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To cite this article: Vincent Alexis Sutjianto Tjia *et al* 2024 *IOP Conf. Ser.: Earth Environ. Sci.* **1361** 012053

IOP Conf. Series: Earth and Environmental Science **1361** (2024) 012053 doi:10.1088/1755-1315/1361/1/012053

Development of an Older Adult Community Centre Based on Biophilic Architecture Principle to Improve the Quality of Life

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Abstract. While living a retirement life, most older adults are facing obstacles from psychological and biological factors. Persons over 65 need to fight off stress and depression as it can weaken the immune system. One of the ways to reduce stress is providing a warm relationship that can be achieved through a place like older adult community center. A specific design of community center is needed to bring a significant impact for the older adult health and happiness. The purpose of this study is to define architectural design strategies that can improve older adult quality of life within a community center. This research was looking into principle of Biophilic Architecture, in which introduce some design elements to connect older adult with nature and provide healthy environment. The research method is using literature study to describe the design elements of Biophilic Architecture. This is deepened by a study of precedents in finding programs and activities that can calm or invite the older adult to be active in socializing to increase their quality of life. The research present strategies for designing an older adult community center with Biophilic Architecture principle. The results show some strategies to promote healing and increase collaboration in older adult environment. Those strategies include the strategy for site development, materiality, activities, and programme, building massing and accessibility in which can help in reducing their loneliness and stress, and achieve a better quality of life. Those strategies applied to make a prototype of Biophilic older adult community center project. The project implemented principles such as visual connection with nature, biomorphic form, material connection with nature, sensory stimuli, well-ventilated, daylight and water element for calming. The design in this project demonstrates how the green buffer, combination of indoor and outdoor activities, and space for social activities can improve the quality of older adult's life.

1. Introduction

The older adult community experiences various impacts from fast external changes and internal changes from themselves. This impact is due to the influence of the limited mobility of the older adult, decreased vision, and decreased sensitivity to space [1]. The limited mobility also limits social interaction and doing many activities which sometimes make the older adult feel lonely. Some elders maintain their quality of life by maintaining physical and mental health, but most of them experience a decrease in activity due to reduced mobility and lack of a social environment for socializing and joint recreation [2].

Some of them experience decreased physical health due to the age factor. So, there is a need for a forum that can support the older adult's social needs and culture [3]. As a result of the decline in physical condition, it will lead to a decrease in quality of life when carrying out daily activities. The decline in quality of life is also affected by the emergence of the COVID-19 pandemic which has made normal activities difficult to carry out. The older adult community needs support from the people around them in carrying out activities. Declining health due to drastic decline in body motor skills is caused by increasing age, as well as the emergence of activity restrictions or large-scale social restrictions in carrying out daily activities. This situation causes health problems due to the lack of face-to-face or direct meetings in an activity. Older adults need to fight off stress, loneliness and depression as it can weaken the immune system. One of the ways to reduce stress is providing a warm relationship that can be achieved through a place like an older adult community center. In improving the quality of life, social interaction is important so that a community center is needed to accommodate all activities. A community center should create a positive attraction that provides various choices for the older adult community to interact and do activities. Not only it does provide social interaction, but the building also needs to be designed naturally by applying the principles of Biophilic architecture. So that the older adult can feel how to have direct dialogue with nature and increase their quality of life. In this study, the criteria for a healthy building and a supportive environment will be the link between activities and the characteristics of the older adult.

