolution of Hospital HRM in India

HR function is in existence in some form or the other in Indian organisations in general, and in hospitals specifically. This is because organisations exist for people. They are made of people and by the people. Their effectiveness depends on the behaviour and performance of the people constituting them. However, organised HR functions can be traced to the concept of concern for the welfare of employees that started in the 1920s. Today, the status of personnel management function in hospitals is not much different from what it has been during the last twenty years, not only in terms of its role and execution, but also, and more importantly, in terms of the approach and philosophy towards human resources. Neither has the evolution of the function been smooth, nor has any significant progress been made lately. The evolution of HR function in India is presented in Table 5.1 to show its logical development.

Table 5.1 Evolution of Hospital HRM Function in India

<i>Period</i>	<i>Status</i>	<i>Emphasis</i>
1920–1939	Clerical	Statutory, welfare, paternalism
1940–1969	Administrative	Introduction of rules, procedures, etc.
1970–1989	Managerial	Regulatory conformance, imposition of standards
1990-continuing	Executive	Human values, productivity through people, employee commitment

Objectives of HRM System in Hospitals

The broad objective of HRM is to contribute towards realisation of the hospital's goals. The specific objectives are to:

- Achieve and maintain good human relations within the hospital.
- Enable each employee to make his/her maximum personal contribution to the effective working of the hospital.
- Ensure respect and the well-being of the individual employee.
- Ensure the maximum development of the individual, and to help him/her contribute his/her best to the hospital
- Ensure the satisfaction of the various needs of individuals in order to obtain their maximum contribution to achieve the hospital's goals.

Personnel Management versus HRM

Conceptual differences between personnel management and human resource management have run into controversies and contradictions. Such differences should be perceived as a matter of emphasis and approach, rather than of substance. The number of established differences are more in number than the similarities that exist between them. However, all such dissimilarities, to a large extent, are related to philosophical tenets. Table 5.2 presents such differences in philosophy.

TABLE 5.2 Personnel Management and Human Resource Management: Differences in Philosophy

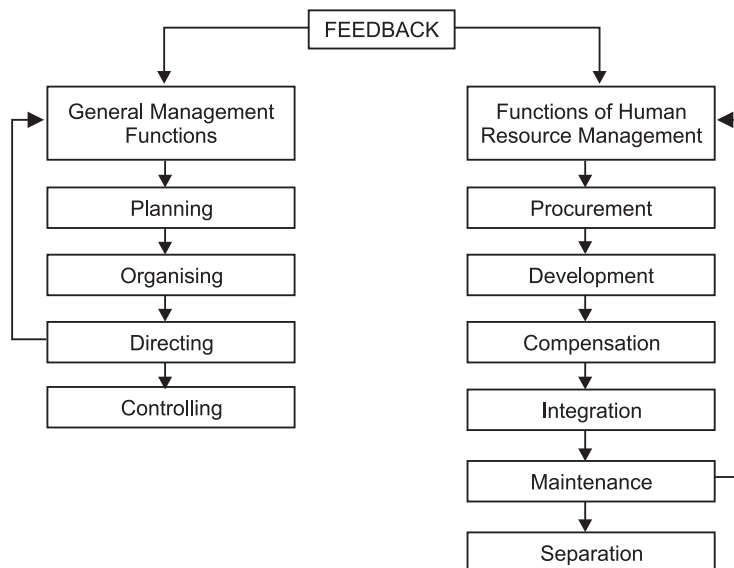
<i>Personnel Management</i>	<i>Human Resource Management</i>
Employee alienation ignored	Employee commitment, involvement, identification and loyalty encouraged
Fear psychosis created	Trust and confidence promoted
Indifference to employee problems	Supportive to employees
Policing poor performers, absentees, late comers, etc.	Understanding, providing autonomy and empowerment
Confrontation practised	Collaboration and counselling arranged for responsibility shared
Power concentrated	Problems of group solved
Problems of individuals solved	Equality of ideas
Inequality in accepting ideas	Recognition of person
Anonymity of person	Knowledge dissemination the main motive
Knowledge conservation the main motive	Proximity with management
Distancing from management	Managing performance and process
Managing people	Unions involved in HRD programmes
Unions resented	

Today, the emphasis of HRM is on commitment rather than compliance, which was emphasised by the personnel function during the past several years. Despite such philosophical differences, the functions remain the same. But, it is noteworthy to mention that a manager with the personnel management philosophy tends to be more traditional in his approach towards employees. Whereas, the approach may be more humane if the manager embraces the human resource management philosophy. Thus, in this chapter, the terms ‘personnel’ and ‘HRM’ are not treated separately while discussing their operative functions in management.

The operative functions of HRM are presented in the following sections. Under each of the operative functions, the tasks, assignments and responsibilities of the HR functionary are listed out and discussed in brief.

The general management functions of planning, organising, directing and controlling are the ubiquitous functions that are carried out by all the clinical and managerial functionaries in the hospital; whereas operative functions are function-specific (see Figure 5.1). Planning involves selecting missions and objectives, and the necessary course of action to accomplish them; it requires decision-making, that is, choosing future courses of action from among alternatives. Organising is a function that involves establishing an intentional and specific structure of roles for people in organisations. Directing people is influencing them so that they will contribute effectively to organisation and group goals. It has to do predominantly with the interpersonal aspect of managing.

Figure 5.1 General Management vs HRM Functions



Controlling is identifying, measuring and correcting the individual and organisational performance against goals and plans, showing where deviations from standards exist, and helping to correct them.

Procurement of Human Resources

Procurement is the planning, organising, directing and controlling of activities that are related to the acquisition and deployment of human resources. The activities of the HR functionary under the procurement sub-system are: first, job analysis, which includes, designing job descriptions, making job specifications and making personal specifications. Second, he/she will perform activities related to human resource planning for estimating the right number and best combination of people needed to start the functioning of the hospital. Last, on the basis of the human resource plan, he/she has to formulate a recruitment programme, followed by selection and induction programmes.

JOB ANALYSIS

Job analysis is the primary function in HRM. It is the prerequisite for all processes leading to recruitment, selection, performance appraisal, training and development of staff. It is defined as the scientific process of generating job description, job specification and person specification.

Job Description

Job description is the organised and factual statement of duties and responsibilities of a specific job in the hospital. It should indicate what is to be done, how it is done, and why is it done. It sets out the purpose, scope, duties and responsibilities of a job. In specific, it contains:

- The job title
- Objectives
- Tasks
- Standards
- Responsibilities
- The environment
- The training required
- Prospects
- Employment conditions

Job Specification

Job specification is a statement of the minimum acceptable human qualities required to perform the job effectively. It is a statement of skills, knowledge and attitudes, that are needed to perform the job.

Person Specification

Person specification is the interpretation of job specification in terms of the kind of person needed to perform the job effectively. This includes characteristics of the person, such as his/her physical qualities, skill attainments, formal education and intelligence, special aptitude, interests, disposition and essential or desirable qualities.

These three elements put together are called a job analysis. There are four methods of collecting data for doing a job analysis:

1. Direct observation
2. Interviews
3. Diaries
4. Questionnaires

Since managing a hospital involves employing a diverse workforce, in broad terms, the staff can be classified into the following types:

- Medical
- Allied professionals (medical)
- Nursing
- Midwifery
- Technical
- Scientific
- Ancillary
- Administrative
- Maintenance
- Ambulance
- Operations or works
- Others

Invariably, for all of them, a job analysis needs to be done.

Human Resource Planning in Hospitals

MANPOWER ESTIMATION

Human resource planning is a process of generating a plan, showing the demand for staff over a period of time, based on assumptions about productivity and costs associated with the employee. The supply of the resources available within the hospital, and the shortfall, that may have to be supplemented from outside, are also estimated. Estimates regarding demand for and for the supply of human resources are always generated in relation to the job analysis.

Human resource planning is a continuous activity in an organisation because people come and go. Further, as and when recruitment and selection take place,

such planning helps the HR manager. It is the process of forecasting, developing and controlling the resource level by which a hospital is assured that it has the right number and kind of people at various activity nodes, doing the work when needed, and for which they are competent and suitable in economic terms. Thus, it consists of projecting future manpower requirements and developing manpower plans for the implementation of the projections. It helps in procuring personnel with the necessary skills, knowledge and attitudes. If the hospital has a corporate plan, this exercise will form a part of it.

An estimate of the future requirements of manpower in a hospital, department-wise, by specialisation, by grade, etc., is made by applying many simple and complex statistical models. Some statistical methods, such as correlation and regression analysis, or stochastic models can also be used for in estimating the demand. Operations research is yet another quantitative approach that can be used to estimate the demand for doctors, nurses and other staff in the out-patient and in-patient sections of the hospital. However, the following are some of the easy and ready methods that help managers to update their HR plans.

Employee turnover index

$$= \frac{\text{Number leaving in a year}}{\text{Average number employed}} \times 100$$

Employee stability index

$$= \frac{\text{Number of employees exceeding one year's service}}{\text{Number of employees employed one year ago}} \times 100$$

Absenteeism index

$$= \frac{\text{Number of man hours lost}}{\text{Total possible man hours worked}} \times 100$$

Accidents index for frequency

$$= \frac{\text{Number of lost time accidents}}{\text{Number of man hours worked}} \times 100,000^*$$

* 100,000 is the total number of hours in average working life.

Health Statistics of Employees (past illness, disabilities, present health condition etc.)—compiled according to department, location, occupation, grade, sex, age, etc.

A five-year manpower plan for a hospital is illustrated in Table 5.3.

Table 5.3 Five-year Manpower Plan (Number of persons)

<i>Year</i>	<i>One</i>	<i>Two</i>	<i>Three</i>	<i>Four</i>	<i>Five</i>
Stock	50	50	48	52	58
Intake	10	10	12	16	20
Losses	10	12	08	10	12
Balance	50	48	52	58	66
Requirements	50	55	60	65	70
Additional Need	00	7	8	7	4

Stock is the current number of staff employed. Intake is the predicted demand for the number of staff. Losses are historical turnover rates, that is, the number of personnel leaving, as a percentage of the existing staff. Balance is from stock, adding the recruits, and subtracting the number of personnel leaving. Requirements are calculated by examining workload predictions, service changes and possible future expansion of services. Additional need is the difference between the 'balance', which is likely to be the stock available, and that which is predicted as really required.

Interestingly, in the domain of HR planning, there is often a conflict that arises from two constituents of the hospital management function—the HR-related estimates of hospital planning, and the estimates generated by HRM function. More often than not, planning estimates for the hospital are accepted as rule of thumb. As such, HR planning is not paid much attention to in hospitals. Taylor, the father of the scientific school of management thought, suggests that there is a need for replacing the rule of thumb with scientific rationality. Therefore, there is a need for a close relationship between these two entities, for the effective and efficient utilisation of human resources in hospitals.

RECRUITMENT

Recruitment is undertaken as an activity to fill vacancies from external or internal sources to comply with the human resource plan. It is the process of identifying the number and quality of people required for the hospital, identifying the sources of availability—internal or external to the hospital—preparing a press announcement containing the job description, job specification, person specification, a brief note on career prospects, and the history, mission/vision,

image and future plans of the hospital, inviting applications, shortlisting the applicants on the basis of the conditions specified and intimating prospective candidates for selection tests. In summary, recruitment is a process of attracting a large pool of applicants for a small number of jobs, thus creating an opportunity to pick the best from the lot.

SELECTION

As recruitment attracts a large number of applicants, the process of selection is used for choosing a few for further consideration on the basis of predetermined criteria—it is the matching of the specified job requirements with the candidate's achievements, the principle of best fit. By and large, selection of candidates is done with the basic assumption that people are different, and job-related skills and abilities can be measured. Thus, some of the tests that can be utilised for the selection of the candidates are:

- Achievement tests
- Aptitude tests
- Interest tests
- Personality tests
- Interview
- IQ and EIQ tests

Of late, intelligence tests are being questioned for their inability to predict accurately and comprehensively job performance. They have been questioned for their poor reliability in assessing real work performance. Often, these tests predicted performance only to the extent of 20 per cent. The rest of the 80 per cent of work performance is predicted by what is called the emotional intelligence quotient (EIQ). Thus, these days, EIQ is being given importance. Since the rest of the 80 per cent of job behaviour is dependent on the emotional IQ of the candidates, there is a need for a deeper understanding of its utility, and its right application during selection. HR functionaries need to pay scrupulous attention to this aspect. Therefore, hospitals need to be careful in administering selection tests to the candidates.

Emotional intelligence quotient is characterised by an individual's self-awareness, mood management, self-motivation, impulse control and people skills. It is strongly suggested that EIQ is far better than mere IQ tests, because it is the EIQ test that separates the stars from the average performers (Goleman 1996). Service orientation is yet another personality attribute that is imperative on the part of hospital employees. Service orientation requires a helpful, thoughtful, considerate, cooperative and kind-hearted disposition, which is an important attitude needed in all kinds of jobs that involve dealing with people and patients

in a hospital. As such, as part of personality assessment, the selection programme should also include scope for assessing the service orientation of the employees. A scale to measure service orientation of hospital employees was developed and tested over 19 jobs in a large corporate hospital (Chandra Sekhar, 1998). The scale was tested and found highly reliable. A brief description of this instrument, for illustration, is given as follows:

Each item of the instrument is measured applying Likert's (1932) 5-point response pattern; where 'strongly agree' is given the score of 5, 'agree' is given the score of 4, 'neutral' is given the score of 3, 'disagree' is given the score of 2, and 'strongly disagree' is given the score of 1. Illustrative sample items of the Service Orientation Scale are given below:

- I willingly assist other hospital personnel.
- I communicate clearly and courteously with others.
- I always notice when people are upset.
- I never resent it when I do not get my way.
- The service I perform is completely done by me.
- I can tell the impact of my job on the service.
- I have got a chance to serve the patients here.
- I feel I am rendering meaningful service to the patients.
- A lot of patients are benefited by my service.
- This job gives me an opportunity to fulfil my desire to serve and work.

The interview is yet another popularly-used selection instrument. There are five types of interviews. They are:

1. Preliminary interview
2. Stress interview
3. Depth interview
4. Patterned interview
5. Panel interview

It is expected that this instrument is able to obtain reasonably accurate information from the incumbents. However, a plethora of research work revealed that interviews are notorious for their poor reliability in obtaining accurate and complete information from the candidates. The reasons are varied, but predominantly it has been found that the element of subjectivity can never be entirely precluded. Despite its failure, it is still in vogue in every sector of business. However, it can be made reliable and effective by taking care of the following aspects:

- An interview should be based on a checklist of what to look for in a candidate. Such a checklist is based on job analysis.
- A specific set of guidelines for the interview should be prepared before the event.
- Interviewers need an orientation on how to evaluate the interviewees' performance objectively.
- There should be consistency in questioning to put the candidate at ease.
- The interview setting should be disturbance-free, and the interview should be conducted in a relaxed physical setting.

INDUCTION OR SOCIALISATION

This is a formal programme, designed and partly carried out to introduce new employees to the organisation, in all its social and work aspects. It is a systematic, planned introduction to the company. It is also a scientific approach to help solve the problems of the new worker, and his/her integration into the organisation of the hospital. The purpose of this programme is:

- To build the confidence of the new employee in the hospital.
- To promote a feeling of belonging and loyalty, and adjusting to the new circumstances.
- To give information about essentials such as working conditions and terms of employment.

In this programme, the employer gives the first impression to the incumbent about the uniqueness of his organisation (hospital). A representative of the HRM department, or the head of the department, with the coordination from the HRM department, will carry out the induction programme. The topics to be covered in the induction programme are about the hospital and its services. They are:

- The geographical location of the hospital.
- The structural and functional aspects of the hospital.
- Terms and conditions of employment.
- Standing orders and various provisions.
- HR policy.
- The department and its employees.

It is important for the concerned HR functionary to carry out the follow-up of the induction programme. This is done by creating informal contacts between the HR functionary and the head of the department periodically, to provide first-

hand information about the performance and personality of the incumbent. Brief monthly reports till the end of the probation period will support decision-making later, counselling the employee in a friendly and impartial manner, in case he/she is not shaping up well, will correct the employee's behaviour and attitude.

PLACEMENT

This is the last in the series of activities to ensure that the selection of the right man for the right job, as a principle, is followed through. The new incumbents need to be put through an intensive training programme in various departments before the ultimate decision is taken about which job they are suitable for. This helps in proper placement. Many organisations which have a high turnover in the initial months of employment do not get the right people for the right job.

In brief, the tasks of a HR functionary include:

- Reviewing vacancies.
- Writing job advertisements.
- Calling candidates for interviews.
- Making and obtaining acceptance of offers.
- Sending for references and arranging medical screening.
- Informing unsuccessful candidates.
- Contract preparation, signing, etc.
- Induction and placement programme.

Development of Human Resources

Development is the planning, organising, directing and controlling of a programme that has a wide range of activities relating to Human Resource Development (HRD) in terms of enabling employees to acquire competencies needed for future job requirements.

Human resource development is a continuous process to ensure the development of employee competencies, dynamism, motivation and effectiveness, in a systematic and planned manner (Rao 1990). It deals with bringing about improvements in physical capacities, relationships, attitudes, values, knowledge and skills of the employee, required for achieving the purposes of the hospital (organisation) (Balaji 1998). If employees are effective, their contribution to the hospital will be effective, consequently the hospital will also be effective in accomplishing its goals. Human resource development in a hospital is achieved

through three sub-functions, which should be well-planned and organised in their execution. They are:

- Training
- Performance and potential appraisal
- Career development.

TRAINING

The aim of any training programme is to provide instruction and experience to new employees to help them reach the required level of performance in their jobs quickly and economically. For the existing staff, training will help develop capabilities to improve their performance in their present jobs, to learn new technologies or procedures and to prepare them to take on increased and higher responsibilities in the future.

Training is formal and informal instruction designed to ensure and improve the individual's performance at work. It helps the individual achieve the stipulated or expected performance standards. Training needs may be derived from appraisal reports, dedicated surveys, human resource plans and corporate strategy; or assessed for the new entrants to the posts in question. Why is training needed? An employee's value is measured not only in terms of the cost of employing them, but in terms of the investment made in their training, development and on-the-job learning. Post-experience training in the hospital should focus on the improvement of the quality of services, and use of better or new technologies. There is enough evidence to show that employees who were trained on a regular basis are the ones who provide a higher quality of services to the patients.

In a hospital, there is a need for the continuous training of the staff in the areas of patient care services. How are the needs identified? The training needs are assessed through task analysis and performance analysis, which can be conducted through surveys, or from information furnished by the heads of department. There are two ways of conducting a training programme—through an established HRD department, or through external trainers coordinated by the HR department. These days hospitals have recognised the need for training and re-training their staff in order to develop a competitive edge over others.

PERFORMANCE APPRAISAL

Performance appraisal is a formal technique for assessing individuals, to advise them about their progress, improve their performance, judge their merit and

identify any personal difficulties. It is considered a powerful tool to control the performance and productivity of human resources. Used effectively, it has tremendous strategic potential for governing employee behaviour, and can be used for selection, training, career planning and reward systems in the hospital. It provides data about past, present and expected performance of hospital employees, which is helpful in taking decisions about several constituent functions of HRM. Unlike traditional appraisal systems, which were in the nature of checks, modern systems are geared to help the employee build his/her potential for future performance. Of the several methods of performance assessment, three are relevant for hospitals. They are:

- *Management by Objectives (MBO)*
A method by which every employee sets his/her own objectives in consultation with his/her superior, and accounts for success or failure in accomplishing these objectives in the stipulated period of time.
- *Behaviourally Anchored Rating System (BARS)*
A system by which good and bad behaviour can be described and measured against a scale of performance levels.
- *360° Feedback*
A procedure by which all concerned superiors, subordinates, and colleagues of the employee give their ratings of his/her performance for a period of time. This system should be carefully designed and executed, with the objective of enabling employees to identify their strengths and weaknesses, rather than making use of them as a basis for reward. If the latter takes place instead of the former, then employees tend to resent it and develop a kind of aversion to it, which consequently will affect their performance adversely. What is needed is a development-oriented performance appraisal rather than a strictly reward-oriented appraisal.

CAREER DEVELOPMENT

A career is a sequence of positions occupied by a person during the course of his/her professional life. It is affected by the changes in values, attitudes and motivation that occur as a person grows older. Career planning is important because the consequences of career success or failure are linked closely with the individual's concept of self, identity and satisfaction with career and life. It is common knowledge that the career planning of employees has a direct bearing on the productivity and quality of their lives. As such, hospitals should be sensitive to the need of career management. In Japan, employees make a lifetime career

commitment to an organisation, because of its well-planned career path for its employees. Though the same may not be possible in Indian organisations, yet a consistent career can be arranged for the employees because the hospital invests large amounts of money in its employees, right from their joining the hospital to their leaving it. It is unwise to let people leave with all the skills, knowledge and expertise that has been imparted to them.

Designing a complete HRD system rather than initiating it on a piecemeal basis can benefit the hospital in a big way. First, a HRD climate assessment should be conducted to know if the hospital is prepared to have HRD programmes. Next is the creation of an HRD function or department in the hospital, and, as a consequence, employing a professional who will design all the HRD processes. All this requires systematic planning, controlling and development of HRM functions.

Some aspects that an HR manager should take into consideration before initiating HRD programmes in the hospital are given below:

- Conduct an HRD climate survey to assess whether a 'developing climate' exists in the hospital.
- Generate a report based on the survey, abstracts of which can be submitted to the top, middle and lower levels of management.
- Assess the top management's belief in and support to HRD.
- Develop the OCTAPAC culture (openness, confrontation for cause, trust, authenticity, proactive, autonomy and collaboration).
- Design HRD mechanisms.
- Implement HRD mechanisms such as training, career development, performance appraisal etc., simultaneously.

Compensation of Human Resources

Compensation is the process of planning, organising, directing and controlling the wages and salaries related to the pay policies and programmes of the hospital. In many cases, it is also called wage and salary administration. The determinants of wages and salaries in the hospital are:

1. The financial position and corporate philosophy of the hospital.
2. Statutory regulations pertaining to wages and salaries.
3. Job evaluation.
4. Cost of living index.
5. Benchmarking.

Statutory regulations, such as the Payment of Wages Act, Minimum Wages Act, Equal Remuneration Act, and Payment of Bonus Act are all applicable to hospitals also. Thus, the provisions under these laws have to be observed while developing a wages and salaries policy. Job evaluation is a method of estimating the relative worth of a job compared to other jobs in the hospital, so that all occupational titles can be graded, and the relative worth of each job can be expressed in monetary terms. Though such a procedure seems scientific, it is cumbersome. Virtually no organisation practises this method of determining wages and salaries. The consumer price index or cost of living index has to be taken into account before finalising the general wage and salary levels in the organisation. Last, yet another practice is to conduct benchmarking—a wage survey with the objective of knowing the wages/salaries and benefits offered in similar hospitals. HR consultants often conduct such surveys, since it is a confidential area of HR function, which no HR functionary would like to share with their counterparts. But it is worthwhile to employ consultants to know the details about pay-related issues in similar organisations. This will also help in revising or reformulating the corporate pay policy. Many organisations are now adopting a kind of corporate policy regarding pay.

1. They lead the market in salaries.
2. They pay on par with other similar organisations.
3. They pay less, but give more fringe benefits.

Incentives are another type of compensation and reward. They are an additional financial motivation. They are planned to improve the efficiency and productivity of the processes in the organisation, and they are the cheapest, easiest, quickest and surest means of increasing productivity. But they suffer from their design considerations in many organisations, and particularly in hospitals, where jobs are not done individually. Group-linked incentives can be worked. Non-wage incentives are more value-driven in motivating employees than wage incentives. They can be planned for.

Integration of Human Resources

Integration is the process of planning, organising, directing and controlling the broad range of relationships in a hospital, in order to ensure a proper interface between individuals and the organisation.

Most hospitals have mission statements. A mission statement defines the purpose and aim of a hospital and gives it a clear focus (Rigby 1998) in society. It

has been seen that even the best mission statements are of no use if they are not followed through and made a part of the company culture. Thus, it is the responsibility of the HR manager to see that employees use the mission statement to work towards combined goals. This is possible only when the needs of the employees are linked with the needs of the organisation. Some of the activities that need to be performed to ensure that greater integration takes place are:

- Building morale and motivation.
- Managing change programmes.
- Managing good industrial relations.

BUILDING MORALE AND MOTIVATION

Morale or *esprit de corps* is the extent to which an employee's needs are satisfied and the extent to which the individual perceives that satisfaction as stemming from his total job situation. Morale involves interactions among group members, and is akin to the common concept of team spirit. It is often stated that when an employee has few frustrations, he/she seems to possess a high morale, and that when he has relatively numerous frustrations, or intense ones, he/she appears to have a low morale. Research evidence shows that morale affects productivity and job satisfaction in organisations. In hospitals, the effect is often of a serious nature. The factors and situations which affect employee morale in the hospital are:

- Frustrations resulting from lack of recognition.
- Frustrations caused by the belief that promotions and pay hikes are unfair.
- Frustrations caused by jealousies between departments and between persons.
- Frustrations from fear of being inefficient.
- Practice of blaming rather than praising.

Some of the severe outcomes of a low morale in hospitals are:

- Absenteeism and tardiness
- Employee unrest
- Disciplinary problems
- Poor commitment
- Fatigue and monotony
- Turnover
- Grievances

In order to improve morale in a hospital, the human relations approach, with its emphasis on employee participation, effective communication, promoting teamwork and ensuring fairness in all aspects of work, should be practised. More

appealing are attempts like paying a bonus to everyone, and encouraging employee investments in the company's shares and so on.

There are many theories for work motivation. What motivates employees has been a question asked over the years. And today, we are back to the crux of the issue of motivation. It is, 'work itself is the greatest motivation'.

Some believe that hospital staff are either motivated or they are not, and that appealing to an employee's need for material gain will not make any difference to their inherent motivation level. The result of monetary inducement is mechanical behaviour, designed to get the reward. In hospitals, it is thought that the staff are motivated to deliver services and care at the level they have been trained to provide it. As Handy (1994) puts it, 'the wealth creation of a business is as worth doing and as valuable as the health creation of a hospital'. This is very much different from the common view which emphasises that an employee's performance will improve if a monetary reward lies at the end of the work undertaken, and, if individual employees know they will gain cash or other tangible benefits, they will work harder.

Contrary to this belief, the theory propounded by Hackman and Oldham (1976) claims that if all the core dimensions exist in the jobs carried out by people, they are well-motivated to perform. The core dimensions of a job are:

- Skill variety
- Task identity
- Task significance
- Autonomy
- Feedback

Skill variety is the degree to which the job requires a variety of different activities, so the worker can use a number of different skills and talents. *Task identity* is the degree to which the job requires completion of a meaningful whole and identifiable piece of work. *Task significance* is the degree to which the job has a substantial impact on the lives or work of other people in the organisation. *Autonomy* is the degree to which the job provides substantial freedom, independence and discretion to the individual, in scheduling the work, and in determining the procedures to be used in carrying it out. Last, *feedback* is the degree to which carrying out the work activities required by the job results in the individual obtaining direct and clear information about the effectiveness of his or her performance.

It is understood that if the first three dimensions exist in a job, participating employees feel that their job is meaningful, important, valuable and worthwhile. Autonomy gives them a feeling of personal responsibility for the results, and if the job provides feedback, employees know how effectively they are performing, and this leads to learning. In order to measure this level of motivation, Hackman

and Oldham (1976) have suggested the scale, Motivating Potential Score (MPS), for a job. The formula to compute MPS is

$$1/3(\text{Task Variety} + \text{Task Identity} + \text{Task Significance}) + (\text{Autonomy}) + (\text{Feedback}).$$

With the help of MPS, every individual employee's motivation level can be periodically assessed, and decisions to improve his/her work can be taken. This way, all jobs in the hospital can be made powerful in their motivational potential. A scale to measure the MPS of hospital employees has been developed and used in a corporate hospital by Chandra Sekhar and Ramesh (1998). Nearly 19 corporate hospital jobs have been diagnosed with the help of this scale.

MANAGING CHANGE PROGRAMMES

Change in the social and economic environment is an inevitable phenomenon. Forces of change that are external to the organisation necessitate adjustment in the internal structure and process of the hospital. Some of the sources of major change affecting hospital management are:

- Innovations in medical technology, leading to new services and methods of delivery of services.
- Greater competition, especially as a result of lower tariffs.
- Changes in government regulations and taxation.
- New tools of management, such as computers.
- Changes in the employee's, background, training and occupation of those already employed.

Employees look upon change with suspicion and generally resist them. Such resistance could be due to the following reasons:

- The pressure to maintain equilibrium in their work lives.
- Habits are not easily changed.
- Selective perception and retention.
- Feeling of insecurity about their job, status, position, etc.
- Attitudes do not change easily.

Therefore, one of the most difficult tasks of an HR functionary is to make employees responsive to change. These days, organisations are resorting to planned organisational development (OD) programmes to achieve this. OD is a long-term, systematic and comprehensive change programme involving all levels in the

organisation. This is carried out by an external change agent, an OD consultant, and an internal change agent—the HR manager. Together they coordinate and initiate the change programmes in the organisation.

MANAGEMENT OF INDUSTRIAL RELATIONS

Industrial relations in a hospital are bifurcated into *individual relations* and *collective relations*. With regard to *individual relations*, the hospital HR manager deals with some significant issues, such as grievance procedures, disciplinary procedures, counselling, and so on.

Grievance is the dissatisfaction or discomfort an employee feels regarding his/her job, or conditions of work in the hospital. A grievance procedure is a mechanism by which a hospital ensures that an employee's grievances are redressed as expeditiously as possible, to the satisfaction of the employee. It is a kind of assurance to the employee that there is a mechanism available to him/her, that will consider his grievance in a dispassionate manner. In some organisations, this procedure facilitates multiple levels of redressal. That is, in case the employee is not satisfied with the decision taken by his supervisor, he/she can go to the next higher level in the hierarchy.

Discipline is orderliness obedience and conforming with the rules, regulations and procedures of the organisation. Employees are expected to adhere to established norms and regulations, thereby creating a state of order in the company. This is also one of the principles of management stated by Henry Fayol (1987). Indiscipline refers to the absence of discipline or nonconformity to rules, regulations and procedures. A hospital cannot afford it, because it affects the morale, involvement and motivation of other employees, often leading to chaos, confusion, reduced organisational efficiency, strikes, go-slows, absenteeism, loss of production, and, hence, loss of profit and wages. Some forms of indiscipline are:

- Inconsistent discharge of duties.
- Immoral acts.
- Acts that trigger disloyalty.
- Insulting and insubordinate behaviour that affects relationships.
- Abusive acts.
- Habitual negligence in discharging duties.
- Indecent behaviour with the patients.

In order to ensure discipline in a hospital, there is the need for a code of discipline, and a disciplinary procedure that can handle indiscipline or misconduct cases.

This should be reinforced with the hot stove rule. It is a sound disciplinary system, having the following characteristics:

- Advance warning is given.
- Immediate action is taken.
- There is consistency.
- It is impersonal.

Like a hot stove that burns anything touching it, in the same manner, penalty for the violation of rules should be immediate and automatic for everyone.

As part of *collective relations*, a major task of the manager is to work with trade unions, followed by participating in collective bargaining. Trade union movements are also increasingly growing in hospitals these days. A trade union is a collective of wage earners, for the purpose of improving conditions of employment. More often than not, the HR manager resents the word, union. But he should take time to find answers to questions, such as, 'Why did it happen?' 'How did it happen?' The simple answer is, people join unions because managers are not able to protect the employees' rights and privileges. Unions assure them of getting these rights. Hence they join them. The existence of unions may create the following problems in hospitals:

- Inter-union rivalry.
- Vested interests.
- Productivity decline.
- Services coming to a standstill.
- Poor image.

One way of preventing the formation of unions is through extensive HRD programmes and good HR policies. In case unions are already there, HRD programmes should be gradually introduced in order to win the confidence of the employees. But it should be handled carefully, because employees in unionised organisations suspect motives in management decisions and initiatives.

Collective bargaining is another challenge that has to be faced by HR managers in unionised hospitals. Collective bargaining is a procedure by which the terms and conditions of employment of workers are regulated by agreements between the bargaining agents—union representatives and management representatives. Prerequisites for successful bargaining are:

- Preparation by managers and union members.
- A realistic charter of demands.

- Mutual trust.
- Both parties' willingness to arrive at agreements.

Management in India still does not realise a trade union's position. Understanding them is very important and involving them in the strategic management will benefit the organisation in the long run.

Participation takes place when management and employees are jointly involved in taking decisions regarding matters of mutual interest, where the objective is to arrive at solutions that will benefit all concerned. At the job level, encouraging participative management is the task of the HR functionary. Groups such as the works committee, the joint management council, the quality circle and project teams may be called on an *ad hoc* basis, to consider a particular situation. Successful organisations are characterised by a higher degree of employee participation and involvement.

Maintenance of Human Resource

Maintenance is the process of planning, organising, directing and controlling health, safety and welfare programmes that contain a wide range of activities related to the sustenance of the human resources in the hospital.

It is a recognised fact that the health, safety and welfare functions within the organisation have been the 'Cinderella' of HRM, despite the enormous human and economic benefits that can flow from a well-conceived and properly implemented health and safety policy within the company (McKenna and Beech 1997). There have been counter arguments about why an organisation should take care of the health, safety and welfare needs of its employees. These services are provided by the hospital to ensure acceptable standards of performance, and so that the hospital can prevent personal difficulties from inhibiting performance. Therefore, welfare of the individual should be taken into account.

FACTORIES ACT, 1948

The Factories Act 1948 by the Government of India makes it obligatory for the employer to observe the provisions contained in the Act. Some of the main provisions are regarding health, safety, welfare and working conditions. However, this Act is not applicable to a hospital, since a hospital is not a factory as per the definition. Hence, only the first three are relevant for a hospital. It becomes a moral obligation, in the absence of a legal requirement, of the employer to provide the following facilities to the hospital employees.

Health

Health provisions have to be arranged by the management, to ensure that they have healthy employees working for them. Healthy employees make a healthy organisation. Most of these health programmes are concerned with the identification and control of occupational health hazards arising from toxic substances such as radiation, noise, infection, fatigue and the work stress imposed on the employees. Good housekeeping, periodic medical examinations, regular environmental checks, vaccinations, training and so on, will prevent the deterioration of the health of the employees. Hospitals need to have a separate health programme for their employees, since employee health should be part of their regular activity.

Safety

Safety is the prevention of accidents, by identifying actual or potential causes. The process of identifying them is mainly by conducting inspections, checks and investigations. Most accidents are related to the system of work, and some of them are also related to personal factors, which in many cases arise from the system of work. In hospitals, there are several places where accidents can occur. They can occur in the case of electrical or electronic equipment, which may give violent electric shocks. They can also occur in diagnostics, where inexperience or carelessness could result in an accident. Some of the hospital staff in clinical departments may get HIV infection while handling patients without taking proper precautions—using gloves, handling infected syringes or other equipment. Poor housekeeping—congestion, blocked gangways or exits, inadequate disposal arrangements for swabs or other waste and infected materials, lack of storage facilities, unclean working conditions, assaults on staff members by outsiders and fire can cause accidents. Almost all of these can be prevented if a carefully worked out safety policy is adopted.

In many instances, an activity in a hospital can cause health and safety problems. Sometimes they may be inseparable. A faulty handling in diagnostics could cause an infection, which is not only an accident, but also a health problem. Hence, there may be a need for a combined health and safety policy.

Welfare

Welfare is the total well-being of the employee. It is improving the morale and commitment of the employees. Some of the welfare measures that can be provided are transport facilities, housing, co-operatives, canteen facilities, education for the employees' children and other benefits or facilities where the families of the

employees also avail of benefits such as paid holidays, and so on. In this case, families influence the employee's decision to stay or leave the organisation in the long run.

Separation of Human Resources

Separation is the process of planning, organising, directing and controlling the activities that deal with the physical separation of human resources, as and when required, or provided by the separation policy in the hospital. Organisations have to pay attention to this particular function, because there is a general feeling that there is not much benefit derived from executing this function in elaborate form. However, a planned separation programme can be useful for hospitals.

In these days of fierce competition, hospitals have to ensure that they have the right number and right quality of employees. A single extra employee could result in additional cost. Further, as the saying goes, 'an idle brain is the devil's workshop', and a single employee with no work could cost the hospital a great deal in terms of discipline and unionism. Reducing the number of employees who are not needed in a systematic manner, and also reducing employee costs without tears is a perplexing problem. Many a time, there are cases pending in labour courts, causing additional cost to the hospital. A separation programme will also help hospitals downsize when they realise that the hospital is overstaffed. Thus, it is necessary to have a well-planned separation programme. Hospitals can also learn from their mistakes and from those who are leaving about what made them get jobs elsewhere. The activities that are included in the separation programme are listed below.

1. Exit interviews should be conducted for all staff members who are leaving. They should be asked frankly to give their impression about the hospital in general, about their job activities while working there, its HRM operations, and suggestions for improvement.
2. Voluntary retirement schemes should be formulated, which are economical for the hospital in the long run, and should be implemented when necessary.
3. In anticipation of a probable turnover reformulation, further plans regarding manpower should be formulated.

Human Resource Information System (HRIS)

HRIS, earlier called personnel information system (PIS), uses computer hardware, software and database. Information pertaining to all human resources are

incorporated into the computer system, as far as possible in numerical form. These numbers can then be manipulated by the HRIS to provide the type of information needed for planning and controlling, decision-making, or preparing reports about all operational functions of HRM. Computer systems have simplified the task of analysing vast amounts of HR data. It is an invaluable tool for HRM, with the capability of preparing the payroll process, to the retention and retrieval of records.

HOSPITAL HRIS

A hospital HRIS should consist of the following modules:

- Personal profile—name, age, sex, domicile, marital status and address of employees.
- Career profile—performance appraisal, job title changes, salary changes, promotions, transfers and career paths designed for employees.
- Skill profile—education, training, license, degrees, skills, hobbies and interests.
- Benefits profile—insurance coverage, provident fund or pension, holidays, leave, bonus, etc.

HRIS will help the hospital know the core competencies of its human resources—managerial, supervisory, clinical and operative competencies. Such reports will enable the hospital to make the right decisions in the event of a probable merger and acquisition on a future date.

Putting HRM into Practice

The most important task of the HR manager is implementing the HRM function. Many managerial initiatives fail sooner than they have been commissioned. Some organisations have a negative attitude towards HR function, as a consequence of faulty implementation. Therefore, the modus operandi for implementing HRM is as follows:

- Elicit top management's ideas about the importance of HRM, and their full commitment.
- Formulate a comprehensive HR policy for the hospital. This will include issues such as

- (a) emphasis on strategy,
 - (b) concern for cultural change,
 - (c) concern for empowerment,
 - (d) the importance of resourcing,
 - (e) stress put on performance,
 - (f) focus on quality and customer care.
- Establish an HRM department and allocate a budget for its operations.
 - Develop and execute sub-systems of HRM, as explained above.
 - Periodically monitor the effective execution of all sub-systems, in order to avoid errors or deviations. If needed, correct them and continue their implementation.
 - Generate reports periodically about the effectiveness of each sub-system for designing a strategic HRM for future consideration.

The Future of HR Function in Hospitals

Modern organisations are moving from a monolithic, vertical, homogeneous and slow-paced scenario to divergent, horizontal, centralised, heterogeneous, flat, network-based and fast-paced organisations. Hospitals also have to be alert and responsive to changing times and demands. They should be multifunctional, multidisciplinary, multisectoral, develop the skills of a think-tank, rapidly disperse new knowledge, new capabilities and acquire a reservoir of knowledge about people.

Therefore the challenges that will be faced by hospital HR managers, to understand and solve the problems of the future will be related to:

- The increasing size of the workforce.
- The changing psychosocial system.
- Satisfying the higher level needs of the employee.
- Creating an equitable social system.
- Absorbing new medical and technological advances and ideas.
- Taking advantage of the computer-aided information system.
- Adjusting to the changes in the legal environment of hospitals.
- The management of human relations.
- The emerging concept of the knowledge worker.
- Developing a highly committed workforce.

They should also examine and improve their ability to learn. Today, people do not want to be 'used' by the organisation as a 'victim' or 'pawn'. They want to have a sense of ownership over the resources they use, to feel that the tasks they perform

have a significant impact on others in the organisation, and that they are meaningful. They expect to be empowered to take decisions on their own, and desire an atmosphere favourable for learning and personal development.

As mentioned earlier, future hospitals need to have a well-designed and operational HRIS to keep track of the changing status of their human resources. HRIS will play a revolutionary developmental role in the managerial decision-making process. It will have an increasing impact at the coordinating and strategic levels of hospitals. Thus, an earnest endeavour should be made to redesign and restructure the HRM system, in order to enable hospitals to have the best employees working for them.

At this juncture, it would be worthwhile to recollect the contributions of corporate culture analysts, Pascale and Athos (1981), and Peters and Waterman (1982). They have analysed a number of attributes of successful organisations which have influenced the thinking about HRM, regarding the need for commitment and a strong culture. Pascale and Athos emphasised the importance of 'super-ordinate goals', the significant meaning of the guiding concepts or values by means of which an organisation influences its members. Peters and Waterman suggested that excellent organisations are characterised by the following attributes:

- *Productivity through people*—The belief that the basis for productivity and quality is the workforce. Therefore, encouraging commitment and getting everyone in the organisation involved, is important.
- *Hands-on and value-driven*—The people who run the organisation get close to those who work for them and ensure that the organisation's values are understood and acted on. This is very important in the context of a hospital.
- *Visionary leadership*—The value-shaping leader is concerned with 'soaring lofty visions that will generate excitement and enthusiasm. Clarifying the value system and breathing life into it are the greatest contribution a leader can make'. Thus, excellent organisations are characterised by visionary leadership.

Conclusion

In conclusion, management of human resources in a hospital is a very challenging job, because of the dynamic nature of the human element. Since human resources decide the destiny of hospitals, there is a need for a properly organised HRM department. The HR functionary is a dynamic, formally qualified professional, who understands the needs of personnel in the hospital, and plans the entire HR

strategy, which includes procuring, developing, compensating, integrating, maintaining and separating human resources in the hospital. These days, emphasis is laid on a transformation from a personnel philosophy to a human resources philosophy, also called 'from control perspective to commitment perspective'. This kind of transformation is needed in existing hospitals in order to gear this resource for the efficient and effective functioning of hospitals.

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Hospital Materials Management

6

V. Venkat Reddy

PART 1

MATERIALS MANAGEMENT

Introduction

Controls in materials management can be a twin-edged sword. Intense control of inventory can be just as undesirable and costly as not keeping it under control. A desultory attitude towards new or sophisticated control systems can be very costly for the organisation. A system that saves hundreds of rupees, but costs thousands to install and operate is obviously not desirable either. A control system for materials management should be installed after a careful analysis of its costs and benefits, considering both tangible and intangible costs, complexity of implementation, limitations in operation, and benefits for the organisation. Control as an end in itself is never a healthy practice of management and this is very true in the case of materials management.

In the first part of this chapter, materials management in general is discussed. Generic Selective Management rules are given in detail, supported with examples related to hospital activities. Application of Selective Management principles alone show a considerable improvement in materials management. The second part of the chapter presents a comparative picture of materials management practices related to hospitals and practices prevalent in an engineering industry. This comparison will clarify the details and help in better understanding specific rules for application in a hospital.

Selective Controls

The first step in developing a system for materials management is to choose the right type of classification for the materials and then apply appropriate techniques, such as:

- The Economic Order Quantity (EOQ) formula.
- Bulk ordering with time-phased delivery.
- A fixed order quantity system.
- A fixed order period system.
- A probability-based trade off matrix.
- Speculative considerations.
- The just-in-time system.

The application procedure for any of these techniques can be found in any standard book about inventory control. Some selected titles are listed in the bibliography at the end of this chapter.

Table 6.1 presents different types of selective controls, their basis and their use.

Table 6.1 Types of Selective Controls

<i>Type of Control</i>	<i>Basis</i>	<i>Main Use</i>
1. A-B-C	Value of consumption of item	Control inventory value
2. H-M-L	Unit price of item	Control purchases
3. X-Y-Z	Value of items in store	Review inventories
4. V-E-D	Criticality of item	Inventory control of spares
5. F-S-N	Consumption pattern of item	Control obsolescence
6. S-D-E	Problems of procurement	Lead time analysis and purchasing strategies
7. G-O-L-F	Source of supply	Procurement strategies
8. S-O-S	Nature of supply	Procurement and holding strategies for seasonal items

A-B-C Classification

A-B-C analysis is a basic analytical management tool which enables any executive to expend efforts and energy where the results will be best. This is also known as the Selective Management Principle or Pareto's Law (Lorenz 1905). Vilfredo Pareto,

an Italian philosopher and economist, observed that a very large percentage of the total national income and wealth was concentrated in a small percentage of the population. Believing that it reflected a universal principle, he formulated the axiom that the significant value in a given group of items normally constitute a small portion of the total number of items in the group and that the majority of the items in the group, in the aggregate, will be of small significance. This is expressed as a thumb rule—'80 per cent of the total value will be accounted by 20 per cent of the items'.

However, according to the A-B-C classification for materials management for any kind of organisation, the monetary values of the annual consumption of all items of materials are classified roughly as—10 per cent of items contributing to 70 per cent of value as 'A'; the next 20 per cent of items contributing to 20 per cent of value as 'B'; and the balance 70 per cent of the items contributing to the remaining 10 per cent of the value as 'C'.

It is evident that controlling the small number of items amounting to 10 per cent of the total number of items will result in the control of 70 per cent of the monetary value of the inventory held and ordered.

The cumulative value of the items can also be plotted after arranging them in descending order and setting the points of inflection as boundary points for A-B-C classes.

MECHANICS OF A-B-C ANALYSIS

The mechanics of classifying items into A, B and C categories is given step-wise below:

1. Calculate the rupee value of the issues for each item in the inventory by multiplying the unit cost by the number of units issued during the year. It is assumed that all issues are for consumption.
2. Sort out all items by the rupee value of annual issues, in descending sequence.
3. Prepare a list from these ranked items, showing item number, unit cost, annual units issued and the annual rupee value of units issued.
4. Starting at the top of the list, compute a running total of *item-by-item* issue value and rupee consumption value.
5. Compute and print for each item the cumulative percentage for the item count and the cumulative annual issue rupee value.

The normal consumption pattern of most of the items referred above show the following pattern:

- 5 per cent to 10 per cent of the top number of items account for about 70 per cent of the total value of the items consumed. These are called 'A' items.
- 15 per cent to 20 per cent of the next number of items account for 20 per cent of the total consumption value. These items are called 'B' items.
- The remaining 70 per cent to 80 per cent of items account for 10 per cent of the total consumption value. These items are called 'C' items.

POINTS TO NOTE

While working on an A-B-C analysis, the following points should be kept in mind:

- Where items can be substituted for each other, they should be preferably treated as a single item.
- While classifying the items as A, B and C, what should be considered is the total consumption value, and not the unit price of the item.
- All the items that the company consumes must be considered in totality for classification. Separate groupings, such as raw materials, consumables, components, and so on, may not always be meaningful.
- The period of consumption need not necessarily be one year, it can be six months, four months, or even one month.

There is no hard and fast rule that the material must be classified in three groups (A, B and C) only. Depending upon the condition of each industry, and the standard of control that can be effectively applied, it can be categorised into 4 or more groups. It is also possible that the 'A' group of items can be further subdivided into A1, A2, A3... groups of items, or super A and A items. It is left to the convenience and rationality of the controlling authority.

SELECTIVE CONTROLS

The purchasing policy and procedure should be so formulated that for 'A' items, maximum attention is devoted to considerations of optimisation during pre-design and pre-purchase stages, application of value analysis, application of market research, source development and follow-up of orders placed for stores items. Generally, 'A' items are ordered more frequently and in small quantities, or as annual orders with staggered deliveries in small quantities, while 'C' items are ordered just once or twice a year for the entire year's requirement. Selective control procedures to be adopted for A-B-C classified items is presented in Table 6.2.

Table 6.2 Selective Control Procedures for A-B-C Items

<i>Nature of Control Procedures</i>	<i>A Items: High Consumption Value</i>	<i>B Items: Moderate Consumption Value</i>	<i>C Items: Low Consumption Value</i>
1. Type of control and authority	Very strict control. The controller should have great authority	Moderate control. Controller may be from the middle management.	Low control. Powers can be delegated to the user departments to determine stock level.
2. Quantity of safety stock	Very low or practically nil safety stock, combined with frequent ordering and/or staggered supplies.	Low safety stock. Ordering can be done monthly or quarterly.	High safety stock and bulk ordering. Half yearly or annual orders to take advantage of bulk discounts.
3. Consumption control	Consumption control and flow should be regular—weekly or daily.	This period can be extended to a fortnight or a month.	This period can be extended to a quarter.
4. Material planning	Material planning should be accurate. Data base should be up-to-date.	Past consumption can be used as a basis.	Rough estimates are sufficient.
5. Application of value analysis	A concerted attempt should be made at value analysis, waste reduction, obsolete and surplus reduction.	Moderate attempts are sufficient.	Annual reviews are sufficient.
6. Number of sources of supply	Increase the number of sources. Centralise purchase and stores. Reduce lead time.	2 or 4 reliable sources. Combined purchase. Moderate attempt to reduce lead time.	1 or 2 reliable sources. Annual or half-yearly purchase. Decentralised and low clerical effort.

ADVANTAGES OF A-B-C ANALYSIS

Equal attention give to all items would

- be very expensive;
- diffuse the effect of control; and
- misalign priorities.

The A-B-C analysis helps to rationalise the number of orders and reduce the average inventory during a specific period. For instance, consider the three items,

T1, T2, T3, with an annual consumption value of Rs 60,000, Rs 6,000 and Rs 1,000 respectively; each being ordered four times a year. The inventory computations, when A-B-C analysis is not applied, are given in Table 6.3.

