



Design and socialization of elderly-friendly hydraulic toilets for Elderly Shelter PCA Dau, Malang


Iis Siti Aisyah ^{a,1,*}, Dini Kurniawati ^{a,2}, Nur Hasanah ^{a,3}, Moch. Syamsul Ma'arif ^{b,4}

^a Mechanical Engineering Department, Faculty of Engineering, Universitas Muhammadiyah Malang, Jl. Raya Tlogomas 246, Malang, East Java 65414, Indonesia

^b Mechanical Engineering Department, Faculty of Engineering, Universitas Brawijaya, Jl. Veteran No.10-11, Malang, East Java 65145, Indonesia

¹ siti@umm.ac.id; ² dini@umm.ac.id; ³ nurhasanah02@umm.ac.id, ⁴ syamsulm@ub.ac.id

* Corresponding author

ARTICLE INFO	ABSTRACT
<p>Article history Received: 2024-10-26 Revised: 2024-12-7 Accepted: 2024-12-9 Published: 2024-12-17</p> <p>Keywords Aisyiyah Elderly-friendly Hydraulic toilets Physical factors</p>	<p><i>The spirit of improving the welfare of the elderly is the concern of Amal Usaha Aisyiyah, an autonomous organization under Muhammadiyah by establishing a Shelter for the Elderly in the Dau area, under the management of the Aisyiyah Dau Branch Leadership. One thing that is a serious problem is the need for infrastructure that supports the ease of movement of the elderly. It is common knowledge that the elderly's movements slow down and their motor skills are greatly reduced due to physical factors and age. This is what causes them to fall easily and get injured. And the majority of falls occur in the bathroom, in addition to wet conditions that can cause slipping, also because the toilet is not suitable, or is not friendly to the elderly. This community service is aimed at creating a special toilet design that provides convenience and safety when used. The method applied is by conducting anthropometric observations, interviews with elderly users and administrators and caregivers, conducting design calculations, fabrication followed by product testing and socialization to users. Finally, this community service succeeded in building an elderly-friendly hydraulic toilet with special specifications and has been given to the Shelter for the Elderly. The handover of the product was carried out simultaneously with testing and socialization. This product is expected to increase comfort for the elderly and reduce the occurrence of accidents involving falls in the bathroom.</i></p>
<p>Kata Kunci Aisyiyah Faktor fisik Ramah lansia Toilet hidrolik</p>	<p>Desain dan sosialisasi toilet hidraulik ramah lansia pada rumah singgah lansia PCA Dau. Semangat dalam mensejahterakan Lansia menjadi perhatian Amal Usaha Aisyiyah, organisasi otonom di bawah Muhammadiyah dengan mendirikan Rumah Singgah Lansia di daerah Dau, dibawah pengelolaan Pimpinan Cabang Aisyiyah Dau. Satu hal yang menjadi permasalahan serius adalah diperlukannya sarana prasarana yang menunjang kemudahan pergerakan para Lansia. Sudah menjadi permakluman dimana gerakan lansia melambat dan motoriknya sangat berkurang karena faktor fisik dan umur. Hal inilah yang mengakibatkan mereka mudah terjatuh, dan cidera. Dan mayoritas kejadian terjatuh adalah di kamar mandi, selain kondisi basah yang bisa mengakibatkan terpeleset, juga karena toilet yang belum sesuai, atau belum ramah terhadap lansia. Pengabdian ini ditujukan untuk membuat desain khusus toilet yang memberikan kemudahan dan keamanan saat digunakan. Metode yang diterapkan dengan melakukan observasi antropometri, wawancara kepada pengguna lansia dan pengurus serta pendamping, perhitungan desain, fabrikasi dilanjutkan dengan pengujian produk dan sosialisasi kepada pengguna. Akhirnya pengabdian ini berhasil membangun toilet hidrolik ramah lansia dengan spesifikasi khusus, dan telah diberikan kepada Rumah Singgah Lansia. Serah terima dilakukan sekaligus dengan pengujian serta sosialisasi. Produk ini diharapkan dapat menambah kenyamanan pada Lansia serta dapat mengurangi terjadinya kecelakaan terjatuh di kamar mandi.</p> <p style="text-align: right;">Copyright © 2024, Aisyah, et al This is an open access article under the CC-BY-SA license</p> <div style="text-align: right;">  </div>

