NATIONAL TOBERCULOSIS CENTRE, JOS

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A THESIS SUBMITTED TO TUB POSTGRADUATE SCHOOL, AHMADU BELLO UNIVERSITY, ZARIA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE (ARCIIITSCTORE) .

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DEDICATION

This thesis is dedicated to the entire members of Alhaji Audi's Family who in no small measure contribute to see the reality of it.

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My first vote of thanks is to the almighty Allah who has guided me through this rough road.

A special thanks is due to my parents who saw the need to educate ~~it~~ me and prayed persistently for my success in life.

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Thanks is also due to Mr. Lasisi Gbadamosi of the Centre for Social and Economic Research for typing this thesis.

Architecture for health service calls for a new strategy of participation in the architecture of the whole connunity. A building is only as conpetent as is the health care system it serves. The final challenge is to establish COMMunication of the uses of the building to its staff and to the community at large.

- Michael Brown -

"It is difficult to think of more vital and far-reachining factor in ones life than the health serving institition. Directly and indirectly, every person, from birth to death at one time or the other, pins hope on the positive outcome of the health servicer these institutions provide."

- Redstone L.G. -

PREFACE

NATIONAL TUBERCULOSIS CENTRE is the topic of this thesis. Tuberculosis is known to afflict mankind since the earliest known times due to its infectious nature. This makes tuberculosis as a major health problem. In most countries of the world, the major health problem is still environmental sanitation, involving such elementary factors as water supply, sewage disposal, personal hygiene and simultaneously there is much to be done in the areas of nutrition, population control and the impact of the environmental of urbanization and industrialization.[1] In the above statement, urbanization, nutrition and personal hygiene are the words to be looked when dealing with tuberculosis.

A person once infected with mycobacterium tuberculosis the etiological agent in the disease of tuberculosis is likely to harbour live bacilli for the rest of his life and the disease may occur whenever condition is favourable.[2] While the number of people with disease has not decline, the death due to tuberculosis has declined.[3] This is due to the chemotherapy that has been introduced at the middle of this century.

Tuberculosis is not handled like headache where the victim is expected to feel alright after a dose of two of medicine. Tuberculosis is an illness that require much care in a gradual process, the amount of time depending on the extent of the infection and its stage. The minimum time of hospitalization with tuberculosis is two months.[4]

Reference

1. WHO, Second World Report on World Health Situation (1963).
2. Myquick, Q.N., Medical Bacteriology and Mycology.
3. Welch, M.H., Pulmunary Medicine.
4. Parry, H.O., Diseases of the Chest.

TABLE OF CONTENTS

	PAGE
Title Page	i
Dodication	ii
Acknowledgement	iii
Abstract	iv
Table of Contents	v
CHAPTER ONE: INTRODUCTION	
1.2. Definition of Tuberculosis	1
1.3. History of Tuberculosis	1
1.4. Epidermiology of Tuberculosis	2
1.5. Etiology of Tuberculosis	3
1.6. Pathology of Tuberculosis	4
1.7. Housing and Tuberculosis	5
1.8. Research Methodology	5
1.9. References	7
CHAPTER TWO: TYPES OF TUBERCULOSIS	
2.1. Extrapulmunary Tuberculosis	8
2.2. Tuberculosis of Lymphatic Glands	8
2.3. Tuberculosis of Bone and Joints	9
2.4. Tuberculous Pleuritis	9
2.5. Tuberculous Pericaditis	9
2.6. Peritoneal Tuberculosis	10
2.7. Tuberculous Enteritis	10
2.8. Tuberculosis of Central Nervous System	10
2.9. Genitourinary Tuberculosis.	10
2.10. Miliary Tuberculosis	11
2.11. Design for Isolation	11
2.12. References	13

CHAPTER THREE

3.1. Ancient Method 14

3.2. Sanatoria 14

3.3. Hospital Method 15

3.4. In-Patient Treatment 15

3.5. Out-Patient Treatment 16

3.6. Tuberculosis Drugs 17

3.7. Historical 17

3.8. Classification of Drugs 17

3.9. Control of Treatment and Progress 19

3.10. Health Propaganda 19

3.11. References 21

CHAPTER FOUR: CASE STUDIES

4.1. Ahmadu Bello University Teaching Hospital Annex 22

4.2. Ahmadu Bello University Teaching Hospital T.B. Unit, Malumfashi 25

4.3. Tuberculosis Ward: General Hospital, Katsina 27

4.4. Tuberculosis Sanatorium, Kaduna

CHAPTER FIVE: DESIGN DETERMINANTS

5.1. Siting

5.2. Site Location

5.3. Site Location Factors

5.4. Climate

5.5. Temperature

5.6. Rainfall

5.7. Solar Radiation

5.8. Winds

5.9. Synthesis from Macroclimate

5.10. External Spaces

5.11. Roofs and Walls

5.12. Surface Treatment

5.13. Openings

5.14. Site Analysis

5.15. Physical Site Factors

5.16. Topography

5.17. Altitude

5.18. Geology and Soils

5.19. Vegetation

5.20. Accessibility

5.21. Infrastructures

CHAPTER SIX: DIAGNOSTIC AND TREATMENT FACILITIES

6.1. Clinical Laboratory

6.2. Radiology

6.3. Pharmacy

CHAPTER SEVEN

Design Concepts

Site Concept

Landscapping

Ventilation

Design Brief

Architects Brief

Schedule of Accomodation

Conclusion

CHAPTER ONE

INTRODUCTION

Human tuberculosis or "phthisis" as it was called in ancient times is one of the oldest diseases known to afflict man since the esarliest known times; it can be found everywhere in the world cutting across races, tribes and religion.

Although its prevalence and the relative frequency of its clinical and pathologic manifestations may vary widely in different regions, tuberculosis is largely a disease of domesticated animals and man.[1] Its rarity in other wild animals probably rest on the lack of adequate patterns of transmission and or/lack of contact between the diseased and healthy individuals.[2]

1.2. DEFINITION OF TUBERCULOSIS

"Tuberculosis is an airborne infection spread by dioplet nuclei which are invisible, minute particules suspended in the air and dispersed like cigarette smoke". 'Tuberculosis is caused by infection with mycobacterium tuberculosis and sometimes mycobacterium bouis'. Sometimes, although rarely the disease is caused by a typical mycobacteria. Tuberculosis is a disease that can affect any organ in the body; but the most common one is the lung or pulmunary tuberculosis, which accounts for 85% of all forms of tuberculosis.

1.3. HISTORY OF TUBERCULOSIS

The history of tuberculosis can be traced to the history of mankind. The early Greek philosophers were able to identify people with pulmunary tuberculosis. Hippocrates the "fater of medicine" was able to describle people with pulmunary tuberculosis and he first

used the term "phthisis" which meant to consume due to the loss of weight the patients suffer. Descriptions of lung cough or lung fever were found in Chinese books as far back as 2698 B.C.

In Africa, there is evidence that tuberculosis occured in Egypt in 300 BC, northern parts of Ethiopia and the Sudan have also had the disease for centuries. In terior Africa the disease seems to have been introduced by adventurers and explorers. Dr. David Livingstone wrote to his brother-in-law who was starting a journey in South Africa, "take note of the diseases of the country and observe the absence of pulmunary diseases". The scanty evidences available suggest that until recently the disease was rare in West and East Africa, but by early 1900 it was recognised more and more.

The recent surveys showed that since about 1950 information of the prevalence of tuberculosis has emerged it was highest inland where it was recently introduced and lower in the constal regions where it has been introduced much longer.

1.4. EPIDERMIOLOGY OF TUBERCULOSIS

Epidermiology in its modern usage refers to the "study of the distribution of disease in human population against the background of their environment". Epidermiology of tuberculosis is extremely complex. 'Susceptibility to infection, pathogenesis and clinical manifestations are not uniform in all racial and ethnic groups. The World Health Organization (WHO) estimates 'that at least 15-20 million people in the world today are infectious with tuberculosis and that in poorly developed areas morbidity is about 1% (one) percent.

Although tuberculosis can be contracted by accidential inoculation

and through alimentary tract by ingestion of contaminated milk or other products, the most important and usual route of tuberculosis is by whalation of infected droplet nuclei. Studies have shown that this method of contamination is 'inversely proportional to ventilation'.

In Africa there is more tuberculous infection in males than in females and 'level of infection is consistently higher in urban than in rural areas'. Among factors that are responsible for its high prevalence in certain countries are:

1. Poverty.
2. Over population.
3. Inadequate nutrition.
4. Poor housing condition.
5. Lack of proper health care.

The above conditions are frequently present in urban tropical areas where there is a concentration of the lower socio-economic populations; also in the living quarters of the rural population of most developing countries.

1.5. ETIOLOGY OF TUBERCULOSIS

The principal agent in the disease of tuberculosis is the mycobacterium tuberculosis, and sometimes mycobacterium boris and mycobacterium kansaii are also known to cause tuberculosis. 'Below is the range of pathogenicity of medically important mycobacteria that naturally produce tuberculosis and tuberculosis like diseases in man and certain animals'.

Animal	Mycobacterium Tuberculosis	M. Bovis	M. Avian	A Typical
Man	+++	+++	Rare	- To +++
Pig	++++	++++	-	- To +
Rabbit	+	++++	++	-
Mouse	+++	+++	-	- To ++
Cow	-	+++	-	?
Cat	++	++	-	?
Chicken	-	-	+++	?
Swine	+	++	++	?

+ The degree of pathogenicity is designated by plus sign which is based on natural or experimental infections

1.6. PATHOLOGY

When tubercle bacilli is inhaled or ingested into the body, the bacilli grow abundantly in the cytoplasm of macrophages after being phagocytosed and may be carried from the initial focus to other parts of the body with little restraint. The primary complex consists of a small peripheral focus of tuberculous pneumonia, usually in one segment of lower lobes and enlargement of the regional hilar lymph nodes. There by the symptoms of the disease develop usually a loss of weight, night fever, night sweating etc.

1.7. HOUSING AND TUBERCULOSIS

Among factors that are responsible to the prevalence of tuberculosis listed initially includes poor housing conditions among other factors. This comes second to none. The poor conditionss in houses contribute alot to the disease of tuberculosis. The inadequate ventilation of the rooms within the houses and the overcrowdness of the rooms aid to spread tuberculosis. The minimum air of ten cubic feet per person is never achieved in most cases. The United Nations maximum number of people per room of two is never observed. This is mainly due to the lack of available resources to do so.

The conditions is worst in developing countries. In semi-arid and arid regions like the Katsina climate. The houses are made of massive walls of mud and very small openings are made to beat the excessive solar radiation. In so doing ventilation is over-looked.

1.8. RESEARCH METHODOLOGY

The research has been carried out in order to:

1. Understand the nature of tuberculosis.
2. To know who tuberculosis patients are.
3. To know and understand the different forms of tuberculosis.
4. To know the type of treatment and its effectiveness.
5. Enumerate the surrounding circumstances that leads to widespread of tuberculosis and know how best to arrest them.

6. Study the possible facilities that would be made available for utilization in the centre.
7. Study the existing institutions or places where tuberculous patients are treated.
8. Study the site, weather and all other physical factors relating to the establishment of the centre.

Informations had been obtained largely in the tuberculosis literature. The Kashin Ibrahim Library, the Medical Library has been a good place to obtain them. The interviews from public health workers, doctors, patients and their relatives of tuberculous patients had been of great help.

