

Review

The application of the mobile information technology in continuous care for hypertension patients

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Highlights

This article introduces the concepts of mobile information technology and continuous care, develops a systematic review of the application of mobile information technology for continuous care in patients with hypertension from three aspects.

Editor's Summary

Hypertension is a universal and worldwide public health problem and is also regarded as one of the most dangerous chronic diseases. This article reviewed the current status of mobile information technology applied in the continuous care of hypertension in China and abroad, provide a reference for mobile information technology application in the clinical practice of continuous hypertension care in China.

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ABSTRACT

Objective: This article introduces the concepts of mobile information technology and continuous care, develops a systematic review of the application of mobile information technology for continuous care in patients with hypertension from three aspects: mobile communication technology, internet technology, health management platform, and puts forward the existing questions, influence and the research prospect of the application of mobile information technology using in hypertension continuous care, in order to provide evidence for the application of mobile information technology in continuous care for hypertension patients in clinical practice.

Key words: Information system, Hypertension, Continuous care, Literature review

摘要

本文介绍了移动信息技术及延续性护理的概念，从移动通讯技术、互联网技术、健康管理平台三个方面对移动信息技术在高血压患者延续性护理的应用现状进行了系统综述，并提出移动信息技术在高血压延续性护理中应用的现存问题、影响和研究展望，以期为我国将移动信息技术应用于高血压延续性护理的临床实践提供参考。

关键词: 信息系统；高血压患者；延续性护理；综述文献

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1. Introduction

In “13th Five-Year” period, with the continuous development of networking, cloud computing, mobile Internet, mobile information technology is widely used in clinical nursing practice, especially in the field of continuous nursing care of chronic diseases, it develops a new form to optimize the medical resources, improve nursing service efficiency, ensure the continuity and coordination of care, enhance the relationship between nurses and patients [1]. Hypertension is a universal and worldwide public health problem and is also regarded as one of the most dangerous chronic diseases. At present, about one billion people around the world suffer from high blood pressure [2, 3]. If no effective measures are taken, the number of global hypertension is expected to reach 1560 million by 2025 [4]. In recent years, the prevalence of hypertension in China has increased rapidly. At present, nearly 200 million of patients in China are suffering hypertension, however, they are facing the severe situation of low awareness, low treatment rate, and low control rate [5]. Study has pointed that daily lifestyle is one of the main factors influencing the level of blood pressure control in hypertensive patients and the combined medication and lifestyle intervention are conducive to the prevention and treatment of hypertension [6]. It also claimed that even though guidelines, and education program have already been laid out, but only 1/4 to 1/3 of treated patients had good control of blood pressure. The main reasons are as follows: (1) only less than 50% of the hypertension patients can adhere to the treatment; (2) it is difficult for patients to maintain the lifestyle adjustment. The current research showed that continuous nursing plays an important role in improving medication compliance and self-management, establishing healthy behaviors, effectively controlling blood pressure and improving quality of life in patients with hypertension [7]. However, the continuous care of hypertension in our country is still in its infancy, it is facing a series of problems such as irrational distribution of medical resources and the shortage of professional staffs [8]. With the development of mobile information technology, mobile phone APP, WeChat, QQ, remote monitoring and other mobile information technology are used in continuous care, that can break the limitation of time and space, reduce the cost of medical care, improve the quality of medical services, effectively change the status quo. This article will review the current status of mobile information technology applied in the continuous care of hypertension in China and abroad, provide a reference for mobile information technology application in the clinical practice of continuous hypertension care in China.

2. The review of related concepts

2.1 Mobile information technology

The application of mobile information technology in the continuous care refers to health care professionals help patients to establish healthy function, chronic disease

management by using the mobile information technology such as of mobile APP and mobile phone for the clinical decision support system and data acquisition [9]. Mobile health is known as mobile communication devices, such as mobile phones, tablet personal computer, and personal digital assistants are used for communication between the medical staffs and the patients [10]. The mobile information technology applied to the continuous care of hypertension includes SMS, WeChat group, QQ group, remote monitoring devices, mobile blood pressure measurement devices and APP cooperatively developed with various medical technology companies. The service process is [11, 12]: the establishment of hypertension continuous care team and the development of the electronic record of hypertension patients through the mobile information technology platform; patients are encouraged to use mobile blood pressure testing equipment to collect physiological data and to collect their life data by answering a lifestyle questionnaire; patients' blood pressure and life style are monitored remotely and sent to the medical management terminal through the network; medical staffs assess health records, communicate regularly with patients, adjust their health management plan, carry out related health education, establish patients' health belief and health behaviors.

