

Design of Telemedicine Service System for the Elderly from the Perspective of Active Aging

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Abstract: The rapid development of population aging has brought many problems to human society, and the health of the elderly has become a focus of social concern. As an important tool to support the health of the elderly, telemedicine service systems are significance to the realization of active aging. This study aims to explore a telemedicine service system for the elderly that adapts to the needs of active aging, to solve the obstacles that the elderly encounter when accessing medical services, and to provide more convenient, efficient and personalized medical services for the elderly. A mixed research method was used, including a literature review, questionnaires and qualitative interviews. First, a literature review is conducted to understand the concept of active aging and the current status of telemedicine services. Secondly, the opinions, expectations and needs of the elderly and their families on telemedicine services were collected through qualitative interviews and questionnaires. Thirdly, based on the collected information, integrate user behavior data, build a user experience journey map and user role model, and propose design opportunities. Finally, taking into account the physiological, psychological and social needs of the elderly, a telemedicine service system for the elderly was designed, and user testing and feedback were conducted to verify the feasibility and effectiveness of the system. The study found that the elderly have a high acceptance of telemedicine services and can meet their basic medical needs, but they also have concerns about technology use, privacy protection and service quality.

Keywords: Active Aging; Telemedicine; Elderly; Service System; Health Management.

1. Introduction

As the aging of the global population accelerates, the proportion of the elderly population continues to increase, which brings unprecedented challenges to the social economy, health care system, and family structure. According to the United Nations, by 2050, the global elderly population aged 60 and above will reach 2.1 billion, accounting for 22% of the total population [1]. Due to the gradual deterioration of physiological functions, the elderly have stronger demand for medical and health services. The traditional face-to-face consultation medical service model is not friendly to the elderly who live in remote areas or have limited mobility. The existing telemedicine system does not take into account the preferences and characteristics of the elderly [2].

Active aging emphasizes that the elderly continue to participate in social, economic and cultural activities, fully realize their potential, and achieve the goals of health, safety and social participation [3]. Telemedicine uses modern information technology to provide convenient medical services to the elderly remotely. Telemedicine has shown great potential in improving the quality of medical services, reducing medical costs, reducing travel barriers, and expanding medical service coverage. It has become an alternative to face-to-face medical visits, effectively reducing absentee visits [4]. This study aims to design a telemedicine service system for the elderly based on their preferences and characteristics to promote active aging and improve their quality of life and health. Research questions include:

1. What are the user pain points and needs of the elderly for telemedicine service systems?

2. How to design a comprehensive and easy-to-use telemedicine service system for the elderly?

3. How to evaluate the effectiveness of telemedicine systems for the elderly?

2. Literature Review

Active aging not only focuses on the physical health of the elderly, but also includes aspects such as mental health, social participation and economic security. The World Health Organization (WHO) defines active aging as optimizing opportunities for health, participation and safety, ensuring that all people continue to improve their quality of life as they age [5]. Many countries have taken a series of measures to promote active aging for the elderly, such as improving the living environment of the elderly, providing lifelong learning opportunities, and encouraging the elderly to participate in social activities [6].

The telemedicine service system can provide a variety of services such as online consultation, remote diagnosis, disease assessment, health management, and drug delivery, which greatly facilitates patients' medical treatment. As a special user group, the elderly have unique and diverse needs for telemedicine service systems. On the one hand, due to their different health status, educational background, economic status, family structure, living environment, life experience and other factors, their demand for medical services is different. On the other hand, due to the decline in physical functions, memory and cognition of the elderly, they may suffer from a variety of chronic diseases. Compared with young people, they pay more attention to the practicality, functionality and accuracy of the medical system [7]. In

addition, the elderly may face obstacles such as operational difficulties and concerns about privacy and security when using telemedicine service systems [8]. Therefore, when designing telemedicine service systems, these needs and barriers of the elderly need to be fully considered to improve the usability and acceptance of the system. Existing research has proposed a variety of design principles and evaluation methods for telemedicine service systems. Design principles usually include user-centered design, ease of use, accessibility, confidentiality, security, etc. [9]. Evaluation methods mainly include user usability testing and user experience evaluation. The existing system still has deficiencies in design, such as complex operating interfaces, lack of telemedicine operation training for the elderly, lack of attention to health education and psychological support functions for the elderly, and insufficient security and privacy protection measures to satisfy the needs of the elderly. etc.

