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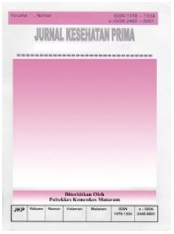

Healthy Home Assesment Using Healthy Home Environmental Health Inspection Form

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Abstract

Home hygiene and sanitation are associated with health problems such as respiratory disorders, cardiovascular disease, infections, and mental health. A healthy home assessment needs to identify home variables that have met hygiene and sanitation requirements. This study was a descriptive cross-sectional design. Families of Diponegoro University Undergraduate Nutrition Study Program students became subjects in this study. The respondent chose a total sampling technique (121 respondents). The healthy house assessment uses the Healthy Home Environmental Health Inspection form, which includes three parts: I. House components, II. home sanitation, and III. Occupant behavior. The data were processed and analyzed descriptively. Instrument validity analysis uses the Spearman Rho correlation test, while the reliability analysis uses the Cronbach value. Most of the subject's houses were included in the healthy house category (88.9%) both from the aspect of the house components, house sanitation, and occupant behavior. The aspects which the achievement < 80% and needs improvement are ventilation, kitchen smoke holes, sewage, waterproof and closed waste disposal facilities, opening bedroom windows everyday behavior, and opening family room windows every day. Most of the aspects in this home environmental health inspection assessment form (sections 1, 2, and 3) have met the element of validity ($p<0.05$). The range of values for Cronbach's sections 1-3 is 0.584; 0.644; and 0.638. Most of the subject's houses belong to the category of healthy homes, but some aspects still need to be optimized. Further studies are needed to analyze factors related to healthy home assessment.

Keywords: Behavior; Healthy Home Environment; Hygiene Sanitation

INTRODUCTION

Healthy homes are one of the health determinants included in the SDGs target in the 11th goal, which is sustainable urban and residential development. Specifically, the target related to healthy homes is to ensure access for all communities to decent, safe, affordable housing and basic services as well as managing slum areas by 2030. In addition, clean water and proper sanitation (including in the household) are also goals. 6th of the SDGs. The target by 2030 is to achieve universal and equitable access to safe drinking water for all, access to adequate and equitable sanitation and hygiene for all, and stop open defecation (Kementerian Perencanaan Pembangunan Nasional/BAPPENAS, 2017).

Housing data in Indonesia states that 75.1% of Indonesian households are unhealthy. The province with the lowest percentage of healthy houses was Lampung (14.1%) and the highest is East Kalimantan (43.6%) (Kartiningrum, 2013). This achievement needs to be improved. Housing quality is the key to

intervention in urban environments to reduce health risks. However, housing quality is still a problem in many countries. Hazards such as excess cold, excess heat and lack of ventilation leading to dampness and mold have been identified as prominent issues related to the physical condition of the house. Research shows that these hazards can lead to various health conditions, such as respiratory and cardiovascular disease, infections and mental health problems (Carmichael et al., 2020). Humidity is a protective factor in the incidence of pulmonary TB (Paat et al., 2013). Other studies have shown that temperature and humidity in the house are associated with the incidence of Dengue Hemorrhagic Fever (Pham et al., 2011; Sofia et al., 2018). Humidity <60% can reduce the lifespan of mosquitoes (Pham et al., 2011).

Poor quality of household hygiene is also associated with increased morbidity of diarrhea and other acute infectious diseases in household members (even after controlling for socioeconomic variables). The family members who experienced pain were significantly reduced after improving hygiene conditions. This finding indicates that it is necessary to improve sanitation and drinking water facilities and also aspects of hygiene behavior (Brahmanandam & Nagarajan, 2021). Other studies have reported that house sanitation and household behavior related to diarrhea are drinking water sources, waste disposal facilities, hand washing habits after defecating, and hand washing habits before eating (Nugraheni, 2012). Home sanitation is also closely related to the health of toddlers living in the house. Previous studies have reported that latrine facilities and family drinking water sources are associated with under-five mortality (Karlsson et al., 2020). Home hygiene and sanitation are also indirectly related to nutritional status. Poor home hygiene and sanitation conditions can make it easier for individuals to get infectious diseases, which can impact low nutritional status (Bappenas, 2011).