2.2 Continuous care

As a part of holistic nursing, continuous care is a continuation of hospitalization care which has a series of activities to ensure the coordination and continuity between patients in different health care sites or nursing levels [13]. High blood pressure is lifelong and controllable, which is in line with the consistency and continuity of continuous care. The main contents of the continuous care for patients with hypertension are nursing assessment, health education, the patients' compliance behavior intervention, blood pressure monitoring, lifestyle changing, diet care and psychological counseling [14]. It can improve patients' ability of self-management, control the disease and reduce further complications.

3. The application of mobile information technology in the continuous care of hypertension

3.1 Mobile information technology

The continuous care of mobile information technology for patients with hypertension mainly includes phone follow-up and health education by SMS. The nurses take return visits for the hypertensive patients by telephone to learn about the level of blood pressure in time. Through that, nurses can send related medication, monitor blood pressure, encourage exercise activity, adjust patients' lifestyle and unhealthy habits. In one systematic review of the effectiveness of mobile health technology in improving health services, mobile information technology is mainly used for sending SMS with medication use reminding and health information, which can effectively improve patient medication compliance [15]. The study of Anton used SMS and mobile phone to intervene



hypertensive patients' behaviors [16]. Medical staffs sent SMS to remind patients to follow their suggestions such as regular monitoring blood pressure, daily treatment and weight control and recorded the clinical data of patients' blood pressure, weight and smoking. Through this system monitoring the state of hypertension patients, the results showed that patients in the experimental group had better compliance, it reduced the cost of nursing and improved the efficiency of health care and the quality of continuous care. In the study of Barry, except routine continuous nursing was applied to discharged hypertension patients, the telephone connection between nurses and patients was also used in the experimental group [17]. The results showed that the medication compliance and blood pressure control in the experimental group were significantly better than those in the control group. Zhang based on remote information interactive platform such as phone, SMS for the management of hypertension patients to develop health education and cognitive therapy [18]. The compliance, living habits and the awareness rate of health information in the experimental group were obviously better than those of the control group.

3.2 Internet technology

With the continuous development of the Internet, the continuous care based on Internet technology has gradually expanded, including mobile APP, Facebook, Twitter, WeChat, QQ and other social networking platforms. Compared with telephone communication, SMS and other communication technologies, continuous nursing based on Internet has the characters of continuity, interactivity, and intuitiveness. Patients and their families through the mobile phone APP and social networking platform, regularly upload blood pressure, communicate with healthcare staffs at any time. Other activities such as exercise clock-in, medication clock-in and accessing to relevant knowledge can also be achieved. As a view of the continuous care teams, they can assess the condition of patients online, remind medication using and exercise, and propagate of health knowledge through video and brochure. It can change the lifestyle of patients, enhance the medication compliance, strengthen the communication between healthcare staffs and patients. Nilay used mobile phone APP for the management of patients with hypertension, it included accelerated blood pressure monitor, blood pressure watch, real hypertension calculator, blood pressure log, blood pressure companion, heart blood pressure tracker, IBP blood pressure and other applications [19]. It presented that almost half of the applications can directly export spreadsheets or chart information to the doctors' office which can promote effective communication between doctors and patients and about 1/4 of the applications can enhance patient's medication compliance. Research displayed that, after analyzing 107 applications, only 2.8% of them were cooperatively developed with professional medical institutions, the main push content of applications included hypertension general information, information about sticking to a healthy diet, taking medicine notice, medication log, reminding blood pressure measurement

notice [20]. Wen mainly used QQ group for discussion, follow-up, getting feedback and sharing health knowledge [21]. Qian used WeChat group and Official Accounts to guide patients' behavior [22]. In this study, medical staffs can carry out PPT for health education about hypertension, share health knowledge and remind patients to take medication, while patients can give feedback through consultation. The result showed that the control of hypertension patients' blood pressure and compliance of medication have been promoted. Studies have also shown that medical staffs through the QQ, WeChat platform can communicate with patients timely, answer specific questions, improve patients' lifestyle and establish healthy behavior.