3. Research Design

This study adopts the service design concept, focuses on improving user satisfaction and user experience, and designs and evaluates telemedicine service systems through an iterative approach [10]. A mixed qualitative and quantitative research method was used to collect the opinions and preferences of the elderly through questionnaires and in-depth interviews, as well as their needs for system functions, operating interfaces, information content, etc., as well as the problems and challenges encountered during the operation process. Quantitative analysis is mainly used to evaluate the basic situation, influencing factors and the feasibility and effectiveness of system design for the elderly to use telemedicine. Qualitative analysis is used to deeply explore the user needs and design opportunities of the elderly.

This study surveyed a total of 65 users, and 46.15% had not heard about it but were willing to try it. 41% of users who have learned about telemedicine have used telemedicine. During the survey on the telemedicine service needs of the

elderly, it was found that the service demand for registration, finding a doctor, online consultation, and health encyclopedia exceeded 50%. In terms of the response speed of online consultation services, 30.77% of users believed that they would receive an immediate reply, 46.15% of users believed that they would receive a response within 5-10 minutes, and 23.08% of users received a reply within half an hour. Most users believe that the advantages of online consultation services include saving time and transportation costs, being convenient and fast, and providing diversified medical resources. However, there are also problems such as the inability to conduct physical examinations, delayed responses from doctors, and information security issues. 61.54% of users are relatively satisfied with the professional level of online doctors, and 15.38% of users are very satisfied. In terms of preferences and needs for the interface design of telemedicine APPs, easy-to-operate layout, clear interface, voice interaction function, large fonts and easy adjustment are the functional preferences expected by the elderly. Health monitoring and guidance, medication reminders, exercise guidance, personal health data recording and analysis are important needs for telemedicine services.

In order to better understand user needs, in-depth interviews were conducted with typical elderly telemedicine users, to gain an in-depth understanding of the multi-dimensional characteristics of the target group, and to construct a user role model and user experience map. When describing user roles, we mainly focus on basic information, behavioral models, psychological motivations, usage scenarios, user pain points, etc. The user role model helps designers understand the diverse needs of users more deeply and provides design guidance for telemedicine interface designers for the elderly [11], as shown in Figure 1. Dismantle the main stages and key behaviors of users using telemedicine services, analyze user touch points, emotional curves, user needs, and design opportunities, and construct a user experience journey map of telemedicine for the elderly, as shown in Figure 2.