2. Materials and methods

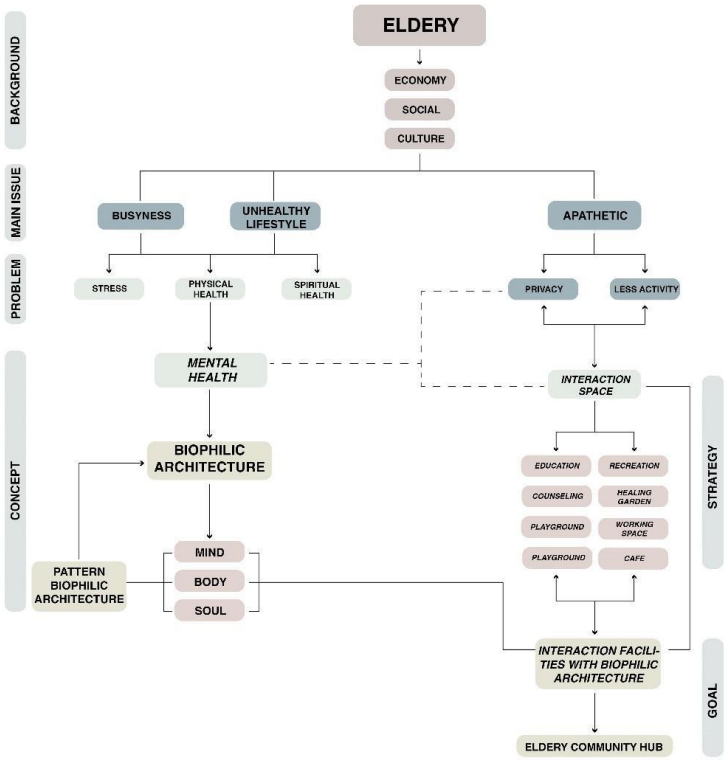


Figure 1. Older adult Center Framework
Source: Author

2.1 Older Adult's Activities and Needs

In the decline in quality of life there are several health problems in the older adult which are symptoms of mental and physical disorders that can occur repeatedly but are 'non-specific'. Even disorders that occur can affect aspects of the body in humans which will cause allergic symptoms, dizziness, nausea, fatigue, and difficulty concentrating or thinking which is called sick building syndrome, while symptoms of health problems in the older adult are more severe or specific such as decreased physical aspects of the nose, eyes, and mobility that occur in the body of the older adult thereby affecting several factors of quality of life [4]. To increase the quality of life, we need to pay attention to environmental factors, accessibility, space planning, building materials, air quality, color and lighting which are the principles of well-being architecture. Those are also included in the criteria of Biophilic architecture for designing the older adult health centers [5]. According to Almusaed, life problems can be divided into two, namely comprehensive activities and physical activity intensity [6]. To increase quality of older adult's life, some activities should be provided in an older adult community center such as indoor-outdoor space to increase physical and mental health. For this designed project, our framework is a connection between main issue, older adult's obstacle, the needs of center and strategy for providing older adult's needs and activities that can increase their quality of life (figure 1).

2.2 Biophilic Architecture Concept

Maintaining and appreciating health is the most important thing in our life. The human body has a system for maintaining health, and in nature there is a system, called Biophilic. Biophilic concentrates on improving the quality of the surrounding environment. The improvement includes quality of the habitat, increasing the oxygen released into the air. and help shape the system. With a Biophilic architecture system that is affiliated and has accessibility to nature, it really helps building users with their health and well-being. According to HOK, Well-being architecture is included in the principles of Biophilic architecture which has basic principles related to buildings that are sustainable, safe, comfortable, healthy, and provide welfare for the occupants [7]. According to Kartika Nurrachma, the application of Biophilic architecture in buildings has several criteria that need to be considered to obtain the maximum healthy building solution [8]. Several criteria for implementing Biophilic architecture consist of visual connection with nature, non-visual connection with nature, non-rhythmic sensory stimuli, thermal and airflow variability, presence of water, dynamic and diffuse light, movement and decentralization, prospect, refuge and mystery, biomorphic form and pattern, material connection with nature, and complexity.

2.2.1 Pattern Biophilic Architecture

The pattern of Biophilic architecture consists of 11 principles that explain the definition of the concept of Biophilic architecture. According to Stephen, the pattern of Biophilic architecture is a concept that integrates all aspects of mental and physical health [9]. Based on the pattern of Biophilic architecture will improve the mental and physical quality of the older adult community. The eleven principles for developing a Biophilic architecture pattern can be grouped into 3 major groups [10], namely: nature in the space, nature of the space, and nature analogue.