Table 6.3 When A-B-C Analysis is Not Applied

<i>Items</i>	<i>Annual Consumption in Rupees</i>	<i>Number of Orders</i>	<i>Value per Order in Rupees</i>	<i>Average Inventory in Rupees</i>
T1	60,000	4	15,000	7,500
T2	6,000	4	1,500	750
T3	1,000	4	250	125
Total	67,000	12	–	8,375

If A-B-C analysis has been applied, then it would show that A items should be ordered more number of times, say 8 times, and C items a fewer number of times. Then the inventory computations will appear as shown in Table 6.4.

Table 6.4 When A-B-C Analysis is Applied

<i>Items</i>	<i>Annual Consumption in Rupees</i>	<i>Number of Orders</i>	<i>Value per Order in Rupees</i>	<i>Average Inventory in Rupees</i>
T1	60,000	8	7,500	3,750
T2	6,000	3	2,000	1,000
T3	1,000	1	1,000	500
Total	67,000	12	–	5,250

It is evident that the total number of orders are the same, but the average inventory is significantly reduced by recognising that 'A' items should be ordered more frequently. Further, the A-B-C analysis gives a deeper cost perspective to the management and enables them to decide on priorities for improvement or cost reduction programmes. It prevents wasting time and energy in making improvements, where improvements yield a marginal benefit ('C' class items). The advantage of the A-B-C analysis lies in relaxing rather than tightening of inventory control—separating the 'vital few' from the 'trivial many', control is relaxed and less emphasis put on 'C' items, which represent the bulk of the inventory items. The A-B-C analysis gives a measure of inventory importance to each item. It reinforces the principle of 'management by exception'.

LIMITATIONS OF THE A-B-C ANALYSIS

- The A-B-C analysis, in order to be fully effective, should be carried out with standardisation and codification.
- It indicates nothing regarding profitability or criticality. Importance is given to an item on the basis of its consumption value, and not on criticality. Hence, such classification can lead to overlooking the need for an item whose criticality is high, but whose consumption value is low.
- The A-B-C analysis should be reviewed periodically so that changes in prices and consumption are taken into account.

SHORT CUT METHOD (THUMB RULE) TO THE A-B-C ANALYSIS

Compute the average usage value and multiply it by 2.25 to get the dividing line between class 'A' and class 'B'. The dividing line between class 'B' and class 'C' is taken as half the average usage value.

The average usage value can be obtained by dividing the total number of items by the total usage value per year (or month or week, depending on inventory practices). This data is available with the accounts department. This quick and rough method may have to be adjusted in the light of experience, or when a sample analysis or a complete analysis is made later. However, it will provide a reference value to start with.

H-M-L Classification

This method is similar to A-B-C classification. But in this case, instead of the consumption value of items, their unit value is considered for classification. As the name implies, the materials are classified according to their unit value as high, medium and low. The cut-off point will depend on the individual user.

The procedure is to list out the items in descending order of unit value and invoke management policy to fix the cut-off points. The management may decide and delegate authority to various levels of officers depending on the classification.

X-Y-Z Classification

While A-B-C classification has the value of consumption as its basis, X-Y-Z has the value of inventory available on a particular date in the stores as its basis. This study is taken up once in a year during the annual stock-taking exercise. X

items are those items whose stock value is high, while Z items are those whose stock values are low. Understandably Y items fall between the two categories. This classification helps in identifying the items which are being extensively stocked. If the management is caught napping, one can expect C items in the X category. Therefore, controls should be developed for A-B-C items in conjunction with X-Y-Z items. These controls are shown in Table 6.5.

Table 6.5 Control of A-B-C Items with X-Y-Z Classification

<i>Class of Item</i>	<i>X Items</i>	<i>Y Items</i>	<i>Z Items</i>
A Items	A critical analysis must be made to reduce the stocks.	Attempts must be made to convert to 'Z' category.	Items are within control.
B Items	Consumption and stock control must be reviewed more often.	Further action in control may not be necessary.	Can be reviewed twice a year.
C Items	Steps should be taken to dispose off surplus stocks.	Controls should be tightened.	Can be reviewed once a year.

X-Y-Z analysis helps to control obsolescence and shows how the stock values are distributed amongst the materials in the stores.

PROCEDURE TO CARRY OUT X-Y-Z ANALYSIS

After annual stock-taking is over, arrange the closing stock values of items in descending order; enter the respective cumulative values against each item; the descending number of item is computed as a percentage of the total value of all items in stores; the cut-off points are set depending on the distribution.

V-E-D Classification

V-E-D classification is applicable to a large extent in spare parts management. Stocking a spare part is based on strategies different from those of raw materials. While the consumption of raw materials depend directly and definitely on the market demand, the spare part demand, on the other hand, depends on the performance of plant and machinery. Therefore, the method of classification designed for one type of inventory may not be compatible with another type of inventory. Statistically too, it has been noted that the demand for spares follows a Poisson distribution. Spare parts are classified as vital, essential and desirable to the operation of the equipment. This implies that 'V' class spares have to be stocked adequately to ensure continuity in the operations of the plant. Vital spares

can cause havoc and bring the wheels of the machines to a grinding halt, if they are not available. Some risk can be taken in the case of 'E' class spares. Stocking of desirables, 'D', can be done away with if the lead time for procurement is low. It is important that this classification should be done with the assistance and concurrence of those who are responsible for maintenance of equipment.

Vital spares are those which may cause stoppage of the plant and service. The down time cost for want of these spares (or parts) will be very high. Essential spares are those, in the absence of which the plant may run, but perhaps at a substandard level of performance. Desirable spares are those whose non-availability may not adversely affect the plant performance, but may increase the maintenance time. A-B-C and V-E-D analysis can be combined to evolve a matrix to control spare parts inventories (Table 6.6).

Table 6.6 Control of Spare Parts

<i>Classification</i>	<i>V Items</i>	<i>E Items</i>	<i>D Items</i>
A Items	Constant control and regular follow-up	Moderate stocks	Nil stocks
B Items	Moderate stocks	Moderate stocks	Very low stocks
C Items	High stocks	Moderate stocks	Low stocks

As V-E-D classification is based on the criticality of the item, at times it can be used in the case of some special materials which are difficult to obtain. A combination of V-E-D and X-Y-Z methods may give some indication about items that should be disposed off so as to trim the inventories.

Just like the V-E-D classification for spare parts, plant and machinery can also be classified as vital, essential, important and normal, 'V-E-I-N'. If V-E-D and V-E-I-N classifications are combined, there will be 12 different classes, such as, vital spares for vital plant, to vital spares for essential plant, and so on. Naturally, the criticality will reduce from 'V' to 'D' for parts, and 'V' to 'N' for plant and machinery. Hence, a finer control is possible if these two methods are applied in conjunction.

V-E-D and V-E-I-N classifications are very relevant for drugs, instruments and equipment needed in operation theatres and critical care units.

F-S-N Classification

Movement analysis forms the basis for this classification. The items are classified as fast-moving, slow-moving and non-moving, based on their consumption pattern.

If there is a rapid change in technology, this classification should be updated more often.

F-S-N analysis is specially useful to control obsolescence, spoilage and deterioration in all kinds of items. Cut-off points for fast-, slow-and non-moving items usually depend on the characteristics of the items, their value and utility for operations. For example, zero issues may be placed in the non-moving class, as many as 10 issues in the past two years may be placed in the slow-moving category, and more than 10 issues in the fast-moving category.

A thumb rule for F-S-N classification is as follows:

Fast moving

Items which have moved at least once in a year.

Slow moving

Items which have moved at least once in a period of one to two years.

Non-moving

Items which have not moved even once during a two-year duration.

CONTROL OF SLOW AND NON-MOVING ITEMS

X-Y-Z and F-S-N analysis can be combined to control obsolete items. Disposal of obsolete items gain importance as inventory is built up over years. If the item can be salvaged as scrap, the organisation has to deal with unscrupulous traders in the scrap market. Organisations have to choose between obsolete items as sunk investment, or prevent obsolescence by timely and appropriate control. The X-Y-Z and F-S-N classification exercise will help in the timely prevention of obsolescence. Table 6.7 shows how controls can be effected for different classes of items.

Table 6.7 Control of Slow, Fast and Non-moving Items

<i>Classification</i>	<i>F Items</i>	<i>S Items</i>	<i>N Items</i>
X Items	Impose tight inventory control.	Reduce stock to low level.	Dispose of items at the best price.
Y Items	Apply normal inventory control.	Keep low level of stock.	Dispose of as quickly as possible.
Z Items	Increase stocks to reduce clerical work.	Keep low level of stock.	Dispose of even at low price.

DISPOSAL OF NON-MOVING STORES

Circulate a list of non-moving items to all departments to explore their use within the organisation. It is possible that some of the items may be used in future as they are, or with some modification. The rest may have to be discarded. The list of these items should be circulated to similar organisations, or to probable users for sale or exchange. Those items which cannot be disposed of to similar organisations should be put up at an open auction.

Combination of various selective controls between F-S-N and X-Y-Z can be used to achieve the best inventory management. For example, more controls have to be exercised for the class 'F' and 'X'. This control will reduce steadily when class 'N' and 'Z' is reached.

Classification by Source of Supply

So far, classification methods were based on monetary value, criticality of items, or their consumption pattern. There are other methods which are primarily directed towards controlling purchase, lead time and supply management. One cannot ignore the fact that inventory levels are also dependent on the source of supply. To illustrate this point, a scarce item with a long lead time definitely deserves a higher safety stock than a locally available item for a given consumption level. Classifications based on source of supply are discussed in the following section.

S-D-E Classification

S-D-E classification is a system where materials are sorted out as scarce to obtain, difficult to obtain, or easy to obtain. It is quite obvious that when an item is scarce, and also is in the 'A' class, an imaginative regulation has to be found to manage it. For example, it would be quite absurd to lay down a rule that an item which is imported should be procured, say, once in every six weeks. It should be obtained, perhaps, once in three or six months, considering the time, effort and expenditure involved.

A scarce item may be an item which is not easily available in the market, which requires source development, has a long waiting period, may be difficult to manufacture, or there are only a few manufacturers who supply them and who demand advance orders.

G-O-L-F Classification

In the G-O-L-F system, classification is based on the availability and nature of suppliers. The nature of the suppliers will determine the quantity and continuity of supply, lead time payment terms and clerical processing cost and time.

GOVERNMENT SUPPLIERS

In the 'G' category are government departments, canalising agencies like STC and MMTC, public sector undertakings, and so on. Transactions with these suppliers involve long clerical processing and the lead time will also generally be long. Usually no credit is available and payment has to be made in advance.

ORDINARY SUPPLIERS

In the 'O' category are those who form the bulk of suppliers. The quality and continuity of supply from them is good especially if the sources have a good standing in the market. Credit availability from some of these sources may be available, though not from all. The market convention is to provide credit for 30 days.

LOCAL SUPPLIERS

In the 'L' category are those from whom cash purchases are generally made. They are usually in the market areas of cities.

FOREIGN SUPPLIERS

Foreign suppliers belong to the 'F' category. Dealing with a foreign source will involve heavy clerical work—starting with government clearance, such as, obtaining an import licence for customs clearance before the foreign source of supply is contracted. After orders have been placed, the shipping formalities must be followed up and port clearance work done. Therefore, the coordination involved will be much more than in other cases and is generally complicated if being done for the first time.

S-O-S Classification

Raw materials can also be classified as seasonal or off-season items. Agricultural products have a seasonal availability pattern depending on the monsoon. The

prices will be lowest at the time of harvest. Hence, the inventory system will have to balance for a longer period of time between the holding cost and the lower prices at which it will be available, while working out the levels for this class of items. One cannot apply the Economic Order Quantity formula in this situation. For instance, inventories at the time of procurement will be somewhat high, but that cannot be helped. In the case of a hospital, for example, all items related to burns will have to be stocked before the beginnings of the festive season; and in flood-affected areas, items related to water-borne diseases will have to be kept in large quantities.

PART 2

COMPARISON OF MATERIALS MANAGEMENT SYSTEMS BETWEEN THE HOSPITAL AND ENGINEERING INDUSTRIES

Introduction

Hospital management encompasses all the supporting services such as personnel, secretarial, finance, materials, medical records, public relations, housekeeping, etc. Among these functions, materials management is considered an important function because it is responsible for satisfying the day-to-day material (drugs and other therapeutic materials) requirements of the patients and hospital. The role and importance of the materials management department can be better understood by comparing the salient features of materials management applied to a hospital with that of the engineering industry. The following sections enumerate their comparative status in various aspects of materials management. In each aspect, the status related to a hospital is denoted by HMM, and the status related to the engineering industry is denoted by EIM.

DEMAND FOR MATERIALS

HMM

Materials requirement is continuous, since work in a hospital goes on throughout the day, all 365 days in a year.

EIM

There may be no material consumption during weekly and declared holidays; or when it is not scheduled for production. Typically, the material requirement is limited to five or six days a week.

TYPES OF MATERIAL PURCHASED

HMM

1. Medical items: pharmaceutical, surgical, consumable and protective.
2. Capital equipment and accessories.
3. Electrical/mechanical/civil material for maintenance work.
4. Catering items.
5. Housekeeping material.
6. Linen.
7. Office equipment.
8. Printing and stationery.

EIM

1. Raw materials.
2. Sub-assemblies.
3. Electrical and mechanical spares for maintenance.
4. Housekeeping items.
5. Office equipment and accessories.
6. Printing and stationery.

MATERIAL CONTENT

HMM

Material content in the hospital is around 12 per cent of the total turnover.

EIM

Material content in an engineering industry is over 50 per cent of the total turnover.

CHARACTERISTICS OF MATERIAL REQUIREMENT

HMM

Material requirement is very critical. Non-availability of a particular material can cost a human life, for example, the non-availability of oxygen or of life-saving drugs. When the patient suffers for want of materials, the buyer's feeling of guilt will be acute.

EIM

Material requirement is critical to the extent that the entire production may come to a grinding halt for want of material. It may cause heavy financial loss to the company, which can be compensated by other means.

QUALITY OF MATERIALS

HMM

The quality of materials purchased is critically important. Sub-standard quality materials cannot be tolerated. For example, use of contaminated disposable plastic syringes will cause a dangerous reaction in the patients; infected blood can cause hepatitis and AIDS.

EIM

The poor quality of a material can affect it to the extent that the product may fail in its ultimate quality specifications, leading to rejection, or re-working on the production floor, or rejection by the customer, thereby increasing the cost. Occasionally, the product may fail in the market if it happens to pass the quality control check.

MATERIAL INSPECTION

HMM

The hospital has no separate quality control department to certify the quality of material purchased. Medical items purchased for each department have to be checked by specialists in that particular department. It is impossible to run a quality control department employing specialists in various specialities, such as cardiology, nephrology, dentistry, and so on.

EIM

A central quality control section is usually available to check and approve the quality of material purchased.

PURCHASE DECISIONS

HMM

Doctors play a dominant role in purchase decisions.

EIM

Production, quality control, engineering and design departments play an important role in purchase decisions.

IMPORT PROCEDURES***HMM***

Import procedures with respect to hospital materials is simpler when compared to import of regular industrial materials, since most hospital materials fall under Open General License (OGL). It is also possible to get customs duty exemption for actual users.

EIM

Import of materials call for elaborate procedures. Customs duty exemption is seldom granted.

SOURCE FOR IMPORT***HMM***

Over 50 per cent of the materials purchased for most of the medical departments, such as cardiology, nephrology, dental and radiology, are imported. These imported materials are available through Indian agents or directly from foreign manufacturers.

EIM

Generally, the import content is hardly 5 per cent to 10 per cent, except in the electronics industry. Indigenous materials are available for purchase and they are also of an acceptable quality.

BASIS FOR MATERIAL REQUIREMENT***HMM***

Requirement of materials is based on the inflow of patients, which in turn depends on several factors, such as the reputation of the hospital, the climate, holidays, the financial capacity of the potential patient, etc. Therefore, materials requirement planning is difficult to carry out.

EIM

Materials planning is easy since it can be based on the sales forecast and production plans.

SPARES PLANNING

HMM

Spares planning for sophisticated equipment is difficult because of the high rate of obsolescence in the biomedical field.

EIM

Spares planning is relatively easy because of long experience in operating factory equipment, and the availability of experienced maintenance personnel.

CENTRALISED STORES

HMM

Centralised stores are difficult to operate.

EIM

Centralised stores are possible.

LOSS OF EFFICACY

HMM

Expiry dates play an important role in the case of hospital materials. Oxygenerators, cardiotomy reservoirs used in open heart surgeries cannot be used after the expiry date. Most of the drugs purchased have a finite shelf life beyond which they cannot and should not be used.

EIM

Engineering items, such as castings, forging and metallic components have a fairly long shelf life, with exceptions such as paints, chemicals and rubber components.

DOCUMENTATION PROCEDURES

HMM

Implementation of controls and documentation procedures is difficult, because doctors, paramedical staff, such as, nurses, dieticians and hospital administration staff, have to be convinced and won over, which takes a considerable amount of time and effort.

EIM

Documents and controls are usually accepted as part of the normal system and procedures in an industrial organisation.

BACKDROP

HMM

Foresight and risk analysis is essential in day-to-day activities. Knowledge of medicine and engineering will be of great advantage in the actual work situation.

EIM

Good engineering knowledge, in addition to analytical ability, is essential for day-to-day operations.

SKILL TRANSFER

HMM

Transfer of materials management skill from a non-hospital organisation to a hospital is almost impossible. Hence, this skill has to be developed, nurtured and retained *in situ*.

EIM

The skill can be transferred to different types of industrial organisations, including service organisations other than hospitals.

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Hospital Stores Organisation and Pharmacy **7**

A.V. Srinivasan

Introduction

This case study is about the materials department of a 300-bed hospital located in a sub-metro city, providing multispecialty service, having 300 beds and a patient turnover of 300 per day. This hospital handles as many as 2,500 items of materials, holds an inventory of Rs 120,000 per bed, which is about 11 per cent of the turnover, deals with as many as 1,000 suppliers in an urban area, and raises about 1,000 store receipt vouchers and 500 purchase orders every month.

Computerisation of inventory management brings a great deal of efficiency to an organisation, more so to a hospital. A variety of computer programmes for inventory management, for different sizes and needs, are available in the market, which can be adapted to the requirements of a hospital. In an urban area, just-in-time inventory policies can be easily applied because of the availability of several distributors and the keen competition among suppliers. In this context, networking among the materials management departments of hospitals in urban areas will increase their efficiency and bring down their cost of operations.

Since the bulk needs of a hospital are large numbers of small units of an item, the demand is generally smooth, predictable and amenable to inventory models. Most basic inventory models developed in classic inventory management literature can be effectively and easily applied to control inventory in a hospital.

Objectives

The objectives of the materials department are to:

- Purchase materials in time and as required by the user departments for the smooth functioning of the hospital.
- Maintain optimum levels of stock in order to avoid wastage, scrap and obsolescence.

- Keep in contact with user departments to ensure that the quality supplied to them is of specified standards.
- Procure the specified material for the best or acceptable price to make it available in time and to the right user.
- Maintain good vendor relationship.

Typically, the type of materials used in a hospital can be classified into medical and non-medical items.

MEDICAL ITEMS

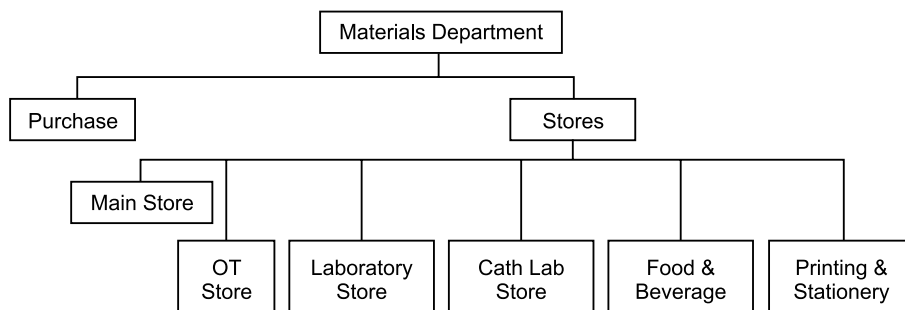
- Capital items, such as X-Ray, CAT Scan and MRI.
- Expensive materials that are actually consumables, such as Stent, which is used in cardiac surgeries.
- Consumables, such as IV fluids, catheters, syringes, gloves, drugs and medicines in their myriad forms, which are under the purview of the pharmacy department.
- Consumables used in the operation theatre, such as surgical items, dressings, gauze, cotton wool, pads, masks and gowns.

NON-MEDICAL ITEMS

- Housekeeping—linen, toiletries, washing materials and blankets.
- Printing and stationery—note pads, doctor’s pads, OHP sheets and record books.
- Food and beverage—vegetables, grocery and kitchen items.
- Engineering and maintenance—spares and repair parts for the upkeep of capital items, tools and testing instruments.

The materials department may be divided functionally into the purchase department and the stores department, for effective coordination. The organisation chart is shown in Figure 7.1.

Figure 7.1 Organisation Chart



Functions

PURCHASE

All regular items are purchased on the basis of reorder levels maintained in the stores. In the case of medical equipment, the approval of the head of the user department is required. For equipments that have to be imported, the purchase department coordinates with the accounts department for opening a letter of credit with the bankers. Some hospitals have the system of providing a running monthly budget of a specified amount, which is a percentage of the hospital collections, for purchases. All purchases are centralised for all departments in the hospital.

MAIN STORE

The main store supplies materials to all other stores in the hospital. Materials are accepted by the store through a *delivery challan*, which is stamped as received. Before accepting them, items are inspected, and those which are damaged and rejected are returned to the supplier. After the inspection, a *stores receipt voucher* is prepared, based on the *delivery challan*. Materials are issued against a *materials requisition slip*. In the stores, items are arranged department wise, with numeric codes for item groups. Twice a week, the stock levels of items in the radiology, nephrology, cardiology, laboratory services and housekeeping departments are sent to the purchase department.

The main store holds over 1,500 items, which cost over Rs 45 lakh a month. The most expensive item is the pacemaker and arterial stent, which are valued at Rs 60,000 a piece. The fastest moving items are soaps and tissue paper. About 1,000 suppliers may provide service to a well-developed sub-metro city hospital.

On an average, a stock of one month's consumption of capital goods is held in the main store. One week's consumption of spares and parts are stocked.

OT, LABORATORY AND CATH LAB STORES

These stores receive materials from the main store. They are open for two shifts in a day—8 am to 8 pm. The stock of materials is taken on a daily basis. Cath Lab and OT stores prepare trays for each case requisitioned. Each tray has a collection of items as per the orders of the concerned doctor.

In the OT stores, about 300 items are held in store, carrying a value of over Rs 20 lakh. The most expensive item is injection Supacef, and the fastest items are IV fluids, syringes and gloves.

On an average, a stock of one month's consumption is held in the laboratory store and the cath lab store. The OT store holds items needed for two or three months of consumption.

FOOD AND BEVERAGE STORE

Items for both daily and monthly consumption are stored in the food and beverage department. Vegetables and perishables are received directly by the store. Vegetables bought by the daily consumption store are purchased according to an estimate. Perishable items are stored in the refrigerator. Emergency purchases are made by sending an internal office memo to the purchase department, and later collecting cash for the expenses incurred. The food and beverage store stocks over 250 items for about 10 days of consumption. Vegetables are cleaned with cold water. Utensils, serving plates, spoons, tumblers, and so on, are sterilised. Leftover food is given away in sealed polythene bags.

PRINTING AND STATIONERY STORE

This store caters to almost all departments in the hospital. It deals with 16 printers from whom price quotations are received once a year, or once in six months, as a contract price for the subsequent period. A monthly statement of consumption by each department, according to the amount of money and quantity of items required, is prepared. Weekly reports are prepared, audited and reviewed.

The printing and stationery store may handle as many as 400 items of the value of about four lakhs in a month. The most expensive item is computer stationery and the fastest-moving items are *requisition books*. As many as 20 suppliers may provide their services in an urban city. The printing and stationery store holds between two and three months of consumption.

Procedure

Any department in the hospital in need of material fills the *requisition slip* and sends it to the materials department. The materials department checks regarding its availability, using the *materials stock file* and *materials transaction file*. If the item is available, a comparison is made with the stock in hand. If the quantity available covers the quantity required, the item is supplied or issued to the department which made the requisition. Then the transaction is noted in the *materials transaction file*.

In case the stock in hand of the item is scarce or not available, the item is ordered by using the *dealer file*—for selecting the dealer, and the *order file*—for placing the order. In some situations, the materials department may check if the item is locally available. If it has to be imported, it is sent to the finance department to help open the letter of credit. Then an order is placed with the selected supplier. This transaction is entered into the *order file*.

Once the material is received, it is inspected to check whether it tallies with the number ordered, and for damage, if there is any, with the help of the *order file*. If found satisfactory, the receipt is recorded in the *materials stock file*. The stock received and inspected is finally stored in the main store, from where the material is issued in required quantities to the requisitioning department.

Documentation

This section lists the major files that are maintained in the materials department, and the items of information collected in each of them.

Materials stock file

- Name of item
- Code number
- Class (A, B, C)
- Lead time to procure
- EOQ
- Stock as on previous order
- Value of item as on previous order
- Unit price for previous order

Material transaction file

- Name of item
- Code number
- Stock as on previous day
- Number of units issued
- Number of units received
- Stock at the end of current day

Dealer file

- Name of item
- Name of the supplier

- Supplier code
- Lead time for the item
- Price at which previously purchased
- Per cent discount given

Order file

- Code number of item
- Code number of supplier
- The next best supplier
- Value of the order
- Quantity of the order
- Date of expected receipt

Requisition slip

- Department making requisition
- Date
- Name of item
- Quantity required
- When required
- Suggested supplier

Inspection report

- Date
- Item inspected
- Method of inspection
- Name of supplier
- Passed
- Rejected/sent back

Issue register

- Date
- Item name
- Opening stock
- Quantity issued
- To whom issued
- Closing stock

Skills

The specific skills needed to manage a store are—the person should be honest, meticulous, efficient and intelligent; the person should have the necessary patience and readiness required to handle queries from user departments about the availability of material, reason for the denial of a request and reasons for any delay. A postgraduate diploma in materials management will help in executing the task objectively and rationally. This diploma will provide knowledge about store practices, ordering procedures, inventory policies, inventory analysis and computerisation. A knowledge of computer software for inventory management, spreadsheet, database management will increase the person's speed and efficiency.

The constraints and limitations under which a purchase department functions are not always appreciated by other departments. They need to inform the purchase department well in advance, so as to avoid delay, and to give clear instructions about specifications regarding the items. It is necessary to work out an effective system for the timely delivery of vital items and the storage of critical items.

Pharmacy Objectives

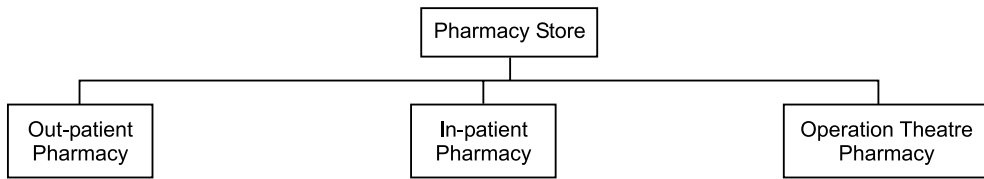
A hospital purchases and supplies drugs for the convenience of its patients. The objective of running a pharmacy in a hospital is to ensure convenience and reliability. These are to:

- Provide standard drugs and medicines to the patients.
- Facilitate easy and immediate access to these drugs.
- Maintain an optimum stock level of drugs.

Organisation

The manager of the hospital pharmacy is assisted by the pharmacy in-charge, the pharmacist and pharmacy aides. They are all qualified graduates or diploma holders from a recognised pharmacy institute. The pharmacy may also employ clerical assistants, a cashier, a computer operator and a helper. It has three designated areas of operation: the out-patient pharmacy, the in-patient pharmacy and the operation theatre pharmacy (Figure 7.2).

FIGURE 7.2 Pharmacy Organisation



Pharmacy Store

The pharmacy store is the pivot controlling the three pharmacies in the hospital. This store places orders every week for fast-moving items with a stockist, who carries the stocks of several companies, and also with certain distributors. All items with a short expiry date extending up to a six-month expiry period are stored as a fast-moving category. About three per cent of the medicines are returned to the stockist or distributor because they are dated. The slow-moving items are ordered twice a month, and non-moving items once a month. Being in a sub-metro city, the orders are filled and received in the store within two days. Credit bills are computerised for accounting. Stock is checked every day. Drugs are stored by company name and in alphabetic order. All expensive medicines, which are priced over Rs 15 per unit, are stocked separately in a different location. Everyday, the store gets an order for stock replenishment from each pharmacy. The store is kept open from eight in the morning till six in the evening.

Stocking of drugs is done according to the A-B-C analysis and F-S-N analysis. The drugs are arranged in the first-in, first-out method of item movement. The drugs are ordered based on the principles of A-B-C and V-E-D analysis.

OUT-PATIENT PHARMACY

In the out-patient pharmacy medicines are arranged on the shelf in alphabetic order. Physical stock-checking with computer reports are made every three days. Orders are placed with the pharmacy store daily for replenishment of stock. This pharmacy is open 24 hours a day and makes cash sales.

IN-PATIENT PHARMACY

Medicines are arranged in the shelf in alphabetic order and using the movement classification—fast, slow and non-moving. The in-patient pharmacy provides drugs

to all the wards, special rooms and general wards. Ward nurses send *requisition slips* to the in-patient pharmacy for medicines as per prescriptions of the attending doctors. Drugs are issued by the pharmacy, the transaction information is fed into the computer and the bill is sent to accounts for billing and later collection at the time of discharge. Physical stock is tallied with the computer output of transactions every day. Orders are placed daily for the replenishment of stock. Feedback on the stock is made to the pharmacy stores daily. In the case of emergency, the in-patient pharmacy supplies drugs to the out-patient pharmacy and operation theatre pharmacy. This pharmacy is open 24 hours a day.

OPERATION THEATRE PHARMACY

The surgeon gives the prescription one day before the operation to the theatre nurse or secretary, who makes an indent to the operation theatre pharmacy. All life-saving and vital drugs, blood coagulant injections, anti-infection drugs and whatever is required and prescribed by the doctor is kept ready one day before the operation. The pharmacy prepares a tray of requisitioned material for each operation and sends them to the operation theatre. The trays containing unused items are returned to the operation theatre pharmacy, along with a computer printout of the total number of items supplied, the number of items used and the number of items returned. At the operation theatre pharmacy, a list of the used items is fed into the computer, with the in-patient number. Based on this information, the bill to be charged to the patient is prepared and collected at the time of discharge.

The operation theatre pharmacy receives its daily requirements from the pharmacy stores by placing an indent. Drugs and medicines are arranged on the shelf in alphabetic order. The operation theatre pharmacy also stocks sutures and other instruments required for the surgery. To cater to emergencies and during the night, three standard trays are left in the operation theatre. They contain emergency drugs as per standard classification. This includes some orthopaedic drugs. The reorder level is fixed on a weekly basis and the indent for ordering is placed with the purchase store. The operation theatre pharmacy functions in two shifts from 8 am to 8 pm.

In all pharmacy stores, the medicines which are to be stored below 10 degrees centigrade are kept in refrigerators. All medicines reaching the expiry date are sent to the stockists or distributors for replacement.

Categorisation of Drug Items

In the in-patient and out-patient pharmacies the drugs are categorised as:

- Tablets
- Injections
- Ointments
- Drops
- Powders
- Fluids
- Capsules
- Liquids
- Surgical
- Over the counter
- Miscellaneous

In the operation theatre pharmacy the categories are:

- Injections
- Surgicals
- Fluids
- Ointments
- Drops
- Miscellaneous

Documentation

The following registers and files are maintained in the pharmacy stores and the pharmacies:

STORES

1. Monthly and weekly statements of stock held
2. Price list of items
3. Quotation file
4. Stock movement register
5. In-patient (IP) material issue slip
6. Stores issue register
7. Stock receipts register
8. Bills from distributors
9. Suppliers list
10. Orders from pharmacies
11. Returned to stores bill
12. Drug licence

IN-PATIENT PHARMACY

1. Nurse's requisition slip
2. Issued medicines from stores
3. Patient returns bill
4. List of fast-moving items
5. Return to stores bill
6. Reorder level
7. Monthly report

OUT-PATIENT PHARMACY

1. Monthly sales statement
2. Reorder slips
3. Bank deposit
4. Credit bills file
5. Return to stores bill

OPERATION THEATRE PHARMACY

1. Patient material requisition
2. Material issue slip
3. Bills
4. Category-wise stock list
5. Expiry and damage file
6. Monthly stock statement

Information Sets

The information collected in major files and registers are listed in this section.

PHARMACY STOCK FILE

1. Medical drug name
2. Drug code
3. Batch number
4. Unit price of last purchase

5. Manufacturing date of last order received
6. Current stock level
7. Reorder level
8. Value of drugs in stock
9. Quantity received
10. Quantity issued
11. Date
12. Class of drug

DEALER FILE

1. Drug name
2. Drug code
3. Supplier company
4. Unit price
5. Lead time
6. Alternate suppliers

OUT-PATIENT TRANSACTION FILE

1. Drug name
2. Drug code
3. Batch number
4. Manufacturing date and expiry date
5. Unit price
6. Quantity issued
7. Total amount
8. Patient's name
9. Doctor's name

IN-PATIENT TRANSACTION FILE

1. Ward/room
2. In-patient number
3. Patient's name
4. Drug name
5. Drug code
6. Manufacturing date
7. Expiry date

8. Quantity issued
9. Total amount

OPERATION THEATRE TRANSACTION FILE

1. Patient's name
2. Operation theatre number
3. Doctor's name
4. In-patient number
5. Drug name
6. Drug code
7. Batch number
8. Manufacturing date
9. Expiry date
10. Unit price
11. Quantity issued
12. Total amount

Selective Systems of Materials Management in a Hospital—Case Illustration

8

A.V. Srinivasan

This case illustration from a hospital in operation in India contains examples of the systems of classification of materials. The classifications will keep changing based on variations in price, consumption quantities and availability. They may also change because of the size, ownership and specialty level of the hospital. The detailed working of A-B-C, H-M-L and X-Y-Z systems are also presented to help in understanding and applying the systems where they are needed (see Tables 8.1 to 8.8).

Table 8.1 A-B-C Classification—Bio-medical Department

<i>Serial No.</i>	<i>Item Description</i>	<i>UOM</i>	<i>Rate</i>	<i>Quantity</i>	<i>Value</i>	<i>% Cumulative</i>	
							<i>%</i>
<i>Class A</i>							
1	PO2 ELECTRODE FOR 1620, 1650 BGE	NOS	73,601.00	1	73,601.00	14.8	14.8
2	PH ELECTRODE 70963 BGE	NOS	56,930.50	1	56,930.00	11.4	26.2
3	FINGER CLIPS	NOS	8,764.08	4	35,056.32	7.0	33.2
4	LAMP HTI (HALOGEN) 250 W/32 C	NOS	16,000.00	2	32,000.00	6.4	39.7
5	AG + KV CONTROL PCBA 01781	NOS	24,543.10	1	24,543.10	4.9	44.6
6	PROGRAMME SWITCH GROUP 21061	NOS	11,253.42	2	22,506.84	4.5	49.1
7	PCO2 DISP MEMBRANE CAPS	NOS	10,807.50	2	21,615.00	4.3	53.4
8	REF DISP MEMB KIT 70987 BGE	NOS	10,807.50	2	21,615.00	4.3	57.8
9	PO2 DISP MEMB KIT 70986 BGE	NOS	6,927.25	3	20,781.75	4.2	61.9
10	K + DISP MEMB KIT 70988 BGE	NOS	19,008.00	1	19,008.00	3.8	65.8
11	SAMPLE DETECTOR	NOS	16,521.41	1	16,521.41	3.3	69.1
12	SWITCH 2 WAY CROSS BAR 17551	NOS	7,817.40	2	15,634.80	3.1	72.2
13	SWITCH 4 WAY CROSS BAR 17561	NOS	6,908.40	2	13,816.80	2.8	75.0
14	MICRO SWITCH	NOS	1,536.21	8	12,289.68	2.5	77.4
15	REF MEMB KIT 669446 BGE	NOS	6,116.00	2	12,232.00	2.5	79.9

continued

Table 8.1 continued

Serial No.	Item Description	UOM	Rate	Quantity	Value	% Cumulative %	
<i>Class B</i>							
16	FOOT SWITCH L&T 2 PEDALS EXPLOS	NOS	11,998.82	1	11,998.82	2.4	82.3
17	HALOGEN LAMP—21V/150W W/R	NOS	911.18	10	9,111.80	1.8	84.1
18	BIPOLAR FOOT SWITCH MARTIN	KIT	7,590.00	1	7,590.00	1.5	85.7
19	CA + MEMBRANE	SET	7,550.00	1	7,550.00	1.5	87.2
20	PO2 MEMB KIT 69443 BGE	NOS	7,040.00	1	7,040.00	1.4	88.6
21	INTERFACE CABLE FOR PT NONON	NOS	2,059.20	3	6,177.60	1.2	89.8
22	PUSH BUTTON 88142	NOS	1,527.12	4	6,108.48	1.2	91.0
23	HALOGEN LAMP—12V×50W W/R	NOS	385.35	14	5,394.90	1.1	92.1
24	FUSE 00537	NOS	436.32	12	5,235.84	1.1	93.2
25	HEAT SINK BG 12PCBA 03953	NOS	5,090.40	1	5,090.40	1.0	94.2
<i>Class C</i>							
26	OPHTHALMOSCOPE BULBS	NOS	900.00	4	3,600.00	0.7	94.9
27	HALOGEN LAMP—150W W/O/R	NOS	180.00	20	3,600.00	0.7	95.6
28	PHOTO CONDUCTORS NEON-VTS	NOS	3,599.63	1	3,599.63	0.7	96.4
29	HALOGEN LAMP 2V/1500 W/O/R	NOS	147.50	20	2,950.00	0.6	97.0
30	LAMP 21703	NOS	727.20	4	2,908.80	0.6	97.5
31	HALOGEN LAMP—6W/20V	NOS	237.82	12	2,853.00	0.6	98.1
32	TRANSISTOR POWER	NOS	363.60	6	2,181.60	0.4	98.5
33	SAMPLE NEEDLE	NOS	1,997.28	1	1,997.28	0.4	98.9
34	HALOGEN LAMP—150W W/O/R	NOS	290.00	6	1,740.00	0.3	99.3
35	TUBING KIT (2 PCS) BGE	PKT	1,489.00	1	1,489.00	0.3	99.6
36	KCL TABLET P/N98315 BGE	NOS	1,067.00	1	1,067.00	0.2	99.8
37	PLUG IOP 3 PIN-5A	NOS	20.00	13	270.40	0.1	99.9
38	BATTERIES 9V SQUARE (DURACELL)	BOTT	49.58	3	148.74	0.0	99.9
39	INSULATION-TAPE	ROLL	11.44	10	114.40	0.0	99.9
40	TISSUE PAPER—25 PULLS	NOS	5.00	22	110.00	0.0	99.9
41	TEFLON TAPE	NOS	21.42	5	107.10	0.0	100.0
42	SPECIAL WHITE CLOTH	PKT	7.00	12	84.00	0.0	100.0
43	BATTERIES—9V SQUARE	NOS	17.17	4	68.68	0.0	100.0
44	COLIN SPRAY	NOS	31.50	2	63.00	0.0	100.0
45	LUBRICATING OIL	LTRS	60.00	1	60.00	0.0	100.0
46	BATTERY CELLS (LARGE)	NOS	9.00	5	45.50	0.0	100.0
47	PENCIL CELLS	NOS	5.00	8	40.60	0.0	100.0
48	WASHING POWDER	NOS	16.15	2	32.30	0.0	100.0
49	TOILET SOAPS	PKTS	1.30	7	9.10	0.0	100.0

Table 8.2 H-M-L Classification—Bio-medical Department

Serial No.	Item Description	UOM	Rate	Quantity	Value
<i>Class High</i>					
1	PO2 ELECTRODE FOR 1620, 1650 BGE	NOS	73,601.00	1	73,601.00
2	PH ELECTRODE 70963 BGE	NOS	56,930.50	1	56,930.00
3	AG + KV CONTROL PCBA 01781	NOS	24,543.10	1	24,543.10
4	K + DISP MEMB KIT 70988 BGE	NOS	19,008.00	1	19,008.00
5	SAMPLE DETECTOR	NOS	16,521.41	1	16,521.41
6	LAMP HTI (HALOGEN) 250W/32C	NOS	16,000.00	2	32,000.00
7	FOOT SWITCH L&T 2 PEDALS EXPLOS	NOS	11,998.82	1	11,998.82
8	PROGRAM SWITCH GROUP 21061	NOS	11,253.42	2	22,506.84
9	PCO2 DISP MEMBRANE CAPS	NOS	10,807.50	2	21,615.00
10	REF DISP MEMB KIT 70987 BGE	NOS	10,807.50	2	21,615.00
<i>Class Medium</i>					
11	FINGER CLIPS	NOS	8,764.08	4	35,056.32
12	SWITCH 2 WAY CROSS 17551	NOS	7,817.40	2	15,634.80
13	BIPOLAR FOOT SWITCH MARTIN	KIT	7,590.00	1	7,590.00
14	PO2 MEMB KIT 69443 BGE	NOS	7,040.00	1	7,040.00
15	PO2 DIP MEMB KIT 70986 BGE	NOS	6,927.25	3	20,781.75
16	SWITCH 4-WAY CROSS BAR 17561	NOS	6,908.40	2	13,816.00
17	REF MEMB KIT 669446 BGE	NOS	6,116.00	2	12,232.00
18	HEAT SINK BG 12PCBA 03953	NOS	5,090.40	1	5,090.40
19	PHOTO CONDUCTORS NEON—VTS	NOS	3,599.63	1	3,599.63
20	INTERFACE CABLE FOR PT NONON	NOS	2,059.20	3	6,177.60
21	SAMPLE NEEDLE	NOS	1,997.28	1	1,997.28
22	MICRO SWITCH	NOS	1,536.21	8	12,289.68
23	PUSH BUTTON 88142	NOS	1,527.12	4	6,108.48
24	TUBING KIT (2 PCS) BGE	PKT	1,489.00	1	1,489.00
25	KCL TABLET P/N98315 BGE	NOS	1,067.00	1	1,067.00
<i>Class Low</i>					
26	HALOGEN LAMP—21V/150W W/R	NOS	911.18	10	9,111.80
27	OPHTHALMOSCOPE BULBS	NOS	900.00	4	3,600.00
28	LAMP 21703	NOS	727.20	4	2,908.80
29	FUSE 00537	NOS	436.32	12	5,235.84
30	HALOGEN LAMP—12V × 50W W/R	NOS	385.35	14	5,394.90
31	TRANSISTOR POWER	NOS	363.60	6	2,181.60
32	HALOGEN LAMP—150W W/O/R	NOS	290.00	6	1,740.00
33	HALOGEN LAMP—6W/20V	NOS	237.82	12	2,853.00
34	HALOGEN LAMP—150W W/O/R	NOS	180.00	20	3,600.00

continued

Table 8.2 continued

Serial No.	Item Description	UOM	Rate	Quantity	Value
35	HALOGEN LAMP 2V/150 W/O/R	NOS	147.50	20	2,950.00
36	LUBRICATING OIL	LTRS	60.00	1	60.00
37	BATTERIES 9V SQUARE (DURACELL)	BOTT	49.58	3	148.74
38	COLIN SPRAY	NOS	31.50	2	63.00
39	TEFLON TAPE	NOS	21.42	5	107.10
40	PLUG IOP 3 PIN—5A	NOS	20.00	13	270.40
41	BATTERIES—9V SQUARE	NOS	17.17	4	68.68
42	WASHING POWDER	NOS	16.15	2	32.30
43	INSULATION TAPE	ROLL	11.44	10	114.40
44	BATTERY CELLS (LARGE)	NOS	9.00	5	45.50
45	SPECIAL WHITE CLOTH	PKT	7.00	12	84.00
46	TISSUE PAPER—25 PULLS	NOS	5.00	22	110.00
47	PENCIL CELLS	NOS	5.00	8	40.60
48	TOILET SOAPS	PKTS	1.30	7	9.10
49	CA + MEMBRANE	SET	7,550.00	1	7,550.00

Table 8.3 X-Y-Z Classification—Bio-medical Department

Serial No.	Item Description	UOM	Stock on Hand Number	Stock on Hand Value
<i>Class X</i>				
1	IMAGING FILM 14	PKT	10	72,977.89
2	APHERESIS KIT OPEN SYSTEM	NOS	6	28,875.00
3	PALL FILTERS RCXL 1KTE	NOS	20	20,925.00
4	X-RAY FILM 12×12 (KODAK)	PKT	10	17,249.83
5	X-RAY FILM 10×12 (KONICA)	PKT	3	16,567.20
6	BLOOD BAG DOUBLE—450 ML (TERMO)	NOS	150	16,499.93
7	CHIBA NEEDLE ANGIOMED 70×226	NOS	13	13,975.00
8	FIXER SOLU—KODAK RO X	UNIT	14	13,178.00
9	X-RAY FILM 10×8 (KODAK)	PKT	8	12,892.81
10	MAMMOGRAPHY FILM 18×24	PKT	3	11,650.46
11	ACETATE FLUID	LTRS	720	11,012.70
12	GUIDE WIRE—35	NOS	40	11,004.57
13	LEAD GOGGLES	NOS	4	10,888.00
<i>Class Y</i>				
14	E.O. GAS CARTRIDGES KIT—AB 1005	BOX	1	7,562.00
15	ECG RECORDING PAPER FOR (H.P.)	NOS	12	7,394.17

continued

Table 8.3 continued

Serial No.	Item Description	UOM	Stock on Hand Number	Stock on Hand Value
16	ACD SOLUTION	PKT	16	6,251.16
17	A.V. FISTULA NEEDLE—16 B	NOS	450	5,906.43
18	VIDEO CASSETTE (20 MINUTES)	NOS	6	5,556.56
19	E.C.G. ROLL	ROLL	47	4,826.68
20	E.E.G. PASTE	BOTT	29	4,772.67
21	TRANSFER BAGS—300 ML	NOS	100	4,757.00
22	SUTURE CUTTING NEEDLE	PKT	340	4,567.00
23	TROCAR CATHETER	NOS	20	4,491.78
24	SUCTION TUBING	MTRS	70	2,756.91
25	EMBELECTOMY CATHETER	NOS	2	2,224.00
26	ORWO FILM BLACK AND WHITE	ROLL	20	2,200.0
27	DOUBLE LUMEN WEDGE PRES CATH	NOS	1	1,950.00
28	SUCTION CATHETER JAR	NOS	2	1,540.00
29	DILATOR—10FR	NOS	10	1,540.00
30	FIXER POWDER 13.5 LTR	PKT	5	1,521.59
31	X-RAY FILM 12 × 15 (KONICA)	PKT	12	1,355.42
32	FIXER SOLUTION PART A	BOTT	9	1,177.42
33	NEBULIZER KIT	NOS	6	1,130.16
<i>Class Z</i>				
34	RECTIFIED SPIRIT	LTRS	50	932.00
35	DEVELOPER POWDER—13.5 LTRS	PKT	3	899.99
36	MICROBAR SOLUTION	BOTT	6	886.40
37	THERMAL PRINTER PAPER—72 × 20	ROLL	10	750.00
38	THERMAL PRINTER PAPER 57C30	ROLL	11	667.00
39	DEVELOPER POWDER 9 LTRS	PKT	3	615.00
40	CONNECTORS FOR AMBU BAG	NOS	7	560.00
41	RINE SOL FOR RADIOMETER HEMAXI	BOTT	14	458.00
42	ABRAHAM SLUNG BIOPSY NEEDLE	NOS	2	380.00
43	ALUMINIUM SEALING CLIPS	NOS	400	230.00
44	E.C.G. JELLY—250	BOTT	8	185.83
45	THERMAL PRINTER PAPER 100S210 × 297	PKT	3	165.15
46	SYRINGES GLASSES—50CC	NOS	1	157.00
47	HUDSON OXYGEN MASK	NOS	1	144.66
48	RE-BREATHING BAG 1LTR	NOS	5	125.00
49	CORRUGATED RUBBER SHEETS	NOS	10	120.00
50	FLATUS TUBE	NOS	3	45.00
51	TONGUE DEPRESSOR WOODEN	NOS	50	42.04

Table 8.4 V-E-D Classification

<i>Vital</i>	<i>Essential</i>	<i>Desirable</i>
<i>Operation Theatre</i>		
Defibrillator	Haemodyliser	Other equipment
Cardiac Monitor	Emergency sets for incubation	Extra linen
Pulse Oximeter	Trachioostemy	
Ventilator	Veinous section set	
	Standby power set	
<i>Pharmacy</i>		
Actilase	Antimalarial	IV Fluids
Streptokinase	Sedatives	Cetrizine
Morphine	Antihypertensive	Syringes
<i>Maintenance</i>		
V Belts	Thermometer	
Bearings	Fuses	
Connector pipes	Flow meters	

Table 8.5 F-S-N Classification

<i>Fast-moving</i>	<i>Slow-moving</i>	<i>Non-moving</i>
<i>Pharmacy</i>		
Crocin	Euroflox	Actilase inj
Digene	Cloxicillin	Amoxycillin inj
Ibugesic	Emdopa	Cifran 250 mg
Ciprofloxin	Nitrepen	Brufen 200 mg
Brufen	Metronidazole	Amoxycillin 250 mg
Becosules tablets	Glynase	
<i>Maintenance</i>		
Fuses	Tools	Thermometer
Bearings	Fuses (high capacity)	Containers
Connector	Flow meters	Gauges—X
Copper pipes	V Belts	

Table 8.6 S-D-E Classification

<i>Scarce to Obtain</i>	<i>Difficult to Obtain</i>	<i>Easy to Obtain</i>
<i>General</i>		
Cysgen Inj	Component collection kits	CBP sets
Intraocular Inj	of blood sugar, urea,	Thyroxine test set
Balloon (Imp)	bilirubin and uric acid	Other test sets
Stents (Imp)		

Table 8.7 G-O-L-F Classification

<i>Government</i>	<i>Ordinary</i>	<i>Local</i>
<i>Pharmacy</i>		
Morphine	All lab kits	Antibiotics
Pethidine		Analgesics
		B complex tabs

Table 8.8 S-O-S Classification

<i>Seasonal</i>	<i>Non-seasonal</i>
<i>General</i>	
Antimalarial	Antihypertensive
Antidiarrhoeal	Diabetic drugs
Elective Surgeries	Antibiotics
	Emergencies

MBASIC System for Effective Drug Management

K.P. Kumar

9

Introduction

Those in the field of hospital administration in India are very concerned about the rising cost of patient care. The goal of financial and cost management in a hospital is to ensure that the community is provided with the service it needs at an acceptable level of quality and at an optimum cost. Materials constitute about 50 per cent of the total expenditure of hospital administration. The optimum utilisation of these resources must be ensured in order to achieve a high level of productivity. The hospital pharmacy is indispensable for the treatment of patients and efficiency in this field would provide service to them at an acceptable level of quality and at an optimum cost. A thorough understanding and use of techniques of materials management would help in achieving this by determining the categories of stock required in terms of quantity from various sources, at low prices.

