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Research Article

Keywords: Breast cancer, Rehabilitation, Usability evaluation, Mobile healthcare

Posted Date: July 16th, 2025

DOI: https://doi.org/10.21203/rs.3.rs-6937483/v1

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Additional Declarations: No competing interests reported.

Usability Evaluation of an Incentive-Based Home Mobile Rehabilitation Platform for Breast Cancer Patients

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Acknowledgments

We sincerely thank the university-level research fund for providing financial support of 10,000 CNY, which was utilized for expert consultation fees, meeting expenses, materials, and video production. We also gratefully acknowledge the partial funding of the 2023 Major Scientific Research Project for High-level Health and Medical Talents in Hunan Province project, which was primarily allocated for meeting expenses. This support was instrumental in facilitating the completion of this research.

Abstract:

Objective: To evaluate the usability of the home rehabilitation platform V1.0 for breast cancer patients and their experience using the platform.

Methods: Twelve breast cancer patients who visited a tertiary hospital in Hunan Province in March 2024 were selected. The participants used the rehabilitation platform under the guidance of researchers and had a two-week trial experience. After two weeks, the usability of the platform was evaluated through a usability questionnaire and semi-structured interviews to investigate the participants' experience.

Results: The usability questionnaire score was 74.167±7.915. The participants showed an acceptable

attitude towards the usability of the platform, with an overall positive experience. At the same time, they provided targeted improvement suggestions during the process of obtaining beneficial experiences.

Conclusion: The usability evaluation results of the home mobile rehabilitation platform for breast cancer show that the V1.0 version is acceptable and has good usability.

Clinical trial number: not applicable

Keywords: Breast cancer; Rehabilitation; Usability evaluation; Mobile healthcare

1. Introduction

According to the latest global cancer statistics report 2022 released by the International Agency for Research on Cancer (IARC) of the World Health Organization (WHO), breast cancer is still a major threat to women's healthçwith a total of 2,297,000 new breast cancers in the world in 2022, which is ranked the 2nd among all cancers in the whole population and the 1st among all cancers in the female population, accounting for 23% of the global female cancer incidence. In 2022, the total number of new breast cancers in China was 2.297 million, ranking the 6th among all cancers in the population and the 2nd among all cancers in the female population, accounting for 15.6% of all cancers in Chinese females, and 15.5% of all cancers in females globally[1], with the continuous improvement of medical technology, the diagnosis and treatment of breast cancer have been improved year by year, and the 5-year survival rate of early to mid-stage breast cancer in China has been as high as 82%[2]，prolonged survival means that the focus of breast cancer attention gradually shifts from treatment to improving the patient's long-term quality of life, and often, due to the lack of medical knowledge and interruption of healthcare resources, the patient's level of attention and control of his/her own disease decreases after discharge from the hospital, which leads to the patient difficulty in managing the disease and the range of psychological and physical complications it brings[3,4,5,6,7].As a product of the intelligent era, mobile health (mHealth) is a brand-new medical service model that integrates advanced information technology, network communication, artificial intelligence and big data analysis to provide more convenient, efficient and personalized medical services. mHealth has made significant breakthroughs in the fields of disease prevention, disease monitoring, self-management of chronic diseases, treatment compliance and health promotion[8]. For breast cancer patients undergoing home rehabilitation, it breaks down the medical information

barriers after discharge, and can better assist patients in professional medical rehabilitation management, thereby improving the quality of life of patients, reducing the rate of readmission and time and economic costs[9,10,11]. In the early stage of the project, the research team adopted the "user-centered" design principle, focusing on the needs of breast cancer patients in self-management and rehabilitation, and initially designed and developed the "Breast Cancer Home Mobile Rehabilitation Platform V1.0" based on WeChat (hereinafter referred to as the rehabilitation platform V1.0). This study aims to conduct a usability evaluation of the rehabilitation platform V1.0 to explore the overall level of user convenience in using the platform.

2. Materials and Methods

2.1 Participants

Participants were selected using purposive sampling from patients who visited the breast department of a tertiary hospital in Hunan Province in March 2024. (1) Inclusion criteria: ① Diagnosed with breast cancer; ② Age ≥ 18 years old; ③ Clear understanding of their condition and willing to participate in the study; ④ Possessing a smart phone and proficient in using WeChat, with good communication and comprehension skills. (2) Exclusion criteria: ① Having other life-threatening diseases; ② Inability to cooperate. The sample size was determined based on the principle of data saturation, with saturation achieved when no new opinions emerged[12].

2.2 Research Methods and Implementation Process

The usability evaluation of the patients was conducted through a combination of scale surveys and qualitative interviews. The researchers thoroughly explained the research purpose and implementation details to the participants to ensure their full understanding of the research content and their voluntary participation. The researchers further provided a comprehensive introduction to the operation process of the platform and offered necessary technical support to start a two-week trial and experience period. During the trial, participants could freely explore the functions of the rehabilitation platform V1.0. If any questions arose, they could contact the researchers at any time for answers and professional guidance.

