The Application Progress of Mobile Healthcare in Drug Management for Elderly Patients with Comorbidities

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Abstract: *This article reviews the application forms, effects, existing problems and suggestions of various mobile medical services at home and abroad in the drug management of elderly patients with comorbidities, with the aim of providing a theoretical basis and practical reference for the better implementation of mobile medical services in the drug management of elderly patients with comorbidities.*

Keywords: Geriatric comorbidity, Chronic disease, Drug management, Mobile healthcare, Overview.

1. Introduction

The results of the seventh national census show that the elderly population in China accounts for 18.70% of the total population [1]. With the acceleration of the aging process in our country, the phenomenon of comorbidity among elderly patients is becoming increasingly common. In 2008, the World Health Organization (WHO) officially defined chronic disease comorbidity as an individual having two or more chronic diseases simultaneously, abbreviated as "comorbidity" [2]. Reports show that the prevalence rate of comorbidities among the elderly in our country is as high as 90% [3]. Geriatric comorbidities increase the risk of falls [4], adverse outcomes of admitted patients [5], etc., posing a severe challenge to the health and quality of life of the elderly. Elderly patients with comorbidities often need to manage multiple chronic diseases simultaneously. Drug management, as a key link among them, its complexity and importance cannot be ignored. The phenomenon of polypharmacy is widespread. There are numerous types of drugs and complex administration methods, resulting in poor patient compliance [6]. And it increases the adverse reactions of the drug and aggravates the psychological burden of the patients. Mobile healthcare is a means of providing medical information services by using mobile communication technology [7], which can offer various medical services such as remote diagnosis and treatment and health management. Providing scientific and reasonable drug management for elderly patients with comorbidities is an important measure to ensure their health and safety. Through in-depth research on drug management in elderly patients with comorbidities, the drug management level of elderly patients with comorbidities can be improved, the therapeutic effect can be optimized, drug-related risks can be reduced, and more accurate drug management suggestions can be provided for elderly patients with comorbidities. This study reviews the application of mobile healthcare in the management of elderly comorbidities at home and abroad, aiming to provide a reference for the application of mobile healthcare in the management of elderly comorbidities in China.

2. An Overview of Mobile Healthcare

The World Health Organization defines mobile healthcare as medical and public health practices conducted using wireless communication technologies and mobile devices (such as smart phones, tablet computers, patient monitoring devices, and other wireless smart devices, etc.) [8]. It serves as a carrier for telemedicine, health services, health monitoring, and follow-up. Its core objective is to enhance service efficiency, control medical costs, improve the medical experience and reduce the rate of unplanned readmission, making medical services more convenient, efficient and humanized. It has been widely used in various continuous care services for chronic diseases [9]. Mobile healthcare is mainly based on three carriers: text messages, applications and wearable devices [11]. At present, mobile healthcare in China is showing new development trends and directions such as diversification, personalization, and remote operation. Scholars Yu Xinyan [12] and others have utilized single-lead wearable devices to conduct early identification and screening of cardiovascular diseases in the elderly, providing patients with a good medical experience and offering broad room for improvement in the medical industry. In terms of mobile healthcare abroad, the United States, represented by North America, has a far leading technological research and development capability in mobile healthcare. Mobile medical applications in Europe account for 20% of the global total, followed by African and Latin American countries, and finally the Asia-Pacific region [13]. Through mobile medical remote services, patients' confidence in disease management can be enhanced, and their medical expenses and medical service systems can be reduced.