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INTRODUCTION

The Lansia House owned by the Aisyiyah Dau Branch Leadership (Pimpinan Cabang Aisyiyah Dau/PCA Dau) was founded in 2018 by the family of the founder of Muhammadiyah, Mrs. Abdullah Hasyim. Located in Jetis, Mulyoagung Village, Dau District, Malang East Java. This Lansia House is a center for welfare services for the Lansia around the Mulyoagung area. Many activities are carried out at this Lansia House which are routinely scheduled, for example Lansia Health Checks, Distribution of basic necessities and compensation. This Lansia House has 2 (two) officers and 2 (two) volunteers. And there are 6 (six) Lansia people who stay at the Lansia House, and 12 (twelve) people who do not stay, but participate in Lansia house activities. Some things that are serious problems are the need for infrastructure that supports the ease of movement of Lansia. It is common knowledge that Lansia's movements slow down and their motor skills are greatly reduced due to physical factors and age. Individual risk factors include not receiving fall prevention guidelines, walking with a device, loss of sensation in the hands or feet, and using pain medication (Vu et al., 2020). This is what causes them to fall easily and get injured. And the majority of falls occur in the bathroom, because of the wet environmental conditions that can cause slipping, also because the toilet is not suitable, or not friendly to the elderly. There are many tools, devices or equipment that have not been designed to be safe and comfortable for the elderly. For this reason, special designs are needed, such as toilets that provide convenience and safety when the elderly use them. The attention to the health conditions of elderly is in line with the SDG program number three, namely Healthy Lives and Well-Being. Older people need good access to health services, including chronic care and disease prevention. Non-communicable diseases such as diabetes, hypertension, and cognitive impairment are more common in older people. This SDG highlights the importance of inclusive health services for all age groups (Howden-chapman & Chisholm, 2018).

According to the interviewed administrator/manager of the Lansia house (figure 1a), in addition to equipment and infrastructure, there is also the problem of the lack of skills of elderly companions. Certified elderly companions are needed, who have complete competencies so that the handling and care of the elderly can be holistic/comprehensive, in terms of psychological knowledge, knowledge of security and safety, knowledge of health and first aid, and others. Elderly companions are expected to be patient officers, have very good emotional control, are friendly, thorough and meticulous. For this reason, special training is needed for officers and volunteers. In addition, interviews were conducted with Lansia (figure 1b), who stated that there needs to be a qualified health team that is ready to be on standby 24 hours. Because critical conditions can happen to the elderly at any time, without being able to be predicted. However, Lansia House does not yet have full-time health workers. Doctors and nurses only come at certain scheduled times, namely during Lansia Examination and Treatment activities. For this reason, special training is needed for handling critical emergency conditions for companions and volunteers of the Lansia House.



Figure 1. Interview with the manager of the elderly house (left) and interview with the elderly (right)

From the several problems above, based on the agreement with the Partner PCA, it was decided that the main priority is the safety and security of the Elderly in the bathroom. This is because there are often incidents of the Elderly falling and getting injured. For this reason, this Community Service is focused on the design and manufacture of Elderly-Friendly Hydraulic Toilets. Therefore, the importance of the community to play a role in finding solutions is what is expected from the DPPM-UMM (Research and Community Service Institution-University of Muhammadiyah Malang) Service program (Iis Siti Aisyah, 2021).

