ORTHOPAEDIC SPECIALIST HOSPITAL, ABUJA
(Internal Flexibility and External Extendability)

by

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DECLARATION

I hereby declare that this thesis has no bearing for any work done by any individual or group of individuals which has been presented and accepted for a higher degree. It has been composed by me and is a record of my own research work. All quotations are distinguished by quotation marks and all sources of information have been acknowledge by means of references.

Ayinde, Bashir Lawandi

MOTIVATION

The broken skull held together with steel

The broken spine

The nine painful agonizing days in the Hospital

It was not me

It could as well been me

'Cause I felt the pain equally

Almost fourteen years ago!

I can still remember clearly

Daddy, I am ashame I could not help then

Now I have tried though too late

But Daddy, I have tried...

May Your Soul Rest in Perfect Peace.

Bashir Lawandi Ayinde

DEDICATION

This thesis is dedicated to:

- My Late Dad,

  Mr. Boonyamin Ayinde.

  Who Died on 9th December, 1972.

- As a Result of Motor Accident on 1st December, 1972.

- My Devoted Mum,

  Madam Alimat Ayinde;

  and to Almighty God.

CERTIFICATION

This thesis report entitled "Orthopaedic Specialist Hospital, Abuja" by Ayinde, Bashir Lawandi meets the regulations governing the award of the degree of Master of Science in Architecture (M.Sc. Architecture) of Ahmadu Bello University, Zaria, Nigeria, and is approved for its contribution to knowledge and literary presentation.

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Chairman, Supervisory Committee   Date:..................

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Member, Supervisory Committee   Date:..................

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A B S T R A C T

The resolution of the different traffic patterns in a hospital, coupled with the varied requirements of the uncomfortable human beings who are patients in a hospital are enough problems to task the imagination of an architect. Add to this are the rapid changing medical technology which render most hospitals obsolete even before they become functional and the problem of hospital design becomes an enomous one indeed.

The goal of this thesis is therefore, to create an ever-lasting hospital that will satisfy medical and spetial requirements which are subject to continual change as technology changes. This call for the application of an architectural principle of FLEXIBILITY - INTERNAL FLEXIBILITY AND EXTERNAL EXTENDABILITY. The resultant design of this expendable Specialist Teaching Hospital is expected to be highly EFFICIENT in function, and AESTHETIC in appeal as beauty is recognised to have a therapeutic value.

ORTHOPAEDIC SPECIALIST HOSPITAL, ABUJA

CHAPTER ONE

INTRODUCTION

1.1 Historical Background

1.2 Facilities Available in the Hospicals

1.3 Inception of Private Hospital

1.4 Specialist Teaching Hospital

INTRODUCTION

1.1 HISTORICAL BACKGROUND

The traditional bone setting practice dated back to the time of our fore-fathers. The traditional bone setters have been practising even before the pre-colonial era; before the importation of western medical practice. It is sad to note that there are no available statistical data to justify a comment on their success of failure. They still exist today and even some people still prefer to go to the traditional bone setters despite the availability of modern facilities.

Today, there are only three orthopaedic hospitals in the country, namely; Igbobi which served as rehabilitative centre to the wounded soldiers of the east while west African frotier force after the second world war; and Enugu which was an aftermath of the Nigerian Civil War and was founded in 1974.

The concept underlying the establishment of the Orthopaedic Hospital, Dala, Kano is different in that it was conceived, planned and purpose-built to serve the then Northern Region of Nigeria. It was formally opened on 21st December, 1959.

It is certainly glaring that Igbobi and Enugu Orthopaedic Hospitals where founded due to circumstances and to take care of some certain sets of people at their inception. This consequently cause lack of foresight on the part of their designers. Though the Dala Orthopaedic Hospital was planned and purpose-built, it has now past its time; it has not been able to catch up with the medical technological trend. Proper redevelopment of these existing hospitals and creation of modern Orthopaedic Specialist teaching hospital are highly necessary. It is in the light of the later view that this thesis is conceived.

Though there are numerous suitable towns where this proposed Orthopaedic Specialist Teaching Hospital could be located; Abuja is chosen because of its peculiar features of its centrality where-by it could serve as a better catchment area; it could be reached from all parts of the country and because of its estimated future population; which of course it will be the most populated city in the country.

1.2 FACILITIES AVAILABLE IN THE HOSPITALS

Lifes which could have been saved have been lost due to lack of facilities, many people have been rendered permanently disabled due to lack of proper rehabilitative facilities. We have lost millions of Naira in foreign reserves through those who can afford to pay for their way to where these facilities are available.

It can be very agonizing when you see a fellow human being dumped aside and giving 'valium' (sleeping tablets) everyday while he awaits his death simply because these facilities are not within his reach. You could imagine a case where a man has a spinal injury causing some ~~changes~~ damages to his spinal cord. After spending some months in the hospital and all the wounds have been healed he was sent to the physiotherapy section of the hospital in order to give room for other ~~fertilents~~ patients. An helpless situation where there is nothing the doctors could do to the spinal injury because the facilities are not available here in the country, such a man could be passing out urine and feaces without his control. The doctors could know he was going to die. He could be saved if the proper facilities are available but then he needs about ₦80,000 to ₦100,000 to get such facilities in United Kingdom. Beyond more words the solution to this agonizing situation lies in the provision of health institutions and rehabilitative centres comparable with those abroad; in terms of equipments, staffing and environmental conditions. It is in the last solution that an architect can contribute and I intend to do just that through this thesis.

1.3 INCEPTION OF PRIVATE HOSPITAL

We have now realised the need for specialized hospitals but the problem now lies on who will finance the construction and monning cost of such institutions. It will be unfair with the present political and economical system in the country to expect the government, at whatever level, to provide all the facilities needed for health care. Alredy, most governments are having great difficulties running existing health institutions that it will be unrealistic looking up to them for more facilities. The choice now left for us is to look up to rich individuals, medical practioners, philantropic organisations, financial institutions, religious organisations, etc., many individuals and religious organisations are responding to this need (which need you might ask. The need of the populace or their own need to make profits? It is sad to note that the later is more prevalent. Even when medical facilities was free the religious organisations hospitals charged fees), and many private hospitals, clinics and maternities are being opened. But it is sad to note that Orthopaedic case are still being referred to the Orthopaedic Hospitals. The non availability of private orthopaedic hospitals may be due to its high expense of construction, cost running and equipments. Though there is an Orthopaedic Association in Kaduna now, comprising of people who were able to get the proper rehabilitative care abroad and have survived and trying to live a normal life. This Association is looking into the possibilities of building a private orthopaedic specialist hospital with similar standard with those available in United Kingdom.

It is not a secret that private medical practice has become so enovative that most doctors look forward to a time when they can set out on their own. Even laymen are setting up health institutions and employing medical personnel to work in them. There is thus a proliferation of private health clinics, especially in the urban areas.

This set-up has both its advantage and disadvantage. It's advantage is that the health care needs of the populace are being increasingly satisfied as these institutions spring up. It's disadvantage which is dangerous because most of these clinics are ~~mixed~~ run in ill-equiped, converted dwelling houses that hardly meet the requirements for health facilities. Even where some of these are purpose designed, they are limited in scope, being just consulting clinics in most cases, because of individualistic approach prevailent in private medical practice in the country. Most of these 'hospitals' lack proper diagnostic and treatment facilities, such as laboratories and X-ray. Hence, simple laboratory tests and X-ray have to be done outside. This constitute a lot of problems like those listed below:

i. How reliable are such tests? When the manner of collection of specimen is not known by the 'hospital' referring the parient.

ii. Lack of co-ordination between physician and personnel of the diagnostic and treatment facilities.

iii. Consequently, longer time spent in investigations and hence longer stay in hospital by patients.

iv. Higher overall cost to patient as each of these institutions will place a charge on its services.

For this situation to be arrested, I will advocate for a consortium of three or more medical practitioners. This will make it easy to obtain a loan from financial institutions to establish a very functional hospital that is well equiped, and able to cater for a wider range of cases, such a hospital will ensure the reduction in average length of stay of patients and hence a reduction in overall cost since most of the investigations will be carried out within the hospital. It will make for better management of patients since there will be better co-ordination between the physician and personnel of the diagnostic and treatment facilities with such a consortium, it is also possible to establish specialist hospitals.

1.4 SPECIALIST TEACHING HOSPITAL

Specialist teaching hospital is the peak of specialized health care delivery. Cases which cannot be handed by General Hospitals, Teaching Hospitals and even Specialist Hospitals handling similar cases will be referred to this specialist teaching hospital.

For the sake of clearity the roles of specialist hospital will be expanciated. Specialist hospitals and Teaching hospitals, fall into the third tier of health care delivery, known as tertiary care. Essentially, a specialist hospital can be looked at as a hospital devoted to the care of one or a group of related cases. Looked at differently, a specialist hospital may be seen as a place where specialists in health care, e.g., physicians, surgeons, rachologists, etc., work. By this defination even a general hospital can be regarded as a specialist hospital. For the purpose of this thesis, the specialist teaching hospital being advocated for will at its inception combine the triology roles of Health Care Delivery, Education and Research; though with a narrow spectrium of related medical care, i.e., some aspects of surgery.

For some time now, there has been a debate on whether so much money should be spent on specialized hospital facilities when it can as well be used to provide many more with primary health centres; since this deal more with preventive medicine, and if effectively run, it will reduce the incidence of illness enquiring specialist one. This sounds very rational for primary health care, but an objective view would reveal that certain factors beyond the provision of primary health care facilities determine the necessity for specialist care. In our society where most of the ingredients that make for a successful health care (e.g., adult and health education, environmental sanitation, good drinking water, good nutrition, better housing, better family planning, etc.) are lacking, incidence of illness of specialist nature may be more prevalent. And how can primary health care take care of accidents of various nature? Hence, the need for specialist teaching hospital which will at the same time deliver primary health care through its preventive health care programme is much more prevalent.

CHAPTER TWO

2.1 Hospital

2.2 Hospital Systems

2.3 Circulation

2.4 Orthopaedic Specialist Teaching Hospital

2.5 Hospital Form and Ventilation

2.6 Hospital Forms

THE HOSPITAL

2.1 HOSPITAL

The public, demanding improved care and paying a high price for it, has a right to expect its costly new hospital to be designed to produce the last word in effective and efficient patient care.

The sad fact that many hospitals fail to measure up to the patient's needs reveals a basic weakness in the planning. Many wasteful failures could have been successful if they had been designed with proper study and basic understanding of the activities that, properly facilitated, help the patient regain his health.

A design that will expedite hospital care can only evolve when the architect has a fundamental knowledge of the many functions of the hospital. It has been claimed and occasionally demonstrated that an entirely adequate hospital can be built by an architect who has no previous experience with this complicated building type. Such accomplishments are not the results of happy chance, luck or miracle; they are achieved through diligent and expensive research into what should go inside the hospital's walls. Usually this research has been inspired by an administrator who is a serious student of hospital function or by a hospital consultant who is throughly familiar with the facilities each hospital employee must have to do his job.

One basic error that leads to poor planning is reliance on copying technique. Team often team of architects, doctors and student architects tour the country to see how other hospitals "have been built". How much better it would be if their tours were intended to investigate how other hospitals "do this" or what operating innovations another architect may be planning.

An insidious flaw in some planning approaches is the under-estimation of the complicated interrelationship and the perplexing technicalities of the hospital structure.

A hospital is an institution that cares for the sick. As it may be differentiated from health centre, clinics, etc., that also care for the sick, it is one that deals with various conditions of illness requiring specialized equipment and skills not found in health centres. It may be a specialist hospital which deals with a restricted area of diseases or a genral hospital which combines most of the specialised services rendered in specialist hospitals, or a teaching hospital which combines a several hospital and a medical school or even a specialist teaching hospital which combine the specialist hospital an a medical school.

