ABSTRACT

Title of Thesis: ROAD TO RECOVERY: BRINGING THE OUTDOORS IN

Abigail Mencer, Master of Architecture, 2022

Thesis Directed By: Assistant Professor, Joseph Williams, School of Architecture, Planning, Preservation

Patients in oncology centers experience extreme physical and psychological anguish due to illness. Patients spend a lot of time in these facilities, often during the most turbulent times in their lives. Current healthcare facilities are designed around medical technology. Medical centers thrive on scientific ingenuity and innovative technology. However, through this process the wellbeing of patients is disregarded almost entirely, leaving healthcare facilities barren and cold. Incorporating biophilia into the design of healthcare facilities provides for a patient's health and wellbeing. Utilizing biophilic design with a focus on health and wellness within healthcare design can transform the recovery of patients as they seek care. **This thesis investigates how designing for a patient's wellbeing can benefit their medical experience.** The philosophy for the design of this thesis is to utilize biophilic design approaches to focus on the wellbeing of patients as they receive care. This includes design strategies that include natural elements, views to nature, as well as a biophilic

approach to materiality and lighting. The context for this project is a cancer center that incorporates biophilic design with the technology of modern medicine resulting in a facility that is designed for a patient's wellbeing.

ROAD TO RECOVERY: BRINGING THE OUTDOORS IN

by

ABIGAIL BRURYA MENCER

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Advisory Committee:
Professor Joseph Williams, Chair
Julie Gabrielli
David Cronrath

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2023

Dedication

To my family, I could not have accomplished any of this without your unwavering support and constant belief in me. Thank you for showing me that dreams can come true with perseverance and hard work, anything is possible.

Acknowledgements

I want to thank my thesis chair, Professor Joseph Williams for his guidance throughout this process. Your enthusiasm and support for this thesis concept sparked numerous conversations that have propelled this thesis even further. Thank you for acknowledging my strengths and guiding me through my weaknesses.

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Chapter 1: Modern Hospitals Rejection of Wellbeing

Medical Science Advancement

Modern science and technology have enabled modern medicine to advance tremendously in the last century. Ingenuity and research enable medical sciences to keep evolving and provide cures for illness. Medical technology has become so efficient that patients' life expectancy and healing margins have significantly increased in the last century. Groundbreaking surgeries are conducted on a regular basis, changing the quality of life of patients worldwide. Many formally terminal illnesses can now be cured through simple medical interventions. Moreover, medical science and technology keep advancing and improving at a rapid pace. However, in the process of medical advancement the facilities that house these accomplishments have become sterile, barren, and cold.

The Building

The modern hospital building has come to be nothing more than a shell to house the wonderous interventions of modern medicine and technologies. The buildings and spaces are set up around medical functions opposed to the humans that occupy them. This has resulted in long winding corridors and harsh artificial lighting being iconic aspects of hospital interiors. Therefore, healthcare facilities are often lackluster, uninviting, and disorienting for inhabitants. While they may suffice to improve a patient's health, the lack of consideration towards the patient as a human results in detrimental effects on the wellbeing of patients receiving care in these facilities.



Figure 1: Long sterile hallways

The design of healthcare facilities and hospitals are guided by technological decisions and advancements. Consequently, the humanity of the patients they serve often falls to neglect. Without consideration for a patient's wellbeing, critical aspects of design such as light and space planning disregard the patient. Rather they are

intensely focused on the medical technology and as a result patients become a specimen of medical intervention.



Figure 2: Technology based Design

Hospital design of the 20th century strips ornament and design from the healthcare realm. Instead, the plan is the primary focus of the design. The building's mass, ventilation, and circulation become the areas of the upmost importance in healthcare design. The spaces and orientations of these facilities are dictated by healthcare professionals with an emphasis on the medical interventions they house. Rather than strategically designed spaces orchestrated by design professionals that emphasis the individual that inhabits these spaces. As a result, healthcare facilities become the model of the institutional typology. The facility becomes a functioning backdrop for medical interventions instead of an acting participant in the aid of patient care. Through this tradition, healthcare facilities have become hygienic rather

than aesthetic.[1] This drastically impacts the role of the hospital environment on the heath and healing of patients.

The desire for hospitals to be disinfected and prevent the spread of diseases resulted in the consult of doctors in the formation of healthcare spaces rather than designers.[2] Hygiene dictated that hospitals became primarily for treatment of disease and therefore beauty became superfluous in its construction. [3] Moreover, the addition of adornment and design was seen by healthcare professionals as an opportunity for collection of germs and dirt, an obstruction of airflow and an unnecessary expense. Therefore, the austerity of modern hospitals resulted from the over compensation of hygienic appeals and the lack of understanding of what conjugated the spread of disease.[4] Although these misconceptions are now known to be untrue, hospital design did not significantly change. As technology advanced hospitals became machines for disease care. Subsequently, technology informed the design of these spaces. The

[1] Jeanne Kisacky, *Rise of the Modern Hospital: An Architectural History of Health and Healing* (Pittsburgh, PA: University of Pittsburgh Press, 2017), 9.
[2] Kisacky, 31.
[3] Kisacky, 54.
[4] Kisacky, 55.

interior spaces evolved as clumsy enclosures to the everchanging medical equipment.[5]



Figure 3: Current design of typical health centers

Instinctively it is assumed that hospital design is a paradigm for healthy architecture and spaces. Due to the nature of hospitals, it is intended that their structures are designated for good health. However, hospitals are inherently unhealthy spaces that people dread and avoid. The typical hospital experience consists of an anxious sick patient often escorted by an apprehensive family member or friend. Despite the vexed state of their condition, they are met by severe artificial lighting and austere corridors and spaces. Moreover, the constant blare of machinery and indiscernible putrid smells further adds to the patient feeling confused and disoriented. The lack of control, privacy, and denied access further exacerbates the

[5] Richard Miller and Earl Swensson, *New Directions in Hospital and Healthcare Facility Design* (McGraw Hill, Inc, 1995), 17.

patient's condition. Therefore, the standard experience of healthcare facilities is inherently inhospitable.[6]

Recent healthcare design initiatives have begun to break away from the institutional model and utilize a hospitality model for healthcare facilities. Striving to replicate the luxurious comfort of a hotel into the design of the healthcare sector.[7] However, these hospitals are not yet the typical healthcare experience and are conceived as luxury rather than standard care. Consequently, they are often only able to be experienced by elite and wealthy members of society. Nonetheless, current research and science has shown the impact that an environment has on the state of a patient's health. Therefore, utilizing strategies from hospitality model cannot only improve the patient experience but rather benefit patients' overall health status.[8]

The amplified feelings of stress and anxiety of healthcare centers do not only promote discomfort. Moreover, the depressing state that they generate can have ramifications on a patient's state of health. Research conducted at the annual Symposium of Healthcare Design showed that the increase of anxiety induced by the lackluster design of healthcare facilities actually represses a patient's immune system which inhibits the body from effectively fighting disease.[9] Therefore, the architecture

[6] Miller and Swensson, 17.
[7] Miller and Swensson, 10.
[8] Miller and Swensson, 12.
[9] Miller and Swensson, 16.

of healthcare facilities is critical to a patient's treatment. Yet in most hospitals today the design is underutilized and not designed to adhere to a patient's wellbeing.

Studies on the impact of architecture on patients' health deduced that the lack of design, natural light, and constant raucous of machines resulted in patients becoming anxious or delirious. Patients in these environments often require an increase in pain medication. Patients thrust into these conditions were also found to fall into despair and depressive states during the course of treatment. On the other hand, the intentional utilization of natural light or opportunity for the exposure to natural elements such as trees or water resulted in a dramatic decrease in the patient's blood pressure. This concluded the hypothesis that there are positive health ramifications to spaces designed for a patient's health.[10] Furthermore, there is a condition referred to by professionals as ICU syndrome. This is a state where the patient experiences mild psychosis or hallucinations. The onset of this phenomenon is a direct response to the conditions of the space these patients are confined to. These conditions include constant subjugation to glaring light, sterile white or repulsive green wall colors that adorn so many healthcare facilities and the unforgiving rhythm of respirators and monitors. Through strategic design hospitals and healthcare facilities can begin to facilitate wellbeing through the design of space, therefore, improving the negative impact of current hospital conditions on patient's health. facilities can begin to facilitate wellbeing though the design of space therefore improving the negative impact of current hospital conditions on patients' health.

[10] Miller and Swensson, 16.



Figure 4: Technology based Design that lacks wellbeing

Chapter 2: Evolution of Healthcare Design

Healthcare spaces have been in existence since ancient times. Nonetheless, these spaces are drastically different from the healthcare facilities we operate today. Although medical interventions did not comply with the standards of modern medicine the design of these spaces focused on the recuperation of the individual as a whole. This included the mind and soul of the patient which are key elements in the healing process. The design of these spaces varied from the east to the west, however the design intent to accommodate the wellbeing of the patient was consistent worldwide. As knowledge of healthcare and medicine advanced sanitation and technology became the forefront of healthcare design. In the desire to eradicate former unhygienic and unscientific practices, old healing interventions were eliminated. Through this process the emphasis on healthcare facilities providing for the wellbeing of a patient was discarded from medical intervention. As a result, science and technology became the primary focus of healthcare centers. This attitude is apparent in the unappealing design of modern hospitals today. Moreover, despite the incredible advancement of modern medicine on physical health the patients lack a significant aspect of their healing.

The earliest healthcare facilities were cave like structures. During the Neolithic period sick houses were reserved in each settlement for when members of the community became ill. Care for the sick was often conducted by the patient's

family. This is the first recorded example of dedicated space for the purpose of healing.[11]

A focus on the patient's comfort became the typical healthcare setting as civilization progressed. In addition, there was often a multigenerational element of care, where younger members of a family would care for sickly elderly family members.[12] Illness was often strongly related to mystical or religious beliefs therefore the patients mind and soul often took precedent to the physical symptoms of diseases.[13]

Early civilizations in India, Sri Lanka, China, and Southeast Asia had strong traditions of designated healthcare spaces. The Buddhist religion in India had a tradition of healing spaces inside of monasteries that were run by monks. The Indian King Asoka in the third century BC, was accredited for building multiple hospitals in his kingdom both for people and animals. The ancient Chinese civilizations had a strong tradition of healing and spaces within their homes as well as some public hospitals that are less known.[14] Within each of these early civilizations, the healthcare spaces had significant religious and superstitious connection in conjunction with nature and recuperation. Despite being facilities of ancient civilization, these spaces were advanced and ahead of their time. Cleanliness and wellness were at the

[11] Stephen Verderber, *Innovations in Hospital Architecture* (London: Routledge, 2010), 10, https://doi.org/10.4324/9780203855751.
[12] Verderber, 10.
[13] L. Cilliers and F. P. Retief, "The Evolution of the Hospital from Antiquity to the End of the Middle Ages," *Curationis* 25, no. 4 (September 28, 2002): 1.
[14] Cilliers and Retief, 2.

forefront of the design of these spaces, a concept that did not come to the western world for many years.

The advancement of medical institutions and healthcare facilities made significant development during the Greco Roman era.[15] Hippocrates was the first to develop criteria for the location of medical intervention. He supported the notion that there is a direct connection between the environment and health. He believed that sickness and disease was significantly influenced by environmental factors. Therefore, he expressed that aspects such as an understanding of the seasons, water supply, and site orientation were critical to the formation of healing spaces due to their direct connection to a person's health.[16]

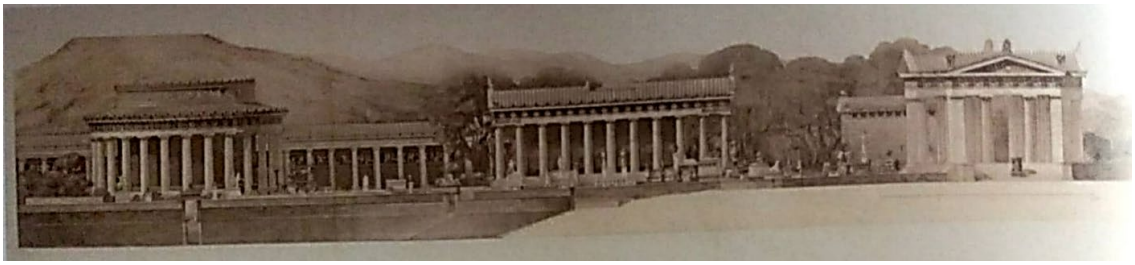


Figure 5: Asclepieion of Epidauros, in Athens

In Greek city states the stoa become the primary setting for patient care. The Asclepieion of Epidauros, in Athens is a prime example of designated healthcare facilities of this time.[17] The temple complex was built strategically on a beautiful site with ample water supply. The building consisted of large rooms enclosed on three sides and open on the south side marked by a series of columns.[18] Patients had a

[15] Cilliers and Retief, 1.
[16] Verderber, *Innovations in Hospital Architecture*, 10.
[17] Verderber, 11.
[18] Cilliers and Retief, "The Evolution of the Hospital from Antiquity to the End of the Middle Ages," 2.

direct view of the temple through the portico that lined the entrance. The southern exposure was a deliberate aspect of the design for the purpose of healing and wellness. It allowed for natural ventilation and maximum daylight to enter the space. Waste was transported off the site through designated waterways that were not utilized for drinking. This shows the dedication to wellbeing as well as sanitation within the strategy of ancient Greek design.

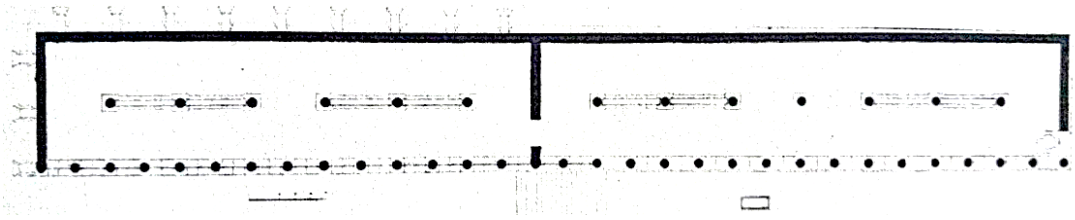


Figure 6: Plan of Asklepieion of Epidauros Health Center

The design of the city of Pergamon is another example of the utilization of nature and health in early Greek civilization. The healthcare building was situated at the bottom of the hillside in order to be closest to the water source. The temple was set on the highest mountain to remain close to the gods and watch over the city. Residential and commercial zones inhabited the spaces in between. Elaborate and sophisticated bathing accommodations were part of the patient's treatment experience. Water was drawn from the nearby springs to fill large tubs and mud baths. The infirmary space was similar to the one at Epidauros. A three-sided enclosure with an open south facing façade, lined with porticos. In addition, a circular terrace and connecting hallways with south facing windows adorned the space.

Awnings at the top of the terrace shielded the space from harsh sun exposure. During the winter months a heated floor was utilized to keep the space warm. [19]

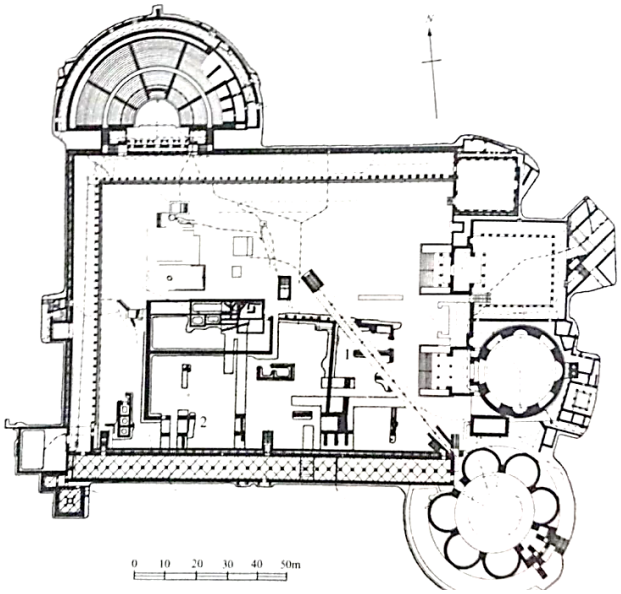


Figure 7: Pergamon Plan

Greek Treatment facilities incorporated luxurious recreational treatment methods and the natural environment as a critical component of the design of healthcare facilities. An emphasis on water, vegetation, sunlight and immersion into the landscape were emphasized as part of the healing process. Although the medical theories were often strongly based on the intense belief in mystical gods the interventions of wellness were a significant aspect of critical care.

[19] Verderber, *Innovations in Hospital Architecture*, 12, 13.