2.3 Research Procedure

The mobile rehabilitation platform for breast cancer patients' self-management, "Integrated Traditional Chinese and Western Medicine Home Rehabilitation Platform for Breast Cancer V1.0":

Based on Orem's self-care theory and user-centered design methods, the research team focused

on the self-management of breast cancer patients, paying attention to their individualized rehabilitation needs, and clearly defined the diagnosis and treatment assessment approach guided by TCM syndrome differentiation. The platform was initially developed with two core paths: integrated TCM and Western medicine rehabilitation management and a daily check-in incentive mechanism, combined with a multidisciplinary team approach. The main modules of the trial version of the rehabilitation platform V1.0 are shown in Figures 2-1, 2-2, 2-3, 2-4, 2-5, and 2-6. The rehabilitation platform V1.0 mainly consists of information collection, rehabilitation plan, and nurse home service sections. The rehabilitation content section includes daily check-in tasks such as arm rehabilitation exercises, auricular point massage, ginger-separated moxibustion, and post-meal walking rehabilitation. The specific sections are as follows: (1) Information collection: name, age, surgery time, whether a venous catheter is retained, living symptoms, and tongue coating photos (including TCM syndrome differentiation items); (2)Analysis report: analysis results, knowledge popularization, etc.; (3) Rehabilitation plan: arm rehabilitation exercises, auricular point massage, ginger-separated moxibustion, post-meal walking rehabilitation, etc. Patients can check in and follow the exercises based on their actual completion and fill in feedback. To enhance patients' adherence and frequency of using the platform, the management model integrates a "daily check-in" list of rehabilitation tasks, supervision by management personnel, and support from patient groups to strengthen patients' self-management willingness and behavior. Compared with other breast cancer management apps, this platform has significant TCM characteristics. The TCM and Western medicine integrated rehabilitation plan on the platform follows an individualized rehabilitation path based on TCM syndrome differentiation: through intelligent data analysis combined with TCM experts' syndrome differentiation, personalized rehabilitation plans are tailored for patients with different syndromes, and their rehabilitation execution is monitored and adjusted in real time. The rehabilitation plan is centered on the concept of "preventing disease before it occurs", aiming to stabilize the patient's condition, enhance their own vital energy, and facilitate their return to normal life. On this basis, it also takes into account the possible adverse symptoms that patients may experience after treatment. It provides rehabilitation strategies for patients based on their adverse symptoms, helping them better manage their symptoms and prevent the deterioration of their condition, thereby maintaining and improving their quality of life.

