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RESEARCH ARTICLE

Design of an Intelligent Rehabilitation Medical System for Elderly Care Apartments

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Abstract

This paper aims to design a rehabilitation medical product system tailored to the needs of future intelligent elderly care environments, with the goal of enhancing the efficiency of rehabilitation training for older adults. Through an in-depth analysis of the anticipated medical needs in elderly care apartments, we propose a comprehensive design concept for a rehabilitation medical product system. The design is approached from three key perspectives: products, services, and systems, ensuring that it aligns with the healthcare requirements specific to elderly care settings. The proposed solutions focus on optimizing rehabilitation training by integrating intelligent technologies and user-centered design principles. This study presents practical and feasible strategies that address the unique rehabilitation challenges faced by the elderly, providing a foundation for improving the quality of care and support in intelligent elderly care apartments.

Keywords: Smart pension, Intelligent rehabilitation equipment, Rehabilitation robot, Elderly apartment emergency system, Rehabilitation medical product system design.

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1 Introduction

Smart pension is a sensor network system and information platform for the elderly at home, communities and pension institutions. On this basis, it provides real-time, fast, efficient, low-cost, iot, interconnection and intelligent pension services [1]. According to relevant forecasts, during the 14th Five-Year Plan period, the elderly population in China will exceed 300 million and enter a moderate aging population. At the same time, more and more elderly people, due to chronic diseases or accidental injuries and other reasons, daily life and activity decreased or obstacles, all need rehabilitation training. At present, China has put forward the concept of "intelligent endowment" [2] , based on this concept, can significantly improve the timeliness and efficiency of the services of the apartment for the elderly, scientific management and facilitate the rehabilitation of the elderly. From the perspective of product design of intelligent rehabilitation equipment in senior apartments, this paper proposes a rehabilitation medical product system design based on intelligent endowment.

2 Analysis of Medical Needs of Future Apartments for the Elderly

Degraded gradually, because of their physical function in the elderly are more likely to lead to chronic diseases or accidents injured condition, therefore in the elderly group of older apartment more need to considerate medical care [3], this article will be the future elderly medical demand of the apartment

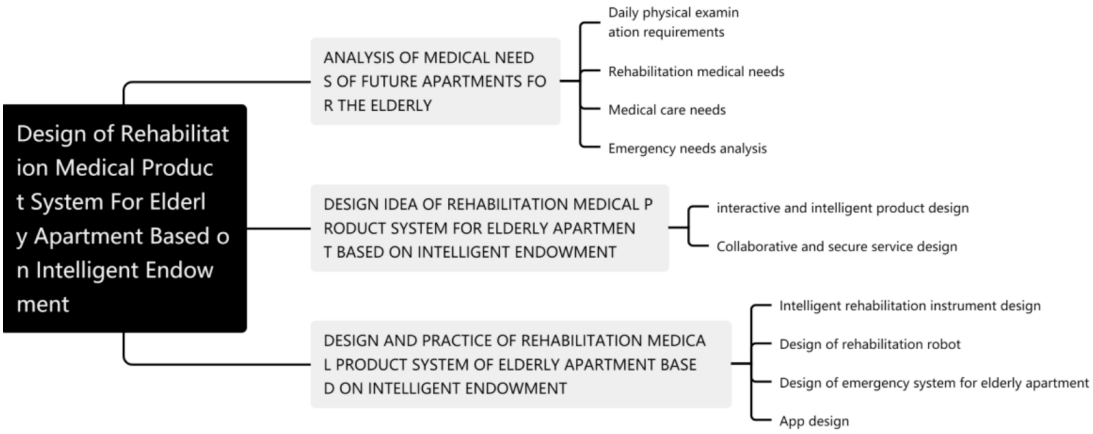

Figure 1. Key points of the thesis mind mapping.

is divided into: the routine physical examination and rehabilitation physical examination, medical care, emergency demand these four pieces of analysis.

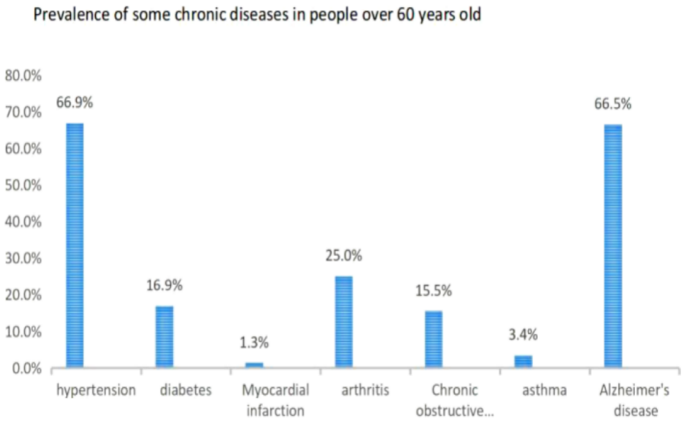

Figure 2. Prevalence of some chronic diseases in people over 60 years old.