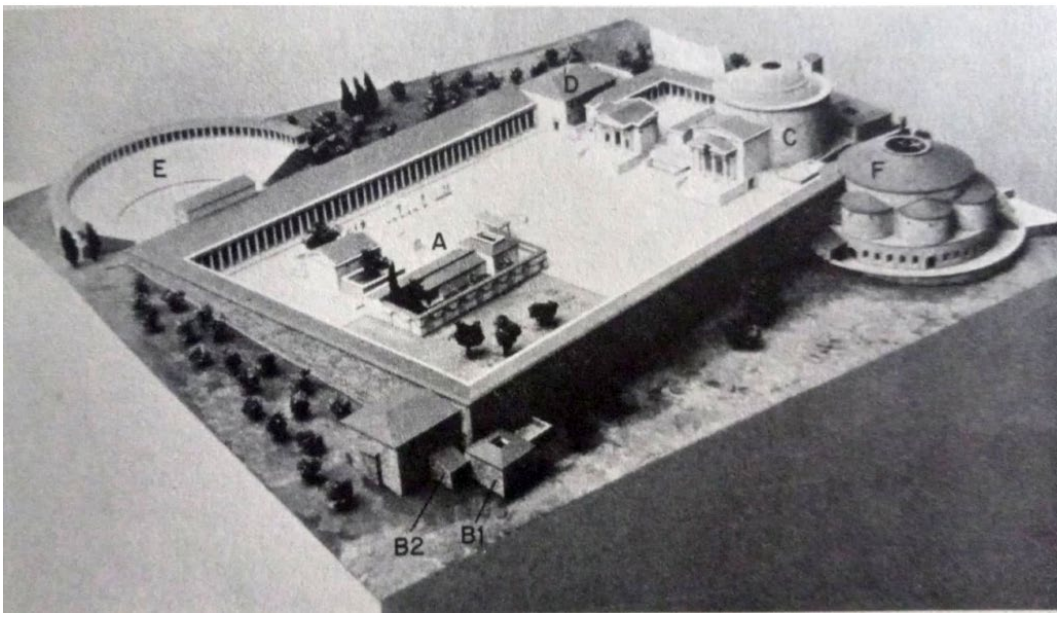


Figure 8: Pergamon Model

The Roman empire synthesized the medical knowledge of Greek influence with their own advancements. Hippocrates beliefs and other philosophers such as Aristotle, Plato, and Stoics were the foundation of medical philosophy. One of the major healthcare advancements of the Roman civilization was the introduction of military hospitals.[20] Expansion was a major goal of the Roman Empire, as concurred territory advanced it became impossible for soldiers to be sent home to receive treatment. Therefore, permanent facilities were set up in designated points for soldiers

[20] John Thompson and Grace Goldin, *The Hospital: A Social and Architectural History* (Yale University Press, n.d.), 5.

space.[21] At later times, these hospitals opened up for the care of Roman public, most often wealthy members of upper class.[22]

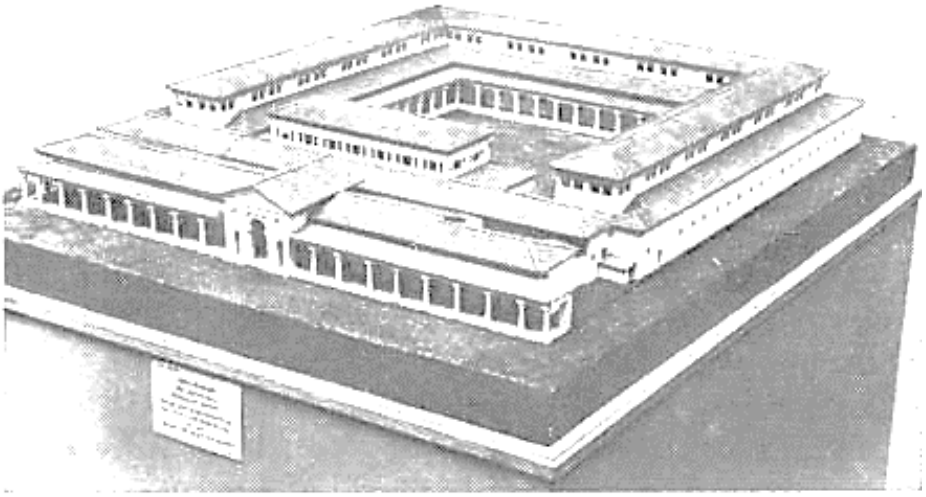


Figure 9: Valetudinarium Model

The Roman Baths were another space designated to health and wellness of the Roman civilization. These spaces incorporated strategic innovation and space planning. The indoor facility required fresh water and the removal of wastewater.

[21] Verderber, *Innovations in Hospital Architecture*, 14.
[22] Cilliers and Retief, "The Evolution of the Hospital from Antiquity to the End of the Middle Ages," 4.

These spaces were designated to recreation, recuperation, health, and cleanliness and became primary typologies in the Roman civilization.[23]



Figure 10: Roman Bath

During the Middles Ages healthcare spaces became congruent with religious architecture. As Christianity developed as the primary religion in Europe, the focus on faith was the source for treatment and salvation. Sickness was believed to have

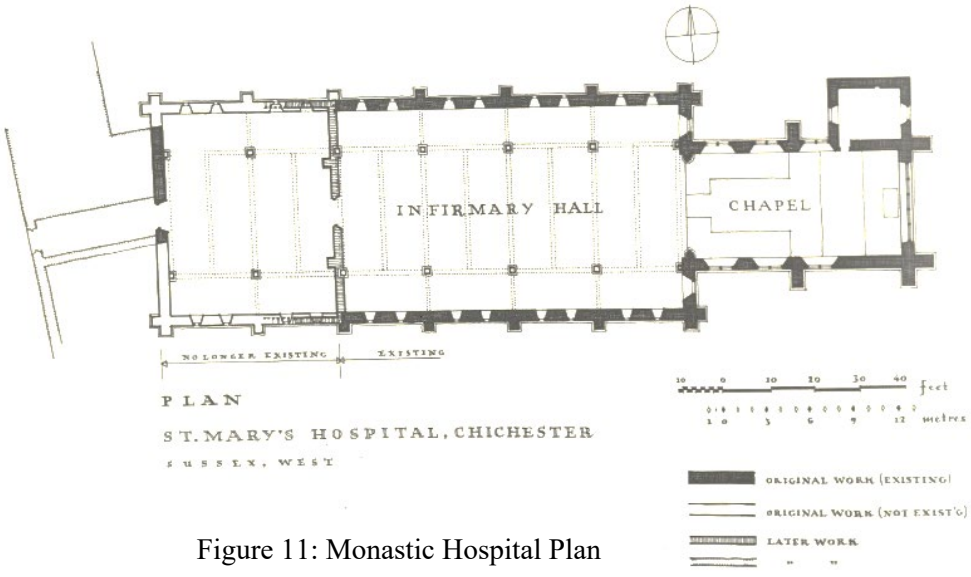


Figure 11: Monastic Hospital Plan

[23] Verderber, *Innovations in Hospital Architecture*, 14.

direct spiritual ramifications therefore the church was the place people turned to for treatment. Consequently, Monastic hospitals became the primary setting for healing.[24] Centered around green spaces and courtyards these places were serene and conducive to healing.

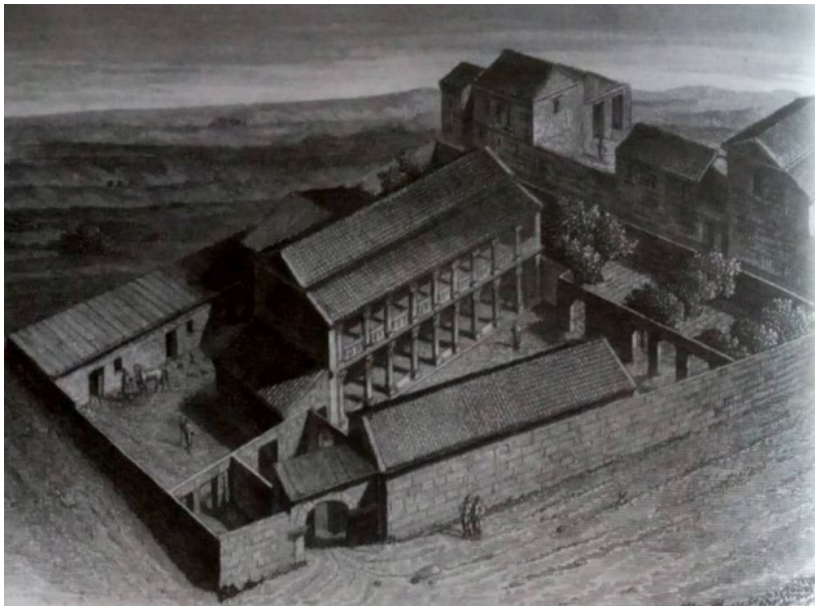


Figure 12: Monastic Hospital

However, as feudalism developed individuals with disorders and illness were placed in institutions due to their inability to contribute to the serfdom. With the formation of these institutions the former connection of healing and nature began to dissipate. Instead, large walls were erected to separate the invalids from the rest of society.[25] The importance of natural daylight and ventilation were considered of little importance.[26] These facilities were often saturated in disease moreover, they were grave and depressive. This began the ideology of healthcare facilities being fortresses for isolating the sick in large, unadorned protected structures.

[24] Verderber, 17.
[25] Verderber, 17.
[26] Verderber, 18.

The organization of these Monastic hospitals was centered around religious beliefs and observances. A series of structures were organized according to functions,

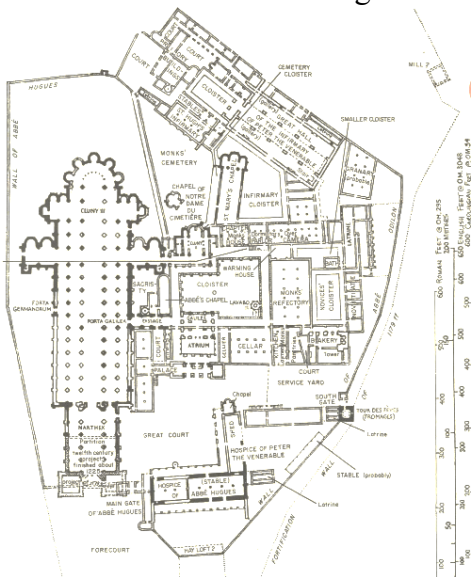


Figure 13: Monastic Hospital Plan

these included open wards, infirmaries, and rooms designated to patients in need of constant observation. Wards were organized with the alters being the focal point of the space and patients were required to hear mass each day. As this typology developed the floor plans of these facilities even began to replicate the cross form.



Figure 14: Monastic Hospital Interior

This further indorsed the attitude towards healthcare being seeped in religious implications.

In the Middle East, healthcare facilities took on a more holistic approach to healing. Middle Eastern, perspective on medicine was influenced by Greek medical philosophy. Healthcare interventions were centered around science and medicine. Moreover, the importance of a patient's wellbeing was a critical aspect to the healing process. Healthcare facilities were innately decorated and beautiful. The courtyard was a central element and believed to contribute to the healing process. These spaces were called Bimaristans which was the amalgamation of the Persian words asylum and sick.



Figure 15: Bimaristan Courtyard

The program of these facilities was divided by departments for mental illness, disease, and surgery. Larger facilities included a library, pharmacy, performance space, and a hammam or bath. Strategic design was utilized formulating patients'

rooms around a central fountain. Halls surrounding the courtyard were exposed to the courtyard on one side enabling views to

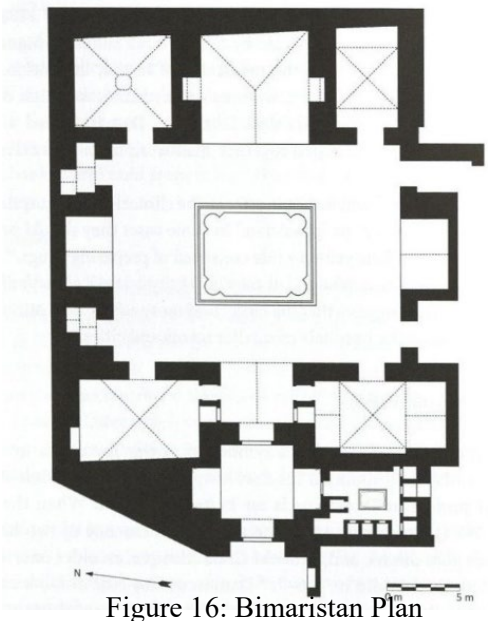


Figure 16: Bimaristan Plan

the exterior as well as natural ventilation. This allowed for three independent wings to formulate. The formation of the building design also served to contain illness and germs. The formation of individual wings allowed for contagious patients to remain separate from other patients.[27]The wellbeing of patients was integral to the treatment



Figure 17: Bimaristan

[27] "History of Hospitals," accessed March 7, 2022, https://www.nursing.upenn.edu/nhhc/nurses-institutions-caring/history-of-hospitals/.

in these facilities. Therefore, aspects of the design integrate the senses to create an environment of tranquility. Acoustics were integral to the design and due to the impact on patients' rehabilitation. In order to promote peace, patient rooms were placed as far from the main entrance and bustling street as possible. The integration of fountains and water promoted feelings of serenity during recovery. Additionally, there are records of payments to musicians which implies that music was playing to add to the calming nature of the facility. Aromatherapy was part of the design of these facilities through aromatic plants and herbs.

As healthcare evolved into the twentieth century, and medical research developed, the importance of hygiene became the forefront of healthcare facilities. The primary purpose of these buildings was for treatment and remedy. Therefore, they were no longer viewed as buildings that required beauty. These buildings had a scientific purpose. Ornamentation was seen as an obstruction of hygiene and sanitation.

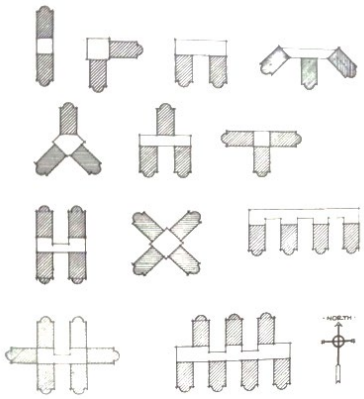


Figure 18: Plans Configurations for Twentieth Century Hospitals

Moreover, with the introduction of steel into the building industry large scale skyscrapers began to adorn the skyline of major cities. In 1905 hospitals joined this phenomenon. Due to the scientific agenda of these facilities the stacked large-scale

building was considered the most effective for this typology. Clinical spaces, remedial spaces, support spaces, staff, and service spaces were all able to be divided by floors in one building. This allowed for medical care to be organized and efficient.[28]

As technology developed into the twenty first century, the scientifically oriented hospital expanded to incorporate new medical technologies. Medical science thrived, while the design of these spaces became less than adequate for the wellbeing of patients. Technology took precedence in the healthcare space and due to the large-scale reality of the new machinery, they consumed the majority of the facilities that housed them. As a result, patients were rammed into dark closet like rooms to receive care. In addition to the lack of light and space the constant subjugation to harsh sterile conditions further added to the privation of wellbeing in modern hospital design.

Research throughout the twenty first century in conjunction with modern technologies, brought an awareness to the importance of wellness and the impact of an environment on patients' recovery and health status. This caused the beginning of a shift to develop within the design of healthcare facilities. More attention to patient comfort and wellness has begun to infiltrate the design of new healthcare facilities. Inspiration drawn from hospitality typologies formulated environments that are more conducive to healing. The inclusion of the importance of wellness within design has instigated the reform of healthcare design ideologies. This paves the way for a more holistic and encompassing view of healthcare to develop into the future. Nonetheless, this is not yet the standard experience within healthcare facilities.

[28] Verderber, *Innovations in Hospital Architecture*, 35.

Chapter 3: Typical Path for Cancer Treatment

Types of cancer centers

In the United States about 1.5 million people are diagnosed with Cancer each year.[29] The process towards recovery is often frightening for patients to navigate. The life-threatening reality of cancer results in tremendous emotional anguish for patients battling illness. Therefore, it is critical that cancer patients receive patient- centered care. The National Institute of Medicine have described patient centered care to be treatment where healthcare providers consider all the medical, social, and cultural needs of the patient.[30] Medical intervention in conjunction with the preferences of the patients and their family enables physicians to formulate an all-encompassing treatment plan that is specific for the prognosis of each patient. Creating a treatment plan at the onset of a patient's diagnosis enables patients to have a strategy for their recovery process. Often the treatment plan is updated as the patient proceeds through treatment to adapt to their progress. This includes prognostic and palliative care as well as the need for hospice at the end of a patient's life.

There are a multitude of cancer treatment options that vary based on the patient's diagnosis. Some treatments are able to take place in a home setting through the form of medication or injections. Most often cancer treatment takes place in a

[29] "Patient-Centered Cancer Treatment Planning : Improving the Quality of Oncology Care: Workshop Summary," 14, accessed May 10, 2022, https://web.p.ebscohost.com/ehost/ebookviewer/ebook/bmxlYmtfXzM5NjU3N19fQU41?sid=c399547f-0ef5-4a06-b7a2-288c2d6f24f3@redis&vid=0&format=EB&rid=1.

