ALTERNATIVE CLOSURE-FASTENERS FOR ELDERLY-FRIENDLY ADAPTIVE CLOTHING: A CASE STUDY OF ELDERLY WOMEN

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ABSTRACT

The growth of the elderly population in Indonesia is predicted to increase in 2025. Changes in the ratio of potential support for the elderly are decreasing, thereby affecting the fulfillment of the elderly's needs. The elderly have difficulty dressing independently due to their declining physical condition. The need for adaptive clothing answers the solution but is rarely found in Indonesia. Previous studies have only focused on physical disabilities, cerebral palsy, and arthritis. This study focuses on problematic factors in dressing for the elderly and the concept of adaptive clothing design that is friendly to the elderly regarding the closure-fastener access feature. This study uses the design thinking method. The respondent selection technique uses the purposive sampling method with criteria 1) women aged at least 60 years, 2) communicating well, 3) having difficulty dressing, and 4) having complaints of physical conditions. Data collection techniques use trials and interviews. Alternative closure features that are tested are magnet, velcro, and zipper. The test results show that the velcro closure feature has a high percentage of access to use in terms of comfort and safety, the magnetic closure feature has a high rate in comfort aspect equivalent to velcro, and the zipper closure feature has a low percentage in all aspects tested. Based on the trial results, the blouse model with velcro closure is most recommended. Furthermore, this research can be expanded to explore adaptive clothing further due to the limited availability of adaptive clothing in Indonesia.

INTRODUCTION

Based on a survey conducted by the Demographic Institute of the Faculty of Economics and Business, University of Indonesia, and published in Kompas.id (May 31, 2022), the number of elderly people in Indonesia is projected to reach 35.4% in 2025 and 63.3% in 2045. Furthermore, according to a survey by the Central Statistics Agency (BPS), the population of Indonesia will reach 278.69 million people in mid-2023. This means that in 2025, the number of elderly people is estimated to reach 96,148,050 people, and in 2045, it will reach 176,410,770 people. However, the elderly population capacity ratio in 2015-2045 is also predicted to decline. This is a significant challenge that must be addressed immediately, considering that the protection and fulfillment of the rights of the elderly is the state's obligation to ensure that the elderly can live prosperously and with dignity [1].

There is a significant correlation between the fulfillment of basic needs and the quality of life of the elderly. In other words, the more the basic needs of the elderly are fulfilled, the better the quality of life they experience [2]. The basic needs of the elderly, identified 14 components, one of which is the selection of comfortable clothing, especially in terms of putting on and taking off clothes. The factual conditions regarding the basic needs of the elderly, especially in terms of clothing, require solutions. The online news entitled 'Buttoning Clothes is Difficult,' Adaptive Clothing is Still Rare in Indonesia, from Detik News, reported that the elderly have difficulty dressing independently. This difficulty is caused by various things, such as joint pain in certain body parts, which causes pain and makes it difficult to put on clothes [3]. The news also stated that adaptive clothing is still rare in Indonesia. Based on these conditions, the concept of adaptive clothing emerged, which is specifically designed to address physical or health problems in various individuals, such as people with disabilities, the elderly, those with autism and cerebral palsy, and people with other motor disorders [4].

