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A CURATION OF HOPE: MALAYSIA'S EAST COAST REGIONAL CANCER CENTRE

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ABSTRACT

Malaysia's East Coast Regional Cancer Centre (ECRCC) endeavours to establish a novel facility dedicated to addressing the comprehensive needs of cancer patients and their families, extending beyond mere medical treatment. Recognising that patients require not only information about their treatments but also emotional support, practical guidance, and a supportive community of individuals going through similar experiences, this centre aims to fulfil these requirements. Through the design of a nurturing environment of hope, ECRCC seeks to provide essential emotional and psychological support to cancer patients and their families. Functionally, the design requires meeting three noble objectives, i.e. (i) to meet the needs of cancer care for the East Coast region where there is a clear lack of cancer treatment services; (ii) to establishment focus on the distinct needs of cancer patients and their relatives from East coast region compassing the state of Kelantan, Terengganu, Pahang and northern Johor; and (iii) to act as a one-stop information centre for cancer thus reduce misinformation, educate and raising awareness on cancer and cancer treatment to the region. Exploratory research from design precedent, technical case studies and a detailed understanding of the operational requirements of the centre were conducted. The ECRCC aspires to establish a compassionate and well-equipped space and facilities that attends to the multifaceted needs of cancer patients and their families, fostering emotional well-being, offering accurate information, and creating a supportive community.

Keywords: Cancer Centre, Compassionate Design, Therapeutic Environment

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INTRODUCTION

"And you see the earth barren, but when We send down upon it rain, it quivers and swells and grows living things of every delightfully beautiful kind." Surat Qaf 50:7

WHO (2022) announced that non-communicable diseases (NCDs) account for around 41 million deaths per year, making up 74% of all global fatalities. The leading NCDs, among others, include cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes. In Malaysia, approximately 8 million adults live with hypercholesterolemia, 6.4 million with hypertension, 4.1 million with obesity, and 3.9 million with diabetes (NHMS, 2019). The likelihood of developing cancer before the age of 75 years is estimated to be 1 in 7 Malaysians. Amidst the COVID-19 crisis, around 49,000 new cancer cases were projected in Malaysia for 2020, with an expected annual increase to more than 66,000 new cases by 2030 (IARC, 2020). Though Malaysia has made progress in achieving universal coverage of cancer care through its health system, effective cancer control remains challenging, impacting thousands of lives, families, and communities. Addressing cancer necessitates tackling late disease presentation, an ageing population, rapid urbanisation, sedentary lifestyles, and unhealthy diets. The prevalence of advanced-stage cancer due to late presentation has been a barrier for decades. In the 1990s, the Penang Cancer Registry revealed that 53% of cases were diagnosed at Stage III and IV, leading to delays in diagnosis and treatment, resulting in poorer outcomes and low survival rates for certain cancers (Lim. G, 2006).

Architecture, on the other hand, is a process of building ideas through design to bring the reality of the challenging phenomena of mankind and the environment from womb to tomb with designed supportive facilities. This research, as a design thesis, aims to resolve these issues through the meaningful use of architectural design solutions based on evidence.

ISSUES AND PROBLEMS

a. Rising Number of Cancer Patients on the East Coast Peninsula Malaysia

The number of cancer cases is on the rise throughout Malaysia, particularly the cancer cases from the East Coast region (Figure 1). However, there is a lack of comprehensive cancer treatment centres on the east coast. This forces many patients and their families to travel to government hospitals, generally to Hospital Kuala Lumpur (HKL) and the National Cancer Institute (IKN), for their specific treatment. The International Agency for Research on Cancer (WHO) predicts a 100% increase in cancer deaths, projected an estimated 57.3k deaths by 2040 compared to 29.5k in 2020. Currently, cancer patients from the east coast seek treatment at HKL or University Science Malaysia Medical Centre (HUSM), Kota Bharu). At the same time, those from the north region are referred to either Hospital Pulau Pinang or HKL. The data reported by the Malaysia Ministry of Health (MoH) in the National Cancer Registry Report (NCRR) 2012 – 2016 indicates the East Coast region experiences the highest increment of cancer ASR. Yet, there are not enough cancer treatment centres catering to this area.

State	2007-2011		2012-2016		Percentage increment			AVG BY REGION
	Male	Female	Male	Female	Male (%)	Female (%)	AVG	
Central	Perlis	405	495	445	602	9%	18%	13%
	Kedah	2,774	3,565	2,944	3,815	6%	7%	6%
	P.Pinang	5,245	6,085	4,807	5,903	-9%	-3%	-6%
	Perak	4,465	5,504	5,627	6,578	21%	16%	18%
	Selangor	6,261	8,484	5,972	8,812	-5%	4%	-1%
Central	W.P Kuala Lumpur & Putrajaya	2,277	3,307	3,319	4,128	31%	20%	26%
	Negeri Sembilan	1,917	2,528	2,227	2,989	14%	15%	15%
Southern	Melaka	1811	2,214	2,395	2,847	24%	22%	23%
	Johor	7,202	8,110	7,408	9,026	3%	10%	6%
East Coast	Kelantan	2,105	2,281	2,675	3,213	21%	29%	25%
	Terengganu	1,668	1,977	1,953	2,280	15%	13%	14%
	Pahang	2,193	2,499	2,774	3,188	21%	22%	21%
Eastern	Sarawak	4,549	5,185	4,869	5,428	7%	4%	6%
	Sabah	3,522	4,045	4,006	4,812	12%	16%	14%
	W.P	53	51	84	112	37%	54%	46%

Figure 1: Number of cancer patients
(Source: National Cancer Registry Report 2012 – 2016)

b. Anxiety and depression of cancer patient and their caretaker

Anxiety is acknowledged as a common psychological response among those who care for cancer patients (Figure 2). Apart from the physical effects of cancer treatment on the patient, it can also profoundly impact the caregiver's mental and emotional well-being. The weight of the cancer burden and the impending battle can be particularly overwhelming, leading to feelings of sadness and depression. Such emotional challenges not only influence the patient's treatment engagement and outcomes but can also affect the mental health of caregivers providing support to cancer patients. (Colleoni, 2014).



Figure 2: Diagram showing challenges faced by cancer patients
(Source: National Cancer Registry Report 2012 – 2016)

In Malaysia, a prevailing belief persists that a cancer diagnosis equates to a grim outcome. Awareness regarding cancer revolves around two key aspects:

- (1) Knowing where to seek treatment and
- (2) Having knowledge about adopting a healthy lifestyle.

Unfortunately, many Malaysians remain fearful of cancer, and the general public's understanding of common cancer signs and symptoms remains inadequate (Mastura, 2022). This lack of awareness leads to cancer patients and caregivers often receiving misinformation and falling prey to unfounded beliefs and practices that hinder their recovery process (Ajith. et al .2023). Despite remarkable progress in cancer research and treatment, there is still a prevalent fear of seeking appropriate medical care. Adding to the problem, unethical traditional and alternative treatments perpetuate misinformation among individuals in the local society.