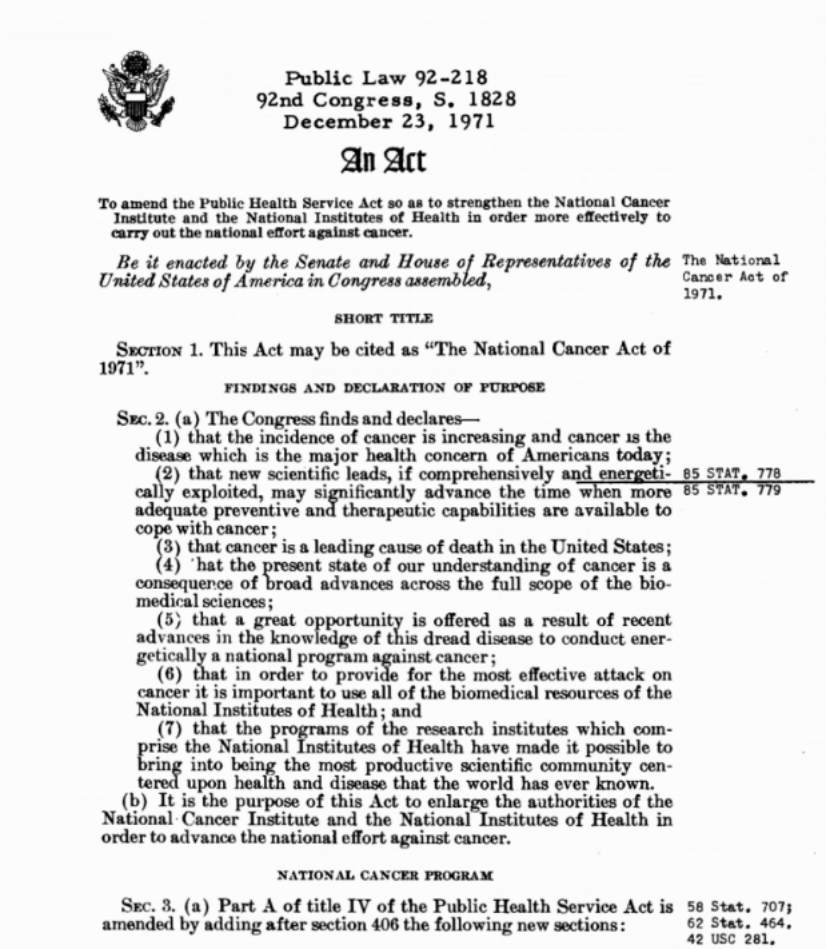
[30] "Patient-Centered Cancer Treatment Planning : Improving the Quality of Oncology Care: Workshop Summary," 4.

clinical setting such as clinic or hospital.[31] Depending on the diagnosis patients, care can be received at an outpatient center where they are able to return home that day at the end of the treatment session. Other times a more extensive treatment is necessary where patients need constant care and supervision. In this form of care patients are required to remain in a hospital for the duration of the treatment.

The National Cancer Institute (NCI) is the leading authority for Cancer treatment in the United States. In 1971 the National Cancer Act was passed as a national initiative for cancer research, treatment, and prevention. As a result of the act two primary types of National Cancer Institute centers were established; Cancer Centers and

[31] "Treatment for Cancer - NCI," cgvMiniLanding, April 29, 2015, nciglobal,ncienterprise, https://www.cancer.gov/about-cancer/treatment.

Comprehensive Cancer Centers.[32] There are currently seventy-one NCI designated centers in the United States.[33]



Public Law 92-218
92nd Congress, S. 1828
December 23, 1971

An Act

To amend the Public Health Service Act so as to strengthen the National Cancer Institute and the National Institutes of Health in order more effectively to carry out the national effort against cancer.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

The National Cancer Act of 1971.

SHORT TITLE

SECTION 1. This Act may be cited as "The National Cancer Act of 1971".

FINDINGS AND DECLARATION OF PURPOSE

SEC. 2. (a) The Congress finds and declares—

(1) that the incidence of cancer is increasing and cancer is the disease which is the major health concern of Americans today;

(2) that new scientific leads, if comprehensively and energetically exploited, may significantly advance the time when more adequate preventive and therapeutic capabilities are available to cope with cancer; 85 STAT. 778 85 STAT. 779

(3) that cancer is a leading cause of death in the United States;

(4) that the present state of our understanding of cancer is a consequence of broad advances across the full scope of the biomedical sciences;

(5) that a great opportunity is offered as a result of recent advances in the knowledge of this dread disease to conduct energetically a national program against cancer;

(6) that in order to provide for the most effective attack on cancer it is important to use all of the biomedical resources of the National Institutes of Health; and

(7) that the programs of the research institutes which comprise the National Institutes of Health have made it possible to bring into being the most productive scientific community centered upon health and disease that the world has ever known.

(b) It is the purpose of this Act to enlarge the authorities of the National Cancer Institute and the National Institutes of Health in order to advance the national effort against cancer.

NATIONAL CANCER PROGRAM

SEC. 3. (a) Part A of title IV of the Public Health Service Act is amended by adding after section 406 the following new sections: 58 Stat. 707; 62 Stat. 464, 42 USC 281.

Figure 19: 1971 National Cancer Act

The primary aspects that distinguish NCI cancer centers are paramount clinical and laboratory services. In order to gain accreditation as an NCI center there are specific requirements and conditions that need to be approved by the NCI board. Due to the affiliation with the NCI these centers offer the highest form of cancer treatment. In order to retain NCI accreditation centers must undergo reaccreditation and a site visit every five years to ensure standards are met.[34] These are often

[32] "National Cancer Institute (NCI)," National Institutes of Health (NIH), July 7, 2015, https://www.nih.gov/about-nih/what-we-do/nih-almanac/national-cancer-institute-nci.
[33] "Treatment for Cancer - NCI."
[34] "Treatment for Cancer - NCI."

community-based centers that offer the most cutting edge advanced cancer care due to NCI accreditation. This includes the latest medications, advanced treatment options, and the opportunity for patients to partake in clinical trials.[35]

Comprehensive cancer centers have to comply to the same vigorous standards as standard NCI cancer centers. Similarly, they have to undergo reaccreditation and a site visit every five years. Just like cancer centers they offer optimal clinical and laboratory services and treatment for cancer patients. The added component of comprehensive cancer centers is the devotion to cancer research and scientific exploration to further cancer treatment and prevention.[36] Many comprehensive cancer centers are associated with universities and medical research centers. Therefore, they are recognized for their scientific leadership in cancer research and treatment.[37]

Due to the advancement of scientific research, there are multiple treatments options available for cancer patients. Cancer treatment is often an extensive journey with a myriad of unknown outcomes and physical torments. Treatment is dependent on the variety of cancer a patient has as well as how advanced the cancer is at the time of diagnosis.[38] Treatments are utilized to stop the cancer from spreading, slow down the illness, or eliminate the cancer completely.[39] There are standard cancer treatment options as well as developing clinical trials. Clinical trials utilize research

[35] "Treatment for Cancer - NCI."
[36] "National Cancer Institute (NCI)."
[37] "National Cancer Institute (NCI)."
[38] "National Cancer Institute (NCI)."
[39] "Making Decisions About Cancer Treatment," Cancer.Net, December 12, 2013, https://www.cancer.net/navigating-cancer-care/how-cancer-treated/making-decisions-about-cancer-treatment.

initiatives and test out their viability on qualified patients.[40] Depending on a patient's condition often a combination of treatment methods is combined for optimal results.[41]



Figure 20: Cancer Treatment: Surgery

Surgery is one of the common treatments for cancer care. Surgery is contingent on the specific type and location of the cancer as well as how advanced the cancer has developed.[42] Dependent on the diagnosis of the patient the objective of surgery is to ideally remove all the cancer that is present. If this is not viable, surgeons aim to remove as much as the cancer as possible. This is to help minimize the spread and relieve some of the

[40] "Patient-Centered Cancer Treatment Planning : Improving the Quality of Oncology Care: Workshop Summary."
[41] "Treatment for Cancer - NCI."
[42] "Treatment For Cancer | Cancer Treatment Options," accessed May 18, 2022, https://www.cancer.org/treatment/treatments-and-side-effects/treatment-types.html.

symptoms of the cancer.[43] Surgery procedures are often the first step of a combination treatment plan. Patients will often undergo additional treatment after the procedure to eradicate the cancer.

Standard cancer surgeries are done through conventional open surgery methods. This requires a surgeon to create an incision to invasively extract the cancer from the body. These are often more complex procedures that result in significant recovery for the patient.

Some cancer surgery procedures are able to be conducted through minimally invasive surgery. This process bypasses the need for large incisions, instead the procedure is conducted through small openings where a camera is inserted to guide the surgeon. Through specialized instruments the cancer can be removed without extensive burden on the body[44].

[43] "Treatment for Cancer - NCI."
[44] "Preparing for Cancer Treatment," Understanding Cancer Together, accessed May 18, 2022, https://www.understandcancertogether.com/learn-about-cancer-treatments/preparing-for-treatment/.

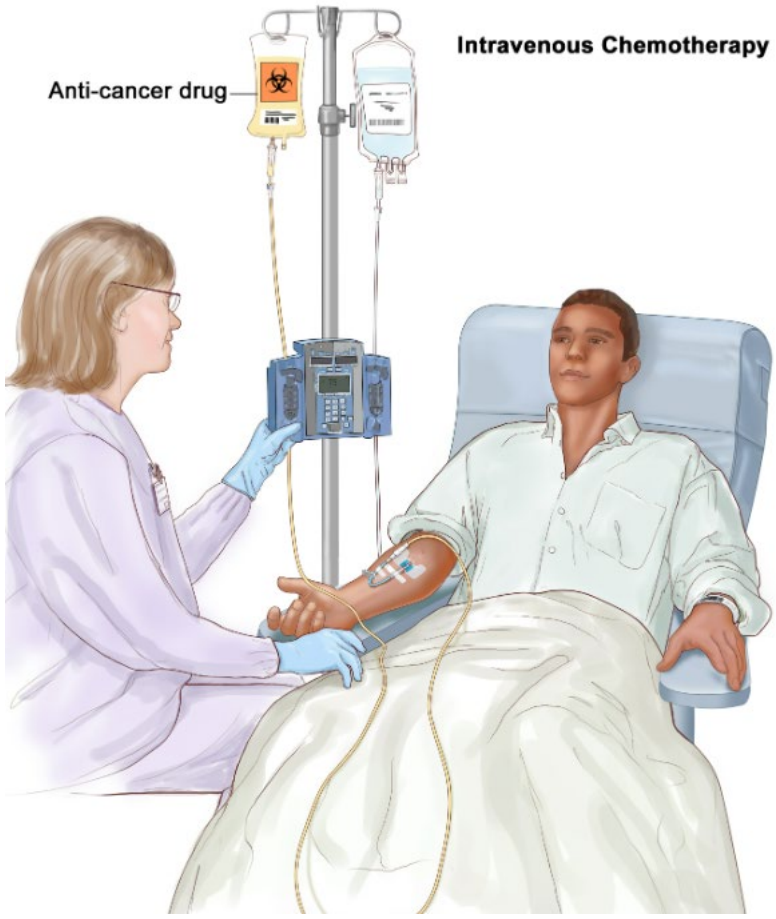


Figure 21: Cancer Treatment: Chemotherapy

Chemotherapy is one of the most well-known cancer treatments. Cancer cells grow, divide, and spread rapidly. Therefore, Chemotherapy uses medication to directly destroy cancer cells. Consequently, many healthy cells are killed through the treatment of the cancerous cells. As a result, Chemotherapy has significant side effects such as nausea and hair loss due to the loss of those cells. At times Chemotherapy can be combined with other cancer treatments or administered as a sole treatment. The intensity of the Chemotherapy process varies based on the individual reaction to the medication. In addition, the severity and stage of the cancer at the time of treatment also influences the effect of the Chemotherapy.

Chemotherapy can be administered in multiple forms. The specific type of chemotherapy is decided based on each individual case of cancer, its stage, and form. Oral and topical forms of chemotherapy are medications that can often be administered by the patient in a home setting. In addition, there are also multiple forms of injection treatments where the chemotherapy is directly injected into various organs or specified body parts in order to be most effective. Depending on the specific shot and injection location, the injections can be done by the patient or at an outpatient center by medical professionals. The most common form of chemotherapy is intravenous, that is dispensed directly into the vein. This process is often lengthy requiring multiple sessions and is administered in a hospital or outpatient center.[45]

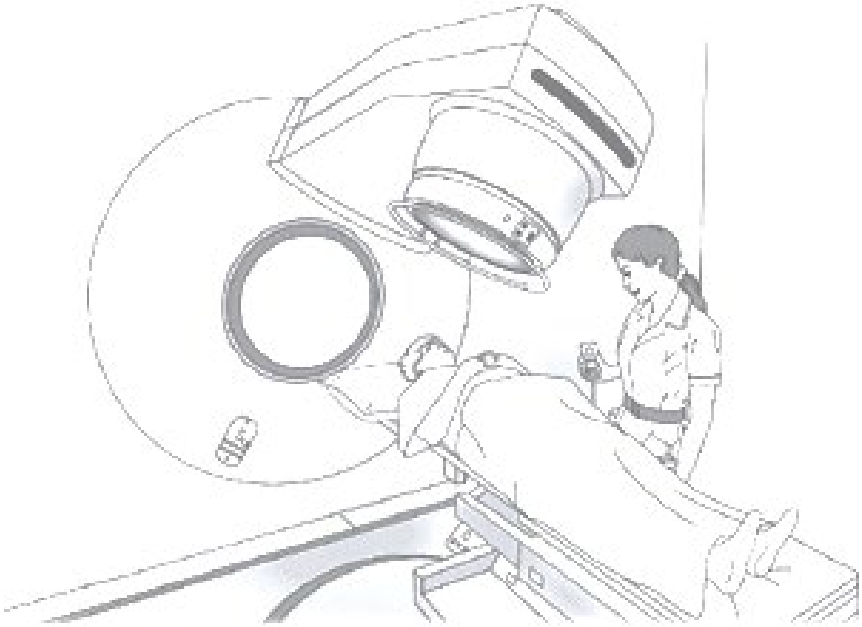


Figure 22: Cancer Treatment: Radiation

Radiation Therapy is a cancer treatment that uses radiation to destroy cancer cells and minimize cancerous tumors. Radiation therapy is often the form of palliative treatment given to patients, when there is no promising cure to their illness. Radiation

[45] "Treatment For Cancer | Cancer Treatment Options."

can help lessen the side effects and pain of the illness allowing patients to be more comfortable.

Radiation therapy is directed at the cancer through external or internal intervention. External radiation therapy uses a large machine to expose the area of the cancer to high levels of radiation to destroy the cancerous cells. Internal radiation therapy is when a source if radiation is placed or swallowed into the body. Once inside the radiation reacts with the cancer cells to destroy them.

There are multiple other forms of cancer treatments that medical professionals provide for cancer patients. These include treatments such as targeted and hormone therapy, transplants, immunotherapy methods, and clinical trials. Cancer treatment is constantly evolving as scientific research strives to find a cure for this disease.

After an initial diagnosis patients work with their oncologist and medical team to derive a treatment plan that provides the most optimal chance of eradicating their form of cancer. Cancer is an overarching term for a myriad of different specified diseases. Therefore, the experience and treatment plan vary from each patient due to their condition and preferences.[46]

[46] "When the Doctor Says 'Cancer,'" Cancer.Net, April 21, 2010, https://www.cancer.net/navigating-cancer-care/diagnosing-cancer/when-doctor-says-%E2%80%9Ccancer%E2%80%9D.



Figure 23: Oncologist and Patient Centered Treatment Plan

Cancer treatment is often a lengthy and grueling journey. It is therefore crucial that a patient has a strong medical and support team. Once diagnosed, the oncologist and patient decide on the most viable treatment option. This determines how and where the treatment will take place. As a result of the illness, the patient will have to undergo multiple tests, procedures, and appointments. This is often difficult and traumatic for patients to navigate in concurrence with the illness.

Cancer treatment is often conducted through a combination of treatment methods. This is in order for the patient to have the most effective eradication of the cancer from their body. This can often be extremely strenuous for the patient to undergo. In addition, there are multiple other interventions, tests, and appointments that the patient needs to attend. Patients are constantly being sent to new medical facilities and new doctors as part of the multi-faceted care process. Therefore, patients

are constantly being thrust from one facility to another which adds to the already strenuous demands of their illness.

LEARN system

Due to the arduous reality of cancer treatment, the Institute of Medicine began considering the benefits of approaching cancer treatment through elements of healing and recovery from the onset of diagnosis. The Institute of Medicine strives to improve the quality of care for cancer patients. There have been symposiums and scientific journals designated to this debate in cancer care. This has formulated the establishment of the LEARN system to help navigate patients and their families through a method of healing that focuses on a patient's wellbeing to improve outcomes of medical treatment and intervention.[47]

The LEARN system views patients as survivors from the time of diagnosis until the disease is eradicated or reoccurs.[48] This promotes positivity for the patients and their families, which is an integral aspect of recovery and healing. LEARN is an acronym for five simple tasks that improve a patient's wellbeing during treatment and therefore improves the result of the medical aspect of the treatment process.[49]

L refers to living. Identifying something that makes life meaningful and creates a broader sense of life outside of treatment. This translates to designating time outside of treatment to find ways to enjoy oneself or reach out to help others.[50]

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[47] Md Stewart B. Fleishman, *Manual of Cancer Treatment Recovery : What the Practitioner Needs to Know and Do* (New York: Demos Medical, 2012), 10, https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=420445&site=ehost-live.
[48] Stewart B. Fleishman, 5.
[49] Stewart B. Fleishman, 18.
[50] Stewart B. Fleishman, 9.

E stands for education. It is important to learn as much as one can handle about their specific form of cancer and recovery process.[51]

A refers to the importance of activity. "Physical activity to the extent that one is able during and after treatment minimizes deconditioning afterwards."[52]

R stands for rest. Rest is critical for the body to heal and energy conservation to optimize a patient's energy.[53]

N is for nutrition it important to maintain nourishment and strength to combat the illness.[54] Through this method patients are able to experience a better quality of life and holistic approach to treatments.

It is critical for patients to have a strong support team as they battle cancer and go through the treatment process. Family and friends are vital to supporting patients through their cancer journey. Cancer treatment causes immense emotional and physical distress. There is a lot for a patient to manage and cope with ranging from the multitude of appointments to physical side effects that result from the illness. Therefore, support members become critical aspects of the patient's treatment process.

Post treatment- reacclimate

"While I was having chemo, I quit doing almost everything. So, when treatment ended the challenge for me was what am I going to do now with my life?

