Research Advances on mHealth Apps for Health Management Intervention in Cancer Patients: Postprint

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Abstract

Cancers exhibit heterogeneous natures and types, involving different tissues and organs, constituting the most common cause of human mortality and severely affecting patients' quality of life. Mobile health refers to the comprehensive utilization of mobile internet communication technologies to provide health management services including physical examination, health care, disease assessment, medical treatment, and rehabilitation. This study introduces the relevant concepts and current development status of mobile health applications, elaborates on the role of mobile health applications for cancer patients, and aims to provide a reference basis for the application of mobile health applications among cancer patients in China.

Full Text

Research Progress on Mobile Health App Interventions in Cancer Patient Health Management

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Abstract

Cancers, with their diverse nature and types affecting various tissues and organs, represent the most common cause of death worldwide and severely impact patients' quality of life. Mobile health (mHealth) leverages mobile internet

communication technology to provide comprehensive health management services including physical examinations, healthcare, disease assessment, medical treatment, and rehabilitation. This study introduces the relevant concepts and current development status of mobile health applications (Apps), and elaborates on their role in cancer patient management, aiming to provide a reference basis for the application of mobile health Apps among cancer patients in China.

Keywords: mobile health; App; cancer; health management; internet

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1. Overview of Mobile Health Apps

Mobile health (mHealth) is defined as the provision of healthcare information or services through mobile communication devices, demonstrating positive effects in improving various health outcomes for patients. Mobile health Apps represent the primary form of mHealth. The U.S. Food and Drug Administration defines mobile health Apps as healthcare-related software on mobile communication platforms. These Apps are health management platforms that use smart devices as terminals and mobile communication technology as the foundation to serve both patients and healthcare providers. They support multiple formats including audio, video, and images, enabling both delivery of disease management and education knowledge to patients and assistance for nursing staff in completing care tasks.

2. Application Scope of Mobile Health Apps in Cancer Patient Health Management

2.1 Treatment Adherence Studies show considerable variation in oral chemotherapy adherence among cancer patients, with overall medication adherence rates varying significantly across different tumor types. Krok-Schoen et al. conducted a study using mobile health Apps with breast cancer survivors, employing daily text message reminders and weekly interactive surveys for several months, resulting in significant improvements in self-reported medication adherence. Lawitschka et al. utilized INTERACCT for adolescents, surveying user satisfaction, acceptability, and suggestions for App improvement. Continuous use of INTERACCT for health data reporting over consecutive days demonstrated superior quality in self-reported medical data adherence compared to traditional paper-and-pencil assessments. While foreign research on mobile health Apps and cancer patient adherence is extensive, domestic research remains limited and in its exploratory stage. Therefore, the impact of mobile health Apps on adherence in Chinese populations requires further multi-center, large-sample studies.

2.2 Anxiety and Depression Anxiety and depression represent the most common emotional disorders among cancer patients. Chow et al. conducted a pilot pre-post study in the United States using mental health Apps with

breast cancer patients, finding significant reductions in both depression and anxiety symptoms. Park et al. implemented a mobile phone-based pulmonary rehabilitation program for chemotherapy-treated patients with advanced lung cancer, reporting significant improvements in depression and anxiety following the intervention. Psychological distress remains a primary concern for female cancer survivors. Chow et al. used iCanThrive to intervene with female cancer survivors, observing significantly reduced depression and sleep disorder symptoms post-intervention. Domestic scholar Yu Jing applied cognitive behavioral therapy combined with a mobile phone App for breast cancer patients during chemotherapy intervals, with the observation group receiving meditation App interventions for minutes per session continuously, demonstrating effective relief of anticipatory grief and improved quality of life. Although mobile health Apps show effectiveness in improving anxiety and depression among cancer patients, timely assessment of these conditions remains necessary, with professional psychological therapy provided when required.