3.3 Health management platform

The health management platform for the continuous care of hypertension mainly includes remote monitoring, electronic medical record and mobile blood pressure monitoring equipment. The mobile information technology for hypertensive patients continuous care should firstly establish electronic health records, comprehensive assess patients, use the remote monitoring system and mobile blood pressure monitoring equipment to real-timely monitor blood pressure and transfer health data [23]. Patients can contact with the medical staffs once facing problems to adjust the medical care program and book doctors' appointments review, so as to prevent the occurrence of complications, improve the relationship between nurses and patients, reduce medical costs and improve service efficiency. In the research of Caroline, electronic health record in the US is becoming more and more popular, which can enhance patient satisfaction and give patients more efficient nursing care [24]. In the study of Lamine, it used comprehensive e-commerce service platform to monitor blood pressure, collect relevant data, communicate between patients and medical staffs, and provide personalized lifestyle advice [25]. In recent years, scholars have developed mobile medical service model of community hypertension and smart blood pressure management system based on wearable blood pressure meter and O2O [26, 27]. It also pointed out that China's existing mobile medical service products for high blood pressure have ComonCare, MuMu Health, ihealth, Shiyun medical treatment, etc. These APP are mainly from the patient's point of view, to develop the patient's habit of taking the initiative to measure blood pressure and the ability to acquire health knowledge actively. The Study of Stefano is about the remote medical monitoring system for a particular application in blood pressure monitoring [28]. Compared with conventional care, it allows the remote information and data transmission and can improve the quality of continuous care, effectively prevent other cardiovascular diseases caused by hypertension. Darshi used remote monitoring system for hypertension patients' management [29]. Patients can send the data of the blood pressure and pulse to the server, while the medical staffs can monitor in a real-time, once the problem of patients with abnormal heart rate or other technical problems occurring, nurses can communicate



with patients in time by telephone or e-mail, and inform doctors to provide necessary intervention measures for patients or arrange appointments with doctors. In this interactive process, the trust and cohesion between patients and medical staff are enhanced.

4. The challenges existing in the application of mobile information technology to the continuous care of hypertension in China

4.1 The members of the continuous care team are relatively single

Applying mobile information technology in hypertension and continuous care, should firstly set up the continuous care team, including nursing managers, clinical nurses, community nurses, cardiologist, pharmacists, nutritionists, healthcare personnel, related technical personnel and platform security personnel etc. However, the application of mobile information technology in continuous care of hypertension has not yet matured, which led to single-member team and the lack of relevant technical personnel. Stefano has used telemedicine and mobile medical applications in hypertension management, it included nurses, pharmacists, doctors and other healthcare professionals [28]. In Zheng's study, continuous care team was composed of organizers with rich nursing knowledge, clinical experience and communication skills, the nurses who were in charge of the patients and information technicians [30]. Compared with foreign countries, the number of the team members involved in the continuous care of hypertension is small, the types are also relatively simple. This is closely related to the shortage of our medical staffs, the heavy workload of clinical nursing and the imperfect development of continuous care. This is also one of the main factors limiting the application of mobile information technology to the continuous care of hypertension.

4.2 The lack of specific patient education system

The ability of installation and use of is the premise to apply mobile information technology in hypertension continuing nursing care. But China's mobile medical development is still in the initial stage, the promotion of mobile medical treatment is limited because of the lack of education system for mobile information technology in clinical care. Patients with different characteristics vary in the using level, acceptance of mobile information technology and the demand of continuous care. Age, family location, educational background and condition of disease influence the popularization and application of mobile information technology in continuous nursing care of hypertension. The study of Darshi stated that after using 6 months of HBP remote monitoring, patients with younger age (average age at 61) were more likely to adhere to monitor and follow research programs, and patients' compliance was considered to be a major limitation of using HBP remote monitoring [29]. The study of Alexander showed that the application of mobile information technology in hypertension continuous care