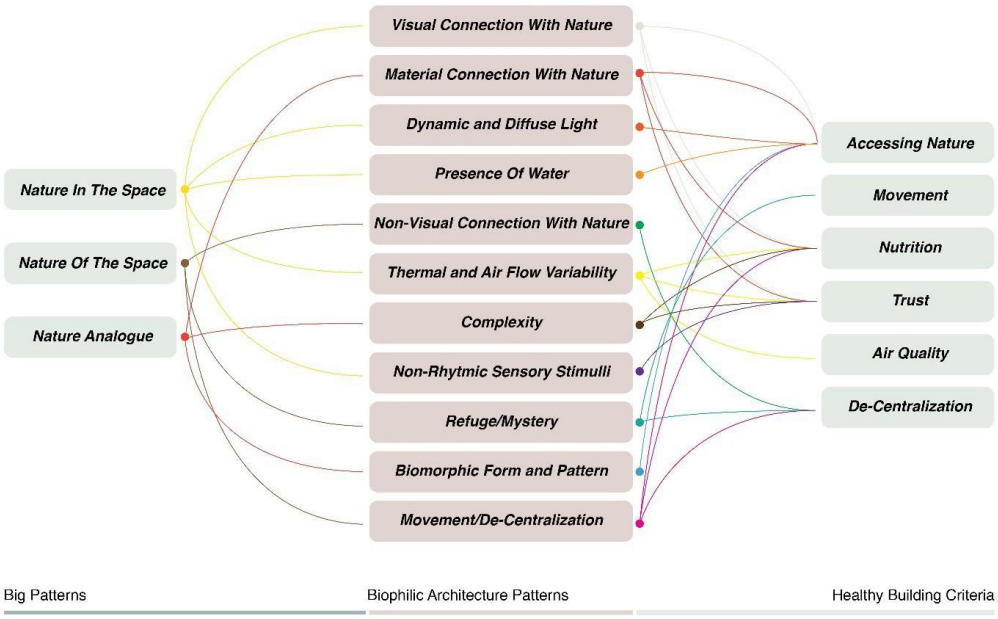


Figure 2. 11 Principles of Biophilic architecture
Source: Author's modification

The concept of Biophilic architecture is related to health problems such as physical and mental decline. These linkages create a relationship between Biophilic architecture and the criteria for healthy buildings.

Table 1. Relationship between Biophilic architecture patterns and healthy building criteria.

Biophilic Pattern	Mental Health Issue			Criteria
	Stress	Cognitive	Emotion	Healthy Building
Visual Connection with Nature	Reduce heart rate and blood pressure	Improve mental health	Improve happiness and positive thinking	Accessing nature, Movement, Nutrition, Trust, Air quality, De-Centralization
Non-Visual Connection with Nature	Reduce stress hormone	Improve cognitive	Improve mental quality	Movement, Trust
Non-Rhythmic Sensory Stimuli	Positive impact to heart rate, systolic blood pressure, dan sympathetic nerve system activity	Promotes improvements in focus, exploration, - and attention		Accessing nature, Movement, Nutrition, Trust, Air quality, De-Centralization

Thermal and Airflow Variability	Comfort, well-being, and increase productivity	Improve concentration	Increase perception of temporal and spatial pleasure (alliesthesia)	Movement, Trust, Air Quality
Presence of water	Reduce stress, increase calmness, lower heart rate and blood pressure.	Increase concentration and memory restoration	Positive emotional response	Movement, Trust
Dynamic and Diffuse light	Increase comfort in the visual aspect	-	-	Movement, Trust
Movement /Decentralization	-	-	Increase the perception of health towards the environment	Accessing nature
Prospect	Reduce stress	Reduce irritation and other disturbance	Increase safety and comfort	Accessing nature, Movement, Trust
Refuge/Mystery	-	Improve concentration and perception	-	Accessing nature, Movement
	-	-	Induced strong pleasure response	Accessing nature, Movement, De-Centralization
	-	-	Generates a strong dopamine or pleasure response	Accessing nature, Movement
Biomorphic forms and pattern	-	-	Forming a new visual view	Accessing nature, Movement, De-Centralization
Material Connection with Nature	-	Reduce diastolic pressure	Increase comfort to space and environment	Accessing nature, Movement, Trust
Complexity	Affect perception and psychology of the mind and soul	-	Forming a new visual image	Accessing nature, Movement, Nutrition, Trust, Air quality, De-Centralization

2.2.2 Biophilic Architecture Indicator

The principle of Biophilic architecture that influences mental health creating an indicator in the strategy of implementing Biophilic architecture for healthy buildings in older adult health center buildings as follows [6]:

Table 2. The Principle of Biophilic Architecture that influences mental health issues.