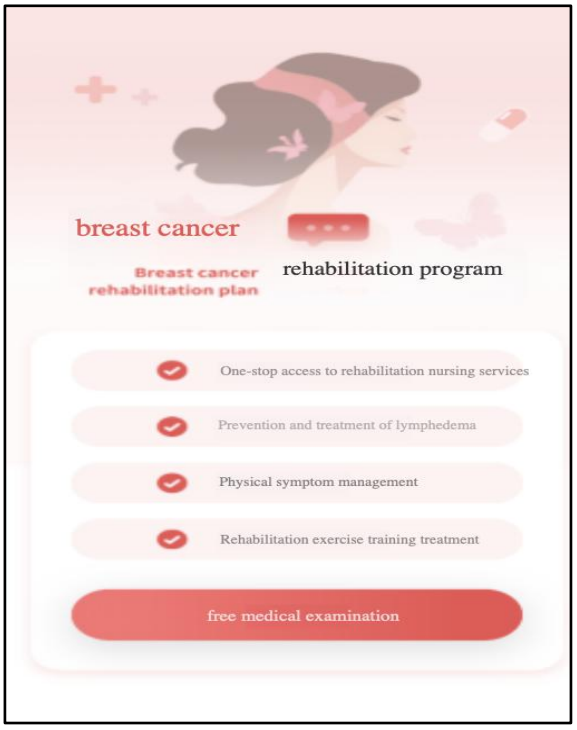


Figure 2-1 Main interface of the rehabilitation platform V1.0

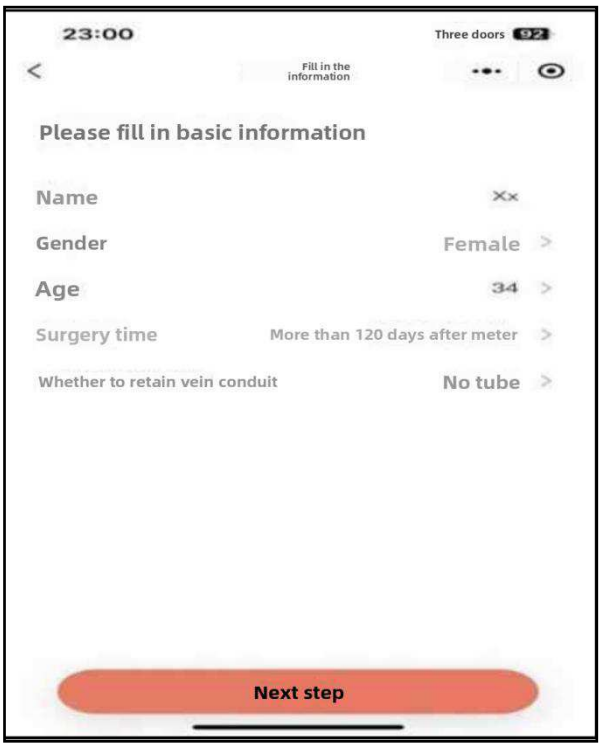


Figure 2-2 Information Collection Interface of the rehabilitation platform V1.0

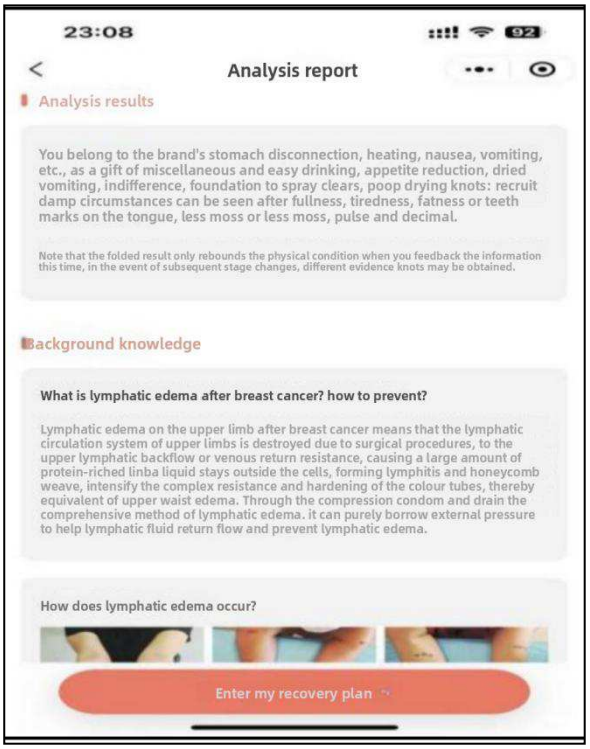


Figure 2-3: Analysis Report Section of the Rehabilitation Platform V1.0

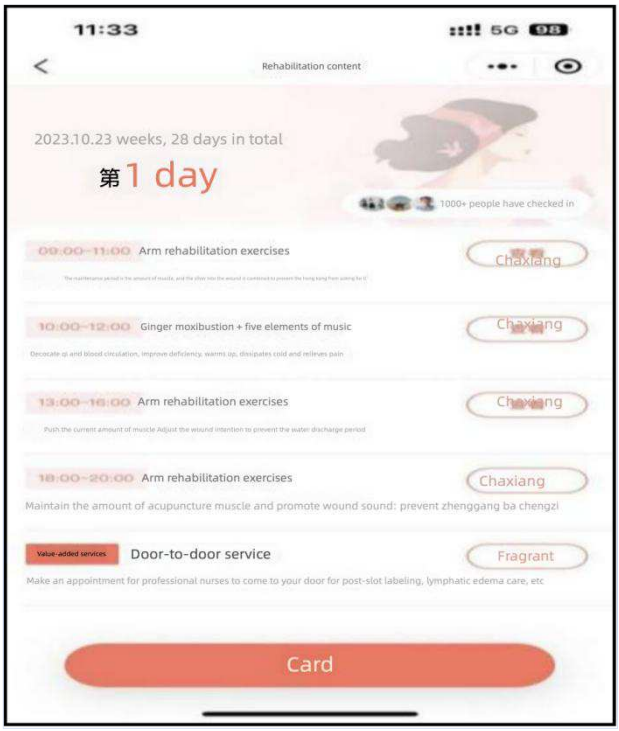


Figure 2-4 Rehabilitation Platform V1.0 Rehabilitation Plan Section

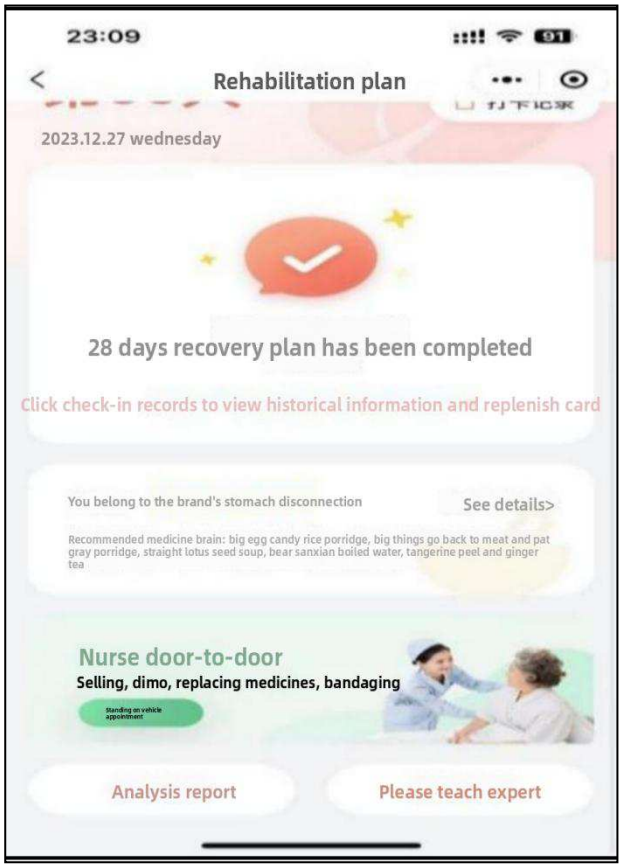


Figure 2-5 Check-in completion interface

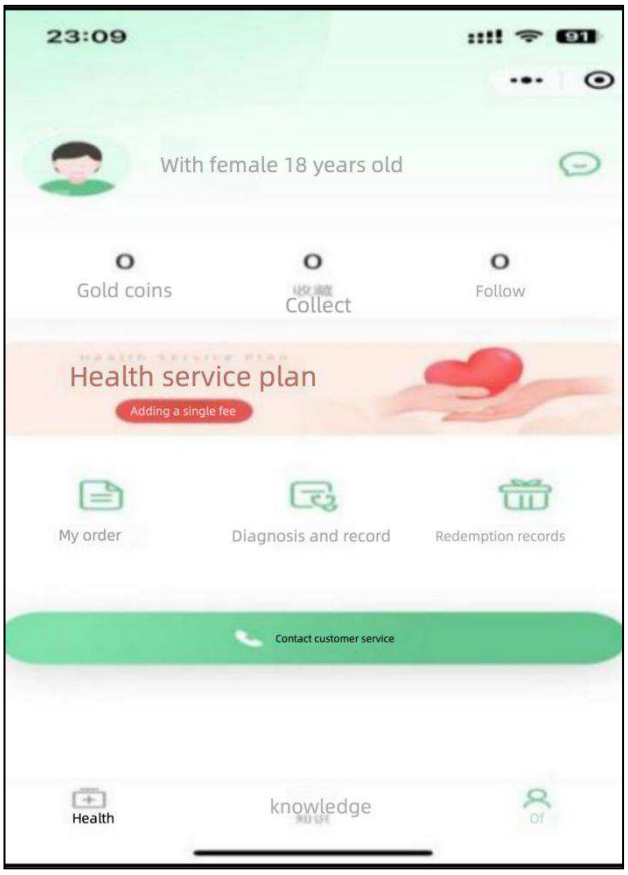


Figure 2-6 Personal Information Interface

2.4 Research Tools and Evaluation Indicators

2.4.1 System Availability Scale

The System Availability Scale (SUS) is a usability evaluation tool developed by Brooke[13]. This scale consists of 10 items, including two dimensions: usability and learnability. The higher the score, the better the usability, a score below 68.0 indicates problems with usability. The overall reliability of the scale is 0.91[14].In this study, this scale is mainly used to reflect the overall user experience of mini-programs.

2.4.2 Patient Experience

Conduct semi-structured online or offline interviews with the research subjects to understand their experience of using the platform. The researchers recorded the patients' suggestions and confirmed them with the patients on the spot. The interview lasted for 20 to 30 minutes. Before the interview, the researcher will introduce themselves, explain the purpose of the interview and obtain the patient's consent. Another researcher was responsible for observing, recording and audio

recording. After the interview, recheck the interview content with the patient according to the outline. The interview outline is as follows:

(1) How does using this platform affect your self-management?

(2) How do you feel when using this platform?

(3) What changes have been brought to you after using this platform?

(4) What beneficial experiences have been brought to you after using this platform?

(5) What shortcomings or inconveniences do you encounter after using this platform?

(6) What suggestions or expectations do you have for the improvement of this platform?

