

**THE CONFORMITY OF ANTHROPOMETRIC  
MEASUREMENTS OF BATHROOM AND BEDROOM  
DESIGNS FOR INDEPENDENT ELDERLY AT PANTI SOSIAL  
TRESNA WERDHA (PSTW)\* BUDI MULIA I JAKARTA IN  
2018**

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**Abstract:** Nowadays, most of the facilities that are available for the elderly are no different from those available for most adults, although they already have different levels of capacity and limitation. In average, the elderly go through 1 cm anthropometric size decrease per decade. This study is a descriptive study with quantitative approach conducted in elderly care owned by local government, which is aimed to find out the conformity between the anthropometric size and the dimension of the facilities available in bathrooms and bedrooms. This research focuses on Catelya House for women and Edelweiss House for men. It is found that the beds, wardrobes, and toilet facilities are still not in conformity with the anthropometric of elderly. The heights of 3 different bed designs in 2 houses are not proportional. Most of the wardrobes shelves are not proportional with the elbow height of elderly, as they are either too high or too low for the elderly. But the bathrooms design in Catelya and Edelweiss is quite proportional. Only the handrails in Edelweiss house are too far for elderly,

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which requires it to be redesigned in order to minimize the safety and health risks to the elderly.

**Keywords:** Anthropometric, Bathroom, Bedroom, Elderly's design, Wardrobe

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## Introduction

With age comes the process of ageing. This process changes different aspects of human life, from physical, psychological, social to economic (Suhadi, 2011). Physical changes are a tangible form of the aging process, which can be immediately observed when the functions of all body systems are deteriorating (Suhadi, 2011). According to Soejono, the elderly population typically suffers from chronic and degenerative health problems (Maryam, Ekasari, Rosidawati, Jubaedi, & Batubara, 2008).

However, this issue is often overlooked by most of the current life support facilities. They are generally designed to accommodate normal human conditions. Oftentimes, the elderly are regarded as having the same needs as most adults' (Kroemer, 2005). On the contrary, elderly people, as an "extraordinary" group undergoing many changes, from physical, psychological, social to economic, have a different set of needs from others'. Such disparity hinders most elderly people from being able to do activities on their own. A less ideal place of living leaves them particularly vulnerable to accidents, especially falls.

The World Health Organization's (WHO) data from 2018 shows that 80% of fall-related fatalities occur in low- and middle-income countries (World Health Organization, 2018). Moreover, regions of the Western Pacific and South East Asia account for 60% of these deaths (World Health Organization, 2018). The elderly are exposed to a greater risk of fall-induced injuries and restricted movement (Turana, 2013). A study in the United States of America finds that older people make up the largest proportion of falls, at

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around 20-30%, due to cognitive decline (World Health Organization, 2018). Besides age and gender, other contributing risk factors include mobility, physiological conditions, and unsafe environments (World Health Organization, 2018). The three places with the highest risk of falls are bathrooms, kitchens, and bedrooms (Lök & Akin, 2013).

In brief, the supporting equipment at Panti Sosial Tresna Werdha (PSTW) Budi Mulia I Jakarta is unsuitable for elderly people amid the fact that their changing bodily functions require different life support equipment than they would in normal conditions. The bathrooms, kitchens, and bedrooms pose a substantial risk of falls. When compared with pre-survey findings, the elderly people spend more time every day inside their rooms, whether for sleeping, chatting, making crafts, etc. Therefore, this research seeks to assess the conformity of bathroom and bedroom designs in PSTW Budi Mulia I for elderly people to further find a solution for improvement.

## **Methodology**

### **Population**

The elderly homes in Jakarta can be put into two categories: government- and private-owned elderly homes. The government-owned elderly homes are mostly for displaced elderly. The purpose of the current study is to evaluate the conformity of the facility for the independent elderly who lived in PSTW Budi Mulia I. Anthropometric data for the elderly from the two houses were gathered and used to evaluate the current design of the bathrooms and bedrooms facilities. Anthropometric data were measured for a sample of a total size of 70 elderly (half being males) aged no less than 60 years old. The samples were randomly selected from Catelya House and Edelweiss House. Measurements were taken after getting permission from the officials of elderly house and all elderly voluntarily participated in the study.

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## Measures of facilities

### 1. Bed

Three bed dimensions will be evaluated in this study to see if they are compatible with the elderly's anthropometry. These three bed dimensions are bed height, bed width, and bed length.

### 2. Wardrobe

Several wardrobe dimensions will be evaluated depending on the type of the wardrobe to see if they are compatible with the elderly's anthropometry. There are several sections of the wardrobe.