References

1. Hunter, G.W., Manual of Tropical Medicine.

2. Mywuick, Q.N., Fundamentals of Medical Bacteriology and Mycology, p. 313.

3. Barry, E.H.O., Principles of Medicine in Africa, p. 264.

4. Krasowski, J.O., Dictionary/Reference Guide for Respiratory Therapy.

5. Hishaw, H. and Murray, J., Diseases of the Chest, p. 293.

6. Norman Meachon, A Short History of Tuberculosis.

7. Barry, E.H.O., Principles of Medicine in Africa.

8. Ibid.

9. Ibid.

10. Ibid.

11. Ibid.

12. Ibid.

13. Elington, G.M., Pathology of the Tropics, p. 341.

14. Sattar Farzan, A Concise Handbook of Respiratory Therapy.

CHAPTER TWO

TYPES OF TUBERCULOSIS

Although tuberobacterium tuberculosis may infect many organs and tissue through many routes, the lung is by far the most common site of infection, 'evidently because of the high oxygen tensions that it provides particularly arteriorly and lower lobes'.[1]

Pulmunary or lung tuberculosis then 'accounts for over eighty five percent of all cases of tuberculosis'. This thesis therefore dedicates itself primarily on pulmunary form of tuberculosis which is more common and deadly. Infection of all other sites usually occurs by dissimination of the organisms from primary implantation in the lungs.

2.1. EXTRAPULMUNARY TUBERCULOSIS

Laennec, P.C. was the first man who established that tuberculosis was not necessarily limited to respiratory system at the beginning of nineteeth century. Many types of tuberculosis do exist. Any form of tuberculosis other than the one of the lung is called extrapulmunary tuberculosis. Some of them resulting from the primary pulmunary infection. Some extrapulmunary tuberculosis includes:

2.2. TUBERCULOSIS OF LYMPHATIC GLANDS:

One of the common form of extrapulmunary tuberculosis found in the tropics. It may be generalized discrete and painless and may be seen in relatively well nourished children. This type of tuberculosis is particularly present in population that consume unpasturized milk. This category of patients can have a large number of nomadic Fulanis.

2.3. TUBERCULOSIS OF BONE AND JOINTS

This is another type of tuberculosis that is very common in the tropics. "The most affected is the spine". The spread to bone can also result from 'Lymphatic drainage from an area of tuberculous pleuritis or renal tuberculosis'. The age of patients with skeletal tuberculosis tends to be increasing as it is for patients with other forms of extrapulmonary tuberculosis. In this type of tuberculosis, the usion commences in the body of vertebra and collapse may follow caseous necrosis.

2.4. TUBERCULOUS PLEURITIS

This type of tuberculosis is when there is involvement of the pleural space with the primary infection or less 'frequently represent reactivation of older diseases'. Pleural disease is more frequent in the younger patients. The symptoms just like the rest of night sweet, chillness, dyspnea, weakness and weight loss were the most common.

2.5. TUBERCULOUS PERICARDITIS

This type of tuberculosis is more common in males than in females and has a much higher incidence among the people with low socio-economic status. This type of tuberculosis cover a wide range of all ages. The symptoms of this include dyspnea, cough, weight loss, chest pain and ankle odema.

2.6. PERITONEAL TUBERCULOSIS

This disease is most probably due to activation of a latent peritoneal tuberculous focus that originated from the primary pulmonary tuberculosis. The disease is frequently observed in younger female patients. The symptoms include the abdominal enlargement, pain, weight loss and night sweats.

2.7. TUBERCULOUS PLEURISIS

This accounts for over seventy percent of all forms of extrapulmonary tuberculosis. This type of tuberculosis is usually the result of human not bovine mycobacterium tuberculosis. The initial symptoms include abdominal pain, distension, weight loss, fever and night sweats.

2.8. TUBERCULOSIS OF CENTRAL NERVOUS SYSTEM

In general, tuberculous meningitis is seen more frequently in children in societies with high incidence of tuberculosis and more often in adults in areas where the incidence is lower. The meninges may be affected by miliary spread by rupture of a small isolated tuberculoma or 'occationally by direct extention of tuberculous focus in bone'. The symptoms include the dysfunctioning of the central nervous system, others include weight loss, fatique and irritability.

2.9. GENITOURINARY TUBERCULOSIS

This form of tuberculosis had generally been one of young adults with first symptoms before age 40'. Renal tuberculosis originates from hematogenous dissemination from the primary infection in the

lung or rarely from 'gastrointestinal tract. The symptoms of this disease include dysuria, frequency nocturia or urgency and back pain'.

2.10. MILIARY TUBERCULOSIS

This type of tuberculosis may be present in the marrow and can cause pancytopenia and myelocytosis with a 'hyperplastic or plastic picture on marrow puncture'. The symptoms include weakness, anorexia, fatigue, weight loss and fever.

2.11. DESIGN FOR ISOLATION

Air-bone diseases like tuberculosis and small pox are communicable diseases that can be got from one person to another as such treatment of these diseases is to make or break this contact from the diseased and healthy individuals.

Leprosy, a communicable disease also had been this type of treatment since the earliest known times. Lepers in those days where isolated from the community so that the disease is little transfered to other people.

This method of isolation had also seen its way in the disease of tuberculosis since 1782 in Naples Italy where a decree promulgated that year ordered the isolation of consumptives. These patients where usually taken to some temporary structures built outside the town or city where they will live till fully satisfied that the disease is no more with them. This type of isolation is called "source isolation". In this case the source of the disease is isolated from the healthy environment which is considered to be the community.

Another type of isolation is the "Protective Isolation", where the patients are protected from being infected from within the community. This category of patients in tuberculosis are the patients with all forms of extrapulmuinary tuberculosis.

Protective isolation is to be given to them in order to be protected from being infected with the pulmunary form of tuberculosis. This type of isolation is normally given at the site for the treatment of both the pulmunary and extrapulmunary form of tuberculosis. The thesis here would give this type of isolation attention considering the fact that cost and inconvenience would increase if this is ignored.

Footnote

1. Nathanson, L.C., A Statistical and Roentgen Analysis of Bone and Joints Tuberculosis.

2. Mandell, G.L., et al. Principles and Practice of Infectious Diseases (Vol. 2, p. 1925).

3.

4. Edington, G.M., Pathology in the Tropics, p. 346.

5. Ibid.

6. Davidson, P.T., et al., Skeletal Tuberculosis.

7. Ibid.

8. Mywick, C.N., Fundamentals of Medical Bacteriology and Mycology.

9. Ibid.

10. Ibid.

11. Ibid.

12. Ibid.

13. Ibid.

14. Ibid.

15. Ibid.

16. Johnson, H.W., Intestinal Tuberculosis.

17. Haas, E.J., et al., Tuberculous Meningitis in Urban General Hospital.

18. Christensen, W.I., et al., Genitourinary Tuberculosis.

CHAPTER THREE

TREATMENT OF TUBERCULOSIS

Treatment of tuberculosis goes back to the early detection of people who were infected.

3.1. ANCIENT METHOD

The original dietetic/hygienic regimen of Hippocrates (the father of Medicine) and Galen another philosopher as laid down in the translation of the Greek texts continued to form the basis of treatment by renaissance physicians in conjunction with medicaments favoured by Galen.

Although treatment differ very much from one area to another, in Africa, the early treatment was in Egypt which was quite similar to Greek treatment earlier described.

3.2. SANATORIA

Sanatorium by definition is an establishment for the treatment of convalescent or invalid people. Sanatoria first appeared in the 12th century when they were established for the lepers. This were usually temporary structures outside the community. In essence Sanatoria were isolation institutions, places where people were primarily isolated from the community other than treatment institutions. In otherwwords, the source of the disease is isolated (patients).

Tuberculosis sanatoria for tuberculosis first came in existence at the end of nineteenth century. The first sanatorium was established in Germany by Drs Brehmer and Dettweiler at Nordrach in the black forest, a fairly isolated area. The Royal Victoria Hospital at Edinburgh was the first sanatorium in Britain established in 1894. Many similar institutions sprung up in Europe and America.

But in Africa the situation remained the same with no similar institutions for the treatment of Tuberculosis.

3.3. HOSPITAL PERIOD

Tuberculosis came to be treated in hospitals like any other disease at the middle of this century. This method of treatment had been widely condemned as a bad method of treatment due to its infectious nature.

3.4. IN-PATIENT TREATMENT

Eventhough long term in-patient treatment has been abandoned in most advanced countries, it can not be said to apply to developing countries like Nigeria. The largely illitrate patients around, in-patient treatment plays a great role in seeing the regular drug administration by doctors and subsequently bringing down the disease incidence.

In this part of the world where people can easily mistake the disease with ordinary cough until the disease is in an advance stage and blood started to come out with sputum; in-patient treatment is the only remedy that can halt the spread of tuberculosis.

In general hospitalization is better accepted and therefore more effective. Most phthisiologists will agree that an initial period of hospitalization is ideal for all tubercular who are to be given antimicrobial therapy. There are also evidences that treatment programmes succeed better when initial hospitalization is possible'.

3.5. OUT-PATIENT TREATMENT

Out-patient treatment is the type in which the patient is non-resident of the hospital. There are three types of out-patients.

1. General Out-patient.
2. Referred Out-patient.
3. Emergency Out-patient.

1. General Out-Patient: Is a person given diagnostic or therapeutic services on an out-patient basis for other than emergency condition and who has not been directly referred for such services by attending physician. These are normally the category of tuberculosis patients.

2. Referred Out-Patient: Is a person referred by his attending physician for specific diagnostic or treatment procedures for other than emergency condition.

3. Emergency Out-Patient: Is a person given out-patient emergency or traumatic care for conditions determined clinically as requiring immediate physician attention.

Out-patient treatment is absolutely necessary in the treatment of tuberculosis and carries about fifty percent of patients requiring treatment. Since an out-patient is a person given general or emergency diagnostic, therapeutic or preventive health services provided by hospital facilities or health programme and who at a time is not registered as or in-patient.

The education to be provided by the Centre for tuberculous patients must involve the whole of the out-patients since they come into contact with the public.

3.6. TUBERCULOSIS DRUGS

Tuberculosis drugs are drugs that are used in the treatment of tuberculosis. Some of the drugs were not intentionally discovered for tuberculous treatment, but have now come to be used in the chemotherapy of tuberculosis.

3.7. Historical

During the past thirty years or so, several drugs were introduced in the chemotherapeutic treatment of tuberculosis. Most of the drugs act against mycobacterium tuberculosis, the etiological agent in the disease of tuberculosis. Beginning with streptomycin in 1946, Para-aminosalicylic acid (PAS) in 1948 and isoniazid in 1952'. Others include thiacetazone (1950) Pyrazinamide (1952), Ethionamide (1959), Ethambutol (1961). Rifampicin was recently discovered.

3.8. CLASSIFICATION OF DRUGS

Tuberculosis drugs are classified as standard and second line.

Standard. In this category of drugs include:

1. Isoniazid: This is a relatively simple compound described simply as (INH) and derived from Nicotinic acid. Isoniazid is taken through the mouth and is readily absorbed from the gastrointestinal tract. Isoniazid is bactericidal to mycobacterium tuberculosis. It is used in the treatment of all forms of clinical tuberculosis.

2. Streptomycin: Is one of the earlier antibiotics. This unlike isoniazid is a fairly complex organic base. Streptomycin is given by intramuscular injection because it is not absorbed from the gastro-intestinal tract. Streptomycin is bactericidal to the mycobacterium.

3. Sodium Aminosalicylate (PAS): Is a fairly simple compound and is readily absorbed from the gastrointestinal tract and so given orally. PAS is only bacteriostatic unlike the rest.

Second Line Drugs

In this category which includes:

1. Pyrazinamide: 'A relatively simple organic compound the pyrazine analogue of inootinamide'. The drug is readily absorbed from the gastro-intestinal tract and therefore given orally. The drug is active against mycobacterium tuberculosis in acid medium.

2. Ethionamide: "This drug is chemically related to isoniazid and pyrazinamide'. It is absorbed from the gastro-intestinal tract and so given orally. Ethionamide is bactricidal like streptomycin and isoniazid. It is used in the treatment of all forms of clinical tuberculosis.

3. Cycloserine: This is a broad spectrum antibiotic readily absorbed from the gastrointestinal tract and so orally given.

4. Ethambutol: This also is a second line drug chemically unrelated to other tuberculosis drugs, but also well absorbed from the gastrointestinal tract and so orally given.