2.5 Data Analysis Methods

The data were sorted and analyzed using SPSS 27.0. Measurement data were expressed as mean and standard deviation, and count data were described as frequency and composition ratio. Qualitative data analysis was conducted using the Colaizzi seven-step analysis method in phenomenological research. Within 24 hours after the interview, the two researchers transcribed the audio materials and made detailed records of the non-verbal behaviors of the respondents. The data were analyzed by using the inductive content analysis method[15].

2.6 Research Results

2.6.1 General Information

Finally, 12 eligible patients were included. The general information of the research subjects is shown in Table 2-1.

Table 2-1 General Information Table of Patients Participating in the Evaluation

number	Age (years)	degree of education	marital status	Employment status
P 1	56	middle school	married	peasant
P 2	52	High school/vocational high school	married	Retired (resigned) personnel
P 3	39	undergraduate course	married	professional

number	Age (years)	degree of education	marital status	Employment status
P 4	53	College degree or above	married	Retired (leaving) personnel
P 5	42	College degree or above	married	staff and workers
P 6	40	College degree or above	married	professional
P 7	68	middle school	married	peasant
P 8	73	middle school	married	Retired (leaving) personnel
P 9	72	primary school	married	peasant
P 10	47	College degree or above	married	staff and workers
P11	57	High school or technical secondary school	married	professional
P12	62	primary school	married	worker

2.6.2 Survey questionnaire scores on system availability scale

The usability evaluation score for the mobile rehabilitation platform for breast cancer patients self-management was 74.167±7.915 points. A score above 68.0 indicates that the products usability is satisfactory. This suggests that most breast cancer patients find the V1.0 version of the rehabilitation platform acceptable, finding it easy to use, practical, and offering a positive overall experience. The platform has good usability.The scores of the System Availability Scale questionnaire and the scores of each item are shown in Table 2-2.