### 3. Bathroom

Toilet and bathtub dimensions will be evaluated to see if they are compatible with the elderly's anthropometry. These dimensions are toilet height, toilet width, toilet length, and bathtub height by also considering the size of bath-scoop.

## Results

### Anthropometric Size

*Table 1. Anthropometric Size of Elderly*

No.	Anthropometric Dimension	Male				Female			
		5th %tile	50th %tile	95th %tile	SD	5th %tile	50th %tile	95th %tile	SD
1	Stature	149	160	167	5,123	135,4	144,5	161,6	7,546

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2	Shoulder Height	122,25	131	152	10,917	108,55	120	131,5	6,594
3	Vertical grip reach	151,75	182,5	201,5	13,002	153	165,5	185,2	9,158
4	Elbow Height	86,5	100	111,25	7,121	80,85	90,5	104,65	5,731
5	Sitting Height	66,5	75,5	85,75	5,507	61,25	71,5	81	5,731
6	Sitting Shoulder Height	42,5	50	59,25	5,321	38,95	45	54,3	5,035
7	Shoulder breadth	35,75	42	49,25	3,406	27,75	38	48,6	6,042
8	Sitting Elbow Height	11,5	16	24,25	3,606	11,85	17	30,3	4,273
9	Hip Breadth	27,5	32	40	3,766	22,2	33	38,15	5,15
10	Sitting Knee Height	43	50	56	3,152	40	46	49,45	2,509
11	Popliteal Height	36,5	41	46	2,493	34,55	38	41,45	2,105
12	Buttock-popliteal Length	38	44	52,25	3,456	35,7	42	46,3	2,97
13	Forward Grip Reach	58,75	62,5	71,5	3,799	51,55	59	70,15	5,286
14	Span	138	153	182,5	11,221	125,4	141	157,2	9,655
15	Elbow Span	81,5	90	98,5	4,996	73,7	85	96	7,001
16	Hand length	13	18	19,25	1,804	14,7	16	18,15	1,188

## Bed

### Frameless Bed

A frameless bed is a bed without a bed frame made of either wood or iron. This type of bed is used in Catelya House, which houses elderly women. The

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following is a comparison between the frameless bed’s dimensions and the anthropometrics of elderly women, as shown in Table 2 below.

Table 2. Comparison between Frameless Bed’s Dimensions and Anthropometrics of Elderly Women

No.	Dimension	Measurement	Anthropometric Dimension	Anthropometric Measurement	Conformity
1	Bed Height	14 cm	50th %tile of Women’s Popliteal Height	35.89 – 40.1 cm	No
2	Bed Length	193 cm	95th %tile of Women’s Body Height	Minimum 169.146 cm	Yes
3	Bed Width	83 cm	95th %tile of Women’s Shoulder Width	Minimum 54.642 cm	Yes

The measurements show non-conforming bed height for elderly women because it is too short. However, a worker said that these beds were only temporary because of additional residents coming in from another house that was under repair.

Low-Frame Bed

A low-frame bed is a bed with a wooden frame that has lower height than other bed frames’. This type of bed is used in Catelya House, which houses elderly women, and Edelweiss House, which houses elderly men. The following is a comparison between the frameless bed’s dimensions [sic] and the anthropometrics of elderly men and women, as shown in Table 3 and Table 4 below.

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*Table 3. Comparison between Low-Frame Bed's Dimensions and Anthropometrics of Elderly Men*

No.	Dimension	Measurement	Anthropometric Dimension	Anthropometric Measurement	Conformity
1	Bed Height	43 cm	50th %tile of Men's Popliteal Height	38.5 – 43.49 cm	Yes
2	Bed Length	193 cm	95th %tile of Men's Body Height	Minimum 172.1 cm	Yes
3	Bed Width	83 cm	95th %tile of Men's Shoulder Width	Minimum 52.65 cm	Yes

*Table 4. Comparison between Low-Frame Bed's Dimensions and Anthropometrics of Elderly Women*

No.	Dimension	Measurement	Anthropometric Dimension	Anthropometric Measurement	Conformity
1	Bed Height	43 cm	50th %tile of Women's Popliteal Height	35.89 – 40.1 cm	No
2	Bed Length	193 cm	95th %tile of Women's Body Height	Minimum 169.146 cm	Yes
3	Bed Width	83 cm	95th %tile of Women's Shoulder Width	Minimum 54.642 cm	Yes

The measurements show conformity between the low-frame bed's dimensions and the anthropometrics of elderly men. However, this type of bed is too tall for elderly women.