Adaptive clothing is designed with medical functions in mind by providing easy access to the body when putting on and taking off clothing. Adaptive clothing is more intended for people with arthritis, the elderly, people with limited mobility, or people with other physical disabilities that limit their movement [5]. The concept of adaptive clothing has been developed in several countries. This can be seen in several foreign brands that have created the concept of adaptive clothing, such as Tommy Hilfiger, Slickchic, Rebound Wear, and Yarrow, with various models of adaptive clothing in the form of tops (blouses, jackets) and pants, even underwear. Several previous studies have examined adaptive clothing [6] 1) the design of a bra that can be used with one hand for hemiplegia patients [7], 2) adaptive clothing that is suitable for people with physical disabilities with modifications to the closures and fasteners such as magnetic features for cerebral palsy and arthritis [8], and 3) the concept of adaptive clothing by replacing buttons with adhesives, using elastic bands on the waist of trousers for people with disabilities [5]. Most of these studies focus on adaptive clothing for physical disabilities, such as cerebral palsy or arthritis. Therefore, research on adaptive clothing design for the elderly still has the potential to be explored further.
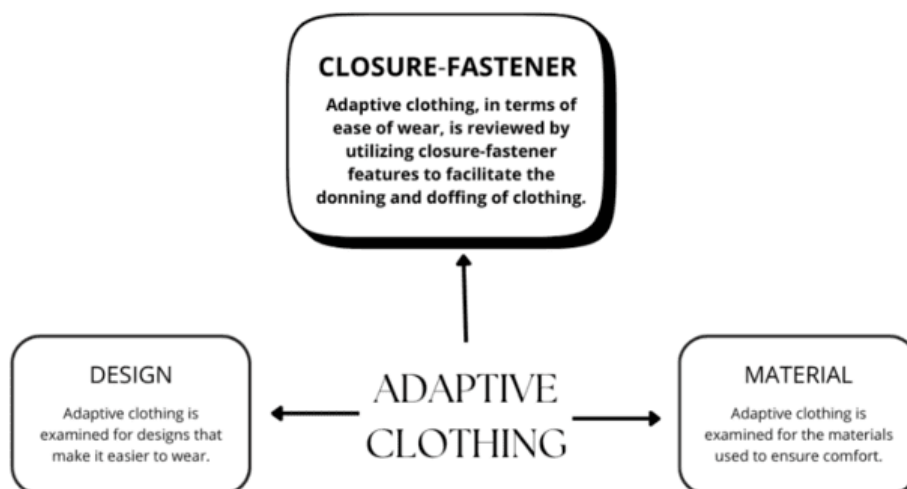

Figure 1. Research Focus on Adaptive Clothing

Therefore, as in Figure 1, this study will focus on designing adaptive clothing that is friendly for the elderly in Indonesia by exploring the factors that contribute to the difficulty of dressing the elderly and how the concept of adaptive clothing design is friendly to the elderly seen from the perspective of features (closure-fasteners).

METHOD

Research Design

This research is qualitative and uses the Design Thinking method. Design Thinking is a creative strategy process that involves an integrative approach, meaning that problem-solving is considered together with its contextual framework in a design process [9]. There are five stages in design thinking: empathize, define, ideate, prototype, and test [10].

Research Setting and Respondents

This research was conducted at the Griya Lansia UPTD located at Jl. Raya Pacet No. 186, Pakutandang Village, Ciparay District, Bandung Regency. Based on client data held by the Griya Lansia UPTD, there are 150 elderly people categorized as independent, semi-independent, bedridden, dementia, hallucinations, and ODGJ, with 106 elderly people living in villas and 44 people in special care rooms (RKK). Respondents were selected by purposive sampling with the following criteria: 1) women aged at least 60 years, 2) elderly people who can communicate well, 3) elderly people who have difficulty dressing, and 4) elderly people who have physical complaints. Based on these criteria, 10 respondents were obtained: six elderly women with complaints of joint pain in the hands and feet, 1 elderly woman with complaints of back pain, three elderly women with complaints of high/low blood pressure, and two elderly women with complaints of myopia. The stages of research and data collection techniques carried out through interviews and observations are as follows:

Table 1. Design Thinking

No	Design Thinking	Stages/Data Collection and Processing Techniques
1.	Empathize	Stages: Understanding the problems faced by elderly people in dressing and what they need. Data collection and processing techniques: Interview
2.	Define	Stages: Defining existing problems and identifying the core issues. Data collection and processing techniques: Data reduction
3.	Ideation	Stages: Developing ideas to find solutions to the problem. Data collection and processing techniques: Data reduction
4.	Prototype	Stages: A simple product sample will be created to test the theory. Data collection and processing techniques: Data display in the form of samples
5.	Test	Stages: Measuring the success of a concept or theory through testing. Data collection and processing techniques: Observation/Data Display