Table 2-2 Average score of each item and total score of usability questionnaire ($\bar{\chi}$±S)

Item content	Average score	Score the ranking
1. I think I would like to use this app frequently	4.42±0.515	1

2. I found the app unnecessarily complicated	2.67±0.778	7
3. I think the app is easy to use	4.17±0.577	3
4. I think I need professional technical support to use the app	2.92±0.669	6
5. I found that the different features of the app were well integrated	4.25±0.452	2
6. I think there are too many inconsistencies in this app	1.92±0.289	10
I think most people will learn to use the app very quickly	3.83±0.577	5
8. I think this app is very difficult to use	2.17±0.389	9
I feel very confident about using this app	4.08±0.669	4
10. I need to learn a lot before I can use this app	2.58±0.793	8

2.6.3 Patient experience

In terms of patient experience, the vast majority of patients have positively evaluated the convenience and practicality of the mobile rehabilitation platform for breast cancer patients. Positive experiences mainly stem from the platforms provision of scientific and beneficial health education, as well as timely reminders, which help enhance patients self-management skills and provide a platform and conditions for their self-management after discharge. Additionally, some patients reported that symptoms such as nausea and fatigue, which they previously experienced, have improved after following the platforms self-management plan. Most patients noted that the platform offers high-quality health education information, particularly beneficial for those with lower knowledge levels. However, some patients pointed out that the interface design of the rehabilitation platform V1.0 is relatively complex, and they hope the operation process can be simplified to reduce the user threshold and make it more convenient and user-friendly. Moreover, it is worth noting that the majority of breast cancer patients are elderly, and the platform should further improve its age-friendly design to better suit the needs of elderly patients, including adding voice navigation and larger font options to better adapt to their usage habits. These valuable feedbacks provide important

references for future platform optimization. User 2-week experience and issues feedbackFor details, see Table 2-3, Table 2-4 and Table 2-5.

Table 2-3 Beneficial experiences

Beneficial experience themes
convenient
P1: "In general, the software is very convenient to use."
P5: "Just open wechat and you can see it."
P6: "Listen to acupoint massage audio lessons during your commute, even on the subway."
P10: "The experience is good and the process is simple."
P11: "The software is very simple and easy to use. Someone taught me how to use it before."
Rich in medical knowledge
P2: "I think the content of this software is very good. It encourages patients to exercise by themselves, such as tai Chi and Baduanjin, which is good for their health."
P6: "There are videos and texts. I am very interested in TCM. There are a lot of relevant content about TCM in it. It is still ok to use it and I feel very professional."
P9: "I often read the medicinal food recommendations inside."
P10: "The safety tips and information in the ginger-separated moxibustion video are really useful."
P11: "A lot of TCM knowledge can be learned."
doing well
P1: "I do arm exercises and eight segments of jin every day. Now it is much easier to lift my hands."
P2: "After chemotherapy, I had nausea and vomiting. Then I did ear acupoint massage, which actually relieved me. I dont have to take antiemetic drugs all the time." "I used to forget to do rehabilitation exercises, but now I have a check-in task. No matter how busy I am, I have to move around. My arms are not so stiff anymore."
P3: "I do ear massage every day, and I feel refreshed after it."
P7: "The analysis report said that I was weak in qi and blood and told me to eat more dates. Indeed, I didnt feel dizzy so easily."

P10: "The analysis report marked the red" qi deficiency and blood stasis "diagnosis results, and compared with drinking astragalus porridge really relieved the fatigue."

Promote self-management

P2: "I used to forget to do the rehabilitation exercises, but now I have a check-in task. No matter how busy I am, I have to move around. My arms are not so stiff."

P4: "I used to think that rehabilitation was a doctors job, but now I can learn it with my mobile phone. It saves money and saves trouble."

P8: "You can check your progress every month."

P11: "I will stick to the content above every day."

P12: "I can see my exercise situation through this software. It feels quite practical."

Table 2-4 Patients adverse experiences

Negative experience themes
content
P1: "There are too many terms in TCM, which are not easy to understand. For example, the family should be assisted in moxibustion with ginger."
P3: "The same is true for the video of Ba Duan Jin. You can do it completely without stopping in the middle."
P7: "The explanation of western medical indicators in the analysis report is too professional to understand what it is."
design
P6: "The font can be set larger. When people get old, they cant see clearly and sometimes cant find the entrance to use it."
P10: "The word cancer in breast cancer looks a little irritating to me and makes me uncomfortable."
personal factors
P2: "I dont have much time. I usually take some courses at an old peoples university."
P6: "I dont have time to do this. I rarely use my mobile phone, but I can use it with the help of my

family."
P8: "I cant do it by myself, I have a poor memory, and I need help to do it. I dont use my mobile phone very often."