5. Rifampicin: Is another second line drug that is very effective in the treatment of tuberculosis. The drug is limited in its use due to its cost.

3.9. CONTROL OF TREATMENT AND PROGRESS

Patients on chemotherapy must be seen at least every month at the centre. The purpose of this visits are:

1. To assess the patient's progress.
2. To give a further supply of drugs.
3. To check as far as possible that the patient is taking his drugs regularly.
4. To observe any toxic effect that may arise due to any side effect of a drug.
5. To encourage the patient to continue to the end of the prescribed course of treatment. This is especially applicable to out-patients.

3.10. HEALTH EDUCATION

To some patients it appears unreasonable to continue taking drugs like INH for several months after ones disease is apparently cured. The need for such prolonged treatment to prevent retapse and other points about tuberculosis and its management must be repeatedly stressed to the patients. To this effect educational facilities are provided at the centre to cater for both the in-patients and out-patients. Its important to note that patients can

play very important role in controlling tuberculosis if they can use what they learnt from social welfare officers.

Footnote

1. Macgraith, N., Management and Treatment of Tropical Diseases.

2. Ibid.

3. Ibid.

4. Ibid.

5. Ibid.

6. Ibid.

7. Ibid.

8. Ibid.

9. Ibid.

10. Ibid.

11. Ibid.

12. US Department of Health Education and Welfare (1963), Facts and Traids on Hospital Out-Patient Services.

13. Hunter, G.W., Manual of Tropical Medicine.

14. Ibid.

15. Ibid.

CHAPTER FOUR

CASE STUDIES

1. AHMADU BELLO UNIVERSITY TEACHING HOSPITAL ANNEX

General Information: The Annex is located along Kaduna road. The Annex was first set up in the 1950's to treat small pox or rather isolate patients with small pox and other equally infectious disease. But with the control and subsequent eradication of small pox, the annex was converted to tuberculosis unit under the then Zaria General Hospital; which was eventually taken over by Ahmadu Bello University Teaching Hospital in the 1960's.

The annex as it is called then come to be housing patients with tuberculous infection. Isolating them from the main teaching hospital at Tudun Wada.

Planning: The annex is accessible through one gate only along the Kaduna Road. Planning wise, the annex is virtually divided into two. One section housing the patients (Nursing Units) and the other section serving the administrative and records division.

The administration unit is situated immediately one gets into the site. Its is a three room unit that served so many functions of consultation, the nurse's station, and of course the pharmcy.

Advantages

1. The location is quite acceptable, because this will enable the patients who are mainly illitrates and poor to find the place easily without any difficulty.

2. There is enough space around the consultation and administrative block for patients to move about before being attended.

Disadvantages

1. The arrangement of a pharmacy, a consulting room and a nurse's station to be at the same place is grossly inadequate. The fact that a lot of people converge at the place to either consult or get their medication makes cross infection more common. People with chronic tuberculosis are allowed to mix with patients with mild tuberculosis, and also make people with no disease to have it, e.g. children who follow their mothers to the annex.
2. The absence of segregation of males and females is also a disadvantage, this make people with purdah wives to prevent them to go to the annex even though the disease might be at an initial stage.
3. Another disadvantage of the administration unit is the fact that one has to pass through it before getting to anywhere within the annex makes it very uncomfortable for people with no tuberculosis to pass to get to either the nursing unit of the records section.

The records section is located some distance away from the administration unit. It is a two room unit with just enough space for a person to sit and record.

The Nursing Units

The next part of the annex is the nursing units where both the males and females patients reside during their stay at the annex.

There are eight rooms in two rows making it four rooms on each row, the rooms are about eight meters apart and about five meters in between the row. Each room contain five patients on five beds. There are two rooms marked for females in the annex, there are two toilets in the annex one each for males and females.

Advantages

1. The orientation of the building in east-west direction makes it possible to bring in air into the annex.
2. A lot of trees have been planted in the annex to shade the rooms.
3. The openings into the rooms are adequate to take away the bacilli emitted by the patients.

Disadvantages

1. The location of the Nursing Unit makes it absolutely necessary for visitors to pass through the administration and diagnostic unit before reaching it. This make visitors susceptible to tuberculosis.
2. The heat from the building material which is the zinc, makes it unbearable for patients to feel comfortable at any one time.
3. There is no conscious effort to segregate the males and the females in the annex, as such there is the possibility of having some social accidents in the annex, since the patients are ambulant so are sexually active.
4. There are no basic facilities to such as laundry, kitchen etc. to support the nursing units. Food which is absolutely essential for the therapytic of tuberculosis

is cooked at the Tudun Wada Hospital and so taken to the annex occasionally.

5. The physical demarcation of the patients has a psychological effect on them. The patients interviewed said they feel like being in prison due to lack of movement and rejection from the nurses.
6. The number of toilets and bathrooms in the annex are inadequate.
7. The lack of place where the patients can spare his time makes life very boring at the annex. Patients go there to spend three to six months only to come out with no skill to live a happier life.
8. There is the absence of any place where patients can develop their muscles which is in itself a therapy in tuberculosis treatment.
9. The number of patients in the room is unacceptable in the treatment of tuberculosis. Five people in a room makes the number of tubercle bacilli in the room and makes cross infection possible.

2. <u>AHMADU BELLO UNIVERSITY TEACHING HOSPITAL T.B. UNIT, MALUMFASHI</u>

Tuberculosis Unit of Ahmadu Bello University Teaching Hospital at Malumfashi is not any special unit, but it is rather a ward curved for tuberculous patients only.

The tuberculosis ward is located right amongst the normal nursing units. From the look of things, this tuberculosis ward is not designed for exclusive use of tuberculous patients but by accident it has been converted to house these patients.

The ward is a Florence Nightingale type of ward, that is a large room with beds arranged perpendicular to windows. The nurses station is situated at the end of the ward while the toilets and bathrooms are located at the other end of the ward.

Advantages

1. The large windows in the building are adequate and serve well to ventilate the building.
2. There is adequate supervision of patients by the nurses in the nurses station. They (the nurses) can virtually see any patient in the building and so can at the shortest be informed when any patient is in need.
3. The building is shaded by large trees which makes it comfortable at any time.

Disadvantages

1. There are no supporting services to cater for the patients during their spare time. The patients are confined to their beds at any time due to the fact that no space to either relax or develop any skill. The long term stay of the hospital makes it absolutely necessary to have this services.
2. There is no privacy in the open ward of this type. All patients are housed in one single room with nothing to actually give any privacy, this makes it possible to see patients taken away when they die.
3. There is no female ward as such but a small room at one side. This calls for social accident because the patients are ambulant.

3. TUBERCULOSIS WARD: GENERAL HOSPITAL KATSINA

This ward was initially not designed to cater for tuberculous patients, but children's ward. This now is used to treat tuberculous patients. The ward is situated near the hospital's mortuary at the pedestrian gate.

The ward is also a Florence Nightingale type of design, with the beds arranged perpendicular to the windows, and the nurse's station situated at the end of the building. The construction materials are the blocks and asbestors for the roofing.

Disadvantages

1. The situation of the ward at the pedestrian gate makes it unacceptable. Any infectious unit is located where the public has little contact. But in the case of the Katsina General Hospital tuberculosis ward the reverse is the case. The public are allowed to come into contact with the patients so making it possible for a cross-infection.
2. The single room ward also prevents any privacy as out-lined above.
3. The lack of segregation also is a disadvantage as outlined above.

Treatment of tuberculosis in a general hospital is generally condemned. As pointed out by Dr. Rodington earlier that "the common hospitals in a large town is the most unfit place imaginable for consumption, but to live in and breath freely the open air without being deformed by the wind or weather is an important and essential remedy in arresting its progress".

The general hospitals usually accommodate patients who are short term, but tuberculosis is a long term stay disease, a minimum of sixty days is required for a patient to stay at the centre for effective control of the disease unlike the children's ward of only five to ten days. Some special facilities are needed then to support the patients during their stay in the hospital which are usually absent in the general hospitals.

Patients that undergo tuberculosis treatment are supposed to be rehabilated to live a normal life after a long stay at the hospital, this rehabilitation facilities are usually absent in a general hospital.

Patients are also supposed to be educated on how to prevent the spread of the disease, because treatment of it is usually expensive; but the facilities to educate them are usually absent in the general hospital.

S.W. Finland Tuberculosis Sanatorium

Painio

Location:- Painio is a village not far away from Turku, where Al Aalto one of the outstanding architects on his time spent much of his early professional life. The Sanatarium that was commissioned after a competition in 1928 and commensed in 1932.

SIZE. The sanatarium was to accommodate 292 beds. It was built with contributions from fifty rural communes and certain towns. Its functional plan, reinforced concrete structure its large scale and uncompromising modern design relate it to the international architecture of the day. Alva, Aaltor's name was immediately joined to those of the great architects then like Le Corbusier Walter Cropius etc.

The Sanatarium is a sun trap. The various activity wings of the Sanatarium were disposed, oriented and related to each other to allow each patient to receive the warming sunshine on his bed. The patient wing is one long wing of the hospital, which is six stories high facing south east. Corridors follow the north wealls, their length mitigated by natural lightining. Open air terraces and balcanies are located in the east end of each floor oriented abit further to the south with provisions for the both large and small group of patients.

As separate wing to the north contains the dining room and lounges and are located with equally carefull orientation to the position of the sun at different tiemes of the day.

The two principal wings are joined by the circulation and service elements. (Sketch) other hospital requirement including ..... nurses and doctors quarters and utilities are provided in separate

building (stie plan). A look at the patient room in the hospital shows that it is [illegible]cated with utmost care. Each unit serves two patients special window details insures proper ventilation. Panel heating is delivered from the ceiling. Wardrobes of plywood are hung from the walls. Hand basins designed to be flash proof are hung on the corridor walls, opposite a continuous working table under the windows.

All the other illumination in the room is in back of the patient. Walls are [illegible] neutral tone with the ceiling somewhat darker. A restfull affect treatment of the corridor wall deadness the usual hospital noises. The frameWork of the Sanatorium is of concrete.

OBSERVATIONS

Eventhough Alvar Aaltor was designing for European climate and situtations, there is a clear understanding of the disease in the design. First, the fact that sun plays an important role in the treatment of tuberculosis makes it a prime consideration in his design to make it a sun trap as mentioned earlier. Aaltor oriented his buildings in such a way that each patient could receive the morning sun for the heliotherapy of the disease.

The provision of balconies and terraces for the patients to have enought air and of course reduce the number of the myeobacteria tuberculosis responsible for the disease of tuberculosis is an important achievement in Alvar Aaltors Sanatorium. The fact that patients can come together in this terraces and balconies is also an important achievement in the design.

The number of days that a patient takes to get cured of

tuberculosis are many, as mentioned earlier that the minimum is two months, makes it very important for interaction of psychotic patients are not produced at the Sanatorium.

Another important achievement in Aator's Sanatorium was the proper ventilation that the patients rooms ensure. Ventilation is an important aspect in the treatment and ultimate control of tuberculosis as mentioned earlier. For septic measures even the hand basins are designed to be flash proof, makes it safer for the mycobacteria to be controlled.

Eventhough the Paimio Sanatorium was a master piece of a great achitect's work it could not go without a negative set back. It could be very workable in Europe with the type of climate and cultural background. The siting of the social wing of the Sanatorium was in-pro the accessibility is not adequate.

The Sanatorium was built like an institutional building as compared to the homely situation.

CHAPTER THREE

Design Determinants

This chapter deals with the physical factors that influence the design concept, design form and the overall planning concept. It comprises of factors such as the siting of the building, location factors, environmental analysis, land use and land acquisition.

3.1 SITING

The site for the National tuberculosis centre in Jos, the capital of Plateau State. Jos is chosen for this type of project for many reasons:-

1. First and formost is the unique climatic conditions of Jos, as comparable to other parts of the country, is one of the most confortable in the topics. For a project like the National tuberculosis centre which requires a very confortable climate suitable for the treatment of tuberculosis Jos is an ideal site.

