

ECABLE (External Catheter Flexible) innovation of catheter external products for women

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ABSTRACT

The increasing age of humans leads to reduced strength and muscle mass. Increasing age can also cause a decrease in the function of other organs, such as the urinary tract so that some elderly people have difficulty moving places to urinate and need to use diapers. The types of urinary catheters on the market are intermittent catheters, suprapubic catheters, and external catheters. The purpose of this study was to design a special external catheter for women with the name Ecable. Ecable is designed according to the needs of users both the elderly themselves and people who care for the elderly. The method used in this design is design thinking. ecable consists of five major components: a urine bag, an alarm, a hose, special underwear, and a urine funnel. The advantages offered by this product are easy to install and remove, comfortable to use, minimize unpleasant odors, there is a full urine bag detection alarm, minimize the cause of irritation, and are cost-effective because they can be used repeatedly. This catheter is expected to help the elderly and caregivers to overcome existing needs.

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1. INTRODUCTION

As we age, humans will experience four phases, weakness, functional limitations, disability, and inhibition simultaneously related to physical, psychological, and social deterioration [1]. The physical deterioration includes skin changes, the amount of fat in the body will increase, muscle mass decreases, and bone mineral density decreases [2]. This certainly affects the motor abilities of elderly humans. The elderly often experience problems with decreased function of organ systems such as the urinary system or urinary tract which causes the release of urine without realizing or urinary incontinence [3]. The process of decline in function due to aging is natural and difficult to avoid, both for men and especially women [4]. The condition of urine incontinence causes some elderly people to use diapers to overcome this condition. The use of diapers for the elderly in fact causes the elderly to be prone to rashes and skin irritation caused by friction between moist skin and a layer of dirty diapers continuously [5]. Diapers also produce other problems, namely unpleasant odors, costs incurred regularly to buy diapers, and the installation process requires the help of a caregiver [6]. These problems can be seen in [Figure 1](#).

The use of diapers can be overcome with the use of urine catheters. There are three types of urine catheters currently on the market, namely intermittent catheters, suprapubic catheters, and external catheters. Intermittent catheters are catheters that are mostly used by postoperative patients because of the use of these catheters in a short time [7].

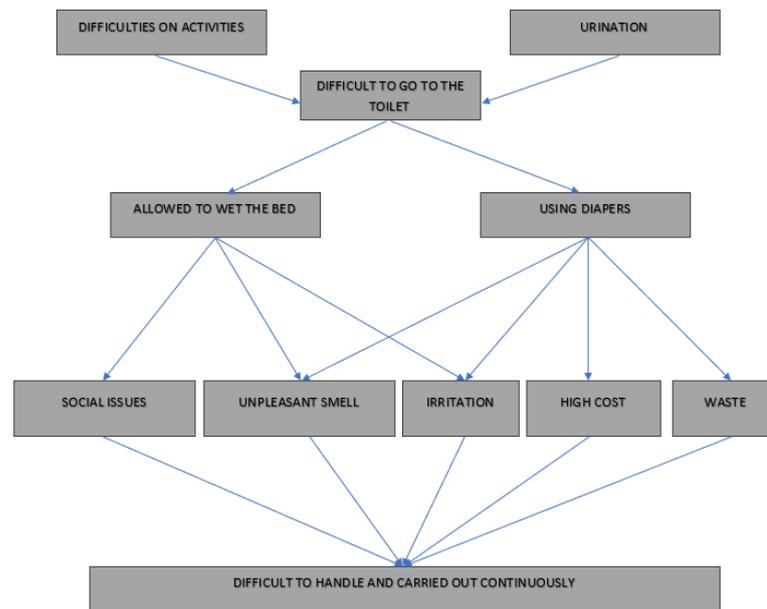


Figure 1. The problems that occur

While suprapubic catheters are catheters used by patients who have a certain disease that requires the use of catheters with a long time [8]. Both types of catheters require a nurse in the insertion process, are uncomfortable when used, and are painful [9]. Meanwhile, an external catheter is a device used to collect urine with the use of a tube connected to a drainage bag placed on the leg. The current external catheters are condom catheters targeted at male users, while external catheters for female users are not yet on the market [10]. Currently on the market are urine bags, which are quite difficult to use. An image of each type of catheter can be seen in Figure 2.