2.3 Cancer-Related Fatigue The U.S. National Comprehensive Cancer Network (NCCN) published guidelines defining cancer-related fatigue (CRF) as a persistent, distressing, subjective sense of tiredness or exhaustion related to cancer treatment, often accompanied by functional impairment. CRF occurs in a substantial proportion of cancer patients. Spahrkas et al. recruited cancer patients from Australia, Canada, the United Kingdom, and the United States who experienced moderate to severe fatigue on social media, providing a self-management program through the Unteal App. After weeks of intervention, they assessed Unteal' s impact on cancer-related fatigue. Huberty et al. conducted a study with myeloproliferative neoplasm (MPN) patients, who performed daily minute-long mobile phone-based meditation sessions. Post-intervention, MPN patients considered the mobile meditation an enjoyable and calming application that improved fatigue. Napoles et al. implemented a month-long intervention with breast cancer patients using bilingual survivorship care plans, booklets, a Spanish-language mobile App with integrated activity trackers, and telephone coaching, resulting in significant fatigue improvement after two months. In summary, mobile health Apps demonstrate good applicability across different populations in improving fatigue conditions, though validation studies in Chinese populations are needed.

2.4 Anticipatory Grief Anticipatory grief generates negative emotions that, if untreated, may impede anti-cancer decision-making, reduce treatment adherence, and prolong disease recovery. Wang Dandan et al. randomized lung cancer patients into two groups, with the control group receiving routine nursing care and the intervention group additionally receiving meditation practice via a mobile App. The intervention effectively alleviated anticipatory grief and improved quality of life. In conclusion, mobile health Apps can effectively mitigate anticipatory grief, though this study had a small sample size limited to lung cancer patients, necessitating further multi-disease, large-sample, multi-center

research.

2.5 Pain Management The International Association for the Study of Pain defines pain as an unpleasant sensory and emotional experience associated with actual or potential tissue damage. The incidence of cancer pain increases among discharged patients, distinguishing cancer-related pain from that experienced by non-malignant patients. Yang et al. recruited cancer pain patients in Fujian, randomizing them into a Pain Guard App nursing intervention group or a traditional pharmaceutical care control group. After weeks, the experimental group showed significantly higher pain relief rates, demonstrating that Pain Guard App is effective, operable, and acceptable for post-discharge cancer pain management. Somers et al. recruited breast, lung, prostate, or colorectal cancer patients, implementing a four-session pain coping skills training intervention using mHealth technology. Significant differences were observed pre- and post-intervention in pain, physical symptoms, psychological distress, and pain catastrophizing. Smith et al. randomized adult breast cancer survivors with chronic pain into a ReImagine App intervention group or routine care group. After weeks, ReImagine showed impact on fatigue symptoms among breast cancer survivors, suggesting it may be a feasible and effective alternative to face-to-face support. Sun et al. recruited cancer pain symptom patients, randomizing them into trial and control groups. The trial group received intervention through an intelligent pain management system, with data collection showing significantly lower average pain scores and improved pain management knowledge scores after days compared to the control group. In summary, both domestic and international applications of mobile health Apps in cancer pain management have achieved positive results, effectively relieving pain severity and improving pain management capabilities.

2.6 Health Education Health education is an indispensable component throughout patient treatment. Lee et al. conducted a randomized controlled trial with Korean American breast cancer patients, where the intervention group received culturally and personally tailored multilevel multimedia health education information through a mobile App and health navigation services, while the control group received printed booklets. After months, the intervention group showed significant changes in breast cancer knowledge and screening guideline scores. Domestic scholar Zeng Jindan et al. recruited rectal cancer patients with preventive stomas, dividing them into observation and control groups. The observation group received additional mobile health education beyond routine care, demonstrating significantly higher mastery of stoma-related knowledge, skills, and adaptability after months. Sun Lin et al. recruited rectal cancer patients with preventive stomas, with the observation group combining a mobile health education platform with routine education and telephone follow-up. At months post-discharge, the observation group scored higher in health knowledge, beliefs, and behaviors related to stoma care. While domestic mobile health App research in health education is extensive,

future applications should expand to other clinical areas, providing a novel approach to health education.