2.2 HOSPITAL SYSTEMS

Hospital functions can be divide into the following six systems:

(a) <u>The Patient Housing System</u>

The reason for the hospital's existence and the focus of all its operations is the patient, most of his stay in the hospital, or even sometimes all of his stay, is spent in the ward. Most of the things that happen to him in this ward are things that could happen in his own bedroom. The ward therefore, with all its ancillary facilities form the patient housing system. The objective of a good hospital design is to relieve the patient's fears and to make patient nursing less cumbersome to nurses.

(b) <u>The Therapy System</u>

This is another block of functions comprises those things that are done to or for the patient in a diagnostic or therapeutic sense. The inpatient is usually brought to the areas where these things are done, while the out-patient usually walks to them. Since all of them contribute to the curative processes, these functions may be called the therapy system and will include the following departments:

- Operating theatre suite, include recovery;
- Laboratories, including autopsy;
- Radiology - Diagnosis, including radioactive. isotopes, and therapy, including radium and cobalt;
- Pharmacy;
- Physical medicine, - physical and occupational therapy;
- Out-patient department and emergency.

All other activities in the hospital, while no less and no more important, function in support of housing and therapy. But because they occupy space and employ people, they must also operate mutually in support of each other.

(c) The Supply System

Every activity requires things to work with, therefore, there must be a system to supply a wide variety of merchandise. The hospital is a complex instituion requiring the supply of different items, e.g., drugs, equipment, linen, food, etc. The problem function within this system is that of distribution. This function is complicated by the far flung locations of the sumits that comprise the patient housing and therapy systems and also by patient needs that tolerate no delays.

The supply system includes central general store and central sterile supply departments (C.S.S.D.)

(d) The House-keeping System

The patient and worker alike must have their domestic needs provided for while they are away from their homes. This system is mainly concerned with the cleanliness of the hospital, hospital personnel and patients as well as feeding.

This system includes the laundry and dietary departments.

(e) The Utilities System

All the hospital functions must be sheltered and protected against the element for proper functioning. They require some degree of controlled environment; their processes require power to be supplied in various forms. The functions that provide for these needs may be called utilities system. The major function of this system is the operation of the mechanical plant.

(f) The Administrative System

This system comprises the administration and business system, these take care of the co-ordination and flow of the hospital economy. Through its admitting function, this system controls the influence of patients and their disposition through the housing system. Through its purchasing function merchandise is acquired to feed the supply system.

Functional Relationships

Functionally, then, the hospital divides into six systems or allied groups of operations. These six systems of the hospital represented as a pseudo-mole-cular model (This is shown in figure 2.1) where the different "spheres" of activities are connected by "rods" relationships. These groups of operations are: the patient housing, therapy, supply house-keeping, utilities, and administration and business. These six systems fall into two groups:

i. Patient care operations, composed of patient housing and therapy;

ii. Supporting operations, composed of supply, house-keeping, utilities and administration and business.

2.3 C I R C U L A T I O N

Another goal of good hospital planning must be to eliminate the need for travel and shorten travel distances. Circulation in a hospital involves the proper intergration of the various departments that make up the hospital in such a way that seperation of the various traffic within the hospital is achieved, traffic routes are kept as short as possible and important functions are protected from intrusion. For this reasons a fresh view of who travels in a hospital may be helpful.

There are five classes of people who generate traffic within the hospital. These are:

i. In-patient

ii. Out-patient

iii. Hospital Employees

iv. Staff Physician

v. Surgeons and Visitors

To achieve proper circulation, the following factors are to be considered:

(a) <u>Separation of Traffic</u>

Separation of the followings are most essential - "clean" and "dirty". Procedures:

- different types of patients;
- noisy and quiet procedures;
- pleasant and non-pleasant functions;
- different types of workers;
- different types of traffic within and outside the hospital.

All these can be achieved by providing separate entrances for in-patient and visitors, out-patients, emergency patients, supply and fuel.

(b) <u>Short Traffic Routes</u>

It separation of different types of traffic is functional asepsis in a hospital will be maintained. Short traffic routes will increase efficiency because few workers are performing useful labour when they are in long transit.

(c) <u>Protection of the Patient</u>

One of the primary principle aim circulation planning is to protect the patient from unnecessary traffic within the nursing unit corridor. This is because traffic could -

i. disturb the patient;

ii. increase the risk of contermination;

iii. create confusion for the nurses and doctors and so lead to inefficient patient care.

The surgical suite must most especially be protected from unwanted traffic if proper aseptic techniques are to be achieved.

Control

Supervision and control of patient's corridors must be implemented; infants must be protected from gains emernating from visitors; out-patient and visitor traffic must be controlled so that they don't wander into restricted areas.

2.4 ORTHOPAEDIC SPECIALIST TEACHING HOSPITAL

Though the roles of a specialist teaching hospital have been difined in chapter one; for the purpose of this thesis its peculiarity will be fully explained in details.

A specialist teaching hospital is a hospital that is devoted to the care of a group or related cases and combined the triology roles of Health Care Delivery, Education and Research in the particular devoted field.

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Orthopaedic Specialist Hospital is a hospital that is devoted to the care of diseases and injury of the bone and the diseases of the conecting tissues that affect the bone.

Thus; an Orthopaedic Specialist Teaching Hospital is a hospital that is devoted to the case of diseases and injury of the bone and combined the triology roles of Health Care Delivery, Education and Research in this devoted field. This hospital falls into the third tier of health care delivery, known as teriary care.

Orthopaedic cases can be divided into the two following groups:

(a) Congenital, this involves the inborn diseases and deformity, this occur mostly with new born children and children between 8 days to 9 years.

(b) Traumatology, this involved accident cases affecting the bone; any kind of fractures of the bones.

2.4.1 <u>Ranges of Orthopaedic Cases</u>

This could further be broken down into three groups:

(a) Diseases of the Bone

- Tuberculosis of the bone
- Tetanous of the bone (a bacteria that may affect the bone)
- Virail diseases, e.g., Acute Poliomyelatis which affects the children limbs.
- Maligeant (Tumor of the bone)
- Spinal cord diseases, e.g., Parkinson's diseases (digenerative diseases of the bone)
- Infertile carebral palsy
- Diseases of the skin and subcutaneous tissues that affect the bone

(b) Diseases of the Musdo - skeletal System and Connecting Tissues

- Rheumatoid arthritis except spine
- Other arthropathies
- Other disorders of joints
- Ankylosing sponchylitis

(c) Injuries

- This involves fractures of the bones which inflict be caused by the following:

i. Accidents

ii. Sucidal and self inflicted injury

iii. Homicide (purposely inflicted by other person)

iv. Injury resulting from war.

2.4.2 Sources and Selection of In-Patients

The sources of in-patients includes the following:

(a) Referrals from other hospitals.

(b) Accident and Emergency Admission.

(c) Referrals from private clinics.

(d) Walk-ins (people that will simply come to the hospital as individuals and people from the traditional bone setters)

The selection of in-patient could be divided into two; through emergency and by elective. The emergency cases are taken directly to the emergency department where they can be attended to immediately (see Accident and Emergency Department in Chapter Five ( ). The accident and emergency is a mini hospital in itself. In the emergency department the patient is taken to the casualty. From the casualty he could be taken to the theatre which comprises of an X-ray unit as well. If the case can be solved at the theatre he is then taken to the recovery ward in the emergency department. From the recovery ward he could be discharge and then return to the out-patient department or sent to the main ward. If it's to be taken to the main hospital theatre he is then sent there. From the main theatre he could be sent to the main ward or to the out-patient department where he attend consultations from time to time and could be referred for physical therapy from time to time.

Elective patients come through the out-patient department where they could be sent to the X-ray unit and back to the consultant or straight to the main theatre. From the main theatre he could be sent to the main ward where he could be referred back to the main theatre if the need arises and could be referred to physical therapy from where he could be discharged and attend the out-patient clinic in the O.P.D.

A patient can pass through the consultation to the Orthopaedic Surgeon and then straight to the main wards where the could be recommended to the main theatre and to the physical therapy department where he could be recommended to the out-patient department from where he attend the clinic and from time to time he could be referred back to the physical therapy department.

In a very complicated case the process may be cyclic (see figure 2.9)

2.4.3 Diagnostic and Treatment Teams

These teams are very important in the hospital set-up if not the basic teams. The diagnostic team includes the consultants, the laboratory technologists and the radiologists. The treatment team includes the surgeons, the physicians and physical therapists.

The housing location of these teams should in a such a way that they are accessible to the out-patient department and the in-patient housing.

Wards

Due to the pecularity of the cases treated in Orthopaedic hospitals a great attention should be paid to type of wards to be provided for different cases and different set of people (age differences and sex).

The wards could be divided into the following:

(a) Children ward, this take care of patients between the age of 8 days and 9 years. The cases most treated in this ward are that of congenital; in-born diseases and in-born deformity.

(b) The adult wards; which is further divided into the female adult ward and male adult ward. These wards house patients of ages between 9 years to 40 years. The cases most treated here are that of traumatology; this involves accident cases affecting the bone. Fractures of the bone of any kind. One must notice that this is most active age when one is more prone to accidents.

(c) Ward for the aged; this is a special ward meant only for the aged ones. It is special in the sense that the design has to suite the delicate nature attained at that age. The beds has to be lower than the ordinary beds so as to allow them to get out of the bed with ease. The floor may be made of wood (preferably soft wood) this is to disallow sliping and tumbling over very hard surfaces that may cause more havoc. There psychology is quite different at this age so they need more of psychological treatment than physical treatment; thus, they require more attention of the nursing care and less noisy area.

(d) Amenity ward; this consist of single rooms for special cases. This may house those who care for more privacy than that provided by the normal wards, very important people and for very delicate case that needs intensive care. The rooms are no different from the personal bedroom at home; its self contained in nature having its own bathroom, toilet and wardrobes.

One may isolate this ward which house all categories of patient cases or may integrate such amenity (single rooms) into the previously mentioned wards where they serve that category of patients who qualified for them.

2.5 HOSPITAL FORM AND VENTILATION

The hospital form plays a very significant role in the efficiency of the hospital among other factors that affect the total hospital form and the relationships of the different parts is primarily the ventilation system adopted. The three possible ventilation systems are as follows:

(a) Complete Natural Ventilation

(b) Complete Artificial Ventilation

(c) Combination of both natural and artificial ventilation.

To rely on total dependency of artificial ventilation may poses some constraints on the hospital, particularly when sophisticated equipments break-down, while on the other hand, total dependency on natural ventilation poses some problems in maintanance of asepsis in some areas of the hospital, e.g., the operating theatre suite; which will require air conditioning to control the temperature below or above ambient temperature, as well as humidity and sterile filtration of the air, which is impossible with natural ventilation. Therefore, there must be a balance between those departments that need the use of air-condition and those in which it is not essential.

Though the use of complete air-conditioning has some advantages. It increases the ratio of internal space to external walls, thus making possible a compact building form that would otherwise be impossible. The compactness of the building form logically leads to a reduction in site areas occupied by the hospital, and hence economy in the cost of the building fabric. However, this economy is checked by the high demands on the maintenance of this air-conditioning, on artificial lighting and other services needed to maintain such a building.

Mainwhile, a great constraints is imposed on the plan shape possible by natural ventilation. It leads to a high ratio of external wall to floor area. This means high cost of building fabric, though services and running costs are reduced.

The form of a naturally ventilated hospital is dominated by the climate, especially in the tropics. In warm humid climates, comfort is achieved by making the buildings shallow and orienting them in such a way that there is maximum exposure of occupied spaces to the prevailing winds. Adequate shading from the sun is essential, as well as separation of the blocks so that there is no shielding of one block by another.

In hot dry climates, the buildings are oriented to keep exposure of external wall surface to the sun to a minimum. Orientation of occupied space is ~~appro~~ approximately North-South. Surfaces facing East-West which are unshaded, are kept to a minimum and the openings made as few as possible.

2.6 HOSPITAL FORMS

Re-known hospital forms ~~the~~ are forementioned below. There advantages and disadvantages are mentioned.

2.6.1 Harness

This consist of open ended aggregate of units linked together by a linear spine of circulation.

Advantages

(a) Standardized design units are dimensionally related to a 15 metres clear span grid.