Table 2-5 Recommendations for patient improvement

Theme of the recommendation for improvement
P1: "There are fewer problems with the data filling there. There is too much time to fill it out."
P4: "Sometimes I feel my face is a little swollen and I want someone to help me look at it." "I hope I can communicate with the medical staff more easily."
P5: "Add intelligent reminders of complications, such as dietary restrictions for diabetics."
P6: "I hope this software can be more targeted. Or it can connect to the data of the sports bracelet and automatically calculate the calories burned for rehabilitation."
P8: "I would like to add an emergency call button to contact the community doctor directly."
P10: "I hope there is a platform to increase communication with patients."

2.6.4 Modify the list

Based on the results of the preliminary functional evaluation of the platform and patient feedback, the items and contents for improvement and optimization of the platform were identified, and a final modification list was formed, as shown in Table 2-6.

Table 2-6 List of modifications

Item content	Address the situation
1. Beautify the interface design and add the function of automatic font size adjustment	Resolved
2.Optimize doctor-patient communication function	Resolved
3.Simplify the operation process of patients and make it more simple	Resolved
4.Annotate professional terms (e.g. tumor location in information collection is presented in the form of a chart)	Resolved
5.Increase the number of user communication groups	Create a wechat group

6. Press the "Emergency Call" button to contact your community doctor	To be developed
7.Access the data of the sports bracelet to realize data interconnection and sharing	To be developed

2.7 Discussion

2.7.1 Beneficial effects of mobile rehabilitation platform on self-management of breast cancer patients

(1) User satisfaction and ease of operation

The WeChat platform boasts a vast user base and has relatively low hardware requirements, needing only a smartphone to access. Compared with other internet tools, WeChat not only offers lower costs and higher efficiency but also reaches a broader audience. According to a study by Jiang Yang et al[16] the intervention group used an Internet+ WeChat public platform disease management system to assist patients. The results showed that the exercise prescription based on Internet+ is convenient, intuitive, and highly operational, which helps improve the exercise compliance of breast cancer patients at home after surgery, the occurrence of related upper limb lymphedema, and shoulder joint mobility. The survey results indicate that breast cancer patients have a positive overall experience with the rehabilitation platform V1.0, particularly appreciating its ease of use and practical functions. This finding aligns with other studies [by other scholars][17] that highlight patients preference for tools that are easy to operate and offer personalized support. Patients noted that they can learn acupoint massage courses during their commute (as mentioned in P6: "I can listen to acupoint massage audio classes during my commute, even on the subway."). This suggests that the design of the rehabilitation platform V1.0 is well-suited to the daily routines of patients, enhancing the flexibility and convenience of using mobile medical apps.

(2) The richness and professionalism of medical knowledge

Research indicates that breast cancer patients require comprehensive support during their recovery, including disease knowledge, dietary advice, and psychological adjustment, among others[18]. The findings of this study show that the diverse medical knowledge content provided by the rehabilitation platform V1.0, including videos and text guidance, is generally rated as highly professional and practical by patients (as mentioned in P2, P6, and P10). This not only meets patients needs for health education but also boosts their confidence in self-management. By integrating these resources, the rehabilitation platform V1.0 has established a comprehensive health management

platform for patients. Moreover, the medical knowledge content on the platform is regularly updated to ensure patients can access the latest medical research and treatment options. This timely and professional information update further enhances patients trust and willingness to use the rehabilitation platform V1.0.

(3) Improvement of symptoms and quality of life

Full-cycle management, multi-level collaboration, and interdisciplinary cooperation are essential for the recovery of breast cancer patients. The V1.0 rehabilitation platform integrates resources from medical care, nursing, psychology, and other fields, forming a multi-level collaborative service system to ensure that patients receive comprehensive care throughout their recovery process. Moreover, the introduction of an interdisciplinary cooperation model enables doctors, nurses, and rehabilitation therapists to work closely together, jointly developing the best rehabilitation plan for patients. The qualitative research findings indicate that some patients have significantly improved postoperative discomfort symptoms (as described in P1, P2, P7, and P10) by using functions such as arm rehabilitation exercises and ear acupoint massage in the mini-program. This finding aligns with research conclusions that exercise and lifestyle interventions are significant for the recovery of breast cancer patients[19]. Additionally, the personalized analysis reports provided by the mini-program, such as Qi and Blood Deficiency and Liver Qi Stagnation TCM diagnostic results, offer targeted health management suggestions, which also help meet patients individualized health needs.

2.7.2 Improved strategies for breast cancer patients to use mobile rehabilitation platforms

(1) Age-appropriateness

The results of the seventh national population census show that the number of elderly women has increased to 20,544,000, which is 5,286,000 more than the number of elderly men. By 2021, the proportion of the population aged 65 and over had reached 14.2%, indicating that China has entered a deeply aging society[20]. In recent years, with the rapid aging process, the incidence of breast cancer among the elderly has been on the rise. However, in daily life, middle-aged and elderly people often lag behind other age groups in terms of their proficiency and learning ability when using mobile phones, computers, and application software. They often find new mobile medical platforms complex and unfriendly, leading to a widening digital divide for middle-aged and elderly patients[21]. In this study, about 66% of the participants were over 50 years old. The results indicate

