Design Research of the Household Diagnosis & Treatment Products for Middle-aged and Older Diabetic Patients

Shanliang Yao¹ and Ying Zhang²*
¹ Wuhan Institute of Technology, Wuhan, China
² Wuhan Institute of Technology, Wuhan, China

*Corresponding author email: 766238657@qq.com

Abstract. The purpose of this research is to improve the user's experience and product treatment effect by improving the humanized product design in response to the functional and emotional needs of Household Diagnosis & Treatment Products for middle-aged and older diabetes patients. We investigated the existing Household Diagnosis & Treatment Products, analyzed the problems. We combined with the physiological and psychological characteristics of the patients, then we observe and researched the diagnosis and treatment process and summarized the needs of patients. At the end, we put forward the improved design method of Household Diagnosis & Treatment Products. The physiological and psychological needs of patients, especially the middle-aged and elderly patients, should be considered its rationality of Household Diagnosis & Treatment Products. It’s order to alleviate the negative emotions in the process of recuperation, improve the user experience of products, and then improve the treatment effect.

Keywords: Improved design; diabetes; Home medical treatment; Emotional design; Humanized design.

1. Introduction
With the improvement of social economy and people's material living standards, the diabetes's prevalence has been increasing for decades. According to the statistics from 8th edition report of International Diabetes Federation (IDF), the number of people with diabetes in the world has reached 424.9 million, in which Chinese patients occupy about thirty percent, nearly 114.4 million people. The alliance predicts that by 2045, the number of people with diabetes worldwide will reach 628.6 million, while the number of patients in China will reach a staggering 119.8 million. The IDF's survey of patient’s age distribution shows that people with diabetes range in age from 20 to 79 years, in elderly population whose age range from 55 to 79 years[1], the prevalence is the highest. Due to the special physiological and psychological characteristics of this group, the research on the Household Diagnosis & Treatment Products for middle-aged and older patients becomes necessary.
Currently, there are many problems occurs when using existing diagnostic products. There is very little about the design of diabetic Household Diagnosis & Treatment Products, especially for middle-aged and older patients. The market’s products for middle-aged and older patients only enlarge font and overlay functions, and does not fully consider their deeper needs. Therefore, from the perspective of physiological and psychological characteristics of middle-aged and older patients, this article discusses the humanized and emotionally improved design of diabetic Household Diagnosis & Treatment Products, aiming at improving the user experience and medical effect of the product.
2. Status and Thinking on Design of Household Diagnosis & Treatment Products for Diabetes

At present, the diabetic Household Diagnosis & Treatment Products are used by the vast majority of patients are fingertip blood glucose meters and insulin pens with needles. Patients need to use a blood glucose meter every day to measure blood glucose levels and provide a basis for the insulin dose that needs to be injected. It shows that diabetes Household Diagnosis & Treatment Products have become an indispensable part of patients' daily lives. According to the research, it is found that most patients have many problems when using the diagnosis & treatment products, such as neglecting the blood glucose detection link, improper disinfection methods, improper preservation of insulin[2,3], cumbersome product use processes[4], etc., leading to a reduction in the treatment effect.

Domestic and foreign research on Household Diagnosis & Treatment Products for diabetes is mainly focused on the innovation of technical structure, and less research on product design. So it is not difficult to find that the research and design of diagnosis and treatment products in China is in a relatively lagging state, especially for special populations such as middle-aged and older patients presents a "blue ocean" phenomenon.

With the rising prevalence of diabetes, the demand for diabetic Household Diagnosis & Treatment Products is increasing. Therefore, the design has to consider the particularity of the main population of middle-aged and older patients as an important factor. From the perspective of products in the Chinese market, the design for the characteristics of middle-aged and older users are not fully considering the needs of patients. This part will through research literature and effective evaluation information from the e-commerce platform to analyze and summarize the problems in the design of diabetes Household Diagnosis & Treatment Products, and it will discuss the shortcomings of the product as a basis for improvement.

2.1. The Product has a Single Appearance Design and Strong Homogeneity

Some foreign brands and domestic senior brands have occupied China's diabetes diagnosis and treatment product market for many years. As market demand increases, emerging brands join the market competition. They open the market with cost-effective advantages[5]. They are mainly based on imitation in appearance and carry out simple improvements to reduce costs and gain market competitiveness. As a result, the appearance of the product is homogeneous, the recognition of the medical product is enhanced, and the products lacks humanity and beauty. These products are monotonous, indifferent and of varying quality.