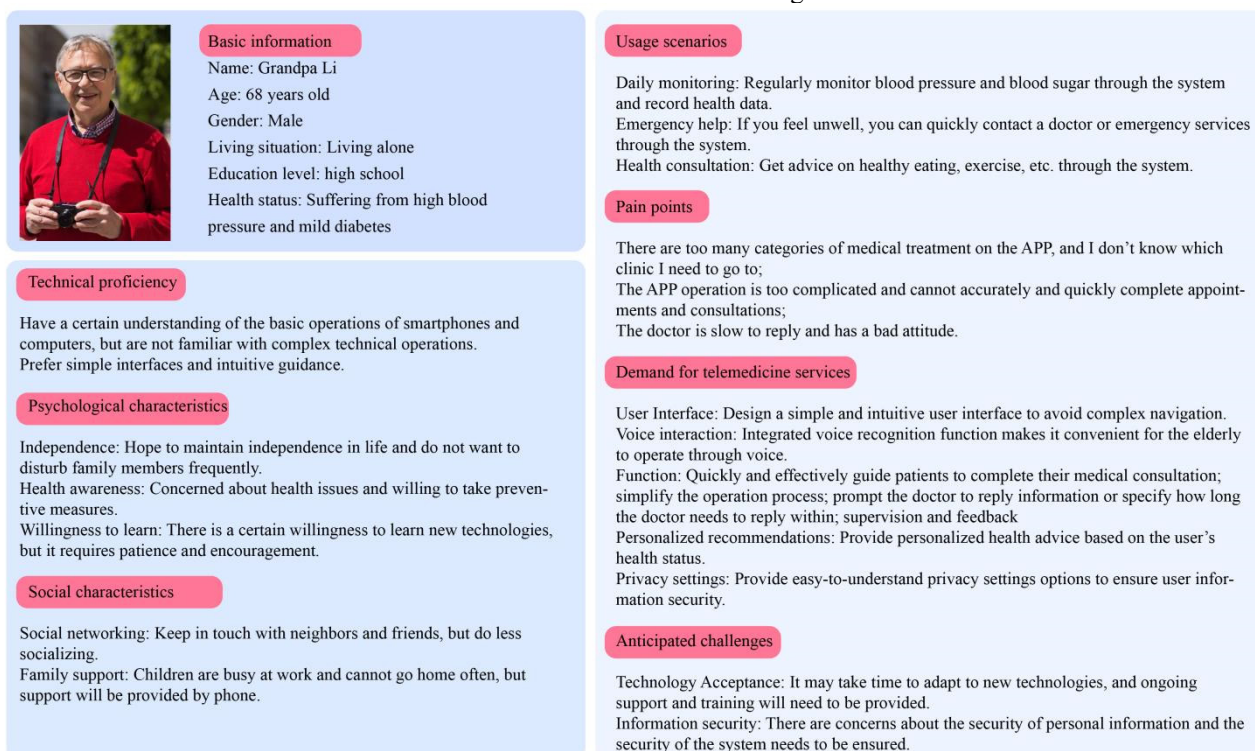


Fig 1. The elderly telemedicine persona for the elderly

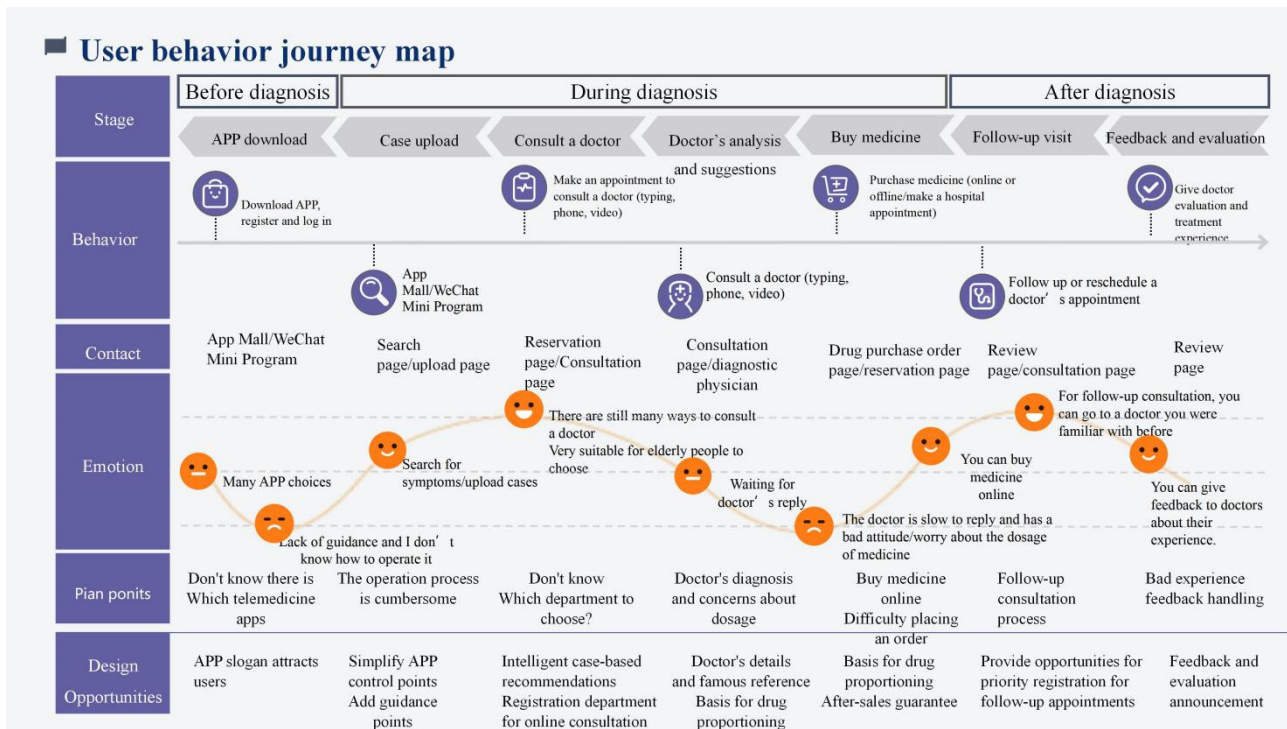


Fig 2. User experience journey map

4. Design of Telemedicine System for the Elderly

4.1. System Architecture Design

Design the information architecture for usability from three aspects: user environment, process and operation, and modularize and cluster functions [12]. Adopting a modular design method, the main modules of the system include user management, online consultation, appointment registration, health management, emergency help, and data analysis. The user management module is responsible for the user's basic personal information and registration and login. The online consultation module provides consultation and communication services with doctors, allowing users to

communicate with doctors through text, voice or video to obtain health advice and disease management guidance. The appointment registration module allows users to make an appointment for a doctor's remote diagnosis and treatment service. The health management module helps users monitor their health status and formulate personalized health plans by collecting data on users' living habits, diet, and