Creating healing environment in cancer rehabilitation centre: a comparison study

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Abstract. Cancer is a deadly disease that continues to increase in the number of sufferers over time. Most patients not only have pain in their body, but also anxiety and depression, and physical fatigue. Therefore, the process of handling cancer must be comprehensive, both from physical and mental and psychological care with the Optimal Healing Environment (OHE) approach. The OHE concept needs to be applied not only in cancer-specific hospitals, but also needs to be applied in comprehensive cancer care facilities to relieve patient pain, fatigue and weakness. This study aims to examine the variable of healing environment applied in Cancer Rehabilitation Center Project. The method used in this research is a comparative study method with qualitative discussion. The results can define the principles parameters of healing environment in cancer rehabilitation design.

Keywords. Cancer Rehabilitation Centres, Optimum Healing Environment, Comparative Studies, Design Guidelines.

1. Introduction
Cancer is the second leading cause of death globally and is responsible for an estimated 9.6 million deaths in 2018. Globally, about 1 in 6 deaths is due to cancer and approximately 70% of deaths from cancer occur in low- and middle-income countries [1]. Based on data from the Indonesian Agency for Health Research and Development, there has been increasing numbers of cancer patient from 1.4 per 1000 population in 2013 to 1.8 per 1000 population in 2018. Comparing with More women are affected by cancer than men, and most of the patients live in urban areas rather in rural areas. The healing process of the disease that is generally carried out by cancer patients is by performing surgery, and only a few are carrying out advanced therapy to resolve the cancer problem [2].

Cancer disease management process is not only done in special hospital of cancer, but also requires a comprehensive care facility to ease the pain, fatigue and weakness. There are five phase of cancer treatment: pre-treatment and evaluation phase, treatment phase, post-treatment phase, Recurrence phase and the end of life phase. Each of those phases had their own symptoms. Most of the patient had pain, anxiety and depression, and physical fatigue. In addition, they need help by professionals to maintain independence and maintain quality of life in each phase of their illness [3]. Although there is a guide implementation of a cancer in Indonesia from the Ministry of Health, but the number of cancer specialty hospital is also not a lot, especially the provision of rehabilitation facilities still rare cancer. Therefore, rehabilitation facilities for this cancer are urgently needed.
Dealing with cancer is not easy because cancer not only causes pain to the patient's body, but also causes mental and psychological disorders. Many cancer sufferers experience anxiety and emotional distress that affects their daily lives [4]. So that the process of handling cancer must be comprehensive, both from physical treatment and mental and psychological treatment, therefore we need an Optimal Healing Environment (OHE) [5]. Optimal Healing Environment is a holistic, transformative process of repair and recovery in mind, body, and spirit resulting in positive change, finding meaning, and movement towards self-realization of wholeness, regardless of the presence or absence of disease [6]. This is in line with changes in the conception of health in the last decade, where the concept of health which was originally in the form of treatment of organs that suffer from illness becomes comprehensive health, both physical and psychological that cannot be separated from one another [7].

Previous studies conducted show that factors that influence the health and human healing process, where the environmental factors are the biggest contributors by 40 percent and the medical factors only play 10 percent of the health and healing process. The genetic factors contribute 20 percent and 30 percent comes from other factors [8]. Therefore, the environment is the essential elements of the healing process that need to be considered to provide a positive experience through all human senses.

This study aims to study the role and application of the concept of healing environment in Cancer Rehabilitation Centers. The method used in this study is a comparative study method with a qualitative discussion. This study studies several architectural works of Cancer Rehabilitation Centers which have applied the concept of healing environment to produce the principles guidelines needed in the design.

2. Health and Healing Environment.

Health is a very important thing for humans. There’s a lot of definition about health [9], but most of the early definition define health as a curing process of diseases. The new concept of health is different, it not only define as curing process but health seen as an important resource for carrying out daily activities [10, 11]. In decades, many researchers studied the relation between health and place where the whole health by physically and mentally depends on its place conditions where research studied on the neighbourhood effect in many levels such the town, city or country to the health of its residents [12].

Samuel Institute in 2004 defines healing as "a holistic, transformative process of repair and recovery in mind, body, and spirit resulting in positive change, finding meaning, and movement towards self-realization of wholeness, regardless of the presence or absence of disease". Therefore, they coined the Optimum Healing Environment (OHE). An OHE stimulates whole aspect of human being by taking account the external factors which is the social relationship of human, and the internal factors such as the physical aspect, the psychological, the spiritual and the behavioural aspect to be healthy [6, 13]. The dimension of Optimum Healing Environment can be seen in figure 1.