that simpler, more convenient, and clearer operation procedures and interfaces are more easily accepted by elderly patients (as stated in P6: "The font can be set larger; some elderly people have difficulty reading and sometimes cannot find the entry points for use."). Additionally, due to the decline in vision, hearing, and other physiological functions, middle-aged and elderly breast cancer patients face challenges in reading screen information and understanding voice prompts. These factors collectively limit the effective use of mobile devices by middle-aged and elderly breast cancer patients.The rehabilitation platforms capability for postoperative recovery and self-health management is crucial[22]. Therefore, enhancing the mobile rehabilitation platforms age-friendliness, simplifying operational procedures, optimizing interface design, and improving the readability and listenability of information are essential for advancing the rehabilitation process of middle-aged and elderly breast cancer patients. Wang Xing et al[23]. found that the breakdown of social support is a significant barrier to the use of digital medical services among middle-aged and elderly patients, meaning that patients often struggle to receive timely assistance from family and society during critical medical visits. In this study, elderly breast cancer patients require help from researchers or their caregivers during both the login and operation stages of the V1.0 version of the rehabilitation platform. Based on these findings, the study recommends the following interventions: first, establishing a dual training mechanism for patients and their primary caregivers, providing systematic operational guidance to ensure the continuity and effectiveness of mobile medical applications; second, implementing a regular follow-up system to dynamically monitor patient experiences and actual needs. From a broader perspective, building an elderly social support network involving multiple stakeholders, including communities, families, medical institutions, and enterprises, is the fundamental approach to bridging the digital divide in elderly healthcare. Future research could focus on middle-aged and elderly usersThe internal demand characteristics; the formation mechanism of digital use disorders; the interaction of influencing factors, etc. Through multi-dimensional in-depth research, it provides theoretical basis and practical guidance for promoting the practical application of mobile health care in the elderly group.

(2) Content optimization

The optimization and upgrade of mobile rehabilitation platforms should focus on the genuine health needs of patients. The research findings indicate that breast cancer patients have diverse needs for mobile rehabilitation platforms. Firstly, patients demand high-quality medical information

resources from these platforms. They expect the platform to provide authoritative, accurate, and timely medical information to help them better understand their health status and develop reasonable rehabilitation plans. High-quality medical information not only enhances patients trust but also boosts their confidence in rehabilitation. Therefore, the platform should strengthen its collaboration with professional medical institutions and experts to ensure the scientific accuracy and reliability of the provided information. Additionally, the update speed of the information should keep pace with the latest advancements in medical research, providing patients with the most up-to-date and cutting-edge rehabilitation knowledge. When explaining, it is important to avoid using medical jargon and instead use simple language to introduce and explain. Secondly, patients hope to achieve online doctor-patient communication. To further enhance the user experience of mobile rehabilitation platforms, patients desire convenient online interactions with doctors to promptly address various issues during their self-management after discharge. By introducing real-time online consultations and appointment scheduling services, patients can receive immediate guidance from professional doctorsTo effectively address the challenges in the rehabilitation process and improve the quality of rehabilitation. Moreover, this communication method can deepen patients trust in the platform and enhance their satisfaction. Therefore, the platform needs to establish an efficient and responsive doctor-patient communication system to ensure that doctors can promptly respond to patients consultation needs and provide precise medical advice. At the same time, by leveraging advanced big data analysis and artificial intelligence technologies, the platform can conduct in-depth analyses of patients consultation content, thereby providing more personalized and accurate rehabilitation guidance. Thirdly, patients expect the mobile rehabilitation platform to have social support attributes. Research shows[24] that breast cancer patients hope to receive supervision and encouragement from others during self-management. Strengthening support from family, fellow patients, and society helps patients build confidence in rehabilitation and further boosts their enthusiasm for self-management. In the upcoming upgrades and optimizations, the platform can create a community of mutual assistance among patients, encouraging them to share their rehabilitation experiences and strengthen the connection between patients and the community.

Statements & Declarations

Funding

This study received funding from the Innovation Project for Postgraduate Students of Hunan University of Chinese Medicine (Grant No. 2023cx121) and the 2023 Major Scientific Research Project for High-level Health and Medical Talents in Hunan Province project (Grant No. 20230570).

Compliance with Ethical Standards

Competing interests

The authors have no competing interests to declare that are relevant to the content of this article.

Ethics Approval and Consent to Participate:

This study was approved by the Institutional Review Board of Hunan University of Chinese Traditional Medicine (ZYYHLLL-2024-01-014). Written informed consent was obtained from all participants, and all methods were performed in accordance with the Declaration of Helsinki. Participant identities were anonymized in the collected data.

Consent to Participate

Informed consent was obtained from all individual participants included in the study.

References

[1] Bray F, Laversanne M, Sung H, et al. Global cancer statistics 2022: globocan estimates of incidence and mortality worldwide for 36 cancers in 185 countries[J]. CA Cancer J Clin.2024, 74(3): 229-263.

[2] Tao X, Li T, Gandomkar Z, et al. Incidence, mortality, survival, and diseaseburden of br east cancer in china compared to other developedcountries[J]. Asia Pac Clin Oncol, 202 3, 19(6): 645-654.