RESEARCH AIM

This design research aims at creating a physical environment that empowers individuals to combat cancer. Having an appropriate program of care and a supportive environment will improve their mental health and boost their spirit to fight cancer.

RESEARCH OBJECTIVES

- i. To apply architectural solutions that address the needs of cancer patients and their relatives.
- ii. To integrate biophilic solutions that have a positive impact on mental health.
- iii. To promote healthy lifestyles and cancer awareness among the public through architecture

METHODOLOGY

- i. There are two methods used in this research where each method has its distinctive target and outcome.
- ii. Through qualitative method, interview sessions were done with Ministry of Health Planning officer, Hospital Kuala Lumpur's Specialist, and Oncologist, Hospital Sultan Abdul Aziz Shah's laboratory technician and pharmacist from Hospital Sungai Petani.
- iii. Information about cancer patients were collected through their videos and writing of their experiences in cancer societies' social media like Majlis Kanser Negara (MAKNA) and National Cancer Society Malaysia (NCSM).
- iv. Field observation were conducted through brief visit of Hospital Kuala Lumpur oncology unit. This is a process of understanding the operation and planning relationship of spaces between department within hospital setting.

SCOPE AND LIMITATIONS

- i. Most data collected and research in MoH facilities require permission through the National Medical Research Register (NMRR) application.
- ii. Due to the time duration to get NMRR approval, most cancer patients' data for this research are mainly acquired through the deductive method from social media among cancer patients or their relatives who share their experiences going through cancer or caring for their family who is fighting cancer.
- iii. Other Secondary data are acquired from published research papers especially post-occupancy evaluation research on cancer facilities and hospitals.
- iv. Some information is confidential, and thus the information provided from are generalised.

WHAT IS CANCER?

World Health Organisation (WHO) classifies cancer as a noncommunicable disease (NCD). Cancer can manifest in various parts of the body, necessitating different types of treatments (Figure 3). Cancer has the potential to develop in any organ or tissue and can affect individuals from diverse racial, ethnic, and age groups (WHO). According to NCRR 2012-2016, there were a total of 115,238 new cancer cases registered between 2012 and 2016, reflecting an 11.3% increase compared to the period from 2007 to 2011. Cancer accounted for 12.18% of all deaths in MoH hospitals, compared to 9.54% in 2004 (NCRR 2012-2016).9.54% in 2004. Figure 4 indicates the stages of Cancer treatment.

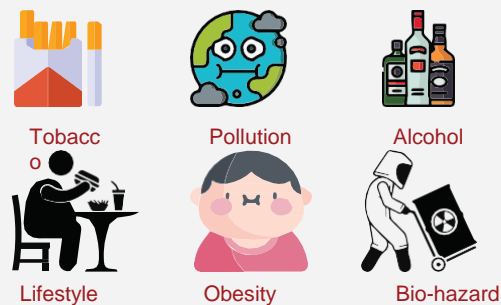


Figure 3: Some common causes of cancer. (Source:)

STAGES OF CANCER TREATMENT

Step 1: Prevention & treatment planning

Step 2: Diagnosis, staging & early detection

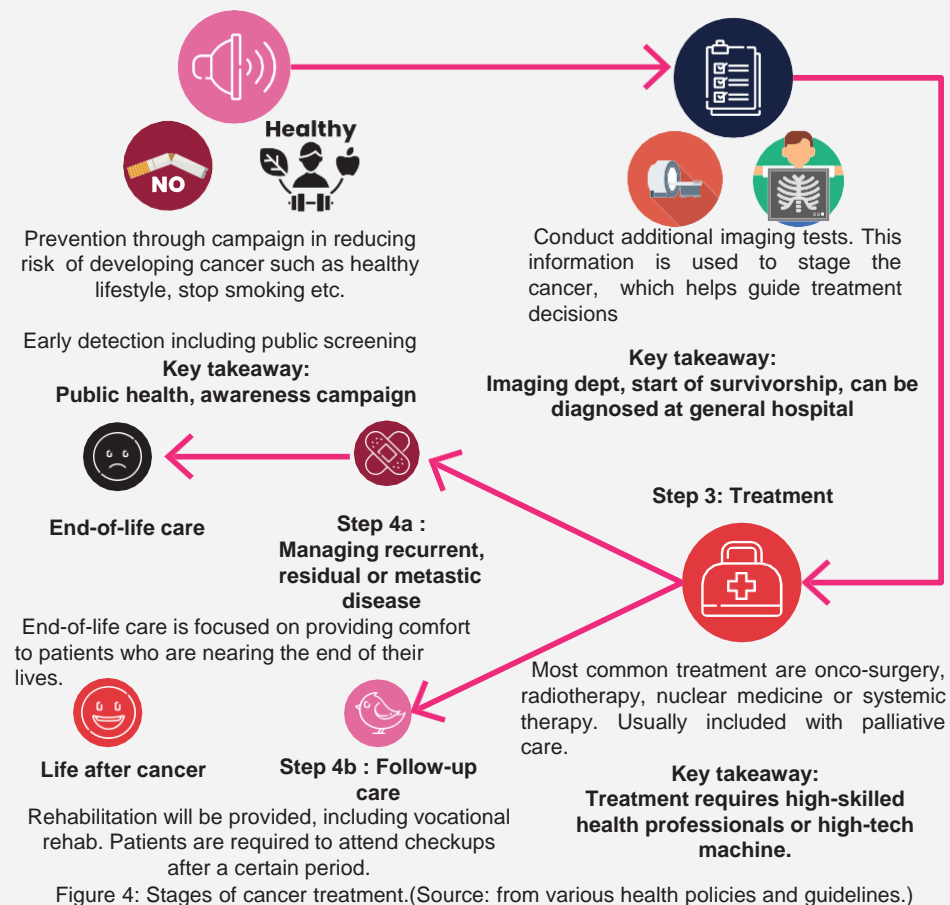


Figure 4: Stages of cancer treatment.(Source: from various health policies and guidelines.)

MALAYSIAN HEALTHCARE SYSTEM

Malaysia's healthcare system is a mixed system, encompassing both public and private healthcare services. The MoH is responsible for supervising the public healthcare system. In contrast, the regulation of the private healthcare sector is shared between the MoH and the Ministry of Domestic Trade and Consumer Affairs to regulate healthcare delivery.

Universal healthcare coverage is provided to all Malaysian citizens and permanent residents through the public healthcare system, which comprises an extensive network of hospitals, clinics, and health centres offering a wide array of medical services. These services encompass preventive care, primary care, and speciality care, and they are funded through taxes and government subsidies (WHO, 2012)

Alongside the public system, Malaysia supports a thriving private healthcare sector. Privately owned hospitals, clinics, and medical centres cater to those who can afford their more expensive services.

The Malaysian healthcare system has earned recognition from the World Health Organization (WHO, 2012) as one of the world's best, with impressive health outcomes, high life expectancies and a relatively low infant mortality rate in the region.