Factors related to healthy housing conditions include the level of education, knowledge level, and attitudes of householders regarding Clean and Healthy Life Behavior (PHBS), as well as knowledge and attitudes towards the health of the home environment (Christiyani, 2019; Purwaningrum et al., 2018; Puteri, 2017; Warlenda & Astuti, 2017).

Health workers are at the first line as role models of clean and healthy behaviors (Perilaku Hidup Bersih dan Sehat/PHBS) that the community will adopt. Health workers must have the responsibility and commitment in practicing PHBS, including maintaining health in their respective home environments (Tejoyuwono et al., 2018). Students from Bachelor of nutrition are prospective health workers who should start practicing PHBS including maintaining health in their respective home environments. However, research on the cleanliness of the home environment and home sanitation hygiene practices among health workers and students is still limited. Seeing the existing problems regarding the importance of having a healthy home, the researchers conducted a study to describe the health of the home environment in the student's family.

METHOD

The study was conducted using a cross-sectional descriptive method to see an overview of the assessment of healthy homes for the families of Diponegoro University students in 2021. The subjects in this study were families of Diponegoro University Undergraduate Nutrition Study Program students who were obtained using a total sampling technique of 121 respondents (class of 2020). There were 4 subjects excluded because the data entry was incomplete. The assessment of a healthy house is carried out using an

instrument in the Healthy home Environmental Health Inspection (IKL) Form based on the 2012 Healthy Home Assessment Technical Guidelines for a healthy home which includes 3 parts, i.e., I). House components, II). Home sanitation, and III). Occupant behavior (Abdillah & Anah, 2018).

Each section consists of several aspects and criteria. Aspects assessed in the house components include ceilings, house walls, floors, bedroom windows, living room windows, ventilation, kitchen smoke holes, and home lighting. Sanitation facilities include clean water, water closets, wastewater disposal, and waste disposal facilities. The behavior of the occupants of the house consists of 5 aspects such as frequency of opening the bedroom window, frequency of opening the family room window, the use of latrines, cleaning the yard habits, and throwing garbage habits. Each section is assessed using scores and weights. The weight for the first part is 31, the weight for the second part is 25, and the weight for the third part is 44. The house is categorized as a healthy house if the final score of 3 parts multiplied by the weight is 1068. The data obtained were analyzed descriptively using computer software. In addition, the instrument's validity and reliability were tested because the instrument was filled out by the subject (subjects filled out the healthy home assessment form themselves). The instrument's validity was tested using the Spearman Rho correlation test, while the instrument's reliability test uses the Cronbach value.

RESULT AND DISCUSSION

Based on the healthy home assessment results using the Healthy Home Environmental Health Inspection form, it is known that most of the subject's houses are included in the healthy home category (88.9%). Most of the components of the house meet the aspects of a healthy home. Aspects of a healthy home component whose achievements are still less than 80% are ventilation and kitchen smoke holes. Only 78.6% of the subject's houses have ventilation with a permanent ventilation area of 10% of the floor area. In addition, only 44.4% of the subject's houses have kitchen smoke holes with a permanent ventilation area of 10% of the kitchen floor area.

Most of the home environment sanitation has met the requirements, namely the existence of their own clean water facilities that meet the health aspect (95.7%) and having a goose-neck latrine equipped with a septic tank (92.3%). The sanitation aspect of Waste Water Disposal Facilities (SPAL) and waste disposal facilities are still not optimal. It is indicated by the 30.8% of the existing SPAL flowing into open sewers. Only 45.3% of SPAL has flowed into closed sewers for further processing. Watertight and closed waste disposal facilities were also found in 62.4% of the subject's houses. The behavior of residents that still needs to be improved is the behavior of opening the bedroom window every day and the behavior of opening the family room window every day because current achievements are only 64.1% and 66.7%, respectively.