[51] Stewart B. Fleishman, 18.
[52] Stewart B. Fleishman, 18.
[53] Stewart B. Fleishman, *Manual of Cancer Treatment Recovery*.
[54] Stewart B. Fleishman, 18.

What is it that I should go back to doing?" [55] Many people assume that cancer treatment ends once a person receives clear margins from their medical professional. However, the ramifications of cancer far outlive this initial milestone. Life does not simply return to how it was precancer. It takes time for cancer survivors to retain a sense of normalcy and compliance with everyday life. Despite the reclamation process there is also significant emotional and physical healing patience undergo post recovery. Moreover, the constant fear of relapse and consistent preventative measure and medical follow up care remain often for a survivor's entire lifetime.[56]

Post cancer treatment cancer survivors return to medical centers for follow up care. The average follow up care plan requires patients to initially visit medical centers every three to four months for the first three years after treatment. Physicians observe for side effects, recurrence of cancerous cells, or spread of the cancer through the body.[57] Follow-up care can also include home care, occupational or vocational therapy, pain management, physical therapy, and support groups.[58]

[55] "Life-after-Treatment.Pdf," 2, accessed May 19, 2022, https://www.cancer.gov/publications/patient-education/life-after-treatment.pdf.
[56] "Life-after-Treatment.Pdf," 15.
[57] "Life-after-Treatment.Pdf," 9.
[58] "Life-after-Treatment.Pdf," 10.

Chapter 4: Wellness

The term wellness is one that has come to adorn many functions and spaces of everyday life. There are wellness brands, wellness spaces, and even wellness conferences and retreats. Wellness has therefore become a key phrase that people strive to achieve, as if it offers a seal of approval. However, due to the term becoming part of our vernacular, a clear understanding of what wellness truly entails has become amalgamated with a multitude of other concepts.

Wellness as a phrase, was coined in the United States post World War II. Nonetheless, concepts of wellness were in circulation and date much further back in history with ideals about morality, personal responsibility, and health.[59] When early health movements and wellness initiatives began to become popular the agenda was to heal civilization from the horrors and confines of the post war era. The fundamental concept of wellness was that an individual's health was so much larger than simply the absence of disease.[60] As the concepts of wellness evolved it became part of an individual's lifestyle choices and self-care process that would ultimately improve one's overall quality of life.[61]

In modern time wellness has retained these fundamental concepts and has become a more holistic element of life that focuses on maximizing the state of an individual's wellbeing. This is achieved through ''self-responsibility, nutritional awareness, physical fitness, stress management, and environmental sensitivity.''[62] Aspects of wellness include optimal physical, mental, and emotional health that

[59] Anna Kirkland, "What Is Wellness Now?," *Journal of Health Politics, Policy & Law* 39, no. 5 (October 2014): 3, https://doi.org/10.1215/03616878-2813647.
[60] Kirkland, 3.
[61] Kirkland, 4.
[62] Kirkland, 4.

improve one's quality of life. Psychologist have established that aspects of spirituality, work, self-reflection, love and friendship are aspects that improve an individual's state of wellbeing.[63]

From a psychological perspective, wellness is derived when an individual's basic needs and desires are met.[64] This incorporates, an interdependency between physical, emotional, intellectual, social, and environmental disciplines.[65] Moreover, neglecting one of the disciplines would result in an impact to the rest of the disciplines, and cause a decrease in life quality and therefore a person's wellness. Consequently, there are direct correlations between wellness and aspects of satisfaction, personal fulfillment, and enjoyment. Therefore, engaging in aspects that improve these feelings creates an environment conducive to wellness. This also promotes the understanding that wellness is an individualized experience that varies based on each individuals' necessities and preferences. While wellness is an overarching term its ramifications can vary based on the individual and situation.[66]

Wellness promotes the ideology that simply surviving is not adequate. Moreover, the key to quality of life and wellness is enabling the body to thrive. As a result, health becomes understood as much greater than simply being physically healthy. There are a multitude of physical and mental factors involved in ensuring

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[63] Kirkland, 4.
[64] James Griffin, *Wellbeing Its Meaning, Measurement and Moral Importance* (Oxford: Oxford University Press, 1986), 41, https://web.p.ebscohost.com/ehost/ebookviewer/ebook/bmxlYmtfXzkyNDM1OV9fQU41?sid=4ce008cd-8134-4c33-a1e6-942674ad8930@redis&vid=0&format=EB&rid=1.
[65] Debbie L. Stoewen, "Dimensions of Wellness: Change Your Habits, Change Your Life," *The Canadian Veterinary Journal* 58, no. 8 (August 2017): 3.
[66] Griffin, *Wellbeing Its Meaning, Measurement and Moral Importance*, 52.

overall wellness. Therefore, aspects such as physical settings and personal interactions become critical components of wellness.

Medical aspect to wellness.

The ideals of wellness have a tremendous impact on health care and medical systems. Providing for a patient's wellness that encompasses their physical, mental, and emotional condition has been seen to improve the outcome of the medical intervention.[67] Specifically in the sector of oncology the combination medical intervention and a strong state of wellbeing has resulted in a stronger recovery process. [68] It is therefore critical that cancer patients have the necessities to ensure that their wellness is being considered and cared for in conjunction with their medical needs. Simply relying on only medical intervention results in patients being at a significant disadvantage. Moreover, this version of care only caters to one aspect of the patient. Providing patients with the tools and empowerment to implement healthy lifestyle choices, applying their personal strengths, and aspects of goal setting strengthens patients physical, mental, and emotional state thereby improving their overall wellness. This provides a more successful and holistic approach to treatment.[69]

A study was conducted by the National Institute of Health to determine the impact of wellness on cancer patients. The objective of the study was to determine how wellbeing impacted cancer symptoms, depression levels, and quality of life of

[67] Kirkland, "What Is Wellness Now?," 4.
[68] Daniela L. Stan et al., "Wellness Coaching Intervention for Increasing Healthy Behaviors in Breast Cancer Survivors," *Clinical Journal of Oncology Nursing* 24, no. 3 (June 1, 2020): 305–15, https://doi.org/10.1188/20.CJON.305-315.
[69] Stan et al., 3.

patients receiving treatment. Eight- five terminally ill cancer patients were assessed prior to being exposed to wellness coaching and wellness focused spaces. The study concluded that for the majority of the patients at least a small improvement was seen in their symptoms. In addition, all the patients had improvement in depression levels across the board.[70] Therefore, this study established the connection between a focus on wellness reducing cancer side effect symptoms and an increase in depression levels which attributed to a better quality of life for cancer patients.[71]

[70] Colleen S. McClain, Barry Rosenfeld, and William Breitbart, "Effect of Spiritual Well-Being on End-of-Life Despair in Terminally-Ill Cancer Patients," *Lancet (London, England)* 361, no. 9369 (May 10, 2003): 1603–7, https://doi.org/10.1016/S0140-6736(03)13310-7.
[71] Yin-Chih Wang and Chia-Chin Lin, "Spiritual Well-Being May Reduce the Negative Impacts of Cancer Symptoms on the Quality of Life and the Desire for Hastened Death in Terminally Ill Cancer Patients," *Cancer Nursing* 39, no. 4 (August 2016): E43-50, https://doi.org/10.1097/NCC.0000000000000298.

Chapter 5: Human Connection to Nature

Researchers and scientists have attempted to understand the complexity of the human brain for centuries. It is an intricate network of systems so strong it is the force that drives human function. On the other hand so fragile it can snap without significant warning. [72] While there are still so many unknowns in the realm of mental health, science has proven that there is a direct correlation between the environment and mental health.[73] A person's environment impacts more than fifty percent of their mood and state of mind.[74] Furthermore, studies have shown that there is a direct relationship between the natural environment and the improvement of mental state.[75]

Historically civilization has operated with a closer connection to the earth. As technology has advanced civilization has moved away from its natural origins.[76] Cities began to develop, and the once lush landscape began to dissipate leaving a concrete jungle in its wake. The withdrawal of access to nature has left humans with an innate deficiency[77]. In the article, Human Nature Connection and Mental Health, the authors discuss how the "domestication of nature" has not resulted in human kind feeling a sense of control over the environment but rather there is an element of

[72] "Environmental Neuroscience. - PsycNET," APA PsycNET, accessed March 10, 2022, https://doi.org/10.1037/amp0000583.
[73] "Environmental Neuroscience. - PsycNET."
[74] Divya Chavaly and K. P. Naachimuthu, "Human Nature Connection and Mental Health: What Do We Know so Far?," *Indian Journal of Health & Wellbeing* 11, no. 1–3 (January 2020): 85, https://doi.org/10.15614/IJHW.v11i01.18.
[75] "Ecopsychology: How Immersion in Nature Benefits Your Health," Yale E360, accessed March 10, 2022, https://e360.yale.edu/features/ecopsychology-how-immersion-in-nature-benefits-your-health.
[76] Timothy Beatley, Carla L. Jones, and Reuben Rainey, *Healthy Environments, Healing Spaces : Practices and Directions in Health, Planning, and Design* (Charlottesville: University of Virginia Press, 2018), https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1946520&site=ehost-live.
[77] Chavaly and Naachimuthu, "Human Nature Connection and Mental Health."

distress and disorientation that results from the lack of natural connections. [78]Therefore, interaction with nature is a critical aspect of human life that directly correlates to the state of one's mental health. [79]



Figure 24: Restorative Element of Nature

Extensive studies have been conducted regarding the impact of the environment on mental health. Conclusively, these studies have shown that even short term exposure to gardens, parks, forests, and other natural conditions reduced stress and depressive symptoms.[80] Simply spending time outdoors evoked positive emotions and evoked psychological relaxation.[81] A study conducted in Japan required two groups of participants to walk distances of equivalent lengths and comparable exertion while their heart rate and blood pressure was measured. One group was led through dense urban fabric without access to natural elements, the other was led through a verdant forest. The results of the study exhibited the participants who went

[78] Chavaly and Naachimuthu.,84.
[79] "Nurtured by Nature," https://www.apa.org, accessed March 10, 2022, https://www.apa.org/monitor/2020/04/nurtured-nature.
[80] Chavaly and Naachimuthu, "Human Nature Connection and Mental Health."
[81] Chavaly and Naachimuthu.

through the forest showed a significantly lower heart rate than those that went through the urban condition. Additionally, fluctuations in heart patterns showed those that went through the forest experienced levels of relaxation and reduction of stress. At the culmination of the study the participants who went through the forest were in better moods and experienced a decrease in anxiety. The conclusion of the study displayed that the exposure to nature has influence on mental health and psychological benefits.[82]

The experience of nature is influenced through all five of the human senses. The sounds, smells, taste, and touch of nature are all conduits for the benefits of nature on mental health.[83] Additionally, the revitalizing effect of nature on one's mental health has been analyzed through the level of interaction one has with the environment. Longer periods of time and close engagement with natural elements not



Figure 25: Nature Improvement on Psychological Condition

[82] "How Nature Can Make You Kinder, Happier, and More Creative," Greater Good, accessed March 10, 2022, https://greatergood.berkeley.edu/article/item/how_nature_makes_you_kinder_happier_more_creative.
[83] Gregory N. Bratman et al., "Nature and Mental Health: An Ecosystem Service Perspective," *Science Advances* 5, no. 7 (n.d.): eaax0903, https://doi.org/10.1126/sciadv.aax0903.

only eliminates symptoms of mental disorders but improves the one's overall all psychological condition.[84]

The opportunity for psychological relaxation in conjunction with the serenity of the natural environment provides the individual with a place for contemplation and self-discovery. Stepping away from technology and societal tribulations gives a sense of freedom that is conducive to self-reflection and is a critical element of a health mental state. [85]



Figure 26: Self Reflection

Impact on cognitive ability

Spending time in nature is not only therapeutic but also can improve one's cognitive ability.[86] The exertion of daily tasks and responsibilities takes a toll on one's concentration and cognitive functions.[87] These tasks are controlled by the prefrontal cortex. Engaging this part of the brain extensively causes mental fatigue

[84] "Environmental Neuroscience. - PsycNET."
[85] "Ecopsychology."
[86] "Environmental Neuroscience. - PsycNET."
[87] Chavaly and Naachimuthu, "Human Nature Connection and Mental Health."

and results in the reduction of cognitive capacity.[88] However, engaging with nature provides rejuvenation and an opportunity for the depleted attention circuits of the prefrontal cortex to recover. Consequently, enabling the restoration of stronger cognitive ability and wellbeing.[89]

In addition, studies have found that the process involved in the perception of natural elements improves cognition. Research studies conducted on animals showed that the clusters of neurons in the retina breakdown elements in nature differently from ordinary elements. Although this occurs subconsciously this complex system has shown to improve the brains cognitive capacity.[90]

Although this theory was discovered through research on animals, to test its validity a study was conducted on humans. Participants were given challenging puzzles to quantify their cognitive ability before and after consistent exposure to a natural environment. After spending considerable time in the natural setting participants were able to complete forty seven percent more puzzles than before the time they spent in nature. While there may be multiple factors attributed to this

[88] Bratman et al., "Nature and Mental Health."
[89] Chavaly and Naachimuthu, "Human Nature Connection and Mental Health."
[90] "Nurtured by Nature."

outcome the direct correlation between the natural environment and improvement of cognitive function is evident.[91]

Impact on mood

The symbiotic relationship between humans and nature is one that provides multiple benefits for people. The improvement that nature has on people's psychological wellbeing has been presumed for centuries. However, modern science has been able to provide tangible evidence for this phenomenon. Study of brain patterns has shown that exposure to nature improves the psychological state.[92] A Stanford University study led by Gregory Bratman used fMRI technology to observe brain movement of participants before and after they partook in ninety-minute walks either through urban or natural environments. Psychological factors and rumination levels were observed at both stages of the experiment. Unanimously the participants who walked through the natural setting exhibited increased activity in the subgenual prefrontal cortex. This is the area of the brain that has an impact on one's mood.[93] Therefore, this study demonstrated that exposure to nature improves mental health as well as person's disposition.

The access to beauty that nature exhibits is also beneficial to the human psyche and condition. The abundance of beauty in nature has shown correlation that provokes positive emotions and improvement of social behaviors.[94] It has been hypothesized that spending time in nature promotes a sense of being part of the larger

[91] "Nurtured by Nature."
[92] "How Nature Can Make You Kinder, Happier, and More Creative."
[93] Bratman et al., "Nature and Mental Health."
[94] Chavaly and Naachimuthu, "Human Nature Connection and Mental Health."

ecological system and larger than one's own confines. Furthermore, observation of natural elements can produce sensations of marvel and amazement. Consequently, this results in an increase of overall positive emotions and the probability for better social interaction and contribution. [95]

Spending time outdoors and experiencing nature is often a rejuvenating experience. However, eighty percent of the population lives in urban communities.[96] Despite the disengagement from nature within the urban context, people on average spend ninety percent of their time indoors.[97] The absence of nature in daily life is a critical disadvantage to human wellbeing. People have reported to feeling more alive and to have more energy after being in natural environments.[98] Moreover, studies and research has proven that access to natural settings improves psychological health, cognitive ability, as well as benefits ones overall temperament.[99] Therefore, it is imperative that despite the advances of technology that often prevent natural interaction we engage and enable the symbiotic relationship we have with nature to allow us to thrive.

[95] "Ecopsychology."
[96] Stephen R. Kellert, *Nature by Design: The Practice of Biophilic Design* (New Haven: Yale University Press, 2018), 15, https://www.degruyter.com/isbn/9780300235432.
[97] Kellert, 15.
[98] "Ecopsychology."
[99] Bratman et al., "Nature and Mental Health."

Chapter 6: Biophilia

Surmounting research has revealed the myriad of advantages that exposure to nature provides. Therefore, designers strive to integrate nature into the vast built environment. Incorporating natural elements into the spaces we inhabit on a daily basis bring the advantages of nature into everyday life and provides for a healthier more sustainable future.[100]

Biophilia is a phenomenon that focuses on the incorporation of nature into the human realm for the purpose of wellbeing. Derived from the Greek word bio meaning life or living things and philia which means the love of. The linkage of these two words generates the meaning love of living things.[101] Biophilic design is an aspect of design that fuses the benefits of the natural world into the confines of the built environment.

