To be an affordable healthy house, case study Medan

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Abstract. House has a paramount meaning in human life. Provision of adequate housing will be able to improve the quality of life. Provision of an affordable house is a major step to fulfilling the needs of houses in the big city. Medan has built a lot of affordable houses, and mostly it takes place in the suburbs. Although the affordable house is for low-income people, it must be worthy of its physical condition, affordable in the budget and healthy for its users. House often saw only as physical alone, the provision of a house only to achieve solely in quantity regardless its quality. This study aims to examine the condition of affordable houses in the suburbs of Medan. The research method used qualitative descriptive, using indicator according to affordable healthy house standard according to the regulation in Indonesia and other related theories. This study took place in Medan by taking three areas in the suburbs of Medan. The results show that most affordable houses in the suburbs of Medan are unhealthy. There are several design recommendations for the houses to meet the affordable healthy house category; the most important is the addition of ventilation and window holes.

1. Introduction
House constitute main elements that are forming a city. Housing sector in urban design requires a lot of attention, therein many complex problems. House is one of the core needs of human beings. A healthy house is always yearning for every family. An increased demand for houses happens every year. The increasing demand of house is a common urban problem that we can find in almost all the main cities in Indonesia. The Government is working hard to meet the needs of the house with affordable house provision. The provision of these affordable houses earmarked for the middle and poor community. The government establishes Perumnas as an institution that builds public housing in Indonesia. Medan as one of the biggest in Indonesia also faces the same housing problems. Perumnas was present in Medan in 1975 [1]. The increased need for the middle and poor community resulted in the rise of lots affordable housing developments in the suburb area. Despite its' poor image, low-cost housing is important for scores of a low-income population. It accommodates places, provides protection and comfort for economically struggling people, which helps those that living in urban where the cost of living is higher than rural [2]. Issues regarding low physical environment quality, which are common among low-cost housings, may limit or hinder residents activities.

However, most of these affordable houses rely solely on the facade of the building, healthy house criteria not be used as a standard in designing affordable house. Often buyers are deceived by attractive facade but once occupied them face various problems of health and comfort. Starting as a necessary human need, a house has amplified to become as a profitable investment at present [3].
environment is one of the key areas of human interaction, almost half of our daily time at the house so that the quality of the house environment will affect the health of its inhabitants.

A healthy house should be able to accommodate the activities of its inhabitants by enough space. Healthy houses can be interpreted as a shelter, refuge, and a place to rest so that it can grow the perfect life in every aspect; physical, spiritual, and social [4]. Healthy house as physical structures or buildings for shelter, where the environment is useful for physical and mental health as well as social circumstances are safe for the health of families and the individual [5]. According to Ministry of the Health of the Republic of Indonesia, there are four principles of Healthy House Standard. The first principle that it can meet the needs of lighting, good air, sufficient space and avoid the interference noise. The second principle is that it can meet the needs of psychological privacy; and healthy communication between family members. The third principle can address the requirements of the prevention of transmission of disease; the provision of clean water, feces and waste management of the household, as well as protect food and beverages from contamination. The last principle is that it can avoid the occurrence of the accident examples the building demarcation line and good construction [6].

A healthy house does not have to be fancy. The affordable house can also be healthy. Affordable healthy house, according to the Ministry of the Health of the Republic of Indonesia Year 2007 should be able to meet the needs of physiological and psychological needs of its occupants as well. According to the decision of the Minister of Settlement and infrastructure of the Republic of Indonesia Number 403 the year 2002 [7] affordable healthy houses must able to meet the minimal needs of the Masses (Appearance) and Space (Outside-Inside), fulfills the needs of Health and Comfort, as well as the minimum requirements of Safety and Security.

1.1. Needs a minimum Mass (Appearance) and Space (Outside-Inside)
Space requirement per person is calculated based on fundamental human activity in the house. A person’s activity involves the requirement of sleeping, eating, sitting, working, bathing, toilet, washing, and cooking as well as the other activities. From the results of the study, space requirement per person is nine sqm with the average height of the ceiling is 2.80 m. The affordable healthy house allows residents to be able to live a healthy life and run the activities of daily living [8]. Based on guidelines healthy house described that for three people needed a minimum of 27 sqm, spacious houses with an area of 60 sqm and four people needed a minimum of 36 sqm spacious house with minimum area 60 sqm.