In Malaysia, healthcare facilities are classified into different levels based on the level of care they provide and the types of services available. The classification system (Figures 5, 7 and 8) is the Malaysian Healthcare Facility Classification (MHFC) based on the Specialty & Subspecialty Framework of the Ministry of Health Hospitals Under the 11th Malaysia Plan (2016).

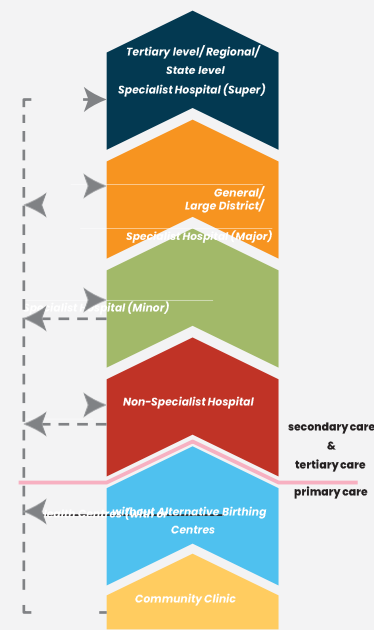


Figure 5: Malaysian Healthcare Facility Classification (Source: Specialty & Subspecialty Framework Of Ministry of Health Hospitals Under 11th Malaysia Plan. (2016)



Figure 6: MoH offices at Putrajaya



Figure 7: MoH clinic at Kuala Kangsar

THERAPEUTIC ENVIRONMENT



Figure 8 Therapeutic Environment

The quest for a therapeutic environment (Figure 8) i.e environment with nature was due to hospitals' association with industrial and antiseptic designs, where healthcare facilities are often viewed as negative spaces. Towards human-centred care, research by many researchers, including Jie Yin (2020), shows that biophilic environments and architecture can reduce tension and promote positive health and well-being effects.

Patients in healthcare facilities often experience anxiety and apprehension related to their health, safety, and social isolation. The complex environment of typical healthcare facilities can compound the traumatic situation, impacting patients' immune system and emotional well-being, thus hindering their recovery process. Researchers have identified four crucial factors (Verderber, S. 2010) that , when incorporated into the design of healthcare environments, can significantly improve patient outcomes :

- Reduce or eliminate environmental stressors, such as noise, congestion, odours, and pollution.
- Provide positive distractions, like nature views from patient rooms and the lobby, access to healing gardens, a chapel, or a meditation room, as well as artwork, music, pets, and other stimulating elements that promote a sense of well-being.
- Facilitate social support by creating spaces that encourage easy interaction among patients, such as non-fixed seating and round tables.
- Empower patients with a sense of control over their immediate surroundings, including lighting, noise levels, visual content, and the ability to locate desired areas.

The term "therapeutic architecture" has emerged as a response to the austere nature of contemporary treatment facilities. While architecture itself cannot heal, the thoughtful manipulation of space allows natural factors like sound, light, colour, privacy, views, and even smell to create a healing environment that can positively impact patients' physical and psychological healing. Beyond supporting advanced medical technology, patient safety, and quality care, healthcare facilities should be designed to provide a psychosocially supportive therapeutic environment for patients, families, and caregivers. This calming and therapeutic environment is essential throughout the entire duration of treatment, supporting patients until their complete physical and psychological recovery.

BIOPHILIC PRINCIPLES

Biophilic design offers various benefits, including stress reduction, enhanced creativity and mental clarity, improved well-being, and faster healing. As the global population increasingly urbanises, these advantages will become even more crucial. Over the years, theorists, research scientists, and design practitioners have endeavoured to determine the specific aspects of nature that most positively influence our satisfaction with the built environment (Browning, 2014).

Biophilia refers to the innate biological connection that humans have with nature (Browning, 2014). It explains the attraction to elements like crackling fires and breaking waves, how a garden view can boost creativity, why shadows and heights can both fascinate and frighten the human senses, and how companionship with animals or a leisurely stroll through a park can have restorative and healing effects. Researchers and designers have extensively studied the natural factors that impact our comfort within the built environment. Numerous scientific studies have been conducted in various settings, such as healthcare facilities, workplaces, children's spaces, and community areas, demonstrating the positive impact of biophilic design on human health and performance. The application of biophilic design in hospitals, for example, has shown fascinating results (Simona, 2018).

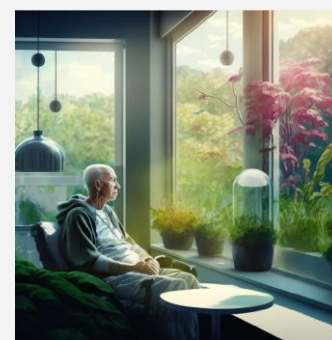


Figure 10 Patient View Biophilic Environment (Generated by Open AI)



Figure 9 Biophilic Environment (Generated by AI)

ENVIRONMENTAL FACTORS

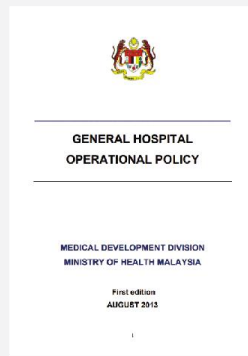
Environmental factors like commotion, crowding, odours, pollution, lighting, proportion, scale, and colours significantly influence the immediate atmosphere of a space. For instance, unpleasant odours can induce stress, while carefully chosen artwork and aesthetics can enhance a space's tranquillity and calming qualities. Conversely, difficulties in locating specific rooms or facilities can lead to anxiety or stress, and overcrowding can cause unease. The thoughtful consideration and implementation of these design elements can have life-altering outcomes for individuals using the space.

HEALTHCARE GUIDELINES

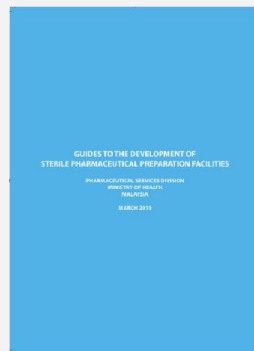
Many healthcare guidelines (Figures 11, 12, and 13) are available to assist with preliminary design, but a precedent study of physically built projects can improve outcomes.



Handbook of setting up private hospital



General Hospital Operational Policy



Guides to the development of sterile pharmaceutical preparation facilities



Departmental policy of pathology services

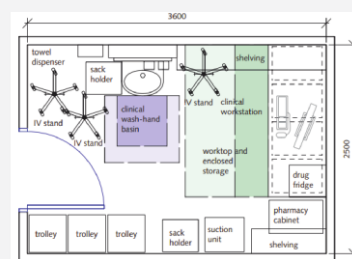


Figure 22 shows an example layout of chemotherapy preparation room in health building Note Series 02-Cancer care

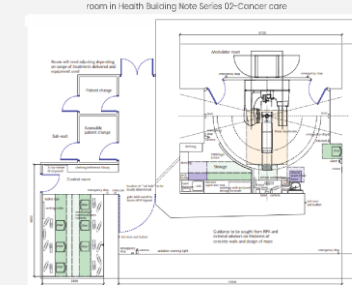


Figure 25 shows an example layout of UNAC room in health building Note Series 02-Cancer care



Figure 7 Consulting/transaction room double-sided access (option 1)

Figure 11 Ministry of Health Malaysia available guidelines.