![Figure 1. Optimal Healing Environment Dimension][1]

Healing environment has several principles in the scope of design in health care buildings. According to Nousiainen (2011), there are nine principles in healing environment [14]:

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[1]: https://example.com/f1.png
1. Nourishing all the senses, create a design that can stimulate & satisfy the five senses of humans.
2. Healthy Lighting, the application lighting used in the principle of healing environment are to maximize natural lighting and use artificial light that has a warm and comfortable impression like an incandescent lamp.
3. Colour Scheme, each colour has a psychological effect. The use of neutral colours and or earth tone colour palette that can make patients feels comfortable and warm both used for health services to reduce anxiety and stress patients.
4. Healthy Air Circulation, creating a room that does not make users allergic and exposed to dust, create cross ventilation system for fresh air exchange, and indoor plant for increasing quality of indoor air.
5. Comfortable Shape, space and shape of the building are made balanced using straight lines (artificial impression) and curved lines (soft and natural impression)
6. Materials can make us better understand the perception of a space by the way we feel it on the skin directly like wood and stone that has soft texture.
7. Connection to Nature, natural elements placed into the treatment of patients that can help eliminate the stress suffered by patients. There are several types of parks / gardens in the hospital, namely contemplative garden, restorative garden, healing garden, enabling garden and therapeutic garden.
8. Easy Way Finding, circulation and arrangement of space are made easy to understand to avoid stress.
9. Transform ability of a space, in order not to cause stress, the space is expected not to be too narrow and messy but allow it to move freely, easy to use, ergonomic, logical and comfortable for all users.

3. Best Practice of Healing Environment in Cancer Rehabilitation Centre

3.1. Maggie’s Cancer Caring Centre [15, 16]
This project located in Aberdeen, Aberdeen City in United Kingdom, completed in 2013 with an area of 350 square meters. This facility is standing alone pavilion in the edge of the fields to maximize the views across the field and sunlight entering the room. This facility is designed cancer patients and their families to receive environment supportive by welcoming, peaceful and homely feelings.

![Figure 2. The application of healing environment in Aberdeen Maggie Cancer Center [15, 16]. Left (2a): overview of the building. Up Right (2b): Warm Colour applied in interior and big curtainwall to let the sunshine enter the buildings. Down Right (2c): Intimate room design to give strong sense of togetherness.](image-url)
This facility is designed for cancer rehabilitation on a non-medical basis, but facility to meet people in the same situation and receive help and guidance. Therefore, the space program provided is also not much. There is a common room as a shared activity room, a consultation room, a dining room and a library on the ground floor and small office in mezzanine floor. The design of the space is made open so that it is easy to access, and spaces are designed on an intimate scale to give a strong sense of togetherness as seen in figure 2c.

The design of Maggie’s Cancer Caring Centre applying several aspects of healing environment. Healthy lighting with the application of curtainwall in several areas to maximize natural light entering the building and connecting the facility with surrounding environment. In addition, there are several light holes on the roof maximize the sunlight directly into the middle room. The colour scheme aspect that is used for this project are brown colour for a comfortable impression, white as a symbol of hope and the colour of grey for a calming psychological effect as seen in figure 2b.

There are also a bunch of indoor plants to improve air quality in the room as an application of the aspects of healthy air circulation. The dominant material used for indoor areas is wood which can create a warm, friendly and comfortable impress. To be directly connected to nature, there is a yard or garden located behind the building for patients to enjoy nature. The shape of the building associated with the aspect of comfortable shape is applied to the curved shape which can make a dynamic and friendly impression as seen in figure 2a. The compact space programming and the open layout allows users to easily determine the way of finding.

Table1. The application of the healing environment concept in Maggie’s Cancer Caring Centre:

| Aspects                      | Application |
|------------------------------|-------------|
| Nourishing all the senses    | √           |
| Healthy Lighting             | √           |
| Colour Scheme                | √           |
| Healthy Air Circulation      | √           |
| Comfortable Shape            | √           |
| Materials                    | √           |
| Connection to Nature         | √           |
| Easy Way Finding             | √           |
| Transform ability of a space | √           |

3.2. Livsrum Cancer Counselling Centre [17, 18, 19]

This project is the competition for a new cancer counseling center at Næstved hospital in Denmark in collaboration with Hoffmann and Lyngkilde. The facility is also a cancer therapy facility with a non-medical approach that emphasizes the comfort and well-being of users. With the location of the cancer counseling center close to the hospital’s cancer ward, it is set for a closer collaboration between the hospital staff and the Danish Cancer Society.