1.2. Health Needs and Comfort
There are three aspects in Health and Comfort; lighting, ventilation, as well as air temperature and humidity in the room. Healthy houses need direct sunlight; the requirement is that the minimum light holes one-tenth of the floor area of a room and sunlight can get into minimum one room. The quality of lighting in a room can be assessed from Sky Factor Value which is primarily determined by the position and dimension of ventilation. The wider the length of the ventilation (L) the larger the value of the Sky Factor. A window should be in 70-80 cm from the floor surface of the room. According to SNI (Indonesia National Standard), an ideal number of a window in a space represented by the value of the WWR (Ratio of Window to Wall). WWR is a comparison between window area with the entire exterior wall on the specified orientation; ideally, the comparison is 20% of the overall wall.

The direction of the openings also became necessary for lighting. In the tropics country, it would better if we used reflected sunlight than direct sunlight because direct sunlight will reduce comfort in activity. The placement of the window holes needs to be organized so that more are on the North and South sides of the building. The location of the Windows on the East and west sides of the building should be avoided. If placed on the West side of the building then the problem occurred because the sunlight from the West is hot and intense. One of the influence of the Sun’s light on buildings is the temperature of the intensity of the rays can increase the temperature of the wall due to conduction and the room temperature when the sunlight directly into the room [9].

To retrieved indoor air freshness is by creating cross-ventilation with a minimum of 5% (five percent) of ventilation area, the air flow enters the same volume of air that flows out of the room, and the air
entering comes not from the smoke or the smell of the kitchen bathroom. Ventilation for kitchen and bathroom that uses electrical-mechanical such as exhaust fans or blowers must not to interfere with the comfort of the surrounding buildings and not interfere with the comfort of indoor activities in buildings such as family rooms, sleeping, living, and work.

The house was indicated healthy and comfortable when air temperature and air humidity of the room suitable for the average human body temperature. Air temperature and humidity of the room was greatly influenced by ventilation and lighting. The less or none ventilation will make a room feel airless or suffocating and will cause high humidity in the room. To set the temperature and humidity, we should concern to the balance between the air volume in and out, sufficient lighting in the room and avoid furniture that covers most of the floor area of the room.

1.3. Minimum Security and Safety Needs
The basic structure of a building is the foundation or footing, walls (skeletons of buildings), roof and floor. Whereas the other parts such as a ceiling, gutter, and others are the aesthetics of the building. In General house foundation systems can be grouped into three systems; single footing; continuous footing; and plate footing. Wall material that is used for the affordable house is con block, board, half con block and half board or other materials such as bamboo, depending on the potency of the dominant material in the local area. Wall structure is made of reinforced concrete structures. For loop are advised to use reinforced concrete. The affordable house uses affordable gable roof with a wooden frame, but because the wood is already rare and expensive, then it can be utilized with light steel. The tilt angle of the roof must follow provisions of angle based on the type of roof.

1.4. Similar research
Based on a search of the literature and journal on the affordable healthy house, the researcher concluded similar studies done by other researchers in table 1 below.

| Researcher          | Year | Findings                                                                 |
|---------------------|------|--------------------------------------------------------------------------|
| Ashadi, Nelfiyanti, Anisa | 2016 | The existence of sufficient openings, light can fit evenly into the room, an exception in a bathroom located in the middle. With the incoming light equally, then all of the room can be used for the activity. This makes all the rooms in the House to become comfortable. The size of the openings in the affordable house which has been examined by standard size so that the Sun can get to light up the room. |
| Putranto, Ary Deddy  | 2013 | The value of selling affordable house environmentally Healthy compared with affordable House is experiencing an increase in the value |
| Djumiko             | 2012 | Affordable healthy house inhabited four person (father, mother, and two children) should ideally have a broad minimum 36 m² with a spacious are 90 sqm, so that the family can run its activities at house comfortably |
| Sunik; Silalahi, Hermanto | 2012 | Domestic household waste disposal not planned, still not paying attention to the environment around so that the health of the residents in the risk |