Drug companies in India have a turnover exceeding Rs 30,000 crores. New drugs have been entering the market, and hospitals procure thousands of different types of drugs to cater to their needs. They should develop an effective mechanism in order to enforce control on the build up of inventory and its use so as to ensure the best use of the resources.

In inventory management, materials are classified so that a major portion of effective managerial time is spent on those materials which are more important. It would be very expensive to critically analyse all the items and exercise control over them. Concentrating on all items would dilute the effect of the entire control process. Hence, the selective management principle should be applied. The Multiple Basis Approach to Selective Inventory Control (MBASIC) is an innovative control technique which helps achieve this. It is a pragmatic approach that utilises monthly data in the form of the value of consumption of each drug, the value of drugs in storage, the relative value of unit prices, criticality, consumption patterns and the sources from where the drugs are supplied. This analytical management

tool enables the management to concentrate its efforts for better results. It also reveals a measure of the inventory importance of each drug and provides the best control as far as spending is concerned. The drug industry is fast developing new drugs to replace the existing ones. Hence it is suggested that monthly data regarding the value of the drugs consumed and stored, their prices, their criticality, their consumption patterns and their sources of supply, be used for analysis.

Classification of Drugs

ON THE BASIS OF THE VALUE OF MONTHLY CONSUMPTION (A-B-C)

This technique, called the A-B-C analysis, is associated with Pareto's law. Each individual drug and its monthly consumption value is listed out separately, and this list is rearranged in descending order of value—beginning with the drugs of the highest value, and ending with the drugs of the lowest value. Generally, it will be observed that the first 10 per cent of the drugs ('A' class) approximately account for 70 per cent of the value. The next 20 per cent of the drugs ('B' class) account for 20 per cent of the value, and the last 70 per cent of the drugs ('C' class) account for only 10 per cent of the consumption value. However, the exact cut-off points for A-B-C classification will vary, depending on the situation. Through this analysis, high (A), moderate (B) and low (C) consumption value drugs are identified. If this analysis alone is considered for control purposes,

- 'A' class drugs should be controlled carefully, dealt with by top management and ordered frequently, so as to keep a low quantity of, or almost zero stocks. Follow-up measures should be carried out on a daily or weekly basis. Regarding these drugs, plans should be made for the quantity, quality and timing of purchase. Efforts to increase the number of sources and reduce the lead time for supply should be taken up.
- 'B' class drugs are less important than 'A' class drugs, and they should have low safety stocks with moderate control. The follow-up can be carried out on a fortnightly or monthly basis. Past data can be utilised for planning the required quantities. A moderate number of suppliers should be identified for these drugs.
- 'C' class drugs can be stocked in large quantities and bulk ordering can be resorted to in order to take advantage of quantity discounts. These drugs can be controlled by the lower management, and the follow-up can be carried out once in three months.

ON THE BASIS OF THE VALUE OF DRUGS IN THE STORE AT THE END OF EVERY MONTH (X-Y-Z)

Each individual drug and the value of its stock on hand at the end of the month is listed. This list is also rearranged in descending order of value. The drugs are classified as those whose inventory value is high (X), those whose inventory value is moderate (Y), and those whose inventory value is low (Z). This analysis reveals how extensively the drugs have been stocked and their usage. It will be useful when used in conjunction with other analysis.

ON THE BASIS OF THE UNIT PRICE OF DRUGS (H-M-L)

Each individual drug consumed during the month and its latest price is listed. The distribution of prices is studied in order to arrive at the cut-off points for classifying drugs as high (H), medium (M) and low (L) cost drugs. This analysis will enable the management to design appropriate purchase procedures and decide on delegation of authority to purchase the drugs.

ON THE CRITICALITY OF THE DRUG (V-E-D)

Drugs consumed and stored during a month are classified as vital (V), essential (E) and desirable (D). The criticality of the drug is identified on the basis of recommendations by a panel of doctors with different specialisations. The doctors are interviewed and the collected information is processed. Drugs which simultaneously appear in all categories are classified as vital. The drugs which appear in both vital and essential categories are classified as vital. Those which appear in both essential and desirable categories are classified as essential, and the drugs which appear in both vital and desirable, are also classified as vital. The degree of importance in procurement and control procedures reduces from vital drugs to desirable drugs. Stocking of drugs is based on strategies different from those of other classifications. Vital drugs should be stocked adequately to meet emergencies. Some risks can be taken in the case of essential drugs. Desirable drugs have substitutes and are easily available in the market.

ON THE BASIS OF THE MONTHLY CONSUMPTION PATTERN OF DRUGS (F-M-S)

The number of units of each individual drug that has been consumed in a month is listed and its distribution studied, in order to arrive at the cut-off points for classifying drugs as fast (F), medium (M) and slow (S) moving drugs. With rapid changes in process and technologies, the movement analysis of drugs assumes importance, in order to combat obsolescence and surplus.

ON THE BASIS OF THE SOURCE OF SUPPLY (G-O-F)

The drugs are classified according to the nature of the supplier. This will determine the continuity of supply, lead time and payment procedures. They are classified as government (G), open market (O) and foreign (F) suppliers. The quality, quantity and continuity of supply is better in open market supplies. Government supplies take a moderate lead time and foreign supplies take a long lead time, as it involves paper work and procedural delays.

Classifying Drugs Using the MBASIC System

All drugs are classified individually on the basis of A-B-C, X-Y-Z, H-M-L, V-E-D, F-M-S and G-O-F analysis. Each item belongs to one of the six classifications. The set of six classifications, to which every item belongs, is then defined as a new category (classification-combination) in the MBASIC system. The total number of classification-combinations that can emerge is s^n , where

s = the number of categories in each selective control technique

n = the number of selective control techniques

For example, in the present study, $n = 6$ and $s = 3$

The total number of classifications will be $3^6 = 729$.

Each drug will have the classification-combination denoted by a string of six letters. The first letter of the classification-combination denotes the category to which the drug belongs on the basis of the value of consumption (A, B or C). The second letter of the classification-combination denotes the category to which the drug belongs on the basis of the value of inventory on hand (X, Y or Z). The third letter of the classification-combination denotes the category to which the drug belongs on the basis of the unit cost (H, M or L). The fourth letter of the classification-combination denotes the category to which the drug belongs on the basis of criticality (V, E or D). The fifth letter of the classification-combination denotes the category to which the drug belongs on the basis of the consumption pattern (F, M or S). The sixth letter of the classification-combination denotes the category to which the drug belongs on the basis of the source of supply (G, O or F).

Apart from the above classification-combination, it would be worthwhile to consider non-moving drugs (N) along with drugs classified on the basis of value, unit price, consumption pattern and sources of supply. Thus, there are four types of classifications, each having three categories. This will give rise to 81 classification-combinations ($n = 4$ and $s = 3$).

Now the total number of possible classification-combination is, $729 + 81 = 810$. Some of these classification-combinations cannot occur, considering the following assumptions:

1. A drug bought from a foreign source cannot have a low unit cost.
2. Government supplies are engaged in supplying only vital drugs.
3. Only vital drugs are purchased from foreign suppliers.
4. A low unit cost drug, with slow movement, cannot be classified as an 'A' class drug.
5. A high unit cost drug, with moderate movement, cannot be classified as a 'B' class drug.
6. A high unit cost drug, with fast movement, cannot be classified as a 'B' class drug.
7. A high unit cost drug, with fast movement, cannot be classified as a 'C' class drug.
8. A medium unit cost drug, with fast movement, cannot be classified as a 'C' class drug.
9. A high unit cost drug, with moderate movement, cannot be classified as a 'C' class drug.

Based on the above assumptions, 483 classification-combinations cannot occur. The remaining 327 classification-combinations can be analysed critically and coded. These codes relate to the inventory management policy, the rationale and the instructions relating to a specific drug. An indicative list of codes and respective comments are given in the next section. These codes and comments can be customised according to the needs of the user.

Codes and Comments

1. Critically analyse to reduce stocks. The drug, as a proportion, is small in number, but is high in consumption value.
2. When ordered last, the drug was bought in excess quantity. Study consumption pattern to determine order quantity. The value of the drug on hand is high.
3. Purchase should be authorised by higher authorities. The unit cost of the drug is high.
4. If needed, it should be stocked adequately, to cover lead time requirements. The drug is vital in nature.
5. Maintain a careful watch on the re-order level. The drug is fast-moving.
6. Lead time for the supply is short. The drug is supplied by government sources.

7. Lead time for the supply is short. The drug is supplied by open market sources.
8. Lead time for the supply is long. The drug is supplied by foreign sources.
9. Maintain a normal watch on the re-order level. The drug is moving at a moderate pace.
10. Maintain a casual watch on the re-order level. The stocks should be reduced to low levels. Expiry dates of the drugs should be analysed. The drug is moving slowly.
11. Based on past requirement, this drug can be stocked for continuous use by the hospital. The drug is essential in nature.
12. This drug to be stocked only if needed. It is easy to find substitutes for it in the market. The drug is desirable in nature.
13. Purchases should be authorised by middle-level management. The unit cost of the drug is moderate.
14. Bulk ordering can be done, taking advantage of quantity discounts. The unit cost of the drug is low.
15. Constant control and regular follow-up is essential. The drug is vital in nature, and is also 'A' class.
16. Tight inventory controls should be adopted. The drug is fast-moving, and the stocks on hand are also high.
17. Attempts should be made to bring this category into 'Z'. The drug is 'A' class and also belongs to the 'Y' category.
18. Drugs inventory is well within control. Continue to maintain the level. The drug belongs to the 'A' and 'Z' categories.
19. Maintain moderate stocks. The drug is essential in nature and belongs to the 'A' class.
20. Make attempts to reduce stocks. The drugs on hand are of moderate value.
21. Consumption pattern and stocks should be reviewed more often. The drug belongs to the 'B' and 'X' categories.
22. Maintain present control procedures. The drug belongs to the 'B' and 'X' categories.
23. Action should be initiated to dispose of the surplus. The drug belongs to the 'C' and 'X' categories.
24. Controls should be tightened. The drug belongs to the 'C' and 'Y' categories.
25. Review period can be extended. The drug belongs to the 'C' and 'Z' categories.
26. Maintain low stocks. The drug belongs to the 'C' category and is desirable in nature.
27. Critically analyse the reasons for non-utilisation, stock levels and obsolescence. The drug is non-moving.
28. Action to be initiated for quick disposal.

29. Plan for early disposal.
30. Plan for early disposal, even at lower prices.

Based on the characteristics and the prevailing controls in the organisation, the classifications are grouped into categories for control by top-, middle- and lower-level management, and control guidelines are suggested, based on comments for each classification-combination. In the remarks column, where the classification-combination string is entered, one more character is appended to the string to indicate the control level.

- 'T' for top-management level
- 'M' for middle-management level
- 'L' for lower-management level.

Comments for each classification-combination, along with guidelines for controls falling under 'T', 'M' or 'L' can be grouped together and a general guideline can be drawn. For example, the drug falling under the classification-combination AXHVFG can be given the following guidelines:

A critical analysis must be carried out to reduce the stocks. When ordered last, the drug was purchased in excess quantity. Hence, the consumption pattern has to be studied for review of order quantity. Drugs that are vital, fast-moving and supplied by government sources, and have a moderate lead time, have to be taken into consideration. As the drug is of a high unit cost, it should be ordered after acquiring approval from top management. There should be a constant and regular follow-up. Taking the above factors into consideration, the drug should be allocated for control and attention from top management.

The MBASIC reveals that out of the 327 classification-combinations which can occur, drugs belonging to:

- 83 classification-combinations need top management attention.
- 179 classification-combinations need middle management attention.
- 65 classification-combinations need lower management attention.

Simulation

Simulation means experiments undertaken before the real system is made operational, so as to aid in its design, or to inspect and check how the system might react, and to evaluate the system-response to changes in its structure. The simulation technique can be applied to drugstore operations in a hospital, on the

basis of data collected over a long period of time, that is, two years or more. The data thus collected can be used for the following purposes:

- To develop the frequency of distribution of the number of times a particular drug was used in specified values.
- The number of times the drug was in store for a specified use.
- The number of times a particular drug belonged to a specified unit price.
- The number of times a particular drug was specially rated on the basis of criticality.
- To obtain information regarding a particular drug which was consumed at a specific rate.
- For information pertaining to a particular drug supplied by a specified source of supply,

and for other similar analysis. Based on these statistical distributions, a model representing the real system can be formulated. Details pertaining to the particular drug being consumed for specified value, specified consumption pattern, specified criticality and specified unit price, and it being supplied by a specified supplier, can be generated, using the Monte Carlo simulation technique. By means of this method, a hospital can identify drugs which come most of the time under a particular classification. The analysis can bring out many facts that will help enhance the effectiveness of control.

Conclusion

MS Excel and Lotus 1-2-3 have data management and graphics capabilities. These make the package useful for an MBASIC analysis. Mathematical, statistical, logical strings, and special functions in them, will be of immense help to perform an MBASIC analysis. The accumulation of data can be programmed in the environment of the computerised pharmacy store operation in a hospital, for a one-time analysis, leading to an evolutionary development of inventory policy based on the MBASIC technique. The initial effort expended may be great, but once implemented, only a marginal effort is needed to maintain and improve it. The benefits are immense.

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Customer Experience Management— A Marketing Initiative

10

Pooja Elizabeth George

New Perspectives

The new view of marketing is that it is the science and art of finding, retaining and growing profitable customers (Kotler and Armstrong 2005). Customers are groups or individuals who have a business relationship with the organisation, those who receive and use or are directly affected by the products and services of the organisation. In the literature on quality management, customer and supplier are treated as '*internal* to the organisation' and '*external* to the organisation'. The customer and supplier *external* to the organisation are the direct recipients of products and services, generally in exchange to a price and these are the ones commonly known to the public without the suffix. However, the customer and supplier *internal* to the organisation are employees within, who are involved in the creation of the product or service. Their objective is not monetary exchange but the well being of the organisation. The internal-supplier converts services and products, within the work centre as per the systems and procedures and passes on to (which is received by) the internal customer. In this chapter, customers include direct recipients of products and services (*external*), and *internal* customers who produce services and products for final recipients, and other organisations and entities that interact with an organisation to produce products and services.

Customers in Hospital Context

Based on this definition, it can be construed that customers of a hospital would not only include those who are direct recipients of the service but also those who come into contact with the hospital and are its potential customers. In addition,

it would comprise those who provide these services to the final recipients. A hospital has two major dimensions of customers: internal and external.

The internal customers would comprise:

- Doctors
- Nurses
- Patient care services staff
- Non patient care services staff

The external customers of the hospital are:

1. Direct clientele

- Patient
- Consumers of the hospital service
- Patient attendants
- Patient visitors

2. Indirect clientele

- Suppliers
- Third Party Administrator (TPA)

This chapter will focus on various aspects of retaining and growing profitable external direct customer clientele in the hospital industry. There are various factors that advocate the need for an in-depth understanding of this subject in the present scenario. These are broadly classified as:

3. Customer-based factors

- customer focus—an important ingredient;
- characteristic features of present day customers of a hospital;
- profitability of loyal customers to the hospital; and

4. Environment-based factors

- increased competition;
- significance of customer retention and customer loyalty through favourable experiences.

Now we give a brief description of customer-based and environment-based factors.

Customer-based Factors

CUSTOMER FOCUS—AN IMPORTANT INGREDIENT

To succeed in today's competitive market, companies must be customer-centred, winning over customers from competitors, then retaining them, increasing their number and delivering greater value. But before it can satisfy customers, a company must first understand who their customers are and how to satisfy their needs and wants. Ability to meet their needs promptly would determine the company's success and future growth. Any organisation can thrive if it learns to be flexible and willing to change constantly to meet the ever-rising demands of the customer. For example, a company long recognised for its emphasis on customer satisfaction is Maine's L.L. Bean, Inc., which runs a mail order catalogue business in clothing and equipment for rugged living. To motivate its employees to serve the customers well, it displays the following poster (Figure 10.1) around its offices.

FIGURE 10.1 Who is a Customer?

A customer is the most important entity in the office... In person or... by mail.
 A customer is not dependent on the company...The company is dependent on him.
 A customer is not an interruption of our work... He is the purpose of it.
 We are not doing a favour by serving him... He is doing us a favour by giving us the opportunity to do so.
 A customer is not someone to argue or match wits with. Nobody ever won an argument with a customer.
 A customer is one who brings us his wants; it is our job to handle them profitably for him and for ourselves.

CHARACTERISTIC FEATURES OF PRESENT DAY CUSTOMERS OF A HOSPITAL

Highly knowledgeable

Today's customer even in health-related issues wants to make his own decisions. The cliché 'Leave it to the doctor' seems to be no longer true always. The patient and the patient attendants want to know the disease profile, the methodology of the treatment to be given, the medicines administered and the side effects entailed. A whole study is conducted by them with the help of the internet about the nature of the disease, the symptoms, the percentage of success rate if surgery is involved and such other aspects (MHS 2003).

Value seekers

The consumer of health care services is demanding more value addition and wants to reduce his/her risk by dealing with trustworthy companies, services

and products. He/she requires immediate attention and service. He/she has become more demanding and is not willing to adjust. The expectations have risen very high. The rise of voicing customer dissatisfactions and opinions has increased considerably. There is not only high quality of service expected from the service providers from the medical fraternity but also from service providers from the non-medical areas.¹

Cost conscious

The consumer today attaches great importance to the component of 'cost' in the treatment. There are price comparisons done on various packages. Many times there remains a feeling in the minds of the customer that the hospital victimizes their fragile condition and charges far more. This feeling rises at the time of payment of bills. Customers have a lot of doubt about the payment structure and feel cheated. They do indulge in clarification of doubts.

Possess preferences

The consumers have a range of preferences when they come to avail of medical services. These would include preference for hospital, food, colour (for example: customised ambience based on choice of colour for curtains, and patient gowns), room type, regional language usage while obtaining (receiving) hospital services, and so on. There is increased pressure on the hospital to provide these services at the earliest, making flexibility the key to customer—the 'WOW' effect, the excitement of the customer on experiencing the product/service.²

Desire customised services

The customers would like to receive individually differentiated services. They are willing to pay extra in order to make their stay in the hospital more pleasant. For example, there are customers who want to make ISD/ STD calls from the room itself or require air conditioning in the out-patient waiting room. In the race for customer acquisition and retention, the one who can deliver faster and better wins the hearts of the customers.

Perform continuous analysis

In the past customers would chiefly rate a hospital based on the quality of medical services provided. Consumers today have a host of factors based on which they rate the hospital (Venkataramana and Somayajulu 2003). These include :

- Clean environment.
- Availability of latest technology.

- Hospital's staff personnel mannerisms while service provision.
- Time spent and methodology of imparting patient information.
- Implementation of suggestions given.
- Clarity and transparency of billing procedure.
- Systematic nature of work.

PROFITABILITY OF LOYAL CUSTOMERS TO THE HOSPITAL³

Lower costs of service

Loyal customers are easier and cheaper to service, since they are familiar with the products and services, they don't

- have as many questions,
- are less likely to make mistakes, and
- would have adjusted their behaviour to simplify their relations with the supplier.

Increased purchase

Loyal customers tend to buy more as time progresses, either because they learn about part of the product line or they give a higher proportion of their spending to the favoured source.

Less price sensitive

They tend to become less price sensitive and willing to pay a premium. As the relationship strengthens over time, they are less susceptible to competitors' appeal, and since they are satisfied by what they are receiving from the enterprise, they are prepared to pay more.

Favourable word-of-mouth

A hospital being a service industry with a noble cause cannot utilise advertising techniques in the way other industries can. In designing an advertisement, care needs to be exercised so as not to sound desperate for clients. This being the case, word-of-mouth is one of the most apt advertising methods the hospital can rely on. Word-of-mouth is personal communication about a product or service between target buyers, neighbours, friends, family members and associates. This could be obtained by creating a positive and meaningful experience for the customer. The power of word-of-mouth is often quoted in terms of how satisfied or dissatisfied customers communicate their experiences with others. This would help to create a lasting impression in the minds of the customers but any happy experience serves to create a positive brand image.

High return on investment

Almost every business should invest money upfront to bring in new customers through the door. Most of these costs are easily identifiable: advertising, commissions on sales, sales force overheads and the like. These may add up to high operating costs. On the other hand, in the case of an already acquired customer the operating costs are low as customers get more awareness about a firm's services, which make them less dependent upon the firm's employees for information and advice. In most service industries, the human interface holds paramount importance so that the cost benefits of loyalty spiral directly from the way the long-term customers, and the long-term employees interact and learn from one another. The repeat customer tends to be pleased with the value they receive and their satisfaction is a source of pride and inspiration for the employees. The customer gets to know the employees better which leads to better service, builds greater customer satisfaction and further improves the relationship and the company's results. Another advantage of holding on to the firm's customer is that in most business relationships, customer spending tends to accelerate over time by up-selling and cross-selling. Besides, in most industries old customers pay effectively higher prices than the new ones. This may be due to the price discounts available to the first time customer or else the willingness of the old customer to pay more for the perceived greater value of the service to him/her. Thus an organisation that undertakes pro-active measures to create a wonderful experience for the customers would yield high dividends in the long run (Shahjahan 2004).

Environment-based Factors

INCREASED COMPETITION

Poor firms ignore their competitors, average firms copy their competitors, winning firms lead their competitors.

(Kotler 2003)

Today, competition is not only rife but growing more intense every year. Many new hospitals are encroaching on the same market. Because markets have become so competitive, mere understanding of customers is no longer enough. Companies must pay keen attention to their competitors. Successful companies design and operate systems for continuously gathering intelligence about their competitors.

Competition allows for the presence of more alternatives to choose from. Thereby, customers do not have a need to be dependent upon a single service provider for meeting their needs. This underlines the necessity for a competitive firm to be abreast of latest developments in the field, so that the distinction created by the firm cannot be easily adopted by a competitor. In the hospital industry medical services, technological advances and infrastructure are easy to replicate but a culture-radiating positive-influence on its customers is not *always* possible to replicate, as this requires a conscientious, systematic and planned approach by the organisation.

SIGNIFICANCE OF CUSTOMER RETENTION AND CUSTOMER LOYALTY THROUGH FAVOURABLE EXPERIENCES

The competitive scenario has made it difficult to continuously look out for new markets in order to generate a new clientele. The markets for the hospital industry are yet to reach a saturation stage, creating a need for forward thinking in this regard, particularly because of our interest in international clientele market. Changing demographics, more sophisticated competitors and excess capacity in many hospitals—all these factors mean there are fewer customers to go around. Many hospitals are now fighting for shares of flat or fading markets. Compounding the problem is the fact that the costs of attracting new customers are also on the rise. In fact, it costs five times more to acquire a new customer than to retain an existing one. Hence, large corporate hospitals must allocate a certain proportion of their resources towards retaining customers so that in the long-term, in spite of tough competition, the clientele acquired by the hospital remains intact. Besides, losing a customer means losing more than a single sale. It means losing the entire stream of opportunities that the customer would provide over a lifetime of patronage. The key to building a long-term relationship is the creation of superior customer value and satisfaction by providing services that are personalised and beyond expectation. Delighted customers are more likely to be loyal customers and loyal customers are more likely to give the company a larger share of their business. This experience provided to the customer with value addition over time develops a deeper and intense bonding with its customers, minimizing the importance of the price factor (Shahjahan op cit.).

Customer Relationship to Customer Experience Management

PREMISE

This concept needs to be well fathomed in order to apply it in the hospital scenario. An article dealing with the shift from Customer Relationship Management (CRM)

to Patient Relationship Management (PRM) (Gale 2002) highlights the importance of this knowledge. Gale states that as a business, health care defies one of the basic laws of economics, supply and demand. In all other businesses it is permitted to create a demand. From cell phones to soft drinks, the idea is to tempt, cajole and drive customers to consume. Marketing techniques include increasing desirability through convenience, quality, cost savings and image enhancements. Discard your old cell phones because the new ones do more, have improved connectivity and better rate plans and are more stylish; but in health care these rules do not apply. As no one would ever purchase appendectomy because it was too good to resist and made them feel cool. Furthermore, no patient would decide to get another one because the latest surgery technique made it that much better.

The surgeons out there are shaking their heads and saying, 'Well, Beating Heart bypass approach really is an improvement, and I've had patients come back for more than one coronary procedure.' Yes. But MedTronics did not sell the consumer on the octopus system, it sold it to the hospital. The pharmaceuticals and device companies sell to the providers, and the consumers listen to their trusted physicians. Meanwhile, actually promoting surgery, drug therapy or any other lucrative health care service runs the risk of defying the Hippocratic Oath:

'I will apply for the benefit of the sick, all measures which are required, avoiding those twin traps of over treatment and therapeutic nihilism' (<http://evans-experientialism.freewebspace.com/hippocrates.htm>)

Indeed, the practice of the healing arts may point to treatments not even reimbursable.

'I will remember that there is art to medicine as well as science, and that warmth, sympathy, and understanding may outweigh the surgeon's knife or the chemist's drug' (<http://evans-experientialism.freewebspace.com/hippocrates.htm>)

Thus the question arises as to how a hospital can increase its business. The ironic thing is that most hospital marketers promote 'Wellness programmes' or 'Early Detection Services', which if truly effective, should lead ultimately to the reduction in health care purchases. The best a health care organisation can then earnestly hope for is to be first in the minds of the consumers when the need for health services does arise.

Consider how most people find a health care service, assuming they have some choice in their health insurance plan. Most ask a friend, neighbour or relative for advice. The question is not, 'have you had a good experience with a certain doctor/hospital?'; rather it is, 'do you know of a good doctor/hospital?' The word 'know' translates to 'what perception do you have of this person's/organisation's quality of service?' It does not matter if the advisor actually had an appendectomy

performed, only that in a critical situation he 'knows' of a good physician or a hospital. Therefore, the challenge for the marketer is primarily to build the perception of delivering great health care.

One thing that is sadly recognised is that health care is not optional. Inevitably, there comes a time when some level of health care is required and often that time is unexpected and unplanned. So, careful consumers try to be as prepared as possible by at least knowing who the health care providers are? The rationale is that should the need arise, there should be some relationship with the people and the organisations that are capable and waiting to help. By understanding the potential health care consumer before he or she actually becomes a paying customer, providers can craft a marketing programme that includes building a relationship.

The business of CRM is beginning to pervade the marketing strategies of companies in all industries. According to experts, while every rupee spent on advertising yields, say, Rs 250 in revenues, the same spent on customer service yields Rs 2,500 in revenues (Internet World Magazine 2001). CRM is the establishment, development, maintenance and optimisation of long term mutually valuable relationships between customer and organisation. It is not a grassroots initiative. CRM must come from the top management. It is an all encompassing strategy and no one department or call centre or information technology manager can drive the cross-functional process changes that are required. Where the CRM of old meant knowing the customers names, their children's names and extending them credit, if need be, today's CRM is propelled by computer technologies that include customer preference analysis and data mining. Grocery stores use basket analysis and issue relevant savings coupons based on the buyer's product purchasing profile. In health care, specialised companies such as CRM Marketing Group promote their databases and predictive scope that can identify health needs and status and even predict future medical needs.

All of this leads to greater anticipation of consumer needs and wants and provides increasing numbers of channels for communication with potential customers. Direct mail and web-based promotions can target certain interest groups and deliver a course of 'personalised' content delivery leading to 'consumer empowerment'. As the customer becomes more knowledgeable about the availability of health care services and comes to trust an organisation for delivery of timely and credible information, he/she is more likely to think of that provider *first* when an appointment needs to be made. Understanding the objectives of health care marketing and the value of good consumer relationship management is the first step in the marketing strategy. In the health care world, a paying customer is called a 'patient'. Now is when the value of true relationship

management begins. The customer, now patient, requires an even higher and more considerate level of communication because he/she has crossed from the world of not-needy consumer relationship management into the world of needy patient relationship management. The migration of CRM to PRM is the natural evolution of building the perception that when the need arises, the promoted physician or hospital is there to help.

UNDERSTANDING PATIENT RELATIONSHIP MANAGEMENT

As stated in CPM White Paper (Daffodil 2005), PRM is more than a fancy list selection and mail programme or solution. In fact, it can enhance an organisation's financial success as well as elevate the status of marketing and connect it more meaningfully to planning operations. As health care becomes more of a 'business' and operates within those parameters, it is essential that marketing be a full participant at the planning table. And since PRM provides data and a data analysis structure that can reduce costs, improve volumes and revenue, it is all the more desirable to pay attention to planning operations. An industry analyst says, 'CRM is undoubtedly gaining importance because more health care organisations understand the cost cutting and revenue enhancing opportunities it presents. Although CRM in health care is relatively immature, health care organisations have an opportunity to differentiate themselves from their competitors' (Galini 2002). Ultimately, PRM is a more strategic way of assessing patients and the marketplace, and then adjusting services and programmes to meet these needs. PRM also shifts health care organisations away from geographic market assessments and perspectives to become more customer focused and driven.

It can now be perceived that the personal communication, education and caring received as a potential customer will—as a patient—be carried forward as sincere physician/patient rapport and quality health care. The expectation is that in some way, this health care provider already knows his/her patient, and is ready to provide the intense personal attention craved for.

The lesson to the health care marketer is this: *own the minds of the consumers*. Manage their perspectives of your health care services so that when the need arises, they think of you first. Build relationships with your potential customers and remember that when you successfully convert them from customers to patients, there exists a need for well-executed patient relationship management.

In order to own the minds of customers, there is the need to register in them the picture of a health care provider who understands the requirement of its customers to the fullest. The health care provider of today, therefore, requires recognising and accordingly incorporating needs of the New Informed Consumer

of the hospital services who takes charge of his health, as stated in Power to the Patient (Chipelo 2003). The New Informed Patient is demanding better customer service in the form of convenience and self-service from an industry that has traditionally resisted this movement. Patient expectations are based on their experiences in banking, financial services, travel and other industries providing personal service, where various levels of self-service have been made available to them over the past few years. Their reasoning follows a simple logical process and poses a familiar question: if they can pay a utility bill, manage their online bank accounts and book a vacation on line, why not health care?

The New Informed Patient is also placing more pressure on the physician to play the role of the expert care-giver and provide him with higher levels of expertise and quality of care than in the past. Patients desire a personal and friendly relationship with their physician and health care provider. For many years the physician was viewed as the clinical expert and sole owner of health care knowledge. However, in the current health care environment, patients feel that the health care industry encourages physician overbooking to increase revenue. With the emergence of Internet technology, consumers have become empowered and have taken a self-education approach to satisfy their health care needs. As a result of the demands and expectations of the New Informed Patient, the health care provider is witnessing the beginning of a 'new' personalised relationship between patient and physician. Within this relationship the patient has easier access to information, the ability to self-educate under the physician's supervision and electronically communicate with the physician and his staff. The consumer wants more than a relationship; he wants worth. A worth that is real in his dealings with the organisation. A worth felt in each of his experiences with the hospital. It now leads us to the necessity of creating a once in a lifetime experience for the consumer with Customer Experience Management.

CUSTOMER EXPERIENCE MANAGEMENT

Customer Experience Management (CEM) is, 'the process of strategically managing a customer's entire experience with a product or a company' (Schmitt 2003). Marketing research has shown that about 70 to 80 per cent of all products are perceived as commodity, that is, seen as being more or less the same as competing products. This makes marketing the product difficult. Marketers have taken various approaches to this problem including: branding, product differentiation, market segmentation and relationship marketing. Relationship marketing, also called loyalty marketing, focuses on establishing and building a long-term relationship between a company and a customer. There are several approaches

that have been espoused including customer experience management, customer relationship management, loyalty programmes and database marketing.

A CRITIQUE OF TRADITIONAL MARKETING

The development of customer experience management originally started with a critique of three existing marketing concepts. It concluded that they do not go far enough.

1. Since the 1970s, there has been a gradual shift from a product–technology–sales focused orientation towards a customer–market oriented approach by determining the wants and needs of customers and satisfying them more efficiently or effectively as compared to competitors. However, the approach is still mostly functional, with similarities and differences between competitors being defined mostly by product features and customer benefits. In addition, the customer perceived as being rational, has been proven to be untrue. Also, it is asserted that market research is mostly analytical, leaving little room for qualitative assessments of customer relationships towards products, services or brands. It is claimed that traditional marketing takes an inside-out approach—starting with internal variables like production capabilities and available capital and then moving to external variables like customer needs, rather than taking an outside-in approach as marketing theory requires.
2. Customer relationship management is claimed to be deficient because it primarily consists of database and software programmes used in call centres and thus focuses too much on quantitative data. By doing this, it is led by transactions rather than a desire to build lasting relationship with customers.
3. Customer satisfaction is an outcome-oriented attitude deriving from customers who compare the performance or value of the product with their expectations of it. It is claimed that the customer satisfaction approach depends too heavily on outcome oriented measures like satisfaction and superficially on direct experiential measures. A customer is said to be satisfied when a product's performance matches the customer's expectations. Thus, traditional customer satisfaction techniques are deficient as they do not help firms to understand and manage customers' experiences, where good experiences lead to satisfaction.

An experience is an affect or knowledge gained through direct observation or participation. Customer experience can also be described in the same way with the addition of emotion; the emotion customers feel as they interact with a business. Customer experience is measured against the customer's expectations

and past experiences. Happy customer experiences exceed both physical and emotional expectations. Every point of contact matters; whether talking face-to-face with an employee, receiving a coupon in the mail, calling a 1-800 number or visiting online. They also want personalised service that extends beyond the purchase phase and the opportunity to speak out their needs to the firm. For this reason, more and more companies are realising the power of the customer experience. It is the one true differentiator in a competitive business. Without it, most business lacks the ability to sustain long-term profitable growth. Punchy product promotions and pretty packaging will not always cut it in a world where customers expect emotional engagement. And as customers interact with companies, there are many opportunities for this, in tune with offering a consistent brand message. The result of these efforts is a better quality customer experience, enhanced customer service, and greater market share and customer loyalty.

Yet, there are also many pressures. It takes work to adapt the company around customers' needs. And many companies are still simply paying lip service to customer centricity, sacrificing the long-term investment in the customer for short-term financial goals. But companies that are moving to the customer-centric way of business are busy establishing clear pictures of the customer experience, questioning themselves as to 'what are the emotions we want to evoke in our customers?' No company can provide a great customer experience unless everyone in the organisation understands what the customer experience looks like. Each customer touch-point may have a specific task, but an underlying strategy for the customer experience is the key.

CUSTOMER EXPERIENCE MANAGEMENT (CEM) FRAMEWORK

CEM is a methodology that tries to overcome the gap between theory and practice by reformulating basic marketing principles. It stresses four aspects of marketing management:

1. CEM focuses on all sorts of customer-related issues.
2. CEM combines the analytical and the creative.
3. CEM considers both strategy and implementation.
4. CEM operates internally and externally.

Although all marketing management and strategic management does all of these, CEM supporters claim that they have a methodology that will yield better results. Being convinced that the marketing concept is too product-centred, CRM too focused on quantitative data and customer satisfaction. CEM looks for another perspective on the relationship of a consumer with a product or service. *And*

what is the key? The *experience* linked to it is the key. This enables companies to strategically manage a customer's experience with a brand and by doing so, achieve a truly customer-focused management concept, resulting in customer retention and loyalty. To accomplish this, the following five step framework, based on clearly defined company objectives, is stated by Schmitt (ibid.), which would help managers understand and manage customer experience.

Step 1: Analyzing the experiential world of the customer

- Analyze socio-cultural context of the customer (needs, wants and lifestyle).
- Analyze business concept (requirements/solutions).

Step 2: Building the experiential platform

- The connection between strategy and implementation.
- Specifies the value that the customer can expect from the product (EVP=experiential value promise).

Step 3: Designing the brand experience

- Experiential features, product aesthetics, 'look and feel', e.g., logos.

Step 4: Structuring the customer interface

- All sorts of dynamic exchanges and contact points with customers.
- Intangible elements (value, attitude, behaviour).

Step 5: Engaging in continuous experiential innovation

- Anything that improves end-customers' personal lives and business-customers' working lives.

Step 1 is Analysis and Step 2 is Strategy, they form the basis for CEM; Steps 3, 4, and 5 focus on implementation.

Customer Experience Management Model

THE CONTEXT

The various components of the study such as evolving new customer, rise of his/her expectations and industry-forces together reinforce the need for provision of a more personalised service. Customer experience management (CEM) has evolved

as the most appropriate approach to be understood, adopted and implemented by the hospital. But the term 'customer' shall not be used, as it would hurt sentiments of the hospital customer base. Therefore, the term 'patient' shall be utilised which would refer to the patient, his/her attendants and visitors. The term 'patient' in the model would encompass all the significant direct hospital clientele. Hence, a model named Customer Experience Management has been formulated to provide the positive and exceptional experience, which would create an everlasting impression in the minds of the customer. PEM involves the following two major approaches:

1. Front End Approach
2. Back End Approach

Front End activities incorporate the bulk of the interactions with the customers of the hospital, which has the greatest impact on the delivery of valuable service experience. It comprises shared values, style of service delivery, best practices and staffing. Back End activities are those that involve all the supportive systems designed in order to facilitate front end service delivery. It includes the strategy, structure and systems of the organisation.

Inputs gained from the McKinsey framework adopted to develop quality (Gupta 2006) have been considered while designing the Customer Experience Management Model for a hospital. The elements are:

1. PEM Vision
2. PEM Strategy: Objectives, Target markets
3. Design of Customer Experience
 - Understanding Requirements
 - Customer Interactions
 - Maintaining Satisfaction
 - Feedback
4. Shared Values and Style
5. Organisational Culture and Structure
6. Skills and Staffing
7. PEM Process/System
8. PEM Information
9. PEM Technology
10. PEM Metric

PEM VISION

The vision is to enable patients and related significant others to have a wonderful experience in the journey towards health and happiness wherein the organisation shall continuously strive to fulfil their needs and desires with a patient-centric approach. The top management must pledge its devotion and commitment towards this purpose, which would ensure that this maxim is felt and imbibed throughout the organisation making PEM a thriving organisational culture that fosters a climate of trust for the patients.

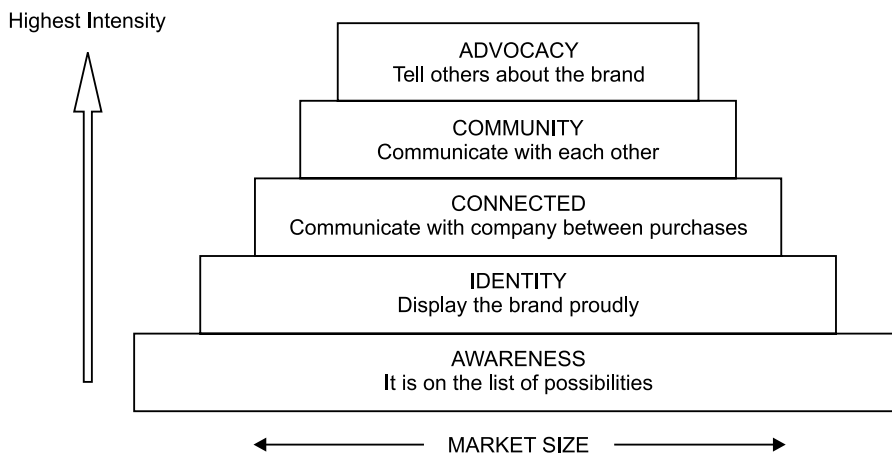
PEM STRATEGY: OBJECTIVES AND TARGET MARKETS

- Provide a valuable experience to the patient in order to make a deep impact.
- Increase the number of transactions of the patient with the hospital in order to more effectively target and cross-sell service offerings.
- Build customer loyalty and repeat sales with relevant and compelling offers.
- Enable multi-channel co-ordination of field sales, inside sales, e-commerce and direct mail through consistent and relevant recommendations for each customer interaction.
- Ensure favourable word-of-mouth by the patient.

Levels of relationship intensity (adapted from Duncan⁴)

The hospital must incorporate the strategy of slowly and steadily trying to move the customers upward in the pyramid as shown in Figure 10.2 below:

FIGURE 10.2 Levels of Relationship Intensity



The pyramid shape indicates that fewer customers are at the highest level. Many people are advocates because of positive experiences.

DESIGN OF CUSTOMER EXPERIENCE

Understanding requirements

The following parameters hold great significance for gaining deeper insight into customer's behaviour:

- **Demographic details:** based on customer age, gender, religion, and so on, patient preferences and tastes would vary.
- **Geographic details:** preferences based on the place from where the patient hails.
- **Psychographic details:** nature and personality type would also influence needs.

The needs of patients can be broadly classified as requirements for:

- **Attention:** The patient requires immediate attention or at least the assurance that he would be attended to within a particular time frame.
- **Information:** The customers of hospital services require information about various aspects of treatment, the facilities available to them, a regular update on the progress of patient's health and the rationale behind formalities and certain hospital rules.
- **Support:** The patient requires counselling in order to be well-prepared for the treatment. The support must extend to family members.
- **Listening:** The patient, though unwell, has the deep desire to be 'listened to' and even the attendants would feel that their patient is being looked after.
- **Delivery of promised services:** Expectations are built on promises. The customers must be given all that is promised and much more.
- **Customisation of services:** Customers of the hospital require that the hospital accommodate certain requests on an individualised basis. There must also be ample scope to meet these requirements.

It would be worthwhile for the hospital to categorise its patients in accordance with the following model to gain understanding of the customer from the business point of view. The hospital could identify its high networth patients by data mining, customer profiling, using RFM analysis (Recency, Frequency and Monetary) and by evaluating sales growth per patient basis over time and determine service costs for individual patients.

THE MODEL

Customer interaction

There are various touch points for interaction between the PEM executive and the customer during the course of recovery for the patient. The possible areas are listed below:

- May-I-Help-You Desk or PEM Support Desk
- Admissions Service
- Billing
- Patient Room
- Blood Bank
- O.T. Waiting Area
- ICU

There is need for great stress on the manner in which the process of interaction occurs. The PEM executive must be genuine and the type of communication, open.

Maintaining satisfaction

The PEM executive must strive to constantly maintain the satisfaction level of patients in each of his interaction in order to truly make the patient's stay in the hospital comfortable and instil loyalty towards the hospital.

Feedback

There is a tendency not to receive exact feedback through the distribution of feedback forms due to the following reasons:

- The patient may not have understood some question in the form.
- The patient may not know English in order to fill the form.
- Sentiment of not hurting anyone when they are leaving, would keep them from giving an honest feedback.
- Fear of upsetting the doctor by giving negative comments about the hospital.
- The nature of the questionnaire being structured may in itself be a limitation to understand the experience of the customer.

Therefore there is need for developing a more accurate feedback mechanism to gain an in-depth understanding of the patient's experience in the hospital.

SHARED VALUES AND STYLE

The value system to be imbibed by the organisation is that of being customer driven. The management must perceive expenditures on these items as an investment and attach importance to service excellence. Top management should support implementation through symbolic actions and commitment of time to customer-related activities. Open communication between all functions and groups is quintessential for realising the PEM vision.

ORGANISATIONAL CULTURE AND STRUCTURE

The culture and climate in the organisation must reverberate patient-centricity. There must be inter-departmental coordination and commitment towards the PEM vision. To facilitate smooth implementation of PEM, an organised structure should be in place. A simple structure based on markets/geography could be followed. A 'key account' structure to serve the most important customers should be in place. There should be decentralised staff to provide close support to customers.

SKILLS AND STAFFING

There should be recruitment of adequate number of people with requisite skills. The PEM executive involved in the delivery of a good experience should be highly skilled and possess the right skill-set or else the delivery of service could suffer.

Required qualities

- Sound judgement
- Candour
- Genuineness
- Kindness
- Patience

Required expertise

- Knowledge about the various departments of the hospital to facilitate knowledgeable interaction with them.
- Knowledge about hospital rules and regulations.

Required skills

- Interaction skills
- Communication skills

- Problem solving skills
- Analytical skills

Job responsibilities

PEM executive

- Explain the range of services and facilities offered by the hospital to the customer.
- Identify apprehensions and address them effectively.
- Provide refreshments for all patients waiting longer than a specified time period.
- Interact and assure patients that they will be well taken care of.
- Arrange for a vehicle if necessary to bring the patient to the hospital and baggage to be taken to allocated room.
- Furnish details about hospital rules.
- Arrange for room-shift if required.
- Study and understand customer preferences and tastes.
- Systematically record the insight gained on the patient.
- Provide for various entertainment devices as sanctioned by hospital to combat boredom.
- Engage in quality interactions with the patient.
- Provide counselling on a continuous basis.
- Handle grievances immediately and effectively.
- Engage in attempts to up-sell or cross-sell, based on patient profile.
- Ensure patient comfort.
- Escort patient at the time of departure from hospital till a vehicle or airport if need be.
- Prepare necessary reports for the management on a weekly basis to assess the number of customers gained from PEM effort. (This could be received by providing an option in the admissions form to track the reason of patient's selection of a particular hospital.)
- Make a genuine call in order to find out the health status of the patient and provide him the option of being reminded of his appointments for follow-up consultation.

Relationship managers

All of the above activities for key customer clientele and additionally preparing cost benefit analysis reports for various key customer accounts.

PEM manager

- Assessing the overall functioning of the department.
- Sanctioning a particular amount for the purpose of grievance redressal or for creating an exhilarating customer experience.

Care must be taken to ensure incentive and compensation for the PEM executive in order to motivate them. Compensation must be based on clientele feedback.

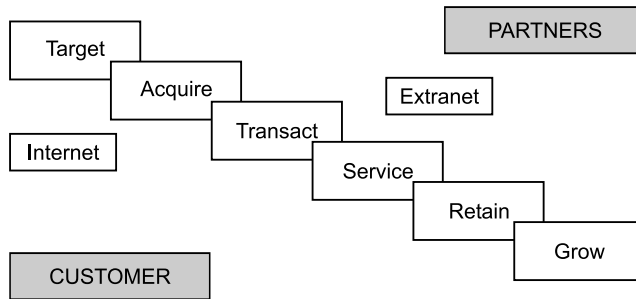
Employee communication

PEM executives need to excel in the art of communication as there is need for them to interact with both internal and external customers of the hospital. It must be genuine, fact based and educational. There must also be elements of social interaction in his communication style.

PEM PROCESS/SYSTEM

The PEM process is cumbersome but it yields results in the long run. It comprises of Customer Care Life-cycle (see Figure 10.3) and knowledge management. (This section is developed and adapted to the hospital domain based on the ideas presented by Tod Famous of Cisco Systems.)

FIGURE 10.3 Customer Care Life-cycle



Target

The target is the patient, his/her attendant(s) and visitors.

Acquire

The customers come into contact with the hospital when they come in for consultation through doctor referrals or by virtue of word-of-mouth recommendation by customers

who have already availed the services of the particular hospital; they influence the target to come in for treatment or second opinion. The acquiring only happens after the customer is fully satisfied with the experience of his/her first visit.

Transact

The hospital during this stage would be able to identify its customer through the databases maintained. It could differentiate by using the tools mentioned under 'Customer Understanding'. The transactions should be personalised and should reinforce a feeling of assurance and trust in customer's minds.

Service

The practices that need to be followed to ensure positive and exhilarating patient experience include all the activities listed out under practices to be incorporated in PEM programme.

Retain

The optimal delivery of these service practices would ensure the retention of the customer for a lifetime, thereby increasing the economic, promotional and loyalty value of the patient to his/her lifetime.

Grow

The patients would enhance the brand reputation of the hospital through their referrals and narration of positive experiences.

Knowledge management

In the PEM process, knowledge of various aspects of the patient would be of paramount importance. It must be well understood that all personnel interacting with the patient and their attendants during the course of his/her stay in the hospital need to record the implications of the interactions they had with the patient. Thereby, the database would provide comprehensive information about the patient.

PEM INFORMATION

The more information a hospital has, the better value it can provide to each patient and prospect in terms of more accurate, timely and relevant offering. Hospitals must entice customers to provide additional information over time.

When a patient provides increasingly more personal information, he trusts the firm enough to invest in the relationship. Information technology allows companies to move beyond the traditional segment profiling to detailed profiles of individuals.