Principle	Strategy	Element	Influence of Mental Factors
Accessing Nature	1. Indoor space has a maximum visual orientation towards nature. 2. Active outdoor space. 3. Walls that bring natural aspects to indoors. 4. Natural material and multi direction view.	1. Indoor nature space 2. Outdoor nature space 3. Natural daylight 4. Green wall/Addressing the inside-outside interface. 5. Natural Materials 6. Natural Patterns	1. Air quality 2. Lighting quality 3. Building materials
Air Quality	1. The use of facades that can maximize ventilation and natural lighting. 2. The application of building ventilation systems. 3. The use of natural ventilation systems.	1. Controlled vent 2. IAQ sensors 3. Low carbon emission materials 4. Biofiltration 5. Daily Flush out 6. Outside air ventilation 7. Natural ventilation	1. Air quality 2. Building materials
Trust	1. User and building management can communicate transparency about deficiencies. 2. Regularly conduct IAQ tests on air quality in buildings	1. Regular engagement 2. Regular IAQ test 3. Data transparency	1. Air quality 2. Safety and convenience quality
De-Centralize	-	1. Intergenerational space 2. Hybrid workplace 3. Collaboration space 4. Recreation space	1. Space orientation 2. Space planning 3. Ergonometric
Nutrition	1. Educational signs about healthy food and drink for daily consumption. 2. Provide places to dine in	1. Access to urban farming 2. Healthy food service 3. Financial incentives 4. Education point about healthy lifestyle	- -
Movement	1. Stairs or circulation that can attract attention. 2. Provide a wide choice of activity spaces	. Accessibility to workspace . Accessibility to collaboration space . Opportunity to exercise. . Opportunity to play. . Opportunity to recreation	1. Space planning 2. Room orientation

2.3 Case Study

In designing a space for the older adult community, the Kampung Admiralty and Khoo Tek Hospital are case studies in this research. The aim of this studies is to know the characteristics, factors and design strategies that can be used to improve the quality of life, such as the safety, comfort, and health factors of the older adult community. In the analysis of the two precedents, there are comparisons and design strategies that can be applied in designing an older adult health center. The needs of the older adult community are important point to be well understood and design. In Indonesia, health centers for the older adult are inadequate and there is a lack of a health center that can accommodate all healthy, safe, and comfortable activities. Those are issues for the sustainability of the older adult community. Planning for older adult health center facilities might supported by Biophilic architecture elements such as visual connection with nature, material connection with nature, dynamic and diffuse light, presence of water, prospect, complexity, non-rhytmic sensory stimuli, refuge/mystery, biomorphic form and pattern, movement / de-centralization, and air quality.

Figure 3. Kampung Admiralty, Singapore

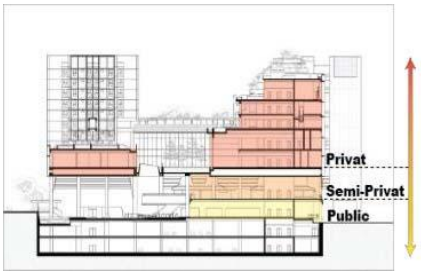
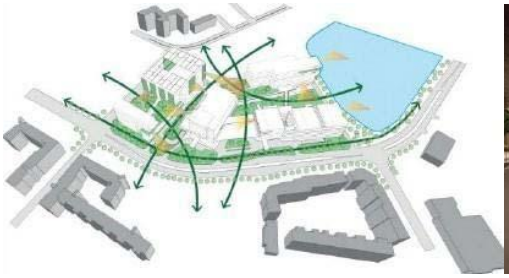
Figure 4. Khoo Tek Hospital, Singapore

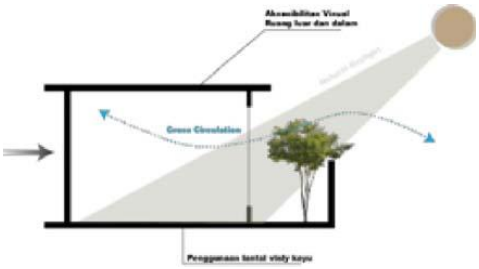
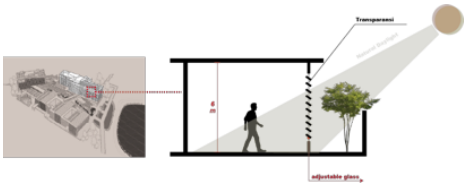
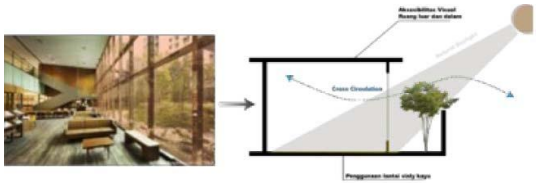
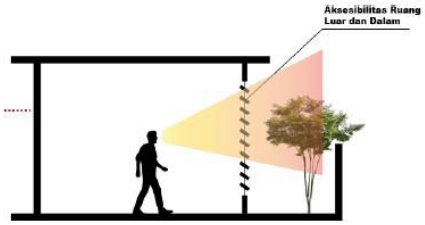
3. Results and discussion

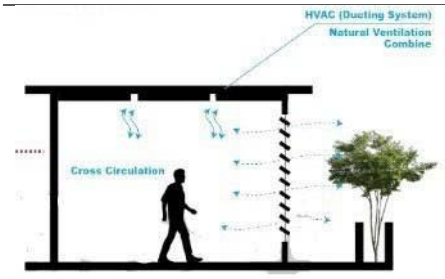
3.1. Older Adult Health Center's Design Strategies

The elaboration and analysis of the two precedents (Kampung Admiralty and Khoo Tek Hospital) demonstrate the characteristics, factors and design strategies that can be used to improve the quality of life of the older adult community center. In the analysis of the two precedent studies, there are comparisons and design strategies that can be applied in designing an older adult health center.