Second reason is that of potentials Jos has in terms of facilities found there. The fact that it is a state capital makes water and electricity supply easy.

The third reason is that Jos is about the geographical centre of Nigeria, close to the new Federal Capital Territory. It is, thus, accessible from all parts of the country by road, rail or by air.

3.2 SITE LOCATION

The site chosen for the centre is between Jos and Bukuru townships and within the proposed Greater Jos. Bukuru Area Plan (1975 - 2000). It is about eight kilometres south-west of Jos and 6.5 km north of Bukuru. The site is close the and almost opposite to the temporary site of Federal Government College Jos.

3.3 SITE LOCATION FACTORS

The factors considered in the selection of the site of this particular project are many:

(1) Relationship of the site to the population of the catchment area, in terms of proximity. As already mentioned earlier, the site is 8km from Jos and 6.5km from Bukuru, thus in terms proximity it is near central positions of both towns.

(2) The quality of major road access to the site. Jos and Bukuru towns are linked by a four lane major arterial road, which has street lights and accessible all year round. Also in the proposed Greater Jos. Bukuru Area Master Plan, there are two collector roads bounding the site running northwards through Barikin Akawu, while the other runs westwards through Kantiya-Gyel. When these roeads are developed, accessibility to the site would be easy. However, presently the site is one from a mining camp, adjutant to the site, while the other passes near the north-eastern portion of the site and runs through Barakin Akawu. Both roads are tapped from Jos-Bukuru major arterial road and are quite accessible all the year round.

(3) Zoning and quality of the surrounding neighbourhoods in the proposed Jos-Bukuru Area Plan, the site falls within the area marked for housing development.

However, site investigation reveals that within that area earmarked for housing, the ministry of lands and survey have already issued plots for business and commercial development. Also there is the Proposed site for an adult education centfe adjacent to the site. There is also an abandoned mining camp, about two hundred metres east of the site. This camp is now used for residential purposes by a few persons who now settled permanently. From reconnaisance, and also from information obtained from the ministry for lands and survey in the form of a geological map. It is observed that the site have not been used for any activity, except for test-boreholes here and there.

(4) Size of the site as related to building needs over a period of time. The area of the site and its environs is quite large, running over twenty hectres. To the east of the site is bounded by the mining camp mentioned above, and to the west by a fast running stream which the author intends to utilize for the relaxation of the patients. Further west about three hundred metres from the steam is a rocky mountain. The north and south are free except for farmlands. Another Rocky mountain is to the north-east, thus, for the expansion of the project if the need arises, there is abundant land for the project.

(5) Site configuration as related to the building requirements and integrated use. This comprises of the

topography
/soil geology, natural drainage patterns.

(6) Site restrictions, easements, views, noises and other nuisances are other factors considered.

The only restriction on the site area is the number of storey heights, which according to the Jos-Bukuru Area Plan should not exceed three storeys. Another restriction unrelated to the project but to the site is the mode of housing development. The master plan ddsignated the surrounding area for mixed development ie. detached and attached hounding development). Other factors such as views, noises odours and nuisances will be considered later in the section dealing with site analysis.

3.4 ENVIRONMENTAL ANALYSIS

Environmental analysis comprises the inter-relationship of land use with the environment. This involve physical, legal, political, economic and social ~~real~~ relationships. The earliest professional decisions that affect physical environment can not be made in the absence of such analysis. In general however, the architect may participate in four different processes, or in a combination of them. The first possibility is the site analysis calls calls for architect to study the feasibility of a project on several different sites. In use analysis, the architect assesses the feasibility and compartibility of a project on a specific site. Impact analysis, the third possibility is the assessment of the impact on the environment of the proposed uses in a proposed location(s) given specific land use programming the architect accesses the most appropriate land use strategy for achieving as

desired environmental impact and goals. Thus environmental analysis refers to the architects ability in four areas.

(1) Understanding the inter-relationship of land use and the environment.

(2) Assessing the feasibility of alternate uses for a specific site.

(3) Assessing the feasibility of a given use on various sites.

(4) Evaluating the environmental criteria relevant to

(a) Programming and

(b) design of selected uses on specific sites.

The physical factors to be dealt with in this chapter include climate, ecology, topography, geology and vegetation. The functional requirements include floor area, catchments, circulation and movement and the commuter which has already been treated previously.

The legal and political constraints include legal documents, restrictions on types of ownership, zonning, codes, proximity, utilities and services, political action groups, while the socio-economic considerations include; demographic consideration, perceptual structure and functionalism and response.

The physical factors will be considered in detail in this chapter. Parts of the others have already been considdered or will be considered later.

CLIMATE

Jos, which is the capital of Plateau State and the administrative headquarters of Jos Local Government council, is almost at the geographical centre of Nigeria. Not very far from the new Federal Capital City of Abuja.

Jos lies on latitude 8° 52' north and longitude 8°54' east. Jos has an altitude of 1266m above sea level standing right on the famous Jos Plateau.

TEMPERATURE

Jos is well known for its pleasant climatic conditions. According to the climatic zones of Nigeria in which the country has been divided into four climatic zones, Jos is placed under zone IIa (diagram). Due to its altitude the temperatures are generally low as compared to other parts of the zone.

It should be noted that for every rise of 120m in altitude the temperature decreases by 0.6°C. This explains why Jos has relatively low temperatures. Generally, the temperature, rarely exceeds 27°C the upper limit comfort limit for tropical zones; and the lower comfort limit of 22°C.

Except in the months of March and April the temperatures rarely reach 30°C. From the Bioclimatic comfort chart for tropical zone, it can be seen that Jos is comfortable during the mid-day for the months of May, June, July, August and September. It is also comfortable during the afternoons of the month of April, May, June, September and November. Generally the weather is cool at evenings, nights and early mornings. It is also dry but not hot during the months of January, February, March, November and December.

Humidity:

Jos has an average relative humidity of 30-70%. The maximum relative humidity is between 60-85%. But the months of January, February, March, April, and November and December are accompanied by dry conditions due to low relative

humiditios ranging from 20-30%. In the ovonings of this months the humidity drops as low as 14%. The tomperatures in the ovonings and nights of thoso months are also as low as 13°C hence the cold discomfort particularly in the nights of April.

RAINFALL

In zone II, Jos has the longest rainy season lasting over eight months at some instances. The rainy season starts from March and ends in October. The rainy season is characterized by relief type of rainfall. Thunderstorms are seldom and the rainfall is heavy sometimes for a whole day. The mean annual rainfall for the past ten years (1970-1980) is 1303mm. From the data collected for the past fifty years, the average maximum rainfall is in August with a peak value of 299.3mm. Other months of heavy rainfall include May, June, July and September with values ranging from 150mm to 250mm.

SOLAR RADIATION

Due to its altitude above sea level, Jos has very high solar radiation values. From the table and figure, the mean daily sunshine table shows the mean annual sunshine for Jos to be 7.25 hours per day. The maximum values occur in the months of February, March, April, May, June, October and November, ranging from six to nine hours per day. January, July, August and September have the lowest values ranging from two to five hours per day.

WINDS

The winds are generally of northeast and southwest direction and is about ten gales per on average speed of fourteen metres per second or 56 km/hr. The dianal variations are mainly the anabatic breeze caused by warm air rising in the

day time and the katabatic breeze caused by the cool air blowing downwards during the night.

SYNTHESIS FROM MACROCLIMATE

1. Physiological Objectives:

(a) As the air temperature rarely exceeds the upper comfort limit ($27^{o}C$) overheating would only be caused by solar radiation when it is incident directly on the building fabric. Excessively glased areas can also be a source of overheating.

Protection against such overheating can be provided by any of the following:

(a) The provision of adequate shading, both for windows and external activity areas.

(b) By limiting the heat radiation of buildings during the strongest sunshine hours, i.e. by insulation, thermal inertia, reflective colouring etc.

(c) The provision of adequate ventilation (air changes for convective cooling, sensitive air movement, i.e. physiological cooling is necessary if the building is over heated.

(d) Cold discomfort can often occur at nights even in the warmest part of the year. Thus people's clothing will be different at nights.

The building itself can ameliorate the cold night conditions by the following means.

(a) Providing a closed (or closeable) internal environment.

(b) Storing some of the solar heat gained during the day to re-emit it at night during cold period.

(c) Providing some amount of heating if all the above two means fail.

(d) Sometimes the weather becomes too dry for comfort, especially in the months of January, February, March, November and December.

This problem can then be solved by means of providing enclosed or semi-enclosed courtyards with fountains, ponds, or water bodies to provide moisture to the surrounding environment by evaporation. This method could also be used to cool the air during the hot afternoons.

FORM OF PLANNING

The building plan should be reasonably compact as it will help in slowing down the response to the changing thermal conditions. It would also reduce the solar heat gain during the day and heat loss during the night.

Windows and openings should be protected against solar radiation by the use of solar control devices or sun shading devices. These could be determined by using the solar chart for latitude 10°N since (Jos is 9°52N). These have been worked out and the figures given below.

Orientation of building and its major openings can greatly influence the solar heat gain, this should be carefully considered. North and south facing vertical walls receive the least amount of solar radiation. Of these two, less is received by the one facing North. South-west and north-east walls receive about the same amount of solar radiation, and the west wall will receive the most.

On this basis with a linear plan, the most logical thing would be to orientate the building along the north-south axis, i.e. the longer walls should face north and south directions and major openings should be on these walls. Windows facing east should admit the sun only when air temperature is low. Windows west should be avoided wherever possible, as the solar heat gain through this wall coincide with the highest solar air temperature.

This arrangement will not only reduce solar radiation but also minimize the extent of solar control devices as the north-south facing openings can be shaded by the simplest means.

3. EXTERNAL SPACES

In the design, most of activities to be either accommodated indoors or outside. The activity that is to be provided outside include the outdoor open air treatment and also the heliotherapy.

4. ROOFS AND WALLS

For this type of climate where over heating is caused mostly by solar radiation, it is necessary that the construction materials should be of high thermal capacity which could store the heat gained during the day and re-emit it at night. For a flat roof, a 200mm thick concrete slab with screed and felt or a 150mm thick lay of about eight hours. This is sufficient to bring the maximum heat gain to 1800 hours which is normally past working hours. East and west walls should be of high weight construction.

5. SURFACE TREATMENT

Reflective surfaces are quite useful in reducing the heat load. While bright metallic surfaces would be most advantageous for buildings occupied only during the day time. In cases of continuous occupancy (the nursing units) it is desirable to admit

solar heat into the building fabric to store it for the night. Therefore, darker and more absorbent surface finish may be more suitable.

Roof surfaces (especially flat roofs) deserve particular attention since horizontal surfaces receive far greater heat than any vertical surface. Thus, a black bituminous or asphalt finish can serve a useful purpose in absorbing much of the solar heat gain during the day to be released after sun set.

6. OPENINGS

As the air temperature rarely exceeds the upper comfort limit (27°C) physiological cooling and cross-ventilation are not the decisive factor for the design of openings. However since the principal aim of this project is to control and ultimately eradicate tuberculosi, openings are obviously required to reduce. The number of hycobacterium tuberculosis, the ethiological agent of T.B., therefore large openings and cross are required in this situation.

SITE ANALYSIS

This is the factual base of the design. It helps, to eliminate any possibility of a preconception establishing itself which could at a stage through the whole design process off balance. It is the factual record of existing elements against the new elements in the design brief.

PHYSICAL SITE FACTORS

Size

The site which location has already been described cover an area of about 12 hectres.

Topography

The site is a stopping piece of land with an average rolling gradient of between 3 - 7%. The percentage rolling gradient increases towards the stream.

Altitude

The vertical height or altitude above sea level of the site drops from 1295m at the north-eastern apex to 1278m at the south-eastern portion as can be observed from the topographical map. In between these contours is a gently slopping area with slope of between 3-7% as mentioned earlier, which gives a uniform natural drainage towards the stream.

