

Pre-Congress Seminar
27th June 2012



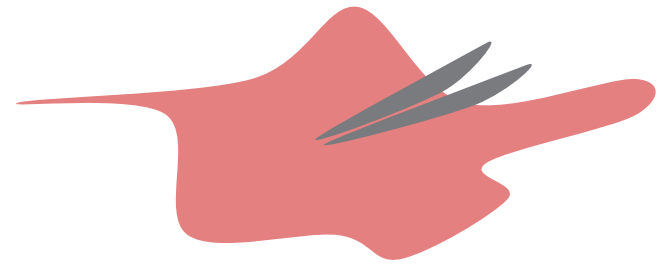
EVOLUTION OF PUBLIC HEALTHCARE FACILITIES DESIGNS TO HEALTH TREND IN MALAYSIA *A RETROSPECT OF NATION BUILDING FROM PRE-COLONIAL TO TODAY*

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ABSTRACT

Malaysia has its own inbuilt history of evolution of healthcare facilities designs from the traditional to contemporary mega structures we witness today. Each designs has its own story foretold the epidemiology phenomena, capacity and inspiration of a developing nation. From simplistic idea of housing aspects of health in single isolated buildings to complex structures that needs reviewing towards a sustainable future. The pictorial presentations briefly explore Malaysian public healthcare facilities from its humble beginnings in nation building from pre-colonial to what it is today. The objective is to provide ideas on the basis of *why and how* these designs were pragmatically evolved through time, to professionals, allied disciplines and users. Both qualitative and quantitative methodologies were adopted for this continuing research. Primary and secondary data, through literature review, observations, random interviews, post occupancy evaluations and hands-on experiences, were utilised. The significance of this presentation includes a sense of importance to the role of individual players in the healthcare services, construction industry, the trust that our Creator, and humanity had conferred on us, towards contributing and sustaining a healthy and hence a ‘wealthy’ nation.

THE OUTLINE



Introduction

Malaysia - the country, Health System and Health Status –pre colonial, colonial and post independence

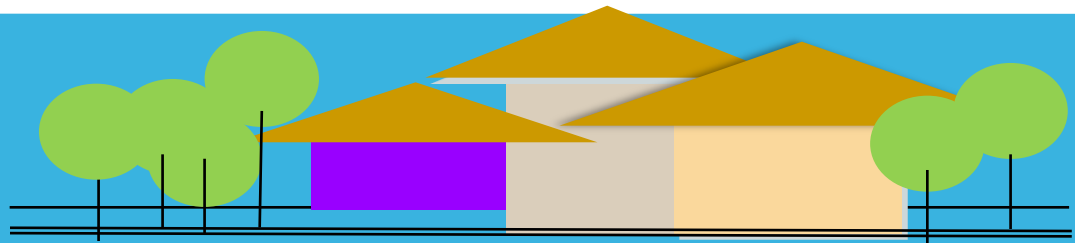
Evolution of Public Healthcare Facilities Designs to health trend in nation building

- Primary care
- Secondary Care
- Tertiary Care
- Special Institutions

Summary

Conclusion

EVOLUTION OF PUBLIC
HEALTHCARE FACILITIES
DESIGNS TO HEALTH
TREND IN MALAYSIA-
NMN



INTRODUCTION

IN BRIEF

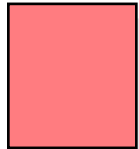
EVOLUTION OF PUBLIC HEALTHCARE FACILITIES DESIGNS
TO HEALTH TREND IN MALAYSIA-NMN

HEALTHCARE ARCHITECTURE

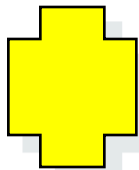
Crisp (1998) defines provision of healthcare architecture as a concept of a life enhancing environment, as a place built or created to support and sustain the well being of the particular occupant of time, place and culture, where the body as a whole, both inner and outer, is regarded as essential to how the space is experienced. She further described that our bodies articulate our relationship to the world around us where how we perceive spaces relate directly to body size, its acuity, range or motion and intentions-i.e. ergonomics, will eventually dictate how we move through space as well as interacts with its geometric forms and sensory stimuli. This movement defines our realm in specific environment or place and place emphasis on our five senses of *see, hear, smell, touch and taste* as fundamentals in architecture

HEALTHCARE ARCHITECTURE

Healthcare / Medical Architecture addresses healthcare function with users as the very core of its creation.



- To consider the people they house and shelter to get well are not infected by the very convergence of all the sickness they harbour at the inception



- To focus on **creating spaces and environment for users**. Thus sustaining the complete balance that could constitute a healthy organisation vis-à-vis human management and its human based facilities.

With its technicalities, **good architecture** is a fundamental issue addressing the **environment**, culture, needs and definitely clinical requirements.

WHAT ARE HEALTH CARE FACILITIES ?

Healthcare impels the provision of a wide variety of buildings, to serve many different functions and accommodate the whole life span of man.

“From cradle to grave”

“From Womb to Tomb”

Shelter is needed for the promotion of health and the prevention of sickness, for assisting natural functions like childbirth, for curing disabilities and repairing malfunctions and for supporting the afflicted and incapacitated.

HEALTH CARE FACILITIES-CONTD

This shelter may fall into a number of generic types.

Although medical knowledge is largely international, the ways in which it is applied and in which it is delivered in one country and another are likely to differ, as are the forms of building appropriate to the particular circumstances.

The forms reflect the nature of the organisation, culture, economy and geography of their respective situation and the peculiarities of their social microclimate.

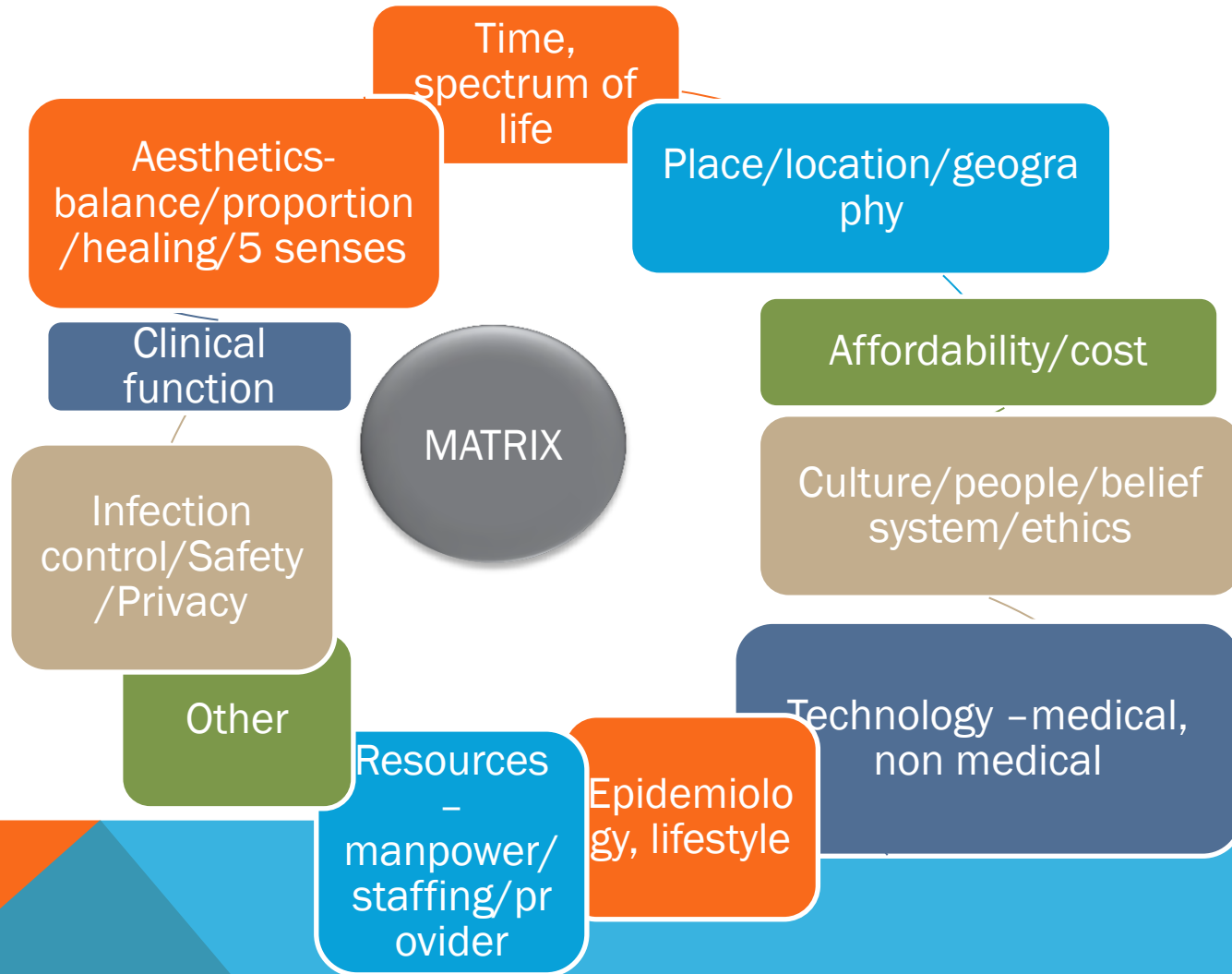
HEALTH CARE FACILITIES

There are no universal solution for the provision of healthcare facilities.

It is dangerous to generalise but it is reasonable to make a broad distinction between the facilities available or provided for between the developed and the developing world.

The differences are most noted in the religious beliefs, in social attitudes, the physical and cultural infrastructure, climate, availability of manpower for staffing and the financial resources to initiate and maintain the running of the facilities.

DESIGNING HEALTHCARE FACILITIES



SPECTRUM OF LIFE



TARGET USER AND TIME FRAME

1950's

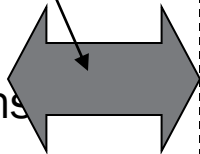


Planning, design, construct

The target user
The would be retirees

Event, experience,

Technology exposure, dreams
needs.....



THE BRIEF
REQUIREMENTS



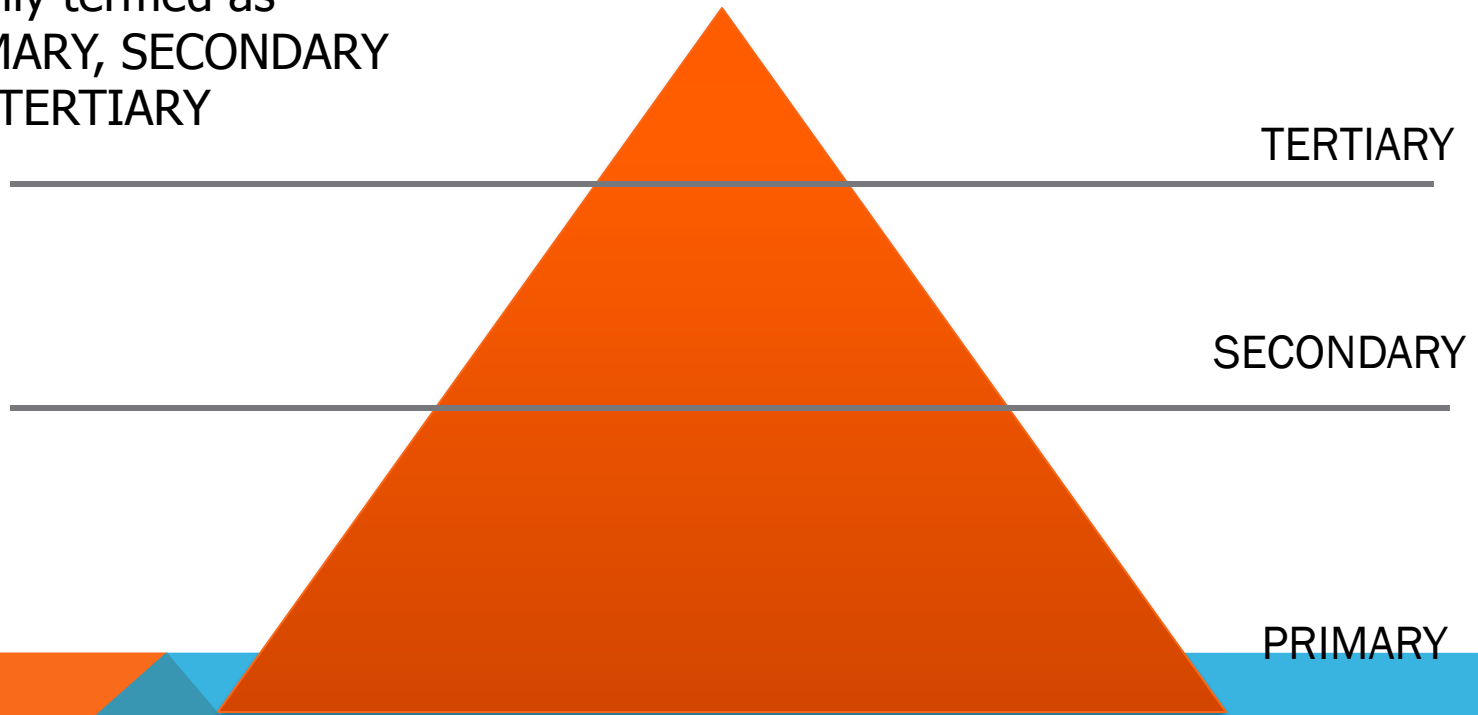
Normal ageing
Sick state
Healthy/exceptional

1950's ...world war II, 1st Man on the
Moon, TV, Computer era, nuclear power,
Tsunami, high rise structures, etc..

56 years old and above
Average old age for man 72 yrs old
Average old age for women 80 yrs old

HEALTHCARE HIERARCHY/PYRAMID

The 3 main levels are usually termed as PRIMARY, SECONDARY and TERTIARY



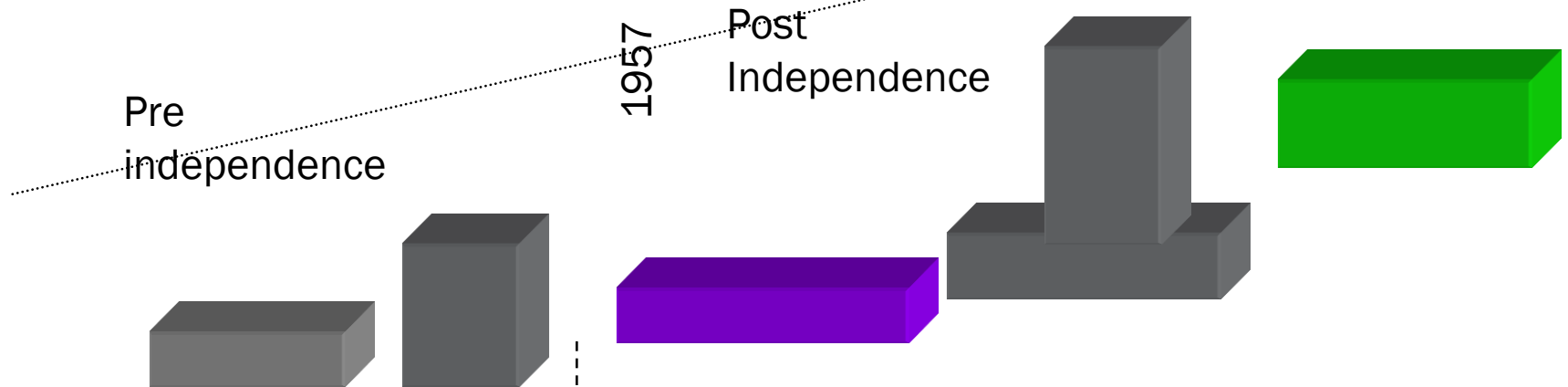
NATIONAL REFERRAL

The nation has to serve its people and it has to reach out to be able to reach them.

The primary care system and facilities has been set out to take that function to ascertain and filter them prior to them being referred to hospitals.