3. The Main Application Forms of Mobile Healthcare in the Drug Management of Elderly Patients with Comorbidities

3.1 Medical Applications

A medical Application (Application, App) refers to a third-party App that provides medical services and information through terminal products such as smart phones and tablet computers [8]. It is one of the main forms of mobile healthcare at present. In the issue of drug management for elderly patients with multiple coexisting diseases, mobile medical programs have played a certain role. A domestic software called "Medication Assistant" that helps patients manage their medication can record the time of taking medicine, remind patients to take it on time, and help patients develop good medication habits. It can also be connected to the doctor's port for consultation at the same time, and is equipped with functions such as health logs. It is widely used in the management of chronic disease drugs. The RWE mobile application abroad [14] is helpful for prevention and diagnosis. For clinicians, the mobile health application RWE can provide a more comprehensive understanding of patients' conditions and allow for timely intervention. Heart360 [15] is a mobile medical application developed by the American Heart Association (AHA), aiming to help heart disease patients manage their health conditions. This application offers personalized medication guidance functions. Based on the patient's medication history and the doctor's advice, it formulates a detailed medication plan for the patient and ensures that the patient takes the medicine on time through an intelligent reminder function. In addition, Heart360 can monitor the patient's physiological indicators such as heart rate and blood pressure in real time, promptly detect abnormal conditions and remind the patient to seek medical attention. Mobile medical applications provide effective drug management means for elderly patients through terminals such as smart phones and tablet computers, improve medication compliance, reduce the number of unplanned hospitalizations and emergency visits, improve health-related quality of life (HRQOL), and also enhance the efficiency and convenience of medical services. However, at present, there are relatively few apps for drug management in China, and their functions are incomplete. Meanwhile, the quality of these apps varies greatly, which is a common problem both at home and abroad. In the future, medical staff need to pay more attention to the drug management technology for elderly patients with multiple coexisting diseases. Combining their own experience, they should further design and develop mobile applications for patient drug management in collaboration with the information technology team.

3.2 Social Media Platforms

The deep integration of intelligent information technology and health management for elderly patients with multiple diseases is one of the important ways to promote rational drug use management and risk prevention and control [16]. With the help of the digital information platform of community hospitals, an intelligent management system for drug knowledge bases can be developed and established. The intelligent information platform can be used to intercept drug use errors in advance, provide prompts during drug use, and conduct evaluations after drug use. Monitor adverse drug reactions and feedback precautions, formulate personalized rational drug use plans, and at the same time require general practitioners to master the principles of rational drug use

proficiently, optimize treatment plans, and select reasonable and effective drugs. Wechat is the most commonly used social platform in China. Due to its convenient operation, simple page and easy communication, it is widely applied in the management of chronic diseases among the elderly. Pan Wen et al. [17] used the wechat platform to provide continuous guidance to epilepsy patients. They pushed medication knowledge every day and a series of self-made videos every week, informing patients of daily life precautions, such as the handling of missed doses of medication. After three months of intervention, it was found that the recurrence rate of epilepsy in patients was reduced and the compliance of patients with medication was improved. A two-arm randomized pilot study abroad [18] showed that the Med Sentry drug monitoring system could effectively provide medication guidance for patients with chronic heart failure. Compared with the control group, the risk of all-cause hospitalization and the number of all-cause hospitalizations in the intervention group were significantly reduced. Med Sentry is mainly used for patients with complex medication regimens and can also serve as a supplement to existing remote monitoring and intervention measures for hypertension. Telemedicine medication compliance technology has to some extent improved patients' self-management ability, enhanced their quality of life, reduced the overall medical utilization rate, and decreased the healthcare usage and expenditure of other chronic disease patients who require complex medication regimens. Drug management based on mobile medical technology in China is still in the exploratory development stage. The application forms are mostly mobile phone apps and online platforms, but mature drug management systems and platforms are rare. Therefore, it is one of the future research directions for medical staff to carry out drug monitoring for elderly patients with comorbidities and improve patients' medication compliance.

3.3 Others

Wearable devices have also played a significant role in the prevention, control and intervention of diseases. For instance, LLOERT proposed an intelligent continuous digital health monitoring architecture based on 5G communication technology, which collects information such as heart rate, blood oxygen saturation, blood pressure, respiratory rate, physical activity, location and temperature through wearable devices and smart phones. The system will send abnormal data to the doctor for verification and send alerts to the patient [19]. Wearable devices can remind elderly patients with multiple coexisting diseases to take their medications on time to improve medication compliance, reduce medication errors, and enhance the self-management ability of elderly patients with multiple coexisting diseases. However, wearable devices also have their drawbacks. For instance, to ensure clear signals, certain household devices, such as microwave ovens, may increase the risk of interference and cross-signals. In conclusion, telemedicine with wearable devices requires on-site technical support. Currently, wearable devices for drug management in China are still in the exploration stage. Developing and improving wearable device technology remains the direction that medical staff should continue to strive for.