GEOLOGY AND SOILS

Jos is in the 'pre-cambia' basement which is an area of strong rocky formations with a very hard soils. The soil formations at the site is of the igneous rocky type with very high load bearing capacity.

According to the geological classification, this type of soil can have a load bearing capacity of up to 60 tons/ft^2. The top soil is well graded gravel sand mixture. There has been no incidence of any mining activity in the area, so the question of fills is eliminated. This could be observed from the geological map which shows areas marked for mining. Except for the mining camp at the eastern side of the site.

VEGETATION

The absence of trees on the site except for a few shrubs has made it liable to erosion. However, the upper and eastern part has good ground cover. It is only the western portion towards the stream which has eroded gullies. Thorny dwarfy type of shrubs which shade their leaves in the dry season are found on the site.

ACCESSIBILITY

The site is accessible through main routes. Through the mining site and also through the laterite road running to Barakin Akowu. The quality of the roads are quite poor even though they are accessible.

There are two proposed roads bounding the site as proposed by in the greater Jos-Bukuru Area. There is a minor road to the south, about 10m from the site boundary and a collector road to the east running through Barakin Akawu.

Local collector could be tapped from these roads to provide vehicular access to the site. However, in the event that these roads are not constructed, the existing roads especially that passing through the mining camp could be utilised for this purpose. Since it provides a good or logical point of entry.

INFRASTRUCTURAL FACILITIES

The intra-structural facilities under consideration here include electricity, pipe-bone water, drainage and sewer lines.

At the moment non of these facilities are presented at the site. But the temporary site of the Federal Government College which is close to the site has all these facilities. So electricity could be tapped from the transformer, located close to the school. So also is pipe bone water from Shendam which runs parallel to the Jos-Bukuru main arterial road to the site.

Also in the proposed Jos-Bukuru master plan, there is provision for water mains and electricity and sewer pipes to run paralleled to the proposed roads passing by the site.

DRAINAGE

Since the site naturally slopes towards the south western side to the stream, all major ground drains should be directed towards [illegible]. The stream can both cater for both the surface water drainage and sewage.

In the treateiont of tuberculosis the di^nostio lent od include?

1. Radiology,
2. Laboratory,

4, Pharmacy,

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This is the busiest Fton largest d ••die faod. re numerous testa are generally sul>»divid< follows!

(a) Chemistry: Chemical analysis are made of sample of blood, urine sputum, faeces, mucosa and other body elements. The sputum test is the most important as far as tuberculosis therapy is concerned. The laboratory offers a forum where the disease is diagnosed at initial stage and subsequently assessed during treatment.

(b) Bacteriology: This is a place where by some space is left for preparation of culture media. The work at this section is entirely microscopic.

(c) Serology: This involves both microscopic and chemical investigation of blood serum.

(d) Hematology: This is mainly concerned with blood chemistry. The laboratory is here by given a special consideration due to the fact that a great number of patients come here for diagnostic and assessment report. The functional relationship (Fig. 6.1) offers no complete flexibility in its design.

2. RADIOLOGY

The primary forms of tuberculosis is common in the tropic in all age group. It is exclusively (about 85%) in the lungs and therefore X-ray examination of the chest is so important or even indispensable. The radiology department is one of the three organs involved in the diagnosis of tuberculosis. It is very important to note that the destructive focus is almost always visible from the beginning of the disease, if the lision develops especially in the bone and joint type. X-ray examinations is therefore so important in prophylaxis, defection and management of tuberculosis.

It is therefore important that the radiology department is given such importance, because as mentioned earlier, the radiology is the department that ranks with the clinical laboratory as well as a prime diagnostic aid. It is a department that offers secondary aid on the prescription of the physician. The department serves both the in-patient and the out-patient".

The essential function of the department is to take shadow pictures of vital parts of the human body (Fig. 5.2). The size of the department and the machines to be used should be given by the radiologist in normal circumstances. For general diagnostic work on the chest, there might be a 300ma radiographic unit with rotating tube, spot film device and a buckey diaphram plus a similar 500ma unit for sharper definition and work on children who can not be expected to hold still.

Patient Movement

The general procedure work of radiology department is that the patient comes to the department by appointment for a prescribed series of pictures. There should be a small dressing room in cases where patients are asked to disrobe. After which he waits in the waiting room of dressing room until the time to take the pictures in which case he is called on and X-ray is taken.

The X-ray to detect or ascertain the progress of tuberculosis takes only two minutes in case of pulmunary form of tuberculosis that is the chest X-ray. And the time varies depending on what form is detected in case of any extrapulmunary form of tuberculosis. This usually takes longer time that the chest X-ray.

Room Design

In addition to the requirement that the room should be absolutely dark at certain times, this makes it easier for the radiologists' eye to become adjustable to frequent light changes. To calculate the number of rooms needed in a hospital a certain formula can be used thus:

$$\text{Number of radiographic rooms} = \frac{DTY}{DTRH \times DW \times WKS \times HD}$$

Where:

DW = Days per week.

WKS = Weeks per year in operation.

HD = Hour per day in operation.

DTRH = Determinations per room per hour.

Designing by such a formula could be misleading because it can lead to many many rooms for a small hospital and vise versa.

Pharmacy:

Another important and at times indispensable adjunct to the doctors care of the patient is found in the prescription pharmacy. This is the department that gives drugs on prescription from the physician only, though the drug is often administered by a nurse or the patient himself. (Fig. 5.4)

Essentially pharmacy performs three main functions namely:

1. Dispensing.
2. Compounding.
3. Manufacturing.

This is mainly a function of big hospitals. In cases of smaller hospitals the function of manufacturing is not carried out but done

elsewhere. Whereas for very small hospitals the function of compounding is not at all carried out, but only dispensing is carried out. For a hospital of this magnitude, the first two function of dispensing and compound would be carried out. The pharmacy department plays a vital role in this direction in which both the in-patients and out-patients get the supply of their drugs.

The in-patients get their drugs through a nurse while the out-patients get theirs by themselves. It is important to note the heavy traffic that could be found around this department. The large number of people that come to this department not necessarily the patients but also the relatives of the patients that may accompany them would have to be given a special consideration.

CHAPTER SEVEN

DESIGN CONCEPTS

Hospital architecture is one that would try to create a therapentic environment for a quick and easy recovery of the patient. The design of the tuberculosis centre is one that is directed towards this end.

Most of our existing hospitals are heavily institutional in character, and very unlike the domestic environment to which the patient is accustomed. Looking at the tuberculosis patients one finds them to fall in the lower socio-economic class, that is why tuberculosis has been called the disease of the masses. It is therefore stressed that we should aim at making the treatment of tuberculosis in a homely environment. This is particularly desirable when one looks at the time a patient stays in the hospital.

Tuberculosis is not handled like a headache where the victim is expected to feel alright after a dose or two of medicine. Tuberculosis is an illness that require much care in a gradual process, the amount of time depending on the extent of the infectious and its stage. The minimum time of hospilization with tuberculosis is 2-3 months. And a person takes up to two years in a centre to get cured.

Looking at the people with tuberculous infection (the masses in this case) and the time it takes them to get cured, it is then understandable that the hospital should have a social purpose, and the patient will appreciate a certain sense of purpose in the architecture as well as the comfort and friendliness of a semi-domestic environment. It is not very easy to strike the right balance, but balance is what the architect must keep.

7.0. Components parts of a Tuberculosis Centre

The components parts include the following:

1. The Diagnostic and Treatment Unit: Where consultation, diagnostic and therapentic facilities are located, offices for visiting consultants (social welfare workers, psychiatrist etc.) Staff common rooms, radiology departments, pathological laboratories, pharmacy department, surgical suite etc.

2. Patient Wards: This will be the patient living quarters. It will also contain some nurses facilities etc.

3. Administrative, Teaching and Research Department: This will house offices for administrative and clerical staff board rooms, library for research etc.

4. The Rehabilitation Department: This will accommodate workshops for occupational therapy, and some offices for instructional staff, common rooms etc,

5. Educational Unit: This will accommodate classrooms for teaching. Theatre for both educational as well as social activity, a library for the in-patients.

6. Auxiliary Services: These would include laundry services, kitchen, central Sterile supply department etc.

7.1. DIAGNOSTIC AND TREATMENT UNIT

This is where the patient is first seen by a specialist. There is a considerable attention at the centre. The architecture can take the form of a general hospital design. The diagnostic and treatment unti will consist of:

7.2. RECEPTION AND WAITING:

This will take the form of enquiry room. When a patient or relatives arrive at the centre for the first time, an immediate attention is provided. The patient is registered with both males and females separated this is line with the custom and religious background of the area that is predominantly muslims. The numerous information of doctors whereabouts, the psychiatrist are all provided at this point. This is in order to win the confidence of the patients and the general public before they reach the out-patient department. This place is to be manned by more than one person for 24 hours a day.

7.3. CONSULTATION ROOMS

These are where the patient is consulted by a specialist. He could be a phthisist or a psychiatrist or even a social worker. It is important to note that a great number of people with emotional disturbances have tuberculosis. This is because mental stress lower their immunity. Therefore these category of patients see more than one specialist at a time. In any case a waiting area is provided near the consulting room for the patients to wait until their turn. The waiting are has a screen wall in order to bring in adequate ventilation into the place to dilute the number of tubercle bacilli among them.

7.4. THE NURSES STATION

The nurses station is to accommodate nurses that will help in the diagnostic and treatment of the patients.

CONSULTATION FACILITIES

7.4. RECEPTION AND WAITING AREA

Patients and relatives or friends, directed to the OPD will have access to the unit through an entrance wall where the patient will be met by a receptionist who will properly register him. During this process the patient will require a waiting area which will link him to the consulting rooms and eventually to other diagnostic facilities.

The waiting area is kept simple with row of silting arrangement separating male and female patients.

7.5. CLINICAL

There are three stages of diagnosing tuberculosis. The first stage is the clinical stage, where history of the disease is recorded. The symptoms of the disease are looked into at this stage. The scale in each of the consulting room is used to record the weight of the patient whether new or old patient. The loss of weight as earlier indicated is the principal sign of tuberculosis and a loss of weight could lead to diagnosing tuberculosis. The term consumption which means 'eating up' is also applied to tuberculosis.

7.6. CONSULTING ROOMS

There are five consulting rooms in all. Two of the rooms are for the psychiatrist due to large number of insane people and one room is for the social welfare officer who advises patients on how to keep their environment clean and how to run away from

infecting other people around them. The design of a consulting room requires careful consideration.

The room should not be too small or it may be inadequate for the proper diagnosis of tuberculosis. Enough room should be provided toaaccommodate all the facilities for the treatment of tuberculosis. This includes a weighting scale, a bed. This is provided behind a screen or even a curtain. The ventilation inside this rooms should be very adequate in order to dilute the number of tubercle bacilli in the room. Adequate lighting is also provided in this rooms so as to disrupt and prevent nulification of tubercle bacilli.

7.7. LABORATORY FACILITIES

Next in the diagnosis of tuberculosis is the examination of sputum to find out the presence of mycobacterium tuberculosis or sometimes the mycobacterium bovis which are the etiological agents in the disease of tuberculosis. This is usually an elaborate unit since the presence of the bacteria is not enough to prescribe but the stage of the damage caused by the bacteria should be determined to give the consultant enough information to prescribe. In this part of the diagnosis, a waiting area is provided for the patients to sit down until their turn to go in. Again here the sitting arrangement is separated for both males and females.

301112

A receptionist ascertain whether the patient is new or old comer to the laboratory and records accordingly. When the patient is called, he moves into a changing room and that too is divided into female changing and male changing depending on the sex of the

301112

patient. In the changing room the patient is required to disrobe so that his chest could be given adequate chance to cough his sputum which is then taken and examined. Other examinations is also done in the laboratory. Examination of the blood, urine, stool etc. are carried out in the laboratory.