Table 1. House component that meet the health requirement

No	Household characteristics		n	%
I	**House components**	**criteria**		
1	Ceilings	Available, not accident prone	106	90.6
2	House walls	Permanent, waterproof	115	98.3
3	Floors	Plastered/tile/ceramic/board (house on still)	116	99.1
4	Bedroom windows	Available	109	93.2
5	Living room windows	Available	106	90.6
6	Ventilation	Available, permanent ventilation area ≥ 10% floor area	92	78.6
7	Kitchen smoke holes	Available, permanent ventilation area ≥ 10% kitchen floor area	52	44.4
8	Home lighting	Bright and not glare, able to read normally	105	89.7

II	**Sanitation facilities**			
1	Clean water facilities	Available, own property and met the health aspects	112	95.7
2	Water closet	Available, goose neck shape, septic tank	108	92.3
3	Wastewater disposal facilities	Available, flowed into closed sewers for processing	53	45.3
4	Waste disposal facilities	Available, waterproof, closed	73	62.4
III	**Occupant behavior**			
1	Opening the bedroom window frequency	Open every day	75	64.1
2	Opening the family room window frequency	Open every day	78	66.7
3	Cleaning the yard habit's	Every day	108	92.3
4	The use of latrines	Used the water closed every day	117	100.0
5	Throwing garbage habit's	Throw in the trash every day	117	100.0
total			117	100.0

Based on table 2, most of the aspects in this home environmental health inspection assessment form (parts 1, 2, and 3) have met the element of validity ($p < 0.05$), except for three aspects in part 1 (house components), namely walls, floors, and bedroom windows, as well as two aspects in part 2 (home sanitation) namely clean water sanitation and latrines. The first part consists of 8 criteria which are comprised of 5 valid criteria and 3 invalid criteria. The second part consists of 4 criteria with 2 valid criteria and 2 other invalid criteria. The third part consists of 5 criteria with 3 valid criteria and 2 constant criteria.

Table 2. Validity of the Healthy Home Environmental Health Inspection Form instrument

No	Criteria		Correlation Coefficient	p	n
I House components					
1	Ceilings	total score 1	.402**	<0.001	117
2	House walls	total score 1	0.078	0.401	117
3	Floors	total score 1	-0.037	0.694	117
4	Bedroom windows	total score 1	0.029	0.757	117
5	Living room windows	total score 1	.224*	0.015	117
6	Ventilation	total score 1	.411**	<0.001	117
7	Kitchen smoke holes	total score 1	.750**	<0.001	117
8	Home lighting	total score 1	.352**	<0.001	117
II Sanitation facilities					
1	Clean water facilities	total score 2	0.125	0.179	117
2	Water closet	total score 2	0.050	0.593	117
3	Wastewater disposal facilities	total score 2	.796**	<0.001	117
4	Waste disposal facilities	total score 2	.594**	<0.001	117
III Occupant behavior					
1	Opening the bedroom window frequency	total score 3	.632**	<0.001	117
2	Opening the family room window frequency	total score 3	.773**	<0.001	117
3	Cleaning the yard habit's	total score 3	.217*	0.019	117
4	The use of latrines	total score 3			117
5	Throwing garbage habit's	total score 3			117

Spearman's rho
*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Table 3 shows the results of instrument reliability testing. Corrected Item-Total Correlation value in part 1 is 0.949; in part 2 of 0.952; and in section 3 it is 1,000. Based on the Cronbach value, part 1 has a Cronbach alpha value of 0.584; part 2 has a Cronbach value of 0.644, and part 3 has a Cronbach value of 0.638.

Table 3. Instrument reliability of the Healthy Home Environmental Health Inspection Form

No	Factors and items (assessed criteria)	α Cronbach	Corrected Item-Total Correlation
I	**House components**	0.584	0.949
1	Ceilings		0.298
2	House walls		0.050
3	Floors		-0.076
4	Bedroom windows		-0.081
5	Living room windows		0.122
6	Ventilation		0.305

7	Kitchen smoke holes		0.538
8	Home lighting		0.267
II	**Sanitation facilities**	0.644	0.952
1	Clean water facilities		0.174
2	Water closet		-0.043
3	Wastewater disposal facilities		0.569
4	Waste disposal facilities		0.489
III	**Occupant behavior**	0.638	1.000
1	Opening the bedroom window frequency		0.456
2	Opening the family room window frequency		0.618
3	Cleaning the yard habit's		0.099
4	The use of latrines		<0.001
5	Throwing garbage habit's		<0.001

Based on this study results, it is known that most of the subject's houses are included in the category of healthy homes (88.9%). Most of the components of the house meet the aspects of a healthy home. Factors that can be related to healthy home conditions include the level of education, knowledge level, and attitudes of the householders regarding Clean and Healthy Life Behavior (PHBS) and the health of the home environment (Christiyani, 2019; Purwaningrum et al., 2018; Puteri, 2017; Warlenda & Astuti, 2017). However, this study is descriptive so there is no strong evidence about the influence of these factors on the fulfillment of the category of healthy homes.