4. The Application Effect of Mobile Healthcare in the Coexistence of Multiple Diseases in the Elderly

4.1 Improve Patients' Medication Compliance

Most patients with chronic diseases need to take medication for a long time or even for life. Their medication compliance is generally low, and they often miss doses or delay taking them, which leads to recurrence of the disease and even complications. Mobile healthcare provides an effective way to solve this problem. For example, the My Health Record application in Australia [20] is an electronic health record system launched by the Australian government, aiming to provide comprehensive health management services for patients. This system allows patients to access their health records through mobile phones or computers, including medication history, examination results, doctor's advice, etc. Through the My Health Record system, elderly patients can conveniently view their medication guidance information and conduct remote consultation and communication with doctors. In addition, this system can also monitor the physiological indicators of patients in real time, promptly detect abnormal conditions and remind patients to seek medical treatment. It can be seen from this that mobile healthcare can help patients understand their physical conditions, remember to take medicine on time, and thus help chronic disease patients with poor medication compliance improve their medication situation.

4.2 Improve the Cognitive Level of Patients

Patients with chronic diseases often lack knowledge about drug names, medication times, adverse reactions and management methods, especially the elderly. Due to cultural limitations and deteriorating vision, they are unable to read drug instructions and lack professional guidance on medication. This leads to potential safety hazards such as self-medicating based on experience, purchasing "three-no" drugs and health supplements, incorrect medication methods and taking expired drugs. In a randomized controlled study in China, 113 patients in the intervention group, on the basis of receiving routine health education, underwent eight units of learning through an APP called "mAFA" to enhance their self-management ability of drugs. After 3 months of intervention, compared with the conventional nursing group, the mastery of medication knowledge in the APP intervention group was significantly improved, and the difference was statistically significant [21]. It can be seen from this that by using mobile medical technology, various forms such as text, pictures, audio and video can be integrated to conduct health education for patients and provide them with nursing consultation. Medical staff play the roles of educators, collaborators, guides and coordinators in this process, which can effectively promote patients' mastery of medication knowledge and thus ensure the safety of patients' medication.

4.3 Improve the Working Efficiency and Quality of Medical Staff

Compared with traditional medical care, mobile healthcare overcomes the limitations of time, space and resources. It is cheap, easy to operate and has a wide audience. It can also provide targeted medication guidance based on the patient's own medication situation, offering more convenient medical services to patients. Pill Pal [22] is a mobile medical application specially designed for elderly patients, mainly used to help them manage drugs. This application helps patients take medicine on time through its intelligent reminder function and records the time and dosage of each medication. Meanwhile, Pill Pal can also synchronize the medication data of patients to the cloud, facilitating family members or doctors to view and understand the medication situation of patients at any time. In addition, this application also provides drug and interaction query functions to help patients avoid adverse reactions between drugs. It can be seen from this that mobile healthcare has overcome geographical barriers and provided more convenient medication reminder and guidance services for patients with chronic diseases. Medical staff use mobile healthcare technology to remind and guide patients on medication, remotely monitor medication compliance, and answer questions online. This not only ensures the safety of patients' medication but also optimizes medical cost resources and solves the problem of uneven resource distribution in China. Meanwhile, effectively using the APP for health education can not only improve nurses' own mastery of safe medication knowledge, but also save the time occupied by medical staff for repeated education, and effectively avoid the situation of inadequate education caused by the knowledge limitations of medical staff themselves or their busy clinical work.

5. The Current Situation and Challenges of Drug Management for Elderly Patients with Comorbidity.

Drug management for elderly patients with comorbidities faces multiple challenges. A study abroad shows [23] that on average, each elderly patient suffers from 4.7 chronic diseases. For each additional disease, the individual's quality of life is impaired by 2.6 points. Among them, the most common ones are hypertension, anxiety, indigestion and diabetes. Patients with multiple coexisting diseases need to take multiple medications simultaneously, which increases the risk of drug interactions and leads to frequent adverse reactions. In addition, the liver and kidney functions of the elderly gradually decline, and their ability to metabolize and excrete drugs decreases. Drugs are prone to accumulate in the body, further increasing the difficulty of drug management.