The area of facilities only around 800 square meters with intimate space programming. The existing space program consists of library, kitchen, common room, lounge, gym and wellness facility which is divided into several rooms. This facilitation is not designed in a single large building but is divided into several small houses that have a special function to increase interaction with open space (figure 2c).

The application of healing environment aspects in the Livsrum Cancer Counselling Centre are as follows, healthy lighting aspect in the presence of voids in 2 inner courts so that sunlight can enter the centre of the building. Another way to incorporate natural light into buildings is using skylights at several spots. The space is created not deep, to let the sun comes from the both directions. The narrow building also gives the healthy air circulation aspect is applied with placing several openings to make cross ventilation for air exchange as seen in figure 3.
The colour scheme used in this project are dominated by white which symbolizes hope and brown which gives the impression of comfort and warmth. These two colours are applied both inside the building and outside the building. Both indoors and outdoors this building tends to use wood material that is soft-textured and can give a natural and warm impression. There are 2 inner courts with every kind of plants, and as we know that tree or plants are symbol of nature so by presence of plants same as a symbol of connection to nature. A garden that designed well can help for the healing process. The shape of the building which is related to the aspect of comfortable shape is applied to the shape of the building which resembles the shape of a simple house so that the patient feels at home and will provide a comfortable effect of its own. The wayfinding to some location are easy since the building applied the single loaded access with two inner court as the aspect that is applied is clustering several areas with different functions and then connected each room with corridors so that the organization of space is easy to understand.

Table 2. The application of the healing environment concept in Livsrum Cancer Counselling Centre:

| Aspects                     | Application |
|-----------------------------|-------------|
| Nourishing all the senses   | √           |
| Healthy Lighting            | √           |
| Colour Scheme               | √           |
| Healthy Air Circulation     | √           |
| Comfortable Shape           |             |
| Materials                   | √           |
| Connection to Nature        | √           |
| Easy Way Finding            | √           |
| Transform ability of a space|             |

3.3. The University of Arizona Cancer [20, 21, 22]

The project designated for comprehensive National Cancer Institute headquarter in Arizona which formed an innovative collaboration to deliver the highest standard of cancer care within an evidence-
based, multidisciplinary model, along with the most modern technologies, and a compassionate, patient-centered approach. As a headquarters, there are many facilities programs in this building such as radiation oncology, clinical laboratory for research, diagnostic, endoscopy and radiology and exam and procedure rooms divided in several levels of the buildings. This facility also provides retail, a boutique, wellness center and conference room. This facility design by ZGF Architect with total approximate area of 20,000 square meters. In addition, the landscaping around the facility is designed to have a restorative effect. The landscape is equipped with outdoor dining and for quite reflection.

By its location in Arizona with a lot of sunlight around, this building incorporate natural lighting by using a comprised of glass for south and north façade to maximize the natural sunlight in. The sun shading that applied at west and east façade are also not blocking completely the sunlight but only minimizing the heat gain in building surface, so the natural light still can get in.

The interior of the building is dominated by monochromatic brown, tan and cream to give the impression of calm. These colors have the same tone to the backdrop, which is desert, in other words these building has creating connection to the surroundings. The brown palette applied in the use of travertine stone and woods to give the sense of nature in the room, especially in treatment area such as radiology room and others. The dominance of the monochromatic color is also applied to cancer therapy treatment rooms which can reduce the level of pain and anxiety in patients.

In addition, there are windows from the floor to the ceiling that serves to enter the sunlight and enter the view around the building as part of the interior. Spaces that are designed with an intimate scale so that it can provide a feeling of warm feeling to building users.

![Figure 4. The University of Arizona Cancer [20, 21, 22]. Left (2a): The image of the exterior building. Up Right (2b): Interior Quality with big windows and the application of intimate scale of interior which dominated by monochromatic brown color. Down Right (2c): Brown palette also applied in treatment room to minimize the pain and anxiety for patient.](image)

This facilities provision at the cancer center are quite a lot, such as radiation oncology facilities, cancer for women, etc. that can make it difficult for building users in wayfinding. Therefore, these facilities are placed on different floors with clustering layout to facilitate wayfinding but somehow it still difficult to orientating and directing inside the building. In the other hand, the division of facilities on each floor makes the room layout inflexible.
Table 3. The application of the healing environment concept in the University of Arizona Cancer Centre is:

| Aspects                        | Application |
|--------------------------------|-------------|
| Nourishing all the senses      | √           |
| Healthy Lighting               | √           |
| Colour Scheme                  | √           |
| Healthy Air Circulation        |             |
| Comfortable Shape              |             |
| Materials                      | √           |
| Connection to Nature           | √           |
| Easy Way Finding               |             |
| Transform ability of a space   |             |

4. Discussion

Based on the explanation above, several principles of healing environment are applied to the project. Nourishing all the senses is applied to all projects through stimulating visual aspects with large openings to incorporate elements of the surrounding park into a part of the building's interior. In addition, several projects also reduce noise levels which can cause stress on building users. Some projects seem to try to stimulate the sense of smell by using plants that have a certain odor to ease anxiety in building users.