Figure 12 Examples of design guides of Cancer care from the NHS guidelines

Table 3 shows all Health Building Note Series published by NHS available on their website.

Health Building Note number and series title	Type of Health Building Note
Health Building Note 00 – Core elements	Support-system-based
Health Building Note 01 – Cardiac care	Care-group-based
Health Building Note 02 – Cancer care	Care-group-based
Health Building Note 03 – Mental health	Care-group-based
Health Building Note 04 – In-patient care	Generic-activity-based
Health Building Note 05 – Older people	Care-group-based
Health Building Note 06 – Diagnostics	Generic-activity-based
Health Building Note 07 – Renal care	Care-group-based
Health Building Note 08 – Long-term conditions/long-stay care	Care-group-based
Health Building Note 09 – Children, young people and maternity services	Care-group-based
Health Building Note 10 – Surgery	Generic-activity-based
Health Building Note 11 – Community care	Generic-activity-based
Health Building Note 12 – Out-patient care	Generic-activity-based
Health Building Note 13 – Decontamination	Support-system-based
Health Building Note 14 – Medicines management	Support-system-based
Health Building Note 15 – Emergency care	Care-group-based
Health Building Note 16 – Pathology	Support-system-based

Figure 13 Health Building Notes Series of the UK National Health Service (NHS) from their website.

PRECEDENT STUDIES

National Cancer Institute, Malaysia

The National Cancer Institute (Figure 14) is a specialised medical institution established to offer comprehensive cancer treatment and care, addressing Malaysia's growing cancer-related needs. It is located at Precinct 7, Putrajaya, which is adjacent to Putrajaya Hospital. According to Perunding Alam Bina, the architect for the project, the building design prioritises modern features, energy efficiency, and an appealing environment. It aspires to be a leading centre for cancer treatment, research, education, and premier healthcare services in Malaysia. In summary, NCI shows what component is essential to a cancer centre, considering it is the national referral for cancer treatment facilities. NCI does not share operations and management with Putrajaya Hospital. However, the location of NCI eases the movement of cancer patients, health professionals and staff with Putrajaya Hospital.



Figure 14 National Cancer Institute, Putrajaya (Source: Perunding Alam Bina)

Other precedent studies (Figures 15a,15b,15c) include Maggie Centres UK, Clatterbride Cancer Centre, Liverpool, UK; Centre for Cancer Prevention and Support, Toronto, Canada.

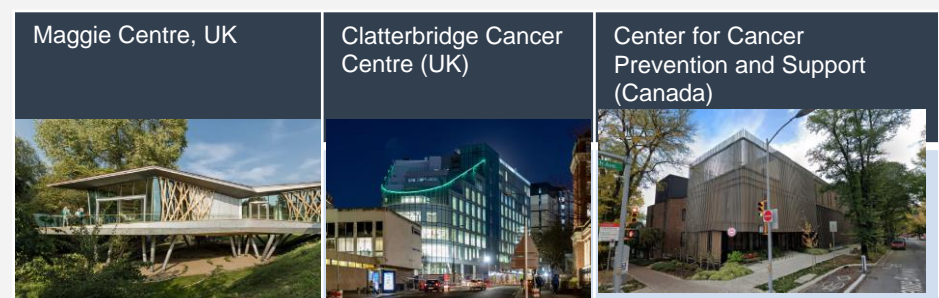


Figure 15a, 15 b, 15c Precedent Studies of Cancer Centre Source Literature Review, Online Conference proceeding

SITE LOCATION

The proposed site for East Coast Region Cancer Centre is located at Bandar Baru Kijal, Kemaman (Figure 16 and Figure 17). Kijal is located at Block 4 of Kemaman district, in the state of Terengganu, on the East coast of Peninsular Malaysia. Kijal is part of the first economic corridor within the Kemaman district, which includes Chukai, Kijal, Kemasek, and Kerteh. This corridor is elongated beside the beach coast of Kemaman district. On the east side of the proposed site, the town, Kijal, is located 2km from the South China Sea. On the west side of Bandar Baru Kijal lies Bukit Panjang and Bukit Kemuning. On the North side, Kijal town is still developing and growing towards Kerteh. Bukit Kemuning separates Kijal and Chukai on the south side. These towns are accessible through the arterial road of Chukai-Kerteh Road. In the future, there will be a high-speed rail station number 8 (Chukai), which will be located 20 minutes from Bandar Baru Kijal.



Figure 16: Location plan of Proposed site for ECRCC

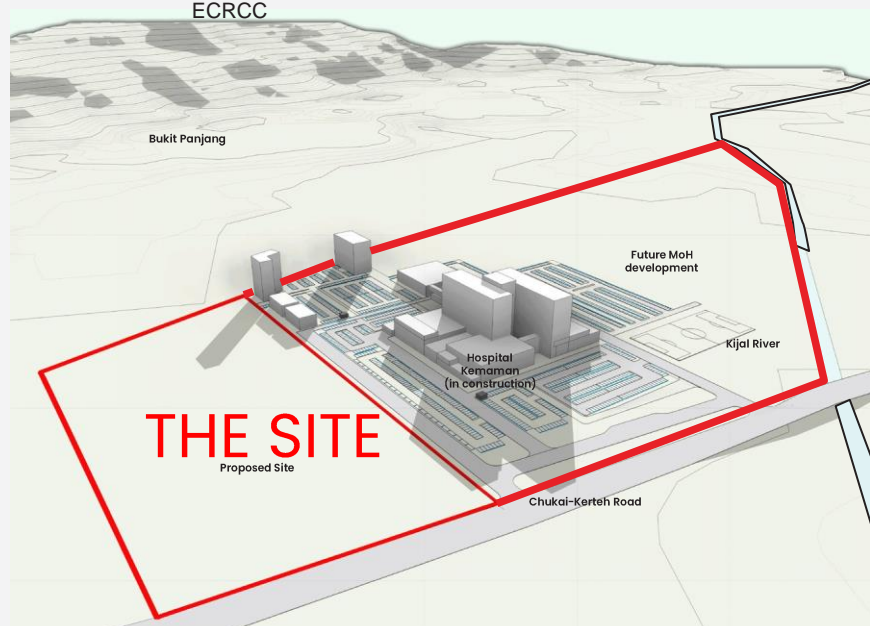


Figure 17: Aerial view of the proposed site for ECRCC

SITE JUSTIFICATION

1. Macro site selection
 - a. Highest ASR of incidence of cancer
 - b. Located approximately centre of east coast region
2. Micro site selection
 - a. Good accessibility
 - b. Nearby to general hospital proximity

SITE ANALYSIS AND SYNTHESIS

NEIGHBOURHOOD

A



Figure 18: Vocational college in Bandar Baru Kijal

B



Figure 19: Hypermarket and bowling centre

C



Figure 20: Shop-lot at Bandar Baru Kijal

1. Neighborhood
 - A. Analysis: Bandar Baru Kijal is a new town and has not fully developed. There is only a handful of developments, including a vocational college, hypermarket and bowling centre, and a terrace of shop-lots within the business area of this town (Figures 18. 19 and 20).
 - B. Synthesis: In future, this area will be developed into an international health tourism hub as planned by the government through Kemaman District Council. Other than institutional use, Bandar Baru, Kijal will have an increment of the population through housing development. Future commercial development also will increase economic activity in this area.