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High-Frame Bed

A high-frame bed is a bed with an iron frame that has higher height than other bed frames'. This type of bed is used in Edelweiss House, which houses elderly men. The following is a comparison between the low-frame bed's dimensions [*sic*] and the anthropometrics of elderly men, as shown in Table 5 below.

*Table 5. Comparison between High-Frame Bed's Dimensions and Anthropometrics of Elderly Men*

No.	Dimension	Measurement	Anthropometric Dimension	Anthropometric Measurement	Conformity
1	Bed Height	66 cm	50th %tile of Men's Popliteal Height	38.5 – 43.49 cm	No
2	Bed Length	187 cm	95th %tile of Men's Body Height	Minimum 172.1 cm	Yes
3	Bed Width	88 cm	95th %tile of Men's Shoulder Width	Minimum 52.65 cm	Yes

The measurements show non-conforming bed height for elderly men because it is too tall. They have to jump a little to get out of bed and use hands to support their body weight when climbing into bed.

### Wardrobe

A wardrobe in this nursing home has several shelves. A shelf is a compartment of the wardrobe used to store clothes and tools. Edelweiss and Catelya Houses each have a different kind of wardrobe.

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Wardrobe in Edelweiss House

A wardrobe in Edelweiss House has four shelves. The following is its comparison with the anthropometrics of elderly men, as shown in Table 6 below.

*Table 6. Comparison between Wardrobe's Dimensions in Edelweiss House and Anthropometrics of Elderly Men*

No.	Dimension	Measurement	Anthropometric Dimension	Anthropometric Measurement	Conformity
1	Top Shelf Height	137 cm	50th %tile of Men's Elbow Height 92.87 -107.12 cm	50th %tile of Men's Elbow Height 92.87 -107.12 cm	No
2	Upper-Middle Shelf Height	97.5 cm	50th %tile of Men's Elbow Height 92.87 -107.12 cm	50th %tile of Men's Elbow Height 92.87 -107.12 cm	Yes
3	Lower-Middle Shelf Height	51 cm	50th %tile of Men's Elbow Height 92.87 -107.12 cm	50th %tile of Men's Elbow Height 92.87 -107.12 cm	No
4	Bottom Shelf Height	10 cm	50th %tile of Men's Elbow Height 92.87 -107.12 cm	50th %tile of Men's Elbow Height 92.87 -107.12 cm	No
5	Wardrobe Depth	43 cm	5th %tile of Men's Thumb Tip Reach	Maximum 54.9 cm	Yes

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The measurements show that only the upper-middle shelves conform to the anthropometrics of elderly men. Meanwhile, other shelves are either too tall or too short.

Wardrobe in Catelya House

A wardrobe in Edelweiss House [sic] has three shelves. The following is its comparison with the anthropometrics of elderly women, as shown in Table 7 below.

*Table 7. Comparison between Wardrobe’s Dimensions in Catelya House and Anthropometrics of Elderly Women*

No.	Dimension	Measurement	Anthropometric Dimension	Anthropometric Measurement	Conformity
1	Wardrobe Height	140 cm	5th %tile of Women’s Vertical Reach	Maximum 143.8 cm	Yes
			Wardrobe Depth: 5th %tile of Women’s Palm Length	Maximum 13.51 cm	No
2	Top Shelf Height	91 cm	50th %tile of Women’s Elbow Height	84.76 – 96.23 cm	Yes
3	Middle Shelf Height	52 cm			No
4	Bottom Shelf Height	12 cm			No
5	Wardrobe Depth	43 cm	5th %tile of Women’s Thumb Tip Reach	46.26 – 56.83 cm	Yes

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The measurements show that only the top shelves conform to the anthropometrics of elderly women. Meanwhile, other shelves are either too tall or too short.

## Bathroom

### Bathroom in Catelya House

Table 8. Comparison between Bathroom's Dimensions in Catelya House and Anthropometrics of Elderly Women

No.	Dimension	Measurement	Anthropometric Dimension	Anthropometric Measurement	Conformity
1	Bathtub Height	85 cm	50th %tile of Women's Elbow Height minus bath scoop's size (7.5 cm radius)	77.2 – 88.73 cm	Yes
2	Toilet Height	40 cm	50th %tile of Women's Popliteal Height	35.89 - 40.10 cm	Yes
3	Toilet Width	36 cm	95th %tile of Women's Hip Width	33 – 43.3 cm	Yes
4	Toilet Length	47 cm	95th %tile of Women's Popliteal Rump Length	43.3 – 49.27 cm	Yes
5	Handrail Height	86 cm	5th %tile of Women's Elbow Height	75.11 - 86.58 cm	Yes

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The measurements show that all facilities inside the bathrooms in Catelya House conform with the anthropometric measurements of elderly women. Thus, they are ideal from the anthropometric standpoint.