[3] Wu Yanwei, Pan Jiali, Xu Jiehui. Qualitative Research on the Experience of Symptom Clusters and Management Needs of Breast Cancer Patients after Surgery [J]. Journal of Qilu Nursing, 2019, 25(22): 50-53.

[4] Liu Xiaohong, Xie Qiuju. The Impact of Surgical Complications on Persistent Postoperative Pain in Breast Cancer Patients [J]. Chinese Journal of Modern General Surgery, 2023, 26(08): 648-651.

[5] Chinese Anti-Cancer Association Guidelines and Standards for the Diagnosis and Treatme nt of Breast Cancer (2019 Edition) [J]. Chinese Journal of Cancer, 2019, 29(08): 609-68 0.

[6] McNeely M L, Campbell K L, Webster M, et al. Efficacy of night-time compression for breast cancer related lymphedema (LYNC): protocol for a multi-centre, randomized cont rolled efficacy trial[J]. BMC cancer, 2016, 16: 1-9.

[7] Jin Jie, Zhong Meirong, Yu Xiuting, et al. Research on the Construction and Application of Continuous Traditional Chinese Medicine Nursing Program for Patients with Acute I schemic Stroke [J] Chinese Journal of Nursing,2021,56(08):1125-1132.

[8] Wu Guofeng, Li Xinrui, Zhong Meirong, et al. Research on the Impact of Continuous N ursing Based on Cloud Platform on Subthreshold Depression in Breast Cancer Patients [J]. Chinese Journal of Nursing,2024,59(02):142-148.

[9] Lu Ping, Li Yiju, Zhang Yunyu, et al. The influence of the intervention model based on mobile wechat on the self-care ability and self-disclosure of patients after radical maste ctomy for breast cancer [J]. China Medical Review,2020,17(35):169-172.

[10] BOER M D, SLATMAN J. Blogging and breast cancer narrating one's life, body and s elf on theinternet[J]. Women's Studies International Forum, 2014, 44: 17-25.

[11] JACQUELINE L B, MARIA-CAROLINA J M, ALEJANDRO RJ. Seeking support on f

acebook:a content analysis of breast cancer groups[J]. J Med Internet Res, 2011, 13(1): e16.

[12] Han Shifan, Meng Yifei, Cao Yan. The application progress of qualitative research in N ursing Research [J]. General Practice Nursing,2019,17(30): 3748-3751.

[13] United States Department of Health and Human Services The usability evaluation metho ds and tools [EB/OL]. [2020-04-20]. https://www.evaluation.gov/agencies/health-and-human -services.

[14] Bangor A,Kortum P,Miller J. Determining what individual sus scores mean:adding an ad jective rating scale[J]. J Usability Studies, 2009, 4(3): 114-123.

[15] Elo S,Kyngs H. The qualitative content analysis process[J]. J Adv Nurs, 2008，62(1):10 7-115.

[16] Jiang Yang, Lu Ziyu, Gao Yujie, et al. Research on the Application of "Internet +" Ho me Exercise Prescriptions in the Rehabilitation Nursing of Postoperative Breast Cancer P atients [J]. Journal of Nursing Management,2023,23(12):972-977.

[17] Shi, N., Wong, A. K. C., et al. A nurse-led mhealth self-management program (mchemo therapy) for breast bancer patients undergoing chemotherapy: study protocol of a random ized controlled pilot study[J]. Cancer control:journal of the Moffitt Cancer Center, 2022, 29, 10732748221115469.

[18] Yu Lili, Song Han, Wang Huining, et al. Meta-analysis of the effects of networked cog nitive-behavioral therapy on symptom improvement in breast cancer patients during the r ecovery period [J]. Chinese Journal of Nursing, 2024,59(10):1248-1255.18

[19] Jia Jie. Multi-dimensional attention strategies for breast cancer patients rehabilitation [J]. Chinese Journal of Rehabilitation Medicine, 2025,40(01):5-7.19

[20] Yan Ping, Wang Juanfen. Characteristics and Trends of the Elderly Female Population i n China —— An Analysis Based on Data from the Seventh National Census [J]. Journ al of Shandong Womens University, 2023, (02):29-42.20

[21] Li Dandan. A Study on the Design Method of Mobile Medical APPs Based on Situatio nal Cognition and Early Aging Experience [D]. East China University of Science and T echnology, 2023.21

[22] Wang Su-xing, Zhang En-ming, Cui Jia-song, et al. Adaptation of Mobile Medical Apps for Elderly Breast Cancer Patients Health Management [J]. Nursing Education in China, 2022,19(12):1067-1072.22

[23] Wang Xing, Li Qirong, Meng Meng, et al. Conceptual Construction and Generation Me chanism of Digital Disability in the Elderly —— A Qualitative Study Based on Medical

Context [J/OL]. Information Resources Management, 1-20[2025-05-16].http://kns.cnki.net/kcms/detail/11.1448.G3.20250510.2040.002.html.23

[24] Brennan L,Kessie T,Caulfield B.24 Patient experiences of rehabilitation and thepotential for an mhealth system with biofeedback after breast cancersurgery:qualitative study[J]. J MIR Mhealth Uhealth, 2020, 29;8(7): e19721.