7.7. THE X-RAY UNIT

This is the third stage of diagnosis where the X-ray of the patient is taken. This is also an elaborate unit being a unit of diagnosis. The waiting area and the receptionist is the first a patient see when he comes into the unit. The sitting arrangement is also separated into male and female.

7.8. PHARMACY DEPARTMENT

This is another point of attraction with heavy traffic to and from it. This is a unit that attracts both out-patient and in-patient. The pharmacy unit has a special consideration to cater for this large number of people. An out-door area is for the relatives to stay while their patients are attended to.

There are two compartments at the patients waiting area where the males and female patients are separated in conformity with the religious and cultural background of the people in the area. The waiting area is directly linked to the dispensing area where drugs are distributed to the patients.

7.9. THE IN-PATIENTS WARDS

The in-patient wards is the place where the patients are nursed. The total number of patients at the centre is calculated using the

following scheme:

1. In any given population, epidemiology of tuberculosis is as follow:

(a)

Not Infected	
Skin test	Negative
X-Ray	Negative
Sputum	Negative

These are the people who are not infected in the community, because they have all the three ways of detecting tuberculosis, negative. That is they have negative skin test, negative X-ray and also negative sputum test. These are the people that have nothing to do at the site at any given time because they are healthy as far as tuberculosis is concern.

(b)

Infected	
Skin test	Positive
X-ray	Negative
Sputum	Negative

The next category of people are the infected people. These are the people who have negative X-ray and sputum test but have skin test positive. These are the people who do not have any symptom or sign of tuberculosis but yet they are infected and can infect other people. These are category of patients that may require an out-patient services but may not necessarily be admitted at the centre.

(c)

Sick (Active Tuberculosis)	
Skin test	Positive
X-ray	Positive
Sputum	Positive

The next category of people within the community ... the sick people. Those who have positive skin test, X-ray and sputum test. These are the people who have active tuberculosis that is they show both sign and symptom of tuberculosis and as such are the category of people who could be possibly admitted at the centre for in-patient treatment. The category of people here could either have mild or chronic tuberculosis depending on the stage the person finds himself.

To calculate the number of people who are either sick or infected with tuberculosis the following formula is applied.

(a) The morbidity in a developing country is between 0.5 - 1%.

Population of ~~Katsina~~ Jos is 105,678.

Morbidity in ~~Katsina~~ Jos therefore is 5% of 100,418 = 1000 people.

In this case the highest morbidity rate of 5% is assumed.

0	+1	+2	+3	+4

The next is the scrutiny and detection of people who are to be given in-patient treatment at the centre.

Tuberculosis just like cancer can be categorise into stages. Ranging from 0 to +4 the disease increase progressively. The category of people who need hospitalization are the people in +2 to +4 category; and 40% of people in the morbidity group are in these categories that is 0, +1, +2, +3, and +4 category.

Therefore 40% of 1000 = 400.persons. This is implied that 400 persons are sick that is they have active tuberculosis in Katsina.

30% of the sick people need hospitalization that are the patients in +2, +3 and +3 category.

$$= \frac{30}{100} \times 400 = 120 \text{ persons.}$$

120 persons in Katsina need hospitalization alone and admission from indirect population that is admission from the neighbouring areas is 60; and the combination gives 180 persons therefore 180 beds at the Centre.

The above scheme therefore can be applied to any given population to obtain the number of people who need hospitalization and as such the number of beds needed for the treatment of tuberculosis.

7.10. THE MALE WARDS

The male wards are the nursing unit of males at the centre. The wards in this case is quite different from the conventional Florence Nightingale type of wards that are found commonly at our hospitals. The type of wards here are the residential type of houses. It consist of a living room, a dinning room, a kitchen,

a laundry, a bathroom, a store, and of course bedrooms. The only difference between the ordinary home and this type of wards is the presence of a nurses' station and utilities (dirty and clean) to cater for the patients need. The residential setting is come about when one looks at the number of days a patient stays at the centre (a minimum of 2-3 months) and the type of patients one is dealing with (the masses in this case).

To live in an institutional building for up to two years to get cured is not at all easy for a poor man who is used to his residential dwelling with abundant of land to roam about.

The number of people accommodated at any nursing unit is ten. This is in order to reduce the density and reduce the chances of cross-infection. There are twelve houses accommodating 120 patients. The accommodation of .120 male patients is in order of the ratio of 2:1 against female.

Tuberculosis by sex.

7.12. PLACE OF WORSHIP

A mosque is provided at the centre of the wards that could be used by the patients to pray. No other workshiping place is provided besides the mosque due to the predominant number of muslims in the area about 89% of the population are muslims.

7.13. FEMALE WARDS

The female wards accommodate the female patients. The method

of accommodation is the same with that of the males. The residential setting is maintained similar to that of the male nursing units.

In any case of the wards, that is, both males and female nursing units, a central kitchen and a laundry are provided to support the units. Feeding is therapentic in itself when dealing with tuberculosis therefore the kitchen is of particular importance at the centre. The patients could eat more but not less than a dietitian requirement that is why a small private kitchen is provided in each of the nursing unit to cater for an increase in feeding but not a decrease. The laundry is provided to cater for the patients services. Centre's facilities are attended here not personal belonging at the central laundry. That is why there is a small laundry at each of the nursing units to take care of personal belongings of the patients.

7.14. SITE CONCEPT

Hospital architecture is one that would try to create a therapentic environment, and the design of the tuberculosis centre is one that is directed towards this end. The site concept is one that allows minimal infection, with very little contact with the patients to the outside people.

The site is zoned into three parts.

1. The Private Zone: This is the patients living quarters. It contains the nurses facilities, living rooms, bedrooms etc. in accommodating the patients. It also contain the dinning and laundry area of the living quarters.

2. The Semi-private Zone: This is the zone that contain the patients rehabilitation and educational facilities. This contain the workshops, classrooms and also some offices to support the facilities.

3. The Public Zone: This is the area where the administration and diagnostic facilities are situated. This includes the offices for the centre's director the social welfare officer, the principal accountant, the research library for the staff etc.

The zoning of the site is done to archieve systematic isolation of the patients to minimize the danger of infecting the healthy individuals by the diseased ones. The core of the nursing units that accommodate the patients is accessible to people outside only when there is a need for so doing. This is particularly important in order to reduce the contact between the diseased (the patients) and the healthy individuals. This type of isolation is called, the source isolation in which the source of the disease is isolated from the community so that little contact is seen between the diseased and the healthy individuals.

Protective isolation is another type of isolation in which the patient is protected from other forms of infection. In the centre this category of patients are the ones with extra pulmunary tuberculosis as mentioned earlier. These patients can be infected with tryeobacterium tuberculosis from other patients if they are not protected.

These category of patients can occupy one nursing unit or more depending on their number. It is important again to determine the position of their unit.

The same approach is taken when determining the site which was elaborated at the beginning, in the site selection heading. In this case a smaller scale is taken. They can either occupy the one at the extreme left hand or right hand corner of the units. This is in order to minimize the air that blows on the other units and at the same time blow at the one in question. The tubercle bacilli carried from the other units is not allowed to blow at the units housing patients with extrapulmunary tuberculosis.

It is also interesting to note at this stage that the possibility of finding a patient with both pulmunary tuberculosis and also extrapulmunary tuberculosis is very high. This is due to the fact that the extrapulmunary tuberculosis is a secondary infection in most cases. If a patient with pulmunary tuberculosis coughs and swallows his sputum, there is a high possibility that other parts of his body will get infected. There are also patients that are emotionally disturbed. The fact is mental stress lowers urmunity in contracting tuberculosis. Therefore it is not surprising to see that there are a lot of patients referred from the mental hospital to be treated of tuberculosis.

The combination of patients in a room is also of particular importance. The patients with the same stage of infection could be paired in a room so as to very much minimize the chance of cross infection.

7.16. LANDSCAPING

The importance of trees and planting can not be overemphasized.

Trees are used as design elements to create visual interest and to shape and articulate the site; they also lower the overall ambient temperature and provide cool shaded environments. Trees play a significant role in the provision of a microclimate therapentic to tuberculosis.

Because of the hostile climate, which is semi-arid in nature. With very little rainfall and a high temperature most of the time and very little humidity; trees are used to create that micro-climate conducive to the patients to heal on time. Creating a therapentic environment means making the site a dust free site. This is very important in controlling the progress of tuberculosis.

Dust do not cause tuberculosis by itself; but dust as a foreign body in the lungs are ejected out of the lungs. This ejection is usually by coughing, and coughing prevents healing to take place. As earlier pointed out that the mycobacterium tuberculosis cause the disease by ulcerative means and as such cause wound on the lungs; that is why when a patient with an advance stage of tuberculosis coughs he coughs blood out.

To prevent dust into the site, trees are planting around the site especially at the north-eastern part of the site to check dust from the Sahara blown by the north-east trade winds during the harmattan. This is usually a natural and cheap method of checking dust.

What about dust within the site that is dust created at the site? This dust is controlled by grass to create lawns where open space exist. This is made possible because of the water that is supplied to this space to wet and give conditions suitable for the growth of these plants.

Besides the function of covering the ground to prevent air blowing dust, the trees also provide shade for the buildings on the site. This is usually a very cheap method of shading to prevent the excessive radiation that is characterize by the semi-arid climate.

For a quick and easy recovery from infection with tuberculosis, there is the need for the patients to breathe air that have a high concentration of oxygen in it. This is provided by the trees that are on the site through the process of transpiration. A process that trees used to take in carbon dioxide to give out oxygen as a by-product. This oxygen is greatly needed by the patients. The whole aim of planting therefore is to provide total environments that answer the emotional, physical and psychological needs of the people as well as the logistics of hospital operation.

7.16. VENTILATION

Ventilation is an important aspect in planning a therapeutic environment for tuberculosis. The absence of ~~tuberculosis~~ ventilation contribute in a great way to the disease of tuberculosis as mentioned earlier. The adequate ventilation that is required in the treatment and control of tuberculosis is not met around the Katsina town and its environs. This is mainly due to the severe radiation that prevents opening large openings to achieve the required ventilation.

The method of building around the area is to open small openings and use mud massively to prevent the radiation into the buildings. That is why it used to be warm during harmattan and cool during the dry seasons. This is usually at the expense of ventilation.

To build in this type of climate is either:

1. To open small openings to create the conducive temperatures, or
2. Open large openings and then shade the buildings to prevent the excessive radiation.

Naturally for a therapeutic environment, to be achieved; where a lot of air is needed into the buildings to dilute the contaminated air from the patients; the second option is chosen. Buildings on this site have large openings to achieve the desired result and of course shading is provided using the natural trees on the site. Natural ventilation is the one that is desired as mechanical ventilation does not augour well for these patients.

DESIGN BRIEF

The Centre is to accommodate 180 patients while a large number are expected on an out-patient treatment. Tuberculosis is expected to decline in both morbidity and mortality when the Centre is utilized effectively.

There is a catering and other services at the Centre which makes it residential in nature; which is actually supposed to be. As mentioned previously, the Centre is an isolation hospital in which the patients are isolated from the community due to the nature of their disease, so in essence, all the basic facilities are to be provided to prevent the patients from coming out to get some. All the patients are accommodated at the Centre.

The Centre should be attractive and inviting as this will undoubtedly make the patients comfortably for all the time they stay at the Centre. This will stimulates respect and affection

for the centre. The present situation of hate of tuberculosis wards by staff of hospitals will also diffuse if the Centre is made very attractive and inviting. In fact now some hospitals post student nurses to tuberculosis wards only if the students are being punished. This attitude is unbecoming in the field of medicine why patients are supposed to be treated irrespective of what type of disease they have be it contagious or not or to be the patients poor or rich.

It is highly desirable that corporate life be fostered among patients, staff and members of the community in general.

Welfare of patients should given priority as this will make life easier for them. Ample opportunity for recreation and rehabilitation should be given consideration.

