A Study of Development of Senior-friendly Products through Usability Test

Myung Kug, Moon¹, Joon Keun, Lee¹, Ki Hyang, Kim¹
¹Support Center for Senior Friendly Industry, Korean Health Industry Development Institute, Chungcheongbuk-do, Korea
kimkh@khidi.or.kr

Abstract

As the population ages, demand for senior-friendly products has gradually increased. Under these circumstances, usability test aimed to make these products more competitive in terms of quality has been perceived as a critical means. In particular, ergonomically wrong-designed products could prove fatal to elderly people. Hence, this study aims to introduce a decent usability test method for the development of senior-friendly products and investigate how to support the development through the usability test. For the usability test of senior citizens, survey indicators were developed by safety, manipulability and satisfaction, and the survey was assessed by the elderly, experts and caregivers. Then, the obtained data were used for the development and improvement of products.

Keywords: senior, senior friendly product, usability test

Introduction

South Korea is one of the countries with the fastest aging of population in the world. Entry into an aged society (14% or more on the ratio of population ages 65 and over) is expected in 2018, and entry into a super-aged society (20% or more on the ratio of population ages 65 and over) is expected in 2026.

Despite the situation, senior friendly product manufacturers in Korea are small businesses and they are in an environment difficult for an independent development of products to be responsive to consumer demand and promote vitalization of a market. Furthermore, the most of products circulating in the market do not show any functional difference, and similar products are being supplied instead.

Accordingly, the government of South Korea is supporting R&D funds for research and development of assistive devices for elderly and disabled people to support vitalization of senior friendly industry, but it only supports localization of import-dependent core components or some items with insurance benefits.

Senior friendly products should be developed based on information on fundamental physical characteristics of senior citizens because they should be easy and safe to use for elderly people, however, the Korean industry is simply imitating the imported products because of the absence of ergonomic information on senior people.

Therefore, this is the time that a support policy is needed to lead development of the Korean industry through a response to demand of senior friendly industry, which is rapidly expanding in this aging society and a usability test and supply of senior friendly products which can be a foundation for healthy development of a market and competitiveness of technology and product of domestic industry.

Thus, this study will be conducted to improve technical competitiveness in senior friendly products through the usability test and to prepare a development plan for improvement of consumer's satisfaction.

In this regard, we would like to check international standards for the usability test of senior friendly products and explain a plan to open usability testing indicators for major products and an introduction plan.

Method

Usability Test of senior friendly products

Usability testing is a meal to determine whether a given senior friendly product will meet it intended users’ needs and preferences. By extension, it is a way to judge if a senior friendly products either resistant to or vulnerable to dangerous use errors that could lead to the user or patient injury of death.(1)

However, a usability test should be performed on senior friendly products from a different viewpoint with consideration that a range is particularly because elderly people are users and they have physical and
psychological distinctiveness.

Various international standards are applied to the usability test, and recently, standards are actively established and revised.

Regarding the international standards, ISO/IEC Guide 71 (2001) lists standards for the needs of elderly and disabled people, especially considerations for products, services, etc. Also, ISO/TR 22411 (2011) proposes a universal design guide related to technical information and data design needed for senior citizen, and recently, guidelines for usability of medical devices are defined by IEC 60601-3 (2015), IEC 62366 (2007), etc.

In the United States, ANSI/AAMO HE74 (2001) defines a human factor designing process for medical devices, and AAMI HE75 (2009) descriptive information on testing and method of usability engineering in designing medical devices.

**Range of senior friendly products**

In general, senior friendly products in Korea have categories just like products for long-term care insurance in Japan, but they are limited to a long-term care service area. Senior friendly products in this study do not have a clear concept and range, but they are used with assistive devices for rehabilitation, orthotic devices, orthotic devices for elderly, medical devices, senior friendly, etc.

**A Comparison of Usability test between Korea and Japan**

In Korea, a policy to certify 23 items, mostly used by elderly as excellent senior friendly products is in place. General standards, such as KS or Autonomy Standard, should be met or relevant testing results should be submitted to be designated as the excellent senior friendly products. It can be seen as a minimum process to provide safe and high quality products. However, even if a product passes the testing standards only described above, it cannot always be an excellent or safe product because the standards only describes minimum safety and performance requirements and testing methods.

In Japan, national standards guarantee quality and safety of medical devices, and it has a connotative meaning that consumers may use those without any worries. However, just like in Korea, it cannot be guaranteed that the products are easy to use although they have these marks. Thus, a policy for clinical evaluation of medical devices (QAP) is introduced and being implemented in Japan, and a purpose of the evaluation is to measure and analyze how effective and satisfying it is to be used by elderly people.

**Figure 2 Certification mark of senior friendly product in Korea (S-Mark)**

**Figure 3 Certification mark of senior friendly product in Japan (New JIS)**

**Figure 4 Certification mark of senior friendly product in**
Procedure of usability test of senior friendly products

A usability test of senior friendly products follows a process in Figure 5.

Once a request for a product is received, cases and data related to usability for each item are collected and usability test indicators for the relevant items and products are developed. Usability test indicators comply with ISO 20282-1 and they are composed of usability, user interface, ease of operation, effectiveness, efficiency, satisfaction, etc.

In general, a group of consumers using the products and experts participates in development of usability test indicators. However, in case of the products for elderly, seniors, care workers or caregivers who help with daily life of seniors, etc. participate in the usability test. They develop product specific usability test indicators through 4 or more meetings, etc.