DISCUSSION

The paper discusses the approach of health planning in relation to the physical provision of healthcare facilities, pre and post independence to date.



MALAYSIA - THE COUNTRY, HEALTH SYSTEM AND HEALTH STATUS - PRE COLONIAL, COLONIAL AND POST INDEPENDENCE

HEALTHCARE FACILITIES DESIGNS

MALAYSIA –THE COUNTRY



26.6 Million Population of Malays, Chinese, Indian Indigenous, Other with 2 million working immigrants from Myanmar, Indonesia and Bangladesh (2006 MoH)

Islam, Buddhist, Hindus, Christians, Other

Healthcare 6.33% of National Budget

EVOLUTION OF PUBLIC
HEALTHCARE FACILITIES DESIGNS
TO HEALTH TREND IN MALAYSIA-
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PENINSULAR MALAYSIA



Ref:

http://www.vidiani.com/maps/maps_of_asia/maps_of_malaysia/detailed_administrative_map_of_west_malaysia.jpg

EVOLUTION OF PUBLIC HEALTHCARE FACILITIES DESIGNS
TO HEALTH TREND IN MALAYSIA-NMN

STATES OF SABAH AND SARAWAK



HEALTH STATUS PRE AND POST INDEPENDENCE

YEARS	1957	1970	1980	1990	1996	1997	1998	2010
Population (millions)	6.3	10.3	13.8	18.0	21.2	21.7	22.2	28,334.1
Population Density (Sq.Km)					63	66	67	86
Growth Rate	N/A	2.7	2.4	2.5	2.3	2.3	2.3	2.0
Life Expectancy								
Male (years)	56.0	64.0	66.0	69.0	69.0	69.6	69.6	71.7
Female (years)	58.0	68.0	70.0	73.0	74.0	74.5	74.7	76.5
Crude Birth Rate	46.2	32.5	30.3	26.8	27.1	25.6	26	17.9
Crude Death Rate	12.4	7.0	5.5	4.8	4.6	4.6	4.6	4.8
Infant Mortality Rate	75.5	40.8	23.9	12.1	9.1	9.5	8.1	7
Toddler Mortality Rate	10.7	4.2	2.1	0.9	0.7	0.7	0.7	0.4
Maternal Mortality Rate (per 1000 livebirth)	3.2	1.5	0.6	0.2	0.2	0.2	0.3	0.3

Table 1: Vital Statistics for Malaysia, 1957-1998, 2010

Source: Department of Statistics, Information and Documentation System Unit, Planning and Development Division, Ministry of Health Malaysia

PUBLIC HEALTHCARE NATION WIDE

Package Deal Procurement

Pre
Colonial
Period

**Colonial
Period
1700-1957**

Conventional Procurement

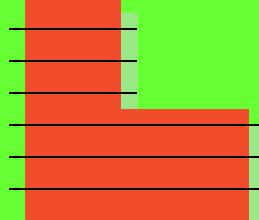
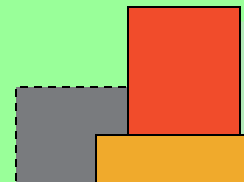
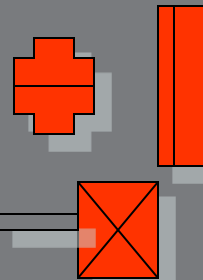
Early post
independent
period
1957-1970s

Upgrading
works
1970s-
1990s

**Paperless
Hospitals
Masterplans
Telemedicine
late 90s-early
2000s**

**Greening
Healing
environmen
up-grading,
customised
design
building
2007-todate**

homebased



High-rise, High-tech, art
décor, post modern, retro,
urban based, smaller land -
lots for Bigger Hospitals

Standard Architecture Design for Nation Building

- Hospitals
- Clinics
- Support Services
- Staff residence
- Medical & Nurisng schools

Single, low rise sprawling
structures in small towns

New Standard Architecture Design for Nation Building

- District Hospitals
- Clinics
- Support Services
- Staff residence
- Teaching facilities

Customised Architecture Design for Nation Building

Simple structures
Tropical
Architecture

Non Standard
Single, low rise sprawling
structures in small towns
and



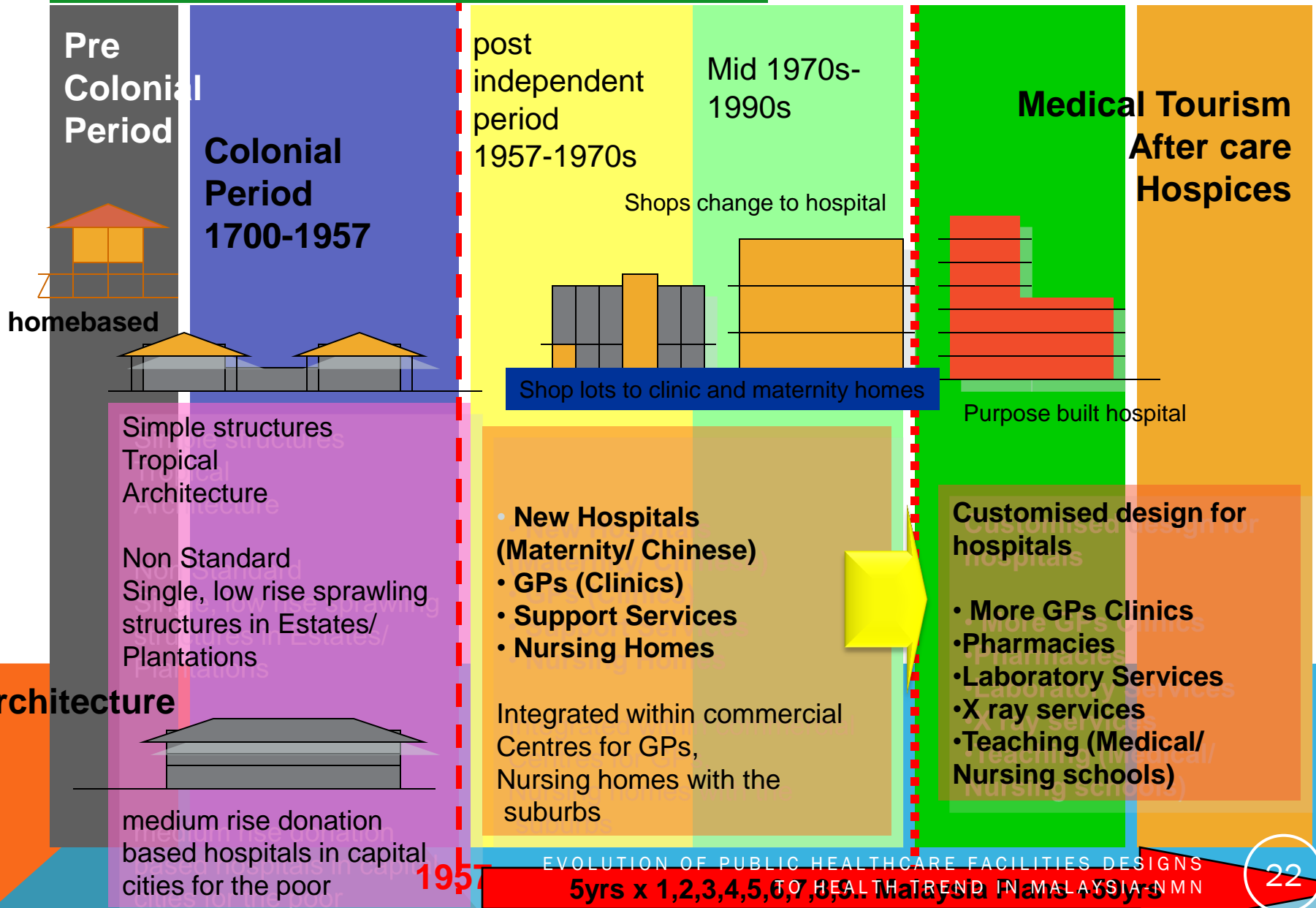
medium rise in capital cities

1957

EVOLUTION OF PUBLIC HEALTHCARE FACILITIES DESIGNS
TO HEALTH TREND IN MALAYSIA NMN
5yrs x 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100yrs

PRIVATE HEALTHCARE (URBAN BASED)

Private Healthcare Facilities
and Services Act 1998



PRE-COLONIAL/ TRADITIONAL ERA

HEALTH CARE FACILITIES DESIGNS

HISTORY AND TRADITION

Not much has been written on the existence of *healthcare facilities* pre colonial that belongs to the cultures of the indigenous people, the Malays, Chinese and Indian traders.

The tradition of healing embedded in these cultures are still home based , in the streets and in shop lots as Sing Seh.



Cheah Boon Kheng .(ed.)(2001). Early modern history.91800-1940). Diseases and Health Care Services. Page 122-123 The Encyclopedia of Malaysia.Kuala Lumpur. Archipelago Press

PRE-INDEPENDENCE/COLONIAL ERA

HEALTH CARE FACILITIES DESIGNS

IN THE MEDICAL OR CURATIVE SERVICES SECTOR

Health or preventive services sector physical development was very slow in 1930-1939 due to economic depression.

The health sector was basically managed by respective sanitary boards of the municipality in the states and companies of the plantation estates until 1958 when the federal government of independent Malaya took over.

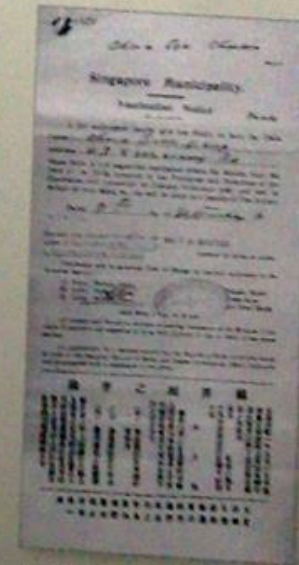
ISSUES WERE BIRTH, INFECTIOUS DISEASE, SANITATION, FOOD.....

Maternal and child health

In the first decade of the 20th century, infant mortality rates continued their upward trend. In the urban areas of the Straits Settlements, they were in the region of 200 per 1,000 live births, rising to over 300 per 1,000 in 1911. The rates in the rural areas were lower, about 150 per 1,000 live births. Infant mortality rates collected at this time were largely estimates, possibly with considerable underreporting of deaths in the first few weeks after birth, particularly in the rural areas.



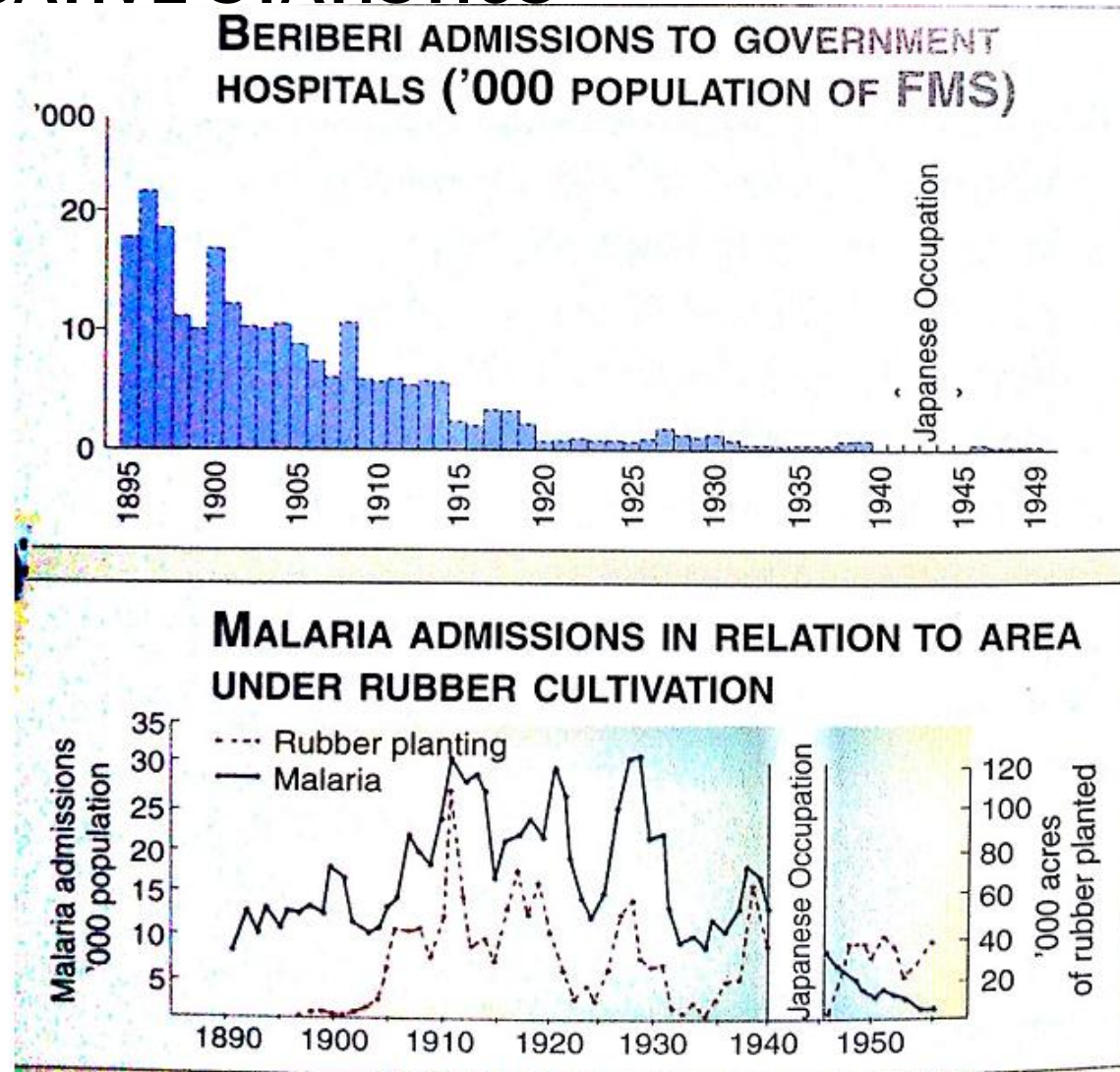
A vaccination programme at government clinics was part of the official strategy to lower the infant mortality rate. This photograph from the 1938 annual report of the Federated Malay States shows mothers and children at a clinic.



A 1936 vaccination notice issued by the Singapore municipality.

Cheah Boon Kheng .(ed.)(2001). Early modern history.91800-1940). Diseases and Health Care Services. Page 122-123 The Encyclopedia of Malaysia.Kuala Lumpur. Archipelago Press

INDICATIVE STATISTICS



Cheah Boon Kheng .(ed.)(2001). Early modern history.91800-1940). Diseases and Health Care Services. Page 122-123 The Encyclopedia of Malaysia.Kuala Lumpur. Archipelago Press

ESTABLISHMENT OF PUBLIC WORKS DEPARTMENT(PWD)

The political changes from 1786 until 1909 to accelerate the development in the Straits Settlement and the Malay States urged the specialised department to be established to undertake infrastructural development.

The event following the formation of Public Works Department (PWD) in India in 1854, lead to establishment of PWD for the whole of the Straits Settlement that was sanctioned through an “Engineer Establishment” in 1856.

HUMAN RESOURCE

Similar to the healthcare sector, the specialise personnel inherited by independent Malaya were generally expatriates.

Citizens were sent abroad to study as part of the human resource training programme to serve the country.....meantime work went on with the limited resources.

COLONIAL HEALTHCARE FACILITIES

The Federated Malay States (FMS) of Malaya had its first hospital built in Penang from 1874 by the British East India Company, driven by the tin industry that require healthy workforce.

Hospitals built between the periods of 1883-1910 provide only curative services and were generally urban based.

At the turn of the century there were 34 hospitals in the FMS of Malaya.

By independence (1957), Malaya inherited 10 major general hospitals and 56 district hospitals with specialise personnel being British expatriates.

COLONIAL HEALTHCARE FACILITIES

Hospitals and health centres were generally customised one-off design.