Table 3. Conclusion of analysis and strategy.

Criteria for older adult development center (Based on Biophilic Architecture)	Conclusion
Activity and Programming	Composed of 4 Zones (Entrance zone, Education zone, Health zone, Commercial zone)
	
Visual Connection with Nature	Has scenic visibility of natural elements.
	

Material Connection with Nature	The use of natural materials in the interior and exterior.
	
Dynamic and Diffuse Light	The use of transparent elements and the application of building skylights.
	
Presence of Water	Use of water element
	
Prospect	There are additional spaces such as healing garden and urban farming.
Complexity	Visual Comfort Providing large openings in public space, using natural elements in indoor and outdoor, and providing full access to the garden from every room. Breathe Comfort Implement active openings and adaptive openings depends on the room requirement for natural air exchange.
	



Thermal Comfort
Using a façade made of wood so that it can reduce heat that will flow to the building envelope and implementing a green roof to reduce thermal transfer into the buildings.

Acoustic Comfort
Applying natural materials to the building exterior and applying vegetation elements as a sound buffer to enter the building.

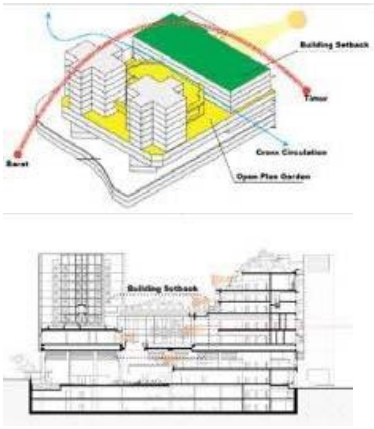
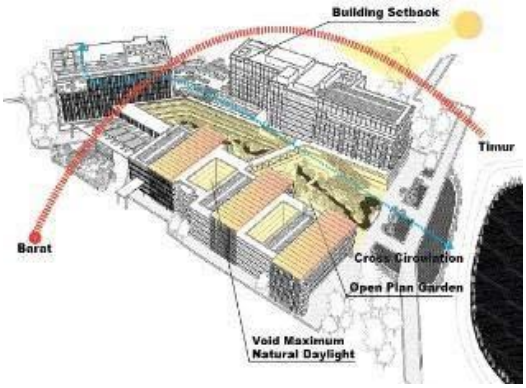
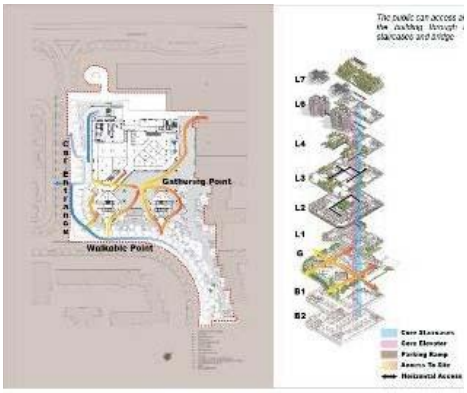
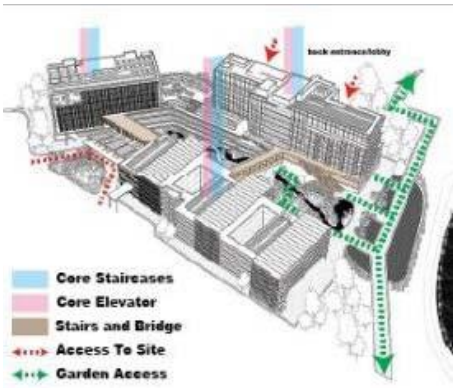
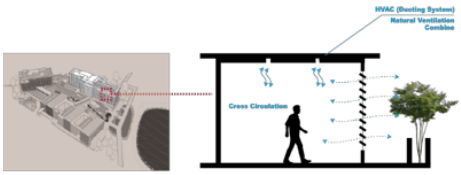
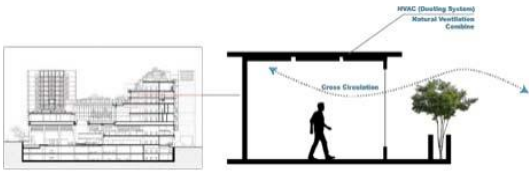
Diffable Comfort
Implementing multi-accessibility horizontally and vertically, and applying hand railing on each side of the building.

