

Research on the Correlation Between The Application Status of Digital Health Tools in Glaucoma Chronic Disease Management and Patients' Self-Management Efficacy

Shutong Wei

The Second Hospital & Clinical Medical School, Lanzhou University, Gansu 730000, China

ABSTRACT

Glaucoma is an irreversible disease that seriously threatens vision. Chronic disease management involves continuous treatment, regular follow-up, and lifestyle interventions, which place high demands on patient compliance and initiative. With the development of digital technology, digital technology represented by applications, wearable sensor technology and the Internet has been widely used in the behavior management and disease prevention of glaucoma patients, such as taking medicine, eye pressure control, education and doctor patient interaction. In summary, this article attempts to summarize the current research results on the application of digital health tools in the self-management of glaucoma patients at home and abroad, while elaborating on the concept and importance of patient self-management efficacy, in order to explore whether the application of digital health tools affects patients' self-management efficacy and promote glaucoma patients to better complete disease self-management work. However, the degree of correlation between the two variables varies due to various factors such as tool category, tool attributes, user characteristics, and medical service environment. Therefore, this article proposes improvement plans including personalized tool matching suggestions, tool design that focuses on user needs, creating a multi-party cooperation platform, and implementing continuous tracking feedback to enhance the effectiveness of mobile health management, ultimately improving the long-term management quality and quality of life of glaucoma patients.

KEYWORDS

Digital health tools; Glaucoma; Chronic disease management; Self management efficacy; Relevance

1. INTRODUCTION

Glaucoma is a group of eye diseases with progressive optic nerve injury and corresponding visual field defect. The incidence rate is low but the progress is slow. It is one of the main causes of irreversible blindness worldwide; Glaucoma itself is a long-term or even lifelong disease control process, and on the basis of hospital treatment, it largely depends on whether patients can adhere to strict and standardized self-management outside the hospital. This includes rational medication use, regular measurement of intraocular pressure and changes in subjective symptoms, adherence to good lifestyle habits, and timely medical treatment [1]. However, in practical work, due to patients' insufficient understanding of the disease, complex disease management processes, forgetting to take medication, inconvenient measurement of intraocular pressure, and mental stress, patients have poor compliance and cannot effectively control the development of the disease, thereby accelerating visual impairment. In recent years, with the development of information technology, digital health intervention tools in the healthcare field have gradually emerged and been applied in the out of hospital management mode for chronic disease patients. At present, mHCA, medication reminders,

home automatic intraocular pressure measurement devices, remote monitoring and tracking software, and AI based diagnostic decision support tools for glaucoma patients have all emerged one after another. Their goal is to simplify management with technology, increase patient engagement, and improve resource allocation. Self management efficacy originates from Bandura's social cognitive theory, which refers to the level of confidence that individuals have in their ability to complete a specific behavior and achieve expected results. In the field of chronic disease management, it can be understood as the patient's confidence in their ability to perform various activities required for chronic disease management, such as following medical advice, controlling the condition, and maintaining social life skills. Multiple studies have confirmed that self-management efficacy is an important psychological influencing factor on the health behavior, disease outcome, and quality of life of chronic disease patients. In summary, exploring how to improve the self-management efficacy of glaucoma patients has important theoretical and practical value for improving their prognosis. Therefore, this article takes digital health tools as the research object of a new intervention method, explores their impact on the management of glaucoma chronic diseases, clarifies the key role of patients' self-management efficacy and its relationship with digital health tools. In order to provide theoretical reference value and practical guidance for designing more targeted and effective digital health interventions in the future.

2. THE CURRENT APPLICATION STATUS OF DIGITAL HEALTH TOOLS IN THE MANAGEMENT OF GLAUCOMA CHRONIC DISEASES

Currently, the application of digital health tools in glaucoma management is showing a trend of diversification and deepening, with functions covering multiple key aspects of disease management.

The commonly used auxiliary drug management systems include intelligent medication boxes and APP applications. The intelligent medication box has functions such as sound and light prompts, dose segmentation, and networking, which can reduce the situation of patients forgetting or taking the wrong medication; The APP software can not only send reminder signals, but also count the patient's medication status and create medication reports for patient examination and physician reference. Some software can even send reminder messages to corresponding family members or doctors and nurses in case the patient forgets to take medication.