The healthcare architecture was a typical tropical architecture that addressed the climatic requirements extremely well.

The general hospital of Penang, Sultanah Aminah of Johor, Sarawak General Hospital, Queen Elizabeth Hospital of Sabah and many district hospitals are still in use today.

Their purported 'standards' were addressed in the building details as well as the quality of workmanship in the construction.

POST INDEPENDENCE

HEALTH CARE FACILITIES DESIGNS

EVOLUTION OF PUBLIC HEALTHCARE FACILITIES DESIGNS
TO HEALTH TREND IN MALAYSIA-NMN

MALAYSIAN HEALTH VISION



“ Malaysia is to be a nation of healthy individual, families, and communities, through a health system that is equitable, affordable, efficient, technological appropriate, environmentally adaptable and consumer friendly, with emphasis on quality, innovation, health promotion and respect for human dignity, and which promotes individual responsibility and community participation towards an enhanced quality of life”

Ministry of Health Malaysia

HEALTH-VISION

The health vision is not static but dynamic that sets in place framework to ensure that the health system could develop and adapt to the changing environment

Health care facilities were pragmatically plan and developed to provide the support towards that vision

Table 1: Federal Government Development Expenditure Original Allocation for Health Sectors and % of National Development Budget for Respective Plan Period

% social sector	RM (million)	Plan Period
23.5	50.0	1 st -5 year Malaya plan (1956-1960)
	145.0	2 nd -5 year Malaya plan (1961-1965)
-	189.4	1 st Malaysian Plan (1966-1970)
20.0	213.7	2 nd Malaysian Plan (1971-1975)
12.2	377.2	3 rd Malaysian Plan (1976-1980)
9.2	588.4	4 th Malaysian Plan (1981-1985)
7.9	715.0	5 th Malaysian Plan (1986-1990)
16.7	2,253.0	6 th Malaysian Plan (1991-1995)
13.4	2,658.0	7 th Malaysian Plan (1996-2000)
5.0	5,5786.0	8 th Malaysian Plan (2001-2005)
5.4	10,710.0	9 th Malaysian Plan (2006-2010)
na	na	10 th Malaysian Plan (2011-2015)

STRATEGIES IN HEALTH SERVICES DEVELOPMENT

Since independence Malaysia has placed a cost-effective interventions in health care.

The establishment of basic public health and essential clinical services was phased in over time and all the geographic areas.

In 1970s, government provide emphasis on health services in the rural areas where 75% of the population lived.

INTRODUCTION

Primary care

The hospitals small and large, on the other hand has been built at speed to fill out the gaps between the primary care and the tertiary care hospitals at areas

- ✓ That needs to have the facility;
- ✓ to replace old dilapidated ones and
- ✓ to accommodate expansion as well as change in the policies to existing ones.

INTRODUCTION

On the **macro level**, the paper relate on the *national referral system* then, in place and in the process of planning;

On **micro aspect**, the design development of these healthcare facilities were discussed on the rationale of its development as outcome of the country's health trend.

HEALTHCARE FACILITY

“....means any premises in which one or more members of the public receive healthcare services..”

Part 1, Preliminary,
Section 2. Interpretation, Private Healthcare Facilities
and Services Act 1998



Proposed HUKM teaching block
Damansara Arkitek

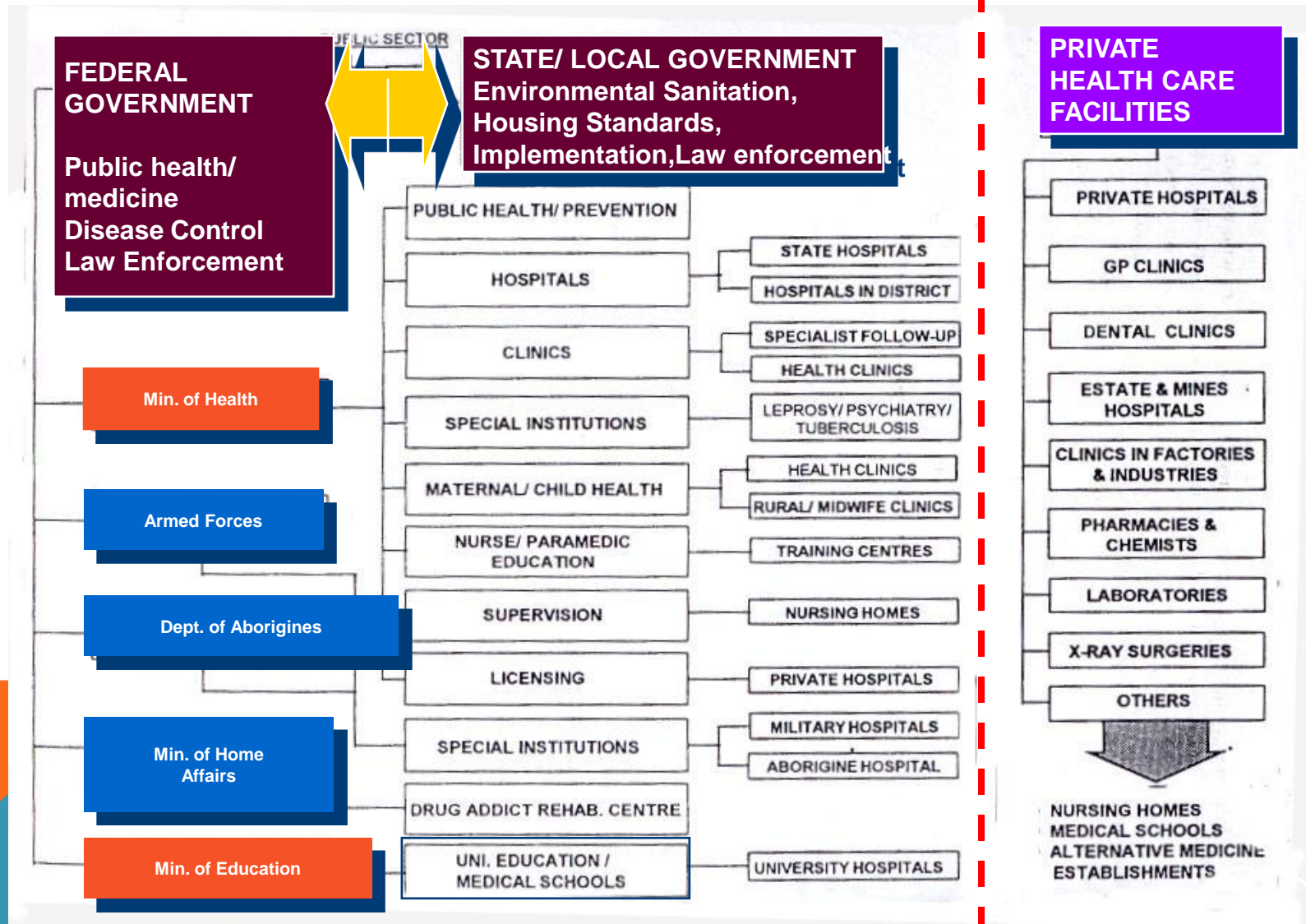
WHAT IS GOVERNMENT HEALTHCARE FACILITY

...” GHF Means any facility used or intended to be used for the provision of healthcare services established, maintained, operated or provide by the Government but excludes privatised or corporatised Government healthcare facilities;”

Part 1, Preliminary,
Section 2. Interpretation
Private Healthcare Facilities and Services
Act 1998

Government / Public Sector 75-80%

Private Sector 20-25 %



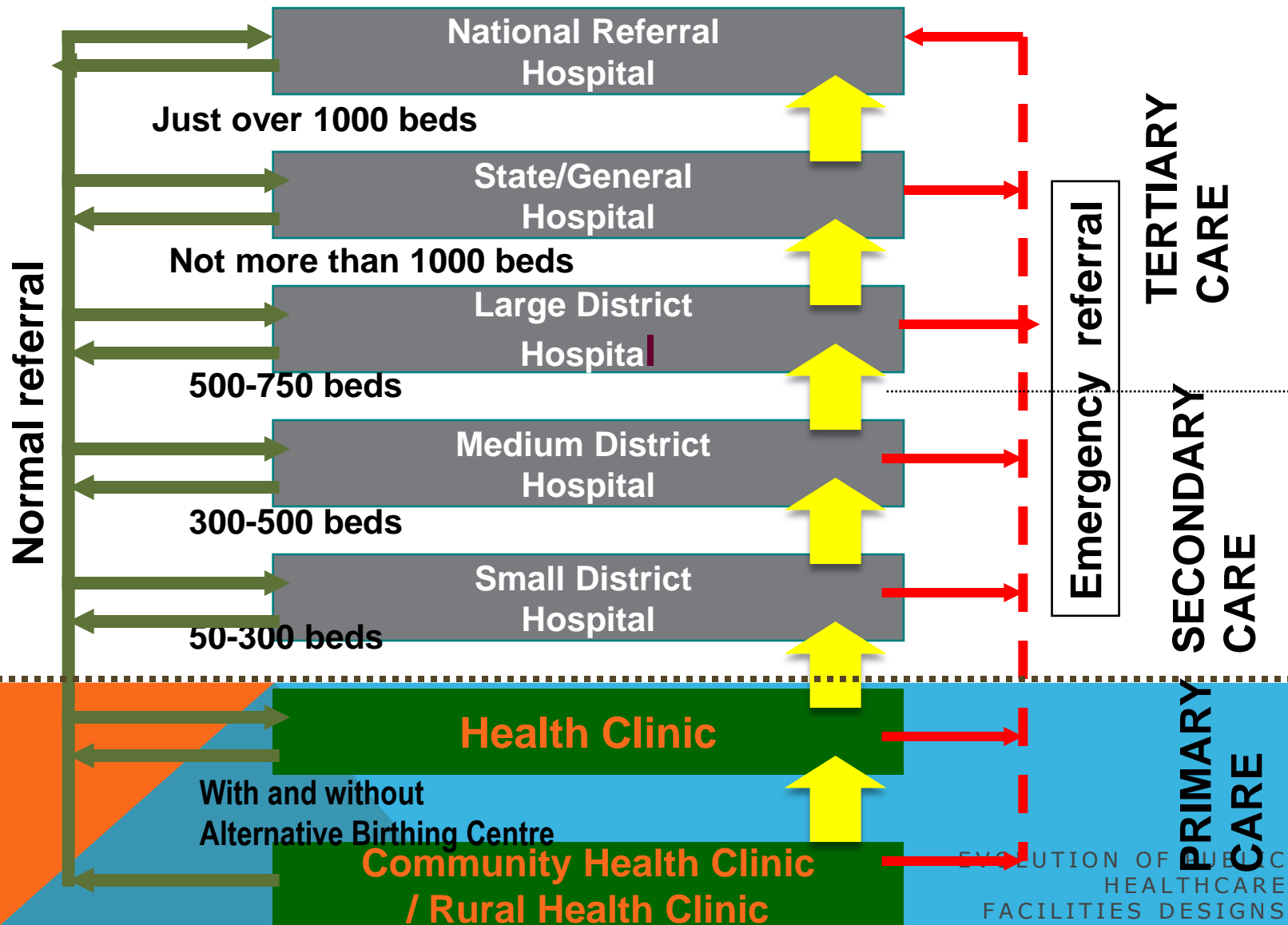
Source: Ministry of Health Malaysia

EVOLUTION OF PUBLIC HEALTHCARE FACILITIES DESIGNS
TO HEALTH TREND IN MALAYSIA-NMN

SPECTRUM OF HEALTHCARE FACILITIES

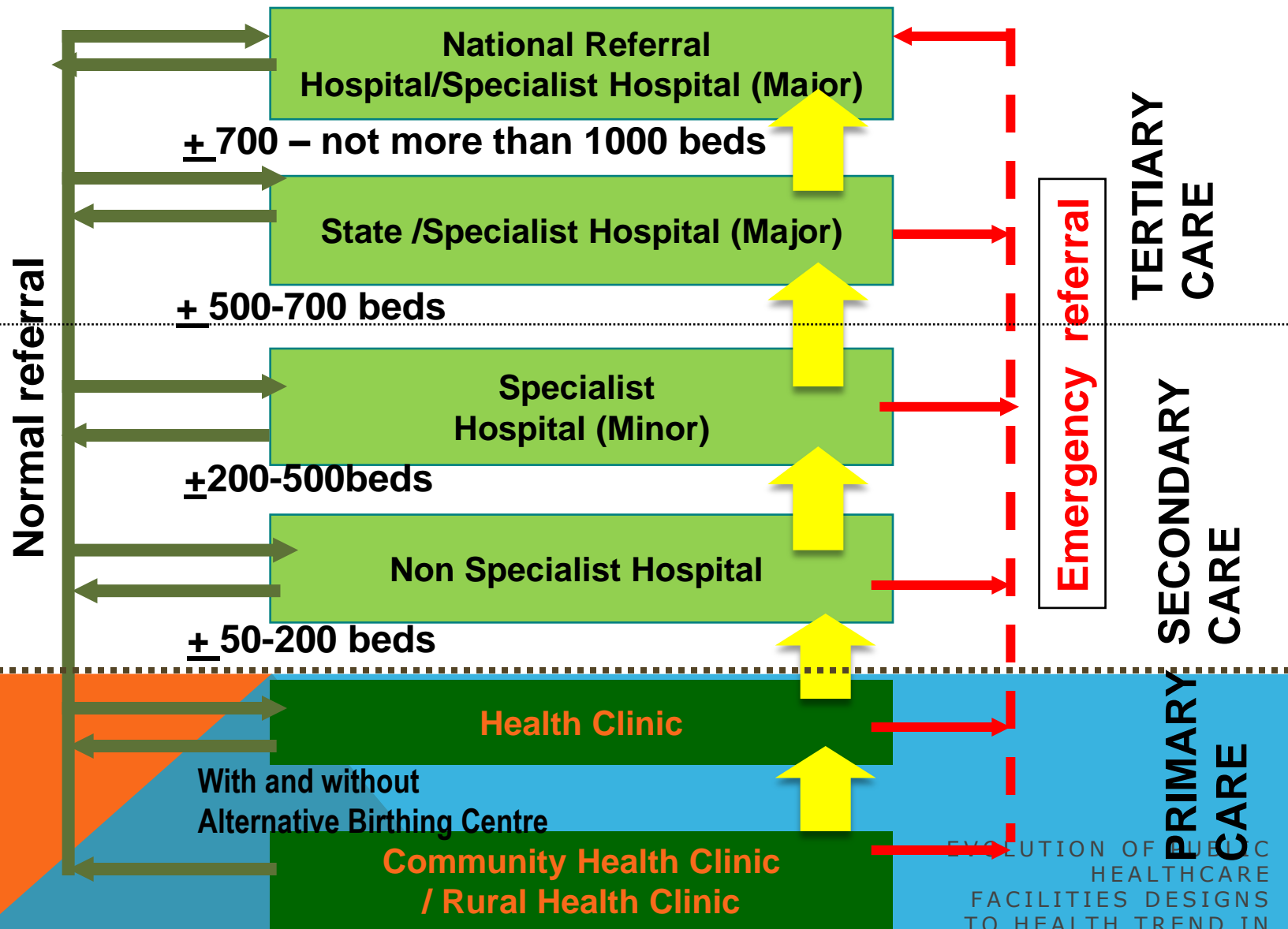
Level	Primary Care	Secondary Care	Tertiary Care	Long Term Care
Type	Promotive . Preventive, Curative	Curative	Curative, Rehabilitative	Home/Palliative/Terminal Care
Built facilities	Midwife/Rural Health Clinic	Cottage Hospital 20- 70 beds	National Referral Centre of Excellence	hospices
	Dispensary / mobile Dispensary	Non Specialist Hospital 70-150 beds	Teaching hospitals – public and private	elderly/retirement homes
	Health post	Specialist Hospital 150-350 beds	Research institutions - Institution of Medical Research (IMR)	Special Institutions – Rehabilitation
	Flying Doctors	Private Hospitals	Organ based hospitals Cardio Thoracic Eye Hospital (Private)	cancer, leprosarium, psychiatry
	Health Clinic /Community Clinic	Specialist Hospital 350-550 beds	- Specialist Hospital 550-750 beds (State /Regional)	nursing homes
	Private GPs Infectious Disease	Infectious Disease (CID) Support Facilities		cerebral palsy centres
	public health/ school /dental	Private Maternity Homes		