(b) Units can be arranged in a variety of patterns.

(c) Natural lighting and ventilation can be achieved through courtyards.

Disadvantage

(a) Large site area is required.

2.6.2 <u>Nucleus</u>

This is similar to the harness type of hospital because of its pre-planned units and the linear hospital street.

A basic nucleus is made-up of cluster of wards and departments or a combination of smaller units. These clusters are placed side by side to form a chequer-board pattern round the linear hospital street. All vertical circulation is related to this street.

<u>Advantages</u>

(a) Phased development is possible.

(b) There is better contiguity of departments.

(c) There is a remarkable possibility for two directional external flexibility - along the hospital street and along streets perpendicular to it.

(d) There is fine compartmentation and hence easy escape from one compartment to another in-case of fire out break.

(e) Has potential for low-key, domestic atmosphere.

(f) Neater and more geometrically lucid system.

Disadvantages

(a) Large site needed.

(b) Restriction on potential development and growth of individual departments.

(c) Long horizontal travel distances in large hospitals.

2.6.3 Best Buy

This is similar to Greenwich, but less compact.

Advantages

(a) It is lit and ventilated by internal courtyards.

(b) It can be expanded in one direction.

Disadvantages

(a) There is very little opportunity for future growth.

(b) Phased development is impossible.

2.6.4 Horizontal Block

This works on the principle of the hospital "street", with the ward blocks on one side of the street while diagnostic departments are on the opposite side.

Advantages

(a) It is human in scale and patients can relate very well to it.

(b) It is simple in design. Visitors can easily find the wards because of the hospital "street".

Disadvantages

(a) Long streets in large hospitals leads to unacceptable travel distances.

(b) It encourages the isolation of specialities in different units, hence creating physical and psychological barrier to inter-departmental communication.

(c) It requires a large site area.

2.6.5 Tower on Podium

It is like tower placedon podium.

Advantages

(a) Simple to build.

(b) Compact form.

(c) Fairly economical.

Disadvantages

(a) Dependance on mechanical equipment for vertical circulation.

(b) Monumental and inhuman in scale.

2.6.6 Greenwich

This is also based on the hospital "street" principles, though in this case, the street is rectangular. It is fully airconditioned and the diagnostic and treatment facilities are located in the area of the rectangular street.

Advantages

(a) It makes possible rapid horizontal movement between the various departments.

(b) The location of the diagnostic and treatment facilities is functionally convenient.

(c) Through it is intersticial service floors, it is succeptible to internal flexibility in both planning and servicing.

(d) It has long span of unencumbered floor space.

Disadvantages

(a) It is a finite solution as no organic growth is possible.

(b) It does not lend itself to phased development.

(c) It is relatively costly.

2.6.7 Mono Block

This consist of a high rise construction in which all the activities of the hospital are housed in a single building.

Advantages

(a) Rational stocking of structure and activities.

(b) Economy of landuse more compact form.

(c) Simplification of circulation patterns.

(d) Effective unification of several floors by the use of elevators.

Disadvantages

(a) Elevators are always insufficient in such hospitals because of the high demand for them and high cost.

(b) Tortous vertical circulation if lifts breakdown.

(c) Over dependence on mechanical equipment.

(d) Inflexible and difficult to expand.

(e) expensive to build and maintain.

(f) Inhuman in scale.

CHAPTER THREE

MEDICAL TECHNOLOGY TREND

3.1 Obsolescence

3.2 Technology Trends

3.3 Physical Accomodation

MEDICAL TECHNOLOGICAL TREND

Medical technological trend is so rapid that it is extremely difficult to keep pase architecturally. Equipments ~~and~~ are being improved and new ones are being invented in that new hospitals have had to change equipments earlier planned for; some departments before the building were being completed.

3.1 OBSOLESCENCE

Obsolescence in hospitals normally occurs along the following three are:

(a) Equipment and Hospital Furniture

This is where the fastest rate of obsolace is experienced as technology change so rapidly that even a 'fast track' is unable to cope.

To accomodate these changes, architectural-planning must reduce the physical inhibitions to future and unforseen growth and maximize the possibility for internal changes and room re-arrangements.

(b) The Structure

Like all other buildings, the physical structure of hospitals age and deteriorate with time. To replace such structures normally involves masive investments. A hospital building should be designed with a life expectancy of says 75 - 100 years.

(c) <u>Services</u>

Services include heating, ventilation and lighting. The life expectancy of services installations in hospitals is about 20 - 25 years. Changes may arise either because a room is being filled for a different use or as a result of deterioration of the services system.

3.2 TECHNOLOGY TRENDS

Most of the recent advances in medical technology have come as a result of the computer. Aero space Engineering has also contributed to medical technology as some space exploration equipments are being miniaturized for use in medical diagnosis, e.g., micro processor.

Broadly speaking, the trends of technology are towards increased ——

Computerization;

Miniaturization;

Automation (including Robotics);

non-invasive techniques in surgery and hence an increase in out-parient services;

Precision in body imaging techniques.

Greatest development in technology are noticeable in the following departments:

(a) Radiology
(b) Surgery
(c) Delivery Suite
(d) Laboratories
(e) Communications

3.2.1 Radiology

Trend in technology is towards a continue improvement in body imaging equipment as well as reduction in the exposure of patients to powerful rays. The new imaging equipments can be divided into radiation based and non-radiation based.

Radiation Based Equipments

(a) C.T.(Computed Tomography) Scanner. This reconstructs X-ray slices through the body by the use of computer.

(b) P.E.T.T.(Position Emission Transaxial Tomography)
Scanner detects particles given off by

radioactive isotopes introduced into the patient.

(c) D.S.A.(Digital Substration Angiography) Equipment

This combines the function of the correctional fluroscopic equipment with a computer. It is much less painful than the previous methods of angiograms and there is minimal exposure to X-rays.

Non-radiation Equipments

(a) Thermography measures the heat given off by the body, cooler areas indicating painful parts of the body.

(b) Ultra sound in which sound ~~names~~ waves are used in the examination of fetuses, detection of internal organ abnormalities, measurement of blood flow, etc.

(c) N.M.R.(Nuclear Magnetic Resonator) Registers the electromagnetic reaction of various tissues, a computer being used to convert this data to find a very precise image of the body.

These trends in radiology lead to an increasing demand for space in the radiology department. In addition to space expansion, advancements have called for an increase in the number personnel as new technicians are needed to operate new equipment.

The future in radiology is towards greater computerization. Radiologists may have to seat down at a 'control post' with four screens and on one unit call up all the ultra sound, C.T., D.S.A. and N.M.R., images on a patient; corelate and analyse the information received for confirmation of final diagnosis.

3.2.2 Surgery

The trend in surgery is more towards non-invasive surgery, making it possible to handle more cases on an out patient basis.

Lasers are used for the treatment of glaicona (eye disease) with a small amount of tropical anaesthesia or no anaesthesia at all.

C.T. scanners have pioned invaluable in pre-operative planning for a variety of craniofacial disorders, and in the direction of a steriotatic method of introducing radio-active sources to intenstitial tumours.

Ultra sound is used in lithotriper to break-up kidney stones. Microwaves at high energy levels use heat to destroy cancerous tissues.

3.2.3 Delivery Suite

As technology advances, obstetricious and gynaecologists, with the dramatic diagnostic and therapeutic tools at their elisposa, can now make definitive diagnoses without exploratory surgery; substitute ambulatory for in-hospital surgery, perform more timely care through in-utero-surgery and objectively confirm results of previously inconclusive examinations.

Ultra sound equipment is used in fetus examination, objective dating of pregnancies, early diagnosis multiple pregnancies, etc. Trend towards more compact, more pertable unit which are more economical and more practical to use.

Fibre optic lighting in laparoseopes is used for the diagnosis of gynaecological disorders without exploratory surgery, and performance of minor out-patient surgical proceedures, e.g., tubal ligations.

Carbon dioxide and Argon lesers are used in surgery for the simultaneous removal of diseased tissue and centralization of the surrounding area.

3.2.4 Laboratory

Clinical pathology has been affected dramatically by the two directional developments in instrumentation and science.

Technologists whose notes were previously monitoring of chemical reactions are fast becoming operators of laboratory instruments as improvements in instrumentation is continous.

The trend of development has been towards automation and computerization.

In laboratory chemistry the major instrument development is the AUDIO ANALYSER which automates and multiplies spesimen testing.

In Hematology election cell counters automatically provide reproducible blood cell counts quickly and easily. Thus, allowing the detection of diseases at an advanced level.

In microbiology, new instruments enable automation of much of the testing for organism in cultures. The most revolutionary development is the MICRO PROCESSOR.

The medical laboratory of the future may witness increased use of ROBOTICS. With thus, much of the routine work done by technologists would be taken over by robotics with greater efficiency and 24 hours a day operation. The nobots with mechanical arms about 90 cm. long, would be located at the centre of circular work stations. For this types of laboratory however, a crack free space would be needed so that bacteria do not grow to ruin increasingly sensitive laboratory techniques.

3.2.5 Computations

Efficiency in the handling and processing of information is sinequanon in any hospital. Records, reports, test results, employee statistics, etc., can be communicated with greater efficiency speed and cost of effectiveness, with the latest technology.

Developments include word processing computers, advanced switching systems, intercoms, etc. One of the latest development is TELEXES. This enables word processors to communicate with each other through the public telephone network and/or private lines. All forms of telex, test and data traffic are instantly distributed to the relevant terminals.

Sick-room Monitors

Not requiring interconnecting wires or installation need only pluged into air-condition electric supply for instant intercommunication.

Nurse Call Systems and Music

Distribution bed pannels provide a patient's call button, reasurance lamp and reset; high/low and "off" switch for over-bed lamp; mains out-let socket; nurses emergency call switch; and radio and Television programme selector.

Pneumatic Tube System

Systems connecting numerous installations, ~~it this~~ this carries all form of paper work, including telexes, advice and dispatch notes, and also samples and small supplies, thus eliminating the need for messengers.

With such improvements, walking distance are reduced greatly and efficiency of personnel is enhanced.

3.3 PHYSICAL ACCOMODATION

Physical accomodation depends on the type of equipment. Some of these new medical technologies, like ULTRA SOUND AND LASERS which can be installed in a doctors consultation room, do not affect the structure of the building. Others do, and these call for the provision of open flexible left space of large bays of 9 metres square; floor-to-floor; heights of 3.9 metre to 4.2 metre; flat slab construction and possibly a slight in structural griad planning for ease of future coring through floors.

3.3.1 Concepts of Accomodation

To accomodate technology and expansion in hospitals, many concepts have been put forward over the years. Prominent among these are:

(a) Structural grid concept;

(b) Loose fit concept;

(c) Spine concept;

(d) Inter-stitial floor concept;

(e) Contiguity concept.

(a) Structural Grid Concept

This comprises of wide span structural grid with horizontal servicing.

Advantages

i. Minimum vertical interruption to users floors.

ii. Internal flexibility

iii. Possibility of the use of prefab panels

iv. Possibility of independent of different departments within the "neutral" structural grid and hence possibility of external extension of hospital.

v. Possibility of phased development.

(b) Loose Fit Concept

This has two applications. Firstly; for the structure, it is known that not all parts of the building deteriorate at the same rate. This system advocates the physical separation of the different parts of the building such that the fabric that suffers the greater obsolescence can easily be replaced without seriously affecting other parts of the building structure.

Secondly, it advocates that the building structure which is more parmanent, i.e., the hard system be physically discrete from soft system of services and equipments which changes more rapidly.

Advantage

In either case, the soft system can be replaced easily without tampering with the hard system.

(c) Spine Concept

This concept is based on the "hospital street" which can take different configuration, e.g. Straight line, cross, T., figure , etc.

Advantages

i. Direct system of communications.

ii. Ease of development and redevelopment of different parts, i.e., ease of internal flexibility and external extendability.

Disadvantages

i. If hospital street is linear, it may require a very large site.

ii. The street may become too long and cumbersome to travel.

(d) Interstitial Floor

This incorporates full-height walk-in services floors alternating with users floors.