Based on this study results, it is also known that the aspects of the home components whose achievements are still less than 80% are ventilation and kitchen smoke holes. The two aspects that are lacking in this component of the house belong to natural ventilation. Natural ventilation can provide adequate ventilation rates (Jomehzadeh et al., 2017; Monghasemi & Vadiee, 2018). In addition to natural ventilation, there are several other types of ventilation, namely natural ventilation + fan, mechanical ventilation, and mechanical ventilation + air conditioning (Litiu, 2012). Ventilation is a natural air exchange space whose presence will reduce humidity in the house. Ventilation can reduce the risk of acute and chronic disease and improve work performance by reducing exposure to various pollutants (including pathogens such as virus droplets). Personal control of ventilation is essential to create comfort and maintain optimal air temperature in the house. However, it should also be noted that natural and mechanical ventilation can also be a source of air pollution, allergens, and sources of pathogens. Ventilation is a factor that can be modified and integrated to optimize temperature and humidity in the house to maintain indoor air quality, health, work performance, and minimize the risk of infectious diseases (Tang et al., 2020; Wolkoff et al., 2021). Another study shows that single-sided ventilation demonstrates the poorest ability to provide thermal comfort. In contrast, cross ventilation highlights better performance in reducing indoor air temperatures compared to outdoor. However, windcatchers and solar chimneys displayed even better performance by producing relatively high ventilation rates (Ahmed et al., 2021).

Experimental and epidemiological studies have reported that room temperature, humidity, and ventilation have an impact on human health, work, and cognitive performance, as well as the risk of infection (Wolkoff et al., 2021). Studies have reported that unhealthy humidity levels in homes are associated with a lack of ventilation. Studies on small and medium-sized high-performance buildings in China also reported that these types of houses did not meet the air humidity aspect of a healthy home due to a lack of ventilation (Tang et al., 2020). Houses with low air temperatures are associated with the incidence of cardiovascular disease and respiratory disorders, whereas high temperatures increase the risk of non-specific symptoms such as dry eyes. Work and

cognitive performance can run optimally at room temperatures between 22 – 24°C for areas in cold climates (Wolkoff et al., 2021). Another study reported that the optimal indoor temperature was in the range of 23.6 – 25.3°C (City et al., 2021).

Increasing and decreasing temperature can affect work performance and efficiency. The low air temperature allows the virus to grow well. Low humidity is associated with susceptibility to the eyes because it can cause dry air. The effects include tired and dry eyes and decreased work performance. Optimum indoor air humidity (40 – 60%) can optimize health, improve work performance, and reduce the risk of infectious diseases (Wolkoff et al., 2021).

The absence of wind movement can cause the feeling of heat in the room (Subagijo & Poerwadibroto, 2016) This condition can occur due to a lack of ventilation in the house. It will affect the release of heat from the body, causing excessive sweating. A healthy home can maintain body temperature so that the body does not lose heat excessively. If the body loses too much heat, it can have an impact on various disorders, such as skin itching, leg cramps, and inflammation. the air temperature that is too hot will also cause dehydration, fatigue, and even stroke (Subagijo & Poerwadibroto, 2016).

This study found that clean water facilities owned by themselves and fulfilled the health aspect had reached 95.7%. In addition, the presence of a goose-neck latrine equipped with a septic tank is 92.3%. It indicates that the achievement of the home sanitation component of most of the subjects is also good. Waste Water Disposal Facilities (SPAL) and waste disposal facilities are aspects of house sanitation that are still less than optimal. The results showed that 30.8% of the existing SPAL was still being flowed into open sewers. Only 45.3% of SPAL has flowed into closed sewers for further processing. The Waste Water Disposal Facility (SPAL) which is impregnated and does not pollute the water source (distance from water source 10m) is 23.9%. These results indicate that the presence of Waste Water Disposal Facilities (SPAL) is 100%, but all households have not implemented further processing methods. Factors that can contribute more to the aspect of regional policy are because the processing of liquid waste cannot be carried out by the community independently.