Table 1 explains that the Design Thinking method was applied through five main stages, each accompanied by data collection and processing techniques. The first stage, Empathize, aims to understand the problems faced by the elderly in dressing and identify their specific needs related to clothing. In this stage, interviews are the primary data collection method, allowing researchers to gather insights and first-hand experiences from the elderly. The next stage, Define, focuses on identifying and defining the core problem based on the findings. The collected data is then processed using data reduction techniques to filter out the most relevant information. In the Ideation stage, creative ideas are developed as potential solutions to the identified problem. Like the previous stage, data reduction is applied to refine and select the most promising ideas. The prototype stage involves creating a simple product sample to visualize the proposed solution. At this point, the data is displayed as a product sample. Finally, the Test stage is conducted to evaluate the effectiveness of the concept or theory through testing. Observation and data display techniques assess how well the prototype meets user needs.

Research Timeline

This research was conducted over one month, using a research methodology involving data collection, problem identification, core problem analysis, development of ideas for solutions, creation of product samples, testing on the elderly, and measuring the success of the elderly-friendly adaptive clothing concept.

RESULTS AND DISCUSSION

Causes of Dressing Difficulties in the Elderly Women

This study analyzes adaptive clothing for elderly women because they often have different needs than elderly men regarding dressing, such as lower muscle strength and different aesthetic preferences. In addition, elderly women also tend to be more susceptible to health problems that affect their ability to dress, such as the risk of joint injury from models and the use of closure fastener features.

Based on interview data, factors that cause difficulty in dressing in the elderly include health and clothing factors. Regarding health problems, there is decreased organ function and limited movement due to joint pain in the hands, feet, and back.

Table 2. Interview Data of Elderly Women at UPTD Griya Lansia

No	Name	Age	Physical and mental conditions	Experienced complaints	Dressing-related complaints
1.	Titi	61	Independent-Dementia	Myopia, Hand arthritis	Difficulty fastening clothing
2.	Patimah	62	Independent-Mentally healthy	Hypotension	Difficulty putting on clothes over the head
3.	Tuti	80	Independent-Mentally healthy	Myopia, Hypertension	Difficulty lifting legs and fastening clothing
4.	Juju	74	Independent-Mentally healthy	Myopia	Difficulty fastening clothing

No	Name	Age	Physical and mental conditions	Experienced complaints	Dressing-related complaints
5.	Rukmini	68	Independent-Mentally healthy	Back arthritis	Difficulty putting on clothes over the head
6.	Subaikah	65	Independent-Mentally healthy	Foot and hand arthritis	Difficulty lifting legs and fastening clothing
7.	Oemi Sumarsih	95	Independent-Dementia	Hand arthritis , Hypertension	Difficulty fastening clothing and putting clothes on over the head
8.	Rusminah	61	Independent-Mentally healthy	Foot and hand arthritis	Difficulty fastening clothing
9.	Salamah	69	Independent-Dementia, Hallucination	Foot and hand arthritis	Difficulty lifting the legs and putting clothes on over the head
10.	Umi Kartinah	65	Independent-Dementia, Hallucination	Foot and hand arthritis	Difficulty lifting the legs and buttoning clothes

This result, Table 2, is in line with the findings that aging is accompanied by decreased body function and worsening health status in the elderly [11]. These factors also contribute to mobility limitations in the elderly, including difficulty dressing.
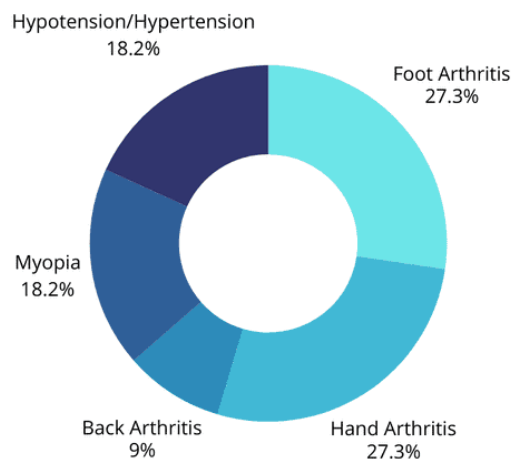