Once the development of usability test indicators is completed, usability test is performed in sample population, and in general, subjective usability, biomechanical test, biophysical test, etc. is also evaluated.

Example of usability test of senior friendly product

This study will examine a method of usability testing on senior friendly products and a product improvement application plan through the usability test on a shower chair for elderly as an example.

Generally, shower chairs are used to prevent falls in bathrooms, but there are no international safety standards or data proposing objective consumers’ opinions in Korea.

Interview of the customer and the producer

The first step in a usability test related to a shower chair is to obtain opinions from the manufacturer and actual users. Through this step, various opinions can be obtained which are related to the product development and which may be helpful for the usability test, such as problems while using the product.

Make a checklist of usability testing

The step after preliminary inspection is to develop usability testing survey indicators for a shower chair. The shower chair is a tool to assist a bath or shower for elderly in a shower room or bathroom at home or long-term care facility. Seniors who use shower chairs are mostly incapable of self-bathing and they receive help from caregivers. However, an item related to operation is added into the evaluation items because the actual users sometimes manipulate a structure, such as an armrest.

Also, an evaluation form for caregiver was developed because the actual people who manipulate the shower chair are caregivers although the product is for elderly people. A usability test for an observer was developed for a supplementary purpose to objectify the test through observation of experts because the test might be limited when users are senior people. The shower chair was evaluated by observing elderly people taking a shower after obtaining consent from them.

Usability testing items for a shower chair were mainly divided into safety, manipulability and satisfaction. Safety is composed of being caught in, harmfulness in contact and fall risks, and manipulability consists of the whole frame, storage and handle. Lastly, satisfaction is composed of easy mobility, seat, comfortableness (upper limbs), comfortableness (lower limbs), cleanliness, easy
Table 1. Example of checklist of satisfaction

| Category | Item | Question |
|----------|------|----------|
| Safety   | Slip | No slip even after soaping. |
|          | Harmfulness in contact | Good finishing touch. |
|          | Fall risks | Safe to use alone. |
|          |      | No risk of fall. |
|          |      | Easy to maintain a comfortable position for taking a shower. |

Usability test using checklist

Elderly people ages 65 and over and care workers or caregivers with 3 or more years of experiences were selected as subjects for this study, and people who do not have problem in cognitive function were recruited for this test.

Table 2. Characteristics of subject

|       | Elder (n=25) | Helper (n=25) |
|-------|--------------|---------------|
| Sex   | M 13 / F 12  | M 5 / F 20    |
| Age(year) | 72.64        | 59.04         |
| Height(cm) | 161.80       | 159.64        |
| Weight(kg) | 66.32        | 60.24         |
| MMSE-K | 25.60        | -             |
| Carrier | -            | 6.48          |

Results of usability test

All scales were indicated with 4-level Likert scale (4: strongly agree, 3: agree, 2: disagree, 1: strongly disagree), and the higher a level is in each category, the more positive an answer is.

As a result of an evaluation of elderly people, in the safety area, there was barely a skin damage from contact with the product, but a fall may occur and stability was also slightly lower. Also, in the satisfied area, satisfaction levels of a material and design of seating surface were relatively high, but a satisfaction level for the width of a seat was the lowest.

Table 3. Results of elderly people (n=25)

| Category | Area | Item | Average |
|----------|------|------|---------|
|          |      | Slip | 2.32    |
|          |      | Harmfulness in contact | 3.04 |
|          | Safety | Fall risks (safety) | 2.92 |
|          |       | When changing position |       |
|          |       | When sitting | 2.40 |
As a result of the evaluation of caregivers, risks during manipulating in the safety area were low, but safety while transferring elders was low. In the manipulability area, it was evaluated that the most difficult manipulation is to adjust the height of the chair while the most positively evaluated items in this area was easy storage. Satisfaction levels were mostly positive.

Table 4. Results of helper (n=25)

| Category | Area       | Item                           | Average |
|----------|------------|--------------------------------|---------|
| User based evaluation | Safety     | Safety for manipulation         | 3.16    |
|          |            | Harmfulness in contact          | 2.84    |
|          |            | Fall risks (safety)             | 2.44    |
|          | Manipulability | Height                       | 2.44    |
|          |             |                                 |         |

Improvements of shower chair

Through the usability test above, following improvements were discovered, and they were applied to the product.

Protruded screws were removed to increase the safety, and width, height and length of a seat were improved with consideration for physical characteristics of elders in Korea.

Figure 8. Improvements of shower chair
Results and conclusions

The usability test has advantages which can contribute to the development of senior friendly products for the manufacturer, and supply safe and highly usable senior friendly products to the users.

Also, the results of usability tests are helpful for the development of competitive products by understanding the users' level of satisfaction with newly developed product in advance, understanding dissatisfactory factors to improve level of satisfaction, and providing an opportunity to correct those factors.

In case of manufacturers planning to export to international markets, scientific bases and analysis data from the results of the usability test can be used as convincing data for a product marketing tool.

Based on these results of the usability tests, the government will be able to improve standards based on baseline data and safety evaluation data as well as quality control standards which provide incentives to manufacturers, and to use them as supportive data for research and development of core components and technology for development of new material and designing technology or improvement of safety.

For consumers, the usability test will be able to contribute to strengthening of safety of products by creating a relevant database, and to help in improving the rights and interests of consumers through a comparison between domestic and foreign products.

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