The watertight and closed garbage disposal facilities were only found in 62.4% of the subject's houses. While the rest of the subjects were using the trash can that was not closed and or not waterproof. This finding indicates that some of the subjects in this study have not used waste disposal facilities that meet health requirements. Previous research reported that there are several types of trash cans. Nowadays, numerous models of dustbins like open dustbins, mesh dustbins, pedal dustbins, and swing lid dustbins square measure accustomed used to dispose of garbage or trash. The matter with open and mesh dustbins is that if the trash is unbroken for several days, it will result in a dangerous odor and children can unfold the trash all-around. Another drawback is for those that have kids, it's terribly troublesome to watch and to distance them from dustbins. The matter with pedal ash-bin is that it's not economical to be utilized by incapacitated folks (Kumar et al., 2020). In this study, using non-closed and/or non-waterproof trash cans can also allow trash to be scattered/fall, produce unpleasant odors, or be reached (to play) with children.

As has been reported by previous studies, closed landfills are considered less practical and less economical (Kumar et al., 2020). Several families in this study also reported that they sometimes use used

goods as trash cans, so the waterproof and closed criteria cannot always be met. However, it can be further reported that the percentage of watertight and closed waste disposal facilities in this study (62.4%) was much higher than the report of a similar study conducted in the Karangasem Bali Health Center area in 2016, which was 2.5% (I Gusti Putu Sinar Adinata Wijaya & Dewi, 2016). That shows that the fulfillment of the aspect of a healthy house for waste disposal facilities in this study is much higher. Previous study reports indicate that solid waste/solid waste management practices are related to knowledge of solid waste/solid waste management (Spandana & Rani, 2020). However, this study has no robust evidence of subjects' knowledge of solid waste/solid waste management.

Recent studies related to waste disposal facilities have led to the use of Internet of Things (IoT)-based trash cans that can give a sound signal when the trash can is opened or there is waste content that comes out, thus providing a signal to the homeowner (Kumar et al., 2020). Another model of place technology, Smart trash, uses ultrasonic waves to identify the type of trash, suppress storage, and wrap and lock trash cans. This finding will not only protect the environment but also reduce the risk of disease transmission due to waste, and provide various benefits for humans (Zhou et al., 2020). Further studies are needed on the application and habituation of this type of IoT-based waste disposal facility.

Based on the study's results, several aspects of the behavior of the occupants of the house still need to be improved. These aspects include the behavior of opening the bedroom window and opening the family room window every day. The behavior of opening the bedroom window and opening the family room window every day currently only reached 64.1% and 66.7%, respectively.

Cleanliness in the house is very important to note because it is related to health. Studies report that exposure to PM2.5 particles (particulate matter less than 2.5 mm in diameter) indoors for 1-4 hours is associated with increased systolic and diastolic blood pressure, and heart rate. The effect on blood pressure and heart rate is greater in homes without air filtration (Lin et al., 2011). Poor quality of home hygiene will also be associated with increased morbidity of diarrhea and other acute infectious diseases in household members (even after controlling for socioeconomic variables). The family members who experienced pain were significantly reduced after improving hygiene conditions. This finding indicates that it is not only necessary to improve sanitation and drinking water facilities, but also aspects of hygiene behavior (Brahmanandam & Nagarajan, 2021). Moreover, previous studies reported a relationship between efforts to improve nutrition, the habit of opening room windows, and adding ventilation holes so that light can enter. rooms with the risk of TB transmission, especially among members who live in the same house (Raditya et al., 2016). These reports strengthen the evidence that there is a very close relationship between occupant behavior and the health of household members.

Previous research has reported that there is a relationship between attitudes about clean and healthy living behavior and home conditions (Puteri, 2017). Knowledge, attitudes, and practices are stages in the formation of behavior. Before adopting a new behavior, a person will learn or increase their understanding of the new behavior. He will also find out what the benefits of the new behavior are for him. The new behavior will be carried out when the benefits to be received are felt to be more than the challenges and barriers to behavior (Notoatmodjo, 2012). As with the concept of Health belief models,

there is a relationship between individual perceptions (perceptions of the severity of disease and susceptibility to disease) with behavioral outcomes. This relationship is influenced by modifying factors such as perceptions of threats, sociodemography of the subject, drivers for action, and enabling factors such as perceptions of the benefits of the new behavior reduced by behavioral barriers, perceptions of the benefits of the behavior, and the ability to perform the new behavior. Regarding sanitation, the motivation that arises due to dissatisfaction with current conditions and an increased understanding of new behaviors are the factors that can also affect. Furthermore, intentions will arise due to a change in priorities (intentions do not arise if the constraint for the new behavior is permanent). Options for action will arise if there are no significant obstacles to achieving the new behavior (Dreibelbis et al., 2013).