was facing many challenges, one challenge is that the need to organize all stakeholders, such as healthcare professionals, academic institutions, hypertensive patients and their families [31]. In addition, the age of patients is a potential obstacle to the application of mobile information technology to hypertension. The patients with hypertension are mostly elderly people and the age more than 50 years old, and it is a challenge for them to learn how to use mobile devices and the Internet. In the study of Lin in China pointed that the age, economic level and cultural background of the patients will affect the use of mobile information equipment [32]. Study used survey about the intention to use mobile phone applications of patients with chronic disease. It showed that 53.7% of patients were willing to use intelligent mobile phone, and the young patients (under 44 years) with higher level education and using experience of application were willing to accept the payment application to promote health condition [33].

4.3 The security of patients' data

The transmission of patients' information and health data is the core of the entire application process [34]. However, due to the virtualization, openness and diversity of mobile information technology, the security of patients' personal information and health data is not effectively guaranteed. Stefano claimed that using mobile information technology in continuous care of hypertension patients, not only need to share health information between healthcare personnel and patients, but also should protect the security and privacy of patients' data [28]. Zhao showed that establishing personal electronic record and collecting related patients data can improve the monitoring of patients' condition and promote health behaviors, but the security and privacy of patients are the major challenge in the application of electronic health record [35]. Security protection should be paid more attention when using application programs.

4.4 Lack of an consummate evaluation system

A comprehensive assessment of patients and the effectiveness of the intervention are the key factors to apply mobile information technology in continuous care of patients with hypertension. It is mainly evaluated from the patient compliance, rehospitalization rate, standard rate of blood pressure and the risk factors. Kari assessed the proportion of patients who reached the target blood pressure in the six months' follow-up, the number of visiting to hospitals, emergency departments and clinics, the condition of telephone and e-mail consultation and medication compliance [36]. In the study of Zhang, the effect of hypertension control was evaluated through blood pressure, risk factors control and self-designed questionnaire [18]. Wang evaluated results by the self-designed demographic questionnaire and blood pressure condition [37]. Compared with foreign countries, the application of mobile information technology in continuous care of hypertension lacks a consummate evaluation system.



4.5 Imperfect infrastructure

Infrastructure construction is the premise and guarantee of applying mobile information technology to continuous care of hypertension. However, in the backward economic development areas of China, the construction of network infrastructure is not consummate, which can affect the implementation of mobile information technology. In Lauren's study, patients and their families were trained by a staff, giving help or assisting the operation when necessary [38]. But in the application process, the imperfect infrastructure is a challenge, especially in rural areas, including less technical support for Internet connection from Internet service providers, hardware, software and other related factors etc. The interruption of Internet service, not only affects the enthusiasm of patients, but also affects nurses to collect relevant data from patients. It is important to strengthen the construction and maintenance of network infrastructure and ensure the stability of network in different areas.

5. Summary and prospect

In summary, the application of mobile information technology in hypertensive patients with continuous care is the inevitable trend of medical care development, which can improve efficient management of patients with hypertension. It is beneficial to improve the medication compliance of patients, enhance the ability of self-management, improve health life style, reduce anxiety, strengthen the communication between patients and healthcare staffs, develop the relationship between nurses and patients, reduce the cost of health care, progress the quality of nursing service, optimize the distribution of medical resources, control the level of blood pressure and prevent the happening of complications. However, there are still some problems in the application process, healthcare services should focus on strengthening multidisciplinary cooperation in order to diversify the continuous nursing team, provide corresponding educational content according to different characteristics of patients, and design mobile information devices in line with the requirements of patients with hypertension, such as simplifying operation on the basis of relatively complete functions, avoiding small buttons and dim screens. Healthcare settings should improve the security system, pay attention to the protection of patient privacy and related health data; professionally manage and improve the related evaluation system, and appeal to the relevant departments to strengthen investment and construction of infrastructure. How to establish suitable mobile information technology platform in the future for our patients with hypertension continuous nursing care needs further exploration and research, so as to effectively use modern mobile information technology to enhance the continuity of care in patients with hypertension.

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