Advances in eHealth Technology for Self-Management in Patients with Hematologic Malignancies: A Postprint

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Abstract

This study provides a comprehensive review of the current status of self-management among patients with hematologic malignancies, the concept, classification, and management strategies of eHealth technology, analyzes their advantages and disadvantages, explores directions for future research, and aims to provide reference and guidance for the self-management of patients with hematologic malignancies in China.

Full Text

Preamble

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Title: Research Progress of Electronic Health Technology in Self-Management of Patients with Hematological Malignancies

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Abstract

This paper summarizes the current state of self-management among patients with hematological malignancies, the concept and classification of e-health technology, and related management strategies. It analyzes the advantages and disadvantages of these approaches, explores future research directions, and aims to provide a reference for improving self-management among patients with hematological malignancies in China.

Keywords: electronic health technology; mobile medicine; hematological tumor; self-management; continuity of care

1. Current Status of Self-Management in Patients with Hematological Malignancies

Self-management refers to the practice whereby individuals maintain their health, manage disease symptoms, and modify lifestyle behaviors through their own actions to manage their conditions over time. As a fundamental approach for the long-term effective management of chronic diseases and cancer, self-management has been widely applied in clinical practice. However, traditional self-management models are constrained by limitations in healthcare professional availability, time, financial resources, facilities, and social support, which prevent them from adequately meeting patients' needs across different stages of their disease trajectory.

With the popularization and advancement of information technology, electronic health (e-Health) interventions have gradually been applied in clinical practice. For cancer self-management, the UK National Cancer Experience Collaborative Organization defines it as effective methods that cancer patients or those with incurable diseases can independently choose to maintain a meaningful quality of life. However, traditional self-management approaches for hematological malignancy patients primarily rely on oral education from nurses, distribution of paper-based health materials, and screening of disease-related videos. These methods are limited by healthcare professionals'expertise, staffing arrangements, and patients' health status, education level, and health literacy, which to some extent affect the effectiveness of patient self-management.

According to WHO statistics, cancer currently ranks as the first or second leading cause of death in the population of many countries. Hematological malignancies, as a special category of tumors, are characterized by high variability, treatment complexity, recurrent episodes, and incurability. With healthcare system reforms, large hospitals have improved diagnostic and treatment efficiency while shortening hospital stays. For most chronic disease patients, especially those with hematological diseases, home observation during chemotherapy intervals and self-care during home periods have become particularly important. These circumstances have prompted clinical exploration of new self-management

models for hematological malignancy patients.

Research by Li et al. shows that home care needs of tumor patients mainly include palliative care, symptom control, information guidance, and psychosocial support. Survey reports indicate that e-Health is primarily manifested in six aspects: meeting needs; reducing information asymmetry between doctors and patients; improving quality and safety; transcending traditional healthcare boundaries; and promoting social equality. When "Internet Plus" integrates with health services, the development of e-Health will inevitably promote the rapid development of electronic health records, electronic medical records, mobile health, telemedicine, e-learning, and big data applications in various fields. As the incidence and mortality rates of hematological malignancies continue to increase annually, and as cancer survivors' lifespans gradually extend, patients' demand for health services continues to grow. However, due to limited medical and health resources, healthcare professionals face limitations in providing full lifecycle health management for patients, and greater efforts are needed to achieve refined health management based on individual patient differences.

2. Definition and Classification of e-Health

The WHO defines e-Health as the use of information and communication technologies to provide healthcare services, manage health systems, and improve communication quality. Research indicates that e-Health has been widely used to promote cancer prevention, improve cancer screening rates, and manage symptoms (including symptoms and side effects), while providing long-term support for cancer survivors. Domestic scholars Ji et al. believe that e-Health refers to "the application of information and communication technologies to implement healthcare," with its scope covering patient treatment, research implementation, medical staff education and training, patient disease tracking, and public health monitoring.

Based on comprehensive definitions from scholars worldwide, e-Health is essentially a digital means of managing patients' full lifecycle health based on information and communication technologies. As e-Health becomes more widespread, establishing unified evaluation standards and processes will be essential to enable healthcare professionals to better manage patients' entire health journey and support self-management.

In 2006, the State Council of the People' s Republic of China established the development of an electronic health system and included it in the "National Medium and Long-Term Plan for Science and Technology Development (2006-2020)." In 2019, the Notice of the National Health Commission Office on Carrying Out the Pilot Work of "Internet Plus Nursing Service" clearly stated that the key service targets of Internet Plus Nursing Service are elderly or disabled individuals, rehabilitation period patients, and end-stage patients with mobility difficulties, providing services in chronic disease management, rehabilitation nursing, specialized nursing, health education, and hospice care.