Figure 2. Health Data Chart for Elderly Women at UPTD Griya Lansia

Based on Table 2, a diagram of elderly health grouping data is produced (figure 2); the data shows most of the elderly had arthritis that affected the difficulty of dressing. Another obstacle for the elderly in dressing is the lack of comfortable clothing designs. Most available clothing uses perforated buttons that are difficult to fasten, especially considering the elderly's declining vision. As a result, the elderly prefer clothing made of elastic or stretchy materials. For example, when dressing, the range of motion of the elderly's hands is often limited, so clothing that is easy to put on and adjust can accommodate the elderly's limited dexterity. However, the choice of material is only one of several considerations in developing adaptive clothing designs. Furthermore, it was also found that the elderly need clothing models that make it easy to put on and take off clothes and require alternative access features that are easily accessible but still comfortable and cover the body safely [12]. This needs to be attempted, considering that the elderly want to

stay healthy, independent, and able to carry out activities as usual, such as bathing, dressing, and moving independently [13].

Elderly-Friendly Adaptive Clothing Concept

The adaptive clothing concept is designed according to the conditions and needs of elderly individuals. A prototype was made to obtain measurements for this design concept, as shown in Table 3 below.

Table 3. Adaptive Clothing Design Concept

No	Complaints	Aspect	Concept Idea
1	Accessibility of blouses with numerous small-sized button closures.	The access features for opening and closing clothing (closures) and the position of these closure features.	Replacing button closures with: 1. Magnetic closure 2. Hook and loop closure (Velcro) 3. Zipper fastener
2	Access to wearing a blouse, mostly from above and requiring closure from behind, is complicated.		Garments access positions: 1. From the side (right-left) 2. From the front 3. Avoid from the back

Table 3 identifies adaptive fashion design concepts by referring to two main complaints often experienced by the elderly, namely difficulty in opening and closing many small buttons, and access to wear blouses which is generally done from above and requires closure at the back. To address the first complaint, the proposed design concept includes replacing small buttons with alternative closures such as magnetic closures, hook and loop (velcro) closures, and zippers (zipper fasteners). As for the second complaint, the design concept focuses on changing the position of clothing access so that it can be worn from the front or side, and avoiding access from behind which makes it difficult for the elderly.

a. Magnetic closure
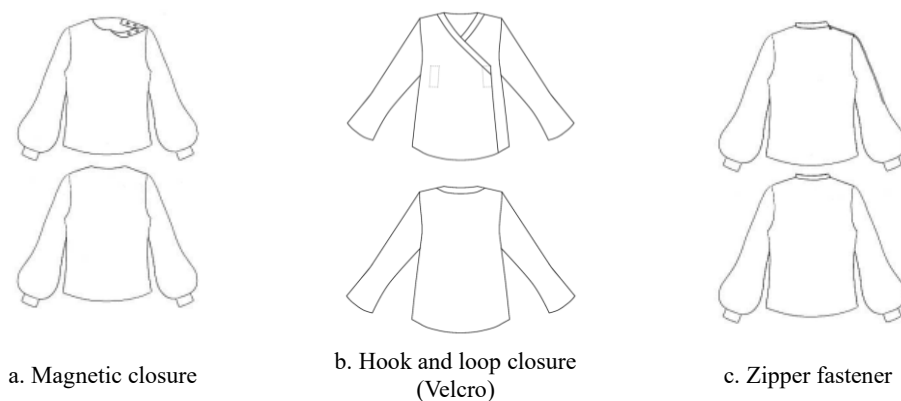
b. Hook and loop closure (Velcro)