The first stage is empathy, this stage is carried out to gain an empathetic understanding of the problem to be solved. Because this method uses the user centered design aspect. The students act as observers carried out this stage by observing the phenomena in Lansia Home. Observation of the Lansia Home, there were 2 people who had entered the elderly age group (around 70 years old). In observing daily activities, the student observed various activities carried out by the elderly. There were several activities that were not so smooth in their implementation such as walking, opening/closing the bedroom door, lying down on the bed, and when using the toilet. Further interviews were conducted with the elderly. The results showed that the elderly felt that using the toilet was a very time-consuming and tiring activity. This happens because when they want to use the toilet, they have to do a lot of processes, such as walking to the toilet first, taking off their clothes, hanging up their clothes, and then using the toilet. It is not uncommon for the elderly to have to take a break

when doing this series of processes. Then they have difficulty standing up from the sitting toilet. Difficulty reaching and taking water, and so on. So many assistive devices have been used, for example the addition of handles for grip, the use of short and easy-to-reach hanging racks, the use of sitting toilets to replace squatting toilets, as shown in Figure 2. Also added are anti-slip/anti-slip carpets, the use of sprays or water sprays that are easy to use.



Figure 2. Sitting Toilet and Squatting Toilet

The use of a sitting toilet has become an absolute necessity, because of the ease of standing back up. A sitting toilet is a type of toilet that is designed with a wide seat and is located at a comfortable height for users to sit when using the toilet. Sitting toilets are currently widely used due to western cultures such as America and Europe (Prayogo et al., 2021). A sitting toilet is used by placing the pelvis and sitting on the toilet seat or chair (Viani, 2019). The sitting toilet is equipped with a lid and seat that can be opened and closed (Martosenjoyo, 2016). In others research which conducted by Dewantoro, (2019) stated that between sitting toilets and squatting toilets have their own advantages and disadvantages. Viewed from several sides such as from the side of modernity, sitting toilets are considered modern, while squatting toilets are considered traditional. The advantages of sitting toilets include better comfort, accessibility, and safety, especially for the elderly or people with certain health problems. A comfortable and high sitting position allows users to get on and off the toilet more easily without having to squat, which can be very useful for people with arthritis or balance disorders. The handles on the side of the toilet also help the elderly to support themselves when sitting and standing, reducing the risk of falls or injury (WHO Regional Office for the Western Pacific, 2009).

However, at the age of the Elderly, they are physically weak, and do not have enough strength to stand up from a sitting position. So, the specific solution is to design a sitting toilet equipped with an aid that lifts the Elderly's hips from a sitting position to a half-standing position and then slowly lifts to a perfect standing position. Through this problem, this design is aimed at the function of a toilet aid that can minimize spontaneous movements from a standing position to a sitting position. Toilet users can later lean their tailbones against the toilet seat which is in a raised condition and follow the movement of the toilet aid to move to a sitting position slowly. Considering that no human power is needed, toilet aid must also be able to move with electricity. Helping with problems with physical limitations or lightening the burden of physical work due to age factors can also be said to be an increase in the welfare of the elderly. The sustainability of this business is seen as one of the team's contributions to fighting for one of the pillars of sustainable development, namely peace, justice, and strong institutions through the empowerment of women and communities so that they are able to make a positive contribution to their environment (Aisyah et al., 2023).

People are said to be elderly if they are more than 60 years old based on Law No. 13 of 1998 (Maryati et al., 2013). The elderly are a period of development marked by a decline in physical, psychological and social functions. This decline in function can reduce the quality of life of the elderly. (Santoso, 2019). Elderly is not a disease but is an advanced stage of a life process characterized by a decrease in the body's ability to adapt to environmental stress. Elderly is a condition characterized by a person's failure to maintain balance against physiological stress conditions, this failure is related to a decrease in the ability to live and an increase in individual sensitivity (Amini & Arsy, 2022). Limited mobility causes major disruptions in daily life activities (Kristiawan & Fauzi, 2015). In Indonesia, elderly people are those aged 60 years and above. This is emphasized in Undang-Undang Nomor 13 Tahun (1998) concerning the welfare of the elderly in Chapter 1 Article 1 Paragraph 2. Some expert opinions on age limits are as follows: (1) according to the World Health Organization (WHO), there are four stages, namely Middle age, namely 45-59 years old. Elderly stage, namely the age range of 60-74 years. Old age stage, namely the age range of 75-90 years, and the very old age stage, age > 90 years; and (2) according to the Indonesian Ministry of Health (2015), the elderly are grouped into the elderly (60-69 years) and the elderly with high risk (over 70 years or more with health problems