In terms of symptoms and signs, traditional measurement of intraocular pressure relies heavily on outpatient clinics in hospitals. However, with the emergence of mobile medical terminals, patients can more conveniently detect changes in intraocular pressure at home and obtain corresponding intraocular pressure fluctuation curves, which can help physicians better adjust their treatment plans. At the same time, with the help of visual function assessment software on mobile apps (such as Amsler grid, simple visual field inspection app) and smart watches, monitoring the lifestyle status in terms of exercise volume, sleep quality, etc., provides a basis for comprehensive analysis of disease status and lifestyle interventions [2].

In addition, there are patient education scenarios where, based on multimedia application software, information about the causes, treatment methods, outcomes, and daily life related knowledge of glaucoma is provided to patients or their families in the form of text, images, videos, or questions through WeChat public accounts, online forums, etc., in order to correct their negative beliefs and establish correct disease concepts.

Digital tools have broken the limitations of time and space in doctor-patient communication and remote healthcare. Using a dedicated follow-up platform allows patients to upload monitoring data, fill out symptom questionnaires, and doctors can remotely access and provide preliminary guidance, as well as arrange necessary offline visits. Online consultation and video follow-up are very convenient for patients who live in remote areas or have difficulty going out. Artificial intelligence

algorithms have also begun to be used to screen for changes in the optic nerve in fundus photographs, assisting communities and primary healthcare institutions in early detection and referral of patients.

However, it should also be noted that there are some difficulties in application: the quality of different products varies greatly, and some lack medical evidence to support them; For the elderly, there may still be a problem of digital divide; The data privacy and security involved have attracted a lot of attention from people; How can these tools better integrate with existing medical information systems to avoid the formation of data silos; Whether one can persist in using and paying is a real challenge.

3. THEORETICAL CONNOTATION OF PATIENT SELF-MANAGEMENT EFFICACY AND ITS IMPORTANCE IN GLAUCOMA MANAGEMENT

Self management efficacy, as an important construct of social cognitive theory in the field of health, refers to an individual's subjective judgment of their ability to use their skills to complete management tasks, and affects their behavioral choices, level of effort, persistence in the face of difficulties, and emotions.

The patient self-care efficacy energy table in the specific management context of glaucoma mainly includes the following aspects: first, drug management efficacy, that is, confidence in being able to use eye drops on time, in the right amount, and correctly; The second is the efficacy of disease observation, which means having confidence in being able to accurately observe and record intraocular pressure and visual symptoms; The third is the sense of efficacy in maintaining healthy behaviors, including believing that one can adhere to a reasonable diet, moderate exercise, and not hold their breath, which can affect eye pressure; The fourth is the sense of communication efficacy between doctors and patients: it refers to the belief that one can clearly tell the doctor about their condition, correctly understand the doctor's advice, and effectively participate in the treatment of the disease; The fifth is the efficacy of problem-solving and emotional regulation, which refers to the confidence in actively responding and seeking solutions when encountering management difficulties or experiencing anxiety and depression [3].

The sense of self-management efficacy is crucial for glaucoma patients' self-management, and a higher sense of self-management efficacy is the driving force that promotes patients to repeatedly complete more complex self-management activities. Having a high sense of self-management efficacy means that patients will be more proactive in learning about glaucoma related knowledge and following medical advice to take medication. They will also actively and standardly conduct regular follow-up and condition monitoring, and be able to seek medical attention promptly upon discovering abnormal situations. Research has shown that patients with high self-management efficacy have good medication adherence, low levels of disease concern and anxiety, high satisfaction with medical care services, and can achieve good intraocular pressure control and slower progression of optic nerve damage in the long term; However, low self-management efficacy can make patients feel powerless and prone to giving up, reducing compliance and forming a vicious cycle of poor disease control [4]. Therefore, improving self-management ability should be one of the main objectives of glaucoma chronic disease management intervention.