MALAYSIAN HEALTHCARE REFERRAL SYSTEM (THEN)



EVOLUTION OF PUBLIC
HEALTHCARE
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MALAYSIA-NMN

MALAYSIAN HEALTHCARE REFERRAL SYSTEM (NOW-2000 ONWARDS)



GEOGRAPHICAL DISTRIBUTION OF SELECTED HOSPITALS



-  National Referral Hospitals
-  Regional Hospital/State/Specialist hospital(major)
-  Tertiary / Secondary State Hospitals
-  Specialist Hospital (major)

EVOLUTION OF PUBLIC HEALTHCARE FACILITIES DESIGNS TO HEALTH TREND IN NATION BUILDING

HEALTHCARE FACILITIES DESIGNS

PRIMARY HEALTHCARE ARCHITECTURE

Healthcare facilities designs

**From rural
simplicity of
needs to urban
refinement on
demand**

COLONIAL ARCHITECTURE



Fraser's Hill Clinic

Clinics at Hill Station
Still in use at outpatient
care (public)
Non standard
Tudor architecture,
masonry with timber
framing, rectangular
planning

RURAL HEALTH CLINICS

Healthcare facilities designs

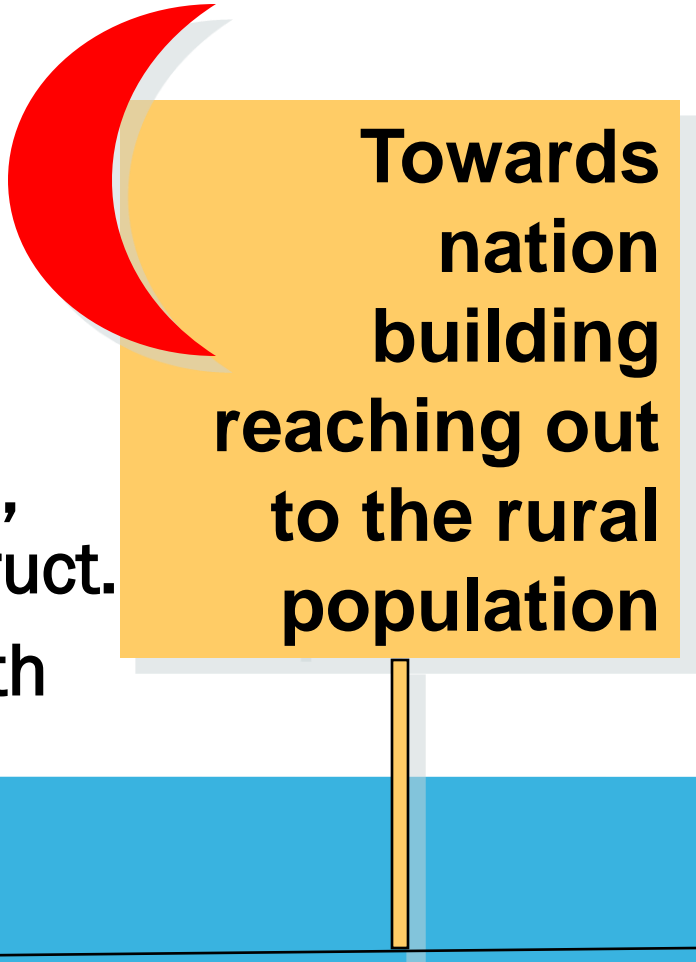
POST INDEPENDENCE PERIOD

Rural & Urban Based
THE CONCEPT

Accessible

Architecture is utilitarian,
modular, easily assemble,
fast and simple to construct.

Easily identifiable, blend with
site context and address
cultural undertones



**Towards
nation
building
reaching out
to the rural
population**

RURAL CLINIC (60-70S)

Timber Structure with pitch
Asbestos free roofing panels
Raised floor on stilts
Clinic and Community Nurse
house under one roof, Later
version separated into different
units for different function.
Natural ventilation
Daylight



RURAL CLINIC (80S)

Batang Kali Type

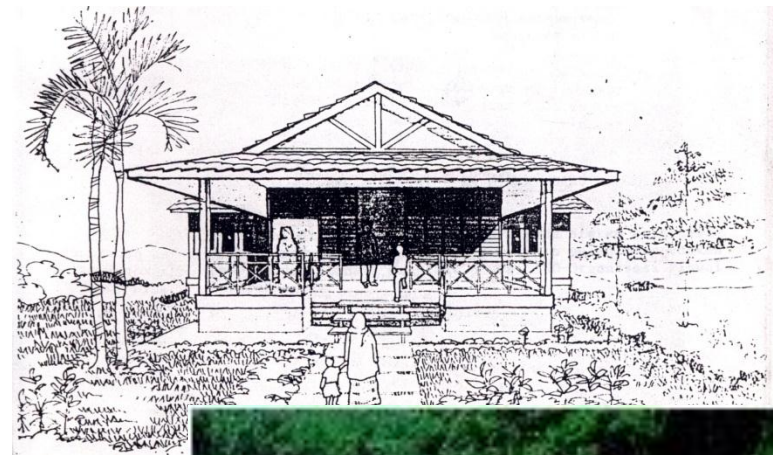
**Timber and Masonry
Construction**

Pitch/Tile Roof

Filled Raised floor

**First building to use
modular coordination
dimensioning system**

**Clinic is separate from
community nurses house**



RURAL CLINIC (2000S)



CONCEPT

Facility under one roof, easily maintained, less acreage

2 version:

Clinic with 1 quarters attached

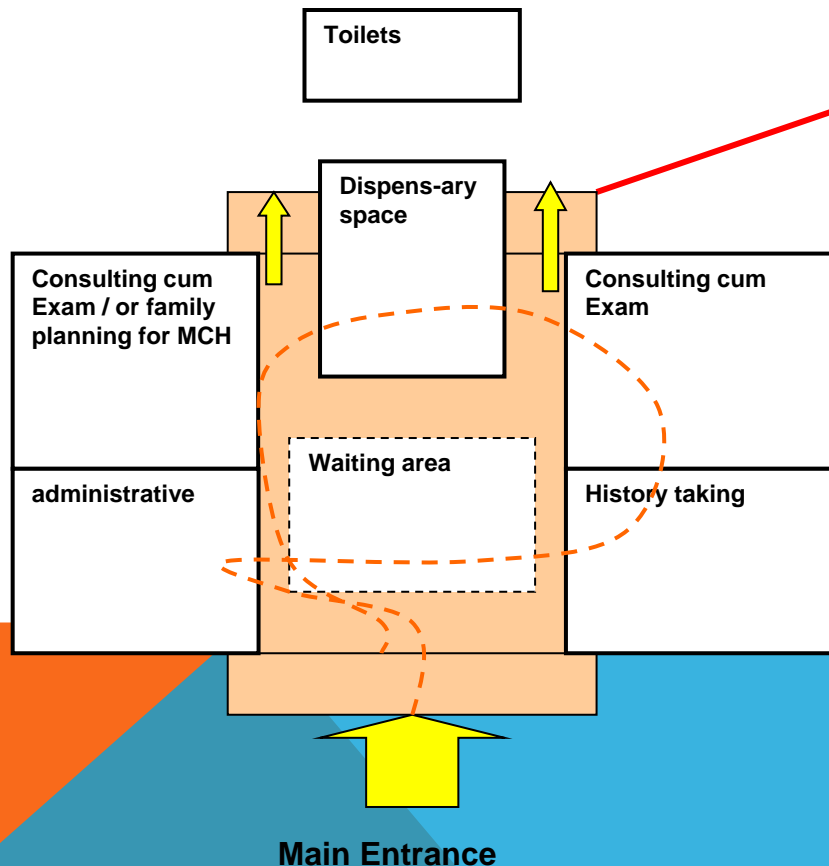
Clinic with 2 quarters attached



JKR

EVOLUTION OF PUBLIC HEALTHCARE FACILITIES DESIGNS
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HEALTH CENTRE BEETLE TYPE PLAN MODULE













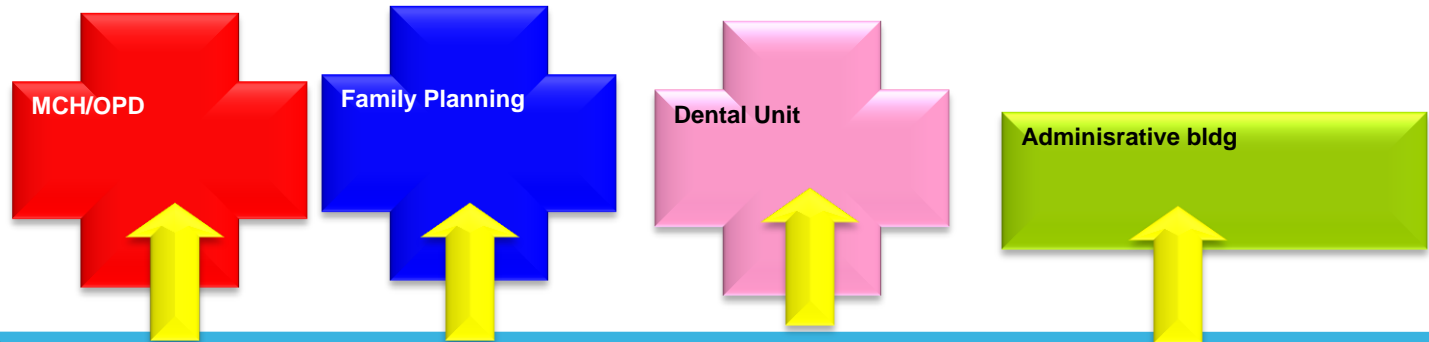
Health Sub - Centre	
Main Health Centre	 
Health Centre (up - graded)	 + 
MHC/HC (U/G) with Family Planning Clinic	  + 
HS - C with Family Planning Clinic	 + 

CHART SHOWING THE TYPES AND UPGRADING OF EXISTING FACILITIES TO HEALTH CENTRES

**Beetle
shaped
modular
clinic
building**

HEALTH CENTRES (60S-70S)



Pavilion Modules that made up the Main Health Centre which a HSC or HC can be upgraded to.

HEALTH CENTRES

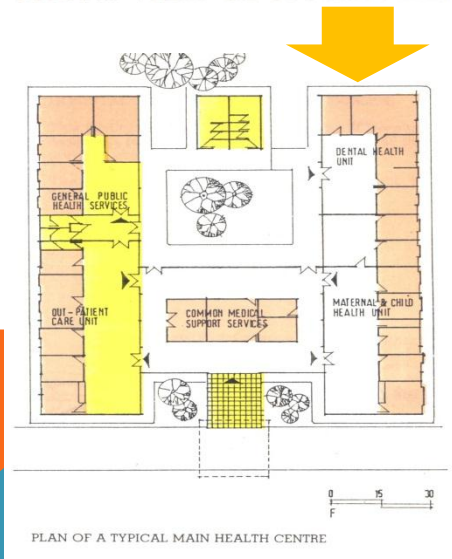
Healthcare facilities designs

HEALTH CENTRES 70-80S



Mantin Type

FRONT VIEW OF A MAIN HEALTH CENTRE (MANTIN-TYPE)



PLAN OF A TYPICAL MAIN HEALTH CENTRE

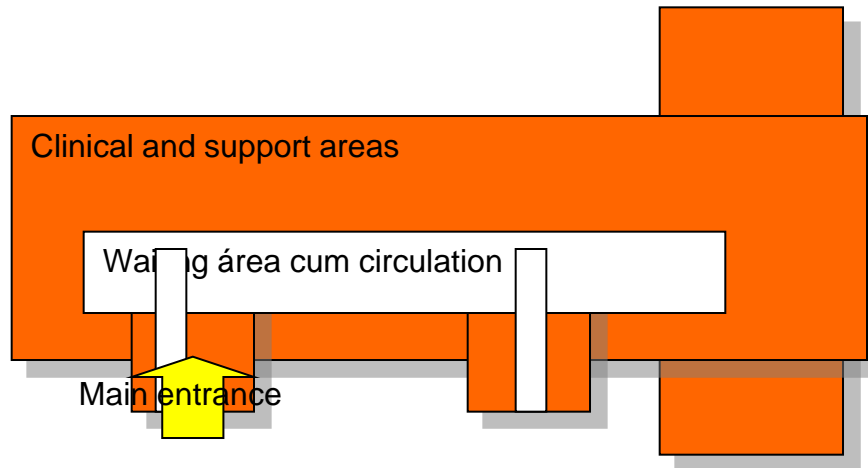


Gulau Type

EVOLUTION OF PUBLIC HEALTHCARE FACILITIES DESIGNS
TO HEALTH TREND IN MALAYSIA-NMN

HEALTH CENTRE-URBAN

URBAN POLYCLINIC – THE MAK MANDIN TYPE

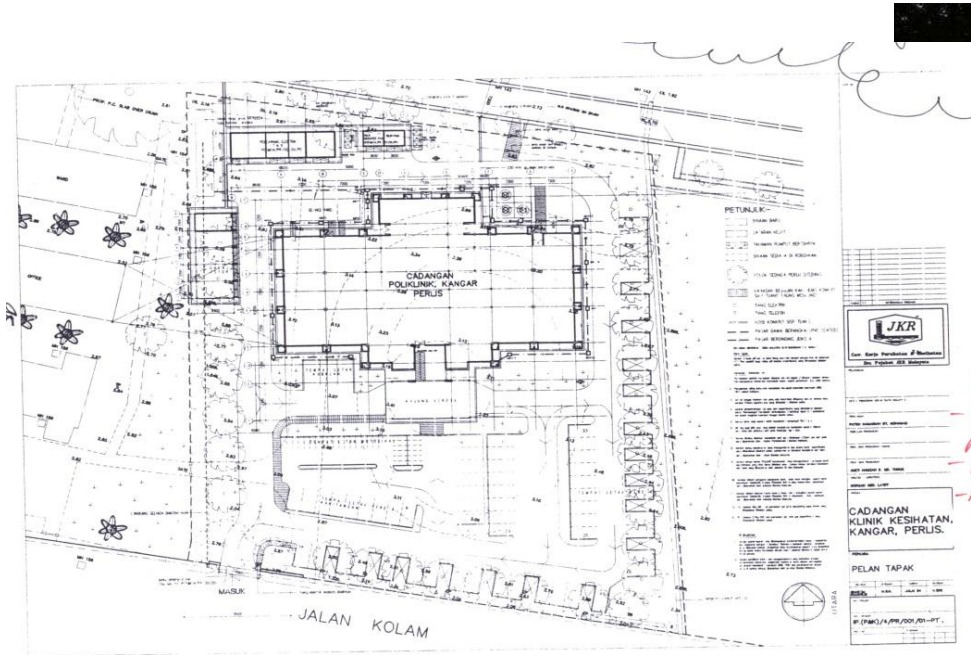


Concept layout plan of Mak Mandin
Type Urban Polyclinic/GOPD



The Kajang Type KK3 (revision of Mak Mandin Typed) Design

HEALTH CENTRE-URBAN TYPE 2-PRE RM 8 >500-800 TOTAL ATTENDANCES PER DAY

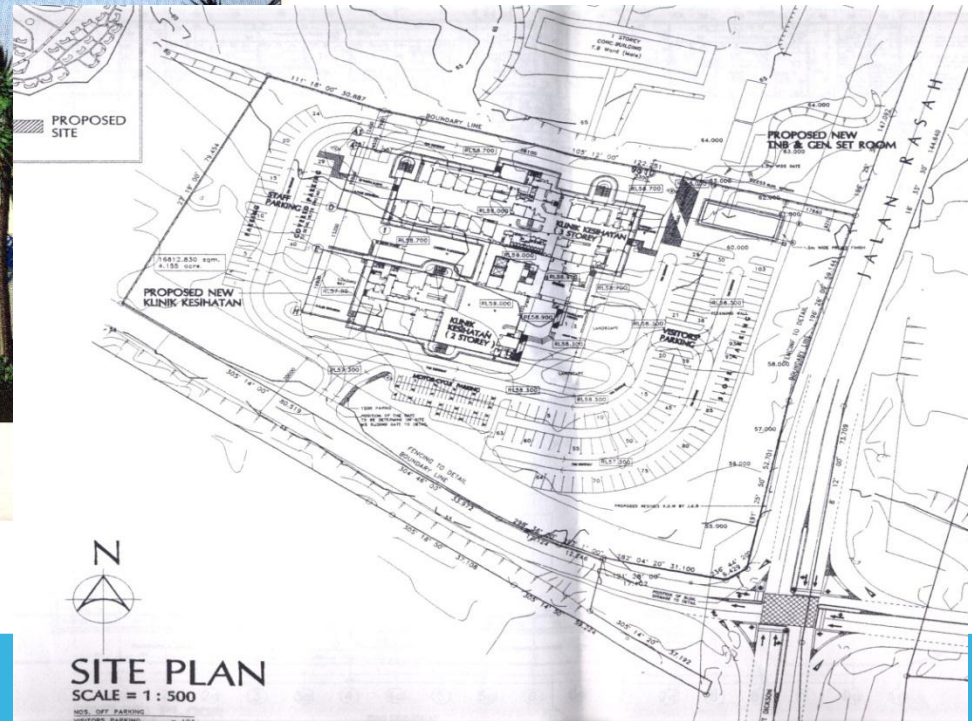


Kangar Health Centre

By JKR Malaysia

Standard design for medium rise health clinic on tight site.