FEATURES AROUND SITE

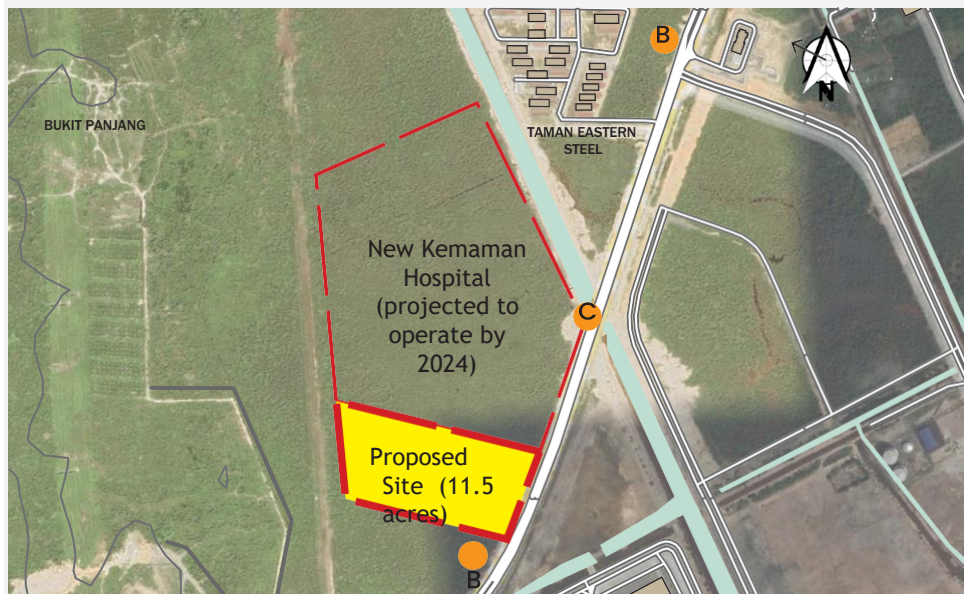


Figure 21: Proposed site location for ECRCC

1. Trees

- A. Analysis: There is an abundance of trees around the site. Most of the tree species are found at the seaside species, such as Rhu. There are also oil palm plantations located on top of Bukit Panjang (Figure 22).
- B. Synthesis: The site needs to be cleared first before construction.

2. Water Element

- A. There is also the presence of river flow located on the north side of the site, which is the Kijal river (Figure 23).



Figure 22: Forest at the Proposed Site



Figure 23: Kijal river near the proposed site.
Source: Google Street View

CLIMATE



Figure 24: Sun hours at Kijal, Terengganu.

Source: <https://weather-and-climate.com/average-monthly-hours-Sunshine-kijal-terengganu-my,Malaysia>

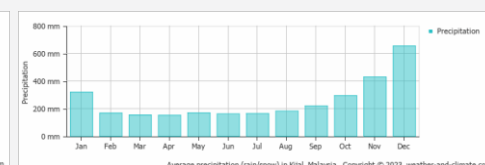


Figure 25: Average amount of precipitation at Kijal, Terengganu

Source: <https://weather-and-climate.com/average-monthly-precipitation-Rainfall,kijal-terengganu-my,Malaysia>

Analysis: The site in Terengganu has average monthly hours of sunshine between 120-150 hrs throughout the year (Figure 24) and average precipitation of 300mm to 650mm per month throughout the year (Figure 25). Being quite near the South China Sea and subjected to the annual monsoon between October to January, the Centre need to be designed to cater for the hot weather and torrential monsoon

1. Climate

- A. Analysis: The site is exposed to sufficient sunlight throughout the day (Figure 24).
- B. Synthesis: The use of daylight can save energy usage in the building and create a sustainable approach to designing.

2. Precipitation

- A. Analysis: Precipitation increases during the rainy season at the end of the year. Overall, the average annual precipitation is 3060mm (Figure 25).
- B. Synthesis: Rainwater harvesting can be installed for landscaping use to reduce the cost of water usage.

DESIGN BRIEF

East Coast Region Cancer Centre (ECRCC) is to be designed as a complementary health facility to Hospital Kemaman (Figure 26) and as the Cancer referral centre for the East Coast Region i.e. for referrals from Kuala Terengganu and Pahang. Hospital Kemaman is a major specialist hospital, and its facilities are adequate to support the secondary services of ECRCC, such as clinical support for sterile supplies, general imaging and laboratory services, as well as non-clinical services such as laundry, maintenance and catering.



purpose
cancer centre

40 Infusion Bays
(Daycare)
40 Beds (Inpatient)

Radiotherapy Dept.

Nuclear Medicine
Dept.
CME

Wellness Centre

Pharmacy

Satellite Lab
(General
Pathology)



location
Kijal, Kemaman

Neighbouring
Hospital
Kemaman

Linkages by bridge & road
+Bridge is for staff & public
Other are delivered through
connection road



**population
catchment**
East Coast region
population

Figure 26: Hospital Kemaman Complimentary to ECRCC services

THE DESIGN PHILOSOPHY

This cancer centre applies biophilic concepts or design philosophy in planning and design to create a therapeutic environment that connects patients, carers, and nature. This centre provides cancer patients, their families, and healthcare professionals with a holistic and supportive environment based on biophilia and the human affection for nature. Design features include:

- **Natural Light and Views:** Plenty of natural light will brighten the interior and reduce stress for patients and employees, especially in long-term care facilities. Patients can connect with nature through large windows and strategically positioned skylights. The major thoroughfare's rainwater harvesting canopies are organised to represent hope from God's subdued daylight rays.
- **Living Greenery and Green Spaces:** The Cancer Centre will have living walls, indoor gardens, and strategically placed potted plants. Greenery indoors purifies the air and calms patients and carers. Greenery avoids regulated environments like isolation rooms.
- **Biophilic Patterns and Textures:** Water themes and organic shapes will be used in the interior design. These design features will make you feel at home and calm.
- **Natural Materials:** The centre will incorporate wood, stone, and repurposed materials. These products will enhance the biophilic experience, boosting eco-consciousness and a connection to nature. In regulated environments, safe artificial material will resemble this natural substance.
- **Therapeutic Gardens:** The Cancer Centre will have therapeutic gardens for patients to meditate, relax, and heal. These gardens will host therapies and support groups.
- **Biophilic art and installations** will decorate the facility's walls, corridors, and waiting spaces. These natural world depictions will inspire hope and positivity in sufferers.
- **Water Features:** Cascading fountains and reflected pools will add tranquilly to the Cancer Centre.
- **Connection to Outdoor Spaces:** The facility will give direct access to outdoor spaces, facilitating seamless transitions between indoor and outdoor surroundings. Accessible walking trails and sitting spots will encourage patients and staff to spend time in nature, mending, healing and rejuvenating.