4. CORRELATION ANALYSIS BETWEEN DIGITAL HEALTH TOOL APPLICATION AND PATIENT SELF-MANAGEMENT EFFICACY

4.1. The Promoting Effect of Tool Use on Self Management Efficacy

Digital health tools mainly have a positive impact on patients' self-management efficacy through the following psychological and social mechanisms.

Firstly, provide successful experiences and behavioral reinforcement. Tools help patients continuously and concretely experience the successful execution of management tasks by reducing difficulty (such as clear reminders), providing timely feedback (such as successful medication check-in prompts), and visualizing results (such as compliance curve graphs). According to Bandura's viewpoint, personally acquired successful experiences are the most effective way to enhance individual confidence. Every record of taking medication on time and every record of stable intraocular pressure is a small affirmation of their level of care, gradually accumulating their confidence [5].

Secondly, alternative learning and role model demonstration. The sharing of patient experiences, successful case stories, or expert guidance videos on digital platforms provides patients with opportunities for observation and learning. Seeing others in similar situations control their condition through effective self-management can enhance the patient's belief that they can do the same.

Thirdly, reduce psychological burden and cognitive pressure. Tools can assist patients with automatic prompts, standardized records, and provide information retrieval functions, entrusting a part of complex and labor-intensive management work to tools, reducing memory and thinking. When they feel that management behavior is easier and more organized, their belief in overcoming the disease naturally increases, and their anxiety level decreases.

Fourth, obtain social support and positive feedback. Building bridges between doctors and patients allows patients to gain more recognition and guidance from professionals, while online communities provide opportunities for emotional companionship and experience sharing for patients [6]. Positive feedback, motivation, and empathy from healthcare workers and other patients are social reinforcing factors that influence individuals to generate higher self-efficacy.

4.2. Comparison of Differences in the Impact of Different Tool Types on Efficacy

Different types of digital health tools have varying effects on improving various dimensions of self-management efficacy due to their functional focus and interaction methods.

Behavioral support tools include smart medication boxes, medication reminder apps, etc., mainly designed to solve a specific and frequent behavior: medication management, and provide precise support in behavior, which can directly improve patients' confidence in their medication management ability, often with immediate results [7].

Monitoring and feedback tools include home tonometers and symptom recording apps, which to some extent give patients the right to monitor themselves and provide them with objective data to understand their situation, thereby enhancing their confidence in symptom monitoring and disease control; However, if the values are unstable or there is no clear reason, the opposite effect may occur. It is also possible to cause anxiety in a short period of time.

Educational support tools such as interactive health education programs help improve patients' disease knowledge and cognitive abilities. Knowledge is the foundation of confidence. Through systematic education, patients understand the principles of treatment and how to manage diseases. During this process, patients' sense of health behavior maintenance and problem-solving efficacy can be further improved, and the effect is more lasting, but it may be slower.

Tools that provide communication convenience, such as telemedicine and doctor-patient communication apps, are mainly used to reduce communication barriers and increase communication frequency to promote the effectiveness of doctor-patient communication among patients. This indirectly affects patients' trust in the overall medical team and their confidence in cooperation with the medical team.

4.3. Key Factors Affecting The Correlation Between The Two

The strength of the correlation between the application of digital tools and the improvement of self-management efficacy is moderated by multiple factors. Whether the tool is easy to use, the interface is friendly, and the information expression is clear is related to the acceptance and willingness of elderly or digital skill deficient users to continue using it; The scientificity and reliability of tools are the foundation for gaining trust, and inaccurate information or measurement results will greatly affect the sense of efficacy; Can the tool be personalized according to different patients' medication plans, lifestyles, etc. Determine the accuracy of its approval [8]. The age, computer skills, education level, and visual acuity of patients can all affect whether they can proficiently use tools and the level of proficiency in their use; In addition, factors such as the patient's initial self-efficacy, understanding of the disease, and willingness to learn will also determine whether the patient will consider the tool useful and effectively utilize it for themselves. The support of the medical system belongs to peripheral guarantee. Whether the tool receives the support and recommendation of the attending physician, whether it can be integrated with the routine diagnosis and treatment process, and whether the physician is willing and good at using the data uploaded by the tool to communicate and guide patients, largely determine the authority and practicality of the tool. Without medical support, digital tools may become independent data recorders, making it difficult to effectively translate them into clinical decisions and increase confidence. After the freshness of the tool, whether it can attract people's continuous attention and use through regular updates, interactive operations, or point rewards is related to whether it can have long-term effects.