HEALTH CENTRE (90S) TYPE 1-PRE RM 8



Seremban Klinik Kesihatan
One Off Design- by
Arkitek MAA

>800 total attendances per day

EVOLUTION OF PUBLIC HEALTHCARE FACILITIES DESIGNS
TO HEALTH TREND IN MALAYSIA-NMN

HEALTH CLINICS (2000S)



- Towards refinement of needs
 - Air condition areas
 - Disease pattern

Meeting urban needs and sustainable issues of building material

- RC frame, concrete tiles, brick infill



Land Issues
Energy Issue

SECONDARY CARE ARCHITECTURE - HOSPITALS

Healthcare facilities designs



**Low rise sprawl,
medium rise dense,
standard and
customise**

**Add-ons, refurbished,
new**

**From tradition, post
modern, to high tech**

PUBLIC HOSPITALS IN MALAYSIA

Hospital design development in Malaysia could be described as design developed

- prior to independence
- and after independence.

In each period the planning and design concept varies as they were subjected to conditions and specific requirements of the situation.

PRE INDEPENDENCE

There were no hospitals prior to the colonisation era.

The treatments of the ill were by traditional means of faith healers and traditional medicine.

The design of hospitals came about in the 19th Century with the earliest being established in the cities of the Straits Settlement i.e. Penang, Melaka, Johore Bahru and Singapore

PRE INDEPENDENCE (>1957)..EXCERPTS

“.....at the end of 1886 which comprises of a general ward for officials and members of the public who could pay the prescribed fees, and four wards for indigent patients (‘the pauper ward’) where treatment was free”

“The average number of patients in the general ward was 24 and in the pauper wards were 182.”

PRE INDEPENDENCE (>1957)..EXCERPTS

“Death rate in the general ward was less than 6% whereas in the pauper wards it was almost 20%.”

“The medical report on the Pauper Hospital in 1891 records that out of 3200 patients admitted to the hospital during the year, 19 died in admission room and 54 more died within the 24 hours of admission.”

JM Gullick,2000, *A History of Kuala Lumpur 1856-1939*, MBRAS- Ch.7 –Health and Environment.

PRE INDEPENDENCE (>1957)..EXCERPTS

“Expansion of Government hospitals continued until the 1890s with higher priorities given to the improvement of environment and reducing the incidence of serious illness in the establishment of the Kuala Lumpur Sanitary Board or the first Municipal body in the Malay States.”

JM Gullick, 2000, *A History of Kuala Lumpur 1856-1939*, MBRAS- Ch.7 –Health and Environment.

PRE INDEPENDENCE (>1957)..

..... hospital designs of pre-independence can be categorized as the pavilion,

- low-rise or the *pauper hospitals*;
- The high-rise general hospital; and
- Special institutions.

...*the Colonial Architecture Designs*

COLONIAL ARCHITECTURE

Pavilion type

Pitch roof 2 tiered high
angled ceiling

Raised from the ground

Verandah all round

Access via verandah

Good passive design



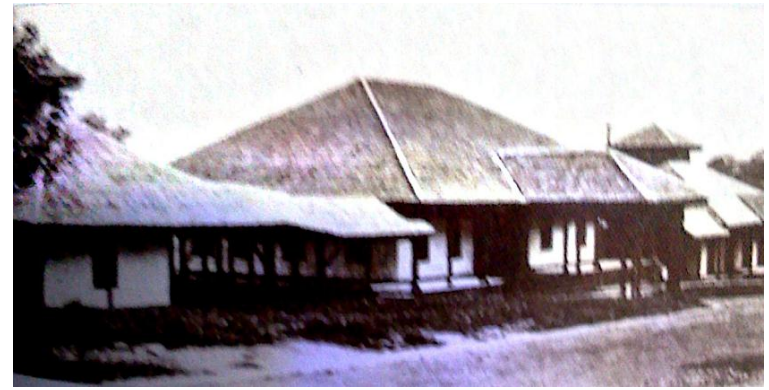
Penang Hospital

COLONIAL ARCHITECTURE

PAVILION LOW RISE EUROPEAN & 'PAUPER' HOSPITALS



The European Hospital at Bangsar with imported equipment to serve the European community



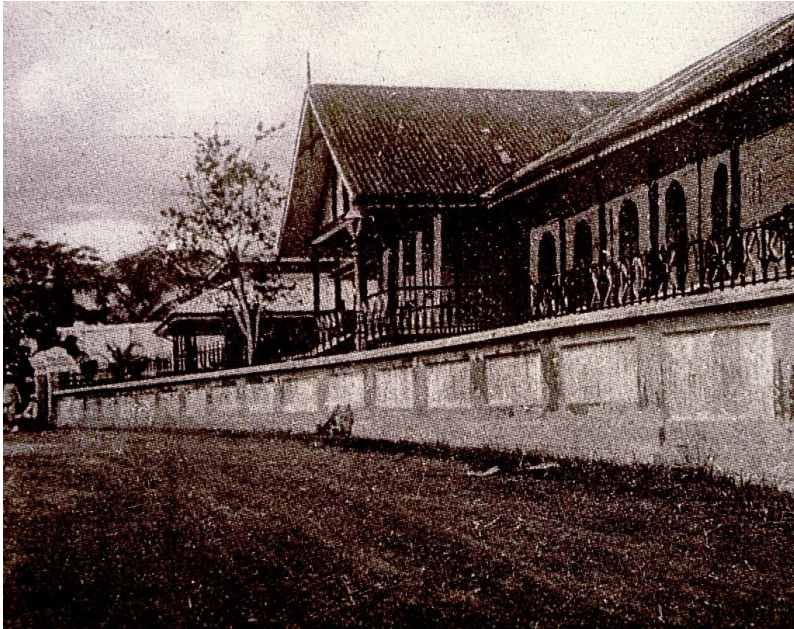
Pauper Hospital /
Tan Tock Seng Hospital, Singapore-funded
by wealthy Chinese for the poor



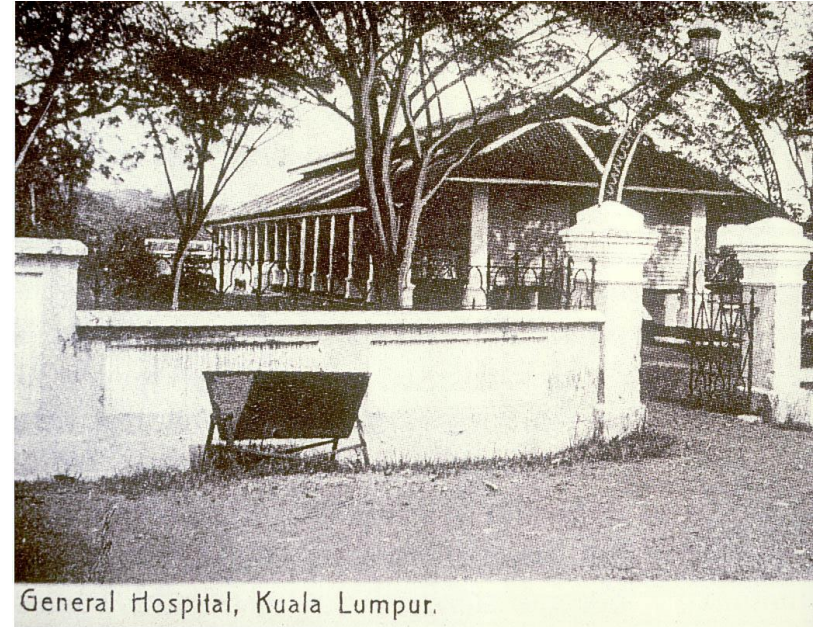
Estate Hospitals for immigrant plantation
workers

Ref: Cheah Boon Kheng .(ed.)(2001). Early modern history.91800-1940). Diseases and Health Care Services. Page 122-123 The Encyclopedia of Malaysia.Kuala Lumpur. Archipelago Press

PAVILION LOW RISE 'PAUPER' HOSPITAL



Tanglin Hospital



General Hospital, Kuala Lumpur.

General Hospital Kuala Lumpur

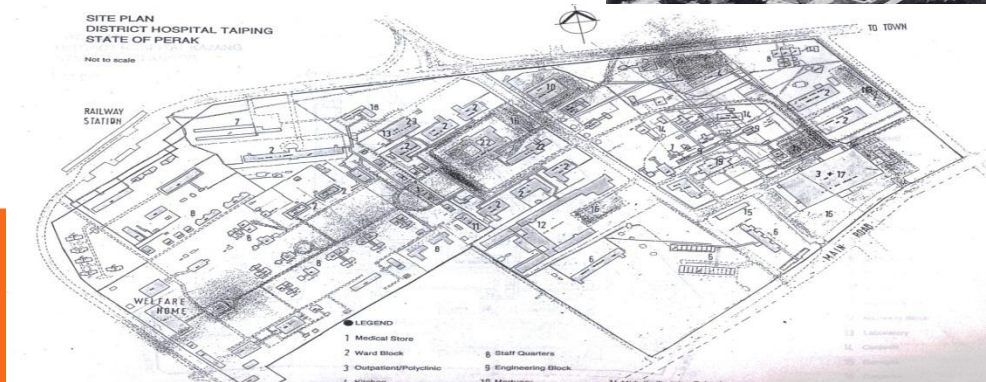
COLONIAL ARCHITECTURE

PAVILION LOW RISE 'PAUPER' HOSPITAL



**Ipoh Hospital
Labout and
Delivery Unit**

Old Kuantan Hospital



Taiping Hospital



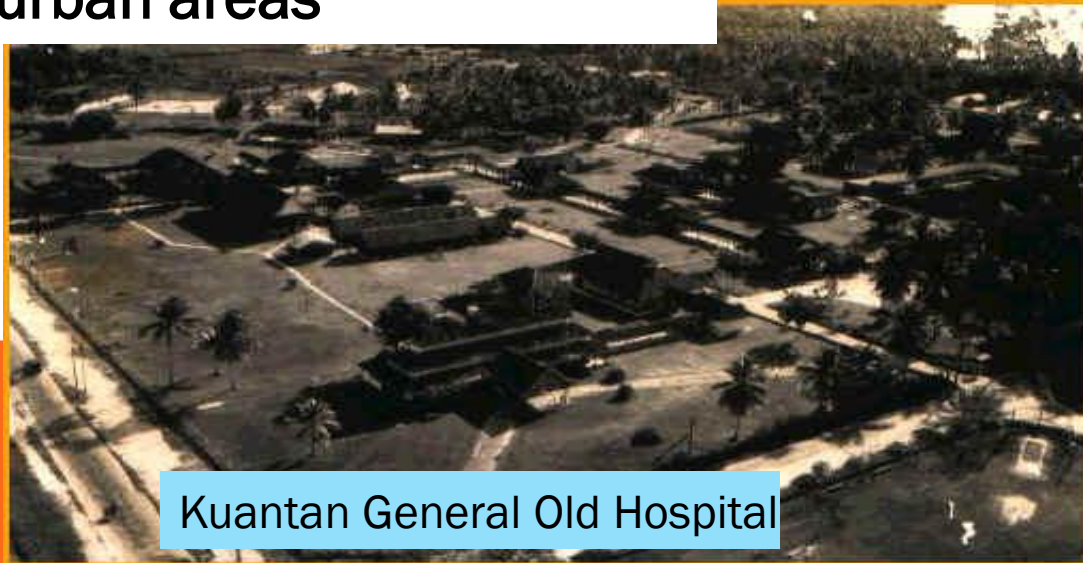
EVOLUTION OF PUBLIC HEALTHCARE FACILITIES DESIGNS
TO HEALTH TREND IN MALAYSIA-NMN

Penang Maternity
Hospital



Cameron Highland
Hospital

Colonial Healthcare Facilities In urban areas



Kuantan General Old Hospital

COLONIAL HOSPITALS



Melaka General Hospital



Sultanah Aminah General Hospital

In big cities:

Medium high rise hospital for inpatient areas, natural ventilation, long overhang, thick wall, windows all around, high ceilings, brickwork, load bearing and reinforced, up-hang open wide windows, sun-shading, lifts and staircases

Sprawl/low rise support building.

POST INDEPENDENCE

Post independence hospitals are planned and designed to the specific requirements of the locality such as the

- ✓ catchment population,
- ✓ disease trend,
- ✓ age groups;
- the national requirements on the level of care appropriate for that locality with regard to specialty such as basic services and specialist services
- its network of services.
- National agenda such as..the caring society..

POST INDEPENDENCE

Hospitals design after post –independence can also be classified as

Standard Design or Type Design,

One-off / Non Standard Complete Hospital,

Redevelopment and upgrading,

One-off/Non Standard Component Design.