In terms of drug management, elderly patients often encounter the problem of poor medication compliance, such as missing doses or taking the wrong ones. This not only reduces the therapeutic effect of the drugs but may also aggravate the patients' conditions. Fran chi C [24] et al. conducted a retrospective cohort study on elderly people (aged 65-94 years) who received chronic multidrug treatment in the communities of northern Italy. The study showed that only 19.3% of the elderly patients fully followed all the prescribed therapies. Liu Jiaming [25] et al. conducted a survey and study on elderly outpatients ($\geq$65 years old) with multiple diseases coexisting and multiple medication in 16 tertiary hospitals in 12 provinces and municipalities of China, and found that the incidence of drug non-compliance was 31.8%. Meanwhile, elderly patients have insufficient ability to understand drug information [26], and it is difficult for them to fully

understand the complex information on the drug instructions, which may lead to improper use of drugs.

The current situation of drug management for elderly patients with comorbidities is severe, and comprehensive measures need to be taken to deal with it. This includes strengthening patient education and improving medication compliance; Optimize drug management strategies to reduce drug interactions and adverse reactions. Through the implementation of these measures, the quality of life of elderly patients with comorbidity can be effectively improved, medical costs can be reduced, and better health management effects can be achieved.

6. Challenges and Countermeasures of Mobile Healthcare in Elderly Drug Management

6.1 Technical Adaptability

As people age, some elderly patients may experience cognitive impairments such as memory decline and decreased comprehension ability, which leads to the challenge of low Internet accessibility and usage rate for some patient groups. Developers of mobile medical applications should fully consider the demand characteristics of elderly users, optimize the operation design, and on the premise of maintaining functional integrity, simplify the operation process of mobile medical applications as much as possible [27]. For instance, functions such as one-click assistance and one-click appointment can be set up to reduce the operational steps for elderly patients. In addition, detailed operation guides and tutorials can be provided to help elderly patients quickly master the usage methods. Intelligent and diversified network intervention is a huge test for groups such as the elderly. Simplify the operation process by adopting design elements such as large fonts, high contrast, and simple layouts to reduce operation difficulty and enhance usability. Help elderly patients complete the operation more easily. To ensure that patients can easily use and participate, meet the needs of different types of people for health knowledge, and increase the coverage and usage rate of the group.

6.2 Data Security and Privacy Protection

Some elderly patients have a fear of new technologies, worrying about operational errors or data leakage and other issues, and thus reject the use of mobile medical applications for drug management [28]. The state and the government should constantly improve relevant laws and regulations, clarify the data security and privacy protection requirements for mobile medical applications, establish a complete data encryption, storage, transmission and authorization mechanism, and ensure that the health data of elderly users is effectively protected. Provide more solid legal protection for the elderly. Meanwhile, by providing transparent data usage policies and user authorization mechanisms, the concerns and doubts of elderly users regarding data leakage can be eliminated.

7. Conclusions and Prospects

To sum up, with the rapid development of Internet communication technology in the medical industry, the application of mobile healthcare in drug management has been continuously enriched. However, in the case of chronic diseases in the elderly, the related technical research and App development design are relatively insufficient. At present, related health apps and wearable technologies have problems such as single functions, insufficient targeting and poor user stickiness, and more attention needs to be paid to the needs of patients. The issue of personal health data security is also a key point that needs to be addressed in the digital age. Furthermore, the shortage of human resources and the uneven regional distribution of medical resources have limited the coverage of mobile medical services, especially in remote areas. Therefore, relevant national departments need to further improve laws and regulations, and technical researchers also need to strengthen the research on information security technology to ensure the security of patient data. In the context of big data, it is necessary to fully mine and accurately analyze valuable data to support real-world research, promote medical development and benefit patients. In the future, researchers can explore and develop localized forms of mobile healthcare that are in line with national conditions, so that mobile healthcare can truly benefit elderly patients with multiple coexisting diseases.

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