Advantages

i. Flexible servicing to all parts of the building.

ii. Ease of meintenance without interference with user activities.

iii. Simplification and acceleration of construction as various trades men can work on the building simultaneously.

iv. More compact building form and hence

v. Reduction in site area.

Disadvantages

i. Total dependance on artificial lighting and ventilation is problematic and uninhabitable on event of equipment breakdown.

ii. Deep plan resulting from such a concept requires more intensive servicing.

iii. It is expensive in terms of construction maintenance and running costs.

(e) Contiguity

This concept is built on the contiguity of hard and soft spaces. Hard spaces are those department that have exaisting physical requirements and grow at very fast rates, e.g. Radiology, nuclear medicine. Soft spaces are departments that can easily be moved without terminally affecting their functions within the hospital, e.g., stores, offices.

Advantage

The expansion requirement of a space can easily be met by moving the soft space to a new location while the hard space expends into the vacant space.

3.3.2 Examples of Accomodation

A. Nuclear Magnetic Resonator (N.M.R.)

This is a new, sophisticated, safe, non-intrusive diagnostic body imaging technique in which a patient is encomposed in a large, circular superconducting magnet, whose magnetic field in 3,000 to 25,000 times that of the earth. In conjuction with radio waves, this magnet reveal details of the body tissues which is processed by a computer and the resulting image displayed on a video screen in a control room.

These magnetic forces which emanate in all direction and the radio waves can easily be distorted by ferous metal, e.g., iron and steel; moving metal objects, e.g., elevators and automobile; and radio frequencies.

Consequently sheilding is necessary. Sheilding of this equipment takes two forms:

i. total sheilding of equipment from surrounding, this involves the sheilding of floors, walls and ceiling from radio frequency interference with prefab radio frequency shielding rooms; metal sheet, e.g., copper, steel, embedded in walls, floors and ceiling, symmetrically placed around the magnet; or magnet placed symmetrically within a structural bay and magnetic coils used as shims.

ii. Sheilding of surroundings from magnet by use of metal detractors at entrance to suite or by locating magnet away from computers and from public corridors.

Construction

The construction to house this type of facility will need a floor slab on grade with minimum vibrations. The floor slab must be fibre glass impregnated or of epoxy concrete and must be able to support the magnet's load of about 7,500 kg.

Installations should be non-ferrous soil-pipes, floor drains and electrical conduit.

Ceiling height should be a clear 4.8 metres over the magnet and there should be no floor on mechanical equipment above.

Enclosing structure should be of minimally reinforced concrete, masonry or wood. Lighting should be incandescent light as flourescent lights produce interference with radio waves and distortion of subsequent image.

Example

Cleveland Clinic N.M.R. Centre

At the Cleveland Clinic, the resistive, superconducting N.M.R. is accommodated in a free standing facility consisting of two dome shaped rooms connected to supporting areas and to other parts of the hospital through sky lighted corridor.

The architects' design objective is the provision of a technically 'ideal' facility that would meet the unique design criteria demanded by N.M.R's delicate instrumentation and also allow high-quality clinical research for on going developments in N.M.R. technology.

The design determinants included:

- insolation of units from forous metallic materials and radio frequencies;

- rapidly evolving technology;
- cooling requirements;
- size and type of magnets;
- existing radio frequency on site;

The facility is designed to accommodate both a 5 and a 15 kilogauss unit; the 15 kilogauss unit being the maximum strength of magnet anticipated in the future. Due to the zone of influence if the magnetic field, the size of the scan rooms was made 7.5 metre radius. A landscaped wall at the outer limit of the magnetic zone eliminates anticipated traffic interference.

The construction consists of:

- Mass concrete slabs without reinforcement;
- Load bearing brick and block walls;
- Stove lintels outside and laminated wood inside;
- Aluminium window and frames;
- Exposed laminated wood beams and deck;
- Stainless steel or aluminium fastners, plates and ties;

- Total elimination of ferous metal from incandescent light fixtures and sprinkler heads;
- Magnetic testing of all elements before installation;
- Subsoil replaced with controlled fill, specialized shielding from radio-frequency interference (R.F.I.) includes

• continous 5 to 12 ounce copper sheeting in floor, wall and ceiling of examination room;

• double copper screens in bronze windows frames;

• copper-roofed dome which also give clearance required for recharging the system conductive unit with cryorganic helium and nitrogen;

• Use of non-ferous construction materials.

The mechanical and electrical systems for the unit were housed separately. The systems were designed to meet the requirements for air conditioning, air handling, lighting and separation of power supply for each unit. Copper R.F.I. shielding erases each screening room, including underground piping to cut internal interference from mechanical and electrical systems and also to shield units from out-side interference.

To humanise these spaces thus, provided the architects to take the challenge of designing a relaxing, non-institutional environment; patient entrance to the new building is via a pedestrial bridge from the old hospital multi-block complex or from a nearby parking lot. Extensive use is made of natural materials, bright colours and subdued lifting to prevent the feeling of claustrophobia that would otherwise have confronted patient's entering the N.M.R. units.

(b) Radiation Therapy

i. Linear Accelerators

Linear accelerators are used in the treatment of canger through the controlled omission of radioactive particles. The trend in linear asselerator development in towards increased power, i.e., from 5 to 25 megavolts, making it necessary for patients to be placed further from machine. This results in a greater scatter of radioactive particles.

Radiation absorption depends on density and thickness of surrounding material.

Laminated lead, steel and bonated polythlene or borated admixture to the concrete help in the absorption of these particles.

An S-shaped corridor or maze leading to the therapy room can help minimize radiation leakage as particles repeatedly bounce between absorptive surfaces. Such maze must be wide enough (say 1.8 metre for quick removal of gurney).

Arhalon extinguisher must be installed.
The soil and foundation must be strong enough to support shielding. Adjacent departments must be protected from dust and vibration that will occur during construction.

Its bulk requires that it be sited in a location a little seperated from other radiological departments. This creates difficulty in circulation and control.

ii. Stanford University Medical Centre

The linear accelerator facility shows the increase in shielding requirements as more powerful machines come into use.

It is designed to accommodate a new 15 to 20 megavolt linear accelerator.

The particles are scattered by an "S" shaped corridor. Shielding is with laminated doors of steel, lead and berated polythylene, walls at the places that receive the greatest radiation are 2.7 metre thick and the ceiling are 55cm. thick, built on the floor, jacked into place and plastered so that reflection of perticles is reduced.

The maze is 1.7 metre wide and can allow knock down components of the linear accelerator to pass through.

There is also a halon sprinkler system.

iii. Neutron Therapy

This is a new method of treatment of cancer. It differs from other radiation techniques because of the special requirement of the machine

Complete rotation of the large circular head round a patient is a requirement. This requires either high ceiling or a pit beneath a moveable floor which partially returns over the head of the generator once it is in the pit.

Its general requirements are similar to those of linear accelerators.

iv. Fox Chase Cancer Centre

The neutron facility here is located underground so that other departmental functions of the hospital are not disrupted during construction and also to make use of the earth as an additional shielding material.

Due to the need for clearance for the neutron accelerator's head both above and below the patient, a pit beneath a moveable floor was designed.

Borated polythylene sheets are mechanically fastened to the concrete to provide obsruptive surfaces.

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Only wood or concrete finishes are needed within the beam's coverage since metal within the range of the neutron beam would heat up.

The mechanical system is completely independent from that of the other departments of the hospital.

CHAPTER FOUR

ORTHOPAEDIC SPECIALIST HOSPITAL, ABUJA

THE ORTHOPAEDIC SPECIALIST TEACHING HOSPITAL DEPARTMENTS

4.1 Accident and Emergency

4.2 Radiology

4.3 Operating

4.4 Pathology and Laboratory

4.5 Mortuary and Post Mortem

4.6 Physical Therapy and Rehabilitation

4.7 Social Services

4.8 In-Patients

4.9 Out-Patients Department

4.10 Pharmacy

4.11 Sterile Supply

4.12 Supply and Disposal Department

4.13 Catering

4.14 Prosphetic and Orthotics

4.15 Medical Records

4.16 Teaching

4.17 Research

CHAPTER FOUR

THE ORTHOPAEDIC SPECIALIST TEACHING HOSPITAL DEPARTMENTS

4.1 Accident and Emergency

This will as a matter of fact be a mini hospital itself in the sense that it will have its own operating room, X-ray, intensive care rooms and a mini ward whereby patients could be looked after even for a few days without necessarily being admitted into the hospital. The function of this demartment include reception, resuscitation, treatment (both emergency and followup treatment) of accident patients and those attacked by sudden illness.

Priority should be given to external access for emergency ambulance, if possible it should be a kind of drive-in access. Seperate access should be provided for walking and stretcher patients.

4.2 Radiology

This department is very important for diagnosis. Its main duty is to produce photographic films of various parts of the body, through X-ray techniques, for the use in diagnosis.

Special protection are needed in rooms where X-ray machines are used because of the high penetrating power and harmful nature of X-rays, e.g., lead or barium plaster finishes are used.

There are two major circulation patterns:

(a) Patient

(b) X-ray films for processing.

The major requirements for flexibility in the design for:

(a) are good patient supervision and reduction of staff walking time.

The design therefore:

(b) depends on; to a large extent the type of film processing method in use.

The radiology department is strongly related with the out-patient department, with the in-patient wards and could have been with the accident and emergency department if not for the "mini hospital" kind of design advocated for accident and emergency department. This relationship, coupled with the weight of X-ray apparatus, may make the radiology department to be located within the area of out-patient department, wards and the theatre.

4.3 Operating

When operating theatres and their auxcillary facilities are centralized in a single department, there is a better organisation of work and through put, and the services of staff and centralized engineering plants are more economically employeed.

For proper aseptic control, there is need for a rigid seperation of 'clean' and 'dirty' traffic. This indicates a two corridor system which imposes limitations on the plan form of the department. There should be as a matter of fact two different types of operating theatres:

i. Aseptic Operating Theatre

ii. Septic Operating Theatre

The three major circulation patterns are patients, staff and supplies (including theatre supplies). The shape and content of the individual clusters of operating theatre and its ancillary rooms also has a major effect on the planning of the department.

The operating theatre department needs a greater floor-to-floor height than other hospital departments. This is because total air conditioning with filtered supply and refrigerator is required.

The department primarily serves the in-patient wards. If possible, there should be close, horizontal relationship to the surgical wards. A quick access from the accident and emergency department is also necessary.

For the quick return of expensive instruments sent for reprocessing between operations, it is important that a good supply route be maintained with the sterile supply unit.

4.4 PATHOLOGY AND LABORATORY

No hospital function reacts to research in biology and medical care as rapidly and as extensively as the laboratory. As more discoveries are made about the nature of blood and the ways in which diseases attacks the human body, laboratory determinations are brought into play to assist the process of diagnosis and determinating the effectiveness of the therapy.

This department is concerned with investigation of specimens taken from patients; blood, tissue, urine, etc., by laboratory techniques for the confimation or establishment of diagnosis. Clinical divisions include mobid anatomy, histology, haematology, bacteriology, clinical pathology, micro-biology, etc. Laboratory work is carried out in self contained sections of large open areas of laboratory bending and smaller spaces of offices, etc., common support facilities such as glass wash up are shared by the units.

Allowance for growth and change is a major design consideration. Planning should not inhibit anticipated change in the balance of space between one clinical area and the other. Reallocation of space without much distruption can be effected by grouping large, open laboratory areas together and the use of demontable partitions. Services to bench units (water, drainage, electricity, piped gases) should not be a hinderance to the arrangement of individual technicians work space. Services could be provided in a services spine and free standing bench units.

This department is quite heavily engineered. Unpleasant or contaminated air from fume cupboards should not blow in the direction of the kitchen and theatre departments as these require clean air intake.

The strongest relationship is with the out-patient department as many out-patients visit the laboratories to give specimen. If the pathology department is sited in the industrial zone, there should be a specimen collection area in the out-patient department. The department should also have a good relationship with the hospital supply route for supply of the large quantities of supplies needed.