PEM TECHNOLOGY

This involves various components like website logs, data mining, real-time profiling, collaborative filtering, out-going e-mail, web forms and incoming e-mail handling.

Website log

By performing website log analysis, hospitals can do many things such as customise webpages based on visitor behaviour. Software packages can also show which sites the users have used along with the key words typed in for search.

Data mining

Marketers do not need an *a priori* hypothesis to find value in databases, but can use software to find patterns of interest.

Real time profiling

Customer profiling uses data warehouse information to help marketers understand the characteristics and behaviour of specific target groups. A real time profiling tracks user-click-stream in real time that allows marketers to profile and make instantaneous and automatic adjustments to site promotional offers and web pages.

Collaborative filtering

This software gathers the recommendations of an entire group of people and presents the results to like-minded individuals. For example, bol.com analysed the time a user spends at the site, and learnt about his/her behaviour and preferences, and so was better able to present relevant products. This increased its revenues in a few months. The same approach could be used at hospitals to talk to patient groups about programmes like 'Healthy Heart'.

Outgoing e-mail

It is used to communicate with individuals to increase their purchases, satisfaction and loyalty. Permission marketing dictates that customers would be pleased to receive e-mail which they have opted for. Customer experience building requires:

- sending e-mails that are valuable to users,
- sending them as often as users require, and
- offering users the chance to be taken off the list any time.

Web forms

Hospitals should use web forms for enabling online registration and appointment scheduling.

Incoming e-mail

Post-transaction customer service is an important part of customer care life-cycle. Hospitals should reply to all in-coming e-mails within a particular time frame with personalised replies. Technology should also enable customer intelligence reports, competitor intelligence reports, planning and control systems, remuneration and performance appraisal systems, and financial reporting systems reflecting product line contribution and profitability.

PEM METRICS

Metrics are used to assess the value in delivering PEM. It provides an account of the contribution of each of the PEM tactics to Return on Investment (ROI), cost savings, revenues and customer loyalty. It involves more back end activities to be performed by the hospital with the help of technology. The various factors of assessment are to be calculated at the various stages of the customer care life cycle.

Target

RFM analysis: this is recency (how recent the customer is to the organisation), frequency and monetary analysis.

- Analysis of proportion of revenues from high value customers as compared to low value customers.
- Updating of key customer clientele.

Acquire

- Calculate cost of acquisition.
- Identify the number of new customers referred by previous consumers of service.
- Campaign responses and conversions.

- Rate of customer recovery: proportion of customers who drop away that the firm can lure back using various offers.

Transact

- Customer cross-sale rate from online and offline.
- Average order value (AOV) is the rupee sales by the number of orders for any given period.
- Referral revenue is the rupee in sales from customers referred to the firm by current consumers of the service.

Service

- Customer satisfaction rating over time.
- Time to answer incoming e-mail from customers.
- Number of complaints.

Retain

- Patient attrition rate: It is the proportion of those who do not come back for service in a given time period.

Grow

- Lifetime value of the patient: It is the net present value of the revenue stream for any particular patient over a number of years.
- Average annual sales growth for repeat patients over time.
- Loyalty programme effectiveness would be indicated by sales increase over time.
- Number of low value consumers that moved to high value consumer slot.

Best Practices Suggested for a Hospital

Based on the research studies ‘Understanding Customer Expectations and Analysis on Patient Experience Mapping’⁵ conducted by the author in a renowned hospital and adaptation of the best CRM practices in service industries, the following practices have been collated to form the core of a PEM programme in a hospital that will provide a rich customer experience.

1. Establish an *exclusive customer service department* comprising:
 - *Patient support desk* manned by adequate staff to provide information about the broad spectrum of the services that the hospital provides and the various facilities available that the customer is entitled to utilise.

- *Relationship managers* to be assigned to priority accounts/patients in order to collect direct feedback and do the needful for them.
 - *Patient care executives* to interact with various patients on a daily basis and deal with various customer queries, suggestions, complaints and timely remediation by working in close collaboration with operations department, with certain limited powers. Also, preparation of reports for the top management.
 - *Customer care manager* must have the authority to provide additional facilities to a particular patient, if need be, like spending up to a certain amount for grievance redressal or creating an experience resulting into a highly favourable and lasting impression in customer minds.
2. *Customer segmentation* based on criteria like designation for corporate clients; based on nationality, foreign or domestic patient; selection of room type based on government service, film industry, sports personality, and so on.
 3. Most *customers* do have *preferences* even in matters of least significance in accordance with the perception of the service provider. Careful attention must be paid towards recording and delivering the same.
 4. *Customer profiles* that are created must contain 'guest history', stating preferences of individual customers. For example, if a particular person prefers Nescafe he needs to be offered that each time he needs to be served a beverage.
 5. *Database* must be *integrated* so that customer care executives throughout the chain of hospitals/clinics may be able to access customer profiles in order to deliver personalised services.
 6. Identify one *dedicated hospital personnel* to be in constant touch with the customer of the hospital in order to reinforce 'belongingness' towards the hospital and to ensure constant attention.
 7. Doctor's should *provide all details* about the disease, drug and its impact. Adequate explanation of the results of various tests conducted must also be provided.
 8. Customer care executives must *visit patient in rooms* twice a day for enquiring about them. During that time they must,
 - Build rapport.
 - Ensure customer satisfaction and service.
 - Understand customer preferences.
 - Provide for those preferences that are possible and record them for reference during next patient visit.
 9. *Patient attendants* must also be *made* to feel *comfortable* and cared for. Periodic updates about patient's progress should be provided especially when the patient is in the ICU.

10. Customer support desk staff or the other staff, who is approached by the *patient's visitors* for direction should be *guided* correctly, promptly, and courteously. A 'Thank You For Visiting Our Patient' card may be issued.
11. Billing *charges* should be *intimated* to patients as per their requirement.
12. Patient should be provided choices and allowed to *tailor-make* his/her *diet* considering required calorie-intake, taste and preferences.
13. *Customer loyalty programmes* should be chalked out:
 - For companies that have a high net worth contribution to the hospital
 - For individuals who have had a long association with the hospital.
14. *Contingency plans* should be formulated to take care of patients when:
 - service is unable to be provided within the stipulated time frame
 - rooms are not available for admitting in-patients
 - preferred rooms are not available.
15. In case of any *mistake* on the part of staff, how is it *to be addressed*.
16. Customer Care Executive must *convey greetings* on occasions like birthdays, wedding anniversaries of the patient.
17. *Provide games*, like chess and board games to relieve from boredom.
18. *Holy books* may be provided to the patient, if required.
19. *Personalised telephone call/email* by the doctor, enquiring the patient's state of health must be done.

Conclusion

A new paradigm in hospital service delivery is presented in this chapter. It comprises a whole new set of systematic and planned efforts for creating a valuable and rich experience to the hospital's customers. Neither the marketing nor the operations department in a hospital can bridge the gap that is presently felt by the customers. Hence the urge to create the new approach making use of the modern technological advancements to successfully address the customers and bring them closer to the hospital. The emphasis is collaboration instead of transaction. Like in quality management, the first step in implementing this model will be participation throughout the whole organisation. The success of this model is chiefly dependent on the commitment to the PEM vision by the organisation.

IMPLEMENTATION STRATEGY

The sequential elements of the strategy for successful implementation are discussed below.

Selection of appropriate software

Considerations to select the software:

- Compare features and functionalities of software which will provide for all facets of PEM Information and Metrics.
- Possess flexibility.
- Reputation and viability of vendor.

Appointment of a capable and efficient PEM manager

The PEM manager must possess expertise in the basic functions and processes of the hospital. He/she must also have knowledge on Operations and Marketing. He should be a leader in the truest sense of the term.

Recruitment of right candidates as PEM executives

The PEM executives must be selected after conducting both E.Q. and I.Q. and other psychological assessments. The qualities and skills to be possessed by the candidate are listed in the proposed model.

Training of these candidates

The training of these executives is an important aspect as they are central to the success of the implementation of the model. Therefore there must be a systematic induction and training programme during which candidates should be exposed to subjects like psychology, counselling, communication, marketing and must be introduced to various activities and functions of the operations department in the hospital. Training must also be imparted on various aspects of personality development.

Review at regular intervals

There must be weekly reviews of the outcomes of the exercise in order to keep the PEM executives well informed about the necessary changes. There must also be informal interviews undertaken by the manager on a random basis in order to get a clear picture of the outcomes of the PEM exercise.

Thus the Customer Experience Management is an effort that entails enthusiastic participation of the entire hospital. The hospital personnel must be attuned to be sensitive in carrying out their duties. PEM cannot be restricted to the set out practices and processes. It must continuously respond to changes occurring in due course of time in order to prove its worth both to the organisation and to its customer.

Notes

1. Based on 'Patient Experience Management for In-Patient CABG (Coronary Artery Bypass Grafting) Cases' submitted to Apollo Institute of Hospital Administration, Hyderabad. July 2006.
2. See note 1.
3. Reichheld 1996.
4. Duncan and Moriarty 1997.
5. See note 1.

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Medical Records 11

Mamta Edwards

*Memories fade
People lie
Witnesses die
But Medical Records live on for ever.*

Introduction

A medical record is defined as a clinical, scientific, administrative and legal document relating to patient care in which sufficient data is written in the sequence of events to justify the diagnosis, treatment and the end results.

The medical record today is a compilation of the pertinent facts relating to a patient's health history, including past and present illness or illnesses, and treatment prescribed by health professionals contributing to the patient's care. The medical record should be compiled chronologically and should contain sufficient data to identify the patient, support the diagnosis or the reason for the treatment, justify the treatment and accurately document the result.

The medical record professional must ensure that it contains all the relevant facts needed for patient care and other uses. The process of ensuring that the medical record is adequate, complete and useful, requires a thorough knowledge not only of the content, but also about information regarding the purpose, ownership, value, uses of, and responsibility for the medical record.

The medical record is assembled after the discharge of the patient, so as to facilitate the logical flow of information regarding the patient's past and present illnesses, diagnosis, treatment and the outcome. The information must be available readily as and when required for several purposes, for example, patient care, legal affairs, research, education, quality review, correspondence, and so on.

Purpose

The primary purpose of the medical record is to accurately and sufficiently document the health history of a patient, including past and present illness or illnesses and treatments prescribed, with special attention on the events affecting the patient during the current episode of care.

Ownership

The medical record developed in the hospital or its branches is considered to be the physical property of that hospital. However, the data contained in it is the property of the patient, and thus, must be available to the patient and/or the patient's legally designated representative on request, according to the rules. Rules concerning access to the medical record vary according to the law of the country or state. However, it does not prevent others from submitting legitimate claims to see and copy the information therein.

Uses

The medical record contains a wealth of information and has several uses. The uses of medical records are of two major types, personal and impersonal.

PERSONAL

Personal use refers to when the identity of the patient is needed and retained, for example, a request for copies of specific portions of a patient's medical record by the insurance company for reimbursement claims. Insurance companies provide coverage for the patient's hospitalisation, and, thus, require specific information from the patient's medical record, in order to substantiate the claims made by the patient.

IMPERSONAL

Impersonal use refers to when the patient's identity is not required and is, therefore, not retained. For example, the use of data from a large number of medical records for a research study or clinical trials. The reason for the medical record department to be concerned with such differences is because, for all

impersonal use, authorisation by the patient, in the form of 'consent for the release of information', needs to be taken before releasing any information to anyone from the patient's record.

The medical record of the patient is used in a number of ways:

PATIENT CARE MANAGEMENT

The course of treatment given to the patient is documented for every episode of care. This provides communication between the primary physician and other medical professionals treating the patient. The documented information in the medical record is also useful when subsequent care is provided to the patient.

QUALITY REVIEW

The medical record enables regular evaluation of the completeness and the appropriateness of the care given to the patient, thus improving on the overall quality of care.

FINANCIAL REIMBURSEMENT

It is used to settle and substantiate reimbursement claims of the hospital and the patient with insurance companies.

LEGAL AFFAIRS

The medical record contains vital information which protects the legal interests of the patient, physician and the hospital.

EDUCATION

It helps in case studies of rare clinical findings or diagnoses which are carried out in many hospitals for the education of the medical faculty of the hospital.

RESEARCH

The medical record provides data for research studies which enrich and advance medical knowledge.

PUBLIC HEALTH

It is used for the identification of the incidence of infectious or other diseases which help in future planning for the overall health of the nation and the world.

PLANNING AND MARKETING

To identify the services for improving and promoting the different services of the hospital.

Value

The information contained in the medical record is valuable to many users.

THE PATIENT

The medical record contains vital information about the patient's past and present health history, the present episode of care documented in the form of history, physical examination and findings, diagnostics, the treatment given (medical, surgical, or both) and the response of the patient to the treatment.

Over a period of time, medical professionals provide care to many patients and are not expected to remember the details about each patient's illness, treatment and their response to the treatment. The patient also may not remember the significant details of his past illnesses and the treatment given. Thus, the record serves as a reference for both: the medical professional and the patient. It substantiates the care given to the patient, and thus, helps in settling the patient's claim for reimbursement from the insurance company. It also provides vital information to the medical professional providing subsequent care, or a different treatment to the patient, thus ensuring continuity of care. The medical record protects the legal interests of the patient in cases related to worker compensation, accidents and the Consumer Protection Act.

THE HOSPITAL

The medical record enables quality review—the performance of medical professionals working in the organisation is evaluated through regular review meetings based on the documentation in the medical record. It enables the hospital management to evaluate the usage of hospital resources, such as special diagnostic

equipment and special services offered by the hospital and human resources. The medical record also protects the legal interests of the hospital in court cases, especially the ones under the Consumer Protection Act. Finally, it is useful for the hospital where financial reimbursement has to be made, in all cases where third-party payers are involved, such as company cases where credit facilities are available and insurance company cases. Specific details from the medical record are provided to them to substantiate the claims of the hospital for the care given to the patient. The record is used by licensing, certifying and accrediting agencies for evaluation and for determining compliance with the standards of the respective agency.

THE MEDICAL PROFESSIONAL

The medical record provides information to the medical professional when treating the patient, guides him in deciding on the proper treatment to be given during the current episode and the subsequent ones. It helps in providing continuity of care to the patient at different levels of health care. It also helps the medical professional in reviewing his own performance by studying the records of the patient. It provides data which is used to educate medical professionals through case studies. Finally, it protects the legal interests of the medical professional.

THE EDUCATOR, RESEARCHER, AND PUBLIC HEALTH OFFICER

The information contained in the medical record is valuable to medical professionals and students of medicine to learn about the occurrence of various disease processes, their treatment and the effectiveness of the treatment given. The data in the medical record helps in tracing (or following) the progress of research; for example, assessing the effectiveness of a specific treatment or a combination of treatments for a particular disease.

The medical record also provides vital statistics regarding the total number of births and deaths in the hospital to the public health agency in each state to revise the population count. In the interest of the individual and public health, it is imperative to provide information regarding the occurrence of certain diseases, such as communicable diseases, and gunshot wounds, accidents, and so on, to the public agency of the state, so that proper precautions and action can be taken by them. Statistics compiled from data gathered in this manner from all public health agencies of different states will help in developing comprehensive health programmes at state and national levels.

THIRD-PARTY PAYERS

Specific portions of information contained in the medical record is required by third-party payers, such as insurance companies or organisations responsible for hospital claim payments, in order to determine the eligibility of the care given to the patient, and to substantiate the claims made by the patient or the hospital for financial reimbursement.

Responsibility for the Medical Record

It is the hospital's responsibility to provide a medical record for each patient availing the services of the hospital, and to safeguard the medical record and its content from any damage, loss, tampering and unauthorised use.

The responsibility of providing an adequate medical record file is directly or indirectly shared by many members of the medical faculty and administration. They are discussed in this section.

THE HOSPITAL MANAGEMENT BODY

The hospital management body is responsible for the proper care of the patient and for providing an appropriate infrastructure, by appointing capable and qualified personnel for the efficient management of the hospital. It is the moral and legal responsibility of the hospital management body, as the ultimate authority, to ensure that each patient receives a high quality of medical care, which is documented completely and accurately in the medical record. This they usually ensure by delegating hospital operations to the chief executive officer and medical director.

THE HOSPITAL ADMINISTRATION

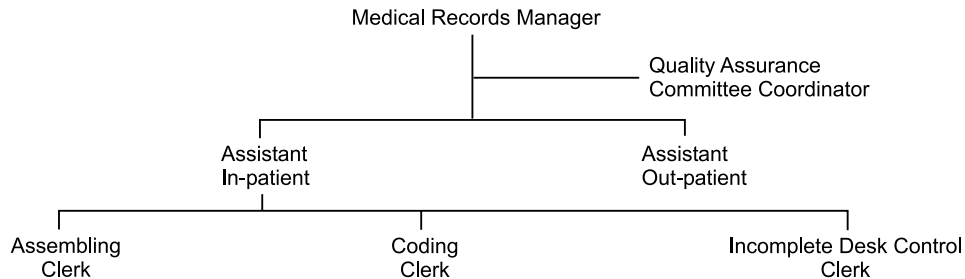
The prime responsibility of the chief executive officer and the medical director, as part of the administration, is to ensure that the medical and non-medical staff follow the rules and regulations established by the hospital with regard to patient care. The medical staff are specifically responsible for proper documentation regarding the treatment given to the patient. This involves the adequacy, accuracy and timely completion of the medical record. The administration is also responsible for providing proper personnel, space, guidance and equipment for the efficient functioning of the medical record department.

Organising the Medical Records Department

STRUCTURE

An example of the structure of the medical records department is illustrated in Figure 11.1

Figure 11.1 Structure of a Medical Records Department



FUNCTIONS

Medical records manager

Planning and organising: Planning includes budgeting, tactical and operational planning; organising includes dividing work and coordinating the inter- and intra-departmental tasks and managerial functions, such as decision-making, delegation, and so on.

Assistants

Supervision, analysis, coordination and carrying out work assigned by the manager.

Clerks

Retrieval, assembling, coding, indexing, statistical calculations and filing.

Responsibility

MANAGER'S RESPONSIBILITY

The manager of the medical record department is responsible for:

1. Proper co-ordination between the department and the physicians.

2. Proper co-ordination with other departments which need medical records, in order to contribute directly or indirectly to patient care.
3. Spreading an awareness among the staff of the hospital regarding the importance of accurate and complete medical records.
4. Evolving proper systems in the department for its efficient working.
5. Coding, indexing and reporting of data related to diagnosis and procedures for clinical use.
6. Notifying concerned persons about errors and deficiencies identified by the medical record department.
7. Checking the completeness of the record according to set standards and regulations, and providing feedback for quality assurance screening.
8. Generating, compiling and storing administrative statistics, vital statistics and demographic statistics.
9. Storing the records securely, retrieving it efficiently and giving access to the record to authorised persons only.

ATTENDING PHYSICIAN'S AND MEDICAL PROFESSIONAL'S RESPONSIBILITY

They are responsible for the following:

1. Timely documentation regarding the patient's daily care in the medical record.
2. Adequate and accurate documentation, with complete details about the clinical part of the record.
3. Timely completion of recording the history and physical findings at the admission stage, and the discharge summary at the discharge stage.
4. Regular review of the medical records.

Development and Content of the Hospital Medical Record

The medical record establishes facts regarding what a hospital is accomplishing. The wealth of data available in the medical record enables the management to make important decisions and review the quality of care given to the patient. Thus it is imperative to maintain an accurate and well-documented medical record for each patient for every episode of care.

The medical record is compiled of data documented by different entities in the hospital. The data is broadly classified into two groups: (1) administrative data, and (2) clinical data.

ADMINISTRATIVE DATA

It comprises the following records or forms:

Face sheet or registration record

This form contains the socio-demographic data of the patient, which is part of the basic identification data of the patient. This record also has specific clinical data such as details of allergies, if any, the final diagnosis and procedures, if any, and the International Statistical Classification of Diseases (ICD) codes and related health problems for them.

Authorisation form

The back of the registration record is often used for the authorisation form which has the following statements:

- That the patient agrees to receive basic and standard procedures for treatment.
- That the hospital does not guarantee the outcome of the treatment.
- That the patient or guardian is responsible for the payment of the treatment given.

This form, when signed by the patient or guardian at registration or admission, becomes the consent record for routine investigations, medical treatment, diagnostic procedures and payment for the treatment.

The clerk at the registration counter must ensure that the patient or guardian has signed the consent form only after completely understanding its contents.

Consent for release of information

This consent is also printed at the back of the registration record. It states that the patient authorises the hospital authorities to release information about his/her treatment to specified organisations or people, such as the insurance company, the employer, and so on. The signature of the patient on this form becomes the patient's consent for the release of his/her treatment information, thus authorising the hospital to release clinical data for specific purposes.

Special consent

This type of consent or authorisation form is used when the patient has to undergo a major procedure or a non-routine investigation. This form, when signed by the

patient, becomes the record of the consent of the patient that he/she is agreeing to undergo the procedure listed in the consent form. This consent form is valid only when the consultant surgeon has explained the details about procedure, the risks, the alternatives and the outcome of this procedure, to the best understanding of the patient or guardian.

CLINICAL DATA

The second major group of data in the medical record is the clinical data. It consists of the following records and reports:

1. *Face sheet or registration form*

It contains authorisation, consent for release of information, summary of the administrative and socio-demographic data, and summary of the clinical data (which includes the final diagnosis and major and minor procedures).

Against the final diagnosis, the relevant ICD codes are entered, using the International Statistical Classification of Diseases and Related Health Problems, or classification by ICD10: volumes 1 and 3. The procedures are coded using the International Classification of Procedures in Medicine: volumes 1 and 2.

2. *History and physical examination chart*

3. *Provisional diagnosis form*

4. *Doctor's orders*

5. *Progress notes*

6. *Investigation chart*

This contains in compact form different laboratory and radiology investigation results. It is especially useful for patients with multiple test results and also for those who have to undergo repetitive tests. The results of a particular test can be compared over time and situations. For example, the blood sugar levels of a diabetic patient observed at different intervals on different days.

7. *Consultation request form*

This is used for cross referral where the primary consultant of one specialty requests the attention and comments of another consultant of a different or related specialty, regarding the patient's illness, for example, a cardiologist referring to a cardiothoracic surgeon.

8. *Operation notes*

9. *Anaesthesia report*

10. *Post-operative orders*

11. *Discharge summary*

12. *TPR or clinical chart*

This chart is used to record the temperature, blood pressure and respiration of a patient at regular intervals.

13. *Nurses' treatment chart*

14. *Nurses' chart*

15. *ICU notes*

16. *Physiotherapy notes*

17. *Medical laboratory reports*

18. *Medico-legal registration form (if it is a medico-legal case)*

19. *Miscellaneous charts*

This includes specialty forms, for example, neurological charts, Cardio Thoracic (C.T.) post-operative charts and occupational therapy.

20. *Miscellaneous notes*

This includes correspondence and referral letters.

21. *Autopsy report (where applicable)*

Format types

The medical record format signifies the systematic arrangement of the forms and their content in the medical record file. There are three types of formats: source-oriented, problem-oriented and integrated.

SOURCE-ORIENTED MEDICAL RECORD

In this type, different records in the medical record are organised according to the department which provides care and initiates data. The forms are arranged according to the date in each section and are usually compiled in reverse chronological order, as long as the patient is under treatment, so that the most recent information is on top. However, after discharge, the medical record is rearranged in the normal chronological order, from admission to discharge.

Advantages

Since the records of each department are filed together, it is easier to determine the assessment, observations, treatment and the follow-up care that has been carried out by a particular department.

Disadvantages

Since the information is organised in sections, it is difficult to quickly determine all the problems of patients and their treatment. The totality of approach and the links are not evident.

PROBLEM-ORIENTED MEDICAL RECORD

The problem-oriented medical record, normally referred to as POMR, was introduced by Dr Lawrence L. Weed in the 1960s. This type of format helps in reflecting the logical thinking of the physician who is giving treatment. It also provides a systematic method of documenting the care given to the patient. The physician precisely states and follows every clinical problem and systematically arranges them for solution. The POMR has four basic parts: (1) data base, (2) problem list, (3) initial plans, and (4) progress notes.

Data base

The data base includes the basic information about the patient, as given by the patient, which includes the main complaint, the patient's profile, current illnesses and other related matters. The past health history includes social data, previous diagnostic reports, review details, history, physical examination, and so on.

Problem list

The problem list is a form placed at the front end of the record. 'Problems' are defined as any situation that requires care and investigation. The situation will include medical, economic, social and demographic problems, both present and past.

This form should have all the problems noted according to the best understanding of the physician. Thus, the problem list may have a specific diagnosis, abnormal investigation findings or symptoms. Suspected conditions, or those conditions which need to be ruled out are not included in the problem list, but are noted in the initial plan. The problem list is updated when new problems are identified, changes made as and when needed, and active or current problems are resolved. Problems in the list are not erased, but they are marked 'dropped' or 'resolved', and the date is noted. The problems are given a number and title, which serves as the table of contents for the record.

Initial plans

The initial plans consist of plans regarding what has to be done to learn more about the patient's condition, treat the condition and educate the patient about the condition. Each problem has a specific plan, which will fall into one of the following three categories: more data for diagnosis (*rule out* statements can be made here), care or therapy (includes the list of drugs, procedures, objectives and contingency plans) and the patient's education. The plans are numbered according to the problem they address.

Progress notes

It contains the follow-up for every problem stated in the problem list. Each note is numbered and titled according to the problem it addresses. Progress notes contain the following elements: subjective (symptomatic), objective (observable and measurable), assessment (interpretation or impression of the current condition) and plan. The acronym for this process is SOAP, and the process of writing the progress notes in the POMR format is usually known as 'soaping'. The emphasis is mostly on unresolved problems. Other than the continuous written notes to describe the patient's progress, flow sheets can be used in cases where many other factors are being monitored, or when the patient's condition is rapidly changing. Progress notes also include the discharge summary. It must address all the numbered problems in the problem list.

Advantages

- All the problems of the patient should be considered by the physician in the total context.
- The logical thought process of the physician can be clearly noted, since the data is organised thus, which enables standard medical education.
- The medical record clearly documents the goals and methods of the physician treating the patient. Since the data is organised, the quality assurance process is easier.

Disadvantages

The major disadvantage of this format is that extra commitment and training is required of the medical and professional staff who makes entries in the medical record.

INTEGRATED MEDICAL RECORDS

In this format, the forms are arranged in strict chronological order. At the nursing station, the forms are arranged in reverse chronological order, with the most recent entry at the front end. But after discharge, the forms are rearranged, from the date of admission to the date of discharge. The main feature of this system is that forms from various sources are intermingled. Thus, the medical record of a discharged patient can have the history and physical examination form followed by the physician's orders, then the progress notes, the investigation chart, some more progress notes, consultation requests, and so on. The forms of each admission are systematically arranged separately in the medical record.

Advantages

- All the information regarding a single episode of care is put together, giving a clear picture of the patient's condition and the treatment given.
- The progress of the patient is quickly determined because current reports from all the specified sources are together.
- The use of special forms is limited, thus reducing the bulk of the record.
- This format type encourages team work in health care.

Disadvantages

In this format, comparison of similar information is difficult, for example, level of lipids over a period of time, since all reports of the same type are not filed together in the record. In a manual medical record system, only a single medical professional can make entries at one time, and it is also difficult to identify the profession of the individual making the entry, unless it is followed by the complete signature and title of the recorder. The majority of physicians feel that their documentation needs some kind of highlighting, in order to differentiate it from other medical professionals' documentation.

The decision regarding which format to be used in the medical record is taken by the medical professionals, with recommendations from the medical record committee.

Required Characteristics of Entries in Medical Records

It is often said that a complete medical record indicates complete care and conversely, a poorly documented medical record reflects poor care. It may also be possible that a complete and meticulously maintained record exists for a patient

who received poor care. However, the reverse is more likely to be true, and a patient may have received good care which is poorly documented.

APPROPRIATE DOCUMENTATION

The information documented in the medical record by the medical professionals who are authorised and responsible to provide care, determines the quality of the medical record. The hospital management and the medical professionals of the hospital must determine the policy about who has the authority and responsibility of making entries in the medical record. The medical record must at all times contain enough information, which will enable the attending physician to give effective continuity of care and determine the condition of the patient at any given time. It should not only enable the physician to review the patient's condition, in order to give an opinion, but also to enable another physician to assume the patient's care at any time.

In addition to all the above functions, the medical record must have sufficient data for a review on utilisation and quality.

AUTHENTICATION

Medical professionals who are authorised and responsible for providing care to patients are also responsible for verifying and documenting the care given, in the medical record, and authenticating the entry with the date of entry and signature. The identification and authentication can be a signature, identifiable initials, or a signature affixed by a rubber stamp, if permitted (most commonly used for pathologists and radiologists).

All physicians must authenticate every entry. A single signature in the initial history and physical examination and provisional diagnosis forms is not sufficient authentication of the complete record. In hospitals with resident or registrar staff, the primary physician must countersign at least the history and physical examination and the discharge summary. All other parts of the record, which are the responsibility of the primary physician, must be authenticated by him.

ABBREVIATIONS

Only standard abbreviations and symbols, which are approved by medical professionals, the ones for which explanatory legend is available with those who are responsible for entry in the medical record, and also those who interpret them, should be used. Every abbreviation or symbol used must have only one

meaning. Abbreviations must never be used in the final diagnosis, and must also be avoided in all entries in the progress sheets.

TIMELINESS

Human memory tends to fail. Hence, it is imperative that all documentation regarding patient care must be done as soon as the treatment or care is given. Records such as history and physical examination, and laboratory and radiology reports, are amongst those which must be completed within 24 hours of admission. Progress notes must be written immediately and continuously from the time of admission to the time of discharge. The discharge summary may be written two to three days after discharge.

COMPLETENESS

The patient's record must be completed at least within a week of discharge. Completeness of medical records implies that all clinical events have been documented, as soon as possible after it took place, and all the required forms and formats have been assembled and authenticated. The final diagnosis must be written without any abbreviations. All forms that need to be in the medical record for that particular admission must be completed and present in the record.

LEGIBILITY

The legibility of the documentation in the medical record determines the usefulness of the record. It is advisable that some of the forms in the record may be typed, if the costs are feasible. For example, the discharge summary, operation notes, radiology and laboratory reports, and such like, can be typed.

CORRECTION OF ERRORS AND OMISSIONS

Correction of any error in the medical record is done by drawing a line through the erroneous entry with the citation, 'wrong record', beside it. The correct information must be documented immediately after striking out the wrong documentation, and it must be authenticated with the signature and date, by the doctor who identified and corrected the error. The error must not be erased or painted with correction fluid. If any clinical event has not been documented through oversight, the entry should be made after the last entry, with an explanation regarding the omission, and the reason for it being out of sequence.

Responsibility for the Quality of the Medical Record

MEDICAL RECORD COMMITTEE

The medical professionals of the hospital have the ultimate responsibility for the overall quality of the medical record. In most of the hospitals, the quality review of the medical record is done by a specific committee constituted for this purpose, which is called the medical record committee. This committee usually has members from the management, medical staff, consultant physicians and surgeons, and the medical record department.

FUNCTIONS OF THE MEDICAL RECORD COMMITTEE

This committee, which is responsible for reviewing various aspects of medical records, is assigned the following functions:

1. Reviewing the medical records for
 - timely completion,
 - clinical relevance,
 - adequacy of the file for use in quality review activities,
 - adequacy of the file for use as a medico-legal document,
 - recording the tests which were carried out, their results and the therapies given,
 - determining whether sufficient forms are being used in the medical record,
 - determining the format of a complete medical record,
 - determining the use of electronic data-processing and storage methods, and
 - determining the classification system to be used in the medical record.
2. Reviewing the security and integrity of the medical records department.
3. Checking the retrieval system of the department for easy and quick retrieval.

The medical record committee can also select records at random from the discharges and check for substandard and delinquent records. In addition to reviewing the records of discharged patients, the members of the medical record committee, can, at any point of time, make an on-the-spot check regarding completeness of the records of patients who are currently admitted in the hospital. The findings of such checks can be then reviewed at the committee meeting for improving the quality of the records. Decisions taken regarding revisions and creation of new policies can be made to rectify any non-conformance found during such checks.

The responsibility of the medical record committee does not end with continuously checking only the in-patient files, but the out-patient records must also be randomly and periodically checked for completeness, and whether the contents of the record are sufficient for continuity of care.

A review of special records, such as those of patients admitted in an emergency, or of those patients who have expired within 24 hours of being admitted to emergency, is also required. Records of patients admitted to emergency due to a calamity or a riot situation should also be reviewed.

ROLE OF THE MEDICAL RECORD PROFESSIONAL

The medical record professional must play an important role in helping the medical staff of the hospital in reviewing the medical records. This is usually done by providing the medical record committee with selected files which carry different kinds of deficiencies and errors. The committee analyses the records and decides on the action to be taken, to avoid such deficiencies and errors in future. The medical record professional also reports to the committee, a summary of the time of the completion of the medical record.

The medical record staff must, with tact and diplomacy, ensure that the rules and regulations decided upon by the medical record committee are adhered to by the medical faculty and all other personnel responsible for making entries in the medical records.

RESPONSIBILITY OF THE MEDICAL DIRECTOR

The medical director has the responsibility of spreading an awareness amongst the medical staff, and stressing the importance of maintaining a high quality in the compilation of medical records. The medical director should ensure that the medical faculty appreciates and adheres to the rules and regulations made by the medical record committee, and thus, enable the hospital to create high-quality medical records that are worth preserving for future use.

EMPOWERMENT OF THE MEDICAL RECORD COMMITTEE

Only with proper rules and regulations, which are approved and implemented by the medical staff of the hospital, can the medical record committee operate efficiently, ensure the completeness of the medical records and be self-regulating, just like any other routine functional group.

The medical record committee must be sufficiently empowered by the management of the hospital to

- refuse substandard records;
- make decisions regarding the quality of clinical entries;
- implement staff rules regarding delinquent case sheets;
- ensure and encourage the maintenance of high standards of recording in every way.

The management of the hospital must also ensure that all medical faculty, when they join the organisation, must agree to adhere to the rules and regulations of the hospital, may be by signing an agreement. For any non-conformance to the existing rules and regulations, the following disciplinary action may be taken by the committee:

- Temporarily suspend admission privileges.
- Temporarily suspend consultation and surgery privileges.
- Defer promotion.
- Reduce privileges.

The object of such disciplinary action is not to demean or damage the reputation of the physician, but to lay stress on discipline, on the importance of maintaining high-quality medical records, and to help in improving it. Many hospitals have rules and regulations whereby the admissions counter personnel are informed by the medical record committee regarding the outstanding records which are incomplete or delinquent, pending against a consultant, and the suspension of admission privileges temporarily for that particular consultant.

Legal Aspects of Medical Records

The medical record serves a secondary and important purpose and being a legal document, is, as such, affected by laws, rules, regulations and institutional policy.

The medical record is the property of the health care facility, while the personal data contained in the record is considered a confidential communication, which must be protected in the interest of the patient. The record is compiled, preserved and protected from unauthorised inspection for the benefit of the patient, the facility and the physician, as required by law in some states, and by administrative practice in others.

Since the medical record is frequently used as legal evidence regarding the patient's care, it can serve as a protection facility for the physician and patient, only when it clearly shows the treatment given to the patient, by whom, and when. It must show that the care and service given by the hospital and by the

physician were consistent with good medical practice. By the same token, the record may prove to be a potent weapon against the physician in any action by the patient when these standards are not met.

The medical record must be maintained to serve the patient, the health care providers and the institution, in accordance with the requirements of legal, accrediting and regulatory agencies. The health facility should have procedures for disclosure, access and amendment of health record information, for making it known to patients upon request. The release of information should be closely controlled with well-laid procedures. A properly completed and signed authorisation should be required for release of all health information, the exceptions being:

- When it is required by law.
- When it is released to another health care provider, currently involved in the care of the patient.
- For medical care evaluation.
- For research and education.

The medical record professional must be familiar with the statutes, regulations and cases governing medical records in general, and those which apply to the state community in which the facility is situated. In addition, he or she must take an active role in the development and enforcement of the policies of the facility, regarding the proper release of information, whether it be in response to a subpoena, to requests from governmental agencies, and to requests from the individual patient, his/her relatives and others.

Retention

One of the problems faced by medical record departments all over the world is shortage of storage space for active files, and more so for inactive files. In all private health care facilities, space that does not generate revenue should be kept to a minimum. A formal plan must be developed by medical record department personnel for the retention of files, transfer of inactive files, and later, destruction of files.

INACTIVITY

To decide on the inactivity of a case record, the following factors should be taken into consideration:

- The total space available for filing.
- The yearly expansion rate, based on the inflow of files and the space occupied by them, when arranged on the racks.

DESTRUCTION

When planning for the destruction of the files, the following factors are important:

1. Extent and intensity of research conducted.
2. Laws and statutes of the state in which the facility is located, that might limit the destruction of specific files.
3. Extent of review and re-admission cases.
4. Cost involved in storing inactive files.
5. Cost involved in destruction of files.

OPTIONS

Some of the options for storage or destruction of inactive records are:

1. Storing in another area of the hospital.
2. Resorting to commercial storage.
3. Microfilming of records.
4. Storage on Magnetic Disks, Optical Media or CD-ROMs.
5. Destroying the records through the incinerator or with a shredder.

Generally, it is sufficient to retain a medical record of a patient for 10 years, since, most often, it is generally not requested for clinical, scientific, legal or audit purposes, after 10 years from the patient's last visit to the hospital. Thus, the files which are ten years old, without any record of a recent visit during that period, can be destroyed, unless it is specifically prohibited by law, ordinance or regulation.

However, the health care facility must retain:

1. Basic information, such as diagnosis and operative procedures, date of registration, dates of admissions and discharges, consultants involved, and so on.
2. Case records of newborn babies in the hospital, till the minor reaches a certain age, or as specified by the law of the state in which the facility exists
3. Mentally disabled patients' cases.

4. Special instances, such as:
 - (a) Cases of rare clinical interest, where the primary consultant has written a special note to retain the file.
 - (b) Cases in which legal proceedings are pending.
 - (c) Cases in which research protocols and clinical trials are conducted.

Computerisation of Medical Records

With the advent of computers in the health care industry, many aspects of health care facilities enjoy a great advantage. Computer usage in health care facilities can be divided into three types:

1. Financial
2. Administrative
3. Clinical

The medical records department is closely associated to all these areas. Computerisation of medical records will improve and help applications in all these areas. Some financial and administrative applications include:

1. Patient registration
2. Master patient index
3. DRG (diagnostic-related groups) grouping
4. Coding and Indexing

Some of the clinical applications are:

1. Quality assurance
2. Utilisation management
3. Registries.

Medical records departments will gain great advantage by using software packages that enable the following tasks:

1. Record tracking and location
2. Record completion
3. Correspondence
4. Management of department
5. Statistics—compilation and analysis

Conclusion

The present scenario in India is that most medical record departments are partially computerised. Computers have enabled enhancement of the speed of certain procedures in the management of medical records. Computerised medical record systems exist in some health care facilities, where entries are made by different health care providers, such as physicians, nurses and therapists, into the computers at different nodes in a local area network. In such systems, information is readily available, and large volumes of information are available at a glance. Access to information and data is faster, and printouts containing any information, are available, neater, more legible and better organised than in the manual process. Since most part of the information is already stored in the computer, the destruction of inactive physical files is made easier. Computerisation also ensures security of data.

The exciting possibility of the electronic medical record is not too far. In the new millennium, we can visualise the patient record existing in an electronic medium, with all its attendant advantages. With the acceptance of digital signatures, and the possibility of an Unique Health Care Identifier (UHID), a patient can have a single record from birth to death, in an electronic medium, which can be accessed from anywhere in the world, using the UHID. The confidentiality of the contents can also be protected.

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Introduction to Operations Research

MAIN FEATURES OF OPERATIONS RESEARCH

Operations research (OR) is an interdisciplinary team approach to find an optimal solution to a problem situation. It uses tools and techniques of scientific research, particularly mathematical modelling, to arrive at the optimal solution. In many cases, OR optimises the output by either maximising profit or revenue, or minimising the cost, loss or time. Basically, this emphasises a total systems approach.

A standard procedure for the application of operations research is to carry out the following steps:

1. Define or formulate the problem.
2. Convert the problem into a mathematical model.
3. Find an acceptable solution to the model.
4. Validate the model.
5. Implement the final solution.

Of these, the first step is the most difficult, and involves the person facing the problem situation (the user) and the OR expert (the model developer). For those who are interested in application development, the OR approach can be seen as a collection of mathematical models out of which the appropriate one should be selected and applied.

The purpose of this chapter is to expose the reader to the principles of OR, and reveal the value of its application through case studies on selected techniques.

Major Tools and Techniques of Operations Research

The tools and techniques of OR may be classified into deterministic and probabilistic models. A deterministic model means that the information and data are totally available, all relations are completely known, and there is full understanding of the situation. This is an ideal and extreme situation. Hence, a given state should be approximated to this condition. When there are too many alternatives as outcomes, the data and information are only known partially, and more and more information collection will lead to an improvement in understanding the situation. This is called probabilistic. Probability is a positive fraction between zero and one. When it takes the value of one, it is called a deterministic situation. For example, many times the diagnosis leads to a probabilistic situation, the response to treatment leads to information-gathering, and improves the probability of reaching the value of one. The first step in problem formulation should be to ascertain if it is a deterministic or probabilistic situation. The OR models have been classified into those belonging to the deterministic state and those to the probabilistic state.

DETERMINISTIC MODELS

- Assignment
- Transportation
- Linear programming
- Dynamic programming
- Sequencing

PROBABILISTIC MODELS

- Queueing
- Inventory
- Replacement
- Network analysis
- Work sampling
- Game theory
- Decision theory
- Heuristics
- Simulation

Phases of Operations Research Study

PHASE 1 FORMULATION OF THE PROBLEM

This phase of the study describes the system from the point of view of OR. This will cover three major aspects:

1. Description of the goal or objective of the study: this will describe the final outcome and its measured value. This is a mathematical expression for which an optimal value is found.
2. Identification of the decision alternatives of the system: this helps in considering alternative ways of allowing the system to function, so that the best way of 'doing' can be chosen.
3. Recognition of the limitations, restrictions and requirements of the system: this describes the environmental conditions under which the system has to function.

PHASE 2 MODEL BUILDING

Depending on the definition of the problem, the OR team should decide on the most suitable model for representing the system. A model describes the system's objectives, decision variables and constraints through mathematical expression and logic. Such a model should specify quantitative expressions for the objective, and the constraints of the problem in terms of its decision variable. If the resulting model fits into one of the standard mathematical models listed in the section on Major Tools and Techniques, a convenient solution can be obtained by using the standard procedure defined for that OR technique. If the mathematical relationships of the model are too complex to allow an analytic solution, a simulation model may be more appropriate. Some cases may require the use of a combination of mathematical simulation and heuristic models.

PHASE 3 SOLUTION TO THE PROBLEM

In mathematical models, this is achieved by using well-defined optimisation techniques and mathematical logic to obtain an optimum solution, which will be the largest or the smallest value to the objective function. The objective function is the final outcome of the system. In addition to the optimum solution of the model, one must also secure wherever possible, additional information concerning the behaviour of the solution, due to allowable or expected changes in the system's parameters. This is usually referred to as *sensitivity analysis*; it helps in deciding

suitable variations to the system, while remaining in harmony with operational conditions.

PHASE 4 VALIDATION OF THE MODEL

A model is valid, if, despite its inexactness in representing the system, it can give a reasonable prediction of the system's performance. A common method for testing the validity of a model is to compare its performance with past data available for the actual system. In some cases, it may be possible to construct a simulation model from which data is obtained to carry out the comparison.

PHASE 5 IMPLEMENTATION

The responsibility of executing these results rests primarily with the operations researchers. The interactions between the operations research team and the personnel (executives) actually involved in operations, is close and frequent during this phase. In other words, it is imperative that the implementation phase be executed through the cooperation of both the OR team and those who will be responsible for managing and operating the system.

Operations Research in Hospital Management

Most countries, including India, have pledged to achieve this goal. The need of the hour is for existing health service facilities at government hospitals, as well as at corporate hospitals, to be strengthened and redirected to attain equitable allocation of resources, and new strategies developed for the implementation of various health care programmes. Because, for a patient, the choice is to either get admitted to a government hospital and suffer the lack of basic facilities, or to go to any corporate hospital, and pay large sums for the good services rendered, where either or both of them may be suffering from high cost operations because of the inefficient allocation of resources. There is a need to review and rejuvenate traditional methods and approaches in managing health and medical care. The operations research approach has good potential and scope to provide better solutions to a large number of problems related to cost minimisation, and increasing patient satisfaction in hospital and health management.

The effective and efficient delivery of health and medical care challenges traditional concepts of management. It requires an interdisciplinary system and a team approach. Over the past years, OR practices have gained prominence in hospitals and health care facilities.

Scope of Operations Research Practices

All major tools of OR discussed in the earlier section have been extensively applied in the hospital and health care management area. However, keeping in mind the limitation of space, some selected and more frequently applied techniques are described here.

Allocation Models, under the class of deterministic models, are more relevant in general management. The *assignment* method can be applied in assigning duties to doctors and medical staff in a hospital, in order to achieve the best performance levels and the optimum utilisation of skill and resources. The *transportation* method is used in minimising total transportation cost or time in utilising ambulatory services, as well as in maintaining a regular supply of materials, including medicines and drugs from one destination to another. The *linear programming* technique is gainfully used in the capital rationing of resources, such as budget allocation, manpower dispersal (medical officers, supporting staff), transfer pricing, outsourcing and investment decisions, etc.

The *Programme Evaluation and Review Technique (PERT)* and *Critical Path Method (CPM)* techniques have ample scope for applications in the planning of projects undertaken in hospitals, in construction and expansion activities, in installing a new equipment or technology, in the preparation of all types of budgets, in planning for appointment scheduling, in the scheduling of major surgical operations, and in planning a promotional programme, such as for camps. To be precise, PERT and CPM are very powerful OR techniques for planning, scheduling, monitoring and then exercising control over performance, performance evaluation and resource reallocation in any project run by a hospital. These are powerful techniques for controlling cost overrun and time overrun in projects.

Replacement Models can be effectively used for studying the economic life of a medical equipment, or tools used for providing medical care. Apart from this, to some extent, the concepts have great similarity with the human system, and hence, can be gainfully applied in the medical insurance area. The interesting and remarkable contrast exists in the last phase: a machine system is discarded (or replaced) when it attains the age beyond which it is not economical to maintain it, whereas in a human system, we try to rejuvenate the health condition of human beings by providing adequate health care facilities, even at a high cost, to prolong (or save) lives till the last minute.

Inventory Control techniques are the backbone of the materials management system, especially for drugs, medicines and other supplies. By using scientific inventory management, a continuous supply of essential materials can be maintained at an acceptable level of cost. This subject has been discussed in

great detail by other authors in this book: A.V Srinivasan, V. Venkat Reddy and K.P. Kumar.

The *Queueing Model* is applicable in the medical care system, surgery planning, patient waiting for service, bed allocation, hospital capacity planning, and for balancing the medical service, resulting in minimal delay and better satisfaction. This is a common and natural phenomenon which has been widely used in service disciplines.

Work Sampling helps in estimating the workload on doctors, nurses and other staff; the time spent by the medical staff on important and productive activities; and the ratios of busy time and idle time at various operational points. This is an industrial engineering technique which has been adopted into OR and is widely used for increasing efficiency.

Apart from work sampling and inventory control, the other techniques listed above are discussed in this chapter.

Allocation Models Transportation Method

Allocation models of OR have been effectively used in hospital management where scarce resources have to be utilised for best returns. The important methods under this category are: (a) assignment, (b) transportation and (c) linear programming. However, just to give the flavour of this technique, only the transportation method will be discussed with a case illustration.

CASE 1

PRIMARY HEALTH CENTRES TO REFERRAL HOSPITAL

Referral hospitals (RHs) and primary health centres (PHCs) are the focal points of the public health care system. PHCs have their own limitations in extending health care facilities due to a lack of infrastructure. Comparatively, the referral hospitals in cities or district headquarters are well-equipped with infrastructure facilities. Often when critical, emergency or chronic cases are brought to a PHC, they are generally sent to referral hospitals. While referring a case, the distance between a PHC and a RH is a major criterion for taking a decision. The shortest distance between them is always preferred so that the travel time and cost is minimum, as far as possible. The District Health and Medical Officer has been receiving complaints that the person in charge at the PHC generally does not follow this criterion always.

The Rayalaseema region of Andhra Pradesh has three well-equipped referral hospitals, call them RH1, RH2 and RH3, having a bed capacity of 90, 40 and 80 respectively. Past historical data revealed that of the 30 PHCs, five, PH1, PH2, PH3, PH4 and PH5 have been found to be demanding referral facilities at a relatively higher level. On an average, monthly cases referred from them were 30, 50, 40, 60 and 30 respectively. The distance in kilometres between each referral hospital and PHC are:

	PH1	PH2	PH3	PH4	PH5
RH1	10	20	5	9	10
RH2	5	10	8	30	6
RH3	3	20	7	10	4

In a more practical situation, a patient will seldom travel alone, but will invariably be accompanied by one or two attendants. Thus, the travel and transportation cost of a patient should include the cost incurred by the attendants too. For simplicity, assume that the travelling cost per kilometre is Rs 10. The District Health and Medical Officer is interested in developing an optimal allocation policy which will minimise the total transportation cost for the community. The objective is to decide the number of cases which will be referred to each RH from each PH, so that the total money spent by the community in a month on transportation is minimal.

This situation is termed as the transportation model, and described through a matrix (a two-sided table). On one side the *sources* (warehouses or storage depot), and on the other side, *destinations* (markets or service centres), are depicted. Generally, when the total availability at the sources is equal to the total requirements at the destinations, the problem is termed as a balanced transportation model, otherwise an artificial source or destination should be created to balance the table.