All the above design elements are applied in the development of the centre's design and planning concept (Figure 27), intended to foster healing, hope, and rejuvenation for everyone who enters the centre. Advanced medicine, care, and nature's calming influence provide a supportive environment for patients' rehabilitation and wellness.

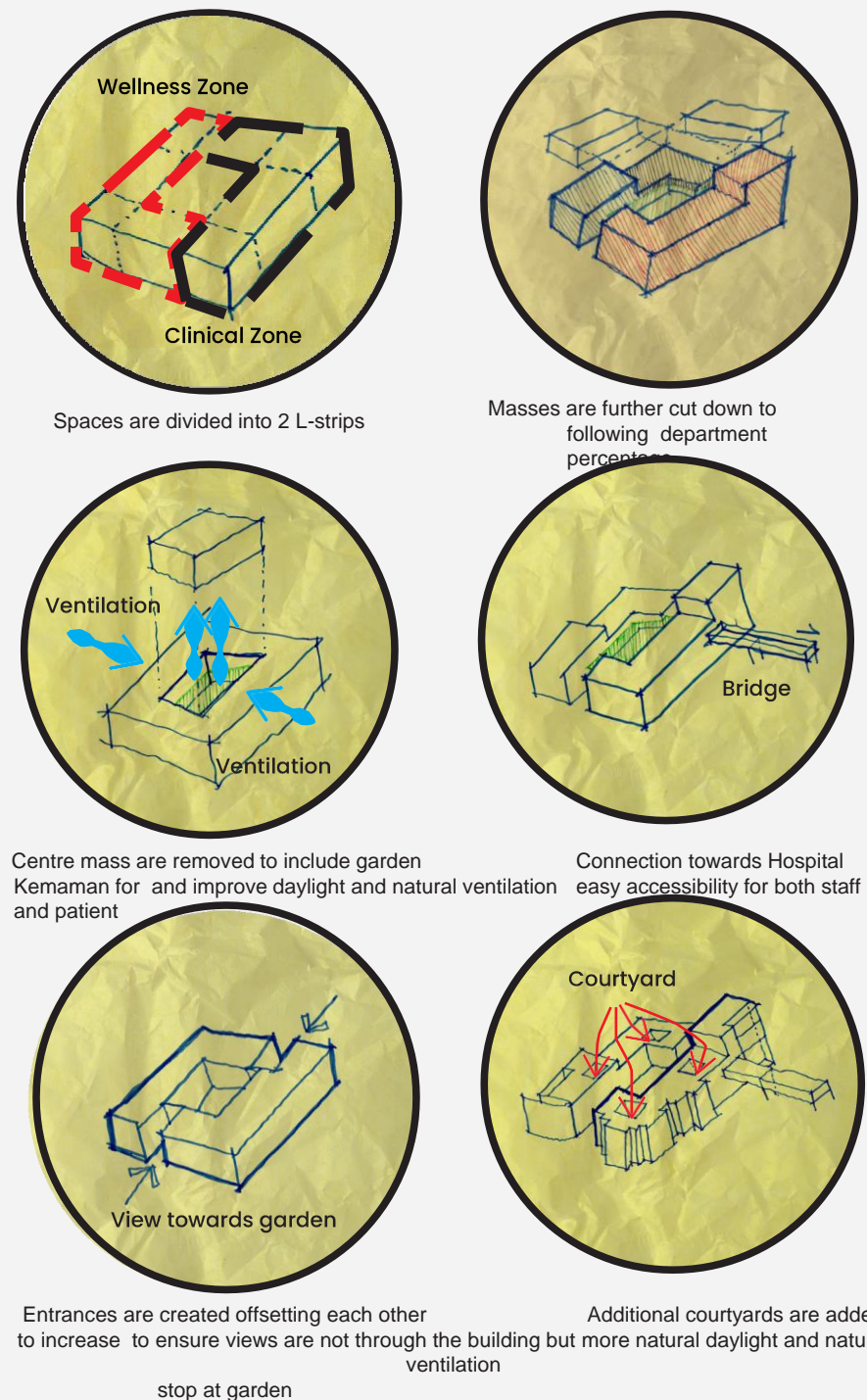


Figure 27: Series development of concept planning sketches

MASTER PLAN

The master plan of ECRCC (Figure 28) is part of the MoH master plan at Kijal Kemaman. Within the ECRCC site, there is a future expansion west of the site for accommodation (medical hotel). The building is placed as near as possible to Hospital Kemaman to shorten the distance between these two buildings. A bridge is placed to connect these two for pedestrian connections to deliver the shared services. The building is designed with a main thoroughfare as the central spine, and each corner has its own courtyard to facilitate natural sunlight and natural ventilation.