With the rapid development of the Internet era, the demand for continuous and high-quality nursing care among malignant tumor patients is increasing. Through mobile health media, self-management methods for tumor patients are diversifying, with specific content as follows:

Remote Medical Care: Traditional remote medical care refers to special medical methods for treating distant patients who cannot visit medical facilities. Based on information globalization and Internet development, remote medical care is redefined as a system that relies on computer technology, remote sensing, telemetry, and remote control technologies to provide off-site medical services. Remote medical systems can be used to detect, monitor, diagnose, and treat off-site objects. Remote medical care can improve patients' access to high-quality, cost-effective health services regardless of location, help achieve unified universal healthcare and holistic nursing, and provide opportunities for resource-lacking areas to access tertiary medical consultations. By expanding the coverage of remote medical care, patients can seek treatment earlier and better adhere to prescribed treatment methods, thereby improving the quality of life for patients with malignant hematological tumors. Currently, objective factors such as inadequate infrastructure, lack of broad interoperability standards for software, and equipment or computer system failures still affect the development of remote medical care.

Electronic Health Records (EHR): EHR is a patient-centered real-time record that provides immediate, secure information to authorized users. Electronic health records typically include patients' medical history, diagnoses and treatments, medications, allergies, immunizations, radiology images, and laboratory results. The Opinions on Deepening Medical and Health System Reform issued by the Central Committee of the Communist Party of China and the State Council in 2009 pointed out the need to establish a public health service system with information exchange and resource sharing. Personal electronic health record management platforms are crucial in the medical and health information subsystem. Yuan et al. conducted a study on outpatients with PICC catheterization, following the catheter care execution process, utilizing modern network and communication facilities combined with the hospital information system (HIS) and picture archiving and communication system (PACS) to implement pre-catheterization telephone appointment assessment, positioning queries during catheterization, electronic medical record documentation post-catheterization, and preservation of catheter file materials. They also conducted regular health education and follow-up via telephone or QQ after catheterization. The results showed that the intervention group had better compliance in daily living habits, functional exercise, observation content, and maintenance, significantly reducing catheter-related complications and improving patient satisfaction. Electronic health records have an important impact on improving the quality of medical and health services. Electronic health record management can effectively improve medical service quality, reduce health costs, and improve health outcomes.

Social Media: In the Web era, the openness of social media and electronic reading habits have gradually become popular, and various types of information based on social networks are easily accessible. Social media is a collection of applications developed based on Internet concepts and technologies. According to 2015 GOe survey data, 78% of countries use social media in healthcare institutions to promote health information dissemination and exchange, and over 50% of communities in more than 50% of countries use social media to improve community health campaigns. Social media is a mainstream promotion method for e-Health. Mainstream social media platforms at home and abroad include Facebook, Twitter, Wikis, YouTube, WeChat, Alipay, and Sina Weibo. The widespread application of social media has brought new opportunities to healthcare and health management, gradually integrating into the medical industry while also affecting relationships between patients, the public, policymakers, and other individuals.

eLearning: eLearning refers to training and education using information and communication technologies. eLearning provides reasonable and convenient educational pathways for medical staff, with relative flexibility in location and time, which can help strengthen the dissemination of knowledge and skills. Surveys show that eLearning programs can effectively improve nurses' awareness and confidence in managing malignant tumor patients, early identification of adverse indicators, and improve patient outcomes. Hematological malignancies have particularity, complexity, and repetitiveness, requiring multidisciplinary cooperation and exchange. Fletcher et al. found that using eLearning facilitates interdisciplinary learning to improve nursing quality and patient outcomes. Despite its unprecedented advantages, eLearning has certain limitations in evaluating effectiveness due to its primary reliance on self-study and lack of interaction.

Big Data: The intersection and integration of information technology and modern society have triggered rapid data growth, making data a national basic strategic resource. The "Healthy China 2030" Planning Outline, reviewed and approved at the 2016 National Health and Health Conference, proposed using big data to achieve the national strategy of "Healthy China." With the rapid development and application of data science in the health field, the evaluation and management of personal health status no longer rely solely on doctors' subjective judgments but are based on results from massive data analysis, making individualized evaluation and prevention more reliable and scientific. For example, in precision interventions for hematological malignancies, including medication adherence intervention, re-examination reminders, disease support, pushing laboratory test results and clinical diagnoses, big data analysis technology provides convenience for patients' self-management and real-time communication with medical staff. As big data analysis technology continues to mature, big data will penetrate various details of various industries, changing people' s lifestyles and medical experiences.