c. Zipper fastener

Figure 3. Adaptive Clothing Alternative Design Concept

Based on the concept in Table 3, Figure 3 shows an alternative adaptive clothing design that implements these features in real terms, namely the use of an easier closing system and an opening position that is adjusted to the mobility limitations of the elderly. Subsequently, Table 4 explains in more detail the concept of access to the use of closure fastening features on several types of closures used, as well as how to open and close adaptive clothing based on variations in models and placement of closure feature access on adaptive clothing designs.
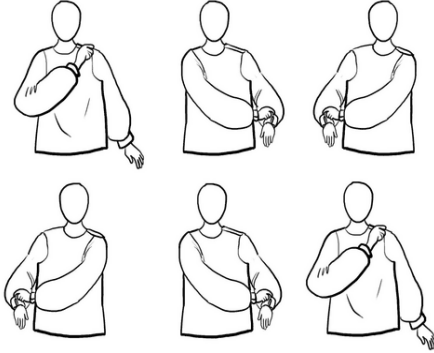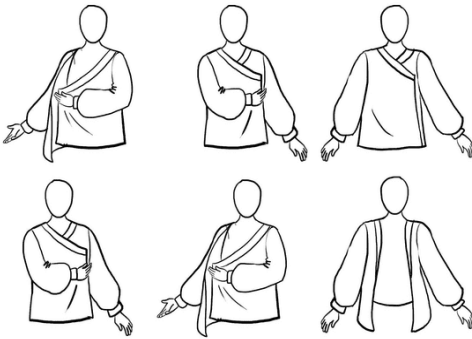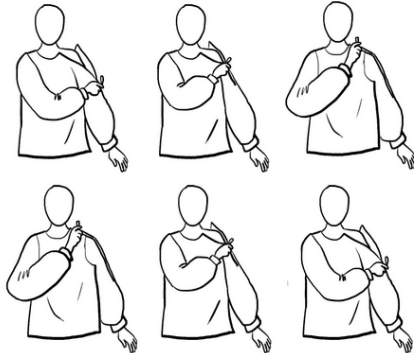
Table 4. Closure-Fastener Access Concept

No	*Closure-Fastener* Feature	Placement of features on adaptive clothing	Methods for opening and closing adaptive clothing
1	Magnet	The left shoulder and sleeve of the garment	Opening: Pull the magnetic closure to detach the two pieces of fabric connected by the magnet. Closing: Pressing the magnetic closure to join the two pieces of fabric on the garment
2	Hook and loop (velcro)	The lower chest area on the front of the garment	Opening: Pull the Velcro closure to detach the two pieces of fabric fastened by hook and loop fastener. Closing: Fastening the Velcro closure to join the two parts of the hook-and-loop fastener on the garment.
3	Zipper	From the shoulder of the garment to the sleeve of the garment	Opening: Pull the zipper fastener downwards from top to bottom to separate/open the two pieces of fabric joined by the zipper. Closing: Joining the two open pieces of garment fabric by pulling the zipper fastener upwards from bottom to top.

Table 5. Adaptive Clothing Prototype

Model	Concept	Product Design
Blouse Model 1	A-line balloon-sleeved blouse made of cotton rayon fabric featuring a 3-magnet closure, each 18 mm in size, at the left shoulder, and a 1-magnet closure, 10 mm in size, on the right and left sleeves.	
Blouse Model 2	A blouse constructed from cotton rayon fabric, designed in an overslag style with balloon sleeves, incorporates a hook-and-loop closure measuring 7 cm by 3 cm at the chest.	
Blouse Model 3	An A-line, balloon-sleeved blouse made of cotton rayon fabric featuring a 25 cm Japanese zipper closure at the left shoulder and on the right and left sleeves.	

In the Table 5, presents the adaptive clothing product prototypes developed based on the concepts outlined in Table 3, Figure 3, and Table 4. This table includes a detailed description of each prototype, such as the garment model, the dimensions of the closure, the type of specific closure used, and its placement on the garment to ensure that the final product supports ease of use, comfort, and efficiency for elderly users.

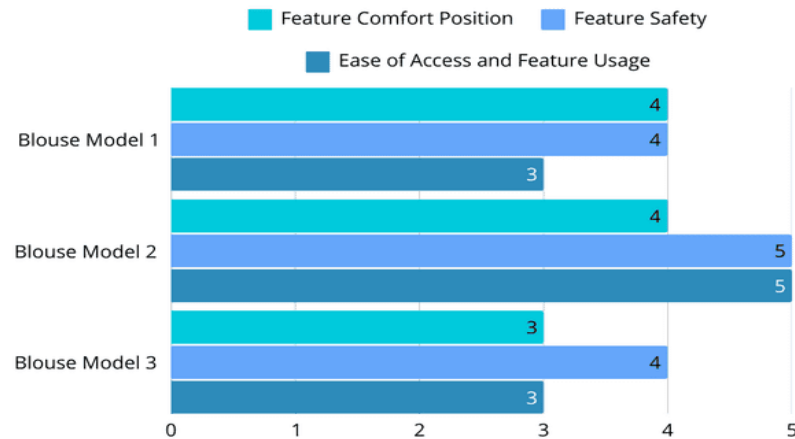**Model and Closure-Fastener Feature Trial Result Scale**