The transportation cost data, the bed capacity of referral hospitals (destinations), and the number of cases referred by the primary health centres (sources) are presented in a standard matrix format. The cost data will include attendants' expenses. For the sake of convenience of the reader's understanding this is constructed as a balanced transportation model and the data matrix is presented in Table 12.1.

The objective function here is to minimise the total distance covered, which will be the same as minimising the total transportation cost, since the cost per kilometre remains the same, and the number of attendants is kept at the same level. If these are varying, then the actual value will be entered into the table.

Table 12.1 Basic Transportation Matrix Data

Referral Hospital (RH) (Destination)	Public Health Centre (Source)					RH bed capacity
	PH1	PH2	PH3	PH4	PH5	
RH1	10	20	5	9	10	[90]
RH2	5	10	8	30	6	[40]
RH3	3	20	7	10	4	[80]
PH Referrals	[30]	[50]	[40]	[60]	[30]	[210]

In OR literature there are a number of methods available to find feasible solutions, such as the North West Corner rule, the Row Minima, the Column Minima, and the Matrix Minima, and also many methods to find the optimal solution. This is where mathematical logic is used and the validity of the method is checked. However, these procedures will not be explained here, since a high level of mathematical knowledge is required on the part of the reader to understand and appreciate the methodology. But this does not preclude finding a solution, because simplified computer solutions, even for a PC, are easily available in the software market. The user only needs to buy the software and follow the instructions to obtain the solution.

One of the logically suited methods for getting a feasible solution may be the Column Minima method. This method suggests that after identifying the minimum element in each column, allocate the maximum feasible number, as determined by the boundary total at these positions. Then cross off that row or column, if availability or requirement is exhausted or satisfied. Then update the matrix rim, and repeat this till all allocations are completed. Arriving at the feasible solution by means of this method suggests the allocations shown in Table 12.2

Table 12.2 Final Transportation Allocation

Referral Hospital (RH) (Destination)	Public Health Centre (Source)					RH bed capacity
	PH1	PH2	PH3	PH4	PH5	
RH1	10	20	5	9	10	
			[40]	[50]		[90]
RH2	5	10	8	30	6	
		[40]				[40]
RH3	3	20	7	10	4	
	[30]	[10]		[10]	[30]	[80]
PH Referrals	[30]	[50]	[40]	[60]	[30]	[210]

Thus, by the Column Minima method, the final allocations are made as follows:

Cases Referred	Travel/distance (km)	
PH1 to RH3	30	30 times 3 = 90
PH2 to RH2	40	40 times 10 = 400
PH2 to RH3	10	10 times 20 = 200
PH3 to RH1	40	40 times 5 = 200
PH4 to RH1	50	50 times 9 = 450
PH4 to RH3	10	10 times 10 = 100
PH5 to RH3	30	30 times 4 = 120
		Total distance = 1,560

Total Transportation cost, 1,560 times Rs 10 = Rs 15,600

The next step is to search for an optimal solution to the problem. OR literature gives the Stepping Stone Method and Vogel's Approximation Method (VAM) for finding the optimal solution. In most cases, VAM will be quite suitable due to its simplicity. However, one can adopt the black box principle and use computer software to arrive at the optimal solution, without utilising the mathematical procedure.

CASE 2

THE COLD CHAIN SYSTEM

'The Cold Chain' is the system of storing and transporting vaccines at the recommended temperature (normally cold storage) from the manufacturer, the medical store at state and district headquarters, and so on, to various PHCs. Till recently, the ultimate aim was to maintain a constant supply to critical PHCs from the three main sources of supply. Of late, it has been observed that the transportation and distribution of vaccine boxes was not cost-effective and allocations were being made *ad hoc*. There is ample scope for cost reduction, if the decision is made on a scientific basis, using methods of operations research.

The Directorate of Health and Medical Services of the Andhra Pradesh Government appointed a study group to look into the matter. The study group, after considering various parameters, such as estimated availability, estimated requirements and the expected transportation cost per unit of shipment, has formulated the information in Table 12.3.

TABLE 12.3 First Feasible Solution Matrix Data

Destination Referral Hospital	Source			Availability
	DHQ (District Head Quarter)	SHQ (State Head Quarter)	MFR (Manufacturer)	
PH1	1,100	1,300	900	[600]
PH2	1,200	900	800	[300]
PH3	1,000	1,100	1,400	[200]
PH4	800	1,100	1,300	[300]
Requirements	[200]	[500]	[1,000]	

MODELLING AND A FEASIBLE SOLUTION

Cost data and other information are already in the matrix notation. However, the problem lies with the unbalanced transportation model. To convert it into a balanced one, a dummy PHC (PH5) with requirement $1700 - 1400 = 300$ units is introduced. PH5 does not exist in reality, but is created for mathematical analysis, as a balanced model. Hence, the transportation cost for P5 is zero.

The Column Minima method, which was explained in Case 1, gives the total transportation cost equaling Rs 13.10 lakh.

MOVING TO AN OPTIMAL SOLUTION

The next phase is to search for the optimal solution. This will be illustrated by making use of Vogel's Approximation Method (VAM). The VAM is an easy and effective procedure, and in many cases, provides the optimal solution. The basic difference in VAM and the other method is that in VAM the criterion used is not only the minimum cost, but the cost difference between minimum cost and next to the minimum cost. The cost differences are calculated row-wise and column-wise. The highest cost difference is identified, then the maximum feasible allocation, which is the minimum of the two margin values, is made at the minimum cost element. The scientific logic is to prevent a high penalty for any wrong decision in allocation at the next higher level than the minimum. Then the new matrix is prepared, and again, the same procedure is repeated. This operation

is performed till all allocations are made. The complete solution is exhibited in Table 12.4 for ready reference:

Table 12.4 Final Transportation Allocation

<i>Destination Referral Hospital</i>	<i>Source</i>			<i>Requirements</i>
	<i>DHQ</i>	<i>SHQ</i>	<i>MFR</i>	
PH1	1,100	1,300	900	[600]
PH2	1,200	900	800	[300]
PH3	1,000	1,100	1,400	[200]
PH4	800	1,100	1,300	[300]
PH5 (Dummy)	0	0	0	[300]
Availability	[200]	[500]	[1,000]	[1,700]

Thus, the optimal allocation will result in

	Units	Cost	Total cost (Rs)
DHQ to PH4	200	800	160,000
SHQ to PH3	200	1100	220,000
SHQ to PH5	300	0	0
MFR to PH1	600	900	540,000
MFR to PH2	300	800	240,000
MFR to PH4	100	1,300	130,000

Total transportation cost is Rs.1,290,000

Thus, the VA Method gives a net saving of Rs (13.10 – 12.90) lakh = Rs 0.20 lakh over the Column Minima method. This is only for demonstration. However, going through the complete iterations on the computer, the optimal solution is found to be Rs 12.70 lakh.

Queueing Models

Queues or waiting lines have become an accepted fact of modern life. Normally, to most of us they mean delay in getting services, and we have endured the

unpleasant experience of the helpless-wait to get the service. The queueing theory is one of the most important techniques of OR, having a tremendous potential for application almost everywhere in medicare systems. Queueing models get complicated due to the variations in demand and delivery of services. Health service operations are affected by variations in demand, which is called the arrival pattern, since accidents or illnesses strike individuals as a chance occurrence. Variations in service delivery result from provider (service) and patient differences, and are further complicated by other aspects of the hospital set-up, such as equipment productivity, facilities arrangement and management policies. Situations where the queueing theory can be applied are in hospital emergency rooms, out-patient clinics, blood banks, admissions, and so on.

CHARACTERISTICS OF THE QUEUEING MODEL

1. **Source of arrivals:** The population source may be finite or infinite, but more realistic is the infinite population. Emergency patients, unscheduled ambulatory patient arrivals, telephone calls for services, and the like are examples of arrivals from an infinite population source. Scheduling of diagnostic tests for in-patients will be arrival from a finite population.
2. **Arrival pattern (scheduled or unscheduled):** Appointment systems and other scheduling methods are to limit random fluctuations in arrivals. In spite of that, arrivals rarely follow the schedule exactly. Most queueing models follow random (unscheduled) arrivals. It may not be possible to predict the arrival of a patient or customer. Emergency and elective admissions for surgery are examples of unscheduled and scheduled arrivals, respectively. The arrival pattern may also be time dependent.
3. **Service time distribution:** The length of time required by an individual patient to get service depends on many factors, and thus follows a random distribution.
4. **Queue discipline:** A queue discipline refers to the manner in which customers are selected or admitted for service. In most queueing models, the discipline is first in, first out (FIFO). However, there may be situations where priority may disturb the discipline. For example, emergency cases and VIPs.
5. **Number of servers (channels):** Queueing models exist for single or multiple servers situations. For multiple servers, the service time distribution for each server is generally assumed to be the same, for the sake of simplicity. There are situations where service is not completed at one centre (phase), and a patient has to go through a number of laboratory tests for diagnosis, so he has to undergo more than one service phase.

A pictorial representation of these characteristics is presented in Figure 12.1.

Figure 12.1 Queue Models

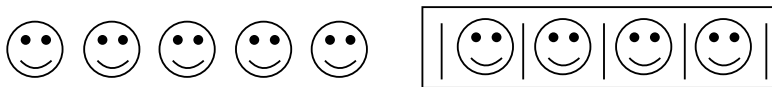
Single Server—Infinite Arrival



Multiple Server—Single Entry—FIFO



Single Entry—Sequential Service



NOTATION

For most queueing models, generally the Poisson Probability Distribution is assumed for the arrival of patients: The probability of ‘n’ units arriving at time ‘t’ is illustrated by the formula

$$\text{Prob } n(t) = [e^{-at}(at)^n]/n!$$

where ‘a’ is the arrival rate, ‘n!’ is factorial, ‘n’ and ‘e’ are exponential distribution.

The service time follows an exponential distribution,

$$f(t) = st^*e^{-st}$$

where ‘s’ is the mean service rate per unit of time.

The ratio, 'a/s', which is the ratio between arrival rate and service rate, is called the traffic intensity of a service facility. This ratio gives a quick idea if the waiting line is going to be out of control or explosive. The information about 'a/s' is vital in order to gain an insight into a given service system. The lower the value of traffic intensity, the higher is the operational efficiency. Therefore, the most important analysis is to find out the value of this ratio. Statistical methods are used to obtain the arrival probability distribution, the value of mean arrival rate (a), the services time distribution, the value of the mean service rate (s). In order to do this, historical data is collected and analysed to fit the distribution. It is also possible that this ratio is declared as a policy decision. For example, the facility will be designed for a waiting time not exceeding so many time units.

MODELS

M/M/1:inf/FIFO: Stands for a queuing model with Poisson arrival, exponential service, having a single server, first in, first out—service discipline with infinite waiting space.

M/M/C:inf/FIFO: Denotes Poisson arrival, exponential service distribution, multiple server C number of channels, first in, first out—service discipline with infinite waiting space.

For these models standard formulae are available to calculate:

- The number of patients in the system—waiting and getting service.
- The average number of patients in the system.
- The average queue length of patients.
- The average waiting time for a patient arriving at time 't'.
- The probability of the system being empty (unutilised).
- The probability of finding 'n' number of patients.
- The cost of waiting.

CASE 3

APPLICATION OF QUEUEING MODEL—APPALACHIA MEMORIAL HOSPITAL

A multiple server model with the FIFO service rule (M/M/C:inf/FIFO), or the multiple server model with the priority service rule (M/M/C:inf/priority), are commonly applicable in hospitals and health care institutions. The second model is applicable for Emergency and VIP admissions.

The case history of Appalachia Memorial Hospital is the finest case for understanding the application of queueing models in medicare systems (Panico 1969: 94–110). The Planning Committee of Appalachia Memorial Hospital collected data, obtained solutions from the application of mathematical models, and used them to design their facilities. This case helps in understanding how the waiting line pervades many departments. Some of the policies derived out of the analysis are:

- **Admissions:** Planned arrivals but random service:
- **Emergency:** Priority queues.
- **Obstetrics:** FIFO discipline.
- **Surgery:** Over-supplying of needs due to decisions based on uncertainty, which complicates scheduling.

CASE 4

APPLICATION OF QUEUEING MODEL—EMERGENCY ROOM OF A HOSPITAL

Nelson (1983) discussed an interesting situation in the emergency room of an urban hospital. The hospital has three examining rooms for non-emergency cases. They are examined according to FIFO discipline after they have been screened by a triage nurse. The hospital management wanted to know how additional resources in the emergency rooms might reduce congestion and waiting time for non-critical patients.

Analysis of past historical data finally provided the following condensed information for multiple server $C=3.0$, $a=9.0$ patients/hour, and $s=3.158$ patients/hour. In order to determine the effect of adding one more examining room; using queueing the theory, formulaes with $C=4$, and the comparison of results for $C=3$, and $C=4$, reveals the following interesting information (See Table 12.5).

Table 12.5 Comparative Analysis

<i>Queueing Model Results</i>	<i>C=3 Rooms</i>	<i>C=4 Rooms</i>
Average Number of Patients Waiting	17.30	1.80
Average Number of Patients in the System	20.15	4.64
Average Waiting Time (hours)	1.92	0.20
Average Time Spent in the System (hours)	2.24	0.52
Probability of all Servers being Idle	.0118	.0839

These results suggest that an additional examining room (and associated staff increases) will positively affect system performance. This analysis helped them arrive at the best and most acceptable policy.

Multi-server queueing models have been extensively used in the analysis of problems related to hospital administration by G.D. Rao and others (1972). Gaur (1997) discussed the application of controlled queueing models in health care services. In this model, the hospital provided the same kind of health care services to two types of patient groups. Type I were walk-in patients, whereas Type II were patients arriving with prior appointments with referrals from clinics of primary and community health centres. No control was imposed on Type II patients, but the entry of Type I patients was controlled by imposing certain rules based on the total number of patients in the combined single queue that had formed for registrations. The conclusions are discussed in detail in the referred paper.

Replacement Models in Health Care

Replacement models can be used both in man and machine systems. Consider first its application in machine systems. In the case of equipment and tools, their efficiency, in terms of productivity and quality output, decreases as they become old. We have to spend more money to keep it in shape and incur increasing repair and maintenance costs, which in turn, will increase the operating cost, with no assurance regarding the retention of productivity and quality. In such cases, replacement of an old equipment or tool with a new one will be a rational and economic alternative. Thus, it becomes necessary to determine the age at which a replacement is more economical, rather than continue operations at an increased cost. Replacement strategies will depend on the failure characteristics of the equipment and tools—the items which decay and slowly fail should be treated differently from those which are fully efficient until they suddenly and totally fail. Surgical tools will fall into the first category, and an X-ray machine will be in the second category.

The replacement of equipment and tools which deteriorate with time is quite significant for the following reasons:

- Increased expenditure on operating and maintenance costs: cost involved in running the equipment, along with repair and other maintenance costs.
- Decrease in the productivity of the equipment can be treated as a cost.
- Decrease in the cash value of the equipment, that is, the resale or scrap value of the equipment decreases with time.

Making use of the following notation if

- C is the capital cost of the equipment
- S(t) is the scrap or resale value of the equipment at time 't'
- U(t) is the operating cost at time 't'
- (t) is the number of time units (age)

then the total average cost (TAC) can be defined as (without going into the details of mathematical derivation):

$$\text{TAC} = [C - S(t) + U(t)]/t$$

This may be stated as a decision rule for minimising total costs as follows:

- Replace the equipment after 't' years, if the (t - 1) year's cost is greater than the weighted average of the cost up to 't' years.

The procedure is explained in Case 5.

CASE 5

REPLACEMENT OF MEDICAL EQUIPMENT

The Directorate of Health and Medical Service in Andhra Pradesh collected data from its past record regarding the yearly operating cost and the resale value of machines which are similar. The data is presented in Table 12.6. The capital cost of the equipment is Rs 2 lakh.

Since the average cost is minimum, Rs 19,750 in the eighth year, and then it increases, the equipment should be replaced at the end of the eighth year.

MACHINE SYSTEM VS HUMAN SYSTEM

There is a remarkable similarity in the failure pattern between the machine system and the human system. We have discussed the phenomenon of age of the equipment or human beings playing a key role in studying the failure probability distribution, along with other factors such as environmental problems, in-built deficiencies, manufacturing defects and natural health or maintenance care provided. If we plot a graph between the probability of failure and the age of a

machine or human system, in a majority of cases it follows the 'Bath Tub' curve. The life span of a machine or the human system is generally divided into three phases:

Table 12.6 Machine Age-cost Data

<i>(a) Data Table</i>										
<i>Year</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>	<i>10</i>
Operating Cost (Rs'000)	1	2	3	4	5	6	7	10	12	15
Resale Value (Rs '000)	180	160	140	120	100	80	80	80	50	40
<i>(b) Average Cost Calculation</i>										
(Rs '000)										
<i>Year (t)</i>	<i>Operating Cost U(t)</i>	<i>Cumulative Maintenance S(t)</i>	<i>Resale Value</i>	<i>C - S(t)</i>	<i>C - S(t) + U(t)</i>	<i>Average Cost</i>				
1	1	1	180	20	21	21				
2	2	3	160	40	43	21.50				
3	3	6	140	60	66	22				
4	4	10	120	80	90	22.50				
5	5	15	100	100	115	23				
6	6	21	80	120	141	23.50				
7	7	28	80	120	148	21.14				
8*	10	38	80	120	155	19.75*				
9	12	50	50	150	200	22.22				
10	15	65	40	160	225	22.50				

Note: *Minimum average cost.

Phase I

Indicates the initial period or age of the system, during which the system settles into stability. During this period, it may face teething problems, may need adjustments and recalibration and may be subjected to training. The probability of a failure is significant and high. This phase is also called infancy.

Phase II

Indicates the productive age of the system, during which time the probability of failure is quite low. Failure during this period is a chance or random occurrence

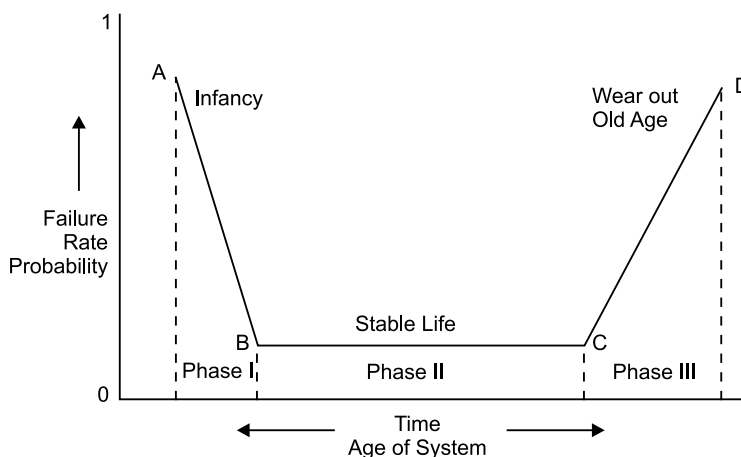
and may follow a Poisson Distribution. This is considered to be a period of useful or stable life.

Phase III

This indicates the wearing out and advancing age of the system. During this period, the probability of failure is on the high side, and ultimately leads to the end of its life. However, the useful life of the machine system can be increased or prolonged by providing substantial maintenance, such as major repair or overhaul; but finally when the machine is beyond repair, and its life is not economical any more, the decision is taken to discard it or totally replace it by a new one—equivalent to it or technologically better. This phase is called wear out or old age.

The three phases are shown in the following 'bath tub' diagram (Figure 12.2).

Figure 12.2 'Bath Tub' Curve



The phenomenon of the 'Bath Tub' failure pattern can be effectively utilised by the health planner or administrator in estimating phase-wise the population distribution in a state or district, and then in identifying the nature and extent of health care required by the population (patients) falling under each phase. Using simple statistical methods, it is possible to estimate the cut-off points 'B' and 'C' in the 'Bath Tub' curve. Phase I may be linked to child health care programmes. Family welfare programmes fit Phase II. Phase III is related to the health care programme for old people. The thrust and requirement of health care facilities, including drugs (medicines) and hospital facilities, and so on, can be then estimated and planned accordingly. This information is very critical in preparing

and estimating budget requirements for different phases related to health programmes and schemes launched by governments.

Network Techniques

CPM AND PERT

The Critical Path Method and Programme Evaluation and Review Technique, which comprise network analysis in OR techniques, have been extensively applied by Walter (1966) in planning the health programme for the US Department of Health. Meredith (1976) used PERT in health services, and Kost (1965) applied PERT to laboratory research and development planning. Sharma (1969) gives descriptions of applications regarding critical path analysis in health services in India. Srinivasan's book (1976) on Critical Path Analysis contains several case studies, is easy to read and has graded chapters. This section is based on Srinivasan (1976). Additional details are available in Gaur (1992).

The CPM is a deterministic model, while the PERT is a model under risk (probabilistic); CPM is capable of taking account of costs, but PERT is primarily concerned with time analysis. Generally, a PERT network is converted into an equivalent deterministic network, CPM, for all analysis—from the basics to the advanced, such as, resource smoothing. Currently, several software programmes are available in the market to apply this technique in a PC. These two techniques are powerful project management aids which help in planning, scheduling, monitoring, review, co-ordination, responsibility identification and mid-course correction. They help in identifying concurrent activities, which result in a shorter duration for the project and sequential activities, which distribute the resource demand.

Basic steps

The basic steps in network analysis are:

1. Breaking the entire project into smaller systems called tasks.
2. For each task determining the activities and events to be performed.
3. For each activity determining the preceding and succeeding activities (sequential restrictions).
4. For each activity determining or estimating the time and other resources needed, such as money, manpower and equipment.

5. Drawing a network depicting the assembly of tasks into a project.
6. Subjecting the network to network analysis—PERT and CPM.

The starting point of the network is the determination of the objective of the project, specifying clearly what is to be achieved, and the end point is the completion of the project contemplated. For the achievement of the objective, various activities must be performed, and corresponding results obtained. Any project, therefore, must be analysed in detail, in order to ascertain all the possible activities that would have to be performed to attain the objective. An analysis of these activities would indicate that some of these are represented in a network form, showing their interdependence and interrelationship. It gives a useful and graphic picture of the complete project at a glance, showing who is responsible for what, and it provides a time schedule. Thus, a network diagram of activities is the key feature of PERT and CPM, and acts as a road map to reach the objective.

ELEMENTS OF PERT AND CPM

Activity

Is a task or an item of work to be done that consumes time, material, money, manpower, skill, efforts and equipment.

Event

The specific point in time at which an activity begins or ends is called an event. Thus, an activity can be depicted by the beginning event and the ending event.

Dummy activity

An imaginary activity created to obey the sequential restriction. This consumes no resources—time and money are zero. This activity is created to provide network logic and continuity of flow.

Time duration

The time taken for completion of the activity. If this is definitely known, it is deterministic and has a single value. Otherwise, three time estimates are made. These are the optimistic time estimate—the shortest possible duration for completion, the pessimistic time estimate—the longest time for the completion of the activity, and the most likely time estimate—which is the reasonable time

duration, working at a normal pace with standard facilities. A statistical average of these three time estimates is made to represent the deterministic equivalent of CPM for the purpose of analysis.

Network

A graphic representation of the activities and events, showing their inter-relationships, and sequential concurrent performance. This helps to determine the earliest starting time for an activity or event, and also the latest starting time. When the network is completed, the longest path will show the activities which are critical for the completion of the project. The time value of this path will define the total duration for the project. The project time can be shortened further only if additional resources are pumped into the project. This analysis is known as crashing.

Slack

Following the logic of network construction, some activities will take a longer time to reach completion from what was specified, because of sequential conditions. This additional time, which is logically available, is called the activity slack. This helps in reallocating and sharing the resources. Manipulating 'slacks' in activities is an essential project management technique.

CASE 6

LAUNCHING A NEW PRODUCT IN A HOSPITAL—NETWORK CONSTRUCTION AND ANALYSIS

This is a case study which is rewritten for the easy understanding of the principles of network analysis. A corporate hospital can think of several products to be marketed. For example, executive health check-ups, Gold Card memberships, Heartline, Family Health Plan, and so on. This case study is about launching one such product in the market. The marketing department in the hospital used network analysis for planning and executing this project. The related activities are presented in Table 12.7. The time duration for the activities is taken as deterministic for convenience and ease of explanation, otherwise the three time estimate methods would have been applied. The format of this table provides a logical pattern for collecting and presenting data.

Table 12.7 Launching a New Product in a Hospital

<i>Activity Name</i>	<i>Description</i>	<i>Duration (days)</i>	<i>Sequential Condition</i>
L	Collect Data on Scope and Capabilities	4	none
M	Prepare Publicity Material	4	L
N	Chart Out Promotion Programme	4	M
P	Make Copies of Publicity and Promotion Material	9	M
Q	Training Drill	16	M
R	Prepare List of Invitees	2	N
S	Briefing the Chief Executive	1	N
T	Distribute Invitation Cards, Arrange Venue	2	S, R
U	Promotional Meetings	2	P,T
V	Product Demonstration	1	U,Q
W	Public Open House	1	V

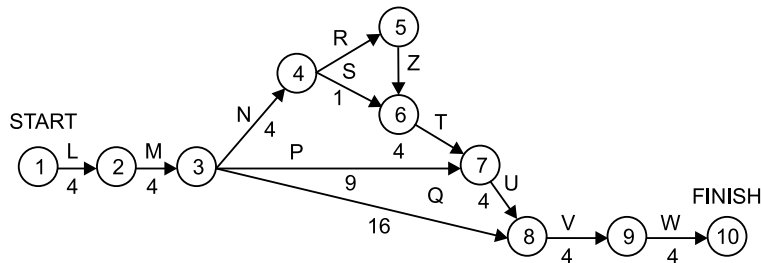
NETWORK ANALYSIS

The total duration of the project is 26 days. The 'critical path' is regarding the activities, L-M-Q-V-W. The activity-slack values are listed in Table 12.8. The activities which fall in the 'critical path' will have the 'slack' value of zero. The network is shown in Figure 12.3.

Table 12.8 Activity-Slack

<i>Activity</i>	<i>Earliest Starting Date</i>	<i>Latest Starting Date</i>	<i>Slack Days</i>
L	0	0	0
M	4	4	0
N	8	14	6
P	8	13	5
Q	8	8	0
R	12	18	6
S	12	19	7
T	14	20	6
U	17	22	5
V	24	24	0
W	26	26	0

Figure 12.3 The Network



Conclusion

This chapter provides an introduction to the non-mathematical reader about the principles and procedures of OR. The emphasis is on the multidisciplinary approach and in optimising resource utilisation. A selected few techniques are explained regarding their applicability in health care through case studies.

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PART 1

EXPERT SYSTEMS

Introduction

The human race is at a very critical crossroads. Our increasing dependence on machines is growing into an inclination towards machines doing most of our work. Our images of the future are fortified from futurists who have painted a picture of a functional and completely mechanised time, when everything is automated. The technology in health care has come a long way. Back from the days of the discovery of X-rays to the present times of fuzzy logic and Artificial Intelligence, humans have progressively made the diagnosis and cure of disease simpler and more efficient. Knowledge-based Expert Systems (ES) are increasingly being used in the delivery of health care. Presently ES can still be considered to be in their nascent stage. Not much is known about ES to the practitioners of medicine in India.

This chapter contributes to understanding the core of ES and Computer Aided Diagnosis. This is best demonstrated by developing a prototype system: a disease that is common to understand can be used to develop the prototype. This disease, for obvious reasons, is malaria. Thus developing a computer diagnostic aid for malaria to be used for preliminary diagnosis is the basic theme of this chapter.

What are Expert Systems?

Expert Systems (ES) are computer programmes that are derived from a branch of computer science research called Artificial Intelligence (AI). AI's scientific goal is

to understand intelligence by building computer programmes that exhibit intelligent behaviour. It is concerned with the concepts and methods of symbolic inference, or reasoning, by a computer, and how the knowledge used to make those inferences will be represented inside the machine.

ES attempt to impersonate human expertise by applying inference methods to a specific body of knowledge called the domain. The difference between knowledge and data is that data is passive and knowledge is active. Knowledge can be used at a later stage to infer new information from what is known about a particular problem. This domain knowledge is frequently represented as rules.

ES aim at exemplifying the knowledge and ability of an expert in a certain domain. Their performances in their specialised domains are often very impressive. The ES however lack the common sense, which human minds possess and this makes them incapable of taking decisions in case of atypical situations. This is the reason, which makes them, at times, very fragile in particular situations. By this is meant that they are difficult to extend beyond the scope originally contemplated by their designers, and they usually do not recognise their own limitations.

STRUCTURE

The three major components that appear virtually in every expert system are the **knowledge base**, **inference engine** and the **user interface**. In general, an expert system may contain the following components:

- Knowledge acquisition subsystem
- Knowledge base
- Inference engine
- User
- User interface
- Blackboard(workplace)
- Explanation subsystem(justifier)

Figure 13.1 shows the relationship of the components of expert system.

Knowledge acquisition subsystem

This refers to the build-up, relocation and transformation of the knowledge and problem solving ability of expert/ documented knowledge sources to the computer programme for forming the knowledge base, or at a later stage to expand it. The sources of knowledge for the knowledge base are the human experts for a particular

system, textbooks and articles for the particular subject, journals, database and the web.

Knowledge base

The knowledge base contains the knowledge necessary for understanding, formulating and solving problems. It includes two basic elements: *facts* such as the problem situation and theory of the problem area; and special *heuristics*, or rules that direct the use of knowledge to solve specific problems in a particular domain.

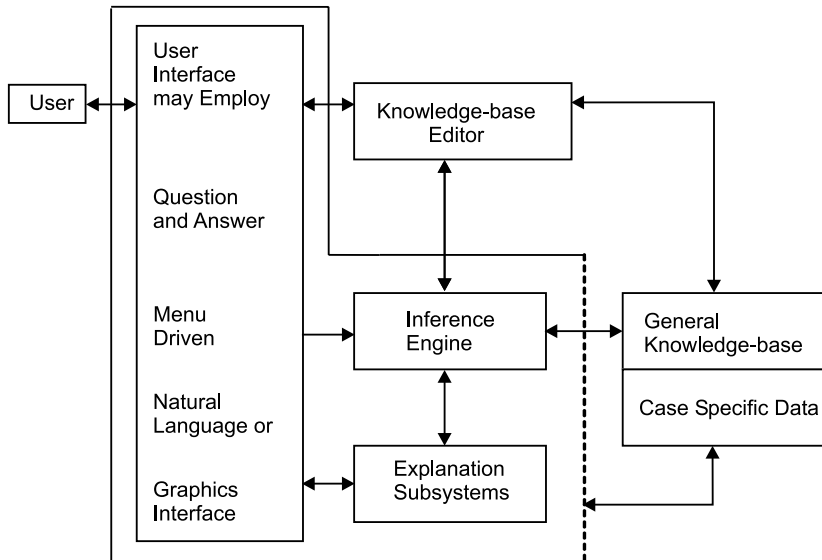
Inference engine

The inference engine is also known as the control structure or the rule analyst. This is fundamentally a computer programme, provides a set of rules or methods for reasoning about information in the knowledge base and the blackboard, and helps to arrive at a conclusion for a particular task.

User

This is the human who questions the Knowledge-base through the Inference Engine to get Explanations, which will help his/her interpretations, simulations and decision-making. The relationship and flow of this activity are shown in Figure 13.1.

Figure 13.1 Architecture of a Typical Expert System



User interface

ES include a language processor and this forms a friendly, pleasant, problem-oriented communication between the user at one end and the computer at the other end. The communication that is carried out in this process can be done using a language or by using menus and graphics.

Blackboard

Blackboard is an area of working memory that is set aside for the explanation of a particular problem, as denoted by the input data. The blackboard also records the intermediate data and this can be viewed from the database, at a later stage.

Explanation subsystem

The explanation subsystem has the capability of tracing backwards from the arrived conclusion to the source, which is very vital for proper problem solving and this explains the ES's ability to answer the questions during an interactive session with the user.

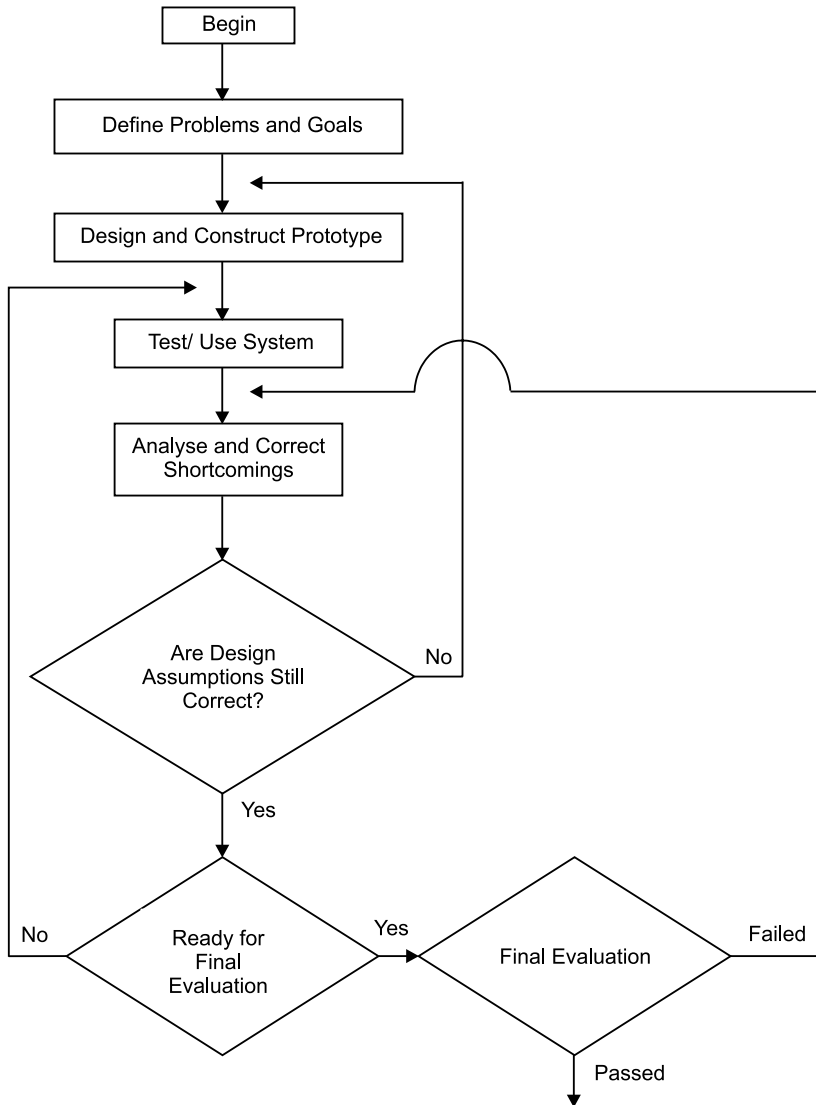
HEURISTICS

The main reason for considering ES as a branch of AI, is their capacity to solve a problem primarily based on heuristics. This is in contrast to the usual problem solving technique, which is based on algorithms. In heuristics, the problem is solved by trial and error method, and this is based on and guided by some reference to pre-determined goal. Heuristics is thus more practical and experimental, with a good knowledge of judgement.

REPRESENTING KNOWLEDGE USING RULES

The most important constituent of an expert system, its knowledge and efficiency, is determined by the high quality precise knowledge it has about various task domains. It is a constant endeavour of the AI researchers to explore and contribute more to the current selection of knowledge representation and interpretation methods to broaden the efficiency of the ES. The knowledge is usually represented in the computer as a set of rules. Figure 13.2 explains the steps in building this logic.

Figure 13.2 Exploratory Development Cycle



THE INFERENCE ENGINE

The real beauty of an expert system is its capacity to draw inferences and to arrive at conclusions and this is what makes it intelligent. To solve a problem, an ES needs to decide, among all the possibilities and options available, as to what

to choose and in what order the rules should be selected for assessment. To do this, the ES uses the inference engine, which is basically a programme that interprets the rules in the knowledge base to arrive at a conclusion. In the process, the Expert System uses two strategies—*Backward Chaining* or *Forward Chaining*. To solve a particular problem, an ES may use either one of them or a combination of both. Most ES have the ability to give explanation for selecting a particular answer amongst all the choices/options available.

A backward chaining inference engine is 'goal-orientated' in the sense that it tries to prove a goal or rule conclusion by confirming the truth of all of its premises. A forward chaining inference engine examines the current state of the knowledge base, finds those rules whose premises can be satisfied from known data, and adds the conclusions of those rules to the knowledge base. It then re-examines the complete knowledge base and repeats the process, which can now progress further, since new information has been added. Both the backward and forward inference process will consist of a chain of steps that can be traced by the expert system.

THE INFERENCE RULE

An understanding of the 'inference rule' concept is important to understand ES. An inference rule is a *statement* that has two parts, an *if-clause* and a *then-clause*.

The rule base of an ES has many statements with if- and then-clauses. They are entered as separate rules and the Inference Engine uses them together in permutations and combinations to draw a conclusion. One advantage of inference rules over traditional programming is that inference rules use reasoning, which closely resembles human reasoning.

Thus, when a conclusion is drawn, it is possible to understand how this conclusion was reached. Furthermore, because the expert system uses knowledge in a form similar to the expert, it may be easier to retrieve this information from the expert.

EXPLANATION FACILITIES

ES have an ability to explain the reasoning processes and these explanation process facilities help the user in a better understanding of the behaviour of the system. This also helps the user to accept the answers of the ES, which are based on some justification. For example, a medical expert providing a diagnosis and treatment of a patient would be expected to explain the reasoning behind his/her

conclusions: the uncertain nature of this type of a decision may demand a detailed explanation so that the patient concerned is aware of any risks, alternative treatments, and so on.

INTELLIGENT FRONT-END PROCESSORS

An Intelligent Front-End (IFE) is a software that is situated between the user and the conventional computer programme. The main advantage of having an IFE is to make the system more user-friendly by the use of Knowledge Base System or AI and permitting more flexible user dialogue. The IFE would do this by gaining an understanding of the user's requirements, and then using this specification to generate instructions for running the software package. To produce the specification of the user's problem, the IFE may use a variety of techniques, particularly when carrying out interactive dialogue with the user.

REQUIREMENTS OF EXPERT SYSTEM

- The ES should support the scrutiny of their own reasoning processes, both in the transitional steps and also in answering the questions about the solution processes.
- The ES should be flexible in the sense that it should support addition and deletion of skills from the knowledge base.
- The ES should use heuristic reasoning while obtaining a useful problem.

DOMAIN FOR AN EXPERT SYSTEM

- Interpretation
- Prediction
- Diagnosis
- Design
- Planning
- Monitoring
- Debugging
- Instruction and control

EXPLANATION AND TRANSPARENCY IN GOAL-DRIVEN REASONING

Usually, the ES answer two types of questions—*Why* and *How*. The *Why* query occurs when the system seeks more inputs/information and the user asks—why

did the system ask for this information? The *How* query occurs when the user asks the system the rationale behind the result that the system arrived at.

OPERATION OF THE SYSTEM

Again there are three modes to the operation of the system:

1. the knowledge acquisition mode;
2. the consultation mode; and
3. the explanation mode.

Knowledge acquisition mode

The flow of knowledge acquisition is shown in Figure 13.3.

Figure 13.3 Flow of Knowledge Acquisition



In order to gain knowledge, the system must have the capability to liaise with people who are specialised in their area of activity. For example, for a medical ES, the system should be able to coordinate with the doctors in order to acquire knowledge and to update itself. The knowledge engineer's job in this is to act as a mediator between the specialist and system. Some typical information such as vocabulary, general concepts and facts, commonly arising problems, the solutions to the problems and the techniques are to be garnered to make it effective. The data that are entered in the system must follow a uniform pattern and should be consistent. A number of tests are to be performed to ensure that the conclusions drawn are sensible and correct.

Consultation mode

The system is in this mode when a user is interacting with it. The user interacts by entering data in English and the system responds to the user's questions by using the inference engine. The role of the inference engine is to search for facts that match the condition part of the productions that match the action part of the question. There is scope for the use of heuristics in this role. The following example is hypothetical but illustrates the action of a typical system.

System: What is the patient's name?

User: Mr. Amit Arora.

System: What is the patient's age?

User: 28 years.

System: Is the patient male or female?

User: Male.

System: What are the symptoms?

User: Fever with chill and rigor, headache, dizziness and upset stomach.

System: When did these symptoms first appear?

User: 28 May 2005.

System: Are the vital parameters within normal limits?

User : Yes.

System: Treat symptomatically for the time being. Evaluate physically and investigate to rule out malaria. Prescribe anti-malarials, if malarial tests are positive.

Explanation mode

This can trace the responsibility from conclusions to their sources, which is crucial in both expertise and also problem solving. This can also explain the ES's behaviour by interactively answering questions.

BENEFITS OF EXPERT SYSTEMS

- **Increased output and productivity:** Once the system is ready for use, it can work much faster than a human brain and fewer workers are needed, thus reducing the costs and increasing the output.
- **Reduced downtime:** ES can save a considerable amount of money for the company involved by reducing the downtime.
- **Increased quality:** ES provide consistent advice and reduce the rate of error.
- **Capture of scarce expertise:** The expert system can capture the knowledge from a human expert in the form of data, which can be used to solve a problem in the later stages.
- **Reliability:** ES are reliable because they can be made to work any time and any day, according to the convenience of the user, with the same amount of consistency of output.
- **Accessibility to knowledge and help desks:** ES make knowledge accessible to people who query the systems for advice.
- **Flexibility**
- **Preservation of scarce expertise:** ES can be used to preserve the scarce expertise of people moving out from an organisation. These can be put to use at a later stage to solve problems by the system.

- Increased capabilities of other computerised systems.
- Improved decision-making process.

PROBLEMS AND LIMITATIONS OF EXPERT SYSTEM

- Knowledge is not always readily available.
- Expertise can be hard to extract from humans.
- Cannot easily adapt to new/unusual situations; not creative.
- Do not learn by experience.
- Not good at representing spatial knowledge.
- No common sense.
- Expensive and time-consuming to develop.

VERIFICATION, VALIDATION AND EVALUATION

An expert system is a computer programme that includes a representation of the experience, knowledge, and reasoning processes of an expert.

- **Verification** of an expert system, or any computer system for that matter, is the task of determining that the system is built according to its specifications.
- **Validation** is the process of determining that the system actually fulfills the purpose for which it was intended.
- **Evaluation** reflects the acceptance of the system by the end users and its performance in the field.

The system should be user-friendly. In other words:

- Verify to show the system is built right.
- Validate to show the right system was built.
- Evaluate to show the usefulness of the system.

Verification

Verification is done taking into consideration the following:

- The design should reflect the requirements and the issues contained in the requirements should be addressed in the design.
- The design should reflect the design goals and the code should accurately reflect the detailed design with correct use of language syntax to avoid bugs or technical errors.

Validation

Validation looks into the following:

- It compares the inferences made with the knowledge and heuristics of experts in the field.
- It also compares the inferences with the past known data.
- The capability of the system to simulate relevant empirical observations is assessed.
- The fraction of model predictions that are empirically correct is assessed.

Evaluation

Evaluation addresses the issue of whether the system gives value to its user.

Pertinent issues in evaluation are:

- The user-friendliness of the system and the acceptance of it by the user.
- The usefulness of the system as a training tool.
- The capability of the system to simulate relevant empirical observations.
- Is the system maintainable by people other than the developers?

NEED FOR VERIFICATION AND VALIDATION

After coding, any computer needs to be verified and validated before being put in for practical use. Since the ES is used for the diagnosis and treatment of diseases, even a minor error can end up claiming someone's life. Therefore, it is imperative to conduct a thorough verification and validation of the ES before using it to solve problems.

ES use computational techniques that involve making guesses, just as human experts do and so the possibility of committing errors cannot be ruled out. Even though the best knowledge is used to frame the ES, it does not completely predict what will happen. It is therefore essential for the human expert to validate the advice given by the ES. This is especially crucial when the ES is used by a person with less expertise in clinical knowledge, who cannot judge the accuracy of the advice from the ES.

In addition to the mistakes which an expert system will make, the knowledge that it has is confined to a limited boundary, that is, they only know what exactly has been put in the knowledge base and there is no underlying truth or fact structure to which it can turn in cases of ambiguity. If the ES does not have the

ability to realise its mistakes, there will be no one to detect the error, if a person with limited expertise in his field uses it. Hence, verification and validation play an important role in the development cycle of an expert system.

PART 2

DEMONSTRATION DATABASE: MALARIA

Introduction

Before we delve into the practical aspect of the ES, let us have a brief idea about the disease we have taken as an example for explaining the ES.

Malaria is a protozoal disease transmitted by the Anopheles mosquito, caused by minute parasitic protozoa of the genus Plasmodium, which infect human and insect hosts alternatively. It probably originated in Africa and accompanied human migration to the Mediterranean shores, India and South-east Asia. Today, some 500 million people in Africa, India, South-east Asia and South America are exposed to endemic malaria, and it is estimated to cause 2.5 million deaths annually, 1 million of which are children.

TYPICAL PRESENTATIONS

How different do patients of malaria look when they are first seen: Initially, the symptoms resemble those of a minor viral illness. These include:

- lack of a sense of well-being,
- headache,
- fatigue,
- abdominal discomfort,
- muscle aches followed by fever, and/or
- nausea/vomiting.

These may be followed by a typical malaria picture:

- Fever spikes (sudden rise and fall in temperature)
- Chills
- Rigors

Cold stage

As the temperature begins to rise, there is intense headache and muscular discomfort. The patient feels cold, clutches blankets, and curls up shivering and becomes uncommunicative (the chill). Within minutes the limbs begin to shake and teeth chatter, and the temperature climbs rapidly to a peak. The rigor usually lasts for 10–30 minutes but can last up to 90 minutes.

Hot stage

By the end of rigor there is peripheral vasodilatation and the skin feels hot and dry. The temperature is high.

Sweating

Profuse sweat then breaks out. It lasts for two to four hours. The patient is soaked in sweat and the temperature falls. The blood pressure is relatively low. The patient feels exhausted and may fall asleep. Defervescence (the abating or disappearance of fever) usually takes four to eight hours. Fever is irregular at first with temperature exceeding 39°C. It may rise up to 40°C.

DIAGNOSIS OF MALARIA

Diagnosis of malaria involves identification of the malaria parasite or its antigens/products in the blood of the patient. Although this seems simple, the efficacy of the diagnosis is subject to many factors. The different forms of the four malaria species; the different stages, the endemicity of different species; the population movements; the interrelation between the levels of transmission, immunity, parasitaemia and the symptoms; the problems of recurrent malaria, drug resistance, persisting viable or non-viable parasitaemia, and sequestration of the parasites in the deeper tissues; and the use of chemoprophylaxis or even presumptive treatment on the basis of clinical diagnosis can all have a bearing on the identification and interpretation of malarial parasitaemia on a diagnostic test.

CLINICAL EXAMINATION

General: Functional status, prostration, breathlessness, level of consciousness, hydration, toxicity, puffiness of face and lids, and so on.

Vital signs: Pulse rate, blood pressure (hypotension), temperature (hyperpyrexia), respiratory rate (tachypnoea, acidotic breathing).

Other signs: Pallor, jaundice, cyanosis, oedema, and so on.

Abdomen: Liver, spleen, bowel sounds—Tender hepatomegaly or splenomegaly is more common in acute malaria.

Respiratory system: Basal crackles, wheezes; sometimes associated pneumonia and its bronchial breath sounds.

Central Nervous System (C.N.S.): Level of sensorium, convulsions, neck stiffness, ocular fundii, any focal deficits.

INVESTIGATIONS

Haemoglobin: Anaemia is common in malaria. Rapid reduction in level of haemoglobin is seen in falciparum malaria and less than 7 g/dl should be a warning.

Total leucocyte count: It can vary from low to high, and neutrophilic leucocytosis is common in severe malaria with or without associated bacterial infection. Leucopenia is seen in severe malaria with septicaemia, and chronic hypersplenism.

Platelet count: Thrombocytopenia is common in *P. falciparum* and *P. vivax* malaria, but it does not correlate with the severity of the infection.

Parasite count: This is a simple yet very important and useful method of assessing the severity of infection in *falciparum* malaria. It should be done routinely in all cases of *falciparum* malaria.

TESTS FOR CONFIRMATION

The specific tests that are done to confirm malaria can be divided into microscopic and non-microscopic tests.

Microscopic tests

For nearly a hundred years, the direct microscopic visualisation of the parasite on the thick and/or thin blood smears has been the accepted method for the diagnosis of malaria in most settings—from the clinical laboratory to the field surveys. The careful examination of a well-prepared and well-stained blood film currently remains the 'gold standard' for diagnosis of malaria.

The microscopic tests involve staining and direct visualisation of the parasite under the microscope. The two tests are the Peripheral Smear Study and the Quantitative Buffy Coat (QBC) test. The simplest and surest test is the time-honoured peripheral smear study for malarial parasites. None of the other newer tests have surpassed the 'gold standard' peripheral smear study.

Points to remember

- Malarial Parasite (MP) test should be asked for in all cases of fever and related symptoms and also whenever there is high level of suspicion.
- MP test can be done at any time. One should not wait for typical symptoms and signs or for chills.
- A negative test DOES NOT rule out malaria. Repeated tests may have to be done in all doubtful cases. Duration of the illness, level of parasitaemia, expertise of the technician and the method of examination may all have a bearing on the result of the MP test.

Peripheral Smear Study for malarial parasites: MP test

Peripheral smear study for malarial parasites is the gold standard in diagnosing malarial infection. It involves collection of a blood smear, its staining with Romanowsky stains and examination of the Red Blood Cells for intracellular malarial parasites. Thick and thin smears are usually prepared. Thick smears are used to identify the parasites and thin smears for identifying the species. The smear can be prepared from blood collected by veinpuncture, finger prick and ear lobe stab. In obstetric practice, cord blood and placental impression smears can be used.