METHOD

The Initiator of this community service program is a team of 4 lecturers, assisted by 3 students who are conducting the Student Community Service program. Lecturers contribute as grant applicants, as design directors, while students help with field work, collect data and team support for all activities. The target partners are managers of Elderly Homes, including the administrators and caregivers of the elderly. This program is carried out in 6 months covering 4 stages of work, namely Observation, Design, Manufacturing and Training. Observations are carried out at the elderly home by conducting direct interviews with the elderly, managers and caregivers. Questions to ask include: (1) Do you need help getting to the toilet? If so, what kind of help is needed; (2) Is the toilet door wide enough for assistive devices such as a wheelchair or walker; (3) Do you need to grab bars in the toilet to help you stand or sit; (4) Is the height of the toilet seat appropriate for your needs; (5) What do you think could be done to make toilets more comfortable for the elderly; (6) If you could design the ideal toilet, what features would you add. From the answers to these questions, it can be concluded that there are needs and requirements for the comfort of a toilet that the elderly want.

This is done to obtain data related to complaints and the need for a comfortable toilet for the elderly, including anthropometry-based observations (Hasiholan et al., 2019; Rashid et al., 2008). To design a comfortable and safe toilet for the elderly based on anthropometry, it is necessary to measure and observe various body dimensions and their physical abilities. From the anthropometric observations some data were obtained, such as standing height, sitting height, arms reach, functional reach, knee height, etc. The data was also obtained on elderly physical ability such as hand and arm strength, standing and sitting ability, movement ability and also balance.

After the data is collected, a design is carried out including calculating the strength and dimensions of the components that build the toilet. The output is in the form of a design drawing. Then the next stage is manufacturing, at this stage mechanical engineering students carry out fabrication in the Production Process laboratory until the product is built. The final stage is training. At this stage, product testing and socialization are carried out regarding use and maintenance. The sequence of the four stages can be seen in Figure 3 below.

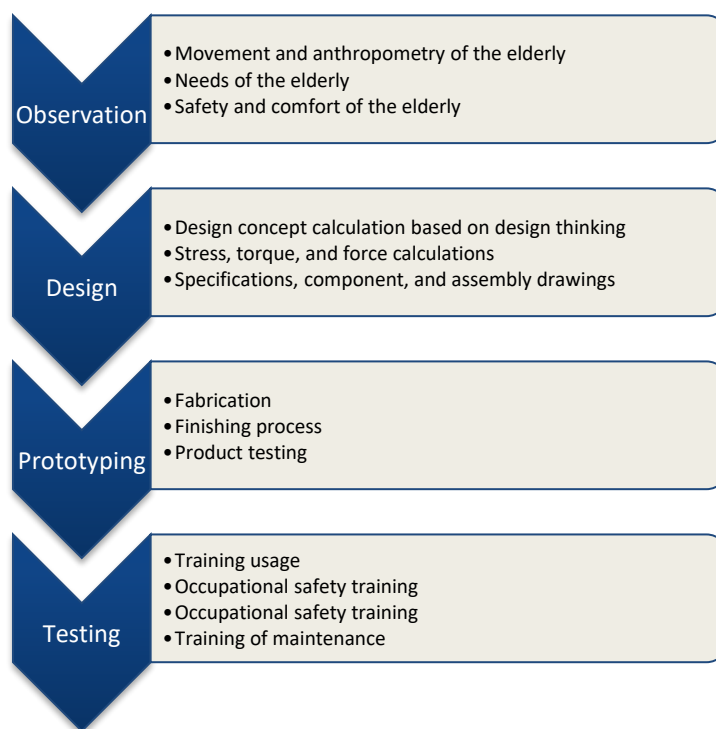


Figure 3. Stages of community service activities

RESULTS AND DISCUSSION

Observation stages include anthropometry, namely observations on body posture in order to produce goods that are comfortable and safe to use. Studies on measuring the human body dimensions of muscle, bone, and fat or adipose tissue can be called anthropometry. According to the research journal that has been conducted by Purwaningsih et al., (2017) states that anthropometry is a study that is related to the measurement of body dimensions in humans. Anthropometry comes from "anthro" which means human and "metri" which means size. Definitely anthropometry can be stated as a study related to the measurement of human body dimensions including the area of size, strength, speed and other aspects of human body movement (Wijaya et al., 2016). The field of anthropometry covers various body measurements in humans such as standing position, weight, body circumference, size when stretching arms, leg length, popliteal height