Figure 4. Rating Scale for Model Trial and Closure-Fastener Access in Adaptive Clothing Design

The adaptive clothing prototype developed based on the design concepts in Table 3, Figure 3, and Table 4 was then tested by elderly participants to evaluate its usability in real-life conditions. This user testing focused on aspects such as ease of access and feature usage, feature comfort position, and feature safety. The results of this testing are presented in Figure 4 in the form of a bar chart, which illustrates the responses and evaluations of the elderly participants regarding the performance of the adaptive clothing design. This data provides valuable insights into how effectively the prototype meets the ergonomic needs of older adults.

Table 6. Results of Model Trial and Closure-Fastener Access in Adaptive Clothing Design

Blouse Model	Closure-Fastener Feature	Trial Aspect
Blouse model 1	Magnet	1. Comfort of closure-fastener position: Adaptive garments utilizing magnetic closures achieved a comfort rating of 4. 2. Security of closure-fastener: Adaptive garments with magnetic closures obtained a security rating of 4. 3. Ease of access to closure-fastener: Adaptive garments incorporating magnetic closures were rated 3 for ease of access, signifying moderate ease of use.
Blouse model 2	Hook and loop (velcro)	1. The comfort of closure-fastener position: The adaptive garment with hook-and-loop closures received a score of 4, indicating comfort. 2. Security of closure-fastener: The adaptive garment with hook-and-loop closures scored 5, indicating excellent security. 3. Ease of access to closure-fastener: The adaptive garment with hook-and-loop closures received a score of 5, indicating exceptional ease of use.
Blouse model 3	Zipper	1. Comfort of closure-fastener position: The adaptive garment with zipper closures scored 3, indicating moderate comfort. 2. Security of closure-fastener: The adaptive garment with zipper closures scored 4, indicating security. 3. Ease of access to closure-fastener: The adaptive garment with zipper closures scored 3, indicating moderate ease of use.

However, in the Table 6 presents data obtained from trials of blouse models using three different types of closure fasteners, namely magnet, hook and loop (velcro), and zipper. The evaluations were conducted with elderly participants and focused on three key aspects of adaptive clothing: comfort, safety, and ease of access to the closure feature. Each closure type was assessed based on how well it met these criteria when applied to the blouse prototypes, providing comparative insight into their effectiveness and suitability for elderly users.

Comparative Analysis of Adaptive Clothing in Indonesia

Although adaptive clothing is still rare in Indonesia, it has begun to be developed, such as that carried out by Adaptive Clothing Indonesia, which the Ministry of Tourism and Creative Economy also promotes. As reported on the official website of Adaptive Clothing Indonesia, they provide adaptive clothing for people with disabilities and the elderly with special needs so that it can still be stylish but functional for everyday use [14]. Adaptive clothing is categorized based on the type of clothing and the patient's condition.

Figure 5. Adaptive Clothing Indonesia Products by Garment Type (Front, Side, and Back Access)
Resource: https://www.adaptiveclothing.id

Figure 5 shows the adaptive clothing category based on the type of clothing: 'Independent Dressing' and 'Assisted Dressing.' Independent Dressing is intended for elderly individuals who are independent in dressing themselves, while Assisted Dressing is designed for elderly individuals who require assistance from caregivers in dressing.

Independent elderly individuals need to be supported by a sense of comfort when dressing independently. Various aspects of comfort that need to be considered include clothing air circulation, touch factors from the hands, freedom of movement, and the pressure required to open and close buttons on clothing. Recommended closing features such as buttons, velcro, and zippers can be used to help people with limited mobility [15]. Based on the results of the model trial and access to the use of closing features, ordinary buttons are not used. However, magnets do not require extra pressure to close clothing, thus allowing the use of adaptive clothing independently by the elderly.