5. OPTIMIZATION STRATEGY FOR GLAUCOMA CHRONIC DISEASE MANAGEMENT BASED ON DIGITAL HEALTH

5.1. Personalized Digital Tool Recommendation and Integrated Application Mode

Avoid simply providing the same tool list for all patients. Provide patients with specific tools or a set of tools that are most suitable for them based on their clinical stage, management issues, characteristics, and emotional state. For example, for elderly patients with memory impairment, it is best to use electronic medication devices with as simple functions as possible, while for young patients who want to understand their own diseases, it is recommended to promote applications with functions such as education, monitoring, and communication [9]. Encourage the development of integrated management software, combining scattered functions, sharing information, and presenting a holistic management model for patients and physicians.

5.2. Tool Design Improvement Centered on Enhancing Self-Management Efficacy

Strengthen positive incentives and create timely, positive, and clear feedback on success. Add target management and gradual upgrade function modules to support patients in setting moderate small goals and achieving achievable goals for the next stage, providing a gradual upgrade experience; Enrich the presentation format of teaching content, present it in a more plot and story based way, enhance immersion and attract imitators; Reduce chart complexity, visualize trends, help patients recognize the relationship between their efforts and results, and increase control.

5.3. Construction of Medical Patient Collaborative Support System

Fully utilize information technology in routine processes, and form a management model led by doctors and coordinated by patients based on evidence. Hospitals need to establish corresponding standards for information operation and result analysis, and provide corresponding technical training to medical staff to enable them to proficiently use information technology data information to provide effective communication and consultation for patients. In clinical practice, physicians need to actively

inquire about the use of tools from patients, discuss uploaded data, and work together to develop or modify patient management plans, allowing patients to feel the value of tools in clinical practice and their active role in the treatment process. In addition, encourage the development of online patient support communities endorsed by hospitals and led by professionals to provide reliable peer support.

5.4. Effectiveness Evaluation and Continuous Improvement Mechanism

In addition to biomedical indicators such as intraocular pressure control rate and visual field progression speed, patient reported outcomes and intermediate indicators (such as self-assessment efficacy: changes in self-management efficacy scale scores; medication adherence, quality of life, medical satisfaction) should be considered when designing research plans, and user participation and its effectiveness relationship should be studied in combination with data collected by the tool itself. Based on the evaluation results, establish a continuous improvement cycle of clinical evidence product optimization practical application. Strengthen real-world research, accumulate evidence of the effectiveness and cost-effectiveness of different tools applied to different populations, and provide support for accurate recommendations and health decisions.

6. CONCLUSION

Digital health management is a highly promising innovative management model for glaucoma, which is one of the lifelong diseases. This article introduces the current development of digital health management from the aspects of medication, follow-up, education, and doctor-patient communication, and elaborates on its relationship with the important concept of self-efficacy in glaucoma patients. Reasonable and effective digital health management can enhance patients' confidence and sense of ability in various aspects of disease management by providing successful experiences, empowering knowledge, and social support, which is the internal driving force for continuous improvement of health behavior. However, the positive impact of this is modulated by multiple factors such as tool design, user characteristics, and medical support environment [10].

In summary, in the future development process, the glaucoma DHM tool should not only be provided as a simple tool, but should also continue to explore and develop in personalized recommendations, humanized design, systematic integration, and scientific evaluation; The ultimate goal is to use DHM technology to transform patients from passively and anxiously accepting disease management to actively and confidently becoming partners with disease managers, requiring collaborative efforts from various stakeholders such as ophthalmologists, DHM developers, health department decision-makers, and patient groups. To create a new model of glaucoma chronic disease management that is truly patient-centered, technology-based, and efficiency oriented.

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