4.5 MORTUARY AND POST MORTEM

For obvious reasons, the location of the mortuary and post mortem, also a part of the pathologist's domain, is always a problem. A standing joke is the hospital planning circles, and come not entirely unwarranted, is that the mortuary will be found opposite the entiance to hospital cafeteria. But it is an understandable fact that hospitals and physicians prefer to advertise their successes rather than their failures, and the location of the mortuary is usually worked out so that bodies can be transferred unobstrusively from the elevator to the mortuary and from the mortuary to an entrance accommodating the undertakers ambulance.

The mortuary requires refrigerators of adequate size to permit the bodies to be readily maneuvered. The need for mortuary facilities is related to the type of hospital population and thus the frequency of death. Elements of the General Hospital suggests mortuary refrigerators for two bodies as a minimum for 100-bed hospitals and the refigerator capable of handling three bodies for a 200-bed hospital.

4.5.1 Functions

(a) Reception of corpses from wards and refrigeration until they can be collected by relatives and undertakers.

(b) Carrying out post mortem examination to confirm or establish cause of death.

Convenience to morbid anatomy section of the pathology department is desirable but not essential.

4.5.2 Post Mortem Table Requirements

Post mortem table requirements include water and drainage services; downward ventilation through tables for prevention of contamination as infected bodies are disected. There is need for special treatment of extract air from the table.

4.5.3 Body Storage

Body storage is in three-tier refrigerated compartments. Seperate compartments should be provided for infected bodies.

4.5.4 Location

Should be on the ground floor and the external access for undertakers' vehicles should be screened.

4.5.5 Research Space

With the growing interest of physicians in participation in research, the planning program should carefully investigate the possible needs of research laboratories in which medical problems can be studied as well as animal quarters and animal surgeries. Such facilities would not ordinarily be located close to the pathology department.

4.6 PHYSICAL THERAPY AND REHABILITATION

Within the memory of most users of this text, patients who suffered functions of the extremities neter regained full use of injured joints, which had, of necessity, been immobilized while their broken bones were healing. The development of the art of physical therapy has made a great change in the out-look for the complete and unhampered use of legs and arms after similar injuries or often illnesses that attack the muscular nervous system.

Although a rigid formula for assessing need is not available, certain basic considerations have been evolved from experience. These are:

1. Number and type of patients in need of physical therapy.

2. Recognition of this need by the medical staff and community.

3. The location of the hospital and type of community it serves.

4. Availability of physical therapy in nearby institutions or communities.

5. Community service programs of other health agencies.

6. Degree to which hospital services are utilized on an out-patient basis.

The recognized aims of physical therapy form the basis for fridging performance. The objectives of physical therapy are to aid the medical doctor in care of patients.

- To combat cumulative disabling effects of prologed physical and mental illness.

- To minimize residual physical disability.

- To help return the individual to optimum living with his capacities.

- To hasten convalescence and reduce time in hospitals.

- To contribute to the comfort and well being of patients.

This department uses both pasive and active exercise and other techniques of physical treatment to rehabilitate patients following illness or disability

The functional areas include:

(a) Physio-theraphy and remidial gymnastics, containing large, open exercise area and individual changing cubicles.

(b) Hydro-therapy - which designers sometimes refer to as a wet area. The principal fixed equipments consists of whirl pool baths in which patients may exercise an arm or leg while water at a controlled temperature swirls around the extrimity or extrimities being treated and pool requiring special engineering controls for temperature humidity and filtration plant and special lifting apparatus for patients with changing and pest areas.

(c) Occupational Therapy

Occupational therapy fractures are also in the realm of the rebulons and can only be discussed in the most general terms, because the requirements will be entirely related to the medical care program of the hospital. Large hospitals that are particularly oriented in the direction of rehabilitation, like this, will frequently go into some forms of occupational frieing to fit the harchopped for jobs in industry. Arts and handcrafts rooms are required. Occasionally, occupational therapy facilities will be limited to storage areas where materials and carts can be kept to serve a program in which occupational therapist goes to bedside, and the patient carries on therapy activities in his bedroom on in a patient lounge.

(d) Electrotherapy

A workshop could be enough for this where it contains beds and electric panels.

(e) <u>Consultation/Examination Rooms</u>

A ground floor location is needed because of the high proportion of out patient work done here. Also, there is need for a separate abulance access.

Special care should be taken in the internal detaching of floor finishes and grabrails. Steps should be avoided as many patients with varying degrees of disability will be treated.

4.7 SOCIAL SERVICES

This department deals with the followings:

(a) Campaign for preventive health care proframe.

(b) Assisting a patient in finding financial support for easing the cost of illness, even greater support is frequently provided in a broad area of social problems.

(c) They work directly with the patients' physician.

The location of the social counselling unit is not necessarily pegged to the patient lobby area.

Sometimes these offices are related to the out patient department, although this not necessarily the best location because some of the social service workers/officers must often work with the patient at the bed-side. The unmber of social service offices that will be required depends on the orientation of the administration and medical staff. Therefore, it is necessary to program this particular function in terms of the needs of this particular hospital organization.

4.8 IN-PATIENTS

This consist of wards and day spaces which are flexible and can cope with the greatest needs as they arise. The demontable pention principle will aid a great lot to achieve ward flexibility.

4.8.1 Principle of Ward Design

(a) The number of beds controlled by one ward nursing sister should be between the ranges of 20 to 28 beds.

(b) Nurses should be able to observe the greatest possible number of beds from the nursing stations and when carrying out routine duties.

(c) Isolation of patients for clinical reasons and for reasons of privacy call for sufficient number of single rooms.

(d) Grouping together of nurse work areas and their close relation to bed areas (to avoid long walking distance by staff) is essential.

(e) Patients' sanitary facilities should related to groups of bed areas instead of being centralized in one area.

(f) Demontable partitions allow for flexibility instead of fixed walls.

4.8.2 Contiguous Wards

If ward units are grouped horizontally so that bed areas of adjacent sections are contiguous, there is the possibility of individual sections "expanding" or "contracting" at will in response to changes in demand. There are, however, certain factors that will limit this possibility. These include:

(a) The desire of ward nursing sisters to have a stable sphere of influence that they can identify as theres;

(b) The presence of five doors at the end of each unit (units are normally designed to be co-terminous with the five sub-compartment; and

(c) The nurse-call system and other communications being linked to one nursing station or the other.

Two or more units can however, be grouped in such a way that there is easy access to facilities which can be shared.

4.9 OUT-PATIENT DEPARTMENT

This department deals with patients that coming as referred by appointment for consultation, examination or treatment. Patients to be of an unemergency cases come to the hospital via this place. This is about the largest department in floor area. Accommodation can be divided into three, viz:

(a) <u>Department</u>

Reception, waiting and sub-waiting, patient amenity, e.g. snack bar, childrens play area, cleaners room,,stores, offices, trolley and wheel chairs parking space, sanitary facilities.

(b) General Purpose Clinic Suites

This form the centre of the out-patient department. There are two types of consulting suites:

i. Combination of consulting and examination room.

ii. Combination of one consulting room and two examination rooms.

Examination Rooms

- The first one provides more flexibility in room allocation to the different specialities as these require different number of rooms for any clinic session.

- The second type can be converted to type; be when it seems insuitable or if other need arises since the rooms are going to demontably partitioned.

(c) Speciality Accommodation

Special accommodation should be limited to the bearest minimum. Examples of single speciality rooms are those dealing with the diseases of the commending tissues that affect the bores, fractures of the limbs, fractures of other nature, prosthetics and orthotics and laboratory.

It is important that the out-patient department should have its own external access since it's going to attract a large amount of both pedestrian and vehicular traffic.

Preferred location is on the ground floor, through part of it can be on an upper floor.

It has a strong relationship with the medical records department.

4.10 P H A R M A C Y

The main function of the pharmacy department is the dispensing of drugs to in-patient wards, departments and out-patient department. Facilities should be provided for goods reception and storage, assembling of individual ward orders, preparation of small quantities of special stirile products and a special dispensing counter for issuing prescriptions to out-patients.

It can be suitably located on the ground floor since it must be related to internal and external supply routes and to the out-patient department.

Its flammable store is to be shared with other departments, e.g. pathology, and should be separated from the main hospital building.

Amount items stored in the pharmacy are controlled drugs, poisons and drugs liable to misuse. For this, special security precautions ought to be made against intrusion and theft and alarm systems should be provided.

The pharmacy department should be located close to the main stores of the hospital so that its stores can spill over into the main stores if the need arises.

4.11 STERILE SUPPLY

The main functions are sterilization and disinfection of hospital equipment. Items dealt with include dressing packs (with or without instruments), linear (e.g. operating gowns), instruments (theatre and ward) symiges and bowls.

Apart from clearsing and sterilizing, the department also disinfects medical equipment which come into close contact with the patient, e.g. ventilators.

The servicing and processing units need stear service to autoclares, and a very good relationship to internal supply routes of the heat generated and the need to keep stear maximum as short as possible.

4.12 SUPPLY AND DISPOSAL DEPARTMENTS

4.12.1 Supply System

Supply system is a domicating factor of hospital design. The supply system is a loose collaboration of various hospital functions equipment which must be co-ordinated to place supplies in premeditation of need at the patient's bed side, at the floor nursing centre, and at designated points in the therapeutic system. It must also encompass facilities for returning flor processing and redistribution various materials and equipment that have been used in patient care.

The supply department serves essentially as a store and distribution centre. It provides species for unloading, chocking, breaking bulk and sorting for delivery to users departments.

Storage space is needed for only a minimum amount of stock for emergencies; the aim being to take most of the supplies directly from the delivery vehicles to the area of use without passing through the distribution centre.

4.12.2 Disposal

The function is to take care of the needs for disposal and reprocessing by all wounds and departments.

The items for disposal by the central kitchen waste disposal units or collection by contractor include the food remainants, plate waste from wards and waste during preparation. General waste are disposed of by incinerator or cremator or collection by local authority contractor. The disposal of some specialised waste, e.g., highly infections or radioactive materials need special arrangements.

Items like linen which are soiled or fouled or infected are reprocessed by the laundry while items like instruments and equipments are reprocessed by the sterile supply department.

4.13 C A T E R I N G

Main function is preparation, cooking and serving of food to patient areas, staff dining rooms and student dinning. Food services to patient areas may be by present tray system or by bulk food trolley. Beverages are made at ward levels while all washing is returned to the central wash up area of the main catering department.

Central staff dinning room should be related to the cooling area of the kitchen. Separate dinning hall is provided for the students. Subsidiary dinning rooms or snack bars may be provided elsewhere in the hospital.

4.13.1 Location of the Kitchen

Three factors control the location of the kitchen. These are assess to the vertical transportation core of the hospital for distribution to the patient areas; access to the cafeteria which in turn must be continently accessible to hospital personel; and finally access to service area where raw food will be delivered.

4.14 PROSTHETIC AND ORTHOTICS

Prosthetic and orthotics department otherwise known as the limb fitting department. This department make artificial limbs for those who have lost any of their limbs.

The workshop should be at the industrial zone and part of the department in-charge of recommendation and consultations should be sited near the out patient and physical therapy department.

4.15 MEDICAL RECORDS

This is a very important department in a specialist teaching hospital. Apart from keeping records for the personel use of the patients by the sugeon records are referred to for research and teaching purposes.

The medical record, begining with the admitting documents and culiminating in the patient discharge summary, contains a variety of profusses notes, surgeon orders, diagnostic reports, and summaries of surgical procedures, among other documents.

During in-patient case it originates with the admission, remains at the floor charting desk to assist the surgeon in planning the course of patient case, and at the discharge of the patient, goes to the medical records department where it is filled, after completion by the attending surgeon. It may thereafter be referred to for information which may be supplied to insurance companies and which may be required in medico-legal proceedings or for the purpose of research and teaching.

In planning the medical records department the social pressures for future provision of increasing out-patient services should be measured. In this context it should be noted that quality of care is best achieved when the out-patient medical records become an intergual part of the entire hospital medical records. A greater amount of stack space is one of the lesser adjustments that must be made to accomodate out-patient activities.