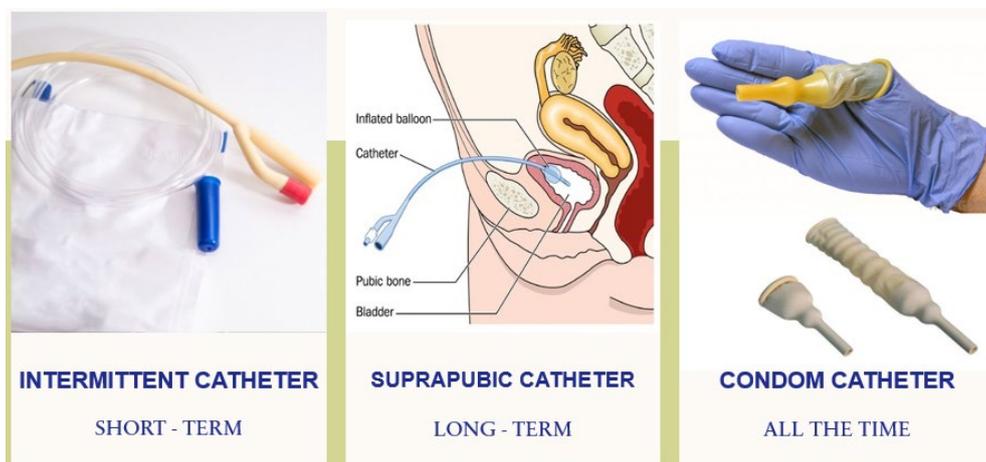


Figure 2. Types of catheters

Based on these problems, an external catheter for women is needed that can be used repeatedly, does not hurt when installed, and is easy to remove. This research will discuss the design of a special external catheter for women called Ecable using the design thinking method. Ecable is designed according to the needs of users both in the elderly themselves and those who care for the elderly. The purpose of this writing are:

1. Knowing the needs of the elderly with incontinence and their caregivers.
2. Designing external urinary catheter products for women.

2. MATERIALS AND METHODS

Research methodology is a technique for obtaining data correctly which aims to process and explore certain knowledge so that problems can be understood, predicted, or resolved [11]. The Ecable design process uses the design thinking method. This method was chosen because the innovation development process is supported by a thorough understanding through direct observation and interviews with the elderly and people who care for them as users. Design thinking has the advantage of knowing the needs and desires of users directly and the stages are quite effective in determining the solution [12]. This method has five stages, namely empathize, define, ideate, prototype, and test [13]. The stages of design thinking can be seen in [Figure 3](#).