2.7 Quality of Life Quality of life has gradually gained clinical attention as an important indicator for evaluating treatment and rehabilitation. Kim et al. randomized Korean women with metastatic breast cancer planning cytotoxic chemotherapy into a mobile game group or routine education group. After weeks of prospective follow-up, the mobile game education proved more effective in patient education and quality of life improvement. Dong et al. conducted a randomized controlled trial in Jinan, where the intervention group' s exercise program included achieving step goals through a mobile phone step-recording App with weekly video-guided individual muscle training sessions and daily social media interactions. After weeks, the combined internet and social media-based exercise intervention significantly improved quality of life for postoperative breast cancer patients. Zhu et al. implemented a multicenter, single-blind, randomized controlled trial with breast cancer patients beginning chemotherapy and using mobile internet, randomizing them into intervention and control groups. The intervention group received a breast cancer e-support program in addition to usual care, with weeks of intervention significantly improving quality of life during chemotherapy. Li Yuhong et al. used convenience sampling for breast cancer patients in Zhengzhou, with the intervention group receiving case management via mobile App for postoperative functional exercises. After months of follow-up, the intervention group demonstrated superior quality of life compared to the control group. In summary, domestic research on mobile health Apps' impact on quality of life is extensive but primarily concentrated on breast cancer patients, lacking studies on other cancer types.

2.8 Dietary Management Catabolism and tumor-specific treatments lead to reduced nutritional intake and weight loss in cancer patients, making maintenance of specific personalized diets challenging. Orlemann et al. studied cancer patients receiving nutritional review, analysis, and counseling, with the intervention group using the OncoFood App. After weeks, the App group showed significant weight gain. Li Yao et al. divided head and neck tumor radiotherapy patients into groups based on admission order, with the experimental group receiving dietary management via mobile App. After weeks and post-intervention, the mobile App dietary management effectively increased energy and protein intake, optimized dietary structure, and reduced treatment interruption rates. Zhang Ying et al. recruited esophageal cancer patients undergoing radical surgery, with the intervention group receiving dietary management via mobile App combined with routine care. Preoperative intervention results showed the intervention group had higher energy and protein intake and higher albumin levels than the control group. In summary, mobile health Apps can improve dietary management capabilities in cancer patients, though these studies had small sample sizes requiring further large-sample research.

2.9 Physical Activity Health behaviors among cancer survivors can improve long-term health outcomes. Quintiliani et al. conducted a pilot feasibility test with overweight female breast cancer survivors using a mobile health-supported behavioral counseling intervention. After weeks of intervention using daily text messages for self-monitoring dietary behaviors and wireless devices for automatic weight and step tracking, participants self-reported increased physical activity. Delrieu et al. performed a single-center, single-arm trial with breast cancer patients using Nokia Go for an unsupervised, personalized physical activity program over months, assessing the impact on physical activity. Phillips et al. explored a technology-supported physical activity intervention for breast cancer survivors using a Fitbit and standard self-monitoring Fit Thrive application, aiming to develop more scalable and effective physical activity interventions. Currently, research on mobile health Apps' impact on physical activity requires more specific data to demonstrate effectiveness.

3. Problems and Recommendations in Mobile Health App Application for Cancer Patients

The primary advantage of mobile health Apps is convenient information access for patients, which requires applications to be easy to operate with simple and diverse information delivery formats to meet different population preferences. Statistics indicate that cancer incidence in China is trending toward younger ages, particularly among women. Generally, cancer patients tend to be older. Influenced by traditional concepts and disease-related stigma, cancer patients are often unwilling to express their emotions or cooperate with interventions. Additionally, varying education levels and acceptance result in insufficient understanding of rapidly developing mobile health Apps. Furthermore, treatment side effects lead to declining physical function, creating barriers to mobile health App usage. Therefore, mobile health Apps designed for cancer patients should be simple with clean interfaces to avoid resistance caused by complex operations. Secondly, mobile health App operation may rely on individual data or wireless networks, raising concerns about data costs and personal information leakage. Thus, constructing free and secure mobile health Apps is particularly important.

In recent years, the internet has become the fastest-growing information technology with the greatest market potential. Beyond mobile health Apps, the development of the Internet of Things has made wearable devices a clinical focus. How to integrate mobile Apps, mobile internet technology, and wearable devices for application in cancer patients warrants careful consideration, and nursing based on this integration will undoubtedly demonstrate tremendous potential.