TOWARDS NATION BUILDING & MEETING WHO 'HEALTH FOR ALL' BY 2000

The Design and Construction Concepts

- Standardisation template design for different component of a hospital for new and upgrading (add-on) works.
- Standard hospital by bed numbers and services
- Natural ventilation and mechanical fans
- Pitch roof, louvred windows, covered corridors
- Decentralised medical gas
- Centralised other services
- Low rise , no deep plans. open 4 beds bay areas
- Standard specification

STANDARD PLAN OR DESIGNS

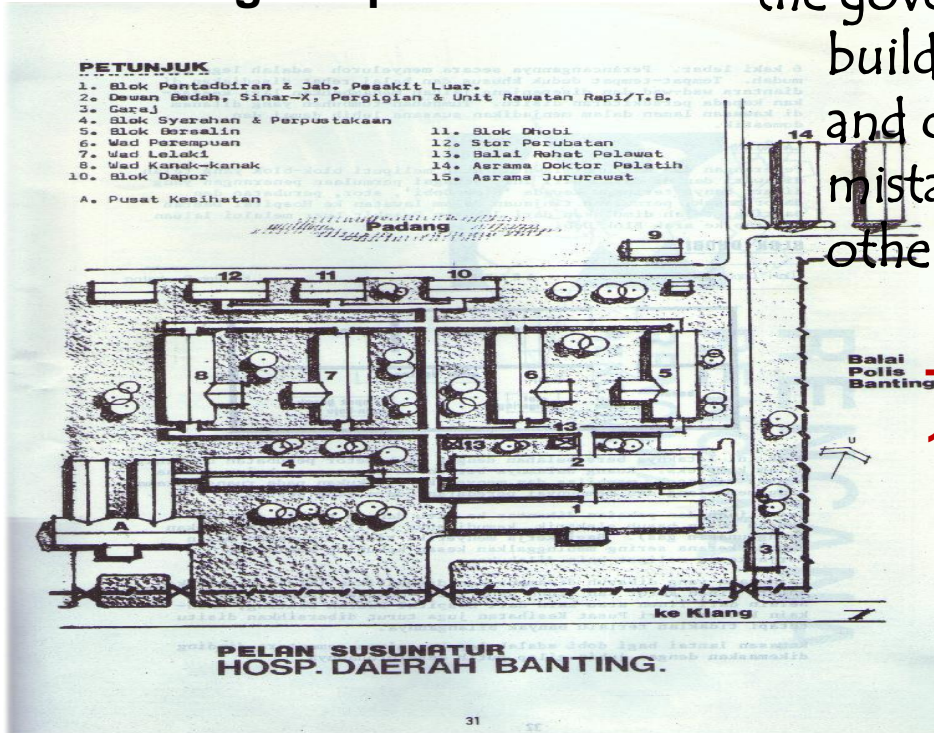
Standardisation was quoted by MoH as an approach in implementation of health facility projects as very effective in the Malaysian context together with a Normative Approach in planning.

MoH also quote that,

“As coverage with health facilities improved, facilities for new facilities had to be assessed more stringently. Existing standards need to be reviewed/evaluated from time to time to take note of new technologies or approaches in the delivery of health care ”

STANDARD DESIGN OR TYPE DESIGN,

Banting Hospital



the government need to built most public buildings at reasonable cost, reasonable speed and of acceptable design standards with less mistakes as well as easy to be supervise by others

The Jerteh Type Hospital 100-150 bed hospital

±45 acres



JERTIH TYPE NON-SPECIALIST HOSPITAL

90-150 BEDS (60S-70S)



Low rise finger like pavilion hospitals. Buildings designed for different service function but linked by covered corridors. At the time of design, no centralised medical gas was installed as a policy.

No first class wards. All wards were naturally ventilated /with mechanical fans.

Structure-frame structure, bricks and asbestos free/ concrete tile roof. Air Con areas were OTs, CSSDs, administration office,

An aerial photograph of GRIK Hospital, showing a large complex of white buildings with orange-tiled roofs. The hospital is situated in a valley, surrounded by dense green forest and mountains in the background. A large orange letter 'H' is overlaid on the bottom left of the image. The text 'GRIK Hospital' and '150 beds' is written in yellow on the bottom right of the image.

150 beds

HOSPITAL OF THE RED CROSS
RAID
SHANGHAI

CHINESE ARCHITECTURAL RESEARCH INSTITUTE

ALTERNATIVE

The tremendous pressure to built within a shorter time to meet needs, drove JKR towards privatization of certain projects.

Previous Malaysian Plans, where JKR's capacity was not able to meet demand of the clients, JKR will outsource portion of design or implementation work process to private consultants.

The scope of work outsourced to the industry were architectural services for basic design; civil and structural design for basic design; and quantity surveyor for tendering and post tender administration.

In 4th Malaysia Plan (1981-1985), JKR continues the implementation of physical facilities development of health centres (HC) and upgrading works to existing facilities.

However, two main hospital projects were procured through turnkey procurement method. These were the 750 beds Kuala Terengganu State Hospital and 500 beds Teluk Intan Hospital. While KT hospital was based on standard but modified plan for hospital with one-off customised design. This moved starts the subsequent procurement using turnkey and design and built for large projects.

THE CONCEPTS OF MID 90S

Transitional period....towards patient focus
care and healing environment

Decentralisation of outpatient

Presence of day care services

Privatisation of maintenance, catering,
linen, security, housekeeping and
engineering services

Introduction of Information Technology

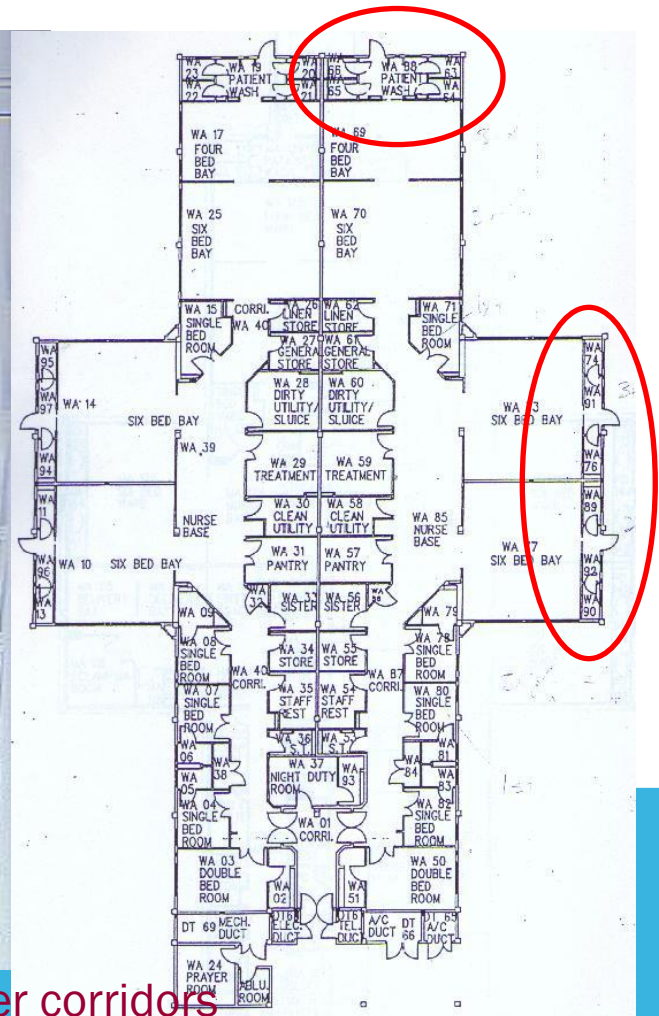
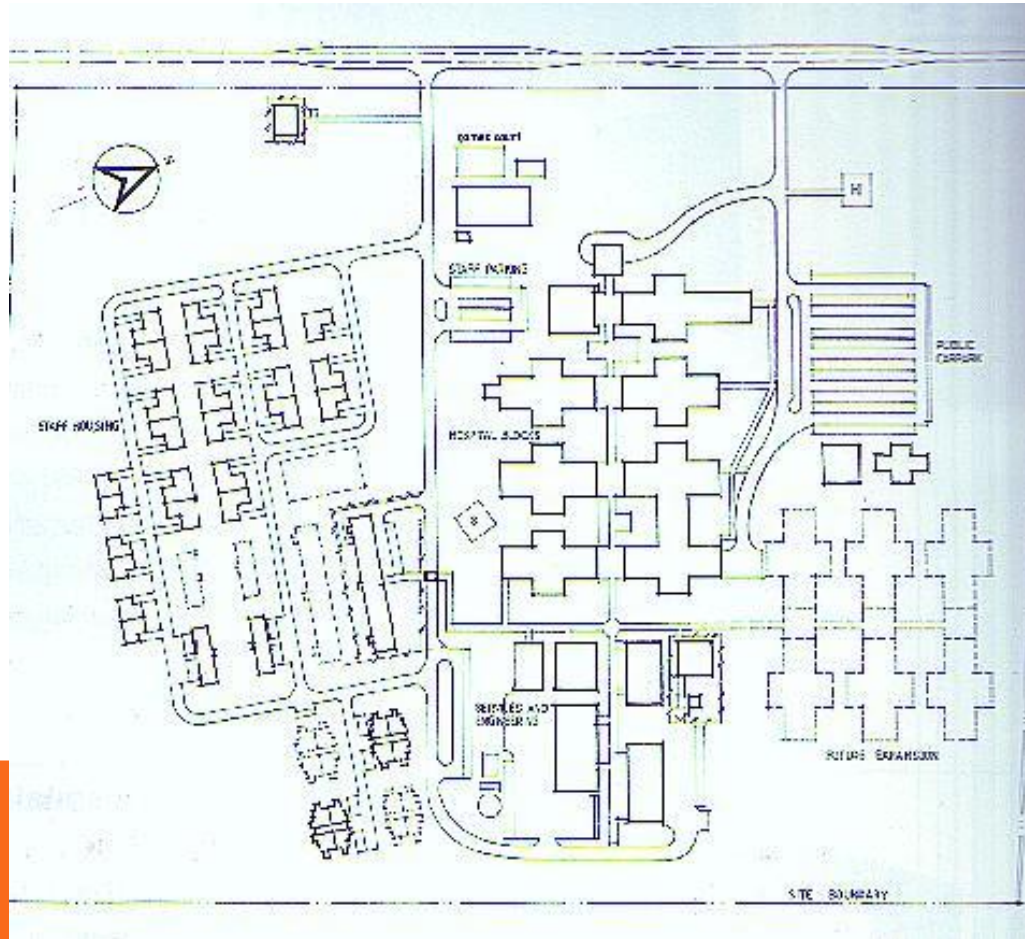
Automation (pneumatic system)

NUCLEUS HOSPITAL MALAYSIAN CONCEPT (1990S)



2 storey low rise
300 beds Hospital

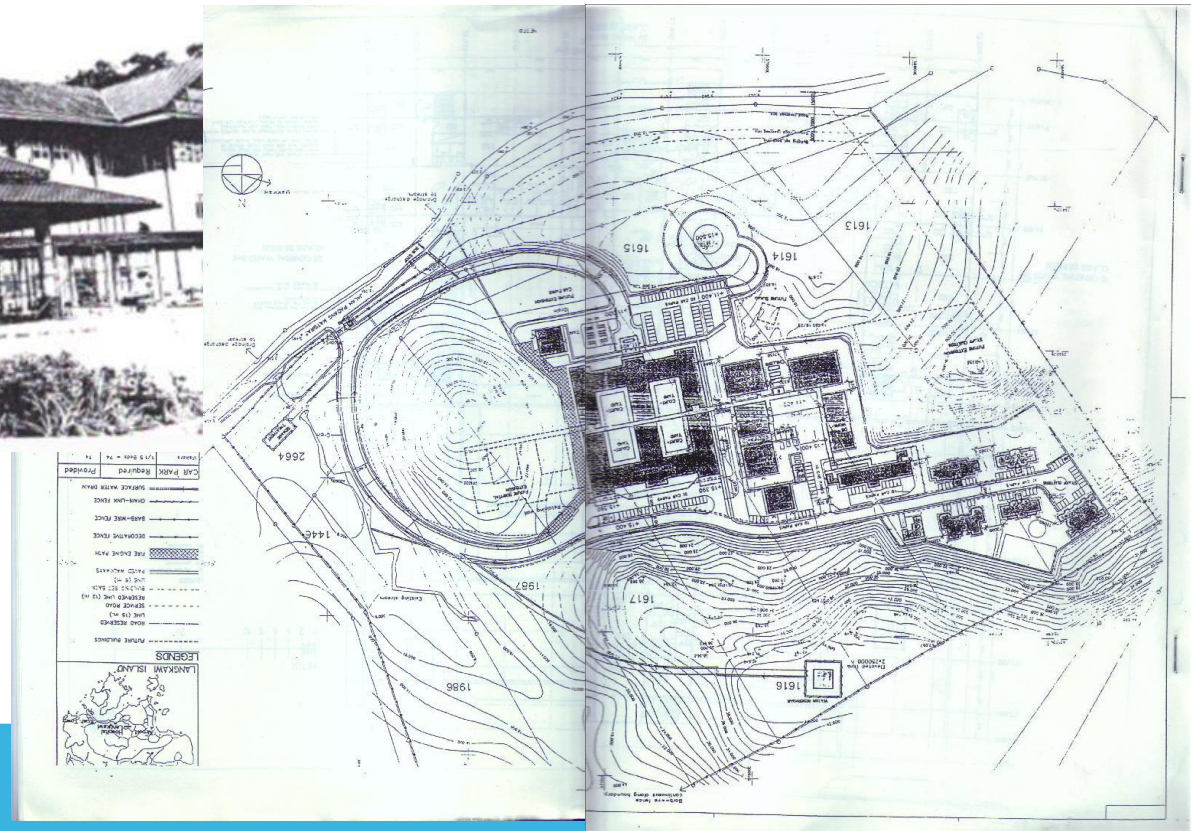
MALAYSIAN NUCLEUS (TROPICALISED)



Flattened the land, long corridors, added **perimeter corridors**

Add toilets at the ends, EVOLUTION OF PUBLIC HEALTHCARE FACILITIES DESIGNS
TO HEALTH TREND IN MALAYSIA-NMN

LANGKAWI HOSPITAL (1995)-SWEDISH



Skanska-pamara jv

EVOLUTION OF PUBLIC HEALTHCARE FACILITIES DESIGNS
TO HEALTH TREND IN MALAYSIA-NMN

DISTRICT HOSPITAL (1990S)



Slim River Hospital (200 beds)
Medium rise
JKR Malaysia



Aisyah K (2007)

DISTRICT HOSPITAL (EARLY 2000S)



Kepala Batas Hospital
150-200 beds
Alternative Medicine
Teaching hospital for USM

Juhari & Hashim Architects Sdn Bhd

RECENT HOSPITAL ARCHITECTURE 2005



Jempol Hospital- 150 beds

Aisyah.K(2007)

One off design, generic brief for 150 bed hospital
Low rise sprawling and interconnected corridors
Courtyards, gardens, wide corridors, wide overhang
Sun shading screen, overall natural ventilation and air conditioning at clinical areas

NEW DISTRICT HOSPITAL (CUSTOMISED)



Jempol Hospital, Negeri Sembilan



RECENT HOSPITAL ARCHITECTURE 2005



Post modern cum tropical architecture
Interior, Courtyard with landscape gardens
Colour scheme, better finishes

RECENT HOSPITAL ARCHITECTURE 2005



SETIU HOSPITAL, TERENGGANU (PAB, JKR)

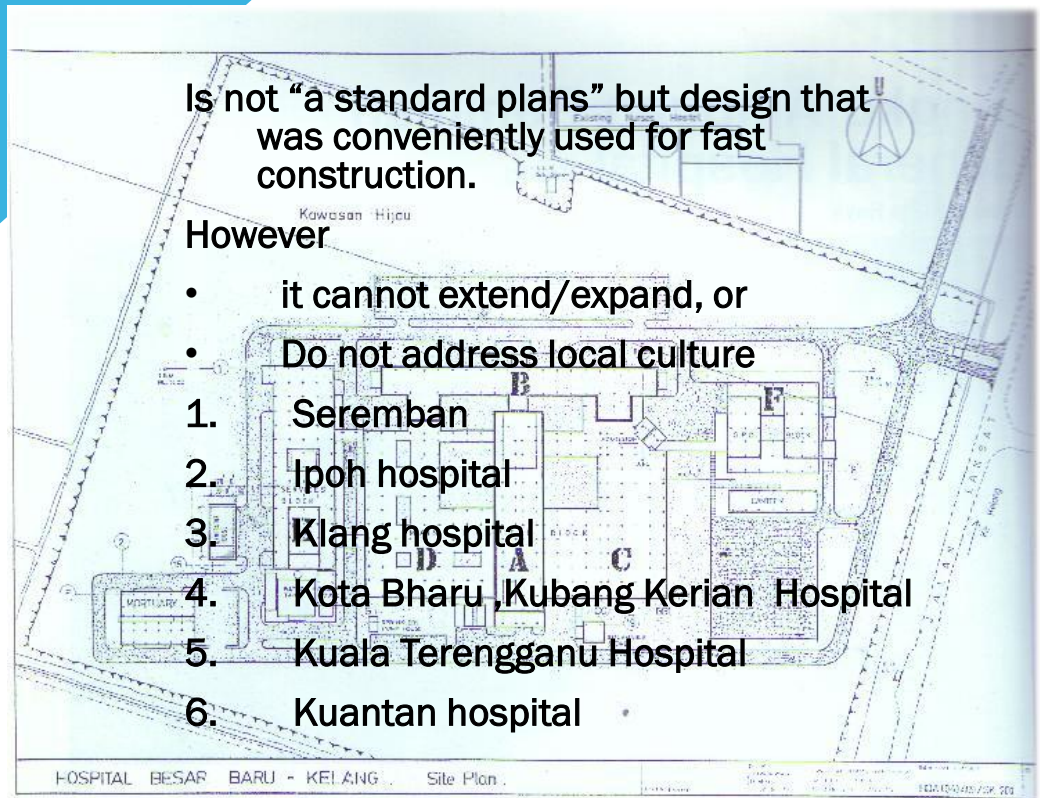
GENERAL HOSPITALS

Healthcare facilities design

Is not “a standard plans” but design that was conveniently used for fast construction.