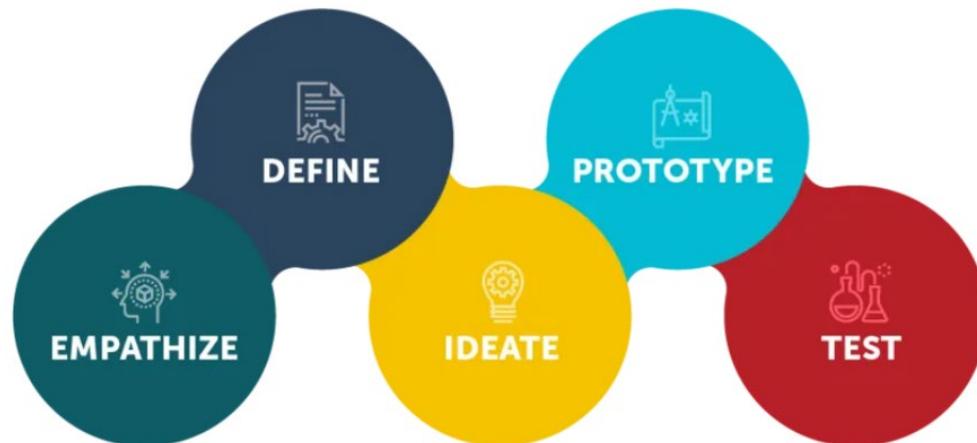


Figure 3. Stages of the design thinking method

- **Empathize**
The first stage in design thinking is empathize. This stage is the core of the process in a human-centered design [14]. The purpose of this stage is to know the product design that will be made by going through several stages such as observation, interviews, combining the two stages and feeling what the user is experiencing. When knowing the intended user, a design thinker needs to know the experiences, emotions, and situations of the user [15]. This can be done by putting yourself as a user so that you can understand in detail the needs of the user. The observation process can use an observation sheet that contains five factors, namely people, objects, environment, messages, and services (POEMS). Interviews in this study were conducted with 5 people (for example 5 people) those that are nurses for the elderly.
- **Define**
Define is a stage that is carried out after all information has been collected to determine the problem statement as a point of view. Design thinkers can identify from the information that has been collected to find the core problems that occur which will be the main goal in making a product to be designed [16]. To collect the information needed, three stages can be carried out, namely in the first stage transcribing. Transcribing is done by collecting various problems or complaints that occur by direct observation or interviews with users. After the various problems or complaints have been collected, the second step is sharing and clustering. The next step is to group these problems according to their clusters so that a design thinker can carry out the third stage, namely identifying insights and needs. This step is a stage carried out by identifying these problems to find solutions so that users do not experience the same complaints.
- **Ideate**
The third stage in design thinking is ideate. This stage is a transition process from a problem that arises to find a solution to the problem [17]. This ideate process focuses on generating an idea or an idea that becomes the basis for being able to create a prototype of the product needed by the user.
- **Prototype**
Prototype is an initial design of a product that will be made from the results of the design of ideas that have been collected into physical or real form. In the application of this stage, the initial design will be tested to be able to get responses and feedback from the user how the user feels (user experience) to be able to evaluate the product so that it can improve the results of the prototype [18].

- **Test**
Testing the design result is carried out to get feedback from users [19]. The completed prototype design will be tested by the user to be able to see firsthand the user's reaction when using the product. This stage is a very important stage to do because if there is an evaluation, improvements can be made by considering feedback that supports the main objectives of making the product [20].

3. RESULTS

3.1. Empathize

People who care for the elderly have different ties/status with the elderly, both grandchildren and workers who specifically care for the elderly. Observations were made by identifying the people, objects, environment, messages, and services (POEMS) factors. The identification results in the form of an observation worksheet can be seen in [Table 1](#).

Table 1. Observation Worksheet

People	Object	Environment	Messages	Services
<ul style="list-style-type: none"> • The elderly have urinary incontinence and difficulty in moving. • They wet their bed when walking to the bathroom. • The elderly are uncomfortable using diapers. • The person caring for the elderly lacks patience because the care process needs to be done continuously. 	<ul style="list-style-type: none"> • Mattress. • Diapers. • Trash can. • Stick • Wipes. • Underpad. 	<ul style="list-style-type: none"> • Bad smelling odor. • Elderly mattresses and negligee are damp. • Urine drips onto the floor. • Pile of diaper waste. 	<p>The elderly experience urination problems that cause the elderly to wet their bed and use diapers. This causes problems, namely people who care for the elderly feel annoyed and the environment becomes uncomfortable.</p>	<p>The services provided by people who care for the elderly are:</p> <ul style="list-style-type: none"> • Diaper change and genital cleansing. • Environmental cleaning caused by elderly urine.

The next stage is to conduct structured interviews / interviews with users directly which aims to find initial information [21]. The initial information collected is the user's needs and desires for external catheter products for women. The results of the interview are the problems that occur in accordance with the results of observations on the observation worksheet and plus the high cost of diapers and some elderly people experience skin irritation due to friction of moist skin with diapers. Users want a urination aid that can be used practically, that are:

1. Easy to install and remove;
2. Does not cause unpleasant odors;
3. Treatment process can be done while doing other work;
4. Can be used many times and is comfortable.

3.2. Define

The result of the defined stage is the grouping of various problems that occur so that an effective solution can be formulated from these problems. [Figure 4](#) is the result of grouping problems based on user needs.