Simple exposure to natural elements or environments is not the extent of biophilic design. Biophilic design strives to impede on the aspects of nature that have been established as contributary to psychological and physiological well-being.[102] Biophilic design emphasizes the understanding of the human condition. Incorporating design focused around how to make individuals feel more at ease, safe, and content in a space.[103] True implementation of biophilic design requires on a multifaceted

[100] Bernard Sheridan, "The Biophilia Effect," *Horticulturist* 26, no. 2 (Spring 2017): 16.
[101] "Biophilia Hypothesis | Description, Nature, & Human Behavior | Britannica," accessed March 17, 2022, https://www.britannica.com/science/biophilia-hypothesis.
[102] Stephen R. Kellert, *Nature by Design: The Practice of Biophilic Design*, 1 online resource (8) : New Haven: Yale University Press, 2018.
[103] "Biophilic Design & the Future of the Built Environment," *Interior Design* 90, no. 12 (August 2019): 76–79.

understanding of natural conditions that have a relevant effect on the human condition.[104]

Technology is at the frontrunner of our daily lives. As a society we have advanced significantly through the advancement of technological means. However, this has drawn society indoors and has limited the exposure to nature and the outdoors.[105] Therefore, biophilic design is a strategy to incorporate the benefits of natural elements on the expanding built environment. Proving a focus on the wellness of individuals as part of a broader ecological system.[106]

Strong biophilic design is not merely a means of decoration of a space. Rather, it promotes integrated connections throughout the space that relate back to the larger global ecological system.[107] This promotes a larger impact through the design on the human condition. Moreover, it mitigates the common human attitude of subjugating nature for mere pleasure.[108] Biophilic design creates an internal setting that then relates back to the natural world through the confines and design elements of space.[109]

Moreover, design elements that relate to multiple human reactions and emotions provide a stronger response to biophilic design. In addition, incorporating the design as an engaging, cohesive aspect of the entire space further supports long

[104] Kellert, *Nature by Design*.
[105] Radoslava Cenká, "Biophilia in Era of Technology," *International Multidisciplinary Scientific Conference on Social Sciences & Arts SGEM*, January 2014, 103.
[106] Kellert, *Nature by Design*, 17.
[107] "Biophilic Design & the Future of the Built Environment."
[108] Cenká, "Biophilia in Era of Technology."
[109] Kellert, *Nature by Design*, 19.

term effects and benefits on individuals through the design.[110] Formulating spaces that evoke productivity, pleasure, and comfort enables a connection between visitors of a space and the building they inhabit. This connection has shown to result in structures that are better cared for and sustained through time which is fundamental to aspects of community.[111]

The incorporation of biophilic design is a strategic process. There is not one specific way to implement it into a setting. However, understanding the fundamental aspects of human reaction to nature enables the design to be executed effectively.[112] Therefore, biophilic design can be understood and categorized through human interaction with nature.

There are three primary categories of implementing biophilic design that are effective in the stimulation of human wellbeing. The first category includes direct experience of natural elements. This involves literal inclusion of natural features into design. Ranging from components such as light, air, water, fire, animals, and plants. This category also includes direct views of natural conditions and elements. Secondly, there is the indirect experience of nature. This involves images of nature, natural representations, natural materials, and patterns derived from elements of nature. The fascinating aspect of the indirect experience is that it involves the human intervention to combine symbolic forms to the experiential experience. This often includes one's own associations and feelings into the experience. The third category

[110] Kellert, *Nature by Design*.
[111] Sheridan, "The Biophilia Effect."
[112] Kellert, *Nature by Design*, 24.

of biophilic design is the experience of space and place. The main focus of this aspect is the division and design of the spatial setting based on components of environmental principles. The design of secluded spaces, opportunity for refuge, transitional spaces, and open spaces through the perspective of the promotion of wellbeing. Additionally, this includes the incorporation of access to exterior spaces into the design. The layout of space becomes fundamental to the human perception of the space. It is therefore critical that the spaces themselves are designed with the understanding of human preference and desire for safety. The premise for these designs is based on the formation of habitats and connections to ecological environments.[113]

Biophilic design is founded on human perception. Human perception of environment and space is conducted through the range of human senses. While the most dominant sense is often visual, aspects relating to sound, smell, touch and taste are equally important. Additionally, the component of time and movement are also aspects that formulate perception. Each of these individual senses combined formulate the impact of biophilic design on the human condition.[114]

When designing for the optimum of the human condition, an integral aspect is the incorporation of light and air. Light impacts how humans adapt spatially, orient to space, times of day, and weather conditions. The fluctuation between light and dark enables people to respond to the environment. This phenomenon is known as the circadian rhythm. This is how the human body acclimates to the changes in the environment. A stable circadian rhythm is a prime factor to one's mental health and

[113] Kellert, 25.
[114] Kellert, 25.

wellness. When the connection to the environment is impeded, this can interfere with homeostasis of the circadian rhythm resulting in disorientation and confusion that often manifests into further issues. Biophilic design facilitates strategies to incorporate aspects of natural light and air into the interior of buildings. There are myriads of design approaches that include ingenious designs to promote naturally lit spaces. For example, curtain walls, atria, even mirrors that reflect the sun path into the space throughout the day. Light wells and shadows further add to the sensations of natural light within interior space. Natural ventilation is an additional consideration to maintain thermal comfort in buildings. Although modern technology has implemented electrical alternatives, the utilization of natural exposure has been found to be more effective in stimulating wellness.



Figure 27:Natural Light

Plants and natural greenery are the most iconic elements of biophilic design. This is often the most convenient way to incorporate the natural environment into interior space. Studies conducted have shown the therapeutic quantifications that result through the integration of plant life into interior spaces. Stress levels reduce, an increase in positivity, as well as an increase in productivity. The inclusion of plant life is more effective when merged with the structure and surfaces of building design. This may be implemented through green walls, vertical plantings, or atria that formulate park like environments. The ideology of biophilic design strives to stay away from scattered potted plants and superficial decoration. Rather the ideology formulates strategies through design that promotes a larger longer lasting impact.



Figure 28: Natural Plants and Greenery:

Exposure to water features and animal life have also been found to improve mental and physical states. The opportunity for these elements to impact multiple sense simultaneously makes them effective elements of biophilic design. Features

including ponds, aquariums, constructed wetlands and even rainwater spouts provide an opportunity to incorporate water and marine life into design.



Figure 29**:**Water Feature

Water can trigger emotional reactions, stimulate intellectual contemplation, as well as aesthetically a beautiful contribution to a building's interior. [115] Indirect approaches incorporation of water has also been found to be effective biophilic design

[115] Kellert, 32.

elements. This includes, pictures, artwork, audio interventions, and inspired patterns based on water formations.[116]



Figure 30**:** Indirect Inclusion of Water Elements

Strategies to incorporate animal life into design is one that while having multiple biophilic benefits needs to be conducted with sensitivity.[117] The most effective examples create an ecosystem of species with plants water and natural features. This includes areas such as ponds, gardens, aquariums, and aviaries. There is

[116] Kellert, 33.
[117] "Biophilic Design & the Future of the Built Environment."

also the opportunity to incorporate the effect of these elements through icons, sculptures, artwork, and decoration. [118]



Figure 31: Interior Ecosystem

Biophilic design is also implemented through color, materials, forms and shapes.[119] There is numerous research and studies on the influence that color has on the individual. Color choice has the ability to induce stress or serenity on

[118] Sheridan, "The Biophilia Effect."
[119] Kellert, *Nature by Design*, 40.

inhabitants.[120] Color is therefore a strategic biophilic design element and should be implemented strategically to promote the intention of the space.

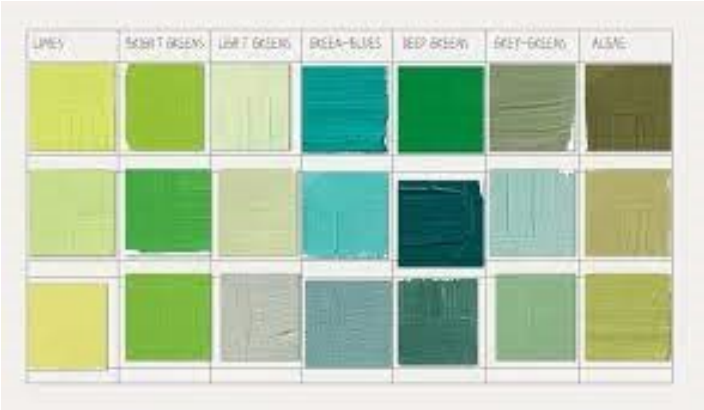


Figure 32**:** Calming Color Palette

Natural materials and textures provide tactile and visual impacts that evoke positive response to the human psyche. The dynamic features of natural materials often provide character and depth to a design that impacts the human perception and feeling with in the space.[121]

The replication or imitation of natural elements into various forms and patterns within the built environment is an additional use of biophilic design. These forms and shapes can emerge through building massing, facades, interior spaces and even furnishings. Naturalistic forms and patterns often can transform mondain lifeless

[120] Faber Birren, *Light, Color,and Environment* (NewYork, New York: Van Nostrand Reinhold Company Inc., 1969), 10.
[121] Kellert, *Nature by Design*, 36.

elements and structures into vibrant more intricate settings that promote allure and pleasure.[122]



Figure 33**:** Bioclimatic Materials

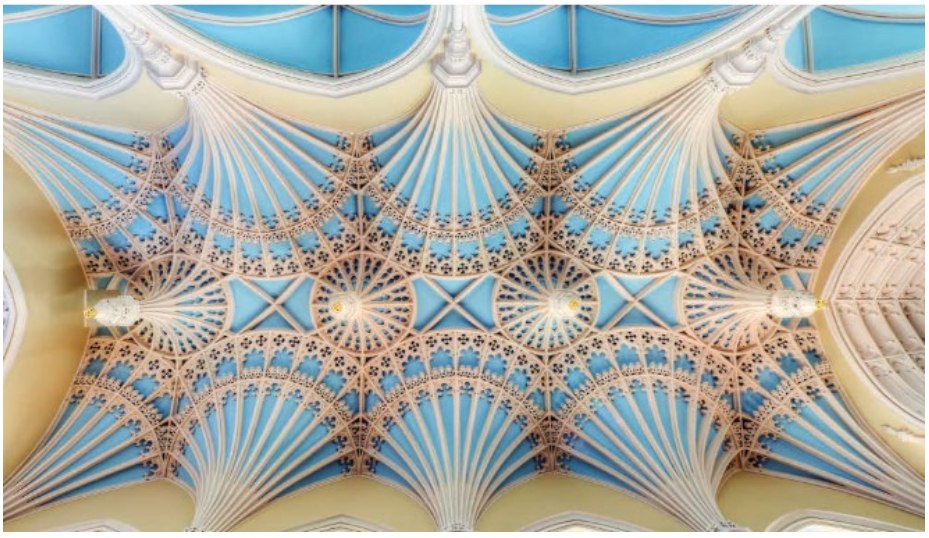


Figure 34**:** Bioclimatic Patterns

[122] Kellert, 94.



Figure 35: Bioclimatic Forms 1

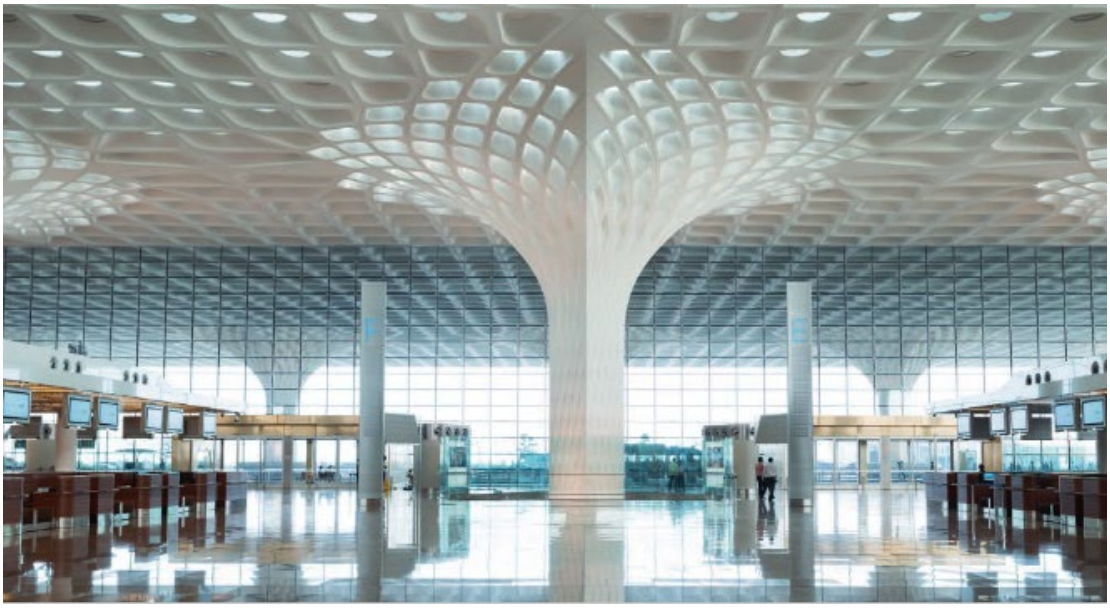


Figure 36**:** Bioclimatic Forms 2

Chapter 7: Health Benefits of Wellness Design

The significance of the connection to the natural world and individuals' health and wellness continues to become a recognized phenomenon. Over the last few decades there have been a reemergence of an emphasis on wellness design as well as the importance of incorporating natural elements into design.[123] With a substantial increase in an understanding of wellness and its importance it has become part of architects agendas, as creators of the built environment, to design buildings that encapsulate wellness and promote a sense of wellbeing for visitors and inhabitants of these designs.[124]

A particular emphasis on the importance of wellness design is critical in the healthcare sector. Through wellness design initiatives, the patient becomes the central focus of the design.[125] Consequently the environment in which they receive care becomes a vital element of a patient's treatment process. The emphasis on a patient's wellbeing as they battle illness improves the overall quality of care they receive within these facilities.

Upon arrival to healthcare facilities patients experience feelings of dread, fear, and anxiety. The imminent fear of treatment and diagnosis is an inevitable concern. However, formulating an atmosphere conducive to wellness can make a tremendous influence on reducing the impact of these feelings.[126]

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[123] Sandra Costa and Sharon Watson, *Pathways to Well-Being in Design: Examples from the Arts, Humanities and the Built Environment* (London: Routledge, 2019), 55.
[124] Costa and Watson, 2.
[125] Geoffrey Purves, *Healthy Living Centers: A Guide to Primary Healthcare Design* (Oxford: Architectural Press, 2002), 2.
[126] Purves, 2.

The incorporation of welcoming spaces that have an abundance of natural light or the ability to view outwards into natural environments is a significant aspect of wellness design. Moreover, in addition to finishes and materials the architectural planning and organization of spaces is critical. The consideration of strong circulation paths between patients and staff becomes an important essential element of a patient's experience. Having a balance between public spaces, waiting spaces, and quite spaces as well as facilities for family members become important aspects of wellness design that add to a patient's composure. The role of artwork in conjunction with biophilic design become prevalent elements to formulating an atmosphere of wellbeing.[127] Through these design focused initiatives the design of the healthcare premise aids and supports patients seeking care and treatment.

Technical Implementation

The ideology of wellness design is a growing phenomenon among design professionals and healthcare workers. There have been considerable studies conducted to determine the influence of wellness spaces on health care centers. The National Institute of Health (NIH) conducted a study to determine the importance of wellness features and design in cancer centers.[128] The study strove to discover the benefits on oncology patients as well as the healthcare staff. Seventy-six staff members and sixty-two oncology patients were placed in a facility that exhibited eleven central wellness features. This included elements such as natural lighting,

[127] Purves, 3.
[128] Michelle Tinner, Paul Crovella, and Paula F. Rosenbaum, "Perceived Importance of Wellness Features at a Cancer Center: Patient and Staff Perspectives," *HERD* 11, no. 3 (July 2018): 1, https://doi.org/10.1177/1937586718758446.

views to nature, artwork, greenery, thermal comfort, and consideration of privacy. The study discovered that both patients and staff were more congenial in this environment. Workers exhibited stronger work ethics and efficiency, while patients appeared to be more at ease and a decrease in depressive symptoms were apparent.[129]

To further the analysis of the study patients and facility workers were polled individually to find out the preferences of which of the wellness features were most effective. The poll results concluded that the top-ranking features were views of nature, natural lighting, and thermal comfort for both the healthcare workers and the patients. Therefore, aspects of wellness design are of particular importance in cancer facilities for patients as well as for the healthcare workers. The inclusion of roof top gardens, addition of more private and quiet spaces into the building program, and aspects of biophilia and artwork become central elements of creating an atmosphere of effective wellness that is critical to the building's inhabitants.[130]

Cancer care centers are not simply about the administering of treatment. However, the environment of these facilities formulates a critical impact on the quality of patients' care. Therefore, the inclusion of biophilic and wellness design is imperative in the design of cancer centers. Moreover, a clear understanding of the treatments cancer patients undergo as well as the preferences of patients within these facilities is necessary to create an environment conducive to wellness.

Studies have shown that the majority of cancer patients receive care in outpatient centers. Treatment times vary dependent on the treatment and range from

[129] Tinner, Crovella, and Rosenbaum, "Perceived Importance of Wellness Features at a Cancer Center."
[130] Tinner, Crovella, and Rosenbaum.

fifteen minutes to over eight hours.[131] In addition to the often long periods of time patients spend in facilities, there are a myriad of physical side effects that cancer patients experience as a result of treatment. Primary common side effects include feeling cold and experiencing chills, sever nausea, and dizziness.[132] In addition, cancer care provokes an intense mental and emotional response to treatment that significantly impacts patients as they undergo treatment. Therefore, the design of these facilities needs to cater to these difficult realities that patients experience. Design research in this area concluded three main categories of primary patient needs for effective wellbeing during treatment. They are, the ability for choice and control during treatment, the option for privacy as well as social support, and lastly, positive distractions from the ordeals of treatment and side effects.[133]

Many cancer patients express frustration regarding cancer removing their sense of control in multiple aspects of their lives.[134] Therefore, having control over aspects of their treatment environment becomes important to patients. Main aspects of control relate to the ability to alter lighting, sound, and temperature.[135] Temperature control is one of the primary elements of control patients' desire. Design consideration to enable patients to have control over the temperature include multiple HVAC control zones or radiant heaters in personal treatment spaces. In larger group spaces the opportunity for patients chairs or recliners to have adjustable temperature options allows patients to adjust based on their needs and preferences.[136] Enabling

[131] Zhe Wang et al., "Cancer Treatment Environments: From Pre-Design Research to Post-Occupancy Evaluation," 2011, 68.
[132] Wang et al., 68.
[133] Wang et al., 69.
[134] Wang et al., 69.
[135] Wang et al., 69.
[136] Wang et al., 68.

patients elements of control over their treatment environment improves the quality of care a patient experience during treatment. Moreover, it is a fundamental aspect of providing for wellness.