2.1 Daily physical examination requirements

Due to the gradual decline of their physical fitness, the elderly need to have a physical examination every 3-4 months, some of which must be carried out in strict accordance with hospital standards, but some of which, such as blood pressure or blood sugar measurement, only need daily home monitoring [3]. These routine tests can help older people ensure their physical health and give them mental and psychological stability. Therefore, the future apartment for the elderly should meet some physical examination needs for common geriatric diseases [4]. According to the physical examination plan for the elderly, simple regular physical examination should be carried out for the elderly in the apartment on schedule [5]. At the same time, the physical examination data should be recorded and linked to the hospital database to provide longer and more continuous physical data for doctors to diagnose the physical condition of the elderly.

2.2 Rehabilitation medical needs

The elderly due to the influence of more and more diseases, such as stroke, paraplegia, orthopedic trauma after surgery, hypertension, coronary heart disease caused by dysfunction; Osteoarthropathy such as lumbar disc herniation, cervical spondylosis; As well as the decline of ADL or IADL daily life function, all need the help of rehabilitation medical treatment [5], among which the most important exercise therapy is to exercise the limbs through rehabilitation medical equipment to achieve the purpose of gradual recovery of the whole body or local motor function and sensory function.

Figure 3. Rehabilitation equipment for the treatment of elderly legs.

2.3 Medical care needs

In the future, more and more elderly people will enter the elderly apartment for retirement, including the elderly with and without self-care ability, they need to get different degrees of care. On the one hand, the relevant personnel of the apartment for the elderly need to remind the elderly to take medicine in time and have regular physical examination; On the other hand, it is also necessary to provide personal daily care for the elderly who have no ability to take care of themselves [5], so as to avoid the disease caused by long-term bed rest [6]. These important but very subtle nursing tasks need to be paid attention to, and these details should be reflected in the whole rehabilitation medical product design system of the apartment for the elderly.

Figure 4. Internal facilities of apartment for the elderly.

2.4 Emergency needs analysis

When the elderly have an emergency, sudden and severe headache and angina pectoris put them in a difficult position. They need to be found in time and rescued in the first time. Relevant personnel first of all to the old man's condition for a brief judgment, whether conscious, whether it may be fracture; First aid was then administered to the elderly after medical assistance was requested. In the critical moment, emergency medical products play a vital role, is an indispensable part of the product system design.

3 Design Idea of Rehabilitation Medical Product System for Elderly Apartment Based on Intelligent Endowment

The design of rehabilitation product system for the elderly apartment is a complete integration of product design [7], service design and system design. In this paper, based on the medical needs of the elderly

Figure 5. First aid facility for the elderly.

apartment, the rehabilitation medical product system of the elderly apartment has been improved in terms of products and services to a certain extent.

3.1 Interactive and intelligent product design

We are in urgent need of rehabilitation facilities suitable for our future smart apartment for the elderly, especially with a high degree of interaction and intelligence [8]. In the process of rehabilitation training for the elderly, rehabilitation equipment is needed for deeper interaction, to assist their rehabilitation exercise to make it more standardized, and record their rehabilitation range and gradually increase. At the same time, due to the current shortage of professional doctors for rehabilitation, the rehabilitation facilities in the apartments for the elderly should be intelligent enough to coordinate with the rehabilitation exercise of the elderly, provide them with rehabilitation suggestions and standardize their movement posture, so as to reduce the burden of professional doctors while ensuring their professionalism. Based on the concept of modern structure, through the study of the psychological and physiological needs of the elderly [8], guided by industrial design and ergonomics, humanized intelligent rehabilitation medical devices and good human-computer interaction are designed to provide better rehabilitation treatment experience [9].

3.2 Collaborative and secure service design

The rehabilitation training for the elderly designed in this design needs to be accompanied by professional rehabilitation physicians. However, due to the current scarcity of rehabilitation physicians, the efficiency of rehabilitation training [10] for the elderly is relatively low, and the rehabilitation training time is shorter than it should be. In the future, the service design based on intelligent rehabilitation medical products

needs to do its best to assist the exercise of the elderly's body activities. With its improvement trend of more functions and intelligence, it can replace the role of rehabilitation doctors to some extent and cooperate with the elderly to carry out autonomous limb rehabilitation.

Figure 6. Nursing equipment for elderly apartment.