Mobile Health: Mobile health is an important component of e-Health. Mobile health supports medical and public health practice through mobile devices

such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices. Mobile health technology forms mainly include mobile applications based on Android, IOS and other systems, mobile text messaging services, WeChat platforms, multimedia messaging services, and web browsing, which can involve various operating systems and functional sensor devices. Currently, mobile health application models mainly include B2C model, B2B model, and D2C model. The D2C model is a medical and health care service terminal established and designed based on mobile health Internet technology, directly delivering health information to patients through various mobile terminal devices. The biggest feature of this model is enabling patients to use mobile medical equipment to participate in their own disease management.

3. Application of e-Health in Self-Management of Patients with Malignant Hematological Tumors

Due to disease and treatment-related factors, cancer patients often experience multiple symptoms such as pain, fatigue, nausea, and vomiting, causing varying degrees of distress to patients and their caregivers, and seriously affecting treatment outcomes and quality of life, particularly when severe. Symptom management refers to taking measures to improve the quality of life of patients with serious or life-threatening diseases, with the goal of preventing or treating symptoms as early as possible, managing side effects caused by disease treatment, and addressing psychological, social, and spiritual problems related to the disease or its treatment. In terms of symptom management, due to the real-time, accessible, and interactive characteristics of electronic health technology, daily symptom assessment by patients, patient-reported outcomes, self-management guidance from healthcare professionals, and family symptom care can play a role in symptom monitoring, continuous tracking, and timely handling of health problems, helping with home management and prevention of adverse reactions after treatment. Specific content is as follows:

Pain Management: Pain has been identified as the “fifth vital sign”after blood pressure, respiration, pulse, and body temperature. Cancer pain negatively affects the quality of life for both patients and caregivers, seriously impacting patients’ survival period and overall quality of life. Breen et al. conducted a randomized controlled trial using remote monitoring and management intervention for leukemia patients undergoing chemotherapy, showing that the experimental group had lower scores for related symptoms such as nausea, mucositis, and constipation. Zheng et al. conducted a meta-analysis on malignant tumor patients, demonstrating that App-based interventions had significant effects on improving the overall quality of life and quality of domains such as nausea and vomiting.

Hochstenbach et al. developed an e-health intervention program provided by registered nurses to support self-management of outpatient cancer pain patients, applying a mobile application designed for patients and a web program designed for nurses to routine clinical practice. Nurses sent detailed information and ed-

ucational content about analgesics to the patient user end through the web program, and patients completed pain diaries, medication intake, and reading educational materials through visual and voice reminders. The nurse end monitored patient-related data and provided corresponding guidance measures. This approach combined patient self-management with professional nursing, promoting a partnership of shared responsibility, providing professional guidance for cancer pain patients, and facilitating subsequent consultations or follow-up visits.

Cheville et al. explored complex intervention measures including remote rehabilitation, physical health, and pain management. Scott et al. tracked reports from patients in Group 1 and pain alerts from Group 2 participants through telephone or web-based survey remote monitoring, assessing their pain and activity levels through arm activity, and timely controlling patient pain to improve quality of life.

Cancer-Related Fatigue: The National Comprehensive Cancer Network (NCCN) defines cancer-related fatigue as a subjective feeling and experience of fatigue caused by tumors or tumor treatment, characterized by subjectivity, long duration, and inability to relieve after rest. Syrjala et al. developed individualized web pages for 250 patients after hematopoietic stem cell transplantation, including content such as emotional management, exercise rehabilitation, self-care skills and tools for common complications, and tailored healthcare guidelines. Healthcare professionals conducted remote medical telephone visits, used the Piper Fatigue Revised Scale to assess patient conditions, collected problem lists, and then solved one of the problems during each telephone visit. After 6 months of intervention and follow-up, patients' fatigue and depression symptoms were effectively alleviated. Li et al. showed that in App development, automatic reminder functions were developed, and chat interaction sections were added to the software to implement peer education, with monthly thematic activities such as knowledge lectures and patient exchange meetings to improve the doctor-patient relationship in continuing care outside the hospital, further inducing changes in patient behavior under internal and external information stimulation, enhancing patients' rehabilitation training awareness and treatment compliance, thereby reducing cancer-related fatigue.

Nausea and Vomiting: Chemotherapy-induced nausea and vomiting (CINV) is one of the most common symptoms in chemotherapy and the most feared subjective experience for chemotherapy patients, with an incidence rate exceeding 70%. Alqadire' s research demonstrated that eHealth-based self-management can effectively improve cancer-related fatigue, self-efficacy, and quality of life in cancer patients, highlighting the broader potential of these interventions.