When it comes to private individual treatment spaces versus public group setting spaces for treatment patients preferences fluctuate and differ based on individual preferences or mood.[137] A study conducted to determine patients' preferences discovered varying opinions. Some patients did not appreciate having to be subjugated to other patients while they receive care and therefore prefer a more individualized setting. One patient expressed feelings of frustration to having to be on display during the difficult treatment process.[138] On the other hand, patients found comfort and benefit to be among other patients in a group setting. It gave them encouragement and support to be with others having similar a experience. One particular patient expressed the benefit of support that a group setting provides. "I really felt good about helping a patient sitting next to me. She didn't speak English but holding hands with another patient means the same thing in any language."[139] These feelings of support and helping others are conducive to a patient's wellness and can help patients endure treatment. However, it is important that patients feel comfortable in treatment environments. Therefore, providing three forms of treatment spaces is beneficial to creating an environment of healing for all types of patients. This includes completely private treatment rooms, semi-private spaces where patients can open a curtain or screen to their comfort of exposure, or public spaces where

[137] Wang et al., 68.
[138] Wang et al., 69.
[139] Wang et al., 69.

patients receive care in a group setting.[140] In this manner, patients can have a choice of the setting they receive treatment dependent on their personal preferences and feelings at the time of treatment.

Within each of these spaces it is important that the medical staff have convenient access and visual ability to observe patients during treatment. Strategic planning for nurses' stations among treatment spaces is imperative for quality care. In addition, many patients express the desire to be able to see medical personnel in case of complications or emergency during care. While constant visual control over patients in private spaces is more challenging proximity to nurses' station can help maintain supervision of patients in private spaces.[141]

Convenient access to restrooms is additionally important for patients during treatment. When designing cancer centers it is therefore important to distribute restrooms in proximity to treatment spaces. In addition, the consideration of the ratio between patients to toilets becomes important. Often infusion patients require restrooms more frequently than other patients. Having adequate conveniently accessible restrooms reduces stress and concern and provides patients with a sense of satisfaction and comfort.[142]

When designing a center focused on patient wellness the distances between spaces and wayfinding becomes critical. Effective design strategy and planning is important to the distribution of the program. The dispersion of service spaces, restrooms, and medical spaces is an effective strategy that prevents patients from

[140] Wang et al., 69.
[141] Wang et al., 69.
[142] Wang et al., 73.

having to go long distances to reach necessary spaces. This enhances a patient's comfort and prevents discouragement. In addition, wayfinding is an important criteria to this strategy. The incorporation of clear signage and designated information desks allows patients to reach their required destination with ease. This prevents an increase in patient stress levels and disorientation to occur resulting in a tranquil environment that promotes patient satisfaction[143].

The need for positive distraction is one of the most fundamental aspects of wellness design. This enables patients to be able to be able to focus elsewhere rather than emphasizing on the illness and treatment. In addition, strong wellness techniques allow patients to build up and improve other areas of their being such as mental health or social interaction that improves their overall quality of life. The incorporation of artwork and materiality helps create an environment to attract patients' attention away from their illness. Successful use of biophilic design has been seen to improve patients' pain levels and treatment in this area. In addition, exterior views to natural environments or garden spaces are helpful to refocus patients. Providing amenities for patients while they are receiving treatment is also beneficial. Some patients simply choose to take a nap. Computers, television, and reading are common distraction patients utilize to pass the time of treatment.

Ninety percent of patients desire competent space for family or companions to provide company during treatment.[144] Therefore adequate space and seating within the treatment area is necessary to account for patients' support. In addition, family

[143] Wang et al., 73.
[144] Wang et al., 68.

lounges and spaces for social interactions during treatment is therefore important for the design of cancer centers.[145]

Color Study



Figure 37**:** Color Therapy

Psychological research has proven that many psychological tensions, anxieties, and fears can have physical manifestations. As a result, an individual's mental condition and physical condition need to be addressed simultaneously, regarding medical intervention.[146] Therefore, a medical center that caters to patients'

[145] Wang et al., 69.
[146] Faber Birren, *Light, Color, and Enviornment* (New York: Van Nostrand Reinhold Company Inc., 1982), 83.

physical needs additionally needs to embrace patients' mental condition as well. This is the foundation of wellness design strategy.

Through this ideology the impact of color is not arbitrary, moreover it becomes imperative to the design and wellbeing of patients. The impact of color has specific reactions on the human psyche. Each color has the ability to evoke a series of varying emotions that impact the human temperament.[147] While the impact of colors is an emotional response and at times subjective it is therefore difficult to gather qualitative results and there are exceptions. However, due to the abundancy of trials and human observations the results are based on the overwhelming consistent results of majority.[148]

Sharp, bright, vivid color shades tend to have a response on autonomic function. This results in an increase of blood pressure, heart rate, respiratory rate. These are similar to the body reactions induced by panic or anger.[149] On the other hand, softer, dimmer shades have the opposite psychological response. Autonomic responses are suppressed and rather these shades promote feelings of inner relaxation.[150] Therefore the usage of color in cancer facilities can be strategically implemented to formulating an environment advantageous to healing.

The emotional impact derived from color usage can be used as a pleasing diversion tactic in cancer centers. When utilized effectively color can facilitate even minimal relief of tensions brought on by illness and treatment. Therefore, the color palate of facilities can benefit recovery and become an aid in the quality of treatment.

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[147] Birren, 83.
[148] Birren, 83.
[149] Birren, 83.
[150] Birren, 83.

WELL Building Standards

The WELL building standard is an up-and-coming design initiative-based certification that emphasizes a standard of health and wellbeing in new and existing buildings. In conjunction with scientific methods and research the WELL ranking system strives to improve human health through design intervention, operational criteria, and policies that provide a culture of health and wellness.[151]



Figure 38**:** WELL Criteria

The WELL system is based on a point based ranking scheme. There are two categories of WELL certification, the standard WELL certification and the WELL Core certification, these are dependent on the building usage. There are ten criteria that all resolve to create the foundations of healthy building. These include elements such as air, water, light, movement, material, mind, community, and innovation. Buildings are then awarded WELL certification at the Bronze, Silver, Gold, or

[151] WELL, "WELL Standard," WELL Standard, accessed May 22, 2022, https://v2.wellcertified.com/en.

Platinum level depending on the score received through the ranking criteria. Through these criteria WELL certification creates high preforming buildings centralized around wellness.[152]

Figure 39**:** WELL Certifications



Moreover, the WELL system enables existing buildings to comprehend where they stand on a wellness spectrum. Through the ranking system buildings can determine where they can institute changes to adapt better wellness strategies. The criteria and certification process of the WELL system also enables buildings to retain health and wellness aspects of the building that may otherwise fall to disrepair.[153] Through the incorporation of this system into the industry the importance of wellness becomes forefront in modern design.

Precedents

Studying a combination of various programmatic precedents enabled an understanding of what is currently being done in the industry. These buildings strove to create a holistic environment for healing and medical care that incorporate biophilic and wellness design principles with the interventions of modern medicine.

[152] WELL, 3.
[153] WELL, 4.

Through these initiatives the buildings are examples of the opportunity to incorporate strong design with science. These designs exhibit strategic biophilic design by utilizing interior and exterior surfaces. This is done in creative ways around the buildings not just relying on the iconic greenery and plants associated with biophilic design. Through the designs these healthcare facilities are providing state of the art medical care in beautiful and inviting settings for patients who seek medical care.



Figure 40: Eskenazi health center, HOK

The Sidney and Louis Eskenazi health center is located in Indianapolis, Indiana designed by HOK Architects. The building is one of the world's largest LEED Gold healthcare campuses. The building strives to set a standard for current modern public hospitals with a focus on healing mind body and soul.[154]

[154] "Sidney & Lois Eskenazi Hospital," HOK, accessed May 22, 2022, https://www.hok.com/projects/view/sidney-lois-eskenazi-hospital/.



Figure 41: Biophilic Design

The building exhibits clear wayfinding strategies to make navigating the campus simple for patients and visitors.[155] In addition the interior materiality is simply and easy to maintain, with natural light and health enhancing exterior views being the primary focus. Strategically designed windows in public spaces and



Figure 42: Exterior Courtyard with Indiana Limestone

[155] "Sidney & Lois Eskenazi Hospital."

patients' rooms bring the feelings of exterior environment indoors through creating spaces that are naturally lit and feel bright and airy. Landscape gardens, water features and open plazas adorn the exterior of the hospital. Native Indiana limestone promotes a connection to the hospital site and community. In the spring and summer, the hospital offers a farmers market to further connect the hospital with the community.[156]

The usage of biophilic design is introduced into the design to promote both sustainable practices and a holistic approach to healing. The agenda of the design was to establish the complex balance of modern medicine technologies with an environment that provides for the bodies need for rest and stress reduction that enables restorative health.[157]



Figure 43: Asplundh Cancer Pavilion Center, EwingCole

The Asplundh Cancer Pavilion Cancer Facility, located in Pennsylvania is another programmatic precedent designed by the architectural firm EwingCole. This

[156] "Sidney & Lois Eskenazi Hospital."
[157] "Sidney & Lois Eskenazi Hospital."

building strives to make a change in the current conditions of cancer facilities. The goal of the design is to enable healing from the outside in. Founded in the name of the center being called a pavilion, the center is designed to create a healing environment that mirrors the surrounding ecological systems. The importance of the natural environment on the healing process is a fundamental aspect of the design.[158]

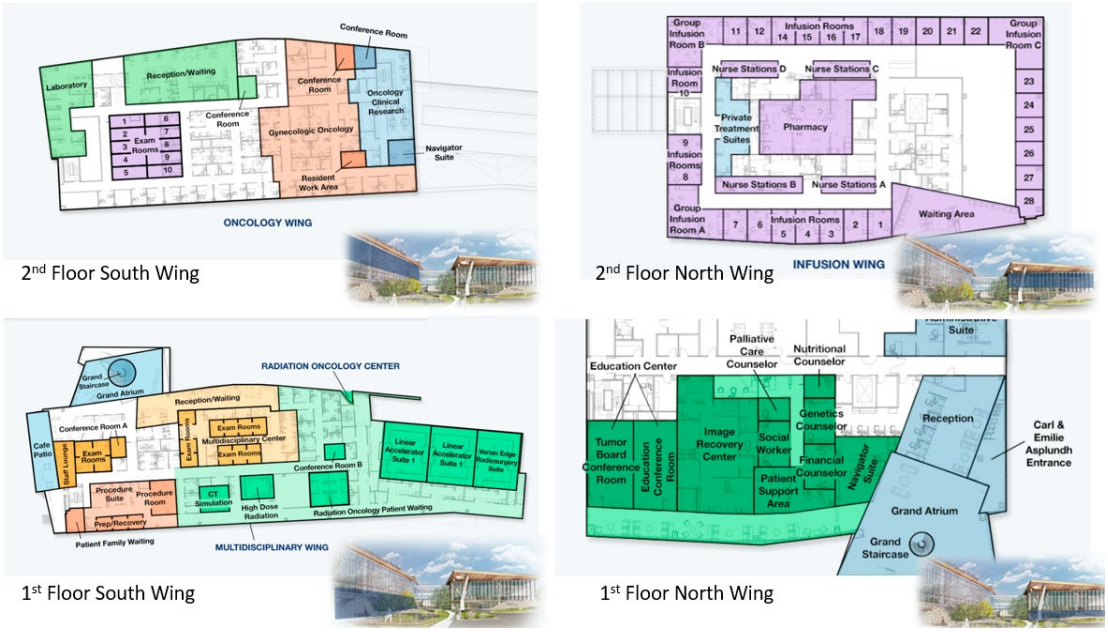


Figure 44: Asplundh Cancer Pavilion Floor Plans

In addition, the program houses multiple amenities of cancer care within the facility. This ranges from nutritionists to hair loss professionals to guide patients through all the tribulations that cancer treatment entails. Thus, provides ease of care for patients during cancer treatment.

[158] "Asplundh Cancer Pavilion," *EwingCole* (blog), 1, accessed May 22, 2022, https://www.ewingcole.com/portfolio_page/asplundh-cancer-pavilion/.



Figure 45: Asplundh Cancer Pavilion Interior

Cedars- Sinai Medical Center: Samuel Oschin Cancer Center is an Infusion Center located in Los Angeles, California. The center was re-designed by the firm Perkins Eastman. Therefore, the existing conditions could not be altered however, through strategic design, the firm created an infusion space centered around the patient's needs. The main design drivers of the design were to formulate a social network within cancer treatment facilities. However, due to the differing preferences among patients the clustering of the infusion spaces provide patients with the choice of a sense of privacy or opportunities to interact with fellow patients.[159]

[159] "Cedars-Sinai Medical Center: Samuel Oschin Cancer Center Infusion Center," *Perkins Eastman*, 1, accessed May 22, 2022, https://www.perkinseastman.com/projects/cedars-sinai-medical-center-samuel-oschin-cancer-center-infusion-center/.



Figure 46: Samuel Oschin Cancer Center, Perkins Eastman

The infusion pods are fashioned after first class airplane seating. The patients have control over opening or closing access to the neighboring pod. This can be altered after the patient's mood or preference for treatment. The spaces between are used as nursing staff, service, equipment, and storage.[160]

Due to the lack of access to natural lighting in the space. Artificial lighting was strategically placed to create an optimistic uplifting atmosphere. Light bars above each pod gently illuminate the spaces as well as providing an intimate more human scale feel to the large atrium space. [161]

[160] "Cedars-Sinai Medical Center."
[161] "Cedars-Sinai Medical Center."

Chapter 8: Program

The programmatic concept for this thesis is an outpatient cancer center. The current typical path for cancer care is a fragmented system. Patients are sent to multiple appointments in a myriad of different facilities. This added burden to the already difficult reality that the patient and their family face during cancer treatment. In addition, the scattered nature of cancer care may impede coordinated care and a lack of strong execution of comprehensive treatment plans. Therefore, the cancer care system requires a facility that encompasses all the services, treatments, and medical needs that oncology patients require under one roof. Through this strategy patients begin to establish a sense of place that aids in the execution of their care. Additionally, one of hardest aspects of cancer care is the constant unknown and state of limbo that patients experience. Having one facility for all the essential aspects of treatment provides a needed sense of consistency that patients can rely on for their treatment and care.

Patients in oncology centers experience extreme physical and psychological anguish due to illness. Moreover, patients spend an extensive amount of time in oncology facilities, often during the most turbulent times in their lives. Patients are under extreme physical, mental, and emotional distress. All these elements are detrimental to patients' wellbeing. Therefore, the program for this design investigates how designing or a patient's wellbeing can benefit their medical experience. Through strategies of biophilic and wellness design the building creates an environment that is

conducive to healing. In this manner the building aids patients and becomes a crucial element of the treatment journey.

A clinical center designed with the incorporation of biophilic design creates an environment conducive to healing. Integrating nature into the design of the center transports patients out of the torments of their illness into a tranquil setting. The improvement of a patient's wellbeing consequently can diminish pain and improve physical and mental health. The beauty of elements of nature, a focus on light, and materiality are no longer superfluous elements of adornment rather they are integral aspects of recovery.

The medical journey towards recovery is one that is met with extreme obstacles and courage. However, incorporating biophilic elements into the design of these facilities can have a profound impact on the wellbeing of patients. This state of wellbeing often contributes to the physical and psychological health of a patient battling illness. Utilizing biophilic design with focus on health and wellness can transform the recovery of patients as they seek care. Incorporating natural elements, views to nature, as well as a biophilic approach to materiality, and lighting can generate the effects of nature for patients as they combat the challenges of illness.

A patient's family and friends become a support team that enables oncology patients to endure treatment. Therefore, the patients support team is critical to the treatment process. As a result, it is imperative that the design of an all-inclusive cancer center provides for these integral members of the treatment process. Additionally, through shared experiences the patients within the center have the

opportunity to create a community of support. The building program and organization therefore becomes an aid to facilitate a sense of community.