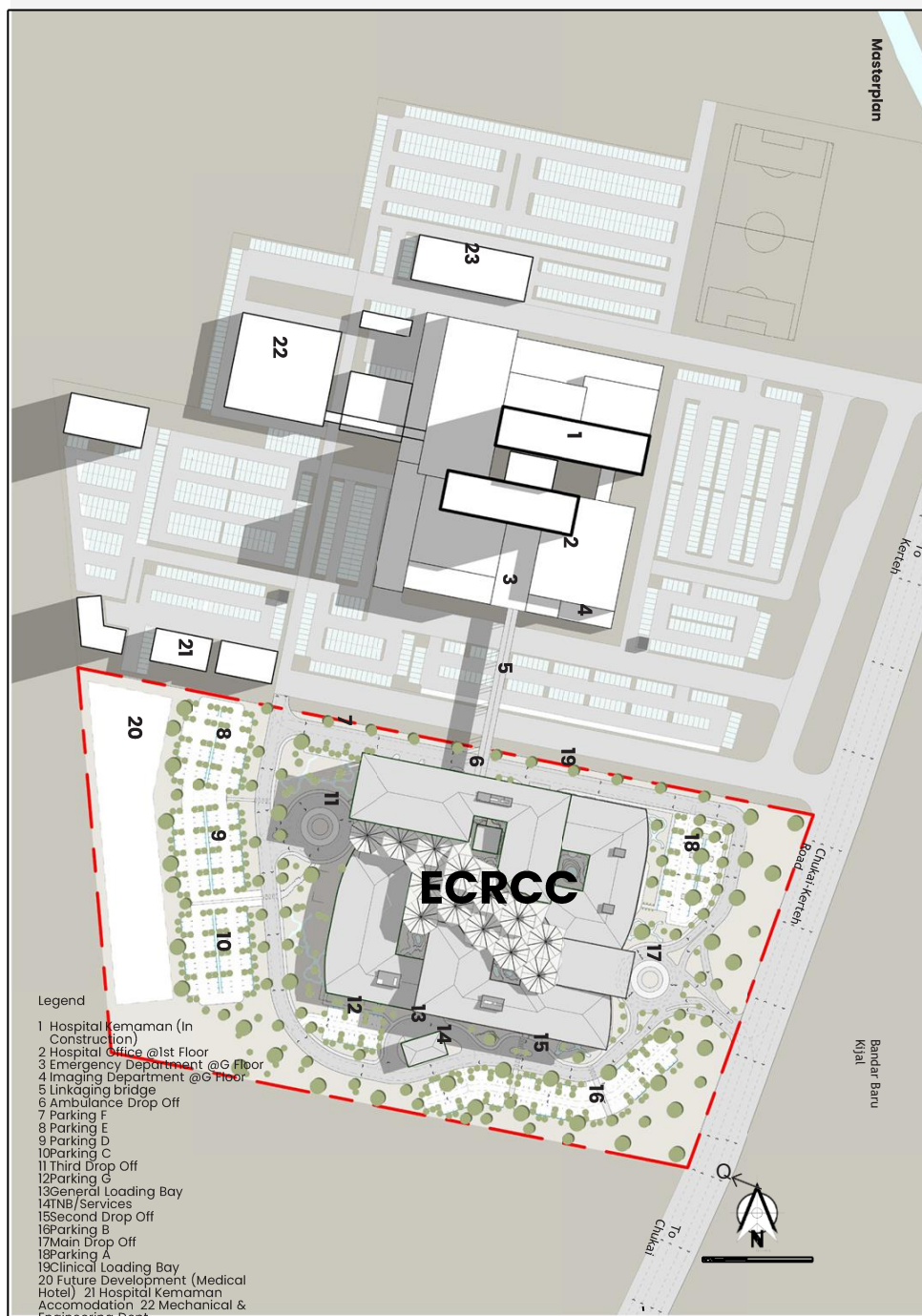


Figure 28: Site plan of ECRCC adjacent to Kemaman Hospital.

SPACE PLANNING

The spaces of the centre (Figures 29, 30, 31) are carefully designed in such a way the circulations between patients, staff, and service do not clash and only meet at a designated point. This is to ensure patient comfort and privacy in ECRCC are achieved. Spaces that are used for long periods, such as chemotherapy bays and waiting areas, are placed near green areas with a view.



Figure 29: Ground floor plan of ECRCC

Figures 22, 23 and 24 show the departments/units that make up the ECRCC in 3 levels such as the oncology clinic, pharmacy, nuclear medicine, radiotherapy, chemotherapy unit, satellite lab, inpatient, continuing medical education, wellness and retail area in ECRCC.

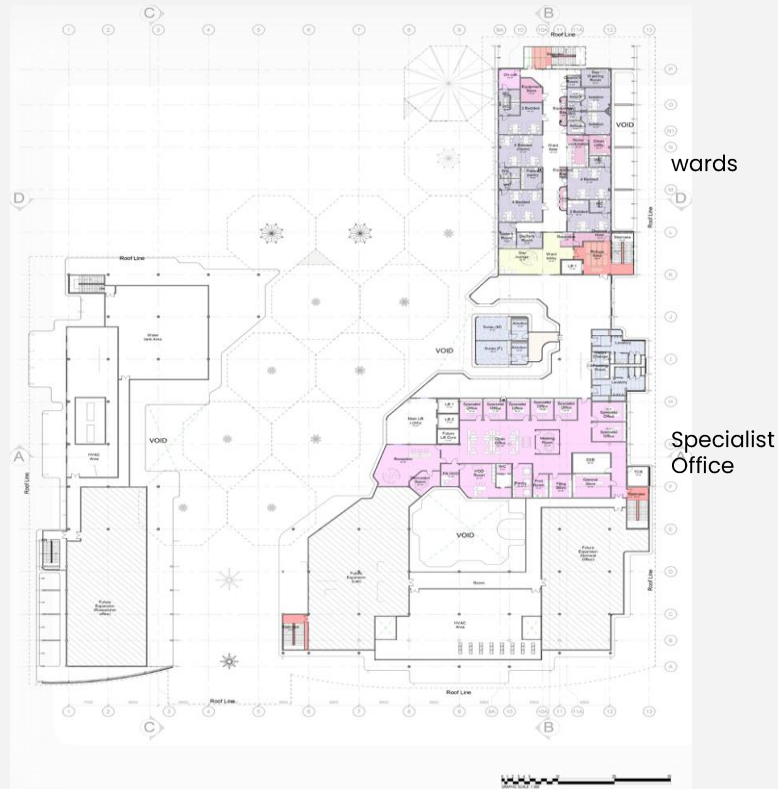


Figure 30: Second floor plan of ECRCC



Figure 31. First floor plan of ECRCC

BIRD'S EYE VIEW



Figure 32: A bird eye view of ECRCC

THERAPEUTIC GARDEN

Based on the characteristics of therapeutic gardens, ECRCC has four garden courtyards within its premises (Figure 29, 32). All the courtyards are designed to allow visitors to use them as part of healing activity. Most of the plants planted in these courtyards are local species. They are durable, cheap, and easy to maintain (Figure 33).







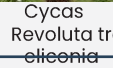
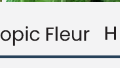




Ground cover	Fern & Allies	Palms	Trees
		 Dypsis  hapis Lutescens  elsa  Cycas  Revoluta tropic Fleur  H. cliconia	
Carpet Grass	Cyathea Contaminans	R EX	
Vines	Flowering		
			