Much of the work done in the Workshops involve handling of small or objects because handling big materials is not easy for patients of this nature that are in the process of developing their muscles and ability to go back to normal life after along time of recess.

The fund available for this project is limited and since the Centre is not profit yielding, running and maintenance cost should be kept as low as practicable. Even though a provision is provided to make some sales of items done in the Workshops, much is not to be expected because the patients can not possibly do much work due to the fact that the energy needed for such work is not there. There muscles to do work has been consumed by tuberculosis.

ARCHITECTS BRIEF

The hospital architecture is one that is intended to create a therapentic environment that would help stimulates early recovery. Not only should a hospital actively and attractively suites the functions of the therapy it serves but should also constitute a special environment for treatment of diseases.

As a step towards meeting the financial limitations of the project, dishonesty of any sort has been avoided in the design and judicious use of space, structure, materials and finishes is advocated. Economy of design, however is not the something as cheapness. Economy on the other part eliminates all that are not strickly necessary in a design.

As a way of meeting client needs the following facilities are to be provided at the Centre.

Administrative/Diagnostic Unit

This is a unit that accommodate the administrative staff as well as the diagnostic facilities at the Centre.

Administration

This mainly is the First Floor Plan of the unit. This is where the administration of the Centre is carried out. The medical director of the Centre is housed here as the chief executive of the Centre. Other staff accomodated here includes the principal accountant, the Chief Social Welfare Officer, the Chief Nursing Officer, the Centres Dietitian, offices for accounts clerks, a general office. In addition, a conference/boardroom are desirable as well as a library.

The boardroom as conference room is used for meetings of the medical board, advisory committees and many other group meetings.

The library is used as a research library with a film viewing room inside. As a major centre for the treatment of the tuberculosis, the centre is furnished with update materials in the field of tuberculosis research. The general findings of new materials concerning tuberculosis is also kept in this library which is used by staff members only.

The film viewing room is also desirable as tuberculosis is a disease that requires constant radiological findings. This is the only building in the centre that is two storeyed. This is to unable the staff members and some visiting people to have a fairly clean air at the top without the contamination with tuberculous bacilli. The ground floor plan of this same building is the consulting part of the Centre where offices of doctors specializing in tuberculosis are located. Other consulting rooms are also located here, like psychiatist, psychologist and a dietitian.

A psychiatrist is very much needed in the Centre because of the great many patients come with emotional disturbances as well as tuberculosis. As mentioned earlier, mental stresses also contribute in the disease of tuberculosis, so a lot of patients from psychiatrist hospitals are also referred here.

The fact that most of these patients in generally people with such a disease are rejected in the community so as not infact other members of the community, makes consulting with a psychologist. A psychologist is therefore part of the medical team.

Other offices found here include nurses' station where the nurses stay; the nurses not only help and assist the patients in general care before either admission or attendance, but also help the medical team in diagnosing and assessing progress of tuberculosis by the sometimes interpreting between the doctor and the patient. Doctor's common rooms are also provided inside this unit where the doctors retire for a cup of tea from the tea room nearby or can take a rest after consulting hours.

PHARMACY

Within the same complex a pharmacy is provided where patients both in and out-patients can get their drugs prescribed by the consulting doctor during consultation. The pharmacy has two waiting areas physically divided between the female and male patients in accordance with the religious and cultural background of the area.

Inside the pharmacy a dispensing area is provided where the staff of the department can stand or sit on a stool and call patients through a window to get their drugs.

There is a compounding room adjacent to the dispensing area. This is the place where some of this drugs are compounded. Tuberculosis drugs are mostly orally administered and therefore materials for compounding are easier to obtain than get a compounded form. In such economic situation where the cost could mean a lot in the maintenance of the Centre. Another office provided inside the pharmacy is that of a pharmacist or overseas all the activities of the department and is consulted whenever necessary. A store is also provided where the remaining stock from the main store is kept before being used.

The Laboratory

This is another part of the diagnostic unit within the same complex. In fact is one of the three units in diagnosing tuberculosis other units include the X-ray and of course the clinical.

Some special requirements of a laboratory building are:

1. Adequate drainage.
2. Service distribution.
3. Layout of benches.
4. Fire protection.
5. Storage and preparation spaces.
6. Lighting.
7. Ventiliation and position and types of fume cupboard.

1. Service Distribution Systems

Common service distribution in storey buildings are:

1. Utility corridor system.
2. The multiple interior shaft system.
3. The multiple exterior shaft system.
4. The corridor ceiling and
5. The utility floor system.

Utility Corridor System

In this system, all service mains and ducts are brought to all the floor levels by means of a vertical central core which helps to distribute the utility by vertical mains. The horizontal distribution of utilities from this core can either be at the ceiling level or downward to individual work areas or directly

along the floor through the pipe space in the base cabinets.

This systems has a high degree of flexibility and high capability to meet the needs of environmental control and ventilation. It is mostly suitable for multi-storey buildings with a square rather than a rectangular building.

Multiple Interior Shaft System

In this system, provision is made for concealed services in a series of regularly spaced shafts located either on both sides or on one side of a circulation corridor. Distribution of utilities into the working areas is generally in the pipe space behind the bench work.

This system is most efficient in multistorey buildings. Advantages include flexibility, moderate initial cost and net to gross area efficiency. The disadvantages include high cost and service interference with traffic flow in corridors.

Multiple Exterior Shaft System

Services and ventilation ducts are brought to individual floors by a series of exterior wall vertical shafts located at each or alternate laboratory module or room.

Distribution of services into work rooms is by means of pipe space behind the base cabinets of the fixed equipment or at ceiling level.

This system is also suitable for multistorey laboratories since its high initial cost does not justify its use for low rise buildings.

Advantages however include good flexibility, easy maintenance

and good appearance.

The disadvantages are the difficulty in servicing or modification and increased expenses over exposed systems. It is also not as flexible as the exposed systems.

Corridor Ceiling Distribution System

In this system of service distribution utilities are located in the corridor ceiling and in some instances above the ceiling of the rooms on each side of the corridor and are supplied by vertical pipe shafts.

Distribution of services from the ceiling mains to work areas may be downward to work areas below and upwards to the floor above.

Advantages include low initial cost and excellent flexibility, modification of services does not interfere with work in adjacent modules.

The disadvantages include higher ceiling height for clearance, limitations in the installation of wall cabinets, increased maintenance cost and poor aesthetics.

Utility Floor Distribution System

This system provides maximum flexibility in laboratory services distributions. Utility and the plumbing services are in separate space between the upper floor and the lower ceiling.

Distribution of services may be down ward to work areas and or upward through the upper floor.

Advantages include new modification and replacement costs. And modifications does not interfere with work in adjacent modules or rooms.

The disadvantages however include low net to gross area efficiency and high initial cost.

BENCH LAYOUT

There are three main types of bench layout.

1. Penisular.
2. Island, and
3. Wall.

Many combinations of the above are also possible.

Penisular benches are at right angles to walls are preferable to island benches as the installation of services is easier and less costly and the shadow cast in the interior by reagent shelves is less.

Island benches require large circulation spaces because of extra spaces required for access to the four sides of the work benches. In the case of this design the wall bench layout is chosen.

In the case of the centre where the laboratory form one of the diagnostic facility, a lot of traffic is expected to be here. Therefore consideration of a large inviting space outside the laboratory is created to take care of the patients relatives who escort them to the centre; while a waiting room is provided for the patients inside the building to wait until their turn.

Radiology Unit

This is the other part that forms the triodiagnostic facilities in the detection and assessment of tuberculosis.

There are two X-ray rooms within the radiology unit, and each of them supported by a dark room for developing film and an office where the radiologist conducts his business.

At the entrance of the building is the waiting area of the patients to wait to be called. A changing room is also provided to enable the patient disrobe while his X-ray is taken. This is again divided into male and female changing.

THE SURGICAL SUITE

The surgical suite also is located within the diagnostic complex. The surgical suite is located behind the X-ray unit and the pharmacy. Surgery in tuberculosis is done under an extreme case where by the patients lungs has been destroyed by the disease or in case of deformity in extrapulmunary form to be adjusted.

There are two surgery rooms within the surgical suite. Each of the room is supported by a preparation room where the patient is prepared for an operation. A room where the patient is changed from his bed to his operating bed, where his clothes are removed and operation clothes are put on him.

Next the patient is taken into the anaesthesis room where anaesthesia is done on the patient to prepare him for an operation. Anaesthesia could be either local or whole. Local is where the place to be operated on is anaesthesized or whole when the patient himself is given in preparation for the operation. The patient is then taken to the surgery room where he is operated.

The next route of the patient is the recovery room, where the patient is allowed to recover before he is taken out of the suite to the nursing unit if the operation is successful or can be taken to mortuary if the patient dies.

The route of the operating team is somewhat different. First the doctor comes out of his office or from outside into the preparation room and gets prepared for an operation. In this room the doctor changes his dress to operating dress and moves straight into the operating room. After the operation the doctor goes to the utility room to clean up before he can go to a retire room where he relaxes before he leaves.

The nurses that help in the operation also have a schedule or going straight to the preparation room and get prepared. Next is to go to the scrub up room to prepare the tools for operation. The nurses also prepare the patients for the operation.

Central Sterile Supply

The central sterile supply department is located also within the complex. It is located near the surgical suite and the central store. In this unit all the items which have been returned from the departments are cleaned, assembled, put up in packs, sterilized and stored for distribution as needed.

The central sterile supply function is that of cleaning, packaging, sterilizing and distributing. The plan of for the distribution of sterile goods can best be handled centrally along with other supplies. Sterile goods here include all instruments used in surgery, all liner used to drape the patient in delivery to surgery, all basins, certain trays tubing gloves, hypodermic needles and in fact anything which might be put into the patient or come in contact with an open wound.

The central sterile supply is accordingly planned to achieve

this process: The space to wash soiled gloves, instruments and all the rest of items as they come from the operation is provided. Linen is rinsed out in surgery and sent directly to laundry. So linens come to the CSS already clean. Rubber surgical gloves are cleaned separately, tested for holes, dusted for ease of getting them on and off and parred for sterilization.

The second step is to assemble clean items and wrap them in packs for protection from contamination in handling. This requires a large worktable with easily accessible bins and shelves for storing the items and with paper or linen wrappings.

The usual flow of goods from receipt to issue or at least storage, define the planning relationship of the elements within this department. For greatest economy the main sterilizers of 36 by 48 inches should be designed for maximum estimated loads. Not all goods that go to this department are necessarily sterilized. Some of the items that go there are cleaned.

Central General Stores

The main department involved in the handling of goods is Central General Stores. In this department which is located behind the surgical suite and the central sterile supply, the function of receiving goods, storage, repair, inventory and distribution are carried out. In this department the reception of sterile goods, the drugs for the patients and special equipment is carried out.

Some additional storage space is needed for equipment which has been issued but not currently in use or has been returned for refinishing or repair. Often such equipment is, in fact absolete and should be disposed of.

It is advisable to separate the solid goods from the liquid ones and sub-divide the stores space into several categories of new goods. To separate sterile supplies and non sterile supplies is also essential in such type of arrangement.

The Central General Stores is served with a delivery road that will allow vehicles carrying goods to get to the stores easily.

REHABILITATION UNIT

In this unit which includes Workshops educational section that will allow patients to know more about their disease and also for some to continue their education.

Education Section

The education section consist of a theatre, classrooms, a library and some offices of the staff.

Lecture Theatre

This is the place where patients are grouped for a special lecture. This may include the out-patients and the in-patients. Film could also be shown in this lecture theatre.

The design of the lecture theatre like the design of any place of assembly require good hearing and sight conditions.

Effective acoustic planning depends on the correct placement of reflective surfaces for all sounds involve in the performance. Other requirements include:

1. Viewing angles to screen.
2. Distance to nearest and furthest eyes.

3. Seat dimensions and spacings, and

4. Gangway width.

Audibility is affected by:

(i) Shape and size of rooms.