Non-Rhythmic Sensory Stimuli

There is a balance between the elements of water and plants

Refuge/Mystery

Application of the circulation area as a communal space that has different elevation in order to trigger activity

Biomorphic form and pattern 	The shape of building resembles nature, the use of street furniture and the orientation of the building is rotated with an inclination of 15 degrees. 
Movement/Decentralization 	Implementing simple circulation, the width of the circulation area is at least 2-5m, the shape of the building is broken down, and the entrance zone is larger 
Air Quality 	Application of adjustable glass, application of active corridors and void elements in every zone. 

From the theoretical study and analysis of the two precedent studies and observations of the site and environment, several design strategies were obtained in designing an older adult health center: Activity

design strategy and programming, Biomorphic form and Pattern strategy, Accessibility and circulation strategy, Facade strategy and building openings, Landscape or outdoor strategy, Strategy for using materials and colors in buildings. The results of the strategy will be a basis for designing an older adult health center according to analysis and literature review.

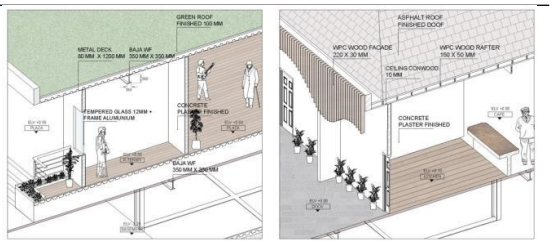
3.2. Discussion

From the formulation of the Biophilic principle that has been described, we obtain criteria and needs that can be applied in designing an older adult health center. The next stage is to combine precedent studies and methods into the design strategy concept. The design strategies that will be studied are divided into 6 groups: activity planning and programming strategies, mass and shape composition strategies, accessibility, and circulation strategies, building facades and openings strategies, landscape or outdoor space strategies, and strategies for using materials and colors in buildings.

Table 4. Conclusion of analysis and strategy.

Requirement	Criteria	Image
Activity and Programming Strategies 1. Has a garden 2. Has 4 zones (Entrance zone, Education zone, Health zone and Commercial zone)	function requirements, connectivity, space programming	  

Mass and Form Composition Strategies 1. The shape of the building adapts to natural forms. 2. Use of street furniture 3. Orientation of the building to the site with inclination of 15 degrees.	form, orientation, proportion, scale	
Accessibility and Circulation Strategies 1. Implement simple circulation 2. Width of circulation area 2-5 m 3. The shape of the building mass is separated by the garden in the middle. 4. Apply the element of water to buildings. 5. Has a view of the visibility of natural elements.	function requirements, connectivity, space programming	
Facade and Building Openings Strategies 1. Application of adjustable window 2. Implement an active corridor 3. Implement void elements in public and semi-private spaces. 4. Apply transparent material 5. Implement artificial lighting 6. Using skylights as a lighting option.	Scale, lighting, and ventilation	 

Landscape and Outdoor Strategies 1. Have a healing garden in the outdoor area 2. Elevation difference 3. Visual Comfort 4. Breathe Comfort 5. Thermal Comfort 6. Accoustic Comfort 7. Difable Comfort	daylighting, orientation, visual dan form	
Material and Color Strategies 1. Room finished with natural materials such as wood. 2. The use of natural elements in the interior. 3. Large openings in public space areas.	form, color dan material	

4. Conclusions

Development community health center for the older adult requires several strategies on how to design healthy buildings and environment for a community center with focus on well-being, both physically and mentally. Besides relations with nature and the landscape of the surrounding environment, we still need to consider space planning and activity programs to support this community development center for the older adult. Several principles of Biophilic architecture which are categorized in nature in the space, nature of the space, and nature analogue become the basis to develop design strategy of the community center for the older adult. Those strategies are activity design and programming strategies, mass and shape composition strategies, accessibility, and circulation strategies, building facades and openings strategies, landscape or outdoor space strategies, and strategies for using materials and colors in buildings. By implementing strategies related to the principles of Biophilic architecture, it is hoped that the older adult community health center can improve the quality of life for the older adult.

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