Sometimes no parasites can be found in peripheral blood smears from patients with malaria, even in severe infections. This may be explained by partial antimalarial treatment or by sequestration of parasitised cells in deep vascular beds. In these cases, parasites, or malarial pigment may be found in the bone marrow aspirates. Presence of malarial pigment in circulating neutrophils and monocytes may also suggest the possibility of malaria.

Diagnostic points for *P. falciparum*

1. Red cells are not enlarged.
2. Rings appear fine and delicate and there may be several in one cell.
3. Some rings may have two chromatin dots.
4. Presence of marginal or applique forms.
5. It is unusual to see developing forms in peripheral blood films.
6. Gametocytes have a characteristic crescent shape appearance. However, they do not usually appear in the blood for the first four weeks of infection.
7. Maurer's dots may be present.

Diagnostic points for *P. vivax*

1. Red cells containing parasites are usually enlarged.
2. Schuffner's dots are frequently present in the red cells as shown above.

3. The mature ring forms tend to be large and coarse.
4. Developing forms are frequently present.

Diagnostic points for *P. malariae*

1. Ring forms may have a squarish appearance.
2. Band forms are a characteristic of this species.
3. Mature schizonts may have a typical daisy head appearance with up to 10 merozoites.
4. Red cells are not enlarged.
5. Chromatin dot may be on the inner surface of the ring.

Diagnostic points for *P. ovale*

1. Red cells enlarged.
2. Comet forms common (top right).
3. Rings large and coarse.
4. Schuffner's dots, when present, may be prominent.
5. Mature schizonts similar to those of *P. malariae* but larger and coarser.

Quantitative Buffy Coat (QBC) test

The QBC test developed by Becton and Dickenson Inc. is a new method for identifying the malarial parasite in the peripheral blood. It involves staining of the centrifuged and compressed red cell layer with acridine orange, and its examination under UV light source. It is fast, easy and claimed to be more sensitive than the traditional thick smear examination. A negative test can be reported within one minute and positive result within minutes. A comparison of factors between 'Peripheral Smear' and 'QBC' is given in Table 13.1.

Table 13.1 Comparison between Peripheral Smear and QBC Test for Detecting Malaria

Factor	Peripheral Smear	QBC
Method	Cumbersome	Easy
Time	Longer, 60–120 minutes	Faster, 15–30 minutes
Sensitivity	5 parasites/ μ l in thick film and 200/ μ l in thin film	Claimed to be more sensitive, at least as good as a thick film
Specificity	Gold standard	False positives, artifacts may be reported as positive by not-so-well-trained technicians
Species Identification	Accurate, gold standard	Difficult to impossible
Cost	Inexpensive	Costly equipment and consumables
Acceptability	Near universal	Limited
Availability	Near universal	Limited
Other	—	Accidentally can detect filarial worms

Therefore, whenever in doubt, one should ask for a peripheral smear study, particularly for species identification. There are instances of cases diagnosed as *vivax* malaria on the QBC, but soon after developed fatal complications of *falciparum* malaria.

Non-microscopic tests

These tests involve identification of the parasitic antigen or the antiplasmodial antibodies or the parasitic metabolic products. Nucleic acid probes and immunofluorescence for the detection of *Plasmodia* within the erythrocytes; gel diffusion, counter-immunoelectrophoresis, radio immunoassay, and enzyme immunoassay for malaria antigens in the body fluids; and haemagglutination test, indirect immunofluorescence, enzyme immunoassay, immunochromatography, and Western blotting for anti-plasmodial antibodies in the serum have all been developed. These tests have found some limited applications in research, retrograde confirmation of malaria, investigation of cryptic malaria, transfusion blood screening, and investigation of transfusion acquired infections.

1. Rapid Diagnostic Tests (RDTs).
2. Para Sight F test.
3. Optimal Assay.
4. The immunochromatographic test (ICT malaria Parasite f. test).
5. Polymerase chain reaction.
6. Detection of antibodies by Radio immunoassay, immunofluorescence or enzyme immunoassay.

Rapid diagnosis of Malaria

Although the peripheral blood smear examination that provides the most comprehensive information on a single test format has been the 'gold standard' for the diagnosis of malaria, the immunochromatographic tests for the detection of malaria antigens, developed in the past decade, have opened a new and exciting avenue in malaria diagnosis. However, their role in the management and control of malaria appears to be limited at present.

The Rapid Malaria Tests

The RDTs have been developed in different test formats like the dipstick, strip, card, pad, well, or cassette; and the latter has provided a more satisfactory device for safety and manipulation. The test procedure varies between the test kits. It is also claimed that the rapid diagnostic tests can be performed by individuals with

minimal training. With the different tests that are currently available, the procedure may involve two to six steps and take five to 30 minutes. The cost of the RDT also varies from test to test and from country to country.

Problems with Rapid Malaria Tests

Cross-reactions with autoantibodies: Studies have reported cross reactivity of the various RDTs with autoantibodies such as rheumatoid factor, resulting in false positive tests for malaria.

Sensitivity: RDTs for the diagnosis of *P. falciparum* malaria generally achieve a sensitivity of >90% at densities above 100 parasites per μL blood and the sensitivity decreases markedly below that level of parasite density.

False positivity: False positive tests can occur with RDTs for many reasons such as persistence of antigens, incomplete treatment and cross infections.

False negativity: On the other hand, false negative tests have been observed even in some cases with severe malaria.

Multiple influences: The performance of the RDTs is reported to be influenced by a multitude of factors like the type of the parasite and the level of parasitaemia, the type of test, the target antigen and the capture antibody, the expression of the target antigens on the parasites and the presence of several isomers.

Persistence of antigens: All the antigens targeted by the RDTs and persistent antigenaemia can cause positive tests on RDTs up to one month of incubation.

Interpretation

Although the RDTs have been reported to be useful and easy tools for field surveys in remote forests and villages, some studies have found that the experience and the level of training of the field staff can influence the sensitivity and specificity of these tests. The RDTs have been evaluated for the diagnosis of malaria in travellers, as self-use kits and at the laboratories.

A potential problem with the dipstick test is that the circulating antigen will be detectable for many days even after the elimination of viable *P. falciparum* from the blood stream. A positive test therefore may not always indicate an active infection.

OTHER TESTS FOR MALARIAL PARASITES

Polymerase Chain Reaction (PCR)

The PCR test is reportedly 10-fold more sensitive than microscopy. The PCR test has also been found useful in unraveling the diagnosis of malaria in cases of undiagnosed fever.

Detection of antimalarial antibodies

Malarial antibodies can be detected by immunofluorescence or enzyme immunoassay. It is useful in epidemiological surveys, and for screening potential blood donors.

Intraleucocytic malaria pigment

Intraleucocytic malaria pigment has been suggested as a measure of disease severity in malaria.

Flowcytometry

Flowcytometry and automated haematology analysers have been found to be useful in indicating a diagnosis of malaria during routine blood counts.

Mass spectrometry

Mass spectrometry is an analytical technique used to measure the mass-to-charge ratio of ions. It is generally used to find the composition of a physical sample by generating a mass spectrum representing the masses of sample components. There are many bits of information that can be gleaned from mass spectrometry data, such as, the masses of the molecules, the purity of the sample and the structure of the molecules.

OTHER INVESTIGATIONS

- Moderate elevation in blood urea and creatinine are common. Significant increase is suggestive of renal impairment.
- Hyperbilirubinaemia is common in malaria, particularly due to haemolysis. Some patients with *falciparum* malaria may have very high levels of conjugated bilirubin due to associated hepatocyte dysfunction.
- Serum albumin levels may be reduced, some times markedly.
- Serum aminotransferases, 5' - nucleotidase and lactic dehydrogenase are elevated.
- Prothrombin time and partial thromboplastin time are elevated in 20 per cent of patients with cerebral malaria. Some may have features of disseminated intravascular coagulation.
- Hyponatraemia is common and needs careful management.
- Lactic acidosis is seen in severely ill patients, especially in patients with hypoglycaemia and renal dysfunction. It can be suspected if there is a wide anion gap.

- Urine examination may show albuminuria, microscopic haematuria, haemoglobinuria and red cell casts. With massive intravascular haemolysis, urine may be black in colour.

APPROACH TO MALARIA DIAGNOSIS

A clinician who faces a case of fever would need answers to the following questions:

- Is it malaria?
- If yes;
 - What is the species?
 - Is it severe?
 - Is it new/ recurrence?
 - Is it active?

At present, ONLY the peripheral smear can provide answers to ALL these questions on a single test. With trained technicians, blood smear remains the gold standard for detection, for speciation, for parasite count and for identification of different forms of the parasites. Therefore, rely ONLY on the peripheral smear for speciation, parasite count and identification of parasite forms. The QBC test performed by trained personnel could match a thick blood smear for detection of malaria. The RDTs cannot be used as reliable tools for diagnosis of malaria. The flow diagram of Clinical Features and MP Test is presented in Figure 13.4. The different states in the interpretation of the Pre-treatment MP Test are shown in Figure 13.5.

Figure 13.4 Clinical Features and MP Test

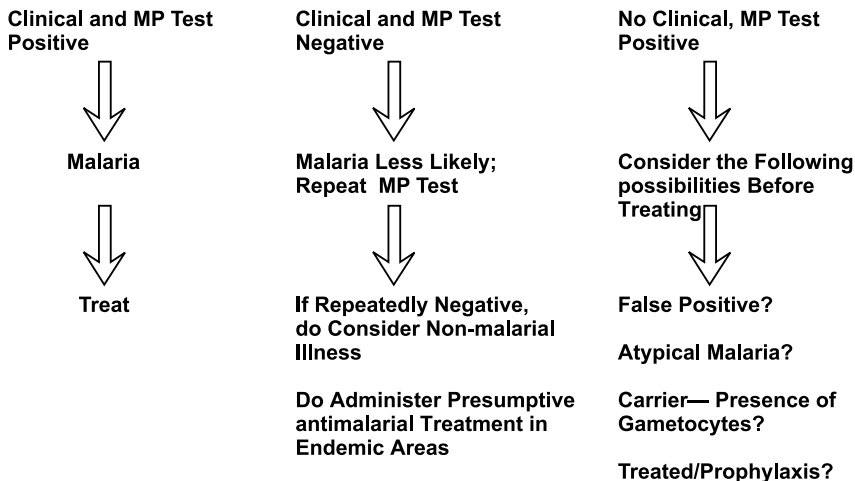
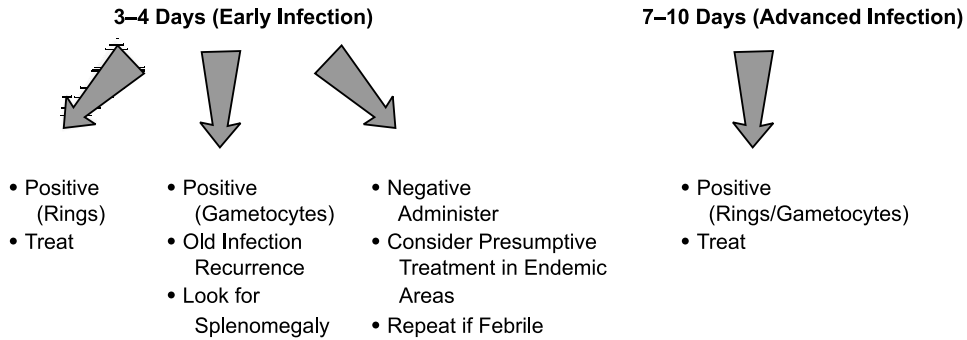


Figure 13.5 Interpretation of Pre-treatment MP Test



TREATMENT

The detailed mode of treatment is beyond the scope of discussion at this level. Only the type of malarial parasite and the type of drugs that are used to treat their different types are mentioned here. It is to be remembered that while prescribing a drug to a patient, several factors are to be taken into consideration. The common ones are the type of patient, various factors like age, gender, physical state, and the area to where he/she belongs, the contraindications, the side effects and above all, the sensitivity of the parasite of that region to that drug.

Plasmodium falciparum

For uncomplicated malaria

The cases are divided into two groups according to the sensitivity of the parasite to Chloroquine.

1. **Chloroquine sensitive cases:** combination of Chloroquine + Primaquine.
2. **Chloroquine resistant cases:** any of the combinations as mentioned below can be used for the treatment:

- Quinine + Pyrimethamine/Sulfa
- Quinine + Tetracycline/Doxycycline
- Artesunate + Mefloquine
- Mefloquine + Pyrimethamine/Sulfa

For complicated malaria

1. For Chloroquine sensitive cases: Chloroquine + Primaquine.

2. For Chloroquine resistant cases any of the following combinations are used:
 - Injectable Quinine + Pyrimethamine + Sulphadoxine.
 - Injectable Quinine + Tetracycline/Doxycycline.
 - Injectable Artemether/Arteether/Artesunate + Mefloquine.

Plasmodium vivax and Plasmodium ovale

Chloroquine + Primaquine

Plasmodium malariae

Atovaquone + Proguanil

SOFTWARES USED

In order to develop the prototype expert system to diagnose malaria, two softwares are used. The Front End is the user interface, that is, what the users see. It consists of the various forms with all the command buttons, pictures, option buttons, and so on. Here, Microsoft Visual Basic is used. The Back End is the database where all the informations are stored in fields. The fields which are related to each other are kept as records for easy retrieval. For this purpose, MS Access has been used in this instance.

PART 3

HOW TO USE THE SYSTEM

The system is just a prototype and needs further improvements to make it fully functional.

The first step is to register the patient. He/she is given a new Unique Health Care Identifier (UHID) number and registered. This data is stored into the database (MS Access). On subsequent visits, the whole profile is retrieved from the database by typing the UHID number and clicking FIND. His/her whole data can be updated by clicking the UPDATE option. In case of new patients, this form is filled up and the NEXT button is clicked, which will ask for the presence or absence of fever. The form template for Registration is given in Figure 13.6. The History of Fever is entered in the format given in Figure 13.7.

Figure 13.6 Registration

The screenshot shows a Microsoft Visual Basic form titled "REGISTRATION" within a window named "Form2". The form is set against a dotted grid background. It contains the following fields and controls:

- Labels: "UHID No", "DATE", "PATIENT NAME", "FATHER'S NAME", "ADDRESS", "AGE", "GENDER", "TYPE of PATIENT".
- Input fields: Text boxes for "UHID No", "DATE", "PATIENT NAME", "FATHER'S NAME", and "ADDRESS".
- Dropdown menus: "select" buttons for "AGE", "GENDER", and "TYPE of PATIENT".
- Buttons: "DIAGNOSIS", "ADD", "UPDATE", "FIND", "DELETE", "EXIT", and "NEXT".

The Windows taskbar at the bottom shows the Start button, several icons, and the system tray with the time 5:34 PM.

Figure 13.7 History of Fever

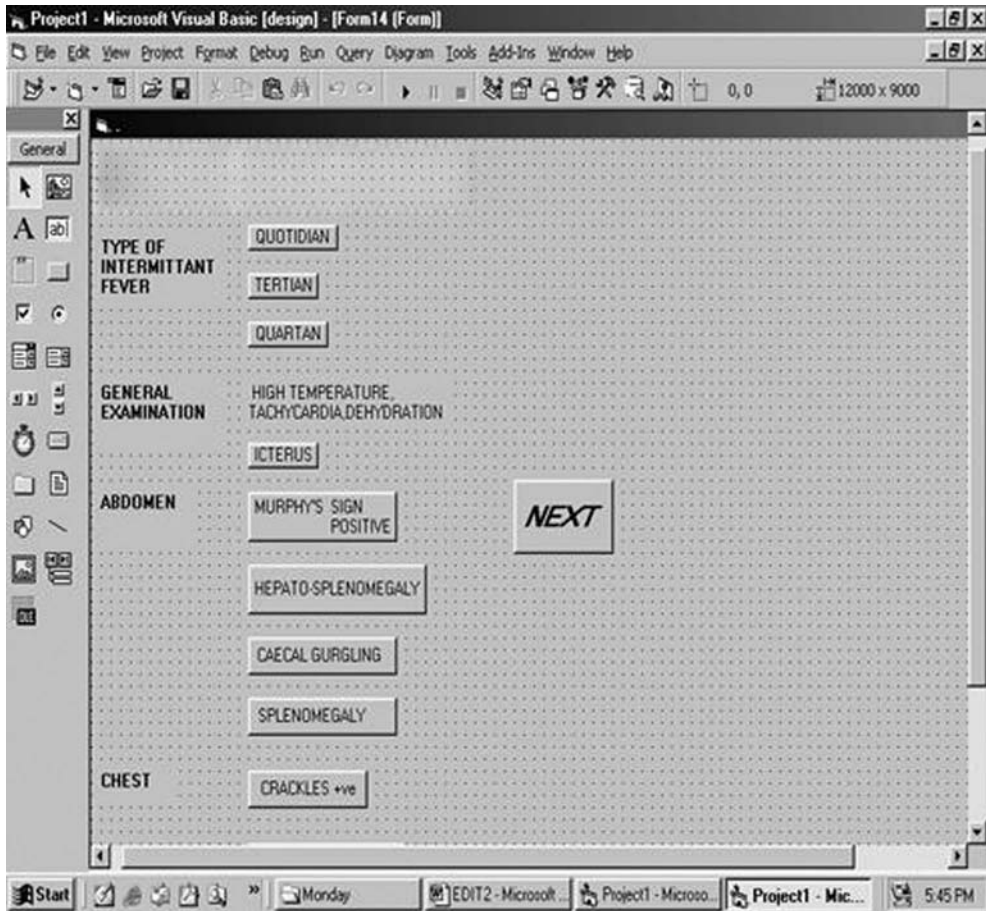
The screenshot shows a Microsoft Visual Basic form titled "HISTORY OF FEVER" within a window named "Form1". The form is set against a dotted grid background. It contains the following controls:

- Buttons: "Present" and "Absent".

The Windows taskbar at the bottom shows the Start button, several icons, and the system tray with the time 5:36 PM.

The patient is asked for the history of fever. If it is absent, then Malaria is ruled out. When the PRESENT button is clicked, the next screen will come which will ask for the type of fever and also the various signs accompanying the fever. The template for evaluation of signs is given in Figure 13.8.

Figure 13.8 Evaluation of Signs



The physician examines the patient and clicks on the findings which are present. This will also help to arrive at a differential diagnosis. Some diseases will be ruled out at this stage. To confirm the disease, a number of tests are available which are done and the results are fed into the system in the next screen (Figure 13.9).

Figure 13.9 Investigations

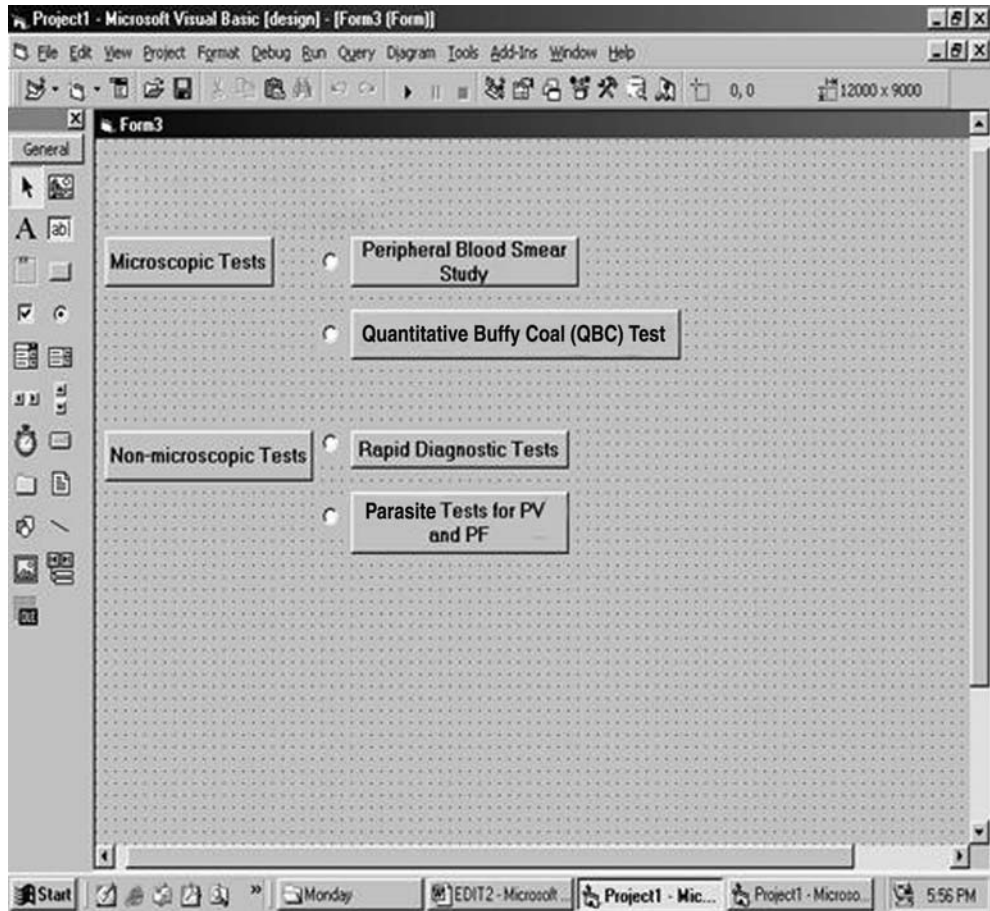
The screenshot shows a Microsoft Visual Basic form titled "INVESTIGATIONS" with the following test results and buttons:

Test	Button 1	Button 2
TC	increased	decreased
DLC	leucopenia with relative lymphocytosis	
ESR	raised	normal
Hb %	normal	decreased
R /E Urine	infection present	infection absent
RBS	normal	decreased
S Bilirubin	unconjugated hyperbilirubinaemia	
	conjugated / mixed hyperbilirubinaemia	
Liver Enzymes	raised	normal
Widal Test	positive	negative
S Creatinine	raised	normal

A "NEXT" button is located in the center of the form.

Here, according to the test results, the buttons are clicked which will give information that will help rule out diseases that mimic malaria. The NEXT will take to the next screen (Figure 13.10).

Figure 13.10 Tests for Malaria



These are specific tests for malaria which not only will confirm the disease but will also help to arrive at the correct diagnosis. The species causing the disease will also be identified.

Figure 13.11 Peripheral Blood Smear

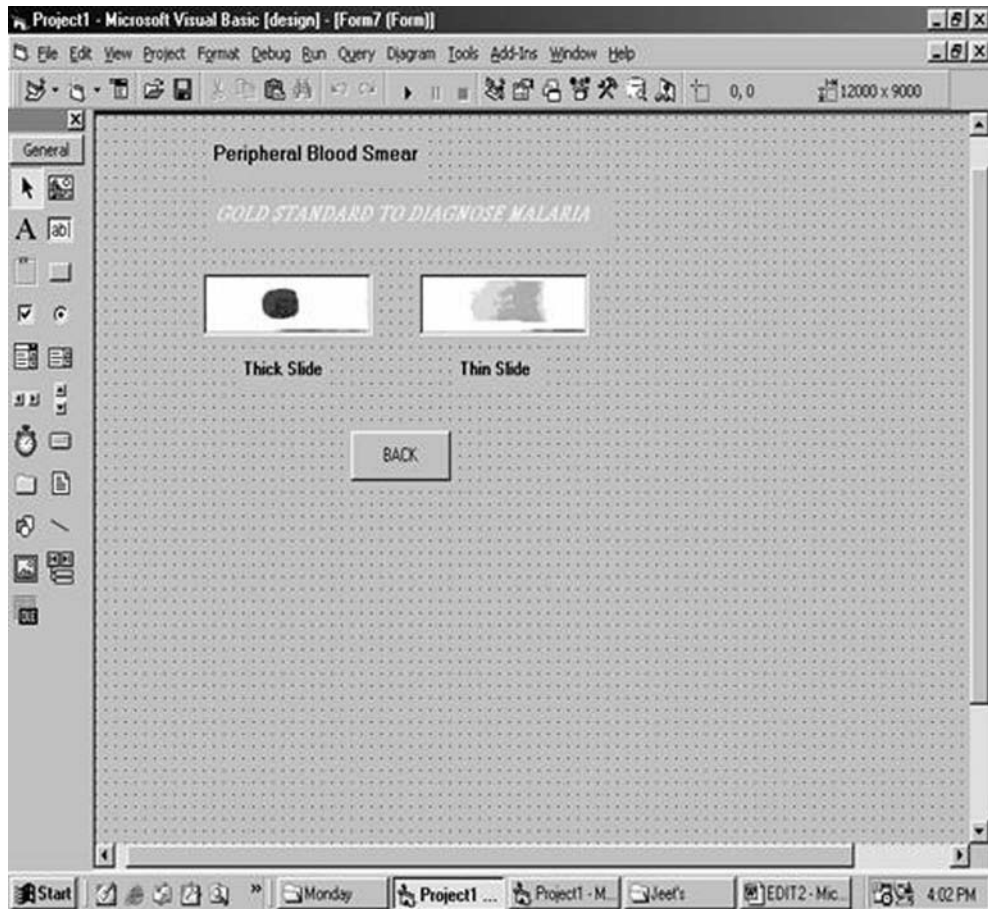


Figure 13.11 shows the Thick and Thin peripheral smears. It involves collection of blood, preparing a smear, its staining with Romanowsky stains and examination of the Red Blood Cells for intracellular malarial parasites.

Figure 13.12 Microscopic Views

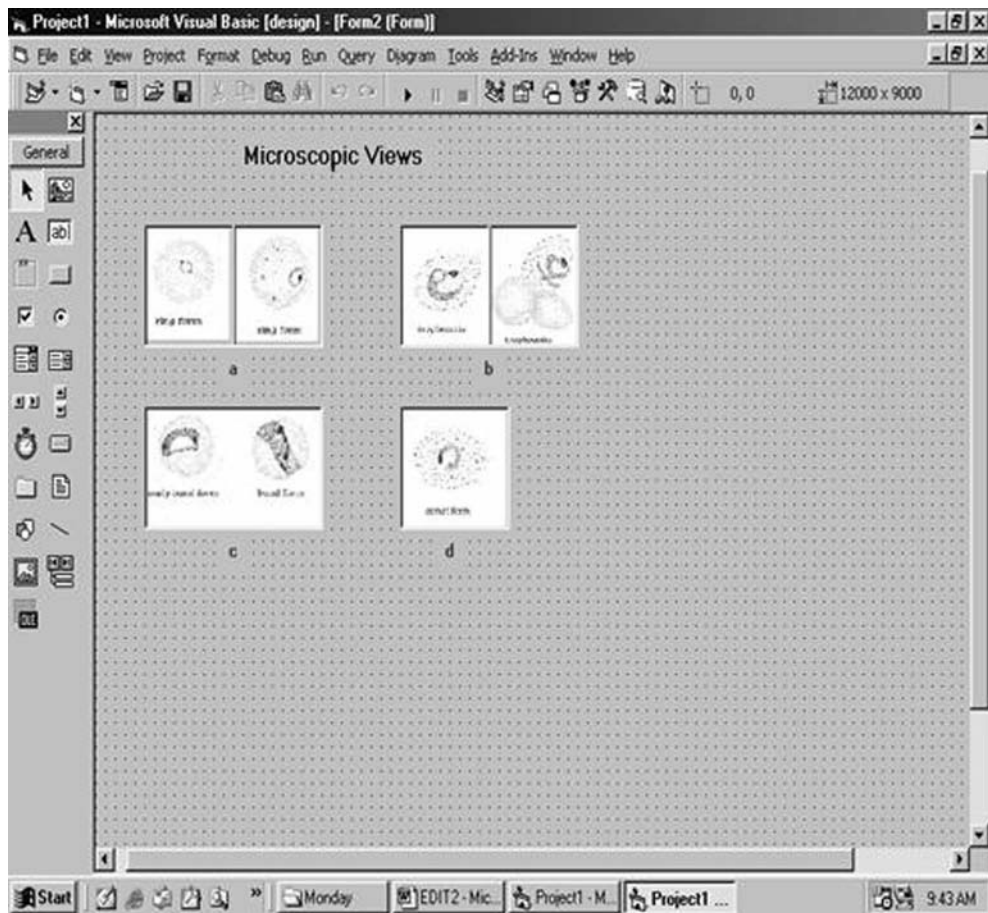


Figure 13.12 shows microscopic pictures of the four different types of malarial parasites. The pictures which are seen on the microscope are compared with those on this screen and clicked. This will give the accurate diagnosis about the type of parasite infecting the patient.

NON-MICROSCOPIC TEST RESULTS

Figure 13.13 Rapid Diagnostic Tests

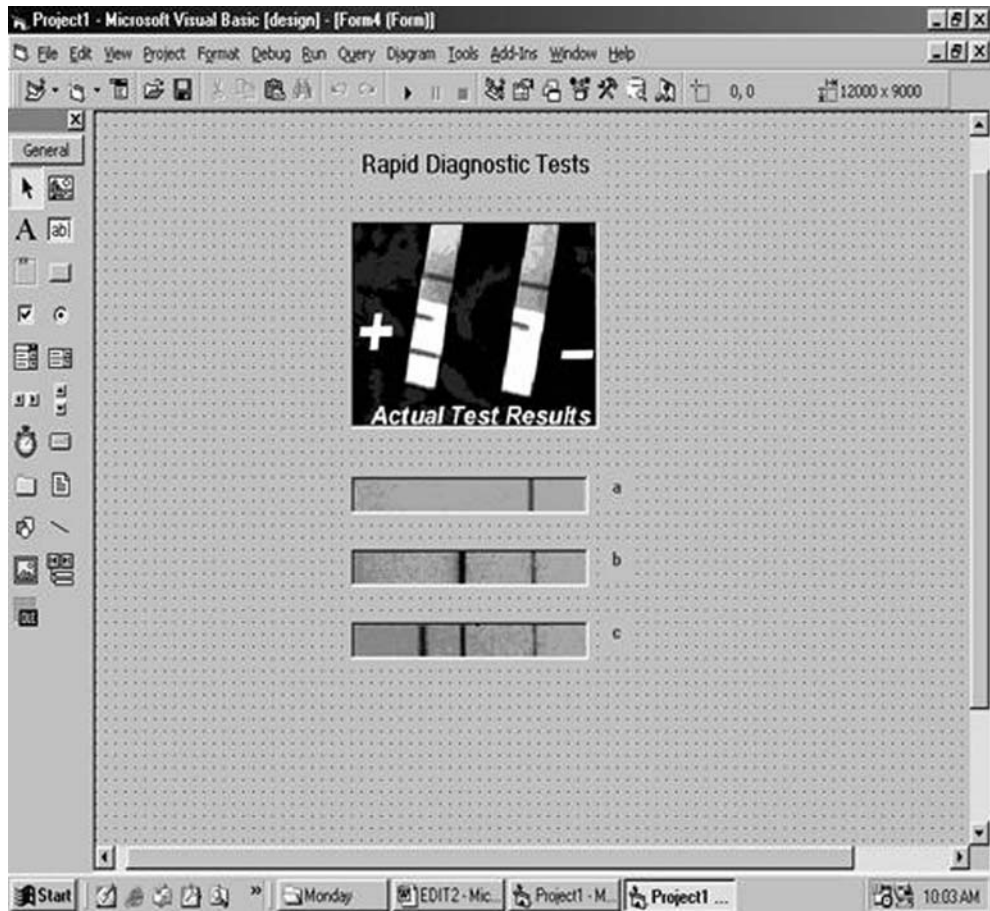


Figure 13.13 shows the Rapid Diagnostic Test results. The only thing that has to be done is to click on the figure which resembles the actual test stripes and the diagnosis will appear on the next screen. When it appears, the next thing to do is to click on the diagnosis which will lead to the next screen with the line of treatment.

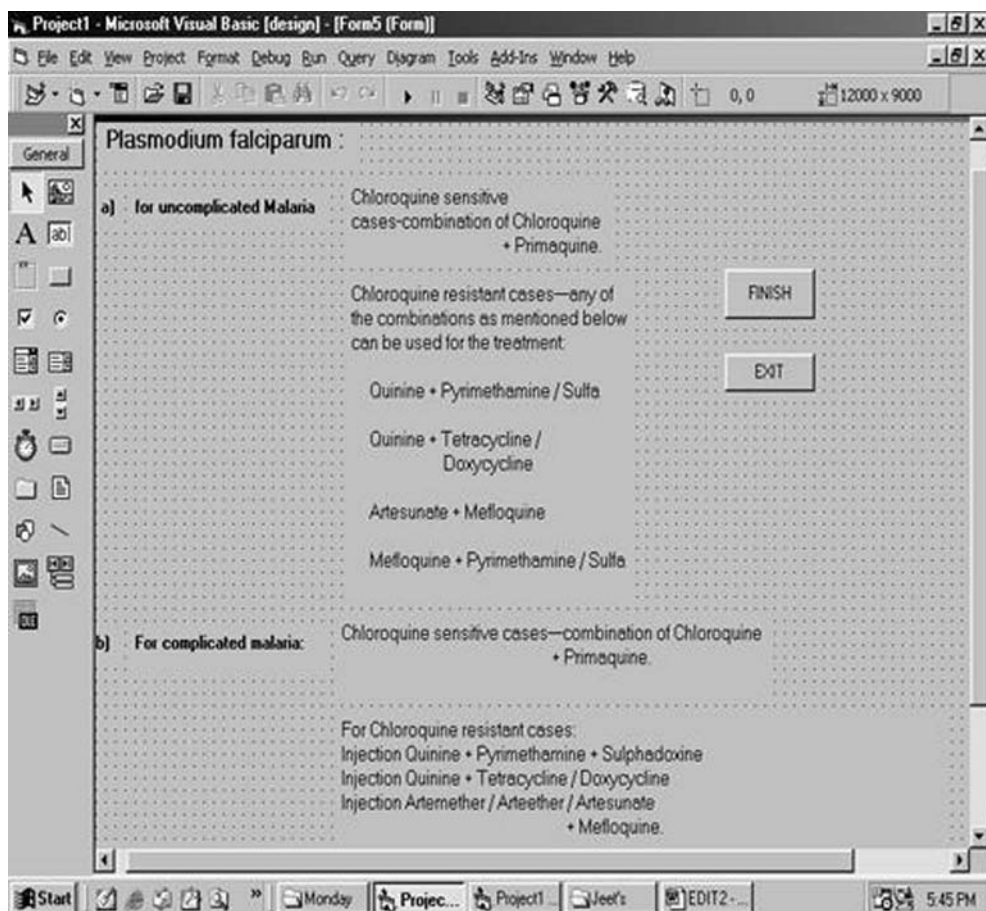
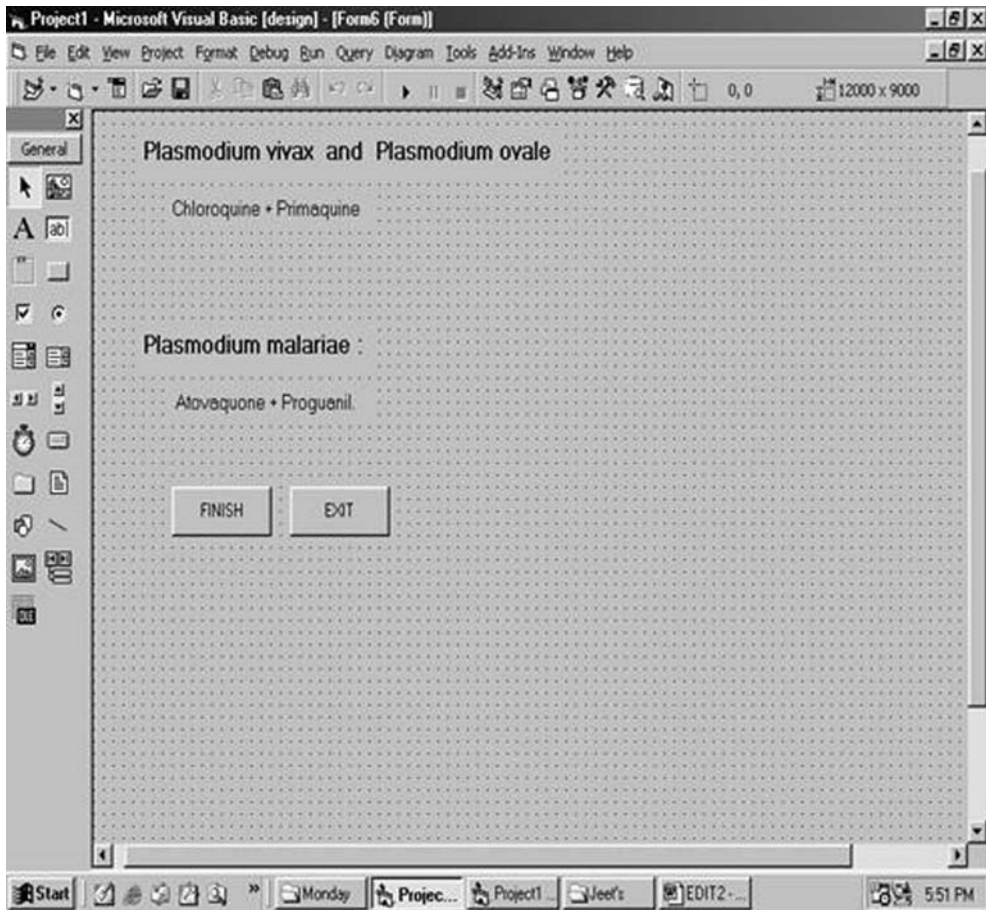
Figure 13.14 *Plasmodium Falciparum*

Figure 13.15 *P. Vivax, P. Ovale and P. Malariae*

Figures 13.14 and 13.15 illustrate the line of treatment for a case of malaria. To make it simple to understand, only the names of the drugs are considered here. The drug or a combination of drugs are prescribed taking into consideration the various factors such as age, gender, the physical state of the patient, the contraindications of the drugs. The physician chooses from the list the drug, which will best suit his patient. He then clicks the FINISH button which will take him to the Registration form from where he can start a new case or else, he can click EXIT which will close the programme.

Conclusion

The Expert System is still at a very nascent stage. Still, it needs improvements and modifications to make it fully functional which will help physicians to diagnose a disease. It is to be noted that this should not be taken as the only tool for any kind of diagnosis. The Expert System will only help in confirming a case and clinical knowledge is absolutely essential to arrive at the final diagnosis.

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WEBSITES

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Introduction

While in the event of an illness or accident we immediately turn to the services of health authorities, the resulting problem of waste disposal is an issue that is often ignored. In developed countries, the quantity of waste produced today has decreased in the hospital sector and has stabilised at a very low level. In India, however, the generation of waste by the hospital sector still remains high.

The quantity of waste produced per day and per bed differs greatly from hospital to hospital, and from one country to another, and above all, depends on the attitude of the hospital. About 85 per cent of a hospital's waste is general refuse, while the remaining 15 per cent is contaminated with infectious agents (e.g., microbiological cultures, blood and blood products, body fluids, isolation waste from patients with communicable diseases, pathological specimens and sharps). In the majority of developed countries, unlike India, hospital waste is disposed of selectively, separating it into various groups. In most cases, different disposal concepts are applied to single groups. Thanks to this separation into groups, it is possible to issue regulations and laws for single types of waste, governing their collection, transport, storage, reutilisation and final treatment. This separation often leads to five main groups of hospital waste.

Waste Groups

1. GENERAL REFUSE

Waste that can be treated like household garbage (general refuse), and to the extent possible, should be recycled (e.g., paper, glass, textiles, kitchen waste not contaminated by infectious, hazardous or nuclear waste).

2. WASTE FROM THE MEDICAL ENVIRONMENT

Waste that may present a risk of infection only in a medical environment, but which apart from this aspect, need not be handled as hazardous waste (e.g., plaster casts, disposable clothing, bandages, disposable syringes, and drip bags that are not contaminated with blood or body fluids).

3. HAZARDOUS WASTE

Waste that represents a hazard in the medical environment and elsewhere, and therefore, in both cases, requires special handling (e.g., waste that is tainted with hazardous pathogens, blood and body fluids of human or animal origin, parts of bodies, aborted, stillborn foetuses and sharps).

4. RADIOACTIVE WASTE

Radioactive waste, which includes any substance regulated and licensed under the Nuclear Regulatory Commission, which should be disposed of in accordance with the rules and regulations of the Nuclear Regulatory Commission.

5. OTHER WASTE

Other waste occurring in the medical field, such as disinfectants, photochemicals, waste containing mercury, pharmacological waste, laboratory chemicals, broken mercury-containing equipment, anaesthesia, and so on.

Waste from the medical environment also includes residues from the medical, veterinary, testing and research facilities.

Infectious Waste

Today, infectious waste is very precisely defined as

waste that is tainted with pathogenic agents, and due to the presence of diseases, which, according to the current state of knowledge, may lead to such types of waste.

The quantity of waste that is classified as infectious depends to a great extent on the concept of waste existing in a hospital, and on the consequent implementation of its separation into groups. The estimated amount of unregulated infectious

waste per day per bed varies between 8000 gm and 11000 gm, which, if regulated, would vary between 50 gm and 1500 gm (Board of Public Works 1995). While non-infectious waste may be disposed of depending on the country and on the waste reutilisation principles applied there, due to its hazardous nature, infectious waste should be dealt with separately and undergo controlled disposal.

While certain groups of individuals and the Government of India are striving to bring about a change in our environment, environment consciousness in our society is not strongly rooted, and the avoidance of waste production has a low level of priority, or is often lacking. It is precisely in countries like ours, with a relatively carefree approach to waste, that large-scale segregation and allocation of medical waste to the infectious waste group is particularly important. This is the only way to prevent diseases and epidemics from spreading, as they might if this waste is dealt with in an uncontrolled manner. The definition of what waste is infectious, differs from one country to another, and even from one hospital to another, depending on how well informed and trained the personnel are. Normally, the disposal of waste similar to household garbage is not a problem. For infectious waste, however, a concept is needed by means of which it is ensured that infectious waste is disposed of with care, so that it no longer represents a hazard for the environment.

Waste Management

Medical waste management practices that should be employed include

- segregation,
- packaging,
- labelling, and
- tracking.

the waste according to the requirement specified by the state, or by means of a private agreement with transporters or disposal facilities.

SEGREGATION

Infectious waste must be segregated from other waste at the point of origin in the producing facility. What is important is that this separation should not entail additional labour for the health facility personnel. Where applicable, storage, even for one or two days, should be possible in specially cooled rooms.

A successful waste segregation plan undertaken by the hospital is important in implementing cost-effective disposal of waste. Combining the regulated infectious and hazardous waste with the unregulated household waste requires that all the waste is treated as regulated waste. Treating the waste otherwise can result in fines and criminal charges. Furthermore, disposal cost is directly proportionate to the stringency of disposal regulations.

PACKAGING AND LABELLING

Stringent and safe practices should be adopted to separate infectious waste from the rest, in specially marked waste containers, right at the point of origin, where the waste is produced.

Containers of regulated medical waste must be properly labelled and marked, and infectious waste containers must have the universal biological hazard symbol on them. Colour-coded double-lined plastic bags must be used in all regulated medical waste containers.

Needles (sharps) are of concern because of their infectious potential, and because of the direct injury they can cause. Puncture-proof containers should be used for sharps. The previous practice of recapping or chopping needles is no longer prevalent because of the potential of injury to workers, and because of the aerosolisation of micro-organisms during the chopping procedure.

Infectious waste should be stored in areas that are disinfected regularly and that are maintained at appropriate temperatures, particularly if waste is being stored prior to treatment. Such storage areas should be clearly identified with the biohazard symbol, and access should be limited. The packaging should be rodent and vermin proof. It is important to note that the time duration and temperature for storing infectious waste is significant and a cause for concern, due to increase in the rate of microbial growth and putrefaction.

TRACKING

Radioactive waste cannot be treated, destroyed or immobilised by any method in this fact sheet. However, radioisotopes decay by emitting radiation until they eventually become stable (non-radioactive) material, which then can be disposed of as a non-hazardous waste. The length of time depends on the isotope. Containers of radioactive waste are isolated in temporary collection areas, with minimum exposure to individuals, until the waste has decayed to the point that it can be disposed of in a designated labelled container. Items used in handling radioactive materials, such as pipettes, disposable syringes, tissues, should be segregated in labelled containers. Sharps contaminated with radioactive materials should also be kept in a separate waste container. The waste containers are eventually collected by the hospital radiation safety office, so that the quantity disposed of can be monitored.

Categories of Biomedical Wastes, Containers, Colour Codes

CATEGORY 1

Class

Human, anatomical wastes, blood and body fluids.

Waste description

Waste consisting of human organs, body parts, body fluids, blood and blood products, and items saturated or dripping with blood and body fluids removed during or after treatment, surgery or autopsy, or other medical procedures.

Type of container

Single-use containers or plastic disposable bags.

Colour coding

Red.

CATEGORY 2

Class

Animal wastes.

Waste description

Waste consisting of animal tissues, organs, body parts, carcasses, bedding, fluid blood and blood products, items contaminated with blood and fluids, wastes from surgery, treatment, autopsy and wastes of experimental animals used in research as well as waste generated by veterinary hospitals, colleges and animal houses.

Type of container

Single-use containers or plastic disposable bags.

Colour coding

Orange.

CATEGORY 3

Class

Microbiological waste.

Waste description

Wastes from laboratory cultures, stocks or specimens of micro-organisms, live or attenuated vaccines, human and animal cell cultures used in research, infectious agents from research and industrial laboratories, waste from the production of biological toxins, dishes and devices used to transfer cultures.

Type of container

Single-use containers or plastic disposable bags.

Colour coding

Light blue or yellow.

CATEGORY 4

Class

Waste sharps.

Waste description

Waste consisting of used and unused sharps such as needles, syringes, scalpels, blades, glass, etc., that are capable of causing puncture and cuts.

Type of container

Sturdy cardboard, glass or plastic container.

Colour coding

Yellow with black stripes.

CATEGORY 5

Class

Highly infectious waste.

Waste description

Wastes containing highly infectious living and non-living pathogens, exposure to which could cause disease.

Type of container

Single-use containers or plastic disposable bags.

Colour coding

Yellow.

CATEGORY 6

Class

Isolated waste.

Waste description

Biological wastes from discarded materials contaminated with blood, excretion exudes or secretions from humans or animals isolated due to communicable disease.

Type of container

Single-use containers or plastic disposable bags.

Colour coding

Yellow or yellow with black stripes.

CATEGORY 7

Class

Discarded medicines.

Waste description

Waste comprising outdated, contaminated and discarded medicines.

Type of container

Reusable sturdy cardboard, glass or plastic container.

Colour coding

Yellow or yellow with black stripes.

CATEGORY 8

Class

Discarded glassware.

Waste description

Wastes generated from glassware and equipments used.

Type of container

Reusable sturdy cardboard, glass or plastic container.

Colour coding

Black.

CATEGORY 9

Class

Solid waste.

Waste description

Waste generated from soiled cotton, dressings, plaster casts, linen, bedding, including packaging materials.

Type of container

Single-use containers or plastic disposable bags.

Colour coding

Yellow.

CATEGORY 10

Class

Disposables.

Waste description

Waste generated from disposable items other than waste sharps.

Type of container

Reusable sturdy cardboard, glass or plastic container or plastic bag.

Colour coding

Yellow, light blue or yellow with black stripes.

CATEGORY 11***Class***

Liquid waste.

Waste description

Waste generated from the laboratory and washing, cleaning, house-keeping and disinfecting activities.

Type of container

Not applicable.

Colour coding

Not applicable.

CATEGORY 12***Class***

Biotechnological waste.

Waste description

Waste generated from activities involving genetically engineered organisms or products and their cultures that have been declared unsafe.

Type of container

Single-use containers or plastic disposable bags.

Colour coding

Yellow, light blue or yellow with black stripes.

CATEGORY 13

Class

Slaughterhouse waste.

Waste description

Waste generated in the form of animal tissues, blood and body fluids.

Type of container

Disposable plastic bags.

Colour coding

Orange.

CATEGORY 14

Class

Incineration ash.

Waste description

Ash from the incineration of any biomedical waste.

Type of container

Disposable plastic bags.

Colour coding

Yellow with black stripes.

CATEGORY 15

Class

Chemical waste.

Waste description

Chemicals used in the production of biologicals, and chemicals used in disinfection, such as insecticides.

Type of container

Sturdy containers or plastic holding bags.

Colour coding

Yellow or yellow with black stripes.

Waste Collection

Collected wastes must be transferred from the point of generation to collection points for processing and appropriate disposal. They should be placed in rigid or semi-rigid and leak-proof containers. The infectious waste management plan should include procedures to be used if liquid infectious waste is spilled, if plastic bags rupture, other containers leak, or the equipment fails.

Hospital wastes are collected in one of three ways:

1. Gravity chutes
2. Carts
3. Pneumatic tubes

Gravity chutes are limited to vertical transport and there is some risk of contaminants being exhausted into hallways, if the door is left open during use. This can be avoided by maintaining a higher pressure in the hallways, and/or using self-closing doors. A major disadvantage of gravity chutes is that the waste container can get jammed while dropping, or break upon hitting the bottom.

Carts are primarily for the horizontal transport of bagged or containerised wastes. The main risk in this procedure is that the bags can break or tear during transport, exposing the worker to the wastes. Protective clothing and safety glasses can substantially reduce the workers' risk as far as exposure is concerned.

Pneumatic tubes are the best means of waste transport in a large facility. Its advantages include high-speed movement, movement in any direction and minimal intermediate storage of untreated waste. Though some objects cannot be conveyed pneumatically, its overall advantages far outweigh the disadvantages.

Waste Disposal

Today the actual disposal is usually carried out using one of the following technologies:

- Sterilisation with steam, hot water or partly with microwaves.
- Incineration.