Because of its particularity, the apartment for the aged must pay more attention to its emergency service. In addition, there is still a shortage of pre-hospital emergency workers in large and medium-sized cities in China, and the time for emergency treatment is uncertain. Therefore, the emergency services of the apartment for the elderly should put safety in the first place, ensure that the vital signs of the elderly can be confirmed in the first time, there is enough reserve of first-aid experience to maintain their life, and there is a reasonable way to transport the elderly to the hospital for diagnosis.

4 Design and Practice of of Rehabilitation Medical Product System of Elderly Apartment Based on Intelligent Endowment

The medical product system designed in this study is placed at the smart old-age apartment. It starts from meeting the rehabilitation needs of the elderly, integrates the future trend of wisdom and care, and develops according to the product, service and system design ideas extracted above. The final product system [15–17] design mainly consists of intelligent rehabilitation facilities, rehabilitation robot, apartment emergency system and data summary and analysis APP [11].

4.1 Intelligent rehabilitation instrument design

The intelligent rehabilitation equipment is based on the modern medical system, through reasonable and scientific rehabilitation medical methods, as well as the guidance of industrial design, ergonomics, common diseases of the elderly for systematic medical treatment. At the same time, aiming at the problem that the current rehabilitation equipment has no warm experience, through humanized design and intelligent transformation of the rehabilitation equipment, the rehabilitation equipment placed in the elderly rehabilitation center will bring better rehabilitation experience to the elderly. The intelligent rehabilitation instrument system is designed through a small database network community, which is connected with the hospital database to provide basis for rehabilitation plan and samples for rehabilitation medical research.

Figure 7. Intelligent geriatric rehabilitation medical products.

At the same time, aiming at the separation of medical rehabilitation area and hospital, the organic combination of real-time monitoring system [12] and intelligent rehabilitation nursing system is realized to provide efficient and timely medical care, making the rehabilitation medical procedures of the elderly more convenient and humanized, so as to reduce the burden of relatives and medical staff.

4.2 Design of rehabilitation robot

Based on the future smart city medical system and future medical development trend [7–10], this rehabilitation medical product system design also includes a medical robot, which can record the data of autonomous rehabilitation training for the elderly in the rehabilitation area of the apartment for the elderly and provide corresponding guidance [12]. Starting from the design concept of big data and intelligence, the robot database is connected with the

hospital database to provide necessary data records for the hospital doctors, so that the doctors can timely understand the physical condition of the elderly and provide accurate medical plans [12].

Figure 8. Database connectivity.

The medical robot also has a common medical medicine box, can provide simple medical advice, and in emergency situations to provide a certain auxiliary role and emergency registration services. That is, through the principle of photoelectric volume pulse wave, the user's body scan inspection, for the subsequent arrival of the apartment nurse to play an auxiliary first-aid role.

4.3 Design of emergency system for elderly apartment

Inside the smart apartment for the elderly, medical emergency system is adopted. Dynamic capture and sound capture sensors are equipped in the private space and public area of the elderly to monitor the safety of the elderly at any time. In case of emergency, the medical robot will rush to the specific room in the first time, preliminarily judge the specific situation of the elderly, and assist the apartment staff to take the next first-aid measures. In case of emergency medical care, the medical robot will contact the emergency center and send relevant information.

By setting up an intelligent medical first aid system in the apartment for the elderly, it can shorten the time for the robot and the first aid personnel to arrive at the scene when an emergency occurs, and the intelligent robot designed in this paper can provide a certain auxiliary first aid function.

4.4 App design

In the products system design, the APP is also an integral part of, it can be the old man, old relatives, old apartment, and hospital closely connected, medical robots recording the accurate data of old man use of rehabilitation equipment, and sending them to the hospital in the database [13], in the heart of the APP intuitive to present these data. Doctors can provide professional medical advice in the APP based on the long-term physical data of the elderly for reference by the apartment for the elderly and their relatives. The apartment for the elderly can also make specific rehabilitation plans and medical care plans according to the medical advice. Meanwhile, the relatives of the elderly can also learn the real-time situation of the elderly through the APP.

5 Conclusion

As a group that should be paid great attention to, the elderly group especially shows the special demand for rehabilitation medical treatment. By combing the design, integrating a group enterprises, designers, medical, health care data processing center, the elderly, the elderly apartment in the design of rehabilitation medical products system design, with the seniors who need rehabilitation training has brought the actual plan, wisdom for the future pension of the implementation of the general direction provides a feasible path. In the era of "smart elderly care", we should pay more attention to the people-oriented product service system, and provide a practical and operable rehabilitation medical product system for the future apartment for the elderly through the mining of the demand for the future apartment for the elderly, as well as interdisciplinary and cross-industry cooperation.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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