2.2. The Product’s Using is Complicated

On the one hand, the meanings of color differentiation, function keys, graphic symbols, and interfaces of Household Diagnosis & Treatment Products are difficult to understand for mid-aged and elderly patients. The design of the product's operation interface uses multiple graphics or English initials, which limits the access to product information for middle-aged and older patients. On the other hand, the products' operation are complicated for middle-aged and older patients, their weak understanding and poor learning and memory abilities lead to more difficulty of operation, which increases the error rate and makes patients feel frustrated.

2.3. The Product’s Undemanding Packaging Lacks Safety and Hygiene

The commercially available diagnosis and treatment products mostly use canvas packaging or plastic boxes to store the products and related medical equipment. The packaging ignores the safety performance of protecting the products and medicines, such as shock resistance, anti-fall, heat insulation, and shading.

2.4. The Two Types of Products are Independent, Patients Need to Buy Separately

The products are indispensable in the process of diabetic treatment. However, the separate purchase of the two types of products increases the selection difficulty and cost of purchasing, meanwhile reduces the efficiency of patient use.

In summary, there is a lot of space for improvement in Household Diagnosis & Treatment Products for diabetes in China. Norman pointed out that when product conflicts with the user, the person should
blame the design rather than the themselves[6]. Therefore, the improved design of diabetes diagnosis and treatment products is one of the important method to circumvent these problems and improve the treatment effect.

2.5. Demand Analysis of Middle-aged and Older Diabetes Patients
In order to understand the needs of middle-aged and older diabetic patients in depth, firstly, the author investigates and analyzes the physiological and psychological characteristics of middle-aged and older patients. Subsequently, five representative middle-aged and older patients with diabetes were selected from the perspectives of gender, age, age of illness, education level, and income. This study observes using process, then summarizes the user journey map and analyzes the needs of patients using Household Diagnosis & Treatment Products to guide practice by combining the characteristics of the elderly and middle-aged patients.

2.6. Analysis of Physiological Characteristics of Middle-aged and Older Patients
Due to the prolonged duration of diabetes, it can cause damage to multiple organs and tissues such as cardiovascular, cerebrovascular, kidney, eye, and nerves, even may result in causing coronary atherosclerotic heart disease, cerebrovascular disease, retinopathy, diabetes Neuropathy and other complications[7,8]. These complications reduce the quality of life of patients and even endanger life. So, the physiological functions of middle-aged and older patients will decline more rapidly and significantly than healthy peers. By summary, the decline in physiological function of these patients is mainly manifested in the following points:

2.6.1. The perceptual characteristics of middle-aged and older people are mainly manifested in the following characteristics. First, decreased vision and reduced color recognition. Second, the auditory function is reduced, especially the more complex and fast information understanding. Third, the tactile function is reduced and the response time is enhanced.

2.6.2. Memory characteristics of middle-aged and older people. First, long-term memory is clear and transient memory is poor. Second, information processing capacity has declined. Third, the recognizing activities of the middle-aged and old people remain good, the memory activity decreases but it is not very obvious, and the memory speed is significantly slowed down. Fourth, the meaning and memory of middle-aged and older people decreased less, and the decrease of mechanical memory was more.

2.6.3. Intelligence and learning characteristics of middle-aged and older people. First, middle-aged and older people have a large amount of knowledge reserves and social practical experience. Second, the group's reaction to things gradually becomes slow, and its ability to make judgments quickly decreases. Third, the middle-aged and older people have weak ability to learn new knowledge. Fourth, the ability to think and solve problems is significantly reduced.

2.7. Analysis of Psychological Characteristics of Middle-aged and Older Patients
First, the psychological characteristics make people feel "old", but they still pursuit new things and fashion in their hearts. Second, middle-aged and older people are in the middle and late stages of life, and the separation of life and death that they experience in life easily makes them have Negative feeling[9]. And compared with healthy middle-aged and older people, this negative emotion will be more obvious for Diabetic patients of the same age[10].