4.15.1 Location

Location of the medical records department becomes more important because, although many out-patients will come on appointment and their records may be extracted from the file in advance so that they may be on the surgeons desk prior to the patient's appearance, some patients arrive without advance appointments, and their records should also be available to the surgeon at the time of consultation. To facilitate such prout movement of records to the out-patient department, it is necessary either that there be a physical relationship between the out-patient department and the medical records department or that there be a mechanical means of delivering these records, such as an appropriately sized pneumatic tube system.

Where the concept of a patient entrance is adopted, thought may be given to locating the medical records department close to the admitting administrative unit and to the out-patient department.

4.16 TEACHING

This department run the post-graduate medical school and post-graduate nursing school. Though some undergraduate medical students might be sent for some courses on Orthopaedic Surgery. Staff for the prosthetic and orthotics were trained in the hospital.

Teaching facilities are needed on each nursing floor. House-officer cubicle are located in a room just inside the door of the nursing unit and across from the teaching apartment.

Rooms are provided in the wards along the corridor essentially for use by the allied health professions and administration.

Lecture rooms, auditorium, mock wards for demonstration, laboratories, students rest lodge, etc., are provided.for teaching purposes.

The teaching department should have direct access to the wards and pathology department.

The main aim of this department is to produce orthopaedic surgeons and orthopaedic nurses.

4.17 RESEARCH

The repetition of epidemics in our populace stimulate research. Efforts were placed on the chemical prevention of wound infections as well as the treatment of bacterial and panasitic diseases which might affect the bones.

The application of physical and chemical techniques in the development of the field of molecular biology led to existensive programs of very sophisticated research. The development of new instrumentation, the application and utilization of radioactive isotops, and the increasingly accurate quantitation and precision of data fostened the expansion of research. The huge volume of data generated required the medical methods for analysis and the application of computer techniques to biologic research.

These needs and the anailability of funding will lead to emphasis on construction of facilities for research with primary attention to laboratories and equipment for that purpose rather than for teaching. Supposing facilities such as adequate animal care units, which are necessary for dependable biologic research, or for the specific requirements of teaching hospitals should be provided.

4.17.1 Future Projection

Profueins for the delivery of health care will continue to endue as a university responsibility.

Academic health science centres increasingly may be expected to foster the team approach to delivery of care. A greater variety of educational progress and health science schools may be expected to develop. With the educational programs in all health fields, more integration can be anticipated between teaching in the basic science, clinical patient care, and research. The future role of the academic health centre is not yet entirely cheer, whether only models of systems for delivery of health care with corresponding examples of practice facilities should be provided or whether universities should accept complete responsibility for all aspects of care in a given geographic area or population, as is the case with the very large teaching hospitals in Nigeria, will be a public and political decision for which proper facilities ultimately must be planned.

CHAPTER FIVE

OPERATING THEATRES

5.1 Historical Development

5.2 The Problem Today

5.3 General Planning Considerations

5.4 General Recommendations

5.5 Operating Rooms

5.1 HISTORICAL DEVELOPMENT

Consideration of the comfort and welfare of patients undergoing operations and the design of special rooms for surgery advanced enormously following the period 1847 to 1867 when Dr. Simpson discovered the anaesthetic properties of chloroform, Posteur introduced the theory of putrefication and Joseph Lister, the famous surgeon, demonstrated how germs infected surgical wounds. His use of carbolic acid sprays and other techniques intended to kill the harmful bacteria in operating rooms pioneered antiseptic surgery; before this time, it was uncommon for surgeons to wash their hands or put on clean clothes before operating, and because of the pain involved patients were held down by straps during operations.

A number of surgeons can still recall performing operations in a patient's home on the kitchen table, where as today, only in exceptional circumstances would operations be carried out anywhere but in an operating suite. However, treatment in hospital, where a large number of sick people are congregated, has the serious disadvantage that disease may be transmitted from one patient to another, or form a member of the staff to the patient.

The introduction of aseptic, rather than antiseptic methods, led to the need for improvements in the design of operating suites, and in their planning, finishes and fittings, lighting, ventilation and sterilizing equipment. Operations were first performed in single rooms where also the surgeons scrubbed, the patients were prepared and the instruments were washed and sterilized. Indeed, a number of rooms of this type are still in use; many operating rooms built during war time were equiped to allow four operations to be carried out at one time. The large, north-facing opening window, which provided natural light and ventilation, was a feature of early operating room design.

As more surgical operations were carried out, pairs of operating rooms were built, which shared facilities for scrubbing, cleaning and sterilizing, thus, removing the ancillary proceedures from the operating rooms. However, these suites introduced the problem of the possible transfer of infection from one operating room to another, the degree of risk depending upon their design, the provision or absence of doors, and the aseptic methods adopted by the staff. Some ten years ago, in Germany, the design of "twin" operating rooms was developed (to the layout shown illustration, Number 1) in which the clean and unclean proceedures were separated, while in United Kingdom many regions returned to single operating suites similar to that shown in illustration number 2.

In company with general increase in hospital building over the past twenty years, operating departments possessing grouped operating rooms have been built in United Kingdom. This has resulted partly from a need for economy in the use of both money and nursing staff, and partly from a general trend towards the centralization of operating facilities which offered such advantages centralized sterilizing facilities, a more even distribution of the case load and the availability of other rooms during maintenance. The design of multi suite operating departments varied considerably from the comparatively simple arrangement of a number of operating rooms opening off a central supply room (illustration number 3) to the more elaborate arrangement(illustration number 4) proposed for use in this country, where it is considered necessary not only to provide separate clean supply and disposal corridors, but to isolate, as far as practicable, the individual operating suites and the central preparation areas.

Multi-suite operating departments are most common in the United States of America where, because many of those who are responsible, believe that it is dangerous to move an anaesthetised patient, it is deemed unnecessary to provide anaethetic rooms. It should be added that the operating departments in America, Germany and Sweden were not planned to include such elaborate precautions as one proposed in England, nor indeed, were these precautions generally considered necessary.

5.2 THE PROBLEM TODAY

Sufficient records are not available to indicate whether the incedence of sepsis has increased recently or weather there is now a better and more effective appreciation of this long-standing problem. After a survey between April, 1982 to April, 1984, a total of 157 Orthopaedic - Traumatological cases were admitted into the Department of Orthopaedic and Traumatological surgary of the Jos University Teaching Hospital, Jos, Plateau State. 43 of the 157 patients (28.02%) who were operated upon acquired wound infections during their stay in hospital, Proteus (18, 14.86%) was found to be the most frequently isolated organism followed by stap staphylocus aureus (11, 25.58%), Coliforms (6; 13.95%), Streptococus and Pseudomonas aeruginosa (3; 6.98%). The establishment of Hospital infections control committee for every large hospital in Nigeria is recommended.

The result of wound infection is often no more than a need to keep the patient in hospital for an extra day or two until a stitch abscess has healed; on the other hand it can be much more serious, resulting in the loss of a limb, or even of life.

All who are concerned with the design and maintenance of operating suites including medical and nursing staff, architects and engineers, contractors and manufacturers, administrative and maintenance staff should work as a team so that conditions will be provided in which it is easier for the staff to do what is right for the patient, rather what is wrong.

Engineering is an important aspect of operating suite design and much of the success of the department depends on the quality of the special and general lighting, and on the performance of the ventilation and sterilizing equipment.

Many of the basic features in the design of operating suites have changed. For example, boiler sterilizers (which were a source of wild heat and steam) are no longer installed; large autocleaness, another source of wild heat, will rarely be installed in the immediate proximity of future operating rooms; the use of rubber makintoshes and the setting of trolleys in sterilizing or preparation rooms is no longer favoured; the former preference for individual operating suites has given way to the adoption of multi-suite operating departments, external windows in operating rooms are now regarded as a liability rather than an asset; the conventional X-ray Mobile Unit is being displaced by self contained image intensifier, and even traditional brick construction and terrazzo floors are being replaced by prefabricated constructions and materials.

Such changes serve to illustrate how important it is that the design of operating suites should be kept under constant review. Only thus, will it be possible to ensure that all new methods and proceedures are considered at the initial design stage and that the best that can be afforded is provided for those whose need is great.

5.3 GENERAL PLANNING CONSIDERATION

Due to the complexity of operating theatre, it is consequently the most important and most complicated parts of the hospital. This department of the hospital receive patients to be operated upon, anaesthetize them, operate on them, and supervise them post-operatively until they are fit to be taken back to their wards.

Thus, the primary design consideration is the patient, his comfort and safety. Safety in the sense that the operating suite must be free from bacterial infection. The best aseptic control technique must be applied. Patients comfort on the other hand requires that the best climatic condition for the patient be maintained during operation procedures. Another factor in the planning of the department is the provision of a good climatic condition for the surgion's work.

Based on the pre-mentioned factors, the operating theatre department can be divided into three different zones:

(a) The administrative and control areas, e.g., offices for surgical supervisors and clerks, entrance and patients' reception, lacker, dictating rooms, coffee room, etc., these constitute the outer zone.

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(b) The work and storage areas of the department which can be stage as the intermediate zone. The recovery room as well as the staff rest rooms are part of this zone. Personel from other departments can deliver supplies to this area but are not normally allowed to exceed this zone.

(c) This zone, known as the inner zone consists of the operating rooms and their ancillaries of scrub-up rooms, anaesthetic rooms, sterilizing rooms, plaster rooms, etc. This is the area where the highest level of aseptic control is exercised and unwanted and unauthorized traffic should be eliminated.

It is recommended that the operating department should be separated in a block from the other hospital departments, possibly in a cul-de-sac department off the main hospital corridor in order to ensure quiet and to minimize air borne infector.

The planning of the surgical suite should be such that flexibility of the pattern of work is possible, instead of the plan entirely dictating the pattern of work.

5.4 GENERAL RECOMMENDATIONS

It has been increasingly impressed upon me during my study of operating suites that the first essential in the prevention of infection is for medical and nursing staff to maintain a strict aseptic discipline and that the incidence of wound infection may only be indirectly related to the finishes and fittings in the suites. It is necessary, of course, for the rooms to be kept meticulously clean, for doors to be kept closed during an operation, and for the ventilation system, section units and autoclaves to be satisfactory. It must follow, therefore, that to simplify cleaning, to prevent unnecessary work caused by unsatisfactory and incorrectly sited fittings, and to obviate any possible association of infection with the design of the building, suites must be designed, built, and maintained to provide ideal conditions in which the staff may work. Prevention is better than cure.

The recommendations I am about to give which is based on the Newcastle Report on Operating Theatre Design and personal research into various existing theatres considering their defects based on design and materials used. If implimented, should provide such conditions, but it cannot be too strongly emphasised that new medical, architectural and engineering methods and materials are constantly developing and that it will be necessary for these recommendations to be revised periodically. The developments which have taken place in the finishes, fittings and general design of operating suites cannot be neglected. These recommendations does not, however, claim to offer ultimate solutions to the problems which already exist, or to others which will doubtless soon emerge.

A short summary of my recommendations is written hereafter, but it is intended as a general guide only; each architect and engineer directly concerned with an operating suite is invited to study the appropriate sectors in detail to be in a position to ensure that the work is carried out in accordance with recommendations contained in their.

It may be that, in practice, certain modifications of the recommendations may be considered necessary. If as these should be noted and brought to the attention of the architects concerned in the design of operating suites.

5.4.1 Operating Rooms

(a) Recommended area - $36m^2$ satisfactory room size - 6m x 6m with a ceiling height of 3.0m.

All fittings should be set flush with the face of the wall or ceiling.

(b) The siting of doors and fittings should be similar to illustration number 5 including "surgeons" and "nurses" equipment panels as illustrated, clocks, recessed cupboards and electrical socket out-lets.

(c) Flush mounted ceiling lightings fittings and diffusers should be installed as shown in illustrations number 6 and 7.

(d) Air evacuation values should be installed as shown in illustration number 8.