STERILISATION

With sterilisation it is necessary to ensure that the waste really does reach the temperatures needed to be able to kill all the disease-causing agents. In order to achieve this, the waste is treated with saturated steam in the first disinfection chamber, and reduced in size by means of slitting rollers. In the second disinfection chamber, the process then continues, and the waste, treated in this way is finally disposed of with normal household waste. The air emitted from there is cleaned in an activated carbon filter. In order to carry out microwave sterilisation, the waste has to have a sufficiently high moisture content. Since the personnel working at the disinfection facility are unaware of the actual composition of the waste, and of its moisture content, steam is always sprayed into the treatment chamber in order to make sure that the treatment is effective. The facility must be completely sealed, and as mentioned earlier, the air emitted from there must be made safe by passing it over an activated carbon filter.

INCINERATION

In disposing of infectious waste by sterilisation the germs are killed, but there is practically no reduction in volume. If the waste does not undergo immediate incineration in a waste incineration plant, there is the risk of it starting to decompose at room temperature. Disposal after sterilisation also requires further supervision. It is not possible to dispose of waste in a garbage dump after sterilisation, since although the pathogenic agents have been killed, it may still contain amputated limbs, cytotoxins and pharmaceuticals.

The far more common, but less problematic disposal method for infectious waste is incineration. Modern facilities of this type are available in all sorts of sizes, from small plants with a daily capacity of about 100 kilos for small hospitals, up to large plants with daily capacities of several tons for waste disposal centres. Due to the large investment required for a new plant, special associations for the

disposal of hospital waste are often founded. This means that several hospitals may join forces to set up a disposal centre, or the waste may be handed over to a specialised undertaking. This type of organisation for the disposal of hospital waste can now be found in all countries throughout the world, including India.

The issue of hospital waste disposal is of concern not only for the hospital, but also for the community at large. This issue has been dealt with by some large hospitals with in-house facilities of their own for the handling and disposal of waste, or by a group of hospitals who either jointly, or on their own, or in collaboration with non-governmental organisations, put up a common facility. The disadvantages and advantages of each facility are discussed in the following section.

Facility Options

1. SINGLE 'IN-HOUSE' FACILITIES

Disadvantages

- Requirement leads to high investment.
- The plant is fully utilised only under certain conditions.

Advantages

- Independence of operation is assured.
- The hospital is sure that the waste is correctly dealt with.
- Daily disposal is possible.

2. JOINT FACILITIES SERVING SEVERAL HOSPITALS

Disadvantages

- Cooled storage rooms are necessary.
- Dependence on external organisations may lead to problems.

Advantages

- Better utilisation of the plant is ensured. Lower investment is required.

3. DELEGATING THE TASK TO AN INDEPENDENT COLLECTION SERVICE

Disadvantages

- The waste is not under the hospital's control right up to the time of disposal.
- There is the risk of arbitrary pricing.
- Cooled storage rooms are needed.

Advantages

- No investment in incineration is required.
- The costs can be kept under control by proper selection of waste.
- Waste disposal is not a part of the functions of a hospital.

Emission Limits of the Central Pollution Board

Can the emission limits issued by the Central Pollution Board of India be complied with by installing incineration plants?

Today this question can be answered with a definite 'yes'. The industry has taken up the challenge and has acquired the know-how to implement the pre-requisites for creating optimum conditions in line with the current state-of-the-art technology suitable even for small-and medium-sized incineration plants. Modern incineration plants, equipped with systems for the downstream purification of exhaust gases, meet the currently applicable emission limits.

Waste Treatment

LOADING WASTE

Small plants with a daily capacity of up to about 500 kilos are often loaded by hand. The combustion chamber is filled with waste and topped up once or twice. The larger plants are loaded discontinuously for about eight hours by means of a loading system. In this way, waste is burned in the combustion chamber every 10–15 minutes.

COMBUSTION CHAMBER (LOW-TEMPERATURE CARBONISATION CHAMBER)

In this chamber, the waste is dried and broken down. The quantity of air introduced is just sufficient for the drying process, and the production of low-temperature

carbonisation gas consequent to the breakdown takes place without added energy. The carbon that forms with the production of low-temperature carbonisation gas is burnt after the last loading (after eight hours) by introducing sufficient air.

REHEATING CHAMBER

The reheating chamber is in a state of constant depression. The low-temperature carbonisation gases contain a large volume of combustible energy-rich gases. In the mixing area, these are turned into an inflammable gas by adding fresh air. This mixture of gases is then burned in the ignition and burning area, with the addition of more fresh air. In order to achieve complete burnout, the necessary quantity of fresh air is monitored using oxygen probes.

Temperatures between 400°C (at the start of the process) and about 800°C (at the end of the process) are reached in the combustion chamber. On completion of the process, any unflammable residues become sterile. Depending on local legislation, processing in the reheating chamber takes place at temperatures ranging from 850°C to 1200°C. The turnaround time of the flue gases at these minimal temperatures is between 0.5 and 2 seconds. By building the reheating chamber in segments, the latter can be adapted to the regulations in force at the time. This also makes subsequent adaptations to changes in regulations possible.

Heat exchangers

The energy contained in the hot flue gases can be utilised for the production of warm water, hot water, and in the larger plants, steam. This energy is available for the duration of the loading period and during the burning out phase of the carbon. Integration of the utilisation of process heat into an existing energy supply system is a state-of-the-art technology today, and can be implemented without problems.

PURIFICATION OF THE FLUE GASES

In most countries, there are now regulations pertaining to the maximum permissible emission limits from incineration plants. The gas scrubbing facilities required to comply with these limits are divided up into several stages of scrubbing, and can, therefore, be put together, depending on local regulations. In dry flue-gas cleaning, the dust content in the air emitted is reduced by means of a film. The use of additives such as, for example, lime, can also precipitate certain harmful acid components. Filtering facilities can be installed anywhere where emission regulations for hospital waste and crematoriums are the same, and where

incineration of the waste ensures that only pathological waste has to be disposed of.

If the limits to be complied with are stricter, wet purification systems can be installed. In the first stage, the harmful gases are quenched and brought down to a temperature of about 80°C. In the wet scrubber, coarse dust and harmful acid gases are separated. To do this, caustic soda is added to the water circulation system. In the next stage, fine dust and aerosols are separated and often washed by ionisation.

Starting from these three stages (quenching, wet scrubbing and washing by ionisation), all the harmful components can be broken right down into dioxin and furan. Following the introduction of stricter emission limits for both these harmful substances in several countries, including India, either catalysts or active carbon filters have to be installed downstream.

The first small plants for hospital waste, in which the dioxin and furan originating from the flue gases are limited to a maximum value of 0.1 ngr/Nm³, have been proving their worth for some years now. These systems have matured, and even in subsequent control measurement operations, the original values can be achieved once again.

Significant Advantages of Incineration

The following are the significant advantages of the incineration of waste as compared to other disposal systems:

- The temperature in the combustion chamber guarantees that the residues are sterile.
- The waste is reduced to about 3 per cent of its original volume, depending on the amount of incombustible waste loaded.
- The residues require no further treatment and can be handed over to a controlled final place of storage.
- The process works regardless of the composition of the waste, and does not require special monitoring.
- The service personnel never come into contact with the waste, and therefore, it is universally acceptable from an ethical point of view. Even in the event of a possible breakdown of the various components of the plant, the personnel do not come into contact with the waste during the trouble-shooting period.
- The process complies with even today's very strict environmental protection limits.

- Implementation of this technology is possible not only in industrialised countries, but it is particularly suitable for third-world countries.

Presently, a large number of indigenous and multinational companies are providing equipment and solutions for hospital waste. The Yellow Pages list many of these companies and can act as a good reference guide.

While deciding on the equipment to handle hospital waste, it is advisable to keep the following points in mind:

- The quantity and type of waste to be handled by the equipment.
- Whether the equipment meets the current regulatory standards.
- Can it be upgraded to meet future regulatory norms.
- Will the equipment be supported with maintenance services and spares for the next 10 years.

Waste Minimisation Options

Waste minimisation includes many source reduction or recycling activities by the generator, which result in reducing either the quantity or the toxicity of the hazardous waste, consistent with the goal of minimising present and future threats to health and the environment.

SOURCE REDUCTION

Source reduction can be achieved by process modification and by the implementation of policies and procedures that will reduce waste. The key operating practices that can be utilised to effect waste minimisation are as follows:

- Waste segregation.
- Controlling inventories with 'just-in-time' purchasing.
- Providing areas where chemicals and liquid wastes cannot drain to the sewer in the event of an accident or spill.
- Buying drugs in container sizes that permit formulation of daily doses, with the least quantity of excess product leftover.
- Centralised purchasing and dispensing of drugs and other hazardous chemicals.
- Requesting suppliers for recyclable containers whenever possible, to reduce chemical drum waste and disposal cost.

- Using first-in, first-out policy for dispensing drugs and chemicals, in order to minimise the wastes generated because of extended shelf-life.
- Inventory checks before ordering/using new stocks.
- Minimising acceptance of free samples that are likely to become hazardous waste.
- Avoiding mixing wastes, such as xylene, with alcohols (methyl, ethyl, and isopropyl), chromic acid (glassware cleaners) and water.
- Determining dilution rates of alcohol that can be discharged to the sanitary sewer system.
- Reducing photographic wastes from imaging equipment, such as waste water containing photographic chemicals and silver from film.
- Extending the life of fixing baths by adding ammonium thiosulphate (doubles the allowable concentration of silver build-up in the bath).
- Adding acetic acid to fixing baths to keep the pH level of the baths optimally low.
- Not mixing used X-ray fixer and developer; allocating separate containers and treatment methods.
- Collecting and storing waste in a closed plastic container labelled 'Hazardous Waste—Used Fixer', with the date indicating when the fixer was first added.
- Contacting a recycling service when enough fixer has accumulated (usually 20 to 40 gallons).
- Installing a silver recovery unit at the end of the X-ray processing unit.
- Pouring X-ray developer down the drain (sewer), but not into a septic tank.
- Training employees in hazardous material management and waste minimisation.

Training should include chemical hazards, spill prevention, preventive maintenance and emergency preparedness, and response. Hospitals and other health care organisations that generate infectious wastes should provide their employees with infectious waste management training. Training should include explanations regarding the infectious waste management plan, and assignments of roles and responsibilities for the implementation of the plan. This training is important for all employees who handle infectious wastes.

Mercury usually becomes a waste because of instrument breakage and cannot be treated by techniques described here. It should be collected in a special container and shipped to a recycler. Using electronic devices for measuring temperature and blood pressure is the most effective way of eliminating mercury from waste streams.

RECYCLING AND RECLAMATION

Spent solvents are generated by the laboratory, pathology, histology and maintenance departments. Sometimes aqueous-based cleaners can be substituted for hazardous solvents used in maintenance. Many solvents can be recovered by on-site distillation and recycled.

Dialysis units generate spent solutions that contain 3–4 per cent formaldehyde in water. Some users reportedly use reverse osmosis (RO) units to recover formaldehyde, although this practice is not widespread.

Radiography departments generate large amounts of hazardous waste from developed X-ray films. Spent fixer solutions, in particular, contain high concentrations of silver, which is economically valuable and can be recovered easily. Since the silver cannot be recycled in the generating process, many health care businesses have contracts with commercial recyclers who buy used photo-processing solutions and reclaim silver. One commercial X-ray laboratory found that after it began controlling its processor temperature very closely, to improve image quality, it also greatly extended the useful life of processing chemicals, reducing the quantity sent for disposal.

Conclusion

The problem of disposing of the waste produced by hospitals is far from being solved. Today, most countries including India, have introduced the necessary laws and guidelines for allowing environment-friendly waste disposal. However, the population of India is endangered, as no controlled waste disposal is taking place. There will never be such a thing as a hospital with no infectious waste to be disposed of, and it is, therefore, up to the hospitals, authorities and legislators to make sure that environmentally acceptable waste disposal is also accepted by the population. There is, hence, the urgent need for educating and informing everyone concerned with hospitals and the population at large.

APPENDIX A

Waste Reduction—A Preliminary Assessment

Hospitals are subject to meeting local recycling ordinances and state laws which may vary in specific details, but which have certain standards throughout the

state. This questionnaire has been designed to help formulate a programme for handling infectious/hazardous wastes in hospitals.

Does the hospital recycle waste materials as required by local ordinance and state law?

Yes _____ No _____ Don't know _____

Does the hospital, in your opinion, have a clearly defined procedure for handling and minimising infectious/hazardous waste?

Yes _____ No _____ Don't know _____

Does the hospital generate any large amount of waste material per day/month/year that is difficult to recycle, or which involves substantial expenditure?

Yes _____ No _____ Don't know _____

Does the hospital burn infectious/hazardous waste at its site?

Yes _____ No _____ Don't know _____

Does the hospital conduct infectious/hazardous waste determination daily/monthly/yearly for all potentially infectious/hazardous waste streams?

Yes _____ No _____ Don't know _____

Is the infectious/hazardous waste generated at the hospital properly hauled and disposed of?

Yes _____ No _____ Don't know _____

Is the infectious/hazardous waste properly segregated from other solid or liquid non-infectious/hazardous waste?

Yes _____ No _____ Don't know _____

Is infectious/hazardous waste properly stored?

Yes _____ No _____ Don't know _____

Is all infectious/hazardous waste properly dated and labelled?

Yes _____ No _____ Don't know _____

Does the hospital know how much infectious/hazardous waste it generates a day/month/year?

Yes _____ No _____ Don't know _____

Does the hospital, in your opinion, have a clearly defined procedure for handling and minimising infectious/hazardous waste?

Yes _____ No _____ Don't know _____

APPENDIX B

Procedures in Apollo Hospitals—Hyderabad

WASTE MANAGEMENT PROCEDURES REGULATED WASTE (INFECTIOUS)

This is a case illustration of the waste management procedures adopted in the Hospital.

1. Every facility that generates, transports, stores, treats or disposes of regulated infectious waste must prepare and maintain a file of the following:
 - Type and quantity (weight) of waste generated or handled.
 - Segregation, packaging and labelling procedures.
 - Collection, storage and transportation procedures including the name of the transporter.
2. Infectious waste must be segregated from other wastes at the point of generation and be placed into appropriately coloured double-lined bags marked with the biohazard symbol, or the infectious waste warning sign for storage and disposal.
3. Access to infectious waste storage areas must be limited to authorised personnel. All access doors to these areas must be marked with the biohazard symbol, or the infectious waste warning sign.

4. Infectious waste storage area must be equipped with the following items:
 - Spare biohazard boxes and bags.
 - Label space for the name, ward and phone number of the generator.
 - Tape.
 - Spill-absorbent materials or infectious waste spill kits.
 - Personal protective equipment (coveralls, boots, gloves, goggles, etc.).
 - Disinfectant.
5. Regulated infectious waste, other than sharps, must be placed into appropriately coloured bags marked with the biohazard symbol. The generator must package, label and mark the container as infectious waste.
6. If other waste (unregulated waste) is placed in the same container as regulated infectious waste, the generator must package, label and mark the container and the entire contents as infectious waste.
7. Full biohazard bags must be securely closed and placed into rigid containers marked with the biohazard symbol for transportation and incineration.
8. Sharps (used or unused discarded needles, syringes, scalpel blades, etc.) must be placed into appropriately coloured 'sharps' containers. Sharps containers must be rigid, puncture- and leak-resistant and tightly closed. They must be labelled 'SHARPS', with a biohazard symbol. Full sharps containers must be placed in a blue biohazard bag, which in turn must be placed in a rigid container marked with the biohazard symbol, for transportation and incineration.
9. Infectious waste must be maintained in a non-putrescent state using freezing or refrigeration, if necessary. No infectious waste, other than sharps containers in use, can be stored for longer than 35 days after generation.
10. Regulated infectious waste must be transported in a closed vehicle. No other waste should be transported in the same vehicle, unless all waste is to be treated as regulated infectious waste.
11. Persons manually loading or unloading containers of regulated infectious waste on to transport vehicles must:
 - be trained in the proper use of protective equipment;
 - have available and easily accessible at all times puncture-resistant gloves, shoes, shatterproof glasses and coveralls;
 - have face shields and respirators available as deemed necessary by the hospital;
 - protective gear, which, when it becomes soiled, is either decontaminated or disposed of as regulated infectious waste.

12. All spills of infectious waste must be reported to the Consultant—Research and Development (occupational and environmental health).
13. All transporting vehicles must carry a spill containment and clean-up kit, and all transport workers must be trained in spill containment and clean-up procedures. Spills of infectious waste must be cleaned up immediately.
14. All rigid reusable containers used to store or transport regulated infectious waste must be disinfected after each use.
15. Regulated infectious waste must be incinerated as soon as possible after collection from the generator.

WASTE MANAGEMENT PROCEDURES—UNREGULATED WASTE (HAZARDOUS)

Any waste that is classified as non-infectious, but hazardous, such as used or outdated laboratory and spent chemicals and reagents, outdated detergents and so on, must be segregated in green bags and placed in rigid containers marked as non-infectious hazardous waste. The waste must be segregated in different bags depending on its ignitability, corrosiveness, reactivity and toxicity. The chemical will have to be sent to secured landfills as per the regulations of the pollution board.

WASTE MANAGEMENT PROCEDURES—UNREGULATED WASTE (NON-INFECTIOUS AND NON-HAZARDOUS)

Any waste that is classified as non-infectious and non-hazardous must be segregated in a green bag and placed in rigid containers marked non-infectious waste. The waste must be segregated in different bags to be recycled as follows:

1. Newspapers, journals
 - Product information leaflets
 - Office papers
 - Cardboard boxes, tablet and indictable packaging material made of paper.
2. Glass bottles, injection vials and ampoules which are not contaminated with regulated infectious waste.
3. Metal containers.
4. Kitchen waste, such as leftover food, vegetable peels, and so on.
5. Other waste, such as carbon paper, plastic wrappers, styrofoam pellets, styrofoam packaging materials, and so on.

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Introduction

PATIENT RELATIONS

Patient relations is a planned effort to establish and improve degrees of mutual understanding between the hospital and the patient and his/her relatives, with the primary objective of assisting the patient, and the secondary objective being helping the hospital to deserve, acquire and retain a good reputation. It is a way of developing reciprocal understanding and goodwill, which is one of the essential components of the organisational activities and services rendered by a hospital. Just as cosmetic surgery beautifies the face or other parts of the body, patient relations enhances the various activities carried out in a health service organisation, such as a hospital, nursing home, or even a single practitioner's clinic.

Published material about patient relations in health or hospital services is not readily available. Awareness regarding a scientific and professional management of patient relations in hospitals has still not reached the level it should have by now in India. High quality patient care is the result of not only medical expertise, modern equipment, nursing care and drugs, but also of the efforts of a well-motivated, disciplined and highly professional 'patient relations' department.

Patient relations is not just 'being seen to be nice' to the patient, because a hospital serves people who are sick and their attendants, whose nature and outlook are different from people going to other organisations. Hence, it is not enough to be just nice or polite; the person concerned with patient relations should provide service of the highest degree with uncompromising sincerity. Hospitals deal with human beings under stress and strain, and the treatment and comfort provided by even the best of doctors and nurses may not be able to completely fill the gap between their suffering and its alleviation. Hence, it is necessary, particularly now, in view of changing societal demands and attitudes, that specially trained professionals are available to eliminate the gap. In our country, there are several

agencies providing health services, such as governmental, non-governmental, missionary, voluntary bodies, philanthropic groups and so on. The Indian government has recognised, as stated in the Constitution, that 'the health for a citizen is a fundamental right'. It was mainly government agencies which provided health care to about 70 per cent of the population prior to Independence. The commitment was limited, due to disproportionate workload, limited manpower and other resources. As such, the finer aspects of hospital services, such as the doctor-patient relationship and patient-nursing care services, were limited.

It is only during the last two or three decades that a different view of health care services has come into vogue, and slowly recognition of the finer elements of patient care—such as medico-social services, patient care relations, patient guidance counselling, and so on, have been introduced into hospital activities. These services, additional to therapeutics, have been increasingly recognised mainly by private and corporate hospitals. In the beginning, these special services were considered secondary, or of minor importance. But, in the last one decade, with the advent of high-tech treatment, and with the corporate sector entering the health care industry, the importance of patient relations has been duly recognised, and a certain amount of professionalism has come in. Now this trend has been accepted with some vigour and vitality, giving more importance to patient relations in hospitals. However, much still remains to be done, and there is immense scope for the development of patient relations in hospitals, particularly in large ones.

Another aspect in support of these arguments is that in our country there is a growing awareness and demand now among the public that the medical and health services they receive must be explained to them. For example, if an invasive procedure is to be performed, a good number of people ask several questions about the procedure, its pros and cons, and ultimately, the outcome of these investigative procedures. It may not be possible or practically feasible for the treating doctor and/or nurse alone to explain these matters. Hence, a person who is well-trained in patient relations can take on this onerous responsibility, not only by personally interacting with patients and their attendants, but also by preparing necessary information charts, brochures, pamphlets, and so on in language that is simple to read and easy to understand. Nowadays the importance of 'informed consent' is growing, and this can be handled well only by qualified and trained personnel in the hospital. He/she will bridge the gap in communication between the doctor (service provider) and the patient (service receiver or customer). Several radio and television channels beam various programmes which show many aspects of a disease, its prevention and treatment, and the importance of good health. All these come under patient relations, which is of high value to a patient or attendant.

INTERPERSONAL COMMUNICATION

In a hospital, big or small, even a brilliant doctor may not possess appropriate communication skills. There are very few people belonging to the medical fraternity who are brilliant doctors and also convincing conversationalists. People belonging to the older generation say that some very successful doctors of their times were very good conversationalists. They also say that half the suffering and pain of the patient was relieved by speaking and listening to such doctors. This is an example of the good patient relations practised in those days. It is believed that a doctor should not only be good in the practice of medicine, but he should also be an excellent human being—sympathetic, kind and understanding. It is now relevant and imperative, in every hospital, to develop and practise good communications, keeping in view the advantages of developing a good doctor–patient relationship, and also a good hospital–patient relationship, which ultimately results in a satisfied patient.

Hospital Administration

In the last 30 years or so, our country has made rapid strides in economic, social, scientific and technological fields, as well as in space and atomic technology. The development of computer sciences is phenomenal. In the area of medicine and health too, commendable and extraordinary progress and development has been made during this period. Unfortunately, similar development and progress has not taken place in health care or hospital administration. Even many of the sophisticated and the so-called modern and hi-tech hospitals in the country continue to be managed by the old, stereotyped and archaic systems of hospital administration. Now times have changed, and specialisation has become the order of the day. It is therefore imperative to have specialists for general administration and technical functions in hospitals. Again, with the tremendous expansion in the health services sector, it has become essential to have specialists or expert professionals not only in these two fields, but also in the support services of hospitals. Many now realise that hospital administration can no longer be left to chance in the hands of an individual who is a jack of all trades and master of none.

Hospitals are the focal points of education for the medical and nursing fraternity and for clinical research, which is necessary for the advancement of medical science in order to provide for the betterment of humanity. Thus, the hospital is one of the most complex of all administrative organisations and not comparable to any typical organisation. Hence, what is required is a thorough knowledge not

only of the hospital set-up, but also of its purpose, history, classification and the peculiar conditions related to hospital administration. It is logical to presume that a doctor with a basic medical degree, or even a postgraduate degree, if trained in administrative skills, may prove to be a good administrator. A hospital administrator, chief executive, or managing director need not always be a medical professional. However, if he/she is a medical professional with formal education and experience in management, he/she may perform better. Some medical professionals have an interest in and an aptitude for management. They possess leadership qualities and human relation abilities, which are crucial for the role of a hospital administrator. For example, the 'centralisation' principle of management science has brought one system into existence in large hospitals, the Central Sterile Services Department (CSSD), in India almost 20 years ago. The necessity for such a department was felt because of the resultant efficiency and economy in the centralisation of sterilisation of syringes activity in one location for use all over the hospital. Centralisation of this activity, by way of syringe service in the CSSD, has resulted in safety, efficiency, quality and economy.

Process and Practice of Patient Relations

The role of interpersonal relations in any field of human activity is of utmost importance. This is one of the important processes that every civilised human being passes through, day in and day out. Human values are also enhanced when skills of interpersonal relations are used in daily life, and in one's dealings with one's family, profession and everyone else—a simple example, saying 'Good Morning' with a smile, to anyone one meets for the first time in the morning will bring cheer and a lot of good feeling to both. The day begins bright and warm. Even without our being aware of it, we perform several interpersonal activities in our daily life. Many of these small or large gestures bring goodwill and help maintain cordiality. An exchange of pleasantries always brings rapport with one's fellow human beings.

The major concern in the concept of patient relations in a hospital is patient care, irrespective of the size or category of a hospital, and is applicable to all levels within it. Hospital staff faces challenges from different quarters, and also hostility from ailing patients and their anxiety-stricken attendants. Patients, since they are suffering, need all the sympathy, empathy and unstinted support they can get. Hence, the hospital personnel should put-in all their efforts into relieving the pain and anxiety of the patients, and help them resolve their problems, however trivial they might seem. As a matter of fact, every employee in a hospital, right

from the ward boy to the top-level administrator, should be proficient in patient relations, and should be a friend, philosopher and guide to the patient, whose welfare, comfort and satisfaction should be the only concern of all hospital personnel.

The people or groups of people who interact with the patients, and/or their attendants in the hospital, are listed below.

1. PATIENT/ATTENDANT—INITIAL CONTACT POINTS

- (a) Reception (or Enquiry)
- (b) Casualty/Emergency
- (c) Out-patient/Consultation Room of the Doctor.

Usually the first contact point is of paramount importance from both the patient's and the hospital's point of view. Hence, it is essential that personnel in the enquiry and reception offices should endeavour to guide and direct patients, to the best of their ability, with utmost care, patience and empathy. It is better if a doctor with experience and maturity cares for the patient's well-being and peace of mind, trains and heads the front office, which typically includes the reception, registration and admissions formalities. Some basic knowledge of the activities of various departments and laboratory services would help in providing service acceptable to the patient. The relationship founded at this point will go a long way in building a positive overall image of the hospital. Remember, the first impression is the best impression.

2. PATIENT/ATTENDANT—LABORATORY AND DIAGNOSTIC SERVICES

This step is also equally important because the patient's future stages of diagnosis and plan of treatment depends on and begins here. The role of patient relations at this stage is that the patient should be properly received, courteously treated, and if needed, he/she should be briefed all about the investigation(s) that are being contemplated. One simple sentence, 'I am sorry, but I have to give you a small prick and cause pain, but it will not last long, and it is for your good', uttered in a polite and friendly voice will go a long way in keeping the patient relaxed and ensuring his/her full cooperation. Remember, 'courtesy always pays'.

3. PATIENT/ATTENDANT—TREATMENT

- (a) Doctor
- (b) Nursing Staff

Everyone in hospital service should realise that this stage in patient relations is the most important of all services. Any amount of effort expended at this stage is less, unless one can 'delight' the patient. Hence, an appropriate and a well-designed training programme for creating good patient relations is necessary for both doctors and nurses. In order to reinforce this approach, there are two quotations:

There is an emanation from the heart in genuine hospitality which cannot be described, but is immediately felt and puts the stranger at once at his ease.

—Washington Irving, quoted by R.D. Lele in *Law of Medicine*.
(www.ask.com and www.quotesandsayings.com)

*Do all the good you can,
By all the means you can,
In all the ways you can,
In all the places you can,
At all the times you can,
To all the people you can,
As long as ever you can.*

—Ralph Waldo Trine, *Life's Law*.
(www.ask.com and www.quotesandsayings.com)

4. PATIENT/ATTENDANT—SUPPORT SERVICES

- (a) Housekeeping
- (b) Food and Beverages
- (c) Pharmacy
- (d) Maintenance
- (e) Accounting
- (f) Billing
- (g) Transport Services

It has now been realised and recognised that the role of support services is no less important, and is as essential as doctors and nurses. In building proper patient relations, support services play an equally important role, and as such, an appropriate and well-designed training programme is essential for them. Their interaction, directly or indirectly, has a definite bearing on the final outcome of the patient's satisfaction. Hence, as envisaged earlier, all personnel in these services should be trained meticulously, to become proficient in patient relations.

5. PATIENT/ATTENDANT—AMBULANCE SERVICE AND OTHER SERVICES

Ambulance service plays a vital role in achieving patient satisfaction, and hence, both the vehicle as well as the men concerned should be kept in good shape.

Personnel working in ambulance services should also be trained to provide genuine and sincere care, and equip themselves with excellent patient relations skills.

Among the several patient relations activities in a hospital, communication is an important one, and it is also the focus of many complaints. Because of the low level of literacy among the public, and the medical sciences being an abstract subject for even educated patients or attendants, medical terms are not understood unless they are properly explained. The two-way communication between the hospital staff and the patient/attendant should be ensured by developing appropriate systems. Hence, the right approach should be used for training and developing systems in each case.

Doctor-patient relations are of vital importance in hospital services, for the patient (and/or attendant) and the doctor to have a humane and scientific interaction. No matter what technical skills and medical knowledge a doctor may possess, he/she should also develop and cultivate excellent communication and conversational skills; and gain the confidence of the patient, by behaving with him pleasantly, beginning with the exchange of pleasantries. An old saying goes, 'a good doctor can relieve half the suffering with his good and humane approach to a patient.'

Doctors need to learn new skills to help them prepare an agenda (plan), and interact with patients and their attendants. Seeking information is now considered a basic right of the patients, their kith and kin. The doctor should learn to deal with this situation as a part of his interpersonal communication skill. Doctors should give all relevant and possible information to patients for their adequate understanding of treatment options, the risks involved in the various procedures, the duration of the treatment, and the expenditure expected to be incurred in the course of the treatment. This will ensure a good rapport with the patient. A model interaction (conversation) between a doctor and a patient with a chronic ailment should proceed on these lines:

'I am going to tell you what is wrong with you,
what is being done for you,
what you are supposed to do, and
what is expected from all this.'

A busy consultant or specialist may appoint a junior doctor to obtain and record the patient's ailment history, the results of physical examinations and so on, of the patient, and then examine him or her to decide on the treatment and the care to be provided for the specific problem. This system is known as a referral from a primary physician. It gives confidence to the patient that the consultant has

accurately diagnosed the exact nature of the disease, and is planning to implement the correct treatment. At this stage, all possible queries, doubts, apprehensions and precautions to be followed prior to, during, and after any procedure or surgery, should be explained and clarified in simple layman's language to the patient. In addition, some of these explanations may be given in the form of leaflets or brochures. This exercise, apart from educating the patient, allows the doctor to gain time and the patient's confidence. It is common knowledge that 25 per cent of re-admissions are due to lapses in treatment and insufficient understanding of doctors' instructions. A patient relations executive in a hospital, and the secretary at the entrance of the clinic, are helpful and provide support in important spheres, such as saving time, fee collection and seeking the doctor. An important aspect of patient relations is developing and expressing social skills, which ensure an assertive and positive relationship between the patient and the physician. The physician's ability to express clearly his/her empathy for the patient's feelings, rights and suffering is of paramount importance. Non-verbal communication, such as facial expressions, eye contact, pleasing gestures, and a comforting touch helps in building up this relationship. In many developed countries, such as UK, USA, and Germany, patient communication (or interaction) has been made a part of the medical education curriculum, and from September 1996, all medical graduates and other specialty doctors who completed their vocational training, had to pass an examination in patient communication. Perhaps this is the time for the medical fraternity in India to start thinking along these lines, too, and adopting these systems for a better and more ethical professional practice in the country.

Patient Relations Applied to Support Services

Irrespective of the size or category of the hospital, it is a recognised fact that all support services form an excellent complement to the services of the medical fraternity. The support services are:

- Nursing
- Housekeeping
- Security
- Food and Beverage
- Maintenance and Engineering
- Pharmacy
- Biomedical

- Stores
- Transport
- Pest Control
- Medical Records

These support services are responsible for the welfare of the patient, sometimes directly, and many times indirectly. They interact and provide comfort and an anxiety-free stay for the patient in the hospital.

NURSING

The nursing services are of great importance and an absolute necessity in a hospital. They provide service to the patient and execute the doctors' orders meticulously. Most patients depend on the nurses to convey their problems to the doctors treating them. The nurses play a multifaceted role, with a sense of responsibility and empathy. Nursing is a vital aspect of health care, which should be properly organised. Nursing care, and the management of the nursing staff reflect on the image of the hospital or nursing home. Hence, an effective patient relations training, given to every nurse will enhance the quality of every aspect of nursing in hospitals. Proper and rigorous training in patient relations for nurses should be conducted on a regular basis. They should be trained in communication skills, the right etiquette, and a positive and caring bedside manner. It is the nursing staff that makes the maximum number of visits to the patient and, hence, their interaction with the patient should be congenial, emphatic, firm and cautious. In addition to the execution of doctor's orders every nurse should possess the qualities of a friend, philosopher and guide. However, no nurse should get emotionally attached to a patient. The nurse should help the patient recover as quickly as possible, and with sincerity, help him in his recovery, during his stay in the hospital. A well-trained nurse, with specialised patient relations training, will be an asset to any hospital. Nursing and hospitality, blended with missionary zeal, will bring a good name to, and increase the prestige of, the hospital. As of now, there is hardly any kind of specialised patient relations training available for nurses. It has been now realised that such a training will make an immense difference in the nursing services. Hence, it is essential to include patient relations training as a part of the curriculum for the nurses.

HOUSEKEEPING

The housekeeping staff helps in keeping the hospital clean and tidy. Many of them come in direct contact with the patients. Their services are also important,

since their activities contribute directly to the patient's comfort and peace of mind. For example, a member of the housekeeping department may not behave politely while bringing a urinal to a patient, thereby upsetting him or her. If there is some delay in attending to the patient, the housekeeping staff should politely seek pardon by saying,

I am sorry, sir. I was late because I was attending to some other work.
I assure you that it will not happen again.

The patient's response will be to overlook and forget the inconvenience. Thus, pleasantness and goodwill will pervade the atmosphere, and everyone's task will become much easier. Before providing training in patient relations to the staff, they should undergo rigorous on-the-job training, get acquainted with details about the various services to be rendered to patients, and the need for them. Most of the staff, particularly at the lower level, do not understand the meaning, relevance and content of patient relations. Hence, training them may be a difficult task unless suitably effective methods are applied. They should be made to understand that the patient is their customer, who has come to them in pain and suffering. Hence, they should be accorded hospitality of a high order. The housekeeping, food and beverage staff, or for that matter, staff in any department, should not lose its temper under any circumstances, and should always be polite and accommodating. If there is any problem, they should seek the support of their immediate superior, who in turn, after due enquiry, should convince them and help them to appreciate the need for being empathetic towards patients and their attendants.

SECURITY

The role of the security department has several ramifications and needs modification in their attitude to work, patients, attendants and visitors. They should be helped to understand that their job responsibility is different from that of the staff in an industrial organisation, because a hospital deals with people who are suffering, and are anxious. They are not only the custodians of security, but are also responsible for contributing, may be indirectly, to the welfare and happiness of the patient in many ways. They should learn to use a different and special approach in the discharge of their duties. If the necessity arises, security personnel should carry out the duties of the staff of the transport department, and to every extent possible, help the patient. No service carried out in the interest of the patient can be of small value and lack dignity.

FOOD AND BEVERAGE

It is nowadays a common and necessary practice to serve food and beverages to patients as well as their attendants in a hospital. Most hospitals have become aware that diet contributes to a patient's recovery from disease. In addition, if it is tasty, it keeps the patient happy and satisfied. Hence, an efficient food and beverage service greatly enhances the overall services that a hospital offers. Nutritious and tasty food is essential for the patient. The importance of hospitality shown to a guest in the Indian tradition is emphasised even in the scriptures—*atithi devo bhava* (Guest is equal to God). Hence, a hospital should treat the patient as a guest.

The role of patient relations, for hospital staff, in the food and beverages department is of paramount importance. Every staff in this department should be very polite and should meet the patient as often as necessary, seek his/her views about the service and quality of food served, as well as his comments and suggestions regarding improvement. The food served should conform to the doctor's instructions, and should be of the right temperature, delicious, clean, and it should be served on time. Meals should never be delayed. The attendant, while serving, should make a few courteous remarks and enquiries. For example,

Sir, here is your breakfast as prescribed by your doctor. I hope you enjoy it. If you need any changes, please feel free to ask and we will discuss with your doctor and the dietician.

No attendant should serve the food mechanically. He should smile and serve the food, and arrange the table, water, napkin, etc. If need be, he should wash the patient's hands, lips and so on with concern and care. Not good food alone, but also the way it is served to the patient, goes a long way in creating a positive image. Hence, the role of patient relations is a very relevant one.

MAINTENANCE AND ENGINEERING

This is one area, with which the patient may not come into direct contact. However, the efficiency of this department has a definite bearing on the physical comfort of the patient. These include a 24-hour water and power supply, electrical appliances (fans, air-conditioning), hospital equipment and instruments in a working condition, and uninterrupted laundry services. The maintenance/engineering department has the responsibility of providing these services. During the patient's stay in the hospital, his physical comfort contributes greatly to his progress.

Hence, the maintenance staff should maintain good patient relations. To cite an example: An occasion might arise when the air-conditioning is not working properly, or not working at all. The patient or the attendant may generally complain about this first to the nurse. The nurse, in turn, is expected to inform the housekeeping supervisor, who will inform the maintenance department. This process is circuitous and time-consuming. The maintenance staff member is expected to attend to the complaint as early as possible, diagnose the fault, and rectify it. At this stage, he should speak politely to the patient, express his regrets first, then explain the cause for the problem, and assure him that the rectification process will be initiated immediately. If it cannot be rectified for any reason, it is the maintenance staff member's duty to explain why it cannot be done immediately, to provide a fan, and request the patient to bear with them. He should not think his duty is over, but should endeavour to bring the episode to the notice of his supervisors immediately, and explain his plan of action. In such a situation, the maintenance department staff can build up good patient relations with their polite behaviour, and by showing their deep concern for the patient's comfort. Very often this element is missing. Good communication skills would definitely help in relieving the tension generated at that time.

Conclusion

Patient relations is not an end in itself, but it is also an indispensable aspect of good management. With increasing professionalism in all the departments of a hospital, patient relations has become more oriented to management science. The effectiveness or the utility of a manager depends a lot on his/her personal skills, human, technical and conceptual, based on scientific foundations. The role of patient relations in building up an environment of faith, belief, reliability and quality assurance in a hospital cannot be underestimated. A non-medical person practising patient relations, and also his/her staff, should be able to avail of the benefit of a carefully designed and 'tailored-to-the-needs' training, and should be able to use medical terms and phrases. This will help them to gain understanding, confidence and clarity, and enable them to interact effectively with the patients. Hence, rigorous and high profile training programmes need to be conducted for all the staff working at the front office, reception and enquiry counters.

Only a life lived for others is a life worthwhile.

—Albert Einstein

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Medical Audit and its Administration

16

N. Rajaram and Swati Pandey

The case is a 19-year-old girl, Vivian Labourton....Got a lump below her left knee. Persistent pain. X-ray shows some bone irregularity. These slides are from the biopsy.

There were eight slides and Coleman studied each in turn....At the end he said, 'My opinion is benign.' 'I think it's malignant,' Pearson said quietly... 'And if I am wrong, a 19-year-old girl will lose a leg for nothing.'

'May I suggest we check some past cases,' Coleman said, 'cases with some symptoms?'

The old man shook his head. 'No good. It would take too long.' Trying to be discreet, Coleman persisted, 'But surely if we checked the cross file...' He paused.

'We haven't got one.' It was said softly, and at first Coleman wondered if he had heard it right.

Nothing that Pearson might have said could have shocked David Coleman quite so much as this. To him, and to all pathologists whom he had trained and worked with until now, the cross file was an essential professional tool. It was a source of reference, a means of teaching, a supplement to a pathologist's own knowledge and experience, a detective which could assimilate clues and offer solutions, a means of reassurance, and a staff to lean on in moments of doubt.

—*The Final Diagnosis*, Arthur Hailey (1959).

Introduction

This is perhaps a layman's introduction to medical audit in retrospect. It helps to understand the validity of a procedure conducted in the past, which becomes a source of reference for the future, and forms what is known as the essence of medical audit. The final diagnosis of the pathologist in the book (Hailey 1959) is a result of years of experience, where instinct and intuition play a crucial role in avoiding a 'near miss'. In order to discharge their duties as responsible

medical professionals, doctors require education and experience. Medical audit is a tool which ensures a high level of knowledge through the constant pursuit of observation and inquiry.

Medical Audit

The history of medical audit can be traced to Dr George Gray Ward, a noted gynaecologist at the Womens' Hospital, New York City. He was the Secretary of American Gynecological Society, from 1917 to 1921, and its President in 1922. He considered medical audit a systematic review and analysis of all patients who were treated by him. He put into practice probably the first organised medical audit, emphasised the importance of maintaining accurate medical records, and paid great attention to the study of end results. Medical audit was suggested as a regular feature for all government hospitals in India by Dr Sushila Nayyar, the Health Minister of India in 1969. Medical audit has been defined as:

an evaluation system in which established standards are used to measure performance. Once corrective action has been taken about problems identified through a review process, performance is re-measured after an appropriate time period.

The following are acknowledged as *the attributes of medical audit*:

- It aims to improve the quality of medical care.
- It compares actual medical practice with agreed standards of practice.
- It is formal and systematic.
- It involves peer review.
- It requires the identification of variations between practice and standards followed by the analysis of causes of such variations.
- It provides feedback for those whose records are audited.
- It includes following up or repeating an audit some time later, to find out if the practice is fulfilling the agreed standards.

Medical audit is justified on the basis that it is a stimulus to the practice of scientific medicine, and an objective and specific check on the professional tasks performed in the hospital. In this context, it has frequently been compared with financial audit. Over the years, people have argued, 'If it is important to have an audit in rupees, is it not more important to have an audit of the professional work of the hospital, an account of the medical care rendered in terms of lives

saved, avoidable and unavoidable deaths, diseases averted and patients rehabilitated?' There is, therefore, a need for medical audit. There is no doubt that this would lead to improved patient care, as well as a reduction in hospital expenditure, due to the better utilisation of hospital facilities, and avoidance of wasteful and unproductive methods.

It should be noted that there exists a professional motive for auditing medical practice. Most medical students graduate as altruistic physicians, wishing to provide the best possible care to their patients. Medical audit fosters this altruism and provides a system for generating self-correcting and self-regulating improvements in their practice. It also encourages and helps them to maintain a high quality practice. Then, there is a social motivation too. All doctors are accountable to the people they serve, how they dispose of the resources made available to them and provide good service to the best of their abilities. Thus, medical audit fosters both effectiveness and efficiency. In addition to this, it ensures that patients receive optimum care, and helps in avoiding unnecessary risks in the provision of that care.

Medical audit provides the relevant information by means of which doctors and other health care professionals can defend themselves against criticism, support claims for more resources, and improve on the deficiencies in their service. As a corollary to this, it helps medical practitioners provide evidence to funding agencies, and informs managers of the need for more resources for improved efficiency. Medical audit thus helps in streamlining hospital procedures, by exposing the bottlenecks in the diagnostic, therapeutic and supportive services of a hospital. For this purpose, a systematic procedure for audit is required. Protocols need to be laid down, all the individuals involved need to be motivated, and the relevance of such an exercise should be explained to them. The idea that it is not policing but a step towards greater knowledge and understanding, by way of joint effort, is what will determine the success of such an endeavour.

Protocols

Protocols for medical audit need to address the following questions:

- Who is being audited?
- Who is auditing?
- What is being audited?
- How is the audit conducted?
- How often and when is the audit conducted?

Clarity regarding these issues will lay the foundation for starting a medical audit in a hospital. The following components should form an integral part of a medical audit protocol:

COMMITTEE

A medical audit committee should be constituted, comprising the following professionals from the medical section:

- Director of Medical Services
- Heads of medical departments (Medicine, Surgery, Obstetrics and Gynaecology, Paediatrics)
- Head of Pathology
- Nursing Superintendent

and the following from the administrative section:

- CEO/MD
- Administrator

In case the CEO/MD and/or Administrator do not have a medical background, they are only observers at committee meetings. In addition to this, depending on the area of audit, certain other administrative personnel could form a part of this committee. For example, the bio-medical in-charge in an equipment audit.

FREQUENCY OF AUDIT

The audit should be conducted in the following manner:

- Periodic/regular: Monthly audit of cases (this includes death cases collected over a month). This periodicity is subject to the patient turnover in the hospital.
- Surprise checks of medical records conducted fortnightly.

Elements of Audit

- (a) Case audit
 - Mortality review

- Complications audit
 - Antibiotic utilisation
 - Overstay audit
 - Investigation audit
 - Check sheet: pre-operative, pre-anaesthetic, pre-procedural.
- (b) Infection control audit
- Hospital-acquired infection
 - Environmental infection.
- (c) Critical areas audit, such as, ICUs, OT, burns, dialysis
- Standard operating procedures laid down for these areas, to be strictly followed.
- (d) Medical record audit
- (e) Resource utilisation
- Frequency of consultation.
 - Frequency of sample collection.
 - Frequency of usage of consumables.
 - Frequency of usage of OT, diagnostics, physiotherapy, the medico-social worker.
- (f) Equipment audit

Audit needs to be organised in such a way that leads to the maximum participation of the organisation, with the prime objective of improving hospital services. Files should not be opened to evaluate personnel and label them good or bad. A 'we' approach would go a long way in making audit acceptable. In order to carry out a complete review, each area of audit should have a predetermined checklist. The elements which could serve as indicators of how to carry out a medical audit are described in detail.

CASE AUDIT

An ideal subject for audit would be a common, well-defined, clinically significant diagnosis or treatment.

Mortality review

Autopsies should be performed. The final diagnosis, or the cause for the death must be given by the pathologist. Once a death has occurred, it is necessary that the medical records are sealed, so that no alterations can be made. The cases are

then opened at the Mortality Review meeting, and the details of the case sheets are discussed and debated. The factors under consideration for discussion in the meeting include the validity of drugs administered, the dosage, any reactions to the drugs, complications arising out of the disease and so on. The information for this review is built from the data collected in autopsy.

Complications audit

Complications occurring must be determined by verifying observations with the drug therapy, or a change in therapy, and laboratory and radio-imageological findings. It should be stated that the complications were due to causes beyond the doctors' control, whether it was due to the natural course of the illness or the result of poor management on the part of the medical, paramedical or hospital staff. Passing the buck in such situations can only serve to aggravate defensive behaviour. But a planned programme of rectifying faults and finding alternative solutions through direct training and involvement of all those concerned, would go a long way in consolidating interdepartmental co-operation.

Antibiotic utilisation

A trial of a minimum of three days is mandatory in most cases, before any antibiotic is changed. During the management of any infectious disorder, when response to therapy is unsatisfactory, it is appropriate to check the correctness of diagnosis, dosages and acceptance of the prescribed drugs. It is mandatory to state the policy for administering drugs to the old, the young, pregnant women and immunocompromised patients. Periodically review the policy for administration of antibiotics, collect data on its usage and its cost for correlation studies. A representative committee may establish guidelines for the use of antibiotics. Make use of Continuing Medical Education facility to propagate the guidelines, discuss research findings and share information on Prevalence of Antibiotics use in the hospital. Prevalence percent is the ratio of number of patients administered with antibiotics to the total number of patients at a given point in time expressed as a percentage. This percent plotted as a graph over time, disease and department will help in the review and control.

Overstay audit

All interventional and surgical procedures have a fixed period of stay. Any patient's length of stay beyond these acceptable limits needs to be audited, and the causes for overstay need to be examined.

Investigation audit

The relevance of any investigation prescribed needs to be examined. However, a prescribed set of investigations for specific procedures should be complied with. For example, an antenatal check-up should necessarily comprise a total blood count, the Hb percentage, blood grouping and cross-matching, tests for syphilis, HIV, a complete urine examination, a dose of anti-tetanus vaccine, and in addition to the general physical examination, a systemic examination ascertaining the weight of the mother and the relevant obstetric examination. Thus, a checklist should be prepared for each situation.

Check sheet

This is illustrated with an example. In a typical audit, the anaesthetists should reach an agreement about what they want to know about their practices, and they should select their objectives accordingly. They should then agree on the number of cases to be included, the time period to be covered, and whether data should be collected on past, present or future cases. The following is a sample checklist:

1. Find out whether the key aspects of pre-anaesthetic history are being documented for all patients (or for a selected group of patients only).
2. Ensure that the findings of pre-anaesthetic assessments are being documented consistently by all anaesthetists.
3. Confirm that pre-anaesthetic assessments are being carried out at the correct time.
4. Find out whether results of essential investigations are available in time for pre-anaesthetic assessments to be completed.
5. Find out how many unnecessary investigations are being requested by anaesthetists and what they are.
6. Identify cases of disagreement among anaesthetists regarding patients' fitness for operations, based on anaesthetic assessment.
7. Ensure that all patients have given their consent for the anaesthetic to be administered.

INFECTION CONTROL AUDIT

1. Arrange regular swab collection from the environment.
2. Collect samples or swabs from appropriate sources (patients, equipment, personnel) to determine the infection rate.

3. Check whether protocols documented for infection control are being followed. This should include procedures for cleaning and disinfection, regulation of traffic movement, air-conditioning policy and so on.

CRITICAL AREA AUDIT

Specific protocols need to be laid down for the survival and recovery of patients in critical areas, namely in the operation theatre, intensive care unit, dialysis unit, burns unit, isolation rooms and paediatric recovery rooms.