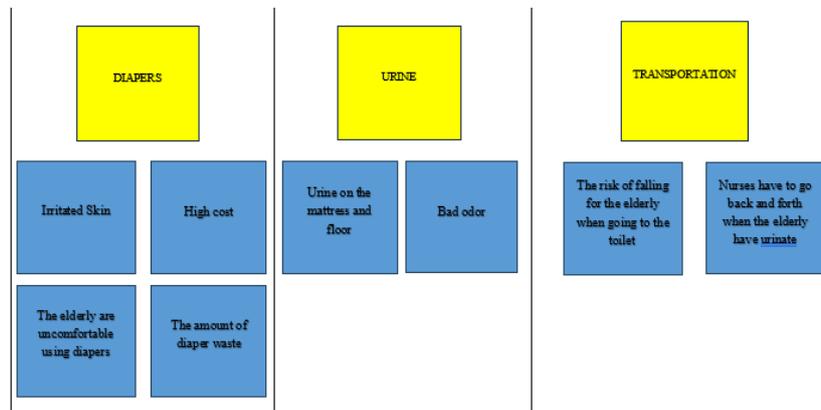


Figure 4. Problem groups

3.3. Ideate

Based on the previous stages, brainstorming was carried out to solve and bring out ideas to produce solutions. The solution provided is an external flexible catheter (Ecable) for elderly women. Figure 5 is a solution to the problem that occurred.

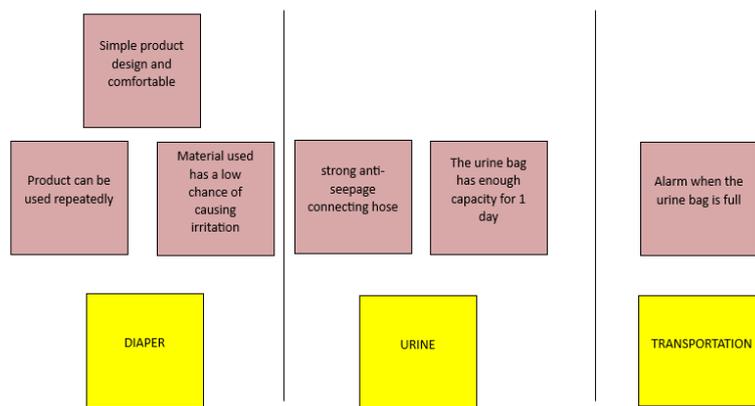


Figure 5. Solution

The features that will be given to Ecable products include:

- The urine bag has a capacity of 2 liters which is based on the average human urine production of 1-2 liters per day [22];
- Alarms are designed using indicators in the form of floats. When urine reaches a capacity of 1.8 liters, the alarm automatically turns on as a reminder for the caring person to immediately dispose of the collected urine.;
- Plastic hose with a diameter of 1 cm and a side thickness of 0.3 cm;
- The product design adopts a urine mouthpiece for women combined with special underwear. Special underwear has a unique design in the middle that serves to insert a removable urine mouthpiece. The urine funnel and the area around the hole are made of elastic soft rubber, while the underwear are made entirely of cotton;
- Giving plastic hangers on urine bags to make it easier when hanging urine bags on cots or other restraints.

3.4. Prototype

The prototype stage or prototype is made by realizing ideas according to the needs of the user. The design of the Ecable prototype was assisted by SolidWorks software. The prototype results of Ecable can be seen in Figure 6.