(e) Any background heating should be provided by means of a two speed ventilation system.

(f) Medical gas, suction, compressed air and certain electrical out-lets should be provided by means as shown in illustrations 5 and 6.

(f) In multi suite operating departments conduit should be installed for monitor connections and the need for observation and monitor panels considered.

(h) The wider use of prefabricated operating suites should be investigated.

5.4.2 Anaesthetic Rooms

(a) Recommended area - $16.20m^2$, satisfactory room size 4.50m x 3.60m.

(b) The axis of the room should be in time with the table in the operating room; the doors should be sited at each end of the room and the lay out as shown in illustration number 9.

(c) The colour of the walls should be beige or similar.

(d) A light grey anti-static is recommended.

(e) The wall and floor bench fittings should be positioned along one side of the room, preferably on the right.

(f) Oxygen, nitrons oxide and suction services should be provided as shown in illustrations number 9.

(g) Any windows, through which the sun may shine onto the patient's face should be fitted with blinds and preferably be double glazed.

(h) The artificial lighting should be of an approved colour and capable of being dimmed. An examination light fitting should be provided.

(i) A clock, with a second hand should be provided on the wall beyond the patient's feet.

(j) A minimum of four 13 Amp. electrical socket out-lets should be provided.

(k) Cylinder and pole racks would normally be provided in the anaesthetic store and trolley bays respectively, but may be required in the anaesthetic room.

(l) A warm blanket cupboard should be formed between the anaesthetic room and exit lobby or in the exit lobby.

(m) A small, through, drug cupboard between the anaesthetic and operating rooms may be required.

(n) A wall mounted, foot operated, paper sack holder should be provided.

5.4.3 Scrub Rooms

(a) Recommended area - $9.0m^2$, satisfactory room size 4.2m x 2.2m.

(b) The room should be narrow in shape with layout and fittings as shown in illustration numbers 10 and 11 with separate areas for scrubbing and gowning clear of opening doors.

(c) Where aprons may be worn, hooks should be provided.

(d) A triple screen unit or trough, 2.25m long and 45cm wide should be installed.

(e) The hot and cold water supplies should be from tanks and should have a balanced, low pressure.

(f) The water supply should be mechanically mixed in individual valves and controlled by a foot-operated unit, or an elbow-action lever.

(g) The water out-lets should be 2.6cm diametre with an anti-splash spray or aerated nozzle positioned as specified and shown.

(h) Removable soap trays should be installed, also provision made for foot-operated medicated soap dispensers.

(i) Nail brush dispensers should be provided.

(j) Where individual pecks are to be used, 1.50m long x 0.45m wide malamine faced, removable shelves should be provided 0.45m and 0.90m from the floor.

5.4.4 <u>Sluice Rooms and Disposal/Cleaning Areas</u>

Sluice rooms in single operating suites including possible variations (e.g., where a peck system is used)

(a) Recommended area - $11m^2$ to $12m^2$
satisfactory room size 4.0m x 3.0m.

(b) The room should have door-ways to the operating room and disposal corridor and should communicate by hatch with the sterilizing.room.

(c) The layout of the room fittings should be similar to that shown in illustrators numbers 12 and 13.

(d) The fittings should include special sink unit, towel dispenser, drying rail, wall taps for bucket filling, apron hooks, specimen cupboard, soap tray, brush bowl, shelves for bowls, lotions and "dry" linen, etc., and bag holders for collecting foul linen, linen, gloves, swabs and glass.

(e) The sink unit should be in accordance with the specification.

(f) <u>Increased Area</u>

i. When two autoclaves are to be used the area should increased by $2m^2$ and the instrument cupboards installed in the suice room.

ii. When instruments are to be packed in this room a bench should be provided and the area increased by $2m^2$.

iii. When instrument packing and through-autoclave systems are to be used, the area should be increased by $4m^2$ (see illustration number 12)

Disposal/cleaning area (in a multi-suite operating department)

(a) Recommended area - $40m^2$.

(b) Layout to be as illustration number 5.

(c) Parking space for disposal and linen trolleys should be allowed near operating room door.

(d) Where plaster work is to be carried out an additional plaster receiver should be provided.

5.4.5 Sterizing and Preparation Rooms

Sterilizing rooms (with instrument sterilizing facilities).

(a) Recommended area $16.00m^2$ (excluding services area), satisfactory room size 4.50m x 3.50m.

(b) Layout and fittings should be similar to those shown on illustration number 14 an area (1.80m x 2.40m) for the set trolleys to be parked.

(c) Bench filling and instrument cabinet should be similar to those shown in illustration numbers 14 and 15.

(d) Heated cabinet for bottled sterile water should be similar to that shown in illustration 16. In isolated operating suites, recessed 50 litres hot and cold water sterilizers may be required as an alternative.

(e) The use of a packed instrument system should be considered in all new operating suites.

(f) The size of the main auto-clave should not exceed 1.5m^2 x 60cm deep and should be fixed 90cm from the floor to the bottom shelf. It is advised that one sterilizer 30cm in diameter by 50cm long should be sufficient.

(g) The high speed autoclave (if provided which should be) should be 22.5cm diameter by 45cm. deep.

(h) The sterilizing equipment, pipe work, and face panel, also the water bottle cabinet must be insulated.

(i) The front of the sterilizer face panel and service space must be ventilated.

(j) Brick or block walls surrounding a service area should be finished with cement render.

(k) Boiler sterilizers should not be installed. (if for any reason they are provided, either built-in or free standing, an extract ventilation system incorporating a canopy should be formed).

Preparation Rooms

(a) Recommended area - 11.25m^2 (10m^2 minimum) satisfactory room size 4.5m x 2.5m.

(b) Layout, fittings, sheling and heated cabinet for bottled sterile water should be similar to those shown in illustration number 16.

5.4.6 Theatre Supply and Sterilizing Units

(a) The minimum floor area of a unit supplying six operating suites should be $110m^2$ and probable break-down would be:

i, Central sink room - $22.5m^2$

ii. Storage and packing area - $22.5m^2$

iii. Sterilizing area - $22.5m^2$ (excluding service space)

iv. Central supply area - $42.5m^2$ (excluding anaesthetic supplies).

(b) General layout and fittings should be similar to those shown illustration number 17.

(c) Facilities for combined instrument and linen packs should be provided, unless instructed otherwise.

(d) The central sink room should be screened from the remainder of the unit.

(e) The fittings in the central sink room should include the following:

i. Linen and disposal bag holders.

ii. Sterilizer for contaminated instruments (if required).

iii. Slop hopper.

iv. Double sink and drainer unit, with jet/spray hose.

v. Mechanical instrument washer.

vi. Instrument dryer.

vii. Shelving.

Facilities for disposal, also troleey washing and parking should be provided.

(f) The fittings in the storage and packing area should include the following:

i. Instrument storage cabinets.

ii. Storage shelves or trays for bowls, trays, linen, swebs, etc.

iii. Process bench including reception hatch, sorting, packing, checking, wraping and despatching sections.

iv. Wash basing.

(g) The sterilizing equipment should be suitable for wrapped instruments, etc., and include two rectangular high-pressure, high-vacuum autoclaves; a lot air oven, a small high-speed autoclave and pasteurization unit may be required.

The sterilizers should be insulated and the work and service areas ventilated to control heat emission.

(h) The storage facilities in the central supply area should include the following:

i. Adjustable shelving.

ii. Adjustable trays/baskets

iii. Heated cabinet or trolley for sterile fluids.

iv. Bench fitting for small bottles, catheters, etc.

v. refrigerator.

Space should be allowed for one trolley per operating room.

5.4.7 Plaster Room Fitting

(a) The plaster sink suit should be similar to that shown in illustration number 18. In a multi-suite an additional slop hopper/receiver should be provided out-side the operating suite to be used for the application of plaster bandages after surgery.

(b) Extension fittings - a ceiling ring, wall cleat and wall ring should be provided (see illustration number 18).

5.4.8 Anti-Static Floor Finishes

In general the use of terrazzo flooring is recommended, however, in operating rooms used *for minor proceedures, vinyl, and ceramic flooring* should be tried to ascertain whether these finishes will withstand the conditions found in operating room in this country.

Anti-Static Terrazzo Flooring

(a) The sub-floor should be formed of reinforced concrete designed to limit movement and support the load of terrazzo flooring. The floor must not be affected unduly by heating from below or in the floor.

(b) The in-situ concrete sub-floor should be mechanically hacked and the terrazzo laid in accordance with specifications.

OR

If limited movement may occur, the sub-floor should be formed and the terrazzo laid in accordance with specifications.

Anti-Static Vinyl Flooring

(a) The sub-floor must be dry.

(b) The screed and finish to be laid, in accordance with the appropriate sections of specifications, where floors will be subjected to wet cleaning use marley floor or poly floor. Where floors will be subjects to semi-dry cleaning, conductile (or equal) may be used.

5.4.9 Wall and Ceiling Finishes

General

To reduce the possibility of defect in finishes such as may be caused by movement, steam and water, care must be taken in the defign of the structure, the installation of the engineering services, the selection of the plaster, the use of timber, the drying out of the structure and the provision of adequate temporary lighting.

Operating Room Walls

Preferred colours

Grey - B.S.9094

Beige - B.S.1015

Pale Yellow - B.S.4052

Pale Green - B.S. 6069

(a) Of all the finishes considered, it is known that ceramic tiles have proved consistently to be the most successful permanent wall finish in operating rooms and the problem of porous points is now replaced by the use of epoxy grout. Ceramic wall tiling is considered to be an acceptable finish, involving the least mistake of failure.

(b) Reinforced paint coating, protected light/ medium weight wall coverings and heavy weight wall coverings have all been successfully used either in the United States or Sweeden. However, lack of experience in application and of suitable materials had increased the risk of failure in this country.

For immediate use on the operating room walls in the single operating suites now being enacted or designed, one may recommend the use of a heavy weight covering, such as Evengleam.

Alternatively, the "thin" two pack coatings reinforced with fibreglass, such as Luxol Polyenethene (semi-glass finish) when a suitable, smooth, matt, protected light/ medium weight wall covering becomes available, this should also be used.

For prefabricated wall and ceiling panels a system of metal framing and sheet metal, faced with Vinyl covering such as Stelvetile, or an enamel finish, and backed with insulation appears to be most suitable.

Operating Room Ceilings

Preferred Colours - Off-white, B.S.4046 and 3033. The smooth, mall, light weight wall coverings (such as stormur 619 Buckskin Emboss) should be used because of their ability to mast any cracks which may occur.

As an alternative, a semi-gloss paint finish should be used.

Finishes for Other Rooms

(a) Scrub, Sluice, Sterilizing and Preparation Rooms

Walls

The semi-gloss finish, this two-part coatings should be used reinforced with 90cm wide sheet fibreglass immediately a above the skirting, around openings and over areas liable to damage or cracking.

Ceilings

Semi-gloss paint or light weight wall covering.

(b) Anaesthetic Rooms

Walls

The use of medium weight covering, such as Suwide 7062 (on a smooth, protected, light/medium weight wall covering, if available) is recommended. Alternatively a coating a coating as recommended for scrub rooms. Preferred colour B.S. 1015.

Ceilings

Light weight wall coverings with a delicate pattern or semi-gloss paint.

(c) Main Corridors

Walls

Here one may recommend the use of heavy duty coverings, such as Evengleam, which will withstand considerable damage, and should damage occur, can be quickly repaired without closing the corridor for more than a limited period.

Ceilings

Type C-1 where access is not required light weight wall coverings or semi-gloss paint.

Type C-2 - where access is required, unperforated heated aluminium ceiling panels, or, Vinyl faced fibre-glass panels.

5.4.10 Windows

(a) Windows should not be provided in operating rooms, unless they are perticularly requested by the Surgeons, and planning permits.

(b) Where provided, the fixed window frames and,

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if possible, the glass should be set flush with the wall face. A blind or shulter should be fitted between double glazing to provide partial blackout (see illustration number 19).

(c) Any windows in anaesthetic or recovery which face is a direction other than North should be filled with blinds between double glazing.