physiological indicators. The emergency help module provides users with rapid response services in emergency situations and quickly contacts doctors to obtain emergency rescue services. The data analysis module is responsible for collecting and analyzing users' health data to provide doctors with reference basis and decision-making support. The information architecture design is shown in Figure 3.

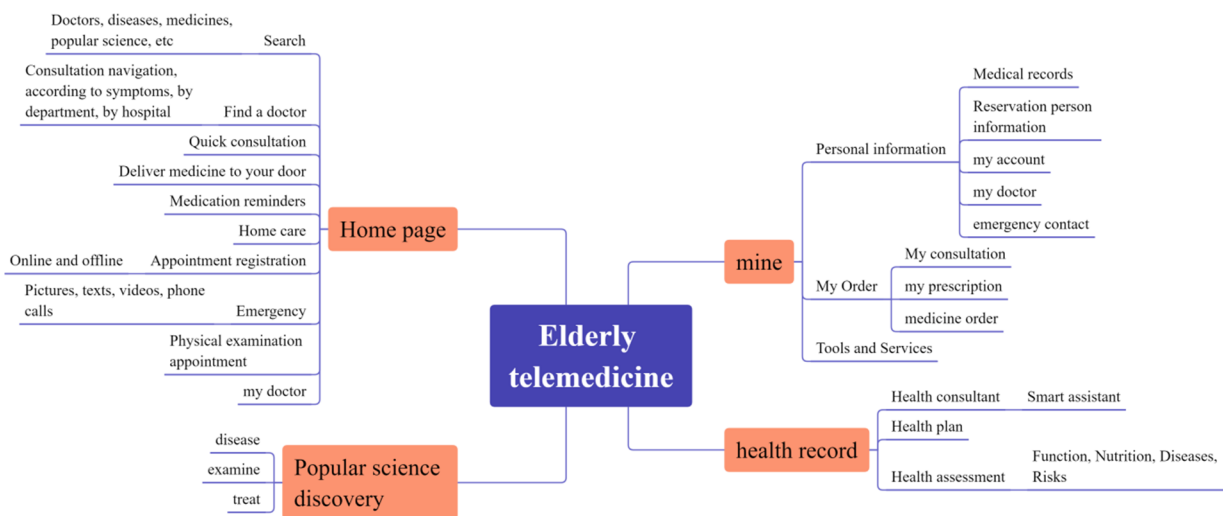


Fig 3. Telemicine information architecture design for the elderly

4.2. User Interface Design

User interface design affects the user's visual sense and experience. A simple and clear layout and intuitive operation

process are adopted to reduce the difficulty for the elderly to use the system, so that users can easily find the functions they need. At the same time, information should be easy to read and understand, and font size, color contrast, and icon design

should all take into account the vision and cognitive characteristics of older adults. Finally, the system should provide an intelligent voice assistant to facilitate voice input

and output, making it convenient for elderly people with poor vision or difficulty in operation. The user interface design is shown in Figure 4.