and so on. Anthropometric data is used for various purposes, such as designing work stations, work facilities, and product design to obtain appropriate and feasible sizes with the dimensions of the human body parts that will use them. Data obtained from Anthropometric observation of Toilet Dimension Measurement is shown in Table 1.

Table 1. Data obtained from Anthropometric observation of Toilet Dimension Measurement

Component	Data
Toilet Seat	Optimal height: 43-48 cm (higher than standard toilets, making it easier to sit/stand)
Grab Bars	Height from floor: 85-95 cm Distance from wall: minimum 5 cm (so that hands can grip comfortably).
Width of Toilet Room	Minimum 1.5 x 1.5 meters (ensuring enough space for assistive devices).
Toilet Door	Minimum width: 80-90 cm (wheelchair accessibility). Make sure the door opens outwards
Washbasin	Washbasin height: 75-85 cm, with empty space underneath for wheelchair users

One of the data in anthropometry is popliteal height data, shown in Figure 4 below. Popliteal height is the vertical distance from the sole of the foot to the bottom of the thigh (Laksono, 2010). The measurement method is by measuring the vertical distance from the floor to the bottom of the thigh (seat base) (SR Simanungkalit, 2016). The research journal conducted by Iskandar & Janari, (2021) states that anthropometric measurements are divided into two parts, the first is static anthropometry, namely measurements taken on the human body in a static position, the second is dynamic anthropometry, namely measurements of body dimensions are measured in various dynamic body positions. The dimensions measured in static anthropometry are taken linearly (straight) and carried out on the surface of the body. In order for the results to be representative, measurements must be carried out using a certain method on individuals (Batubara et al., 2014). This data can be used to design a chair or other product that can be sat on. If the design of a product such as a seat does not consider at all matters relating to human dimensions and body size, it is not surprising that the product will be uncomfortable to use (Dekker et al., 2007).