Upon review of the above theories, researchers concluded that affordable healthy house standard in the regulation of the Minister of Settlement and infrastructure of the Republic of Indonesia Number 403 the year 2002 focused solely upon physical just so still very simple. In the rules, there is a picture of the proposed floor plan affordable healthy house based on the minimum physical needs and intended only for a single house instead of a row house. This is very different from the reality of the situation where
the researcher found that all the provision of the affordable house with a row house instead of a single
House. The row houses only have openings on the front and back. We can easily predict that all the
sample of this research are not in the category healthy, yet this research is the first step to researchers
looking more at the phenomenon of affordable house in the city of Medan, and a later stage will do a
follow-up study to look at the broader health more than just physically building it.

2. Method
The research method is qualitative descriptive. This research also comparative in which the research
will be carried out in a comparison between the sample of the study. In this research will be carried out
observations. The research area is vital, and observation is useful because it is a direct experience of the
researcher in the research area [10]. By observing researchers can find out and identify the conditions
of the field of research. Observations provide data and information that is much more fully and clearly
than depth interview and questionnaire [11].

![Figure 1. Research framework](image)

At the first stage, the researchers develop a theoretical framework based on the previous article and
criterion from Minister of Settlement and infrastructure related to the research topic. The criteria
mentioned in this context is interpreted in defining the best requirement for the affordable healthy house.
The data in this study will be collected using the methods of observation. The method of observation is
conducted by observing the third parameter of the healthy house; Mass and Space Needs, Health Needs
and Comfort, as well as Safety and Security. The research areas are located in suburban area of Medan;
South side, East, and West side of Medan which have the biggest affordable housing growth. Each
location is represented by one affordable house; typed 36 which has an area of thirty-six square meters.
Research framework can be seen in Figure 1.

Observations about the range of light in each of the sample are done three times in 1 day, total
observations conducted for nine times. Observations were done when the weather is bright and sunny.
The observations carried out in the morning (08.00), noon (12:00) and afternoon (16.00). Observations
about the lighting are done for three times to get accurate results. Also, the limitation of time from 08.00
till 16.00 based on Guidelines healthy affordable house.

2.1. Data Analysis
Data analysis was conducted at the stage of sorting and grouping of data. The data grouped based on
four criteria according to the decision of the Minister of Settlement and infrastructure of the Republic
of Indonesia Number 403 The year 2002. These standards i.e. can meet the needs of minimum Mass
(Appearance) and space (Outside-Inside), fulfills the needs of Health and Comfort, as well as the
minimal requirements of Safety and Security. This stage is done by analyzing the conditions that occur
in the research areas and produce conclusions. The following are the parameters that are used in the
assessment:
Table 2. Research parameters

| Minimum Requirements                                      | Parameters                                                                 |
|-----------------------------------------------------------|---------------------------------------------------------------------------|
| Needs a minimum Mass (Appearance) and Space (Outside-Inside) | - Space requirement per person is 9 square meter with the calculation of the average height of the ceiling is 2.80 m.  
  - Three people needed a minimum of 27 sqm spacious house with minimum land area 60 sqm  
  - Four people required a minimum of 36 sqm spacious house with minimum area 60 sqm. |
| Health Needs and Convenience                              | a) Lighting,                                                                |
|                                                          |   - Healthy houses need direct sunlight; the requirement is that the minimum light holes one-tenth of the floor area of a room and sunlight can get into minimum one room  
  - A window should be in 70-80 cm from the floor surface of the room  
  - The comparison between window area with the entire exterior wall on the specified orientation is 20% of the overall wall.  
  - The placement of the window holes needs to be organized so that more are on the North and South sides of the building. |
|                                                          | b) Air ventilation,                                                        |
|                                                          |   - To retrieved indoor air freshness is by creating cross-ventilation with a minimum of 5% (five percent) of ventilation area  
  - Ventilation for kitchen and bathroom that uses electrical-mechanical such as exhaust fans or blowers must not interfere with the comfort of the surrounding buildings and not interfere with the comfort of indoor activities in buildings such as family rooms, sleeping, living, and work |
|                                                          | c) Air temperature and humidity in the room                                 |
|                                                          |   - The House was indicated healthy and comfortable when air temperature and air humidity of the room suitable for the average human body temperature  
  - To set the temperature and humidity usually, we should pay attention to the balance between the air volume in and out, sufficient lighting in the room and avoid furniture that covers most of the floor area of the room. |
| Minimum Security and Safety Needs                        | a) Foundation; footing                                                      |
|                                                          |   - In General house foundation systems can be grouped into three systems; single footing; continuous footing; and plate footing. For sloop are advised to use reinforced concrete. |
|                                                          | b) Wall                                                                    |
|                                                          |   - Wall material that is used for the affordable house is con block, board, half con block and half board or other materials such as bamboo, depending on the potency of the dominant material in the local area. Wall structure is made of reinforced concrete structures. |
|                                                          | c) Roof                                                                    |
|                                                          |   - The affordable house uses affordable gable roof with a wooden frame, but because the wood is already rare and expensive, then it can be utilized with light steel. The tilt angle of the roof must follow provisions of angle based on the type of roof. |
3. Results and Discussions