Antigonon leptopus	Vallaris Solanecia		Carpet Grass

Figure 33: The type of plant planted in courtyards

COURTYARD PLACEMENT

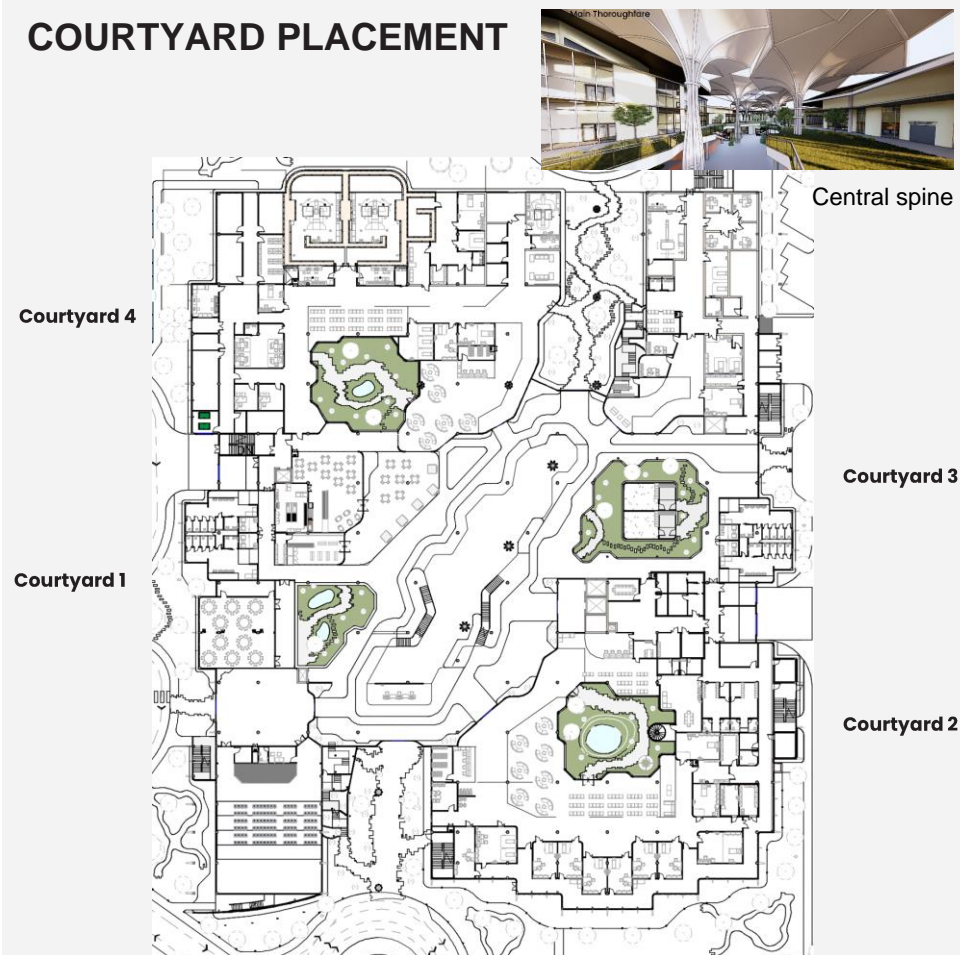


Figure 34 shows the location of the courtyard

COURTYARD 1



Figure 36 Courtyard 1

Courtyard 1 feature stone pavement that leads visitors through the courtyard. The sitting bench is placed facing the mini and shallow pond. There are wall creepers that climb the louvres wall beside this courtyard.

COURTYARD 2



Figure 37 Courtyard 2

Courtyard 2 features a mini and shallow pond in the middle to introduce calmness. This courtyard is accessible from the oncology clinic.

COURTYARD 3



Figure 38 Courtyard 3

Courtyard 3 is where prayer rooms are placed. These prayer rooms have big glass to allow visitors in the prayer room to enjoy greens in this courtyard.

COURTYARD 4



Figure 39 Courtyard 4

Courtyard 4 is located within the radiotherapy unit, and it is accessible from the radiotherapy unit and the kiosk area.

CONCLUSION

Most research in the field of design and health focuses on inpatient environments. However, a typical cancer treatment regimen is ambulatory-based (Zhe Wang et al., 2011). Thus, it is important to explore configurations of chemotherapy bays based on precedent studies and post-occupancy evaluation practised in existing chemotherapy bays (refer Figures 40, 41, 42). In one of the studies by Mahsid Jalalianhosseini et al. in 2019, two types of infusion bay layouts were compared in a study by Kara Freihoefer of the University of Wisconsin-Milwaukee and St. Elizabeth Healthcare. Using mixed methods of gathering data, including observations, post-occupancy evaluation, and simulations, there are several design insights made as follows:

- A** Design of nursing stations and infusion bays to maximise nurse performance. These areas are where staff spend almost 80% of their time.
- B** Provide spacious infusion bays and workstations, with enough space to store supplies and medical equipment, to increase nurses' satisfaction and reduce the need for multiple trips to retrieve supplies, thereby increasing efficiency.
- C** Nurse workstations should facilitate privacy and the ability to concentrate on tasks that require focused concentration as well as provide for monitoring of patients in infusion areas.
- D** Create a balance between patients' visual and auditory privacy and visibility to staff.
- E** Locate medication rooms in a separated area of the infusion bay to allow for nurses to prepare medications without distraction.
- F** Embed a pharmacy within the infusion center, with a mechanism to alert nurses when medications are ready, to increase efficiency of medication

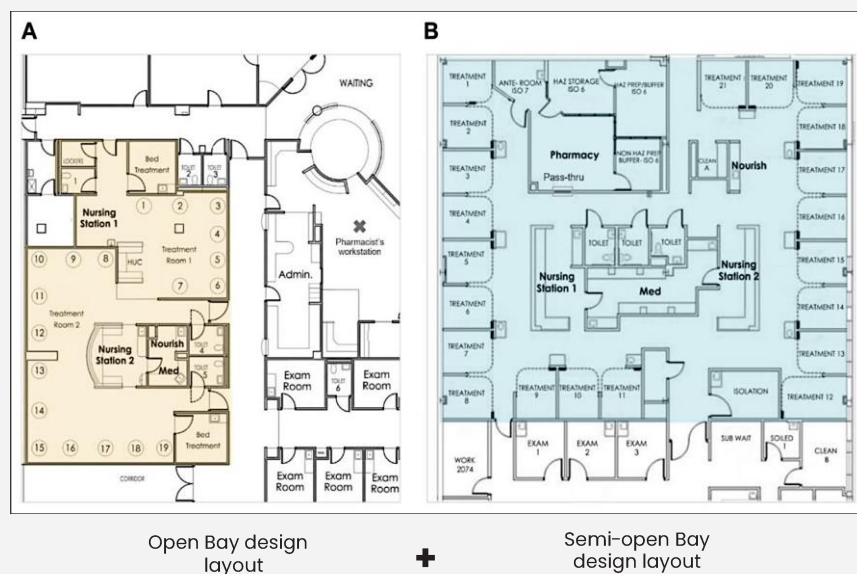


Figure 40: Example of open bay design layout and semi-open design layout (Source: Google)

Special Studies on Chemotherapy Bay Design



Figure 41: Design application on chemotherapy unit

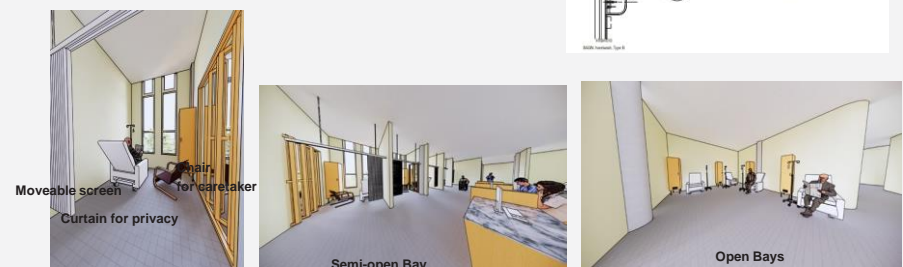


Figure 42: Interior perspective of chemo bays

In conclusion, this design thesis emphasises the need to help cancer patients and their families in their fight against malignancy to help them return to normalcy. The thesis aims to foster cancer patients' mental health and resilience by creating a supportive and empowering atmosphere. The thesis creates healthy, strong settings by tailoring architectural solutions to cancer patients and their families. The concept uses a biophilic design to harness nature's mental health benefits and promote peace and optimism during cancer treatment. Through architectural interventions, the design theory promotes healthy lifestyles and cancer awareness. The architecture promotes cancer awareness and engagement to create a more compassionate society. This design thesis seeks to create settings that enhance emotional well-being and physical recovery. The project aims to improve the lives of cancer patients and their families by thoughtfully designing for their needs.

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