4. Summary

Mobile health Apps can improve health outcomes to varying degrees, enhance treatment efficacy and nursing service quality, and reduce nursing costs. How-

ever, current research has several limitations: small sample sizes, concentration on specific cancer types (particularly breast cancer), and insufficient validation in Chinese populations. Future research should expand to multi-center, large-sample studies across diverse cancer types, while addressing challenges related to usability, accessibility, data security, and integration with emerging technologies.

Conflict of Interest Statement: The authors declare no conflict of interest.

References

[1] SUNG H, FERLAY J, SIEGEL R L, et al. Global cancer statistics: GLOBOCAN estimates of incidence and mortality worldwide for countries[J]. CA Cancer J Clin, .

[2] LEE H E, GHEBRE R, LE C, et al. Mobile phone multilevel and multimedia messaging intervention for breast cancer screening: pilot randomized controlled trial[J]. JMIR Mhealth Uhealth, .

[3] WANG D, NI C P, PAN Y L. Application of the mobile medical Apps in diabetes diet management in community: a review[J]. J Nurs Sci, . (in Chinese)

[4] WANG Y L, LIU Q, WANG Y Q, et al. Application status quo of mobile health APP in self-management of cancer patients[J]. Chin Gen Pract Nurs, . (in Chinese)

[5] CHEN Y L, ZHANG M F, QIN H Y. Oral chemotherapy adherence in cancer patients[J]. Chin J Pract Nurs, . (in Chinese)

[6] KROK-SCHOEN J L, NAUGHTON M J, YOUNG G S, et al. Increasing adherence to adjuvant hormone therapy among patients with breast cancer: a smart phone app-based pilot study[J]. Cancer Control, .

[7] LAWITSCHKA A, BUEHRER S, BAUER D, et al. A web-based mobile app (INTERACCT app) for adolescents undergoing cancer and hematopoietic stem cell transplantation aftercare to improve the quality of medical information for clinicians: observational study[J]. JMIR Mhealth Uhealth, .

[8] ZHANG X Y, ZHANG L Y. Nursing intervention for emotional freedom techniques: a literature review[J]. Mod Clin Nurs, . (in Chinese)

[9] CHOW P I, SHOWALTER S L, GERBER M, et al. Use of mental health apps by patients with breast cancer in the United States: pilot pre-post study[J]. JMIR Cancer, .

[10] PARK S, KIM J Y, LEE J C, et al. Mobile phone app-based pulmonary rehabilitation for chemotherapy-treated patients with advanced lung cancer: pilot study[J]. JMIR Mhealth Uhealth, .

[11] CHOW P I, DRAGO F, KENNEDY E M, et al. A novel mobile phone app intervention with phone coaching to reduce symptoms of depression in survivors of women' s cancer: pre-post pilot study[J]. JMIR Cancer, .

[12] WANG D D, ZHENG W, SHI Y P, et al. Effect of meditation practice based on mobile APP on improving the preparatory sadness of lung cancer patients[J]. Chin Nurs Res, . (in Chinese)

[13] YU J. Application of cognitive behavioral therapy combined with mobile phone APP in patients with intermittent chemotherapy after breast cancer surgery[J]. Henan Med Res, . (in Chinese)

[14] SWARM R A, PAICE J A, ANGHELESCU D L, et al. Adult cancer pain, version , NCCN clinical practice guidelines in oncology[J]. J Natl Compr Canc Netw, .

[15] YANG J, WENG L Z, CHEN Z K, et al. Development and testing of a mobile app for pain management among cancer patients discharged from hospital treatment: randomized controlled trial[J]. JMIR Mhealth Uhealth, .

[16] SOMERS T J, ABERNETHY A P, EDMOND S N, et al. A pilot study of a mobile health pain coping skills training protocol for patients with persistent cancer pain[J]. J Pain Symptom Manag, .

[17] SPAHRKÄS S S, LOOIJMANS A, SANDERMAN R, et al. Beating cancer-related fatigue with the untire mobile app: protocol for a waiting list randomized controlled trial[J]. JMIR Res Protoc, .