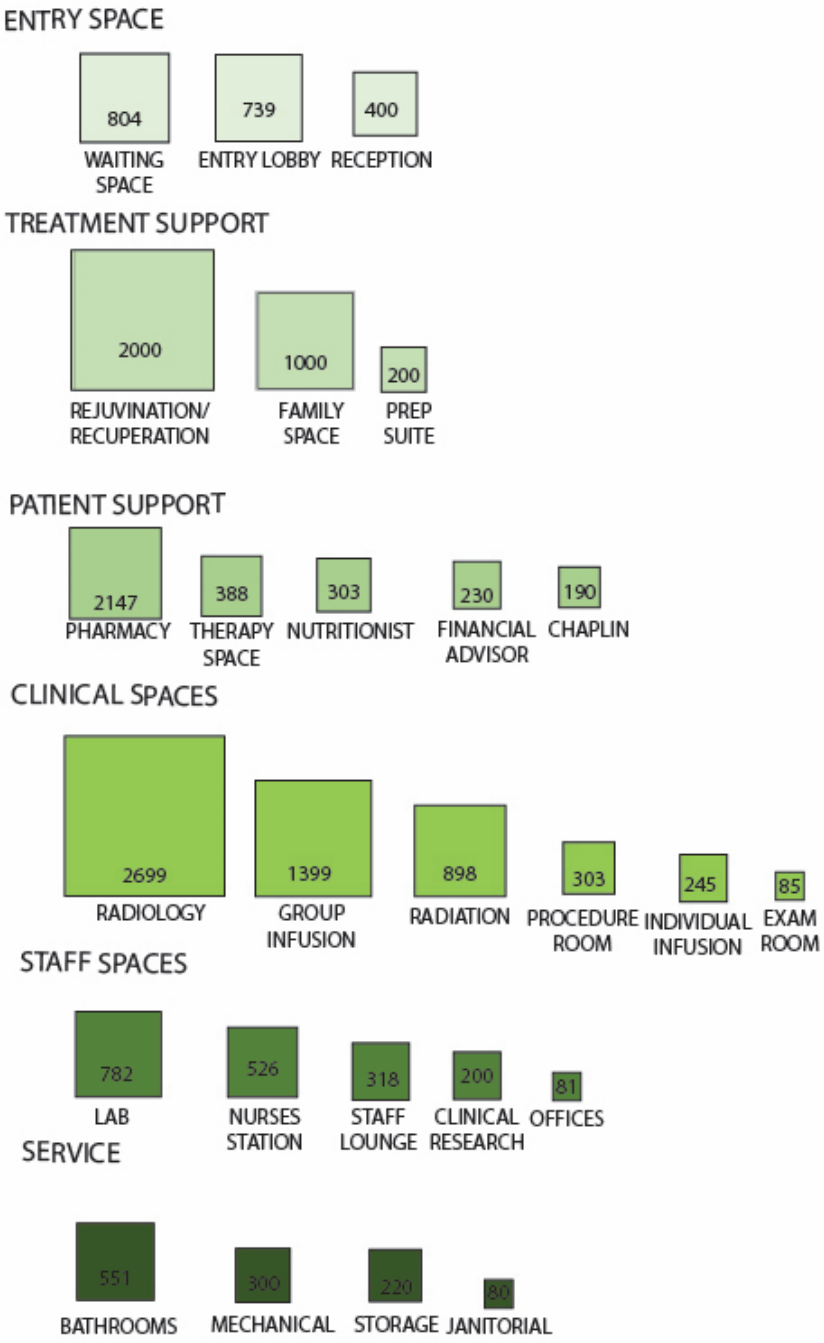


Figure 47: Program Scaled Graphic

Upon entering the facility, the program will incorporate a welcoming entry lobby space where patients check in for their treatment. This space is important because it sets the tone for the entire facility. Upon entry and departure patients will experience tranquility to calm them prior and after treatment. The entry space exhibits a waiting space where patients are directed to await their service, exam, or procedure.

Due to the facility operating as an all-encompassing resource to oncology patients the center has spaces designated for patient support. Providing a pharmacy as part of the program allows patients to have the ability for prescriptions to be filled immediately as well as the added convenience of picking up and dropping off prescriptions. Due to the emotional duress of cancer treatment and the difficulty and trepidation that it entails, a therapy space allows for patients to consult with mental health professionals throughout the treatment process. Common side effects of cancer treatment are malnutrition and weight gain. Patients' relationship with food is often distorted as a result of treatment. However, it is imperative that patients receive strong nutrition during treatment. Therefore, designating a nutritionist space is important to the program. Patients can talk to professionals and gain insights and tips about ways to improve their nutrition. There are often patients who seek religious connection during their care. Therefore, the program offers a contemplation space and opportunity to consult with a Chaplin. Cancer treatment can be a financial burden for many patients. Providing a financial advisor to the program helps patients navigate financial matters with the help of advisors.

Clinical spaces within the program include designated spaces that house the most commonly prescribed cancer treatments. In addition, each space was designed to

be large enough to include designed spaces for family or support members comfortably. The rooms are also stationed for patients to have natural lighting and views to the exterior. Other biophilic design strategies such as color and aspects of nature are incorporated into each of these spaces. Clinical spaces include exam rooms and procedure suites for patients to receive care, examinations, and procedures. In addition, there are specialized radiation spaces for radiation therapy. Moreover, the program includes a radiology center to allow imaging to be done conveniently on site as well as the ability for results to be administered directly without the need for a transfer of information through multiple clinics. Lastly, within the clinical spaces are the infusion spaces. Cancer patients desire a sense of control of their treatment. Therefore, the transfusion space is a centralized space that is designed to create a sense of community for the patients while they receive care. However, there are also individual infusion rooms where patients can receive care independently. Patients have the opportunity to choose based on their preference where treatment is administered. This returns a sense of control to the patient that becomes part of providing for their well-being.

The program also has spaces that are designated for staff and the medical teams. These spaces include strategically placed stations for the staff to maintain tasks and administrative duties while still being able to administer care and observe patients. Offices for administrators and doctors are further elements of the program. In addition, the staff portion of the program houses a laboratory for specimen testing and research.

In order to provide for a patient's wellness spaces were added to the program as support to the treatments the occur within the facility. A prep suite is part of the program in order to give patients a space to physically prepare for their treatment. This includes a rejuvenation space that patients can visit to regain a sense of composure before or after treatment, spend time in a space that provides for their wellness and may ease some of the burden of illness, or a place where patients can gather for small events or support groups. A family space is a space within the program directly designated for family members and support members accompanying patients to treatment.

Each of the spaces within the program will implement biophilic design approaches to focus on the wellbeing of patients as they receive care. This includes design strategies that include Natural elements, views to nature, as well as a biophilic approach to materiality and lighting. Each space is designated to promote ease of care and wellness throughout the treatment process.

	SPACE	QUANTITY	TOTAL SQUARE FOOTAGE
ENTRY SPACES	Entry Lobby	1	739
	Reception	1	400
	Waiting Room	2	804
			2,747
TREATMENT SUPPORT	Rejuvination/Recuperation	1	2000
	Family Space	1	1,000
	Prep Suite	10	200
			5,000
PATIENT SUPPORT	Pharmacy	1	2147
	Counselor/Therapy	1	388
	Nutritionist	1	303
	Finacial Advisor	1	230
	Chaplin	1	190
			3,258
CLINICAL SPACES	Group Infusion	1	1399
	Individual Infusion	10	245 (2450)
	Exam Room	10	85 (850)
	Radiation Treatment	4	898 (3592)
	Radiology/ Imaging	1	2699
	Procedure Room	5	303 (1515)
			12,505
STAFF	Nurses Station	2	526 (1052)
	Staff Lounge	1	318
	Offices	10	81 (810)
	Lab	2	782 (1564)
	Clinical Research Space	1	200
			3,944
SERVICE	Bathrooms	2	551 (1102)
	Mechanical	1	300
	Storage	2	220 (440)
	Janitorial	1	80
			1,922
GARDEN	Garden	3	**3,000**
			3,000
		TOTAL SQFT	**32,376**
		GROSS SQFT	**45,326**
		GROSSING FACTOR	1.4

Figure 48: Program Square Footage Tabulation

Chapter 9: Site

There were multiple criteria to consider when selecting a site for this thesis. Firstly, there was the considerations of a site that provided the necessary criteria for strong biophilic design strategy. This included aspects of orientation and proximity to a natural amenity. Secondly there was the element of locating a site that was in close proximity to an established medical center. This would give a backbone onto which the center would have the credibility and resources to flourish. In addition to medical and emergency services of a neighboring facility that would not be available through the center. The desire for the center to be in a location with convenient access and community based was a critical component. The ideology was that the cancer center would be centralized and not ostracized within a community setting. Lastly, the consideration of family was also a contender in the consideration of the prospective site.

Multiple prospective sites were considered through the ranking system of a site matrix. The matrix considered and ranked locations based on the proximity to a major hospital or research center. The location of mass transit and ease of access through major roads in connection to the site location were examined. This would enable people to reach the site with ease through public transportation or by car. In this manner the center becomes accessible to all patients of various social economic backgrounds. In addition, the consideration of nearby amenities to the site was considered. Therefore, families accompanying patients to treatment can have amenities nearby to occupy them during lengthy treatments. Similarly, the proximity to hotels or accommodations was contemplated. This enables patients traveling in for treatment to have a convenient place to stay near the treatment facility. In addition, if

necessary, it provides a place for support members to stay nearby during periods of prolonged treatment. Having these aspects conveniently located near the center allows for patients to have peace of mind during care. Therefore, these site considerations become aspects of the patient's wellness that are conducive to the design.

Site considerations also included geographical and topographical conditions. Elements such as the proximity to a natural amenity and the light and air located on the premises were important to consider due to the biophilic nature of the project. Additionally, the air quality was important when considering the ramifications of bringing patients with fragile health to the site.

Moreover, having the center be in a diverse demographic and social economic community was influential to the ideology of all access patient care. Removing the stigma that specialized beautiful healthcare centers are a privileged experience afforded only to those who can afford it. In addition, the safety of the neighborhood was considered as an element of patients' wellness and security while at the center.

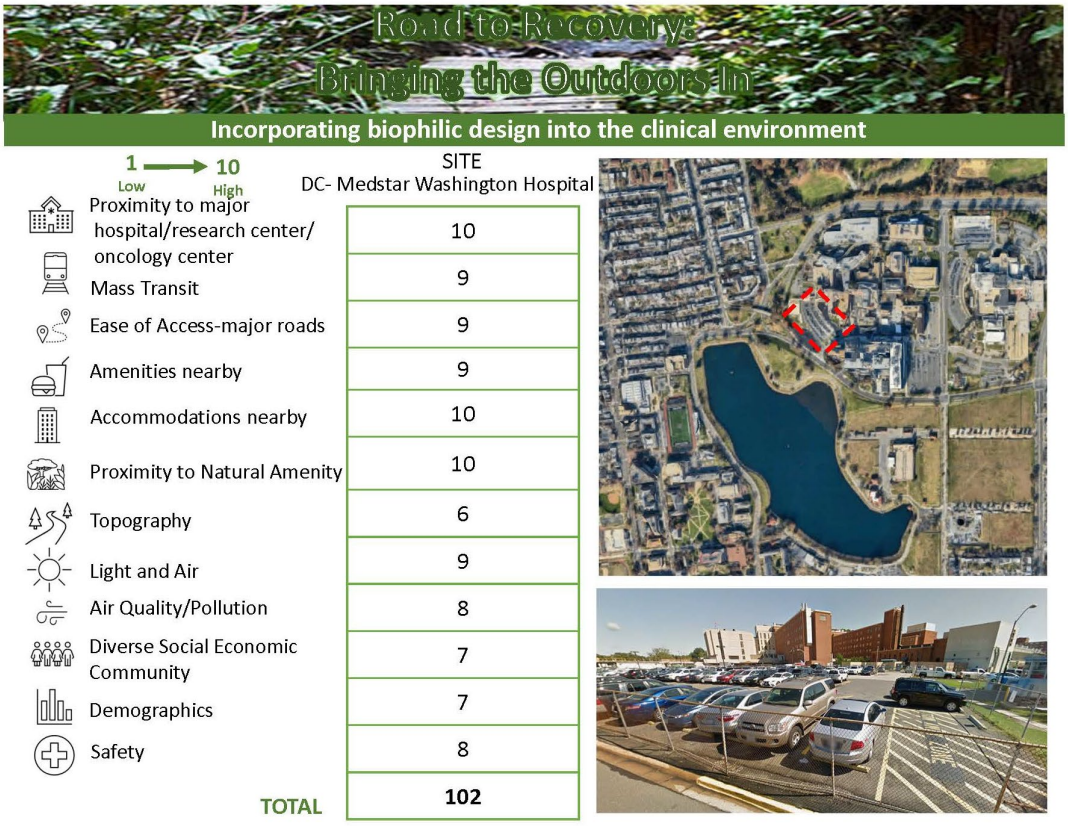


Figure 49: Site Matrix

The selected site for the project is located on the Medstar Washington Hospital Campus. The site is near the Medstar Georgetown hospital and research center that houses the only comprehensive cancer center in the area. Additionally, the location is neighboring Howard University campus where significant cancer research is conducted. There are multiple transportation routes and main roads available to access the site including bus stops directly on the campus. Moreover, the site is directly adjacent to Washington Reservoir which provides a natural amenity that lends to the biophilic nature of the center. The site is centralized around surrounding by thriving communities. Promoting the center as a community-based center for cancer treatment. There are multiple amenities nearby including the tourist attractions of Washington D.C as well as an abundance of accommodation locations nearby.

Therefore, this location becomes prime spot for a community cancer center that is focused on biophilic interventions and wellness to ease the hardship of cancer treatment.

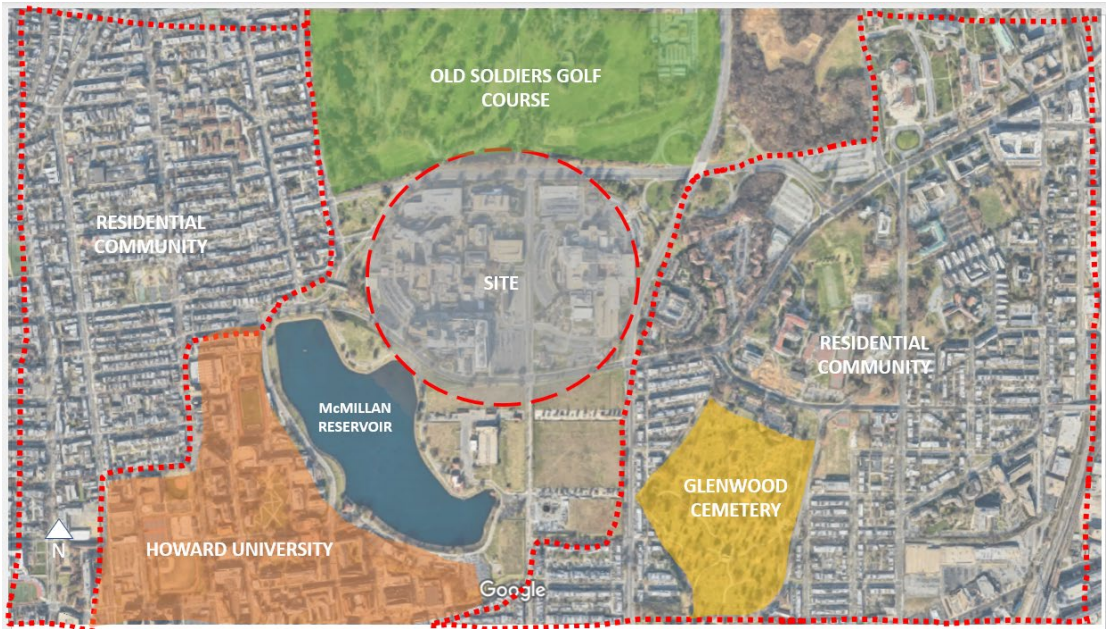


Figure 50: Site Diagram

In addition to the site conditions the current cancer center at the Medstar Washington Hospital currently offers limited care. Patients are often sent between this facility, Howard University and MedStar Georgetown's Lombardi Comprehensive Cancer Center. This complicates and disorganizes cancer treatment for patients seeking care. Therefore, designing a cancer center in this location that houses majority of necessary treatment and resources is strongly needed. Additionally, the conditions are bland and sterile making it optimal for the interventions of this thesis.

Further analysis of the site revealed the immense potential for the facility to be built adjacent to the McMillan reservoir. However due to current conditions of traffic, lack of green space, and unorganized flow of pedestrians and vehicular traffic the site is underutilized and in complete disorder. Therefore, resulting in the current condition being similar to a citadel with no connection to the surrounding community.

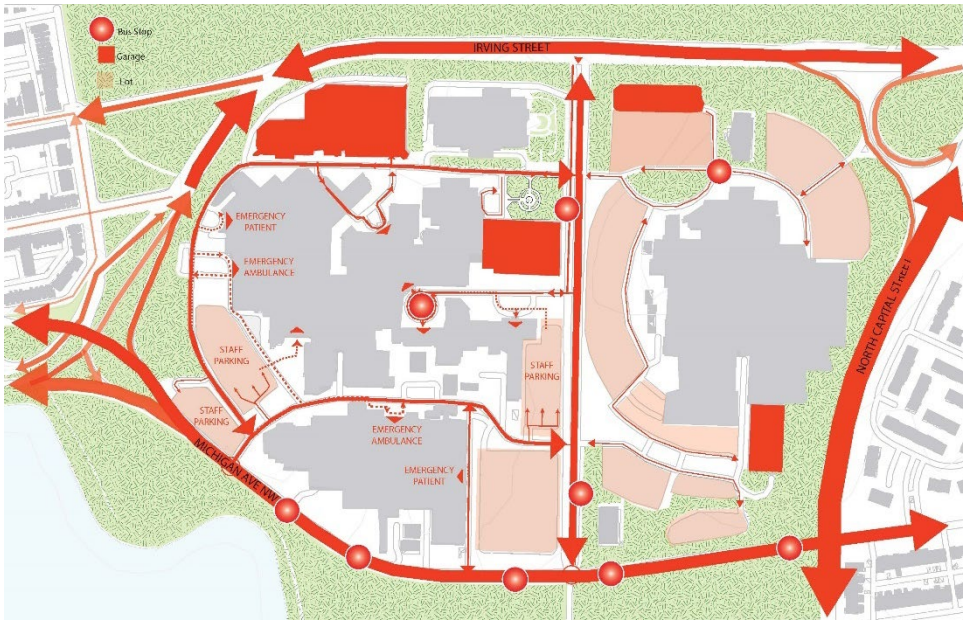


Figure 51: Site Analysis Diagram

Formally used as a staff parking lot the location for the facility on the site is nearest the reservoir providing an easy to access location with potential for

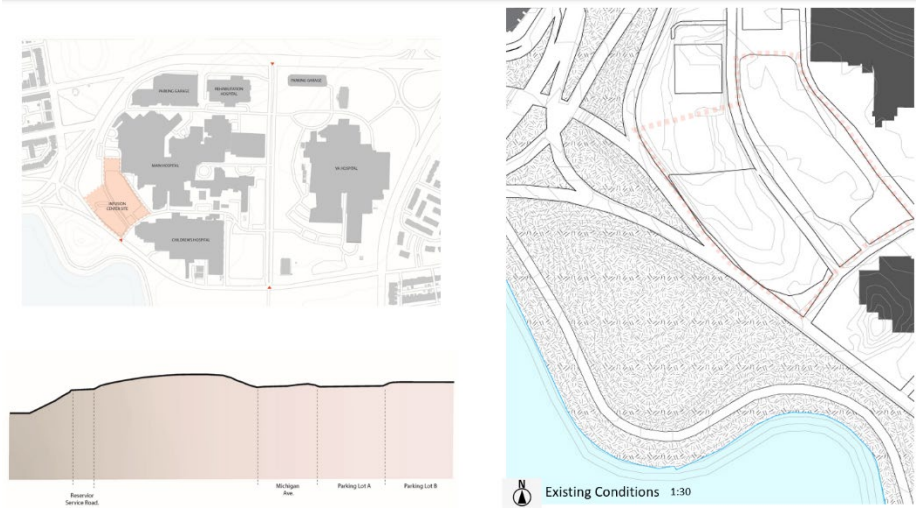


Figure 52: Site Location

connection to green space as well as the reservoir. However, further analysis uncovered that views from the ground floor would be inhibited by the hill across from the site providing further challenge on an already challenging site.