2.8. Analysis of Psychological Characteristics of Middle-aged and Older Patients
The basic information is shown in Table 1. A user journey map by observing the 5 patients using the diagnosis and treatment products, as shown in Figure 1.
According to the above survey results, the author summarizes the needs of middle-aged and older patients for diabetic Household Diagnosis & Treatment Products as follows: Easy-to-understand and identifiable product ideographic system; Multi-perceptual channel interaction; functions to assist patients' memory; Product's ease of operation; Humanized, fashionable, and quality products; Timely feedback and information visualization; Social needs.

2.9. Improved Design Method of Diabetic Household Diagnosis & Treatment Products

According to the above survey and analysis, the improved design methods for Household Diagnosis & Treatment Products for middle-aged and older diabetes patients can be summarized. The detailed design practices are described below in detail.

2.10. Give Appearance Significance to Diabetes Household Diagnosis & Treatment Products

Diabetes Household Diagnosis & Treatment Products are not only a collection of functions but also an aesthetic symbol. The products (refer with: Fig. 2) will be given two levels of meaning. Emotions change the working mode of our cognitive system, and it is easier for people to overcome the problems they encounter in a happy state [11]. The design gives a sense of visual consistency and conveys the beauty of simplicity but not simplicity. And the two color schemes of the design have different styles, which can be freely selected according to the patient's preference. The whole set of design breaks the traditional cognition of medical products and relieves the patients' feelings of embarrassment and inferiority when they use it.

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**Table 1.** Observed patient basic information.

| Patient | Age | Gender | Age of illness | Education level | Income level |
|---------|-----|--------|----------------|-----------------|-------------|
| A       | 56  | Female | 4 Years        | Primary         | 2200 yuan   |
| B       | 58  | Male   | 6 Years        | High School     | 2800 yuan   |
| C       | 60  | Male   | 10 Years       | University      | 5800 yuan   |
| D       | 64  | Female | 9 Years        | Primary         | 3700 yuan   |
| E       | 71  | Male   | 15 Years       | High school     | 4900 yuan   |

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**Figure 1.** User journey map of convalescent process for diabetic patients (drawn by the author).

**Figure 2.** Design of Household Diagnosis & Treatment Products (drawn by the author).
2.11. Improving the Operational Performance of Diabetes Household Diagnosis & Treatment Products

According to the above analysis of the psychological and physiological characteristics of middle-aged and older patients, in this design example, the focus is on improving product operation and use performance from the following points:

2.11.1. Comfort. The insulin injection pen in the design example has a size of 190*30*26.5 mm, and its size conforms to ergonomics and it is convenient for patients to grasp and operate.

2.11.2. Ease of use. The design should be based on the physiological and psychological characteristics of middle-aged and older patients to enhance the comprehension and operability of the product. First of all, a system product can decline the difficulty of product purchase, improve the use efficiency of the product and reduce its purchase cost. Secondly, a system diagnosis and treatment products can avoid the disorder of the product and make the product orderly in the process of storage and use.

2.11.3. Improve the perception of the information feedback by the product. The design displays the blood glucose test result through the mobile phone screen; And the injection pen changes the way of taking medicine by pressing to the medicine window display that combines medicine with magnification, and uses tactile and visual multi-channel information to give patients feedback.

2.11.4. Prevent users from making mistakes in using. The injection pen adds a safety interlock button, which effectively prevents patients from feeling frustrated when using it.

2.12. Create an Ecosystem of Diabetes Household Diagnosis Products

Utilize the advantages of the Internet to build an ecosystem of Household Diagnosis & Treatment Products for diabetes and assist patients in rehabilitation. In the design example, the display of the traditional blood glucose monitor is transferred to the mobile phone, and the blood glucose change can be vividly recorded and displayed through the matching APP. Based on this, APP can provide personalized recuperation programs and create a social circle for diabetic patients to establish patient connections. Then the patients can get more encouragement and attention. This will help alleviate the negative emotions of patients and improving the effectiveness of diagnosis and treatment.

3. Conclusion

Diabetes Household Diagnosis & Treatment Products are an integral part of patients’ daily lives. Middle-aged and older people are the main patients with diabetes, and their real use and emotional needs cannot be ignored. The improvement of diabetic Household Diagnosis & Treatment Products should fully consider the physiological and psychological characteristics of patients. The design is used to give the product a beautiful appearance, improve product operation performance, give patients a sense of security, improve the use experience, and finally improve the diagnosis and treatment effect.

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