3.1. Result

After making observations in the field than the researcher choose Residential Puri Adam Malik Medan city in the South, Residential the Gemini Point on the eastern and Residential Tanjung Selamat Indah 2 on the Western as samples. This housing has some house and researcher took samples of type 36.

| Sample 1 | Sample 2 | Sample 3 |
|----------|----------|----------|
| Residential Puri Adam Malik | Residential Gemini Point | Residential Tanjung Selamat Indah 2 |

The House faces towards the East

| House area: 36 sqm | House area: 36 sqm | House area: 35 sqm |
|-------------------|-------------------|-------------------|
| Kavling area: 73.5 sqm | Kavling area: 73.5 sqm | Kavling area: 78 sqm |

Based on observation and re-drawn the researcher found that two samples meet the standard for space requirements. Residential Puri Adam Malik has an area of 36 sqm and inhabited by four people, with an area of land 73.5 sqm. Residential Gemini Point with spacious 36 sqm and an area of 73.5 sqm land. While the area under the standard is Residential Tanjung Selamat Indah 2 spacious house with 35 sqm with land area 78 sqm and is inhabited by four people. The third sample meets the standards for the average height of the ceiling that is 3.2 m. But only the third sample facing towards the north; Gemini housing Point, while the other two facing towards the East. This has resulted the front of the House receive direct sunlight and increase the temperature in the living room and bedroom in the front house.
### Table 4. Percentage of Ventilation area