Chapter 10: Design Solution

The updated site plan reorganizes the context and surrounding site through turning Michigan Ave. into a green street that introduces trees, bioswales, and a constructed wetlands to add more green infrastructure to the site while simultaneously mitigates run off, water retention, and stormwater management on the site. This allows for the street to function more like an ecological system that promotes habitats and plant life, that contributes to more pedestrian-desirable spaces. Adding sidewalks and a slight curvature to the road also slows down traffic speeds further, making Michigan Ave more pedestrian friendly.

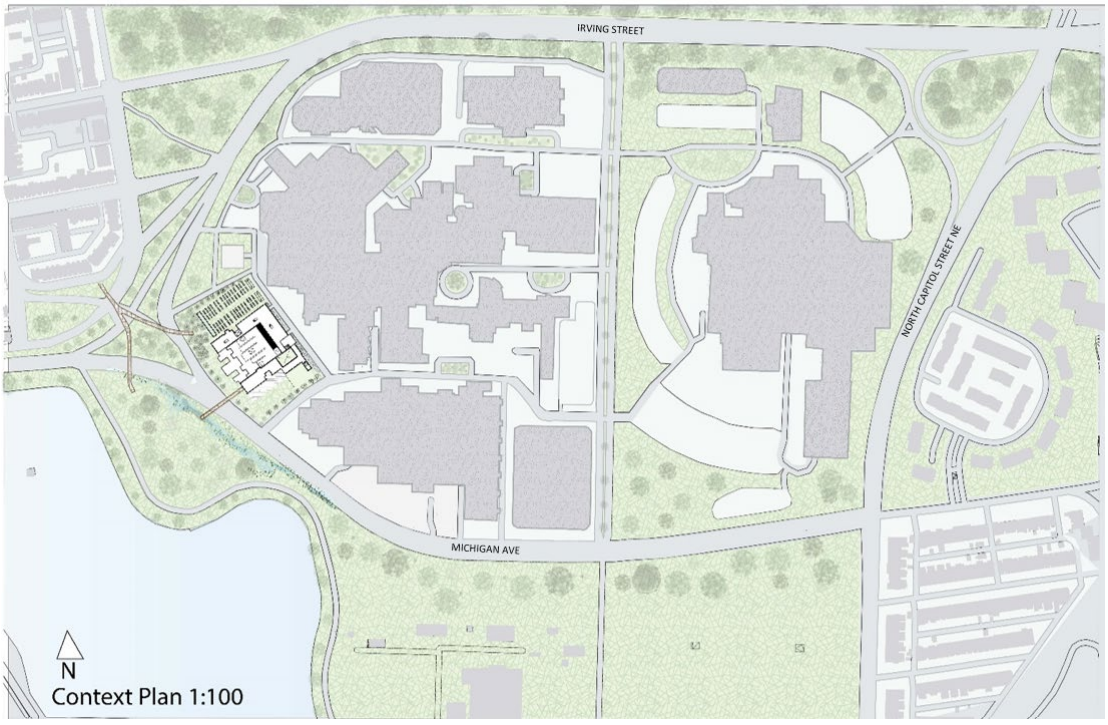


Figure 53: Site Context Plan

In line with the goals of the project it became critical to find ways to open the site up and establish it with a sense of place. The Pedestrian bridge begins to break the confines of the surrounding streets, bringing people from the neighboring area to the site and reservoir. The addition of an urban garden enables community engagement onsite through the amenity of gardening and fresh produce for patients and community members to engage with. The farmers market plaza on the eastern side if the site becomes a hub for local retail and produce to be sold. Through this addition to the site patients have the opportunity to feel and interact with daily life and routine-brought to the site. A bridge from the facility to the reservoir park allows patients and visitors of the center to have direct access to green space and the reservoir.

1. Pedestrian Bridge
2. Urban Produce Garden
3. Farmers Market Plaza
4. Constructed Wetlands
5. Park
6. McMillan Reservoir



Figure 54: Site Plan

Patients enter the clinic through the ground floor parking garage that enables the building to be raised up a level and allows for views to the reservoir from inside of the facility that cannot otherwise be seen from the ground floor. Additionally, patients have the ease of parking directly below the facility without interacting with the rest of the hospital complex.

The garage walls are made out of brick screens to allow of lots of light and shadows to transform the garage from the typical dark and gloomy parking garage into a space that is enjoyable to be in and enter. Small Gardens and light wells make the garage light and enjoyable to enter as well as establish connection with the floor above creating continuity throughout the building.



Figure 55: Entry

An additional pedestrian entrance is available through the garden. Visitors enter through the garden and are guided towards a water feature proving a natural element that acts as a calming feature as they enter the facility, as the path through the

garden turns visitors have the opportunity to remain in the garden and stop and sit in a shaded screened space with views of the garden and water feature.

Both pedestrians and visitors who arrived by their vehicle convene in the garden to enter the facility through the main lobby.



Figure 56: Garden Entry

Visitors enter the triple height lobby space that is bright and airy and acts as a core through the building. The lobby features a greenhouse of exotic plants and a water wall providing the slow soothing sound of falling water. Therefore, resulting in the entry of the space to still be very connected to the exterior experience as well as very soothing to patients entering the facility. Upon reaching the top floor visitors are instantly greeted to the views of the exterior courtyard that is the central orienting feature of the building. Providing the experience of leaving one garden on the lower level to a new garden on the upper level that centralizes visitors throughout the building.

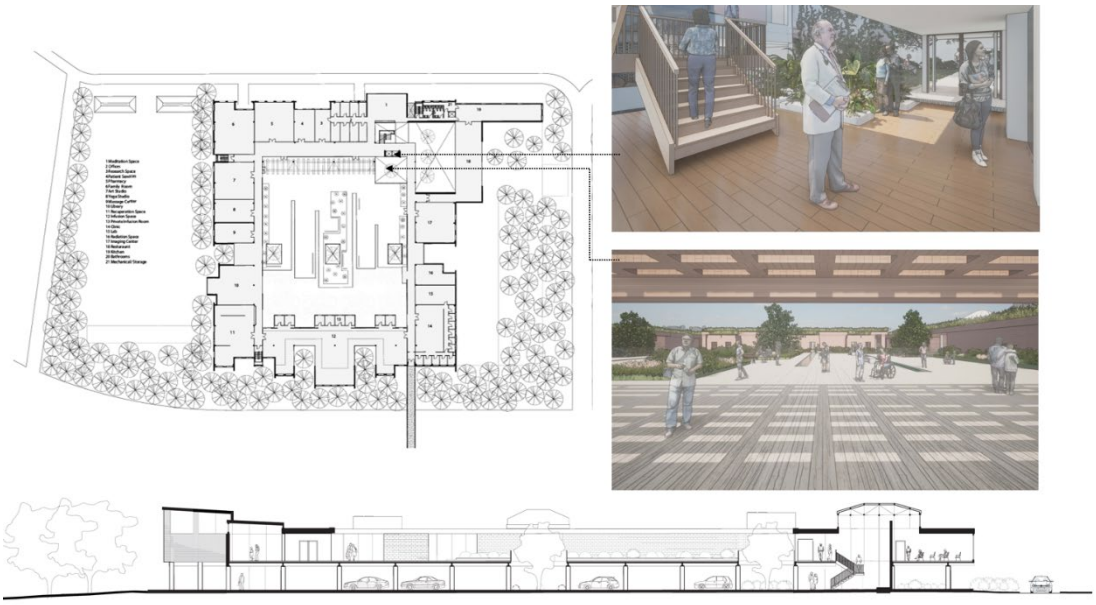


Figure 57: Lobby

The water feature from the lobby runs over the wall and into the contemplation space creating a sense of permeance in the space. The contemplation space is designed to benefit all the users of the facility. Patients can frequent the contemplation space while they are waiting for treatment or regain their composure prior or after their treatment due to the atmosphere that light and water provides in the space. Family members and visitors can also utilize the opportunity as a place of contemplation or recuperation while a loved one is receiving treatment.



Figure 58: Contemplation Space

The plan is organized around a central courtyard. This acts as an orienting feature throughout the entire building giving patients a sense of place and orientation. Additionally, the courtyard enables adequate light and air to penetrate throughout the entire building as well as provides for interior and exterior spaces and programing.



Figure 59: Courtyard

The right side of the plan is dedicated to medical spaces such as the imagining center, radiation space, and the clinic. While the left side of the plan mainly houses the mixed-use elements of the program that includes a library, an art space, and a yoga studio. This further provides opportunities for patients to feel engaged in communal activities as well as conducive space for family members to remain busy when bringing a loved one for treatments that are often lengthy.

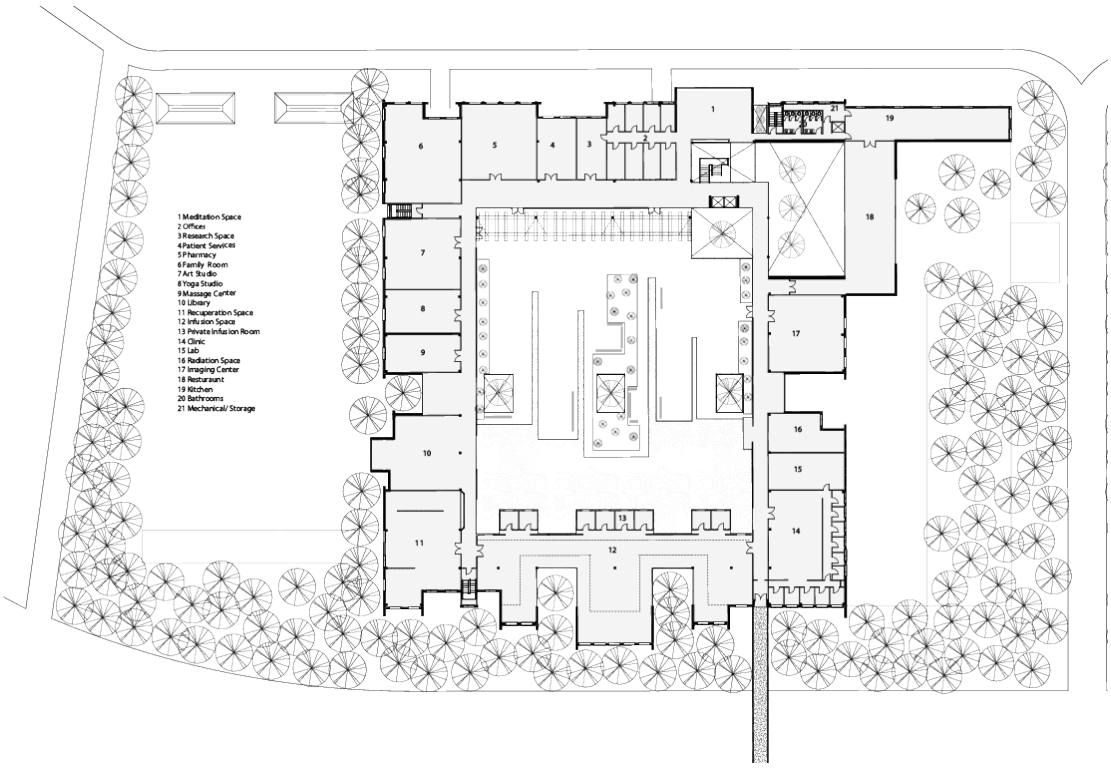


Figure 60: Second Floor Plan

The added aspect of mixed use, such as the café that overlooks the garden further gives the opportunity for an enjoyable memorable experience to take place in the facility and not just one of illness. Little niches in the corridor allow for places of respite and are designed to feel part of the outdoors despite being inside the building.



Figure 61: Window Nook

The building culminates in the infusion center. In this space patients have the opportunity to choose a group setting or a private room to receive their infusion treatment. In this way patients regain feelings of control over their treatment. The group space is designed to be an in the tree top experience which is calming but also can be a novel nostalgic experience that is disassociated from illness and treatment. Through the usage of clearstory glass windows patients gain a view up towards the sky and the treetops. Lower windows have a framed view outwards at the natural environment and the reservoir. Personal rooms are designed to be individual spaces that look out onto the courtyard providing a more private location for family members to accompany a loved one during treatment.

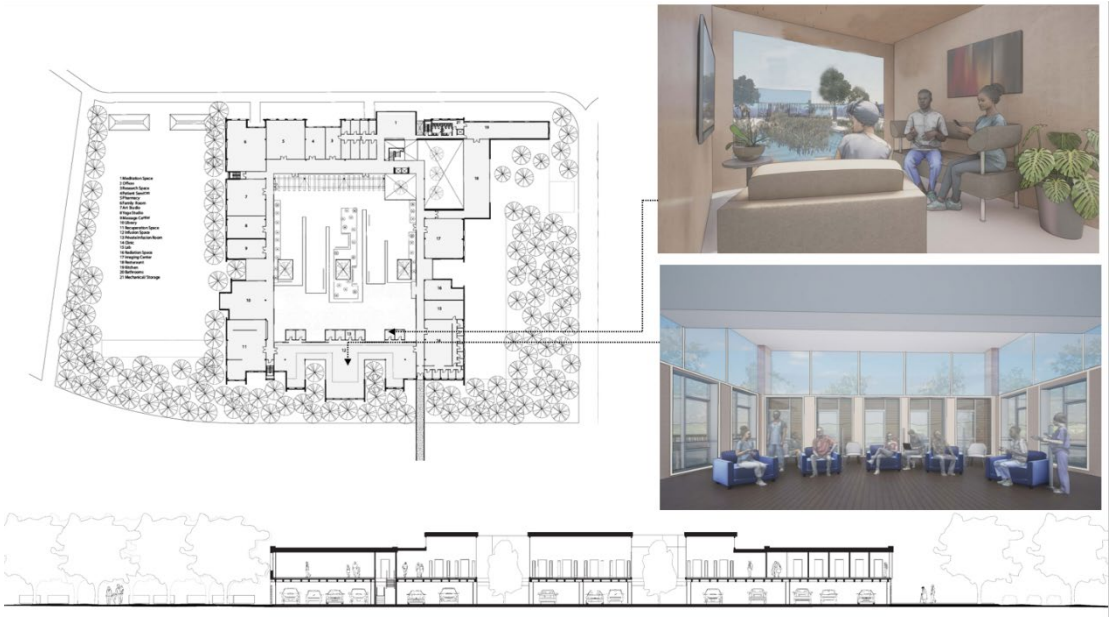


Figure 62: Infusion Space

In conclusion, often during treatment experiences patients feel detachment and instability, therefore through the human centered design of this facility this center

creates closeness to community and permeance based around the patient to enhance wellbeing and therefore becomes conducive to healing.



Figure 63: Section Perspective

Appendices

Figure 1: *Long sterile hallways:* Miller, Richard, and Earl Swensson. *New Directions in Hospital and Healthcare Facility Design*. McGraw Hill, Inc, 1995. p.142

Figure 2: *Technology based Design:* Architectural History of Health and Healing. Pittsburgh, PA: University of Pittsburgh Press, 2017. P.97

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Figure 4: *Technology based Design that lacks wellbeing:* Architectural History of Health and Healing. Pittsburgh, PA: University of Pittsburgh Press, 2017. p.17

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Figure 6: *Plan of Asklepieion of Epidauros Health Center:* Thompson, John, and Grace Goldin. The Hospital: A Social and Architectural History. Yale University Press. p. 3

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Figure 16: *Bimaristan Plan*

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Figure 47: *Program Scaled Graphic:* By Author

Figure 48: *Program Square Footage Tabulation*: By Author

Figure 49: *Site Matrix*: By Author

Figure 50: *Site Context Diagram*: By Author

Figure 51: *Site Analysis Diagram*: By Author

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Figure 59: *Courtyard:* By Author

Figure 60: *Second Floor:* By Author

Figure 61: *Window Nook:* By Author

Figure 62: *Infusion Space: By Author*

Figure 63: *Section Perspective:* By Author

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