Subjective feelings about the house's air quality are a factor significantly related to the habit of opening windows. The effect of room area, wind direction, window size, and air exchange in winter are factors related to the habit of opening windows in the house (Huang et al., 2014). Factors of humidity, weather, and the temperature outside the house are also reported to be associated with the habit of opening windows (Fernández-agüera et al., 2019; Zheng et al., 2019). Thus, subjective factors such as perceptions of air quality in the house and objective factors such as humidity, weather, and the temperature outside the house can affect the subject's habit of opening windows.

The highest frequency of the habit of opening the windows of the house was carried out by the subjects when the temperature outside the house was between 20 – 30°C (Zheng et al., 2019). A study in China reported that the frequency and duration of opening the windows of the house (bedroom and living room) differed depending on the season. In the summer, 65% of the subjects opened the bedroom window and 75% opened the living room window. In the winter, only about 55% of the subjects opened the bedroom and living room windows. Factors that cause differences in the habit of opening windows are the direction of the house, time of day, floor height, season, and weather (Du et al., 2021).

Most of the aspects in this home environmental health inspection assessment form (sections 1, 2, and 3) have met validity ($p<0.05$). A valid measuring instrument is not only able to express the data accurately but also provides an accurate description of the data. Accurate means that measurements can provide an overview of the smallest differences between subjects (Azwar, 2010). Five assessments that don't meet the validity aspect: Part 1 (house components) was walls, floors, and bedroom windows, and Part 2 (house sanitation) regarding clean water and latrine sanitation. Part 1 consists of 8 criteria including 5 valid criteria and 3 invalid criteria. Part 2 consists of 4 criteria, with 2 being proven valid and the other 2 is invalid. Part 3 consists of 5 criteria with 3 valid criteria and 2 constant criteria. Assessment with constant results occurs because all subjects have undertaken questions about habits, so it does not bring up variations in answers.

Corrected Item-Total Correlation value on the house component is 0.949, on home sanitation of 0.952, and the behavior of the occupants of 1.00. Based on the Cronbach value, part 1 has a Cronbach value of 0.584; part 2 has a Cronbach value of 0.644, and part 3 has a Cronbach value of 0.638. Reliability assesses the extent to which the measurement results can be trusted. The measurement results can be trusted if several measurements of the same subject group obtain relatively the same results (as long as the aspects measured in the subject have not changed). If

the measurement results are considerable differences from time to time, the measurement results cannot be trusted or are unreliable. The reliability of measuring instruments is related to the problem of measurement error (Azwar, 2010).

The test result shows that Part I is less reliable (<0.6), while Parts II and III are reliable (>0.6). However, based on the literature, it is known that if the reliability test results show a high number, the actual reliability may be higher than the coefficient obtained. Furthermore, if the coefficient obtained is low, then we cannot confirm whether the question test has low reliability or is just an indication that the - equivalent assumption is not fulfilled (Azwar, 2010).

CONCLUSION

Most of the subject's houses were categorized as healthy houses (88.9%) from the aspect of the house component, house sanitation, and occupant behavior. The assessment shows that the aspect of the house components that need to be improved are ventilation and kitchen smoke holes, according to the criteria for a healthy house. The aspect of house sanitation that needs to be improved is the SPAL aspect and the watertight and closed waste disposal facilities. The behavioral aspects of residents that need to be improved are the behavior of opening the bedroom window and the family room window every day. Most of the aspects in this home environmental health inspection assessment form (sections 1, 2, and 3) have met the element of validity ($p<0.05$). The range of values for Cronbach's parts 1-3 is 0.584; 0.644; and 0.638.

Further studies are needed to analyze the factors associated with the results of this healthy home assessment. In addition, in sustainably achieving healthy and livable homes, it is necessary for the government as a policymaker to issue regulations related to the minimum requirements for residential houses that meet health aspects, as well as facilitate and assist the community in achieving these aspects.

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