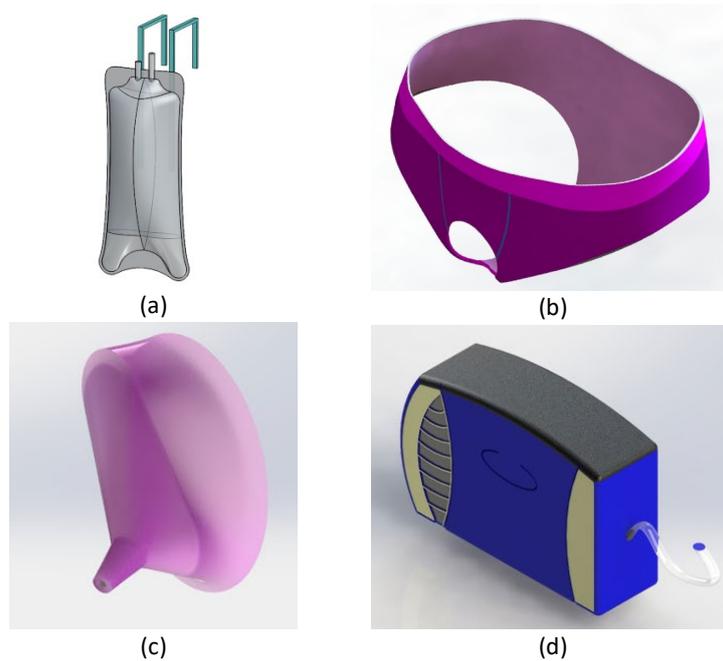


Figure 6. (a) Urine bag; (b) Special underwear; (c) Urine funnel; (d) Alarm

Specifications of Ecable can be seen in Table 2.

Table 2. Ecable Specifications

No	Aspects	Specifications
1	Dimension (cm) (l x w x h)	Urine bag : 30 x 70 x 10 (Capacity 2 liters)
		Special underwear : 25 x 52,9 x 1
		Urine funnel : 10 x 10 x 13
		Alarm : 12 x 4 x 7
		Hose : 700 x 1 x 1
2	Materials	Urine bag : PVC Plastic
		Special underwear : Cotton and rubber
		Urine funnel : Bolus silicone rubber
		Alarm : Plastic and metal
3	Usage	Hose : Rubber
		Can be cleaned and used again

The dimensions of the underwear specifically considered the anthropometry of hip width and abdominal thickness of the 50th percentile, which were 32.32cm and 20.58cm [23]. The 50th percentile was chosen because it can be used generally for the population under 50 and can be used by the population over 50 because the material is flexible [24]. How to use Ecable is as follows:

- Installing a urine mouthpiece with special underwear, hoses, and urine bags;
- Install a float on the urine bag with an alarm;
- Dressing Ecable to elderly women;
- The elderly urinate and wait until the alarm goes off;
- Dispose of urine that is in the urine bag;
- Clean all equipment and the elderly, and repeat the process again.

3.5. Test

The testing process aims to get feedback from users, namely the elderly and people who care for the elderly. The test is carried out by showing the prototype, specifications, and how to use Ecable. The elderly and people who care for the elderly carry out trials by following the instructions according to the stages above. Tests also show that the urine funnel used by the elderly is made from bolus silicone rubber which can reduce the causes of skin irritation [25]. This trial phase uses a check sheet tool that aims to determine the suitability

between the user needs and Ecable products [26]. While using Ecable, elderly people do not experience skin irritation. Other results of the trial showed that Ecable is easy to understand how to use, able to facilitate all the user needs, and users are satisfied with the results of the external design of this flexible catheter for elderly women.

4. DISCUSSION

Authors are advised to analyze the outcomes and consider their explication in relation to prior research and the initial hypotheses. The broader context should encompass both the discoveries and their implications. It is also appropriate to underscore potential pathways for future research.

5. CONCLUSION

Ecable is a medical device designed for the elderly who have difficulty moving so that they can pass urine without having to move. Ecable consists of five major components, namely urine collection bag, alarm, hose, special underwear and urine funnel. The urine collection bag is made from plastic with a capacity of 2 liters, the alarm is equipped with a buoy to give a warning when the bag is almost full, the hose is designed with elastic material, namely plastic, special cotton underwear, and a hood-shaped urine funnel with silicone-based material to be comfortable on the skin and anti-seepage. The advantages offered by this product are that it is easy to install and remove, comfortable to use, minimizes unpleasant odors, has a full urine bag detection alarm, minimizes causes of irritation, and is cost-effective because it can be used repeatedly. This catheter is expected to help the elderly and people who care for the elderly to overcome existing needs and problems.

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