In all the projects seen how the architect's trying to incorporate and control direct sunlight into the building. The general strategy usually using large windows and some projects are seen using a transparent roof to achieve the objective. Another strategy used is to create a width of space that is not too wide so that the sunlight can enter from both sides of the building. Sunlight control is also needed so as not to overdo it by using double skin.

All the project using the monochromatic brown colour in the exterior and interior of the building. The use of this brown group can reduce stress and anxiety levels of building users. The application of this colour appears in the use of materials used, which are dominated by wood elements. The connection to nature is one of the important issues. The connection can be actively, where the users can interact with surrounding nature directly, or can be passive where the user only connected through visual connection. In project discussed, the active interaction usually in small scale of project, and passive interaction with nature usually applied in big scale of project. But it should be considered for interaction with the natural environment on a large project scale.

Healthy air circulation, comfortable shape, easy way finding and transform ability of space can be adjusted to the project requirement. From the project discussed above, this parameter can be easily achieved in small scale of project but challenged to large scale of project. It takes creative effort from the architect to meet these parameters to reduce the level of stress and anxiety of users.

The new parameter found in this comparative study is regarding to the scale of the space. The space scale of cancer rehabilitation centers needs to be designed with an intimate scale, so that it will strengthen the sense of togetherness between sufferers and between sufferers and their families. Outside the medical treatment facilities regarding cancer, it is very necessary to provide a space for joint activities to increase a sense of family.

5. Conclusion

Cancer is a disease that is difficult to cure. Many of the patients cannot be survived from this disease. Healing this cancer needs to be done holistically, where in addition to healing to eliminate the disease, but also how to increase positive feelings in mind, physical and mental, therefore we need an optimal healing environment approach in cancer treatment facilities.

The main parameter in healing environment is nourishing all senses. Usually what is stimulated are the visual senses and the audial senses, although it is also possible for other senses. In addition, the
The main thing is to incorporate natural sunlight into space by using the large window and openings. Even though incorporate sunlight into the room is important, but it should also consider about the level of intensity from the sunlight, so it is comfortable for the human eye.

In addition, the use of large windows and openings can also be used to incorporate the natural landscape into buildings. The relationships with nature are very important to healing process, where the natural environment can help to increase positive emotional feelings. It should be encouraged to actively connection with nature where people can directly interact with nature. Color schemes that are usually used are neutral colors, mostly using brown color palette. The use of natural colors aims to reduce the level of stress and anxiety of cancer patients and their families. The use of brown palette can be emphasized by using material, mostly granite or wood.

Healthy air circulation, comfortable shape, easy way finding and transform ability of space can be adjusted to the project requirements. Allocation of space with unclearly structured will trigger the stress, therefore it should be considered how to arrange the distribution of facilities to make it easier for easy way finding. This parameter is the challenge for big scale project with a lot of facilities needed to provide. Natural air circulation needs to be considered carefully. Architectural forms also need to be considered by creating forms that give the impression of being dynamic and relaxed, compared to formal forms that will add tension to the patient and his family.

Other aspects that need to be considered in designing a rehabilitation facility cancer is the scale space. Scale space needs to be created with the personal scale, to give a sense of belonging among patients and between patients and their families. Proxemic theory suggest that 0 to 46 cm around the people as the intimate space. Within this distance, nobody cannot enter if we do not want to. The next one is personal distance is between 46 cm to 120 centimeters, which is the closed social distance. This distance can be entered by close friends while the social distance in 120 to 210 centimeters and the public is more than 210 centimeters radius [23]. One important area is the provision of shared facilities such as a playroom, family room and dining room together can increase a sense of togetherness. In addition, the spaces need to be created flexibly so will increase patient comfort.

This paper has examined the principles of healing environment parameters in cancer rehabilitation centers project. Some of the parameters are important in cancer rehabilitation centers design, some parameters can be adjustable to project scale, and new parameters that found is the scale of room programming. Although, those parameter needs to deeper study about the impact on cancer rehabilitation programs in further research.

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