Palliative Care Management: Palliative care is a special type of patient- and family-centered health care that emphasizes effective management of symptoms such as pain and depression, and provides psychosocial and spiritual care that meets the needs, values, beliefs, and cultural backgrounds of patients and their families. Most people receiving palliative care express their preference to die at

home, and the important role of family caregivers in helping manage chronic diseases and providing palliative care is widely recognized. It is necessary to support family caregivers by providing evidence-based interventions and services that meet their needs. Demiris et al. collaborated with medical staff and patients to develop an evidence-based palliative care website, identifying palliative care needs and training programs for family caregivers, with core content including: overview of palliative care, self-care, family support, advance care planning, legal affairs and funeral arrangements, and grief counseling. The website was launched in May 2017 and has provided services to over 1,000 people. e-Health is not only used for palliative care guidance for patients and supporters but also for evaluating the quality of remote medical care. Demiris et al. evaluated the quality and effectiveness of remote medical mutual aid groups in hospice environments through recorded web video conferences, ensuring communication quality through video media and continuous improvement of technical quality for remote medical group meetings.

Adherence Management: Patients' medical compliance behavior after discharge directly affects treatment adherence. Xu et al. used the WeChat platform to intervene in medication adherence of discharged cancer pain patients, providing targeted health education on cancer pain-related concepts, medication methods and precautions, non-pharmacological treatment methods, medication guidance, dietary guidance, and regular follow-up visits. The results showed that the observation group' s treatment compliance was significantly higher than the control group. Liu et al. established a WeChat public account to regularly push popular science articles and videos, held online telephone conferences, and in later follow-ups understood patients' mastery of knowledge, providing professional, personalized, and comprehensive answers or suggestions. The results showed that the observation group patients had higher pain self-efficacy and medication adherence than the control group. Compliance behavior is mainly reflected in medication adherence, outpatient follow-up accuracy, and rehabilitation exercise. e-Health enables patients to more effectively master medical consultation, accurately receive follow-up reminders, and promote the development and implementation of continuing care.

4. Problems and Prospects

Improving Construction Mechanisms to Ensure Patient Safety: Currently, e-Health mainly focuses on symptom management, health education, and catheter maintenance in continuing care for home-based malignant tumor patients. Most applications are used among patients in single departments, with small audience coverage and single types, lacking relevant legal supervision, and with relatively ambiguous charging standards, mainly concentrated on WeChat platforms and mobile applications. We recommend improving construction mechanisms, reviewing the effectiveness and safety of applications, strengthening Internet security training for medical staff, enhancing professional knowledge and skills, and preventing medical safety risks. Clinically, publicity

efforts should be increased to improve public awareness of medical health networks, ensure patient privacy and safety; we recommend increasing research on promoting factors and barriers to mobile health to ensure its effectiveness and sustainability.

Developing Evaluation Standards and Methods Based on Evidence: e-Health applications on the market should adopt unified evaluation standards to systematically assess their content and design quality. Future research should use mixed evaluation methods with multidimensional comprehensive goals, focusing on user evaluation, behavior, and subjective experience. Currently, there are no comprehensive and effective standards or guidelines to evaluate their credibility. Patients and clinical medical staff should use electronic health technology cautiously, evaluating whether content follows standards and the latest evidence-based guidelines. Using applications with imperfect quality standards poses risks and may lead to adverse consequences for patient health, affecting the effectiveness of interventions for health problems.

Strengthening Multidisciplinary Cooperation to Promote Refined Management: e-Health intervention research mostly focuses on single diseases or a class of symptoms, yet cancer patients often experience multiple coexisting symptoms. Therefore, we recommend developing symptom cluster intervention-centered, multidimensional, full lifecycle management strategies, fully utilizing network platform advantages to assist in improving patients' self-management abilities, reducing disease symptoms, and promoting refined patient care.

e-Health intervention is an inevitable trend in information technology development. Although its development still needs optimization and improvement, e-Health has shown good application prospects in self-management of patients with hematological malignancies. With the continuous increase in demands from hematological malignancy patients, especially survivors, we recommend that future research improve e-Health devices according to user needs and experiences, applying them in areas such as compliance management, continuing care, management models, and patient physical and mental health for hematological malignancies, helping patients improve their quality of life and providing exquisite nursing technology and quality nursing services for patients with hematological malignancies.

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Note: Figure translations are in progress. See original paper for figures.