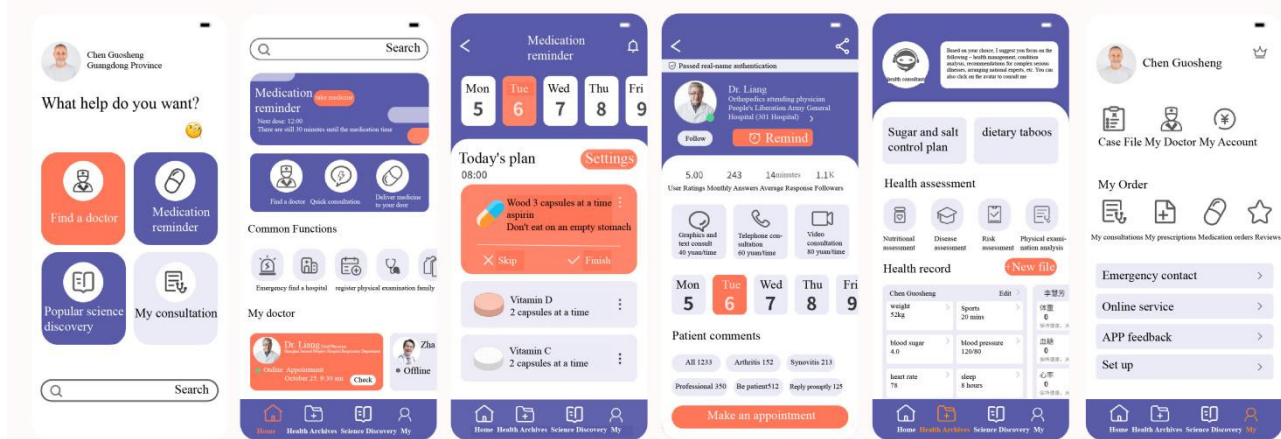


Fig 4. Visual design of telemedicine interface for the elderly

4.3. Usability Testing

User testing mainly uses one-on-one user testing and group discussion methods to understand the specific problems and needs they encounter when using the system, as well as the user's overall satisfaction with the system and improvement suggestions, and record the user's interactive behavior, operating errors and feedback to evaluate system usability and user satisfaction. After the user test is completed, users need to fill in the system usability scale (SUS). The SUS scale is mainly divided into 10 questions. The odd-numbered items are 5 positive questions and the even-numbered items are 5 negative questions, reflecting the user's subjective satisfaction [13]. Test results show that most users believe that the system's interface is simple and clear, and the operation process is intuitive and smooth, which can meet their medical consultation and health management needs. However, some users also put forward some suggestions for improvement, such as adding more health education content, optimizing voice input functions, improving the system's response speed, providing more comprehensive disease management guidance, strengthening system security and privacy protection measures, etc.

5. Conclusion

This study successfully designed and evaluated a telemedicine service system suitable for the elderly, providing a new perspective and method for the design of telemedicine service systems from the perspective of active aging. The system was designed with the specific needs and preferences of older adults in mind and received positive feedback during user testing. Research shows that telemedicine service systems can provide convenient medical services for the elderly and meet their health service needs. The survey found that nearly half of the elderly have not used telemedicine services. Therefore, it is necessary to strengthen the publicity, promotion and training of telemedicine to improve the accessibility and efficiency of medical services and promote active aging of the elderly. The study also has some limitations, such as a small sample size. Due to time and resource constraints, the system has not yet been tested and evaluated by long-term users, so it is impossible to understand the actual application performance and effect of the system. Future research can innovate medical service models, carry

out interdisciplinary cooperation with healthcare practitioners, technology developers, policymakers and elderly user groups, and combine artificial intelligence technology to provide more intelligent and accurate telemedicine services. At the same time, we need to pay attention to the mental health and social participation of the elderly, explore the economic feasibility and policy support of telemedicine service systems, explore how to reduce costs and improve efficiency, and obtain broad support from the government and society.

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