5.4.11 Doors, Hardware and Frames

Doors

(a) The height of the doors, in particular those through which patients and equipment will pass, should be 2.05m.

(b) The width of the doors should be determined by their intended use and position.

(c) Doors should be 45mm thick, constructed with a solid core, with outer frame, and blockings for all springs, etc.

(d) Moisture protection should be provided at all edges (i.e., lipping)

(e) A protective noising (Mipolam P.437 or equal) should be fitted into the opening edge to prevent damage.

(f) A triple-glazed unit with a clear aperture 37.5cm x 17.5cm (40cm x 20cm) should be filled with the bottom inner edge set 1.325m from the floor (see illustration 20). The glass should be held in position by plastic cover strips (such as Mipolam P.802). A sheet of tinted glass may be required to reduce glare.

(g) The finish of the doors should be:

i. 1.6mm melamine with a slight pattern effect to mask any scratch marks.

ii. Painted Alder or Birch fased plywood. Painted doors liable to damage by staff and mobile equipment should be fitted with 30cm deep 16 guage, anodised aluminium protection plates, and fitted over the lower section of the door and the other with the top edge 1.0m. from the floor. The edges of the plates should be splayed and the plates secured by adhesive and counter sink screws.

Hardware

(h) 30cm SC. Pull handles, equal to Dynard H116, or any equally appropriate locally made handle should be fitted to both sides of double swing doors and one side of single swing doors at a height of between 1.0m and 1.3m from the floor. The 30cm x 10cm push plates on single swing doors should also have the edges splayed and be secured by adhesive and counter sunk screws.

(i) Floor springs should be fitted, such as single action or two double action spring. further experiments should be carried out with shoe springs fitted in the heads of the doors, as an alternative floor springs.

(j) No locks, latches, or rebated meeting edges should be fitted on doors into the operating room.

(k) Automatic doors should be used at the entrance to a multi suite operating department.

Frames

(l) 16 S.W.g metal door frames (see illustration number 21) should be used and in traffic areas they should have a 1.0m high stainless steel section to the lower length of the jambs. Alternatively, the flows should be formed of selected Iroko hardwood, pinned before fixing. Secured by dowels and ties, and finished with Booth's flush aluminium architraves, including covering with fibre glass tape at the joint with the plaster. (as illustration number 22).

5.5 OPERATING ROOMS

5.5.1. Use

In addition to general surgery (which may include operations or almost any part of the body) there are the following specialist branches of surgery:

Speciality

Orthopaedic Surgery

Gynaecology Surgery

Urological Surgery

Otorhinolaryngology (E.N.T.)

Ophthalmology

Plastic Surgery

Neurosurgery

Candiological Surgery

Thoracic Surgery

Vascular Surgery

Before one can efficiently design a very functional operating room, one must have the insight of what goes on in it. One must fully understand the proceedure of an operation.

The proceedure for a typical operation is as follows:

(a) The room is prepared. It appears that as a routine, the ceilings is operating rooms should be washed once a month, the whole of the walls once a day and the floors before and after each operating session, as well as limited cleaning between cases. In addition, at least before each session, all fittings in the room - operating lamp, cupboards and shelves (if any), trolleys, tables, etc., should be cleaned.

(b) The operation list is exhibted.

(c) X-Ray films for the particular patient are hung on the viewing screen.

(d) The instruments, linen, tubing, leads, solutions required for the operation are conveyed into the room from the sterilizing or preparation room. These may be either brought in as sterile packs and bottles or on trolleys with a sterile sheet.

(e) The anaesthetised patient connected to the anaesthic machine, is moved into the operating room on the operating table with the minimum of disturbance and the anaesthetic machine is connected to the piped gas supplies. Alternatively, the patient may be brought in on a trolley or bed and transferred to the operating table, or he may be on a mobile operating table top which is then attached to the fixed base.

(f) If not already correctly positoned, the patient is positioned by "unscrubbed" staff and if diathermy is to be used, an earth plate is connected.

(g) Having scrubbed, the surgeons enter the operating room from the scrub room. (when a pack system is used, the "scrubbed" nurse enters shortly before the surgeons).

(h) All doors are closed.

(i) The sterile instruments are uncovered and arranged and the sterile lotions are poured into bowls (depending on when the lotions are required).

(j) The patient is prepared; transfusion fluids may be connected, the area of the wound swabbed and the remaining parts of the body covered with sterile sheets.

(k) The operation commences.

(l) The number of swabs exposed is recorded on a board on list and the used-swabs are exposed on a rack (or placed into bags) by the "unscrubbed" nurse for checking.

(m) The anaesthetist controls the anaesthetising of the patient, the intrevenous fluids, administers drugs if required and records the condition of the patient.

(n) Diathermy equipment may be used for cutting or sealing.

(o) The suction unit, with bottles on a trolley connected to the piped vacuum may be used to drain away fluids.

(p) Other equipment such as X-Ray machines, Image intensifiers as mobile operating lamps may be required.

(q) The surgeons may rinse their hands in bowls of sterile solution and the Sister may place used instruments in similar bowls.

(r) Bowls or bottles for specimens may be required.

(s) Catheters and additional suturs material may be required in addition to those set out.

(t) Dressing materials are removed from a seperate pack and applied.

(u) The operation is completed. The "unscrubbed" nurse may call the porters to take away the patient.

(v) The patient is prepared for return to the ward and transferred to a trolley in the exit lobby or operating room.

(w) The surgeons remove their gloves and gowns, place them in a linen skip on a trolley, and leave the operating room.

(x) The used and exposed instruments, linen, solutions, swabs suture, glass, etc., are transferred to the sluice room or disposal corridor, on or separate from the trolleys.

(y) The floor and any equipment left in the operating room is cleaned in preparation for the next case.

THE SITE

6.1 LOCATION

After much search for a suitable location while considering so many factors; Abuja is chosen because we already have Othopaedic Hospitals in Kano serving the Northern area of the country while we have another in Lagos and one at Enugu. So, for Orthopaedic Specialist Hospital to spring up again it is reasonable enough to site it at Abuja being the central focus of the country and is easily accessible from all part of the country. Abuja being the new Capital and for the projected population and the traffic network is the most suitable to all other cities in the country.

The site is located at the reserved area for public facility. It is at the tail end of the city centre, bounded on three sides by artiery roads which will assist in easy accessibility to the site.

6.2 SITE SELECTION CRITERIA

Site selection criteria is defined by a combination of environmental factors, including soils characteristics, vegetation quality, geological characteristics probable expension zones, quality of climate, and suitability of terrain.

No environmental factor is particularly meaningful, by itself, to determine site suitability. Interpretation and correlation is required to transorm them into useful measures for site evaluation. Key positive-and-negative criteria were employed. A set of most important positive qualities for selection this site includes the following:

(a) The most comfortable and healthful climate available;

(b) Sufficient size to accomodate future growth;

(c) Cofiguration to allow maximum choice in hospital form;

(d) Minimum topographic restrictions precluding the possibility of an efficient transportation system and organization of land uses.

(e) Buildable soils and geologic conditions not requiring unusual or heroic engineering measures for construction;

(f) Unique or exploitable natural features for hospital design purposes;

(g) No flood plain terraces;

(h) Scopes are between 5 - 10 percent;

(i) Good natural drainage.

6.3 SITE ANALYSIS

6.3.1 Access

Apart from the North-eastern part, the accessible from all sides. Though direct access should be from the Southern part of the site.

6.3.2 Size and Future Expansion

The site is five sides with bounding lines of 280 metre, 400 metre, 190 metre, 240 metre and 500 metre starting from the Western line in a clock wise direction. This size is suitable for the anticipated development, for providing parking and future expansion.

6.3.3 Topography and Drainage

The site is fairly flat, it slopes gradually from the Western to the Eastern end. The natural drainage follow the direction of the slope. Their is a protected water way at the Eastern end where the drainage could be collected together and passed away from the site.

6.3.4 Present Land Use and Ground Cover

The site is not been presently used, it is entirely be covered by natural vegetation, though in the Abuja Master Plan it is under the land reserved for public facility. The natural vegetation has a stabilising influence on the soil and prevent erosion. Thus, there is adequate ground cover of greenery.

6.3.5 Top Soil Suitability for Foundation

The upper layer of the soil, like other parts of the land of Abuja, is made up of silt and sand. This type of soil is very suitable for most types of building foundations.

6.3.6 Trees

Few trees exist on the site. The ones that exist are varieties trees including palm trees. where these will not obstruct building construction, they will be retained more trees may be needed to act as noise breakers, sun breakers, screening of glare and pollution, etc.

6 3.7 Climate

A comfortable living environment depend on maximising the aspects of the environment which reduces heat and the effect of humidity, and protection from rain and dust. Planning with climate should take place at all scales. While detailed climatic information is not yet available, extractions from existing airborne meteorological stations have been used to develop basic discription of climatic parametres presented in figure 8.1. These factors and their planning implications are discussed below:

1. Temperature (Humidity)

In human terms, wet radiation is felt as the temperature, the response to which is greatly influenced by the humidity conditions in the air. The Abuja records its highest temperature during rhe dry season when there are few, if any clouds. Changes in temperature of as much as 17°C have been recorded between the highest and lowest temperature in a single day. During the rainy season, the maximum temperature is lower due to dense cloud cover. Annual range is also much lower, sometimes no more than 7°C in July and August.

Human sensibility to temperature is greatly affected by relative humidity. The data shows the monthly variation in temperature and humidity for Abuja taken at 0700 hours and 1600 hours. During the dry season, relative humidity taken in the afternoon to as low as

20 percent in the city. This low relative humidity, coupled with high afternoon temperatures, account for dessicating effects of the dry season. In the rainy season, the relative humidity is much higher, especially in the morning hours when it can reach as high as 95 percent. Even though the temperature is slightly lower. The effect is to create a heat trap. When this situation occurs, the general feeling is to be uncomfortably hot.

ii. Rainfall

The start of rainy season in North-eastern Abuja is around 10th of April. The rain tapers off very rapidily after 20th of October. Thus, this duration of the rainy season is between 180 - 190 days. The data shows the mean monthly rainfall for the Abuja area. The mean monthly distribution shows a tendency for concentration in three or four months. In the Abuja area 60 percent of the annual rainfall is in the months of July, August and September. This concentration of rainfall shows the need for drainage system that can handle large volumes of water very rapidly.

iii. Wind (Dust)

Two major air masses dominate the climate Abuja. These are the tropical maritime air mass and tropical continental air mass. The tropical maritime is formed over Atlantic occean from the South-west to North-east direction. The tropical continental air mass is developed over the Sahara desert and therefore, worm and dry and blow in the opposite direction, North-east to South-west. The oscillitions between these two air mass produces the highest seasonal characteristics of weather conditions in the country. The tropical continental mass is associated with dry season, and the tropical mass creates the West season.

The presence of these two are indicated by the characteristics of privailing winds.

The tropical continental mass is associated with the North-east trade winds and the tropical maritime mass gives the South-west manson winds. The intensity and duration of each type of mind over a particular place is due to intense of these two masses.

In June, the Northernly flow of air component has weakened and only the Southerly flow predominates.

Being moisture - laden. It brings a lot of main. In September, the tropical continental begins to intensify over the territory and the North-east trades become the dominant wind from October to March bringing with it dry, cloudless but dust-laden conditions associated with the harmattan.

iv. Sun and Cloud Cover

In Nigeria, there is a general increase in the total hours of sun shine further North from Atlantic Coast. The amount of sun shine ranges from maximum of 1,300 hours in the Niger Delta to over 3,200 hours in the extreme North-east of the country. Abuja City is exposed to 2,500 sun shine hours annually.(Mabogunje, 1977)

6.3.8 Utilities

Electricity from National Electric Power Authority (N.E.P.A.). Water from the City Water Board and Telephones from the Nigeria Telecommunication Limited.

6.3.9 Nuisance

The only off site nuisance envisaged is noise from vehicular traffic plying almost round the site. Noise breakers in the form of trees and shrubs are needed on these sides.

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