[18] HUBERTY J, ECKERT R, LARKEY L, et al. Experiences of using a consumer-based mobile meditation app to improve fatigue in myeloproliferative patients: qualitative study[J]. JMIR Cancer, .

[19] NÁPOLES A M, SANTOYO-OLSSON J, CHACÓN L, et al. Feasibility of a mobile phone app and telephone coaching survivorship care planning program among Spanish-speaking breast cancer survivors[J]. JMIR Cancer, .

[20] SMITH S K, MACDERMOTT K, AMARASEKARA S, et al. Reimagine: a randomized controlled trial of an online, symptom self-management curriculum among breast cancer survivors[J]. Support Care Cancer, .

[21] SUN Y H, JIANG F, GU J J, et al. Development and testing of an intelligent pain management system (IPMS) on mobile phones through a randomized trial among Chinese cancer patients: a new approach in cancer pain management[J]. JMIR Mhealth Uhealth, .

[22] ZENG J D, YANG Y X, ZHAO M H. Effect analysis of mobile health education in preventive colostomy for rectal cancer[J]. Chin J Urban Rural Enterp Hyg, . (in Chinese)

[23] WANG L, LIU B X, WANG H. Application of mobile health education platform in continuing nursing care of patients with rectal cancer undergoing preventive ostomy[J]. World Healthy Living, . (in Chinese)

[24] ZHANG Y, SHENG Y. The level and influence factors of the health-related quality of life in children with bone tumors[J]. Chin J Nurs, . (in Chinese)

[25] ORLEMANN T, RELJIC D, ZENKER B, et al. A novel mobile phone app (OncoFood) to record and optimize the dietary behavior of oncologic patients: pilot study[J]. JMIR Cancer, .

[26] LI Y, ZHANG W G, WANG D H, et al. Application effect of diet management based on mobile phone APP in patients with head and neck tumor undergoing radiotherapy[J]. Chin Nurs Res, . (in Chinese)

[27] ZHANG Y, LU H Y, ZHOU Y, et al. Effect of dietary management based on mobile phone APP on preoperative nutritional conditions of patients with esophageal cancer[J]. Mod Clin Nurs, . (in Chinese)

[28] LIANG Y P, SHI R C, CHEN Y, et al. Study on multi-directional continuous nursing to improve the quality of life of patients with cancer pain after discharge[J]. Today Nurse, . (in Chinese)

[29] KIM H J, KIM S M, SHIN H, et al. A mobile game for patients with breast cancer for chemotherapy self-management and quality-of-life improvement: randomized controlled trial[J]. J Med Internet Res, .

[30] DONG X S, YI X R, HUANG S Y, et al. The effects of combined exercise intervention based on Internet and social media software for postoperative patients with breast cancer: study protocol for a randomized controlled trial[J]. Trials, .

[31] ZHU J M, EBERT L, LIU X Y, et al. Mobile breast cancer e-support program for Chinese women with breast cancer undergoing chemotherapy (part): multicenter randomized controlled trial[J]. JMIR Mhealth Uhealth, .

[32] LI Y H, LI L, LIU A B, et al. Application of mobile-app-based case management in postoperative functional rehabilitation among breast cancer patients[J]. Chin J Mod Nurs, . (in Chinese)

[33] QUINTILIANI L M, MANN D M, PUPUTTI M, et al. Pilot and feasibility test of a mobile health-supported behavioral counseling intervention for weight management among breast cancer survivors[J]. JMIR Cancer, .

[34] DELRIEU L, PEROL O, FERVERS B, et al. A personalized physical activity program with activity trackers and a mobile phone app for patients with metastatic breast cancer: protocol for a single-arm feasibility trial[J]. JMIR Res Protoc, .

[35] PHILLIPS S M, COLLINS L M, PENEDO F J, et al. Optimization of a technology-supported physical activity intervention for breast cancer survivors: Fit2Thrive study protocol[J]. Contemp Clin Trials, .

[36] ZHENG R S, GU X Y, LI X T, et al. Analysis of cancer incidence trend and age change in China cancer registration area from [J]. Chin J Prev Med, . (in Chinese)

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