However

- it cannot extend/expand, or
 - Do not address local culture
1. Seremban
 2. Ipoh hospital
 3. Klang hospital
 4. Kota Bharu, Kubang Kerian Hospital
 5. Kuala Terengganu Hospital
 6. Kuantan hospital



STATE HOSPITALS (70-80S)

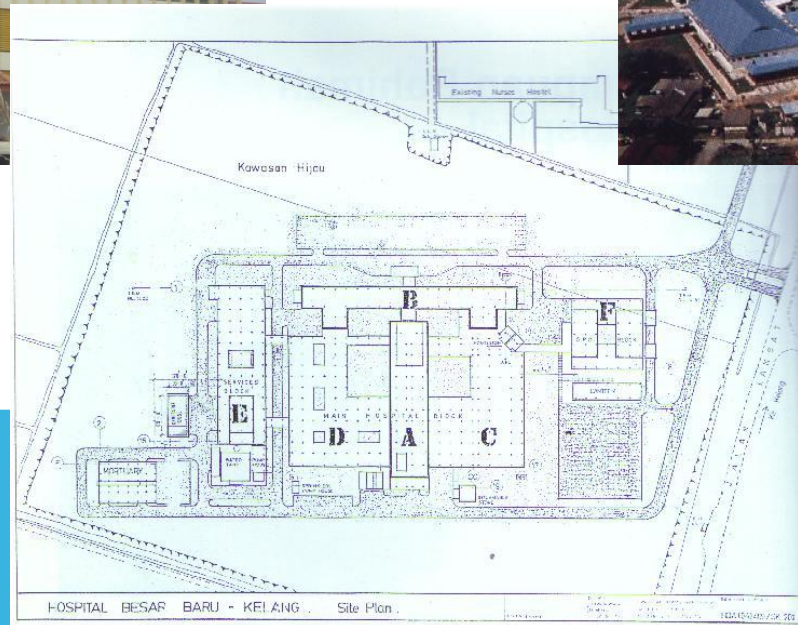


Kuala
Terengganu
Hospital
800 beds



Kuantan
Hospital
800 beds

Typical Layout plan
T-Shape tower
On Podium



REDEVELOPMENT HOSPITAL PROJECT - MID 90S

Kota Bharu
Hospital



Melaka Hospital
Sarawak General Hospital
Taiping Hospital
Muar Hospital
Kajang Hospital
Kangar Hospital
Kota Bharu Hospital
Sultanah Aminah Johor Bharu
Hospital
Queen Elizabeth Hospital, KK
Sg.Petani Hospital

..more

Labour Delivery and Ward Block
Room addition Sultanah Aminah
Hospital, Johor Bharu

EVOLUTION OF PUBLIC
HEALTHCARE FACILITIES DESIGNS
TO HEALTH TREND IN MALAYSIA-
NMN

REDEVELOPMENT HOSPITAL PROJECT - LATE 90S

Ambulatory Care Centre (ACC) establishment at State hospitals



Kuantan Hospital

EVOLUTION OF PUBLIC
HEALTHCARE FACILITIES DESIGNS
TO HEALTH TREND IN MALAYSIA-
NMN

UPGRADING OF HOSPITAL S – 9TH -10TH MALAYSIA PLAN



Women & Children
block, Seremban
hospital
(Majubina website)

**WOMEN AND CHILDREN HOSPITAL to
STATE HOSPITALS**

**MPONENT (OT, WARDS, ACC
BLOCK,etc) to existing hospitals**



Women & Children
block, Kuala Lumpur
Hospital
(internet)

EVOLUTION OF PUBLIC
HEALTHCARE FACILITIES DESIGNS
TO HEALTH TREND IN MALAYSIA-
NMN

TERTIARY CARE SERVICE FACILITIES

Healthcare facilities design

**Centralised,
decentralised,
network,
Changeable
Medium to high rise**

SPECIALIST HOSPITALS

Healthcare facilities designs



**From larger hospitals
to smaller
intensive and
acute hospitals
Patient Focus Care
Towards IT**

LARGER HOSPITALS

Kuala Lumpur Hospital
3000 beds

MA 98



Sprawling, low rise Le Corbusier style architecture with
Large overhang, wide corridors, deep fenestration
Off concrete construction, ramps and daylight

EVOLUTION OF PUBLIC HEALTHCARE FACILITIES DESIGNS
TO HEALTH TREND IN MALAYSIA-NMN

1ST PAPERLESS HOSPITALS



Selayang Hospitals 800 beds
Medium Rise Sprawling Tropical Architecture
(Radicare Sdn Bhd)


CUSTOMISED-ONE OFF HOSPITALS



Hospital Putrajaya,
200 beds (IT hospital)

ADDITIONAL REQUIREMENTS FOR POST 2006 DESIGNS

Healthcare facilities designs



Inclusive Design
**Green/low energy-
passive design
consideration**

Seismic consideration

**Use of IBS in the
construction**



GENERAL HOSPITALS

FROM LARGER HOSPITALS TO
SMALLER INTENSIVE AND ACUTE
HOSPITAL TOWARDS ITS
PATIENT FOCUS CARE

RECENT HOSPITAL ARCHITECTURE 2005

Post modern tropical architecture
with wide overhang, high tech
covered drop off point
Large lobbies, corridors
Short walking distance
Energy conscious
Daylight, natural ventilation
Courtyard and landscape gardens
Better finishes

Patient focus
THIS

Architect & Medical Planning :
Perunding Alam Bina Sdn Bhd



TEMERLOH HOSPITAL
450 beds
Opens 2004

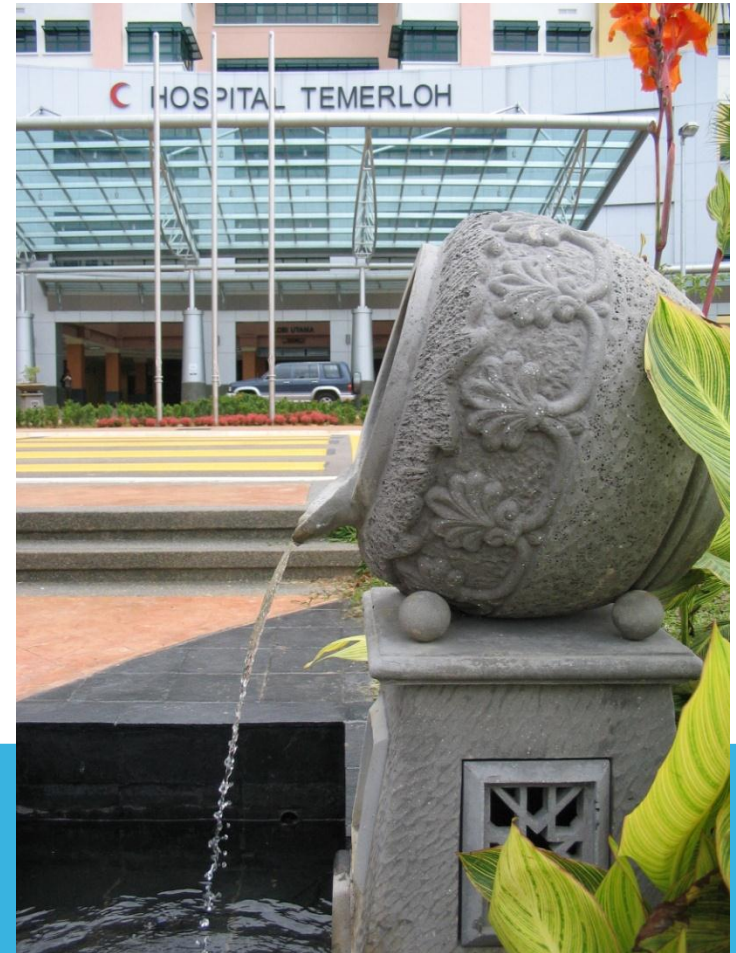
RECENT HOSPITAL ARCHITECTURE

Landscape as integral, enhancing component of the hospital



TEMERLOH HOSPITAL

**Architect & Medical Planning :
Perunding Alam Bina Sdn Bhd**



RECENT HOSPITAL ARCHITECTURE



Aisyah.K (2007)

Ampang Hospital

450 beds (Itaac Architects Sdn Bhd)

Deep plan, tight site, medium rise,
Pitch roof , short distance, daylight, courtyards



EVOLUTION OF PUBLIC HEALTHCARE FACILITIES DESIGNS
TO HEALTH TREND IN MALAYSIA NMN

RECENT HOSPITAL ARCHITECTURE



Aisyah.K (2007)



Aisyah.K (2007)

Ampang Hospital

Atrium, lobby of glass and steel
Landscaped garden

RECENT HOSPITAL ARCHITECTURE



modern, use of materials and forms to reflect technological advances. Use of large central courtyard for daylight, ventilation and focal point. CTH

**Sultan Ismail Hospital
(Pandan Hospital) Johor Bharu, Johor
(600 beds) Partly operationalised**

GDP Architects, Medical Planning: PAB



**SULTAN ISMAIL HOSPITAL (PANDAN HOSPITAL) JOHOR BHARU, JOHOR
(600 BEDS) PARTLY OPERATIONALISED
GDP ARCHITECTS, MEDICAL PLANNING: PAB**

RECENT HOSPITAL ARCHITECTURE

Serdang Hospital 500 beds

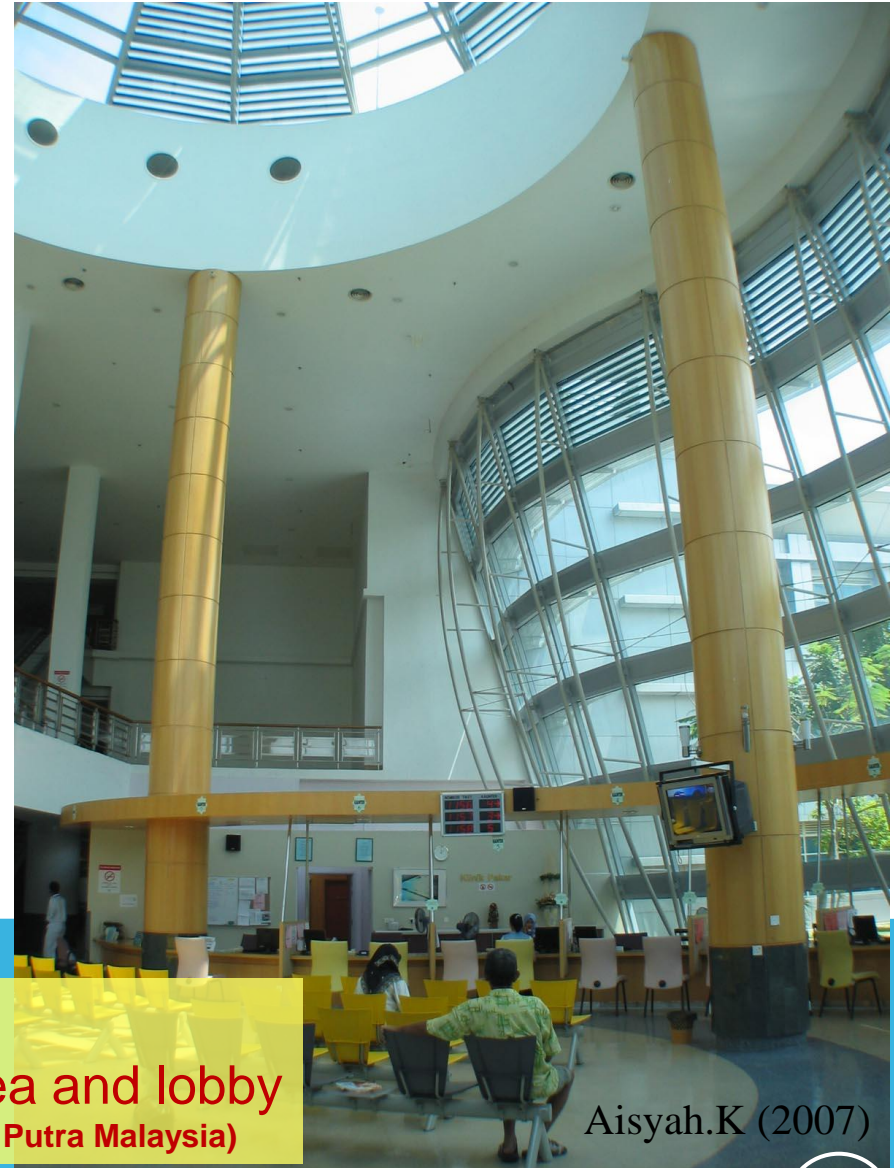
First steel
composite hospital
in the country.
(Outpatient
Entrance)



Aisyah.K (2007)

RECENT HOSPITAL ARCHITECTURE

Atrium / Spacious Lobby and
waiting area
Plenty of sunshine/day light
Extensive gardens
Customised design
Interiors



Serdang Hospital
Outpatient waiting area and lobby
(Teaching hospital for University Putra Malaysia)

Aisyah.K (2007)

RECENT HOSPITAL ARCHITECTURE

Concourse/ Lobby
Shops/Cafeteria
Public Amenities
Main Entrance
Natural Ventilation



Aisyah.K (2007)

EVOLUTION OF PUBLIC HEALTHCARE FACILITIES DESIGNS
TO HEALTH TREND IN MALAYSIA-NMN

RECENT HOSPITAL ARCHITECTURE

Sg Buloh Hospital
600 beds
Traumatology



Aisyah.K (2007)

SPECIAL INSTITUTION

Healthcare Facilities Design

Throughout the ages

History brought along

Psychiatry/mental hospitals of Bahagia in the Northern region and Permai in the Southern region of the peninsular. Sabah and Sarawak each has its own facilities.