Bathroom in Edelweiss House

Unlike Catelya House, the bathrooms in Edelweiss House are non-en suite. Furthermore, they are divided into two types: Toilet Room for urinating and defecating and Bath Room for taking a bath. The following is their comparison with the anthropometrics of elderly men, as shown in Table 9 and Table 10 below.

*Table 9. Comparison between Toilet Room’s Dimensions in Edelweiss House and Anthropometrics of Elderly Men*

No.	Dimension	Measurement	Anthropometric Dimension	Anthropometric Measurement	Conformity
1	Room Width	108 cm	5th %tile of Men’s Elbow Reach	76.5 – 86.49 cm	No
2	Toilet Height	40 cm	50th %tile of Men’s Popliteal Height	38.5 – 43.49 cm	Yes
3	Toilet Width	37 cm	95th %tile of Men’s Hip Width	36.24 – 43.76 cm	Yes
4	Toilet Length	49 cm	95th %tile of Men’s Popliteal Rump Length	48.79 – 55.7 cm	Yes
5	Handrail Height	86 cm	5th %tile of Men’s Elbow Height	79.37 – 93.62 cm	Yes

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*Table 10. Comparison between Bath Room's Dimensions and Anthropometrics of Elderly Men*

No.	Dimension	Measurement	Anthropometric Dimension	Anthropometric Measurement	Conformity
1	Bathtub Height	85 cm	5th %tile of Men's Elbow Height minus bath scoop's radius	71.8 – 86.12 cm	Yes
2	Handrail Height	86 cm	5th %tile of Men's Elbow Height	79.3 – 93.62 cm	Yes

From the two tables above, we can see that anthropometric non-conformity is only found in Toilet Room width because both handrails are placed too wide apart from each other, making it difficult for elderly men to reach and use.

## Discussion

When compared with the data of 47-year-olds collected from antropometriindonesia.org, the anthropometric measurements of elderly people are "shrinking", as shown by an example in the table below.

*Table 11. Anthropometric Changes When Reaching Old Age*

No	Anthropometric Dimension	Age 47 (antropometriindonesia.org)	Factual Age	Decrease (%)
1	95th %tile of Men's Body Height	178.22 cm	161.6 cm	9.32
2	95th %tile of Women's Body Height	174.08 cm	167 cm	4.07

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These changes are in line with what Stoudt (1981) and Barlow and Braid (1990) argue (Kroemer, 2005).

Losses of elasticity in movement, ability to walk, and ability to see are certain in elderly people, and with age, these functions and abilities will continue to deteriorate, as stated by Kroemer (Kroemer, 2005).

In terms of activities, the residents have “no choice” but to eat meals inside their rooms because no room is large enough to seat all of them. The current pantry cannot fit all residents. As a consequence, food remnants are scattered throughout the rooms, attracting pests such as insects and cats.

In terms of occupancy, particularly in Catelya House, *London Housing Design Guide* suggests a minimum room size of 7 m<sup>2</sup> for 1 occupant, and 12 m<sup>2</sup> for 2 occupants (Mayor of London, 2010). The current size of approximately 13.48 m<sup>2</sup> (2.85 m x 4.73 m) for 2 people is actually an ideal capacity. However, if a 3rd person is added, the room will exceed its acceptable capacity.

Meanwhile, the facilities that are designed too tall or too short are putting the elderly residents in significant danger because of a higher risk of falling. A fall may increasingly happen as elderly people lose their ability to maintain posture and balance (Kroemer, 2005). This accident is proven to be the “gateway” to and “catalyst” in more advanced degeneration due to the pain syndromes, functional limitations, dislocations, serious tissue injuries, and fractures that follow - leading to higher treatment costs and mortality rates (Karlsson, Magnusson, Schewelov, & Rosengren, 2013).

Also, all the elderly in this nursing home were homeless brought by the Jakarta Provincial Social Bureau from the city road. Therefore, they don't complain about the facilities because the current place is better than the previous one. But this research can help the management as a reference to procuring the bathroom and bedroom facility with resident conformity. On

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the basis of this research's result, socialization will also be carried out for the elderly to use the facilities safely.

## Conclusion

Not all facilities, such as beds, wardrobes, and bathrooms, conform with the prescribed anthropometric measurements for elderly people living in PSTW Budi Mulia I. The beds are too tall; the wardrobe's top and bottom shelves are difficult to reach, making them practically unusable; and the bathroom's handrails are too wide apart to be comfortably reached. All these design flaws increase the risk of falls for the elderly people living there. In addition, there needs to be further research in both government and private elderly home institutions because of different environmental and facilities condition

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