(ii) Room furnishing.

(iii) Position of source of sound.

(iv) Reverberation time.

Viewing Angles

Angle of elevation from the eye to the upper part of an object on the screen or chalkboard should not exceed 30 degrees. The viewing area should be within an angle of about 45 degrees on the either side of the normal to the screen or chalkboard given a total angle of about 90° degrees.

Distance of Seating

These limitations of viewing distance and angles imposed restrictions on the placement of seats for adequate viewing. The nearest seat usually should be about twice the screen or chalk board width while the furthest seat should be about 6w from the screen.

Seat Dimensions and Spacing

Minimum back to back distance between rows of seats is 760mm preferably 800. Width of seats with arms is 510mm. Unobstructed vertical space between rows (seat way) is 305mm.

Gangway Width

The width of gangway should not be less than 90 cm.

Room Shape

Room shape preferably should be rectangular or trapezoid in the direction of sound. Oral, circular square shapes etc. are acoustically unfavourable. Large curved surfaces of walls and ceilings produces even sound distribution.

Normal speech can be heard up to the distance of between 20-30m in the direction of the speech.

Room Furnishing

Suspended ceilings and claddings with intervening voids, which resonate with the sound are usually preferred places of assembly. Absorbents should be provided on near walls and solid balcony ceilings.

Position of Source of Sound

Source of sound should be in front of a hard reflecting surface.

Reverberation Time

Reveberation is caused by the reflection of sounds from surfaces. This could desirably be registered by the listener as gradually dying down of sound. But when a long time interval exist between the direct and reflected sound, the reflected sound is heard as an echo. This is not desirable.

Library

The library here services the patients only and its main function is to provide facilities for reading, reference and borrowing. In a centre of this nature, medical journals will be in frequent demand by the students. A separate alcove for display and reading of periodicals is necessary. Elementary books are also essential that would help some of the patients in continuing with their formal education.

One of the most important requirement in the design of a library is flexibility. An office space for the librarian and a storage space for back copies of periodicals and old books are also provided. Since other people can also visit this library other than the patients, ventilation is given special consideration to reduce the number of tubercle bacilli in the room and minimize infection.

Classrooms

Lecture rooms, seminar and tutorial rooms, form part of the general teaching room while the Workshops and the laboratories belong to specialized teaching rooms.

In the lecture room, students listen mainly to a continuous exposition of lectures. The students in attendance may be given some opportunity for questions or a little discussion but in the main, they listen and take notes.

Factors of Classroom Design

Major factors usually considered in designing a classroom include:

1. Seating and writing surface.

2. Use of wall surface and chalk boards.
3. Ventilation.
4. Acoustics and lighting, and
5. Aesthetic consideration.

Seating and Writing Surfaces

The seating arrangement, usually is the single most important feature in determining shape and size of a classroom. Seating arrangements should provide all students with good view of the front chalkboard, ready access both to the seats and the chalkboard. Other seating considerations are well illuminated writing surfaces at each seat, a place to set books and papers, privacy in taking examinations and comfort.

The use of "table arm-chair" usually permits close spacing of seats, but has a major shortcomings in that the writing surfaces are usually not adequate for the setting of books and papers.

In this design, tables are provided and enough space is given to each student. Visibility can be improved in a classroom by the avoidance of obstructions, elevating lecturer's platform, maintaining big viewing distances and the extreme vertical and horizontal angles.

Other ways of improving visibility include sloping of classroom floor and installation of vertical sliding chalkboards. Sloping of floors however increased the cost appreciably.

Lighting/Acoustics

The control of lighting in the interior is a vital factor as it affects visibility and comfort.

In all the classrooms, light is admitted through windows at the sides. No teacher should be required to face the windows when lecturing from normal lecturing position. Similarly, the students should not face any window directly from normal seating positions. In small classrooms serious acoustic problems do not generally arise as to the one under consideration.

Echoes do not arise as the time interval between direct and reflected sound is small.

Ventilation

Cross ventilation without drought is desirable in classrooms. Dimensions of openings should allow quick air change. Windows thus are located at the sides of the classroom to meet the lighting and ventilation requirements.

Ventilation as always emphasized in all cases is given special consideration here. Natural ventilation is desirable without any need for an artificial form of ventilation. The number of bacilli within rooms should be kept very low as such openings are needed to allow air in and take away the bacilli outside the classroom as this will reduce the danger of cross-infection.

WORKSHOPS

The main physical requirements of workshops which affect planning include the following:

1. Size and weight of equipment, workshops and surfaces.
2. Production of dirt, dust and fumes.
3. Production of noise.
4. Deliveries of bulky materials and removal of rubbish.
5. Complexity of services.

Workshops for noisy, dirty, dusty and fume producing activities need be placed apart from the rest.

The need for direct access routes for deliveries of materials and equipment is also important.

Noise, dust and fume should be mitigated as much as possible by means of insulating materials, ventilation and extract systems.

The workshops are provided to reflect the traditional crafts in the area. These includes wood Workshop, metal workshop, crafts workshop, pottery workshop, and tailoring and knitting workshop. In each of the workshop a store is provided to store raw materials and also some finished products. The stores are grouped to give easy delivery. The males and females workshops are separated to reflect patients background. The females also are only in the pottery, crafts and tailoring and knitting workshops, while the males are found in metal and wood workshops.

A display area for the display of some of the finished products is provided at the entrance of the building. This enable the members of the public to see and appreciate work done by patients. Sales can also be done to members of the public if they are in need.

Common Room

Common rooms are used for relaxation. Some patients sit and read, others sit and talk while others want some amusement, which may be quite or noisy such as chess or darts. A small kiosk is provided for the patients to have some drinks. A store is also provided to take care of delivery before being used. Some bottles of some drinks are also stored here after being used before they are taken out.

The common room is also used as a place of interaction for the patients during some of their free time. However, sitting arrangement is done in such away that separation between males are females is archieve to conform with the religious and cultural background of the area.

PATIENTS RESIDENCES

Patients accommodation is conceived as a house with a court-yard surrounded by cluster of rooms. There is a sitting room for the patients to relax and receive their guests immediately one gets into the building. The only difference between the patient residence and a typical residence within the community is the presence of a nurse's station with some utilities.

All other spaces found in a normal residence are found also here including a kitchen, a bathroom, a storage, a laundry and a dinning place. The function perform by this residence is similar to that of a normal function in a community. That of housing a patient as his home.

The female residence is detached from the males hostel and fenced round to avoid any social accident. The fact that the patients are sick, does not mean that they are not active sexually. The patients are ambulant therefore all security measure is taken into consideration.

The pattern of arrangement is the same in the female residence too. But the entrance to the female residences is controlled to give the females same security.

A dinning hall is also provided to offer catering services within the residences.

ORIENTATION

All buildings are oriented towards east-west direction. This is to get the maximum ventilation within the buildings. The direction of winds of north-east and south-west are taken into consideration to allow the maximum quantity of air into the buildings to dilute the tubercle bacilli in the buildings.

The excessive solar radiation is also minimise if the buildings are oriented into this direction.

WATER SUPPLY

Planting trees at the boundry of the site is to control the dust that come along with the winds especially from the north-east trade winds that comes from the Sahara desert. This measure is to control the dust from outside the site. What about dust within the site? This is controlled using the planting method too.

~~Katsina, which has a semi-arid~~ This type of climate could pose some problems in the fact that the plants will die off it adequate water is not given. The lawns created for open air therapy is watered using water from the main source meters away from the site.

The pressure of 3 atmosphere is achieved from this main which is used in watering the lawn using sprinklers. The sprinklers are placed 40 meters apart and effective watering is achieved for the plants. The grass then remain dry all year round that covers the ground that generates dust. By this process the whole site remains covered and thus a therapentic environment for tuberculosis.

The residential quarters of the patients and also the diagnostic and administration unit of the centre is supplied with water from the tank that is 7 meters higher than the administration unit.

The tank has the capacity of about 36,000 litres if the rate of 200 litres per patient is adopted.

Number of beds	=	180 beds
Water/bed	=	200 litres
Quantity of water needed	=	200 x 180 = 36,000 litres

The tank is located centrally in the Centre that is to have effective distribution. In places where altitudes differ, the tank should be at the highest point so that the pressure is maximally utilized.

Accommodation Schedule

Administration and Diagnostic Unit

1. Ground Floor	
Main entrance	$30m^2$
Reception	30
Records	30
Telephone exchange	15
Telephone waiting	15
Admittance	30
Stores	15
Consulting rooms	30
Male toilets	3
Female toilets	3
Doctor's resting	35
2. First Floor	
Conference room	56
Medical director	35
Secretary	25
Hospital Secretary	30
Chief Nursing Officer	30
Principal Accountant	30
Library	60
Chief Catering Officer	30
Social Welfare Officer	30
Staff Room	35

3. Laboratory	
Reception and waiting	40m^2
Specimen space	20
Male locker	12
Female locker	12
Pathologist	15
Stores	15
Toilets	3
Bacteriology	18
Hematology	18
Histology	18
Chemistry	18
Serology	18
Dish washing	15
4. Radiology	
Patient waiting	36
Records	12
Dark room	12
X-ray room	25
Office	18
5. Pharmacy Department	
Male waiting	36
Female waiting	24
Preparation	30
Dispensing area	36
Offices	20
Male toilets	3
Female toilets	3

6.	<u>Surgery Suite</u>	
	Reception area	32m^2
	Surgery rooms	36
	Anaesthesia room	12
	Recovery room	20
	Scrub room	12
	Preparation room	20
	Offices	20
	Doctor's changing	20
	Sterilising room	12
7.	<u>Nursing Units</u>	
	Bedrooms	30
	Sitting room	56
	Nurse's Station	20
	Kitchen	25
	Laundry	20
	Bathroom	6
	Toilet	3
	Dirty utility	12
	Clean utility	12
8.	Rehabilitation Unit	
	Entrance	25
	Metal Workshop	72
	Weaving	60
	Offices	25
	Tailoring	56
	Pottery	56

Stores	35
Display area	35
Classrooms	52
Theatre	84
Library	64

9. Central Kitchen

Dinning area	72
Kitchen	54
Cold Store	13
Dry Store	15
Outdoor cooking	24
Staff room	20

10. Central Laundry

Washing area	64
Drying area	36
Ironing	36
Sorting	24
Store	10.8
Staff room	20

11. Central Sterile Supply Department

Cleaning area	52
Packing area	48
Sterilizing area	64
Glove sterilizing	40
Distribution	30
Offices	25
Stores	12

CONCLUSION

This thesis is concerned with the creation of a therapentic environment for tuberculosis, an environment that is dust free and maximum concentration of oxygen in the air. The thesis is concerned with giving the tuberculous patients (mostly poor patients) an upliftment. The tuberculosis patients are treated like all other patients if not better.

Tuberculosis that has become endermic in this country has retard a lot of developments in terms of national and state budgets. The eradication of all forms of communicable diseases from any society is an important development of any country. The Federal Government in realisation of this launched a War Against Communicable Diseases recently.

The realisation of this project will go along way in reinforcing the Governments efforts in eradicating tuberculosis as a communicable disease in the country. The amount of money invested in this projected is never money waited.

The designer is optimistic that this project will go along in the treatment and subsequent eradication of tuberculosis.

The project is one that is prototype in nature. The buildings could be repeatedly built all over Nigeria with a suall nodification in terms of the site and the treatment of the site.

In determining the size of the hospital, the previous formula mentioned above could be used in determining the number of beds to be provided at the hospital. If the population of the place is obtained the percentage morbidity of 0.5 - 1% is assumed. Out of the total obtained then 40% of the total is again assumed to be with active tuberculosis out of which 30% used hospilization.

With the above formula the tuberculosis sanatoria could be built everywhere in Nigeria. As with the regard to the treatment of the site, as mentioned earlier, the sanatoria should be dust free as much as possible, in cases of hostile weathers that is characterized with dust, trees should be planted to screen the buildings.

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