The Adaptive Clothing Indonesia category based on conditions is divided into several needs, including for patients with foot problems, Alzheimer's, arthritis, nursing homes, Parkinson's, and diabetes solutions. Quoted from the online news page entitled 'Kemenparekraf Promotes Adaptive Clothing for People with Disabilities' from Liputan6.com, one of the leading products of Adaptive Clothing Indonesia is elastic side

waist pants that are good for people with arthritis. Differences in patient conditions are one of the references in adjusting the model and features of the fasteners applied to adaptive clothing.
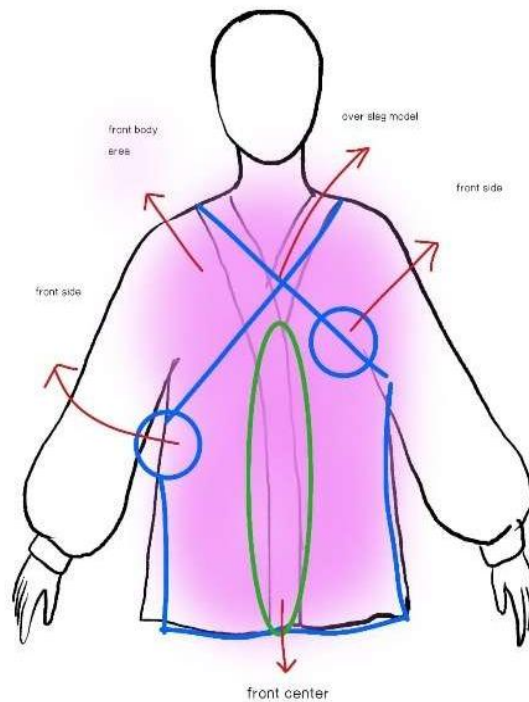

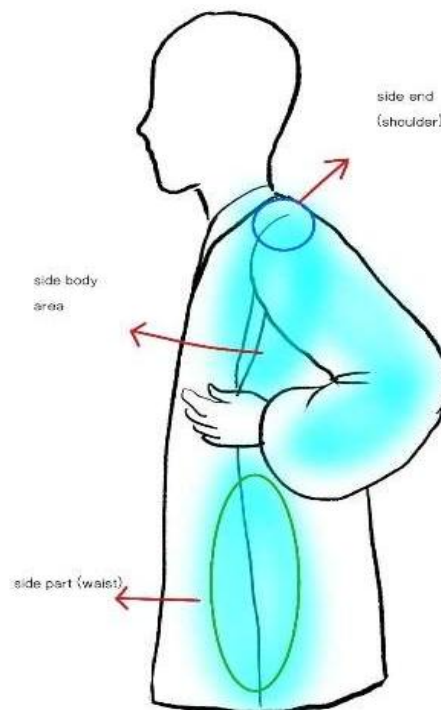Figure 6. Sketch of Adaptive Clothing with Front Closure-Fastener Access

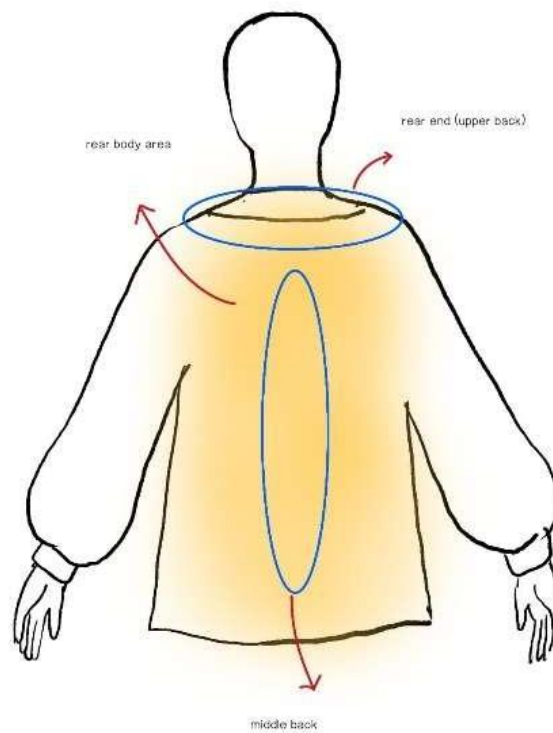Figure 7. Sketch of Adaptive Clothing with Side Closure-Fastener Access