MEDICAL RECORD AUDIT

The primary purpose of medical record audit is to ensure that accurate and complete medical records are maintained for every patient treated. Records are reviewed for their timely completion, clinical pertinence and overall adequacy, for use in patient care, evaluation studies, and in some circumstances, medico-legal documentation. The medical record review ensures that records reflect the condition and progress of the patient, including the results of all tests and therapy given. Some factors to be considered should be:

- The format of the complete medical record.
- The forms to be used in the record.
- The entries should mention the time and date.
- The charts should be problem-oriented and analytical.
- The reasons for actions taken should be mentioned.
- The methods of retaining and retrieving medical records.

The adequacy and accuracy of the records must be ensured by the consultant doctors, who should examine them during their ward rounds.

EQUIPMENT AUDIT

The scope of the medical audit could be stretched, the audit committee could make valuable contributions, and work out new strategies by curtailing costs without compromising efficiency. Equipment audit serves this purpose. Guidelines should be developed to analyse the need for an equipment in a scientific manner.

Deliberations and discussions should be keen and to the point in such meetings. The cases for presentation must be well-prepared, and one member of the staff should be ready to open the discussion. A case critic to review and summarise

the discussion has been found to be helpful. It is not enough to state that good results have been obtained; the medical staff should also justify its work in terms of morbidity and mortality, and show that its successes are consistent with general averages, while failures are inevitable. During the audit, organisational errors must be brought to the attention of the management. Any attempt by medical professionals to correct administrative errors personally should be avoided. The administrator's authority should not be usurped in any manner, and every effort should be made to encourage and strengthen cooperation between the medical and administrative staff.

Audit Types

Audit can be both direct and indirect. Indirect audit for patient care consists of a team of heads of departments visiting various areas in the hospital, along with the nursing supervisor, and submitting a written report on the following points:

- **Buildings:** aesthetic and functional aspects of in-patient and out-patient areas
- **Equipment:** kinds, age and state of repair.
- **Supplies:** amount, quality and availability.
- **Staff:** number, training, and efficiency.
- **Statistics:** in-patient and out-patient statistics every month.
- **Relationship:** of departments with other departments.
- **Plans:** for future departments.

This must be followed by the Medical Superintendent meeting the Heads of Departments, and a discussion regarding written reports, resulting in action plans for improvement. Follow-up must be ensured in all areas. Direct patient care audit is done by a consultant, aided by two senior members of the medical staff. Direct patient care audit involves:

- Maintenance of case study records of all death cases during the year.
- Visiting all patients and examining current records.
- Discussing record-keeping with various clinicians.
- Visiting the OTs, CSSD, X-ray, laboratory, pharmacy and so on, and supervising the general functioning of the department.
- Meeting the medical staff and nursing staff initially, and on completion of the audit reporting and discussing results.

This type of audit is essentially an internal audit. In addition to this, it is advisable to have an outside agency periodically test the completeness and accuracy of the internal audit.

Audit Methods

In order to ensure objectivity and consistency, an audit methodology is necessary. The following are a few methods suggested by professionals in the field:

STATISTICAL METHOD

Statistics should be determined wardwise and unitwise on a monthly basis. Statistics to be collected include the bed occupancy rate, the average length of stay, the infection rate, the consultation rate, the bed turnover interval, the hospital infection rate, the autopsy rate, the caesarian section rate, the neonatal death rate, and so on. A few accepted standards are listed below:

- *Bed occupancy rate* is ideal at 80 per cent.
- *An average length of stay* exceeding 12 days is indicative of the presence of chronic or incurable patients in a hospital intended for acute care, poor medical care, hospital-acquired infection, lack of interdepartmental consultants, or bottlenecks in investigative procedures.
- *Infection ratio* of more than 2 per cent infection in clean surgical cases calls for investigation.
- *Consultation rate*: Formal consultations should be held for 15 to 20 per cent of the patients admitted into a general hospital. Many hospitals find that at least 15 to 20 per cent of the patients treated benefit from consultation. This percentage of consultations is usually considered to be an index of teamwork and cooperation among the members of the medical staff.

In determining the number of consultations, only those which have been recorded are taken into consideration, although they may by no means represent the total number held. In addition to this, it is worth mentioning that the American Medical Association requires—as a minimum—autopsies of 25 per cent of patients who die in a teaching hospital. In conclusion, it can be said that the number of autopsies conducted reflects on the sense of responsibility of the medical practitioners.

DEATH OR MORTALITY REVIEW COMMITTEE METHOD

The *gross death rate* is determined by calculating deaths within 24 hours of admission into a hospital. This gives an assessment of the emergency services in a hospital. *Net death rate* is the total number of deaths occurring after 24 hours of hospital admission. It shows the level of clinical efficiency. However, deaths occurring beyond 48 hours of admission have to be critically reviewed, to rule out the slightest possibility of preventable deaths. Some departments, such as dermatology, ophthalmology and orthopaedics do not have any deaths, but this does not imply that the efficiency level is cent per cent. Hence, it must be kept in mind that death review methods cannot be applied universally. A death rate of 3 to 4 per cent can be used as an acceptable standard for efficiency.

RANDOM TABLE METHOD

In this method, case sheets are taken out from the medical record department at random and scrutinised on various parameters, such as complications audit, overstay audit, investigation audit and infection audit.

SCORING METHOD

A score is worked out for each disease and then selected case sheets of those patients in that disease group are taken out for scoring and evaluation.

ON-THE-SPOT MEDICAL AUDIT METHOD

The medical audit committee meets on a particular day in a particular department, based on random selection, and then case sheets are evaluated against set standards.

Audit Monitoring

In all these methods, 'monitoring' plays a key role in determining the success or failure of medical audit. Harrison (1991) suggested five main methods of monitoring:

1. **Sentinel cases:** the variation from the norm in the outcome. This is applicable in relatively uncommon, but very serious situations. The best known and indeed the first such audit was the British Confidential Enquiry into maternal deaths, which has changed medical practice, and continues to influence it.

2. **Criterion-based audit:** departure from specified outcome criteria. This method is applicable to common conditions, where agreed standards of management or management protocols can be used.
3. **Comparison of small groups in the same field:** applicable at local hospital levels. This concerns the examination, diagnosis and treatment of groups of patients with specific ailments by a general practitioner, and its comparison with the treatment rendered by a specialist under similar situations. Studies have shown that processes and outcomes of treatment rendered by a general practitioner and the specialist differ significantly.
4. **Surveys:** patient satisfaction surveys are very useful in auditing.
5. **Peer review:** such reviews are invariably of mutual benefit for the medical fraternity. The primary idea of peer review is to learn from mistakes.

Audit Practice

Once the quality has been assessed by monitoring, actual or suspected problems should be assessed, and deficiencies detected, with an intent to correct. It must be remembered, that at all points, satisfactory or high quality care must be praised. Improvement can be achieved through re-education, retraining, facilitation in small groups, or by more active persuasion. A case example follows:

In one of the hospitals, attempts were made to improve the recording of a check on an inhaler technique for patients, which was carried out before their discharge from hospital, by providing a stamp which was imprinted on the patients' peak flow chart, and which was hung at the foot of their beds. In order to reduce the number of patients discharged with peak flow variability in excess of the recommended level, repeated training was given and persuasion used. Doctors were encouraged to state in their notes why they were discharging a patient whose peak flow variability was outside the recommended limits, and sometimes there were very good reasons for this. Further monitoring and assessment was conducted to determine what changes resulted from the improved recording of a check on an inhaler technique for patients.

Written checks on the inhaler technique did not initially improve, following the introduction of the stamp, but with a little more persuasion, recorded checks rose from 58 per cent to 96 per cent. Similarly, the proportion of patients discharged when the peak flow variability was within the recommended standards increased from 55 per cent to 75 per cent, and reasons why the standard was not adhered to was given for a further 13 per cent.

However, it must be recognised that though the criterion-based approach is suggested, it has its own limitations. There is a problem in setting explicit standards. The reliability of audit is determined by the reliability of the original measurement. For example, in a comparison of post-operative wound infection, one surgeon or nurse may regard some redness or indication around the incision as nothing untoward, and another may classify it as a clear case of infection. In *post hoc* observational studies, which are the common base for an audit, it is highly improbable that clinicians will use the same criteria when entering data into the patient's record.

Auditors will also face difficulties when confronted by a note that reads: 'Full explanation of illness and prognosis given to patient.' Such a one-line sentence may be a fair summary of a detailed 40 minute discussion with the patient about all the complexities that lie in the future—a conversation laced with empathy and understanding. Equally, it may denote an off-hand, brief and unsympathetic remark by a clinician, along the lines of, 'You have multiple sclerosis, I'm sorry, but we don't have any effective treatment for it.'

An interesting report appeared in the *Journal of the American Medical Association* (July 1995). Out of 186 patients with cardiac chest pain referred for coronary angiography, in a re-evaluation by equally competent heart specialists in other participating research centres, only six were recommended for this test. Only 3 per cent of patients referred by American doctors for coronary angiography needed that test, if strict scientific criteria were applied.

Consider another situation: Two surgeons, with complication rates—after a specific type of operation—of 10 per cent (Surgeon A), and 5 per cent (Surgeon B). But the difference in rates is statistically significant only at a probability of 0.10. Should the difference be reported? Surgeon A would probably argue that the difference is not significant, and thus should not be reported. Surgeon B, on the other hand, might argue that the data is informative and that it reflects a true difference in the quality of care. This may lead to heated arguments and can impair the functioning of the medical audit committee.

More effort should be devoted to ensure that the best methods and measures are employed in quality monitoring and improvement. One should consider the possibility that if no data was released, funding agencies and individuals would be more likely to make decisions based on factors extraneous to quality, such as cost. Thus, statistical validity is a critical issue for measuring quality, but there should be a discussion which includes medical professionals, quality measurement experts and the public so that the statistical measures used, and the methods used for presenting differences and describing uncertainties will be good for most people.

Constraints

It has been observed the world over that hospitals have realised the need for maintaining certain standards. However, the benefits of its execution by means of medical audit still remains to be proved. Be that as it may, the medical audit procedure may suffer from other drawbacks such as poor recording of case histories. Audit works on the basis that if an item of care is not recorded, it did not take place.

Many practitioners state that the most enjoyable part of their job is talking to their patients. In this context, medical records assume lesser importance. Conversely, a common complaint of patients is regarding obsessive record writers who 'spent all the time writing and didn't even look at me'. Similarly, constraint of time may also impede the process of medical audit. Anaesthetists accept the desirability of documentation, of complete assessment and the results of investigation. Reality, however, does not always match with what is desired. Many anaesthetists are quick to admit that they do not always document complete histories. This does not necessarily indicate a negative attitude and lack of knowledge. Anaesthetists may receive short notice regarding a task, and are occasionally requested to be in two places at one time!

Failure owing to the retrieval of records of the sample of patients designated as appropriate for an audit, may also glare the auditors in the face. For example, retrieval of records through diagnostic coding, after a patient's discharge, may not enable the retrieval of the record of a Myocardial Infarction (MI) case, where the patient had a dissecting aneurysm of the aorta mismanaged as an MI for the first 12 hours of his/her care.

In a recent short article in the *British Medical Journal*, it was stated: 'The audit cycle has become a vicious circle, a noose to strangle any chance of it ever being a practical everyday tool' (Farrell 1995). There is a need, therefore, to approach medical audit in a rational manner and achieve pragmatic solutions in order to facilitate better implementation. As with other quality initiatives, medical audit is effective only in a culture of cooperation and supportive mutual criticism. It requires commitment, particularly from the senior staff, who provide leadership. A planned programme of rectification and finding alternate solutions through the direct training and involvement of all concerned people, would go a long way in consolidating interdepartmental cooperation. Medical audit meetings should never be seen as another lunch-hour meeting. Every individual must be made to realise the importance of such an initiative.

The best approach would be to introduce medical audit in a step-by-step manner. Audits, not directly related to a doctor, such as an infection audit, can

be introduced first. This can be followed by more sensitive areas of audit, as the idea gains gradual acceptance in the system.

In all such matters, confidentiality should be maintained. The Conference of Medical Royal Colleges (1991), in their interim guidelines on confidentiality in medical audit stated that:

...the requirements of confidentiality for both patients and clinicians mean that regular reports of audit activities to management must be anonymised. The report should cover the general areas of activity of audit, the overall conclusions and recommendations made, and plans for action....

For high standards and high quality to permeate the audit culture, a system for establishing credentials must be introduced, which will lay down standards for the recruitment of medical personnel. In order to minimize the risk, and carry out a pioneering task, an ethics committee must be formed, so that the burden of decision does not lie on one individual alone. A joint decision in all risky cases will provide the best support.

Implementation

Four important principles for effective implementation must be kept in mind:

1. Attention should be focused on aspects of care, which are either high risk or high volume, or commonly prone to problems, for either patients or the staff.
2. Common conditions should be handled first.
3. Medical audit should be kept simple.
4. It must be ensured that tasks undertaken are achievable and are achieved.

As far as possible, attention should be focused on aspects of care which are either high risk or high volume, or commonly prone to problems, for either patients or the staff. Furthermore, common conditions should be handled first. Finally, medical audit must be kept simple, and it must be ensured that tasks undertaken are achievable and are achieved.

Properly conducted medical audit will result in a demonstrable improvement in the quality of medical care. It is a potentially powerful tool for facilitating improvement. It is, as has been accepted, the ultimate assurance of quality. The only feature that distinguishes medical audit from other aspects of quality

assurance is peer review. Other methods of quality assurance may, but need not incorporate peer review.

Quality of care measurement involves two basic concepts:

- Quality of technical care: adequacy of diagnostic and therapeutic procedures.
- The quality of the art of care: relating to the behaviour of the provider in delivering the care.

Quality is usually assessed under three headings, *structure*, *process* and *outcome*. *Structure* includes the basic resources of personnel, building and equipment. *Process* comprises the procedures and processes involved in the use of the structure, so as to achieve the desired *outcome*. The components of high quality care are directly related to medical audit and they are:

- Good professional performance.
- Efficient use of resources.
- Minimal risk to patient: Joint Commission on Accreditation of Health care Organizations's (JCAHO) definition of quality is worth mentioning: 'Quality of patient care is the degree to which patient care services increase the probability of desired outcomes, and to the extent it reduces the probability of undesired outcomes, given the current state of knowledge.'
- Patient satisfaction: Patients' views of quality are now being sought in various ways, including patient surveys by means of written questionnaires or individual interviews. Another useful technique, which can be used in the case of providers, purchasers and patients, is focus group interviews.

The achievement of quality depends on the interaction of many processes carried out by different individuals or groups, who may not relate to one another in traditional terms. Understanding and controlling the processes, rather than the people, is what is critical in quality management. The process of medical audit comprises:

- Identifying and solving problems.
- Recognising and maintaining high quality services.

Medical audit performed in this way not only improves quality, but also reduces cost. It should be noted that high quality care is not necessarily the most expensive care available. High quality care may be expensive, but frequently low quality care is even more expensive, when one considers such outcomes as preventable

complications or death, preventable morbidity, the time and trouble involved in dealing with complaints and professionals not performing at an acceptable level.

Today, the implementation of a quality assurance programme has become a necessity to ensure the efficiency of a hospital. The Indian Hospital Association started its Quality Assurance Programme (QAP) in 1985. A proforma was developed for the study of the same, and the results were presented before national and international gatherings. The two key features of quality that are fundamental for effective means of assessment and improvement are:

- **Quality is comparative:** Some things are better than others. For instance, a surgeon with a wound infection rate of 1 per cent is providing higher quality care than one with an infection rate of 8 per cent, other aspects, such as case mix, being equal.
- **Quality is dynamic:** Today's high quality is tomorrow's acceptable quality.

With the advent of ISO standards, more and more hospitals are working towards obtaining the certification. ISO 9002 is applicable for the service industry. The corresponding Indian Standard and British Standard are IS 14002 and BS 5750 respectively. Out of the 20 elements mentioned in ISO 9002, 19 are directly applicable to hospitals. Medical audit, with its direct relation to quality, helps in maintaining the standards of patient care. Long ago, during the Crimean war, Florence Nightingale undertook a classic audit study, with a dramatic effect (Starchey 1948). After noting the high mortality rate at the Scutari Military Hospital, she enforced higher standards of care and hygiene, reducing mortality rates to two per cent from 40 per cent within six months.

Conclusion

It should be noted that medical audit should not be directed at a person and discussed in an open meeting. The person's dignity and professional ethics must be taken into consideration while bringing the audit results to his or her notice. One should not fall into the trap of using this as a means of witch-hunting. The advantages are many, from the self-improvement of the professional, to ensuring a high quality of service to the customer—the patient. It provides an opportunity to continuously improve performance, diagnostic ability, treatment and learning in general. However, the spirit of learning through hindsight and inquiry is more important than pulling up someone. There is a growing interest in its implementation and understanding its value among medical professionals, as observed from the results of the face-to-face inquiry survey reported in Appendix 16.1.

The objective of medical audit is an improvement in quality, and the best way to establish it is through an orientation programme, creating definite protocols and obtaining support from a strong and willing administration. The comparison of actual practice (in terms of trend and pattern), with set standards for practice is essential. Follow up, repeating of particular audits to confirm that a specific practice has improved, and review for possible revision of standards as new research findings or professional guidelines come to the fore, are essential to progressively improve medical audit and keep up with the times.

APPENDIX 16.1

Status Survey of Medical Audit

A face-to-face inquiry survey was conducted by the authors among 52 doctors, to assess the current status of medical audit in India. Their responses are summarised in this section.

The response to medical audit ranged from complete ignorance to strong ideas about the subject. Some doctors confused medical audit with financial audit. Their awareness of the subject was quite low. However, there was willingness on the part of the respondent-doctors to accept the fact that *they did not know much about medical audit*. Perhaps this indicates the lacunae in medical education in India, and makes one wonder, whether this subject should not be made mandatory in the curriculum.

The doctors were prepared to participate in medical audit, and they agreed that medical audit provided an opportunity for introspection, although, they conceded the fact that the right spirit was crucial. They expressed their apprehension that it should not turn into an opportunity for vengeance, but serve as a constructive instrument for evaluation and learning. The majority of the respondents felt that the initiative for medical audit must come from doctors, with support from top management. The primary reason why it was not being practised was because of ego clashes and the fear of being 'pulled up'.

In the recall of medical audit, they identified it with quality, standards, statistics, medical records, negligence, policing, outcome and result. Provided the right amount of effort is put in, and people are willing to accept it, the estimated time duration for implementing medical audit in a hospital in India would take six months to two years. Two out of three respondent-doctors assessed the success rate of implementing medical audit in their hospital as over 60 per cent. Three out of four respondent-doctors agreed that standards could be established for

medical audit. However, two points of view regarding standards prevailed—one, that international standards adapted to the Indian set-up would be suitable, and two, each hospital must develop its own standards.

Most of the respondent-doctors agreed that medical audit was required in a hospital; that it led to better patient care; that its success would depend on who conducted the audit, and what method was applied. The reasons for its success abroad are that it is mandatory and is considered a moral obligation.

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Introduction

This chapter describes the preparation required for obtaining the ISO certification. The information is based on the knowledge gained in implementing the ISO system in a hospital, when there were no models available in the Indian hospital industry. Hence, one can say that it is 'home-grown'. Starting from the shift that is taking place towards customer orientation in the service industry, a detailed explanation is provided in the interpretation of the ISO system for a hospital. Then the implementation process is described, concluding with the tangible and intangible benefits that accrue from it.

Paradigm Shift to Quality

QUALITY AND CUSTOMER ORIENTATION

In today's competitive world, the customer becomes the focus of attention of any organisation, both in the manufacturing sector and services sector. The quality of the product or the service provided to the customer comes under a magnifying glass, to be scrutinised by the buyer and the market. Organisations are becoming very sensitive to the needs of the customer, not only to gain their goodwill, but also to avoid facing their wrath. Today, customers are willing to pay a price for value. The key word, as far as the value of a product or service is concerned, is quality.

The quality of a service or a product is the vital factor in the survival and growth of any organisation. Quality is the engine of the economy and the fabric of a corporate organisation. Changes in the economic scenario in the country during the last six years have forced a number of organisations to embark on programmes related to assured quality and standardisation of process, in order to ensure the delivery of quality products or services at a consistent level to the customer.

Quality means conformance to the standards, both stated and implied, over a period of time and at a price the customer can afford or is willing to pay.

Quality in the health care industry is assuming greater significance in the developing world; not only to give the best in the field of medicare to the people, but also to attract patients from other countries, which results in foreign exchange inflow. A hospital can be divided into four segments—medical services, paramedical services, support services and administrative services. However, the system should ensure that all services work in a unidirectional manner, to enable the patient to get the best from the institution. A hospital is a complex organisation, which needs to be supported by trained professionals, state-of-the-art technology, teams of professionals committed to quality, and above all, an attitude of genuine concern and care for the patients, displayed by the hospital personnel. While investment for the procurement of the right type of material, machinery and human resource is fairly high and important in hospitals, the flow of returns for the institution is a slow process. In today's competitive world, a hospital, to be viable and competitive, has to make a mark by providing quality service, coupled with continuous improvement in its respective disciplines. This will ensure a good image as far as the public is concerned, and based on the goodwill it earns, it can become a household name. It is not easy to attain this status unless the internal systems are so clearly defined that the delivery process is smooth and effective.

The complexity of a hospital as an organisation is due to the multicultural and heterogeneous workforce, with high-grade professionals at one end and less qualified housekeeping personnel at the other. The vast difference in qualifications and experience between professionals and non-professionals makes it imperative to create a culture that promotes the right type of organisational climate, supported by documented quality systems for organisational effectiveness. The role of specialisation and super specialisation in various disciplines has created specialty and super specialty hospitals. The services provided and the systems followed in each of these institutions are different, and the demands, as far as the delivery process is concerned, vary from one institution to the other.

There has been a mushrooming of small nursing homes and hospitals in India. The level of service provided by these vary as they are dependent on the professional support and the infrastructural facilities they have. As there are no clear-cut norms for setting up health care units, a lot of compromises have been made in patient care. But today, patients are better informed about their rights and liabilities, when they undergo treatment for any ailment. They scout various hospitals treating the same disease, comparing their reputation as far as results are concerned, and the cost of treatment, before taking the final decision of undergoing treatment in a particular hospital. Hence, it is important for the health care unit to project a positive image in terms of performance.

In order to provide quality service, health care units will have to work out well-defined protocols for their operating systems. They will have to achieve specified international standards in specific disciplines, to enable the community to accept them as primary institutions in a particular medical discipline. Such institutions will automatically become a benchmark for others at the national level. As a proof of their credibility, it is preferable for such institutions to open themselves up for audits, by various certifying bodies, so that the systems can be tested for quality and be certified. This will enhance the image of the institution in the eyes of the consuming public.

In India, though we have institutions such as the Indian Medical Council and the Indian Nursing Council governing the practice of medical and nursing professionals, we do not have institutions such as a Joint Commission of Hospital Accreditation Service, whose mission is to improve the quality of the health care provided to the public in collaboration with professionals and health care organisations. The need of the day is to set up a Board at the national level, which can take care of the standardisation element in a hospital before it starts functioning. This will ensure that patients get the best medical treatment. Until then, institutions can open themselves up for a third party quality system certification audit by various certifying bodies such as BIS, STQC, TUV, BVQI, for their effective functioning.

TOTAL QUALITY MANAGEMENT

Since quality attainment is viewed as a journey, every organisation will have to decide on an approach to please its customers, by meeting their expectations on a continuous basis. Today, a number of organisations have implemented Total Quality Management (TQM) to meet the demands of the customer. The basic principle of TQM is to keep the customer in focus at all stages of operational activities. The process is customer-oriented and involves people at all levels in the organisation. TQM ensures that there is continuous improvement in the effectiveness and efficiency of the organisational systems, procedures and processes. It is an integrated approach which harnesses the human and material resources of the organisation, and uses them in the most effective manner, so as to achieve their objectives, along with a high quality output.

TQM encompasses a set of four principles: delighting the customer, people-based management, management by fact and continuous improvement. It can be implemented by putting into practice suitable TQM methods. However, adopting the right kind of method will depend on the culture, the willingness of the personnel in the organisation, and their knowledge and understanding of the methods. The

Human Resources Department and the Quality Assurance Department will have to work together to decide which method to follow, so that the implementation and outcome are successful.

One of the approaches to TQM is the adoption of the ISO 9000 series of quality standards, systems and procedures. Starting the ISO 9000 process will facilitate the acceptance of the corporate organisation's product or service globally, and is perceived as providing an edge in today's competitive world. In such an organisation, every member plays three roles: a customer, a processor and a supplier. The departmental and sectional barriers are removed by adopting an appropriate structure. Allocation of well-defined responsibilities will ensure the smooth functioning of the triple roles played by each member in the organisation. Every member becomes a link in the process chain, and the process is as strong as the weakest link. Hence, it is essential to ensure the achievement of quality at all levels.

ISO 9000 Series

The International Organisation for Standardisation (ISO) is a worldwide federation of national standards bodies from over 100 countries, and its mission is to promote standardisation throughout the world, for facilitating the international exchange of goods and services. An international standard is the result of an agreement between the member bodies and the publication of a standard, which requires the approval of at least three-fourths of the member bodies. India ratified the General Agreement on Tariffs and Trade (GATT) along with 122 countries, establishing the World Trade Organisation in January 1995, which prescribed rules for international trade. ISO 9000 is a series of standards required by ISO for certification of quality in systems for products and services. The sections that are relevant to our discussion are given below:

ISO Number	Title
9000	Quality System—Vocabulary, ISO 8402–1986
9001	Model for Quality Assurance in Design and Development, Production, Installation and Servicing all Elements
9002	Model for Quality Assurance in Production and Installation
9003	Model for Quality Assurance in Final Inspection and Tests
9004–2	Quality Management and Quality System Elements: Part 2 Guidelines for Services.

The principles of ISO 9000 are applicable to all cross sections of industry, whether it employs four or 4000 people. It identifies the basic disciplines and specific procedures, and lays down the criteria to ensure that whatever leaves the manufacturing or service organisation meets the *necessity* and *needs* of customers. For a service organisation, with specific reference to a hospital, the two standard documents applicable are ISO 9002 and ISO 9004–2.

The practice of quality management and quality systems, as per the above standards, in an organisation, is a process by itself. A number of certifying agencies, including one from the Government of India, provide services for Quality Systems Certification in India. To mention a few:

BIS	Bureau of Indian Standards
BVQ	Bureau Veritas Quality International
DNV	Det Norske Veritas
IRQS	Indian Register Quality Systems
LRQA	Lloyds Register Industrial Services (India) Ltd
NQA	NQA Quality Systems Registrar Ltd
STQC	Standardisation, Testing & Quality Control Directorate
TUV	TUV India Pvt Ltd
SGS	SGS India Ltd

ISO 9002 and Hospital

The primary requirement for a hospital, for the application of these standards, is to check and understand the applicability of the standard clauses for the institution. The interpretation of the clauses of the standards with reference to the existing practice, as required by the standards, will have to be formulated, applied and documented.

ISO 9002 has 20 clauses, 4.1 to 4.20, out of which 19 clauses are definitely applicable for hospitals. Clause 4.4, which deals with design and design control, is a specific element applicable only when the hospital designs a new mode of service, specifically for different types of patients. However, there is an element of subjectivity in this interpretation. It must be noted that in India all hospitals that have been certified are for ISO 9002. These clauses are discussed here.

4.1 Management responsibility

This clause outlines the management's responsibility in providing authority and material resources for all concerned persons. This also refers to the

interrelationship of all personnel who formulate, implement and manage all the systems, in order to render quality service to the patients.

Quality policy forms one element of the corporate policy, and the top management should define and document its quality policy, including objectives for quality and commitment to quality.

4.2 Quality system

There should be a detailed quality manual, which consists of policies and working procedures relevant to the operations, providing a cross reference to the standards.

4.3 Contract review

This clause refers to the agreement reached between the hospital and the patient.

- The hospital's agreement for investigation, treatment, administration of drugs and surgery, as may be deemed necessary for the patients.
- The patient's agreement to follow the guidelines, rules and regulations laid down by the institution, including the financial aspect of the treatment.

This also refers to the understanding between the client company (to which the patient belongs) and the hospital, for the treatment of the patient, either in the form of a contract, or a letter of understanding.

4.4 Design control

Not applicable to hospitals.

4.5 Document and data control

This clause refers to the safekeeping and periodical updating of the quality manual, the quality procedure manual, work instructions and other related documents, and ensuring the availability of the correct and current version at the right place, for the use of the concerned personnel.

4.6 Purchasing

This clause refers to the purchase of equipments (both medical and non-medical), materials (such as reagents, X-rays), and all other items, including those for support services, which directly or indirectly contribute to the quality of patient care. Purchasing also includes evaluation and verification of contracted services (such as laundry and ambulance services).

4.7 Control of product supplied by the customer

This clause refers to the manner in which the patient's documents, such as reference letters and earlier reports, should be handled and kept in safekeeping by the concerned staff.

4.8 Product identification and traceability

This clause refers to giving the hospital number and in-patient number (in case of in-patient), to facilitate easy and unique identification and the efficient retrieval of medical records by the terminal digit system, for tracing the drugs and equipment used, and for future reference.

4.9 Process control

This clause refers to in-patient and out-patient care and related activities, which are carried out under controlled conditions, thereby ensuring that the patient receives the best possible service. This includes documented work instructions, as per defined standards, defining the manner of action in clear and precise terms, and making it available at the right place to all concerned.

Criteria for patient care, including laboratory tests, should be prescribed mainly by means of written standards, or representative samples, where appropriate; the criteria for services should be by means of an agreement between the provider organisation and the patient, or the client representative.

4.10 Inspection and testing

This clause refers to the detailed procedure for inspection and testing of all activities and services rendered by the hospital, which should be documented in the form of checklists or proformas, for attaining the set standards.

4.11 Control of inspection, measuring and test equipment

This clause refers to the procedures used to calibrate, check, control and maintain all equipments and instruments at appropriate time intervals. This also refers to the human resources involved in the service process.

4.12 Inspection and test status

This clause refers to the authentication of the staff, regarding verification and inspection of the various records, such as the registers and log books for recording the test status.

4.13 Control of non-conforming products

This clause refers to the identification of the deficiencies and irregularities of the service conceived, the service rendered by the personnel concerned, and the appropriate corrective action to be taken.

4.14 Corrective and preventive action

This clause refers to the procedures for corrective action, including the effective handling of the customer's complaints, reports of non-conforming products, investigation of the cause, and the implementation of the necessary corrective action. This also refers to appropriate preventive action, to avoid deficiencies and irregularities in the services rendered, and to ensure that such defects do not recur.

4.15 Handling, storage, packaging, preservation and delivery

This clause refers to:

- The handling of the patient by all concerned authorities, and the environment, as per the norms specified for ensuring the safety of all equipments and materials.
- The implementation of appropriate methods for the receipt and issue of materials, and to maintain an adequate stock level through a proper system at any given time.
- Systems which take care of the patient's movement effectively within and outside the hospital, for example, the transport system.

4.16 Control of quality records

This clause refers to the establishment and maintenance of documented procedures for identification, collection, indexing and filling of quality records, to demonstrate conformance to specified needs, and the effective operation of the quality systems.

4.17 Internal quality audit

This clause refers to the adequacy of the quality systems that are being followed in the hospital, their verification by internal quality auditors, the results of the audit recorded and reviewed, and the corrective action taken.

4.18 Training

This clause refers to the quality assurance training of all employees, with respect to hospital services, through in-house and external training programmes.

4.19 Servicing

This clause refers to the provision of pre- and post-treatment counselling for the patients and their relatives regarding the technical and financial procedures of the treatment.

4.20 Statistical techniques

This clause refers to the implementation of suitable statistical methods for the evaluation of various services.

Implementation

TOP MANAGEMENT COMMITMENT

The implementation of the quality system will be dependent on the commitment of the top management. The involvement of the top management in this programme should be realised (felt) by all concerned, and the importance the top management of the hospital attaches to this process will form the basis for the success of its implementation.

ORGANISING IMPLEMENTATION

The management representative, identified by the top management, should be a very committed person and a team leader, who is the centre of focus at all times, constantly endeavouring to keep the system in working order. In principle, he/she should act as a liaison between the management and the rest of the hospital. He/she should be capable of playing different roles and adopting different styles of leadership to ensure that the programme is successful.

In a hospital, since the primary focus is on medical treatment and the service provided to the patient, it is important to have quality assurance officers, who will support the management representative in the implementation and operation of the ISO system. It is advisable to have individual quality assurance officers for medical and non-medical services, depending on the size of the hospital. The

management representative and the quality assurance officers should be duly supported by a document control officer.

ACTION PLAN

After setting up the ISO cell, an awareness and appreciation programme regarding ISO 9000 standards should be the starting point in the process of the implementation of quality systems in the hospital. This programme should create an awareness of the concept at the appropriate levels, so that the whole process can be supported in the correct manner.

On completion of the appreciation programme, the heads of departments in the hospital should draw out a plan of action, setting target dates for the rest of the process to be implemented. The emerging plan should be endorsed by the top management, so that it has their approval and tacit support.

GROUP MEETINGS

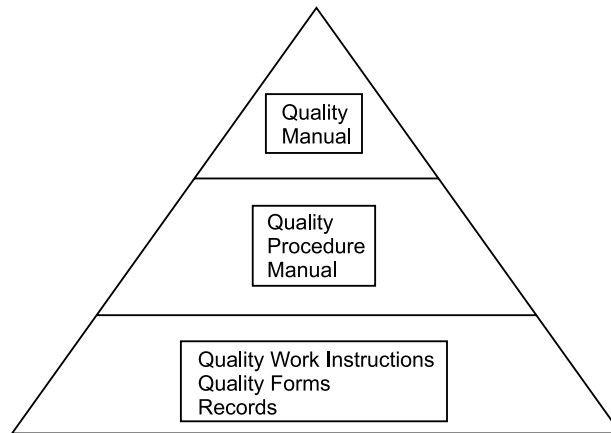
The heads of departments should conduct meetings in their respective departments, to ensure that the concept of quality percolates down the line, and consciousness regarding the subject increases all over the hospital. Based on these meetings, an action plan for the department should be made. This should have the target dates for completion of the documents, and the programme for implementation of the system, in keeping with the overall plan of the hospital.

TRAINING

The HRD department of the hospital should work out a training plan and a schedule, based on identified training needs concerning this subject, and ensure that employees at all levels attend the training programmes. In order to make the ISO implementation process a success, the HRD department will necessarily have to work out programmes with specific reference to quality, systems and productivity. Training, properly supported by group meetings, will help strengthen the implementation process.

DOCUMENTATION

The three-tier documentation process (as illustrated in Figure 17.1) is a very important phase in stabilising the quality system in the hospital. Each tier is linked to the next with the support of relevant associated documents.

Figure 17.1 Three-tier Documentation Process

IMPLEMENTATION

On completion of the documentation, with the support of regular briefings made at the department level and aided by training programmes, every department in the hospital should ensure the implementation of the documented procedures and work instructions in totality. The records should now be maintained as per the documented system, from the date of implementation, to provide evidence for audit, which will determine whether the system has been implemented properly in the hospital.

INTERNAL AUDITS

The process of internal audit is an important step and a powerful management tool to understand how far the system has percolated in the hospital. The auditees should take necessary corrective action for identified non-conformance, major or minor, within a stipulated time, so that the effectiveness of the corrective action taken can be assessed in the subsequent audit. The audit system cuts across the barriers of departments, since every departmental head is an auditor or an auditee at different times in the hospital. The management should ensure that the identified in-house auditors are put through a formal training programme on quality systems audit. The hospital should review the process of implementation of the system, with a minimum of two internal quality audits, before it goes in for the certification audit. However, the management can also go in for a third-party audit after two internal audits, to make sure that the quality system is in place in

the hospital so that the final certification audit can be gone through with confidence.

APPLICATION FOR CERTIFICATION

Once the hospital is ready to be tested by the certifying agency, the management should identify the certifying agency. In India, there are a dozen certifying agencies licensed to give quality systems certification. After identifying the certifying agency, the hospital should apply for certification, giving out all required information, along with the scope of application. The application, along with the stipulated fees and the quality manual, should be sent to the certifying agency for scrutiny.

After scrutinising the quality manual regarding its adequacy, the certifying agency, if satisfied, pays a preliminary visit to understand the ground realities regarding the implementation of the system in the hospital. After completion of the preliminary visit, if the certifying body is satisfied, the dates for the final audit are decided upon, in consultation with the hospital. Though the certifying body has qualified lead assessors and auditors in its panel, it also seeks the support of specialists, such as eminent doctors and nursing professionals of the hospital, during the final audit.

FINAL AUDIT

The external audit committee, supported by specialists, carries out the quality systems audit of the hospital for a specific number of man-days, depending on the size of the institution. Based on their assessment, a recommendation is made by the audit committee to the certifying body either to award certification or to reject the application. The certifying body acts appropriately, on the recommendation of the committee.

Benefits of ISO Certification

TANGIBLE BENEFITS

- Reduction in mean down time of biomedical and hospital maintenance equipments.
- Reduction in total number of breakdowns.
- Reduction in the overall expenditure in the implementation of this programme, due to the in-house calibration of systems.

INTANGIBLE BENEFITS

- Helps in recognising team efforts rather than individual efforts.
- People understand the organisation much better as inter-departmental communication barriers are removed.
- Inspires confidence in existing and potential customers that the hospital is capable of delivering quality treatment and services.
- Results in an improved quality image.
- ISO 9000 implementation puts the hospital on the road to Total Quality Management.

Conclusion

Apollo Cancer Hospitals, Chennai, was the first hospital in India to get the ISO 9002 Quality System Certification in July 1996. Apollo Hospitals, Chennai, was certified in January 1998, and Apollo Hospitals, Hyderabad, in August 1998. The experience gained in the implementation of quality systems in these hospitals has been phenomenally impressive, and has shown a definite improvement in the quality of services at all levels. These institutions have gone through the whole process, as enumerated above, and have come out successfully.

Quality is the fabric of every organisation, and it is a vital component for its survival. It is identified as the cornerstone of the health care delivery system, as it has an impact, not only in the process, but also in the culture of the hospital. Today, the road to total quality management is the only answer for a health care delivery system to face a growing consumer awareness and increasing competition.

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ISO 9002 Certification for a Hospital—An Illustrative Case

18

A.V. Srinivasan

Introduction

These are the days when many hospitals and nursing homes are opening in India, especially in urban areas. Project financing is available, and industrialists, entrepreneurs and technocrats find this an opportune area to invest in. However, in most states, the city authorities do not impose any rules and regulations for starting a hospital. There is no licensing by any legal authority, and much worse, there is no inspection carried out for the renewal of permission. There is also no accreditation certifying the value of the services rendered by these institutions. Many of them charge a high fee and perform complicated procedures on patients. The customer, the sick patient, is not aware of the quality of the product, the *treatment and procedures*, which he/she is purchasing. In many instances, there is no assurance of quality, no known quality control, and no consistency in the procedures followed. The price paid for the services is quite high, and the earning opportunity has allowed the competition to grow. Hence, many service providers make claims which are not intelligible to the customer, the sick patient. One can take the help of the Consumer Protection Act, as a support provided by the state, but it only comes into effect after the treatment, or when there is a dispute. A buyer would like to have an authentication or certification by a third party of repute, to vouch for the quality and consistency of the service rendered by a hospital, before he/she decides to avail of it. This is where ISO certification is justified. This will help the customer choose the right hospital, and ensure that the hospital is subjected to discipline, in order to provide quality and consistency. Many engineering industries have gone-in for this certification in India. It is a value addition for their image in the product market. Many service industries, such as banks, educational institutes, software developers and hospitals are doing the same. This augurs well for the uninformed patient, to help him select the best value for his money and choose a health care organisation with some peace of mind.

The ISO certification is market-oriented. It is a third-party approval for the buyer of services, as a proof of the product quality. The quality, in this case, is the assurance of consistency in service and conformation to specifications. However, higher levels of quality can be achieved through continued improvement of the specifications and procedures. This is called Continuous Quality Improvement. In the internal processes, a system should be established, to ensure the right quality in the various areas, which is known as Quality Assurance. There should also be a constant check on the variations, to prevent non-adherence to specifications, and also to maintain one's quality at a consistent level of acceptance. This process control is termed as Statistical Quality Control. It is evident that each one of these systems deals with one aspect only between the provider of service (or product) and the buyer (or customer) of the service. Total Quality Management (TQM), however, takes care of all aspects in their entirety. It pervades through the organisation, is built on the relationship between the supplier and customer internal to the organisation, brings about an attitudinal change in everyone in the organisation, and finally, through Continuous Quality Improvement, a better and improved service (or product) is provided. An oft-quoted statement in the literature is, 'Quality Improvement is a Journey'. There is no end to improvement if an organisation strives to delight the customer.

The Case Study

APOLLO HOSPITALS AT HYDERABAD

This is a case study from Apollo Hospitals at Hyderabad, which was awarded the ISO 9002 certification in August 1998. The case narration compliments the chapter, Hospitals and ISO 9002 certification, and includes the procedural details and implementation process. It clarifies some of the statements and terminologies, by way of illustrations from the experience of Apollo Hospitals at Hyderabad. This case brings about a better understanding and provides wider knowledge about the ISO 9002 certification.

THE CERTIFICATION

The certificate was awarded by KPMG Quality Registrars of New Jersey in USA. KPMG is accredited by the Registrar Accreditation Board of USA. The scope of certification comprised

Management of Apollo Hospitals, Hyderabad, for health care and treatment of patients, through various super specialities and specialities, nursing, paramedical and lab services, patient frontline service and administrative services.

The quality audit encompassed 47 medical and 12 non-medical departments involving 1200 personnel. The three-tier documentation consisted of one quality manual, 60 quality procedure manuals (with 117 quality procedures and 285 test methods), and 30 quality work instruction manuals (with 332 work instructions). The certification includes Apollo Emergency Hospital, which is a trauma centre located in a different part of the city. This feat was achieved through the concerted effort of every single individual, over a period of nine months.

Quality System Requirements

ILLUSTRATION 1. QUALITY POLICY IN A HOSPITAL

Apollo Hospitals at Hyderabad

Apollo Hospitals, Hyderabad, is committed to provide health care of international standards with a human touch, at optimum cost, and to bring in continuous improvement in line with evolving patient needs.

This we will achieve by a holistic approach and the integrated teamwork of constantly learning and committed professionals, interfaced with state-of-the-art technology.

ILLUSTRATION 2. QUALITY OBJECTIVES IN A HOSPITAL

Apollo Hospitals at Hyderabad

1. To provide multi- and super-specialty medicare under one roof by adopting a holistic approach.
2. To provide health care based on state-of-the-art technology and expertise, at optimum cost, ensuring value for money.
3. To provide a delightful ambience and excellent medical care with a human touch, by integrated teamwork and effective quality systems, with monitoring and feedback.
4. To carry out continuous upgradation of technology and human resource development activities in a congenial and safe environment.

5. To be an environment-friendly, socially and ecologically-conscious organisation.

ILLUSTRATION 3. QUALITY POLICY IN THE SERVICE AREA OF A CORPORATE

Dr Reddy's Laboratories Limited, investor cell

- Prompt service—We believe in.
- Reliability—The core value.
- Committed employees—Our strength.
- Complete investor strength—Our sole aim.

ILLUSTRATION 4. QUALITY OBJECTIVES IN THE SERVICE AREA OF A CORPORATE

Dr Reddy's Laboratories Limited, investor cell

1. To effect transfers within 15 days from the date of lodgement of duly completed transfer deeds.
2. To address any query pertaining to the company from an investor or any other agency within three days.
3. To encourage investors to hold shares in depositories and ensure that 2 per cent of the total number of individual investors opt for dematerialisation every six months.
4. To keep investors informed about the performance of the company and other developments, within 24 hours of the Board's approval.
5. To provide a hospitable reception when the investor visits the investor cell.
6. To enable employees develop skills and confidence levels through frequent training programmes and refresher courses.
7. To enable employees to engage in different activities, in order to break the monotony, and to rotate jobs at least once in 12 months.
8. To provide modern modes of communication and information technology facilities.
9. To optimise the consumption of stationery and other consumables.

ILLUSTRATION 5. QUALITY MANUAL

One part of the quality manual is quality procedure. The procedure specifies what has to be done, by whom, how it is to be done, and where and when. This is used for the overall planning and administering of activities, which have an impact on quality.

Another part of the quality manual is work instructions. The instruction must clearly

- Describe the work.
- Specify the correct sequence of activities in the work.
- Indicate the materials and equipment that must be used.
- Indicate the specific environmental conditions that should be ensured, such as the dust level, cleanliness, and so on.
- List the standards and codes of practice which must be complied with.

Along with quality procedures and work instructions, the quality manual should include a description or statements regarding

- The scope of the work.
- The affected service, activity or process.
- Actions required and persons involved.
- Records which have to be maintained.
- The competent authority who is authorised to sign and initiate procedures.
- Document issue locations and control procedures.

The three-tier documentation in Apollo Hospital at Hyderabad consisted of one quality manual, 60 quality procedure manuals (with 117 quality procedures and 285 test methods), and 30 quality work instruction manuals (with 332 work instructions).

ILLUSTRATION 6. CONTRACT REVIEW

This contract is called the In-patient Guide. It is an ISO numbered document, running into 12 printed pages, and is given to every in-patient after registration is completed. The guide starts with a welcome message from the Managing Director. The first chapter, 'Know Your Hospital', lists where each facility is located in the hospital campus, in an orderly manner—from the basement to the fourth floor and the annexe building. For example, the first floor houses the operation theatre complex, which includes the

- CSSD, Intensive Care Units
- Nursing Superintendent's Office
- Guest Relations Office
- ISO Office, Nephrology Unit
- Patients' rooms (by number)

The second chapter details the admission procedure and room allotment. The third chapter contains details regarding room service, food and beverage, housekeeping, accommodation for attendants, guest room service and entertainment. The fourth chapter details the additional facilities. The fifth chapter, 'Additional Information', deals with counselling, visitor's policy, payment, discharge, checklist before leaving the hospital, gratuities and health insurance. Finally, a list of important internal telephone numbers is provided.

ILLUSTRATION 7. DOCUMENT AND DATA CONTROL

The quality manual, the quality procedure manual and work instructions are controlled by the Documentation Control Officer. This person is generally of the level of a manager, not necessarily qualified in medicine.

ILLUSTRATION 8. CONTROL OF INSPECTION, MEASURING AND TEST EQUIPMENT

Decide the measurement accuracy required; schedule the equipment tests at predetermined dates for calibration to keep up with declared standards; specify the calibration procedure to be followed, the acceptance criteria and the actions if the results show deviation from standard. Do the calibration and testing in acceptable environmental conditions; whenever there is difference in calibration, investigate the immediate past uses for undesirable implications; separate physically or by marking the equipments which are calibrated. In all activities ensure that the equipment is accurate.

ILLUSTRATION 9. CONTROL OF NON-CONFORMING PRODUCTS

Control is imposed for the purpose of preventing products or services from being accidentally used. Where such use has been identified, the hospital should designate the authority that will conduct the review and take appropriate action. The review will decide on whether to repeat the treatment, to take preventive measures for any retrograde stages, to keep under observation, or to accept it with or without any action.

Few examples of non-conformance:

1. A doctor sends a requisition slip to the laboratory for certain tests to be conducted, and the requisition slip does not contain the doctor's signature;
2. The laboratory not having the user's manual for the equipment used in the laboratory;

3. Drugs in the pharmacy which are to be kept in cold conditions being let to stay in open.

ILLUSTRATION 10. INTERNAL QUALITY AUDIT

Internal quality audit is carried out to make sure that

- appropriate procedures are in place,
- documented procedures are being followed, and
- corrective actions are being taken, as indicated in the report.

The purpose and objectives of the internal quality audit are

- to determine the conformity of system elements with the specified requirement,
- to determine the effectiveness of the implemented quality system in meeting the specified quality objectives,
- to provide an opportunity to improve the quality system, and
- to provide information for management review.

Internal quality audit can be conducted as a routine examination, as a consequence of specific incidents, such as a variation or deterioration in service quality, as a follow-up for the evaluation of the quality system, or for meeting regulatory requirements.

ILLUSTRATION 11. APPLICATION FOR CERTIFICATION

The market value of the certificate is related to the competency of the certifying agency, which is dependent on the system of accreditation. Accrediting institutions lay down stringent requirements which the certifying agency has to fulfil. These are:

- The process for certification followed by the agency.
- The process for acquiring lead assessors.
- The process for ensuring an assured quality of service.
- The system for maintaining their records.

Few of the accreditation bodies are:

- The National Accreditation Council for Certifying Bodies of the United Kingdom (NACCB).

- The Raad Voor de Certificate of The Netherlands (RVC).
- Registrar of the Accreditation Board of USA (RAB).

An indicative list of the certification agencies in India are:

- The Bureau of Indian Standards.
- The Indian Register Quality Systems.
- TUV (India) Private Limited.
- The Standardisation Testing and Quality Certification Directorate.
- The Bureau Veritas Quality International.
- KPMG Peat Marwick.
- Det Norska Veritas.

The choice of the certifying agency will depend on the management's perception of the market value of the certificate, the image of the certifying body, and the objectives for obtaining the certification.

ILLUSTRATION 12. A CHECKLIST FOR INSPECTION, MEASURING AND TEST EQUIPMENT

- Refer to national or international standards for specified calibration.
- Convert the calibration to national standards wherever possible. The state of calibration of all measuring instruments must be known.
- Make the calibration procedures effective. Identify all instruments and test equipments separately. Store and handle the equipment in a manner appropriate to its sensitivity.
- Introduce a formal system to calibrate equipment at specified intervals of time. Maintain calibration records.
- Adjust the frequency of calibration on the basis of objective data. Maintain suitable environmental conditions for measurement and calibration activities.
- After the equipment is repaired, take steps to ensure that recalibration is carried out to restore its calibration status.
- Work out a procedure for the revalidation of previous measurements when an equipment is found to be out of calibration.

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