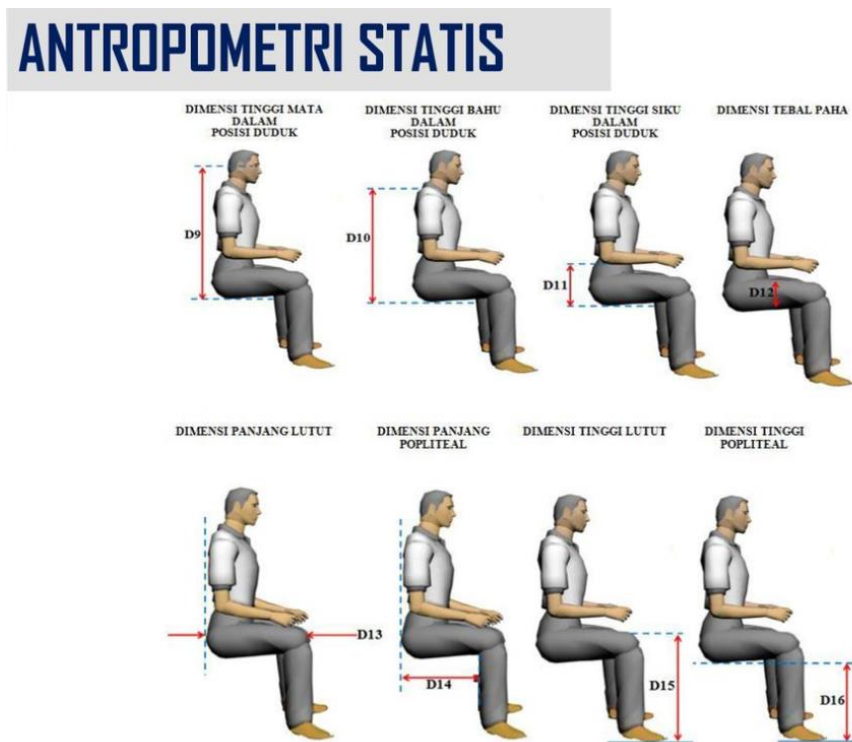


Figure 4. Popliteal height dimensions from Anthropometrics & Facility Design

At the design stage, calculations have been made on each component of the Lansia Friendly Toilet, where the calculations meet the basic things, namely the description of the forces received by the components, the basis for calculating the moment, the selection of materials and safety factors (Poutanen et al., 2021), the calculation of nominal dimensions, the review of deflections, and critical rotations. From the calculations, the final design is obtained as shown in Figure 5.

At the manufacturing stage, fabrication is carried out based on the results of the design drawings and calculations obtained, followed by simulation of the strength of the material. Simulations are conducted to ensure product safety and security. Likewise, they are conducted by workers with proper occupational safety and security K3 procedures (Laurensius Setyabudhi, 2021). According to Arsyad et al., (2019) in Aisyah et al., (2024) stated that In addition, to introduce the importance of wearing Personal Protective Equipment (PPE). This PPE must be worn by welding operators when welding.

Furthermore, the manufacturing process includes the processes of cutting, welding, joining, and others. Finally, finishing is carried out and real strength testing is carried out on use with actual loads/weights. At this stage, a prototype product is produced whose strength is validated (Maropoulos & Ceglarek, 2010; Salovaara et al., 2017). The last stage is training activities, as shown in Figure 6.



Figure 5. Finished design of elderly-friendly hydraulic toilets



Figure 6. Socialization and training for users

The elderly-friendly hydraulic toilet products produced are then given to users and introduced to training methods. The training is aimed at elderly users, elderly caregivers and volunteers. Training is carried out so that the elderly are familiar with the automatic hydraulic movement mechanism of the toilet. Designing an elderly-friendly toilet is quite difficult, especially when installing hydraulics. The speed of going up and down must be very slow so that the elderly feel safe and comfortable sitting on a toilet that automatically moves. The weakness of this automatic hydraulic toilet is that it requires regular maintenance. Because hydraulics are easily damaged by corrosion, so that toilet material is needed that is resistant to corrosion. Training is intended for users to become familiar with the device, so that they can operate it correctly and obtain convenience (Joshi et al., 2018). Maintenance training is also provided, because the operational conditions of the toilet are in wet areas, in a fairly corrosive water environment, so careful maintenance is needed so that the components do not wear out easily, do not corrode easily and are durable in use (Li et al., 2018).

When the training is carried out, the user feels happy, because they felt safe and comfortable using the automatic hydraulic toilet. The elderly felt no difficulty when standing after defecating. Then, the evaluation is also carried out to get feedback for design improvement. For example, there is a request from Partners, the toilet is equipped with several sensors installed for alarm warnings in the event of an accident in the elderly, and the addition of other necessary features.

CONCLUSION

This community services program successfully built a toilet that has high accessibility, physical comfort, and maximum safety. Every design elements have accommodated the physical limitations of the elderly, considering their anthropometry and abilities. With this approach, a special toilet for the elderly has been optimally designed, according to their real needs. The specifications of the elderly-friendly hydraulic toilets include dimensions 103 cm long and 74 cm wide, the material used is Chrome Iron and features a hydraulic drive system with 70 cm hydraulic length and 60 watts of electricity. It is equipped with a handle on the side of the toilet that is useful for reducing the risk of falling or injury. A hydraulic mechanism is added to minimize spontaneous movements from a standing position to a sitting position. This toilet is also equipped with a footrest as an aid to climb and provide comfort and safety. This toilet design significantly reduces accidents in the bathroom, promotes a healthy life and improves the wellbeing of elderly users.

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