Figure 8. Sketch of Adaptive Clothing with Back Closure-Fastener Access

Adaptive clothing with front access closures is recommended for the elderly's ease and comfort of dressing [16]. From Figures 6, 7, and 8, the front closures are easier for independent elderly people to adjust because they are within sight and require less movement compared to closures located on the sides (shoulders) and back (upper back, mid-back) of clothing. Adaptive clothing with side and back closures makes it easier for elderly people to adjust with the help of caregivers.

In general, the front center of clothing is considered the most reliable and safe access point. However, in the trial of model 2 (velcro) with a front side access point, it scored 4 for comfort of the closure position and 5 for comfort of the closure type and ease of closure access. Therefore, the position of the front side closure on adaptive elderly-friendly clothing model 2 can be a new alternative to be developed, as long as the closure remains in the front area of the clothing. In the trial of the closure-fastener feature adjusted to the needs of the elderly, it was found that this feature can minimize the possibility of pain when dressing, especially for those with high mobility.

The results of this study are closely related to previous studies on adaptive clothing while also providing new contributions to the development of elderly-friendly designs. Previously, most studies focused on adaptive clothing for people with physical disabilities. The survey by Shahani also proposed replacing buttons with adhesives and using elastic at the waist to facilitate the dressing process. This study expands this scope by focusing on the elderly, a group that also experiences motor function decline but has not received much attention in developing adaptive clothing. The results show that the front-side closure access position on adaptive clothing models scores high in comfort and ease of use, rivaling the front-center access, which has been considered the most common. This shows the innovative potential of closure placement, which has not been widely explored. In addition, the results of the evaluation of closure features revealed that adhesive types such as velcro

and magnetic closures were superior in terms of comfort and ease of use compared to zippers, which scored low in all aspects. These findings support the results of previous studies on the effectiveness of replacing conventional buttons, but at the same time, strengthen them with empirical evidence from trials on elderly groups.

There are also similarities between elderly-friendly adaptive clothing and Adaptive Clothing Indonesia regarding the fastener-closure features used: magnetic buttons, hook-and-loop fasteners (velcro), and zippers. The difference between Adaptive Clothing Indonesia and elderly-friendly adaptive clothing can be seen from the placement of the fastener-closure feature access points. For example, the results of the blouse model 2 trial, with the closure access point located on the front side, can be an opportunity as an alternative adaptive clothing model for elderly individuals with health conditions such as arthritis. However, further development of the adaptive clothing model is still needed, considering the physical condition of the elderly to meet their needs and overcome obstacles in dressing.

CONCLUSION

Several factors contribute to dressing challenges in older adults, including health conditions, organ function decline, clothing design, and closure mechanisms (fasteners). This research has resulted in adaptive clothing design concepts prioritizing comfort and ease of use for older adults. This research will empower older adults to become more independent, conserve energy for other activities, and enhance their self-esteem despite physical limitations and age-related decline. The proposed adaptive clothing designs for older adults emphasize styles that minimize unnecessary closures and movements. Overslag styles, for example, require minimal movement to dress and undress.

Hook-and-loop (velcro) closures as closures demonstrated high percentages in ease of use and security, while magnetic closures scored high in comfort, similar to hook-and-loop (velcro) closures. On the other hand, zipper closures scored low in all tested aspects, making them less recommended for adaptive clothing. This highlights opportunities for future design and rapid realization of adaptive clothing, especially for individuals with limitations in daily activities such as dressing. Furthermore, this research can be expanded to explore adaptive clothing design further, focusing on models, materials, and alternative research on front closure placement due to the limited availability of adaptive clothing in Indonesia.

ACKNOWLEDGMENT

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