Infectious disease-Leprosy had its own centre being the oldest in the country in Sg.Buloh and so as the

Respiratory Centre or Tuberculosis Unit in Kuala Lumpur Hospital

Medical research institution is the oldest

Other institution presently emerge is Centre of Excellence such as the Heart Institute, The Cancer Institute and the latest The Rehabilitation Hospital

MEDICAL RESEARCH INSTITUTION



SPECIAL INSTITUTIONS



Radiotherapy Unit, HKL

Le Corbusier style Modern
Architecture
ABM



Cardio Thoracic Unit

Tropical Architecture
PAB



Proposed National
Cancer Centre

NATIONAL CANCER INSTITUTE

High tech
Energy conscious
Daylight
Sustainability
Healing environment
NCI (National Cancer Institute) - As above
but linear
development due to
site constraint



Perunding Alam Bina Sdn,Bhd

PRIVATE HEALTHCARE FACILITIES

Healthcare facilities design

From history of Chinese hospitals for the poor, the estate hospitals and the missionary hospitals

Catering for company personnel and foreign expatriates

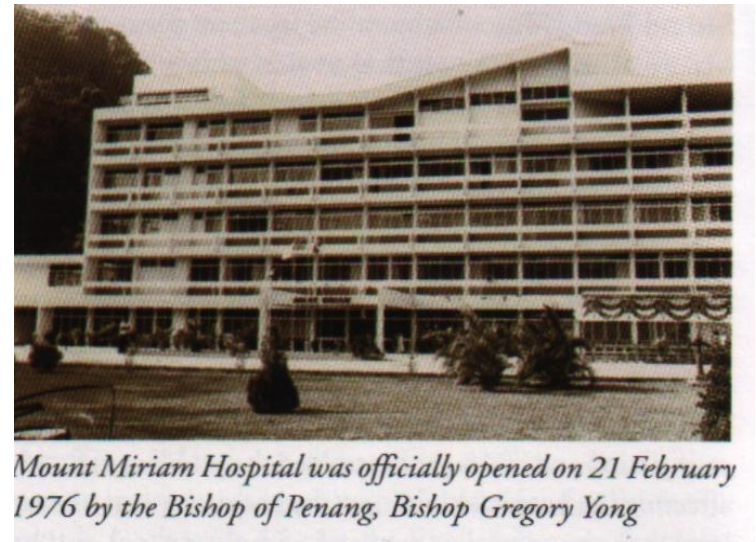
..now Medical Tourism beyond Asia

PRIVATE SECTORS IN THE INDUSTRY



Island Hospital, Penang

Upgrading and expansion



Mount Miriam Hospital was officially opened on 21 February 1976 by the Bishop of Penang, Bishop Gregory Yong

Miriam Hospital, Penang

PRIVATE SECTORS IN THE INDUSTRY



Mahkota Medical Centre,
Melaka



Damansara Specialist Centre

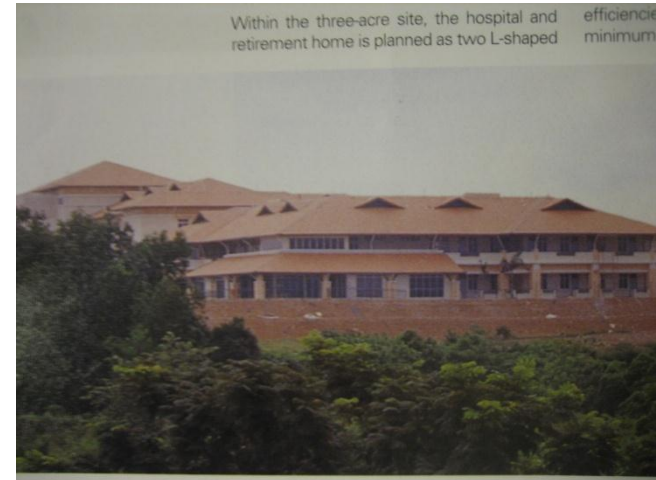
Tower and podium, atrium/lobby, cafeteria, shops,
Services Outpatient (general and specialist) and Inpatient

LONG TERM CARE

HEALTHCARE FACILITIES DESIGNS

New , One Off and
Readaptive reuse to
customise building
typology

HOME, PALLIATIVE & TERMINAL CARE FACILITIES (NON-GOVERNMENT)



Strand Hospital and Retirement Home

Non Standard design, governed by Private Hospital Act (then) and now Private Healthcare Facilities and Services Act



IN SUMMARY

HEALTHCARE FACILITIES DESIGNS


SUMMARY



Throughout the ages, healthcare architecture is synonymous to clinical/medical planning requirements **first** prior to positive enhancement towards healing environment, passive energy or value added amenities.

The physical make up on each of the facilities, i.e. structural grid, choice of structure, space configuration, materials or finishes is wrapped around the provision of needs and balance to cost.

SUMMARY



The short study shows 3 distinct style of architecture adopted within the period based on rural or urban location i.e. (contextual)

- The tropical simple architecture based on traditional Malay house on stilt or raised above ground
- Post modern /classical cum art décor cum colonial architecture with heavy masonry base
- High-tech, glass and steel cladding light architecture of robotic and automation

SUMMARY




Generally almost all designs have
Courtyards, gardens, access to the
outside, thin configuration for
wards and deep plans for
Diagnostic and Treatment zones

All entrances are distinct and
accessible

All facilities were redecorated by staff
as they use to do upon occupying.

SUMMARY



Whether it is high-rise, medium rise or sprawling pavilion, design of inpatient areas had changed many times to provide the patient with better environment, shorter travel distance to treatment and amenities, within affordable space, cost and priorities

SUMMARY



Procurement method has direct implication on the design choice.

Complex design usually comes as a lump sum in either turnkey or design & built

Generally :

- New Standard plans – conventional
- Refurbishment - conventional
- New One Off design – Turnkey, Design and Built, Negotiated, Public Finance Initiatives, Public Private Partnership.

THE CHALLENGERS TO HEALTH AND FACILITIES TO MATCH

Healthcare facilities design

Among others

Infectious Diseases

Emerging Disease to facility design

Geriatric /Elderly Facilities

Green rating/
material/Sustainability/ Life Cycle
Cost

Flexible architecture

Quality

Maintenance

CHALLENGERS TO SUSTAINABILITY OF HUMAN RESOURCE

Healthcare Facilities Design

**Turn over of staff at
workplace with
experiences**

**Training facilities for
specialisation few and
inconsistent**

**Career path for those
interested unclear**

Dynamic, volatile

IN CONCLUSION

HEALTHCARE FACILITIES DESIGN FOR MALAYSIA

FROM 1st Malayan Plan in 1957

to the 9th Malaysian Plan (2006-2010) in the
realisation of Vision 2020 and now

The 10th Malaysian Plan (2010-2015.....)
Malaysia is to quickly transformed....

ON FLEXIBLE ARCHITECTURE

Despite New One Off Designs that customise needs and demands of a particular hospital, .."Standard Plans" had played and will continue to play a very important role in the development of healthcare infrastructure to the population.

While One Off Designs addressed the locality identity and the pressure of today's technology demand generally in the urban areas, "Standard Plans" may continue to be important for rural clinics, health post, or dispensary i.e. in remote areas where infrastructure is a problem, through standardized components or easy assembly of the components by locals.

ON FLEXIBLE ARCHITECTURE.....

As encouraged to the use of IBS technology and method of construction, Standard Plans can be and should be innovatively designed as a flexible smaller modules so as to be environmental friendly to where it will be sited, without the need to cut and fill the site nor cutting down trees to provide space for its erection.

Standards design as smaller modules of clinically tested, may be synthesised as One Off Designs akin to its site, environment and locality.

One Off Designs, Type Designs and Standard plans have be to reviewed constantly not only on its physical design and requirements of spaces but also to address the socio-cultural values as envisioned in Vision 2020 for a caring society.

ON HUMAN RESOURCES

However, due to inadequacy of qualified human resources in healthcare facility planning and design, the Ministry of Health Malaysia had initiated on generic briefs as basis for hospitals and health centres as the brief of requirements for the volatile industry...

that too require constant reviewing , to upkeep with medical discovery and technology and other emerging challenges

Training in healthcare facilities/hospital planning ,design and maintenance need to be carried out as a ritual/tradition/induction for all new staffs (for all disciplines) involved not only in the process but also in the operation and evaluation,

ON QUALITY

For architects and planners on the job, ...

.....do plan and design the projects entrusted to them with a conscience....try not to keep to the minimum standards available or copy from available 'standard drawings' or 'standard details' to embark on a new or upgrading projects without analysing its appropriateness.

We need to constantly learn the bigger picture of health and its implication in order to place whatever we are dutifully assigned.

IN HEALTHCARE FACILITIES DESIGN FOR SUSTAINABILITY..

Malaysia like other countries are moving forward...the Ministry of Health Malaysia had gone further ahead with the Vision towards

Smaller Hospital

Emphasis on acute care

Emphasis on Ambulatory Care

Network of Hospitals

IT Ready

Promote wellness

Smart and intelligent
environment/green

Customer focused

People and community friendly

Flexible & Caring

Accessible, Integrated ,
Affordable.....more

EVOLUTION OF PUBLIC HEALTHCARE FACILITIES DESIGNS TO HEALTH TREND IN NATION BUILDING

THANK YOU
TERIMA KASIH



Norwina Mohd Nawawi
International Islamic University Malaysia
27th June 2012

REFERENCES

- Jim Baker.(2005).*Crossroads-A popular History of Malaysia and Singapore*. Singapore. Times Editions Marshall Cavendish.
- Tan Sri Dato' Dr Abu Bakar Dato' Sulaiman et al (2000).*Health in Malaysia-Achievements and Challenges*. Planning and Development Division, Ministry of Health Malaysia.
- Dr. Amiruddin Hisan (19-20th June 2006). *Malaysia's Health: Transforming Healthcare Services Through ICT*. Inaugural meeting of the global alliance for ICT and development (ppt.pres)
- Medical & Health Works Branch.(1991) *Standard Buildings: Medical & Health Facilities*. Public Works Department (JKR) Publication.
- Public Works Department.(1989).*PWD Standard Buildings*. JKR Publication.
- Planning and Development Division, Ministry of Health Malaysia.(6th September 1986) *Health Facility Planning and Development in Malaysia*. Unpublished.
- Ministry of Health Malaysia.(Oct 1994) *Overview of Hospital Planning and Design & 7th Malaysian Plan*. Unpublished handout
- B.M.Kleczkowski et al (edit)(1985).*Approaches to Planning and Design of Health Care Facilities in Developing Areas* Vol 6. Geneva.WHO publication.
- Memperingati 123 Tahun JKR (Commerating 123 Years of JKR) 1872-1995*. JKR Publication in conjunction with PWD International Seminar "Reengineering PWD for the 21st Century" .14th- 15th December 1995.
- Planning and Development Division, Ministry of Health Malaysia.(August 1999) *Eight Malaysian Plan 2001-2005, Ministry of Health-Policies, Objectives and Strategies*. Unpublished.
- 2003 WHO Report (Malaysia)-pdf.file
- Ministry of Health Malaysia. 1990s *Perkhidmatan Rawatan Pesakit (Hospital)*.
- Planning and Development Division, Ministry of Health Malaysia.(March 1998) *Hospital Planning: Current Norms and Guidelines*. Unpublished
- PAM. Akitek Malaysia (MA) magazine, Pertubuhan Akitek Malaysia
- H.T.Ong (ed). (2004) *To Heal The Sick, The Story of Healthcare Doctors in Penang, 1786-2004*. Penang. Penang Medical Practitioners' Society.
- Architecture Malaysia. Journal of the Pertubuhan Akitek Malaysia, *Editorial*, Nov/Dec 1998, pg 6-11.
- Tan.E.K (1998)Architecture Malaysia, Journal of the Pertubuhan Akitek Malaysia, *Nucleus Concept Hospitals in Malaysia*, Nov/Dec 1998, pg 14-19.
- Architectural Network.(1998).Architecture Malaysia, Journal of the Pertubuhan Akitek Malaysia, *Project Gleneagle Intan Medical Centre,,* Nov/Dec 1998, pg 26-29.
- Perunding Alam Bina Sdn Bhd. (1998)Architecture Malaysia, Journal of the Pertubuhan Akitek Malaysia, *Project Hospital Melaka Redevelopment*, Nov/Dec 1998, pg 30-33.
- 9th Malaysia Plan.
http://hbm.com.my/hlm/Research/Economic_News/Malaysia/9mplan.pdf.
- Cawangan Bangunan. JKR Malaysia (1998).Architecture Malaysia, Journal of the Pertubuhan Akitek Malaysia, *Project The UKM Teaching Hospital*, Nov/Dec 1998, pg 34-39.
- Akitek Bersekutu Malaysia. (1998).Architecture Malaysia, Journal of the Pertubuhan Akitek Malaysia, *Radiotherapy Building*, Nov/Dec 1998, pg 40-43.
- Perunding Alam Bina Sdn Bhd (1998)Architecture Malaysia, Journal of the Pertubuhan Akitek Malaysia, *Project Strand Hospital and Retirement Home, Sg Petani Kedah*, Nov/Dec 1998, pg 44-45.
- Abdullah Bakri Berakan Sdn. (1998)Architecture Malaysia, Journal of the Pertubuhan Akitek Malaysia, *Project Medical Centre, Siah Alam*, Nov/Dec 1998, pg 46-47.
- Perunding Alam Bina Sdn Bhd (1998)Architecture Malaysia, Journal of the Pertubuhan Akitek Malaysia, *Project Damansara Specialist Hospital*, Nov/Dec 1998, pg 48-49.
- Majalah Arkitek (1998)Architecture Malaysia, Journal of the Pertubuhan Akitek Malaysia, *Practice Profile Perunding Alam Bina Sdn Bhd*, Nov/Dec 1998, pg 54-57.
- .Kumpulan Karim-Lai. (1991), Majalah Arkitek, MA, Mar/Apr 1991, *Teluk Intan District Hospital*, Vol 3, No.2, pg 6, 7&9.
- Perunding Alam Bina. (1991),Majalah Arkitek, MA, Mar/Apr 1991, *USM Teaching Hospital*, Vol 3, No.2, pg 11, 13 & 15.
- Perunding Alam Bina. (1991). Majalah Arkitek, MA, Mar/Apr 1991, *The Cardio Thoracic Centre*, Vol 3, No.2, pg 17, 19 & 20.
- Kumpulan Senireka.(1991).Majalah Arkitek, MA, Mar/Apr 1991, *Subang Jaya Medical Centre*, Vol 3, No.2, pg 23-25.
- Akitek Bersekutu Malaysia.(1991).Majalah Arkitek, MA, Mar/Apr 1991, *Children's Hospital,,* Vol 3, No.2, pg 27-29.
- Jabatan Kerja Raya (1991).Majalah Arkitek, MA, Mar/Apr 1991, *Tengku Ampuan Rahimah General Hospital Klang,,* Vol 3, No.2, pg 31-32..
- Majalah Arkitek, MA, Mar/Apr 1991, YTL Since 1955 (advertisement), Vol 3, No.2, pg 34,35,36,37,38,40,41,42,44,45, 48 & 49.
- SN Low Associates (1994). Majalah Arkitek, MA, November/ December 1994, *Mahkota Medical Centre, Melaka*, Vol 6, No.6, pg 21-31
- Medical & Health Works Branch. (1991). *Standard Buildings, Medical & Health Facilities*. Public Works Department Malaysia (Unpublished)
- Norwina. M.N (2004).*The Significance Of Design Evolution In The Primary Health Care To Health Trend Of Malaysia*. Paper presented at the 24th UIA PHG International Seminar, Sao Paolo, Brazil 30th May 2004 (Unpublished)
- Norwina.M.N (2001). *Physical Development of Public Hospitals in Malaysia*, *Architecture Forum III*, 32nd IHF Conference in Hong Kong 15-18th May 2001. (Unpublished).
- Contribution from Ar.Chiam Tat Hong of Perunding Alam Bina for images and short write up of hospital projects (Nov 2007).
- Contribution from student Aisyah Khalid , IIUM for images of new hospitals taken for her design thesis case studies (Nov 2007)
- Cheah Boon Kheng. (ed)(2001). *Early modern history 91800-1940). Diseases and Health Care Services*. Page 122-123 The Encyclopedia of Malaysia.Kuala Lumpur. Archipelago Press
- Vavili. F (2005). *Hospital Building from Temple to Mall* at http://www.uia-public-health-group.org/Seminars/Istanbul_2005/presentaties/Vavili/UIA_Congress_05.pdf
- http://www.who.int/globalchange/publications/climatefootprint_report.pdf
- <http://www.silb.org/news/171-SIIB/version/default/part/AttachmentData/data/Sweitzer%20Gillpin%20and%20Frampton.pdf>