| Space                  | Sample 1 Residential Puri Adam Malik | Sample 2 Residential Gemini Point | Sample 3 Residential Tanjung Selamat Indah 2 |
|------------------------|--------------------------------------|----------------------------------|---------------------------------------------|
| **Today conditions**   |                                      |                                  |                                             |
| **Total area**         |                                       |                                  |                                             |
| Living Room            | 7.5 sqm                              | 7.5 sqm                          | 7.5 sqm                                     |
| Bed Room (front)       | 9 sqm                                | 9 sqm                            | 9 sqm                                       |
| Bed Room (back)        | 8.25 sqm                             | 8.25 sqm                         | 7.75 sqm                                    |
| Kitchen                | 9 sqm                                | 9 sqm                            | 7.75 sqm                                    |
| **Ventilation area**   |                                       |                                  |                                             |
| Living Room            | 1.12 sqm                             | 2.02 sqm                         | 1.99 sqm                                    |
| Bed Room (front)       | 1.6 sqm                              | 1.43 sqm                         | 1.735 sqm                                   |
| Bed Room (back)        | 1.6 sqm                              | 0.67 sqm                         | 1.735 sqm                                   |
| Kitchen                | 0                                     | 1.17 sqm                         | 0.0                                         |
| **Percentage**         |                                       |                                  |                                             |
| Living Room            | 14.9 %                               | 26.9 %                           | 26.5 %                                      |
| Bed Room (front)       | 17 %                                 | 15.8 %                           | 19.2 %                                      |
| Bed Room (back)        | 19.3 %                               | 8.9 %                            | 20 %                                        |
| Kitchen                | 0                                     | 13 %                             | 0.1 %                                       |
| **Space**              |                                       |                                  |                                             |
| **Total area**         |                                       |                                  |                                             |
| Living Room            | 2.25 sqm                             | 2.25 sqm                         |                                              |
| Bed Room (front)       | 0                                    | 0.225 sqm                        |                                              |
| Bed Room (back)        |                                      |                                  |                                              |
| Kitchen                | 0                                    |                                  |                                              |
| **Ventilation area**   |                                       |                                  |                                              |
| Living Room            | 0                                     | 0.225 sqm                        |                                              |
| Bed Room (front)       | 0                                     |                                  |                                              |
| Bed Room (back)        |                                      |                                  |                                              |
| Kitchen                | 0                                    |                                  |                                              |
| **Percentage**         |                                       |                                  |                                              |
| Living Room            | 0                                     | 0.1 %                            |                                              |
Only third sample; Residential Gemini Point, that has openings in the North South, while the other two facing East West. It resulted in the acceptance of direct sunlight which increases the temperature of the room on the front and back of the building. The windows are of 40-60 cm from the floor surface of the room. Based on Affordable Healthy House standard mentioned that extensive comparisons of the window with the entire outer walls value ideally is 20% of the overall wall but in reality is not found in a third sample. Almost all the rooms in the third house have wide openings that do not meet health standards, an average of under 20 per cent; there is even a house that has a bathroom without a ventilation hole. This can result in increased humidity and air cannot come out from the inside. Likewise with the bedroom still have openings and ventilation holes that do not meet standards, it can increase the humidity, the less ventilation that can potentially interfere with the health of its inhabitants. The placement of the bathroom in Residential Gemini Point is wrong because the bathroom has no ventilation holes, even if it made the hole ventilation, then it will go towards the dining room. It is less precise due to the bad air will flow into the dining room. To anticipate these things then it is advisable to add an exhaust fan to the bathroom. The exhaust fan can help drain the air from the bathroom to the ceiling, but on the other hand, will add electricity cost. The Residential Puri Adam Malik and Residential Tanjung Selamat Indah 2 which has a bathroom in the back of the house so the ventilation hole can be created leading to the outside. Meanwhile, the construction of the samples is safe. The third example wears brick walls and a roof with light steel frame. The thickness of the walls and the columns are safe enough for a one-story building. Roofing material is metal roof 20-25 degrees.

3.2. Discussion

House is one of the most significant parts of the built environment. The quality of life starts at a house. The design of suitable housing, where individuals spent a long time in their lifetimes, is one of the most significant factors to increase the quality of life. The problem is the cost reduction with specific budget cuts, for example, window sills and ventilation holes. Then they make additions on the façade of the building to adds the appearance so that people interested in buying the house. This happened on the third sample of this research. Not to mention we were talking about a very low-quality material. This condition it is unfortunate because the minimum health standards must be applied in the construction of affordable houses.

House is where an individual grows physically, and develops essential values as a human being and builds a family. In a broader context, a single house is what creates a neighborhood, and an individual is what composes a community [12]. To be able to grow physically every man requires minimum space for her daily activities. The study found that in the dimension of the sample of this research still meets the standards of room for families with four members of the family. But space will not function optimally if the quality does not comply with health standards. Ventilation holes are still very less; all samples have ventilation holes under 5 per cent as determined by the norm affordable healthy house. If this goes then inevitably, residents will be forced to wear air conditioned, and it is very damning because residents are the low-income community. Instead of being honest residents will most likely steal electricity, and this will give rise to new problems again. The building construction of research samples already meets the minimum standards of Safety and Security, but need to consider the location of the sample that is in the city of Medan which is earthquake-prone areas.

These findings fit with the simple prediction at the beginning of the study that all samples are not healthy. But the standards are less appropriate applied for row houses. There should be a more detailed follow-up research specifically for a row house, and standard series are used not only the physical but also more in the comfort room psychologically. Many things should be incorporated into the norm.

4. Conclusion

A healthy house is the needs of every family. However, most of the affordable house rely solely on the facade of the building, healthy house criteria not be used as a standard in designing the house. This research found that a third of the sample was still in that category is not healthy. The affordable houses require improvements in dimension openings and ventilation holes. The construction of all examples is
still in standard security. As a recommendation is necessary a more detailed research with assisted the right tools to measure the room temperature and humidity level of the room.

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