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Lymphedema self-management mobile application with nurse support for post breast cancer surgery survivors: description of the design process and prototype evaluation

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Abstract

Background Self-management is the key to control breast cancer related lymphedema (BCRL). This study aimed to develop a mobile application with nurse support for lymphedema self-management and evaluate its usability from the patients' points of view.

Methods This applied developmental study was conducted on 87 women in a lymphedema clinic, Shiraz, Iran, May-November 2023. The study included three phases: development, distribution of the application and usability evaluation. In the development phase, the researchers developed application using the Java programming language. In distribution phase, the application was installed on the participants' phones. For usability evaluation, 87 patients completed the user satisfaction questionnaire after three months access to the application. Data was analyzed using descriptive and analytical statistics using SPSS software 22. *P*-value less than 0.05 was considered significant.

Results We designed a self-management application specific to BCRL that included ten unique modules mainly related to patient education, interaction with peers and nurse, self-management support, and settings. The application mean usability score was 7.72 ± 1.08 . The usability dimensions of "screen" (8.06 ± 1.02) and "terminology and systems information" (7.29 ± 1.62) received the highest and lowest mean scores, respectively.

Conclusion The application has new features to meet more patients' needs compared to what other existing lymphedema self-management applications already have addressed. The findings showed that the participants rated the application usability at the "good" level that is similar to some previous studies. Considering the unique nature of the application and its favorable usability, we recommend its use for BCRL self-management.

Keywords Breast cancer lymphedema, Self-management, Mobile applications, Nurse, Breast cancer, Smartphone

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duration of participants' access to the application was three months in the current study, while this time was two weeks in the other studies [26, 40]. According to the Nielsen Norman Group report, three months is a more suitable time to access the application for usability evaluation purposes [41]. Moreover, the sample size of our study was more than the previous studies [26, 27]. An appropriate duration of participants' access to the application in addition to a larger sample size could strengthen the accuracy of the current findings.

Findings showed that patients with academic education and people living in the city assigned higher scores to this dimension than other patients. Although satisfaction scores of people with primary and secondary education and village residents with this dimension place in the good range. This shows that even though the educated people and city residents were more satisfied with the application screen, it was favorable for other participants as well. In general, evaluation of the role of demographic information in the usability of the application showed that it is useful for all women with BCRL who are over 18 years old, and have different educational levels.

Strengths and limitations

Among the strengths of our study is designing an application to improve the patients' contribution in their self-management and facilitate individualized care. This application provides the nurse support for patients with BCRL that can reinforce the community-oriented roles of nurses. The use of such technologies can promote access to lymphedema management services for patients, especially who do not have access to specialized lymphedema clinics due to financial issues or distance [5]. Unlike other studies, the present application was designed for both Android and IOS operating systems. Application usability was evaluated in a larger sample size of patients and a longer follow-up period compared to the previous studies. One of the other strengths of this study was the assignment of a personal username and password for each patient to protect her privacy. However, our study had some limitations. One of the limitations is that the usability evaluation in our study was questionnaire-based, so we suggest using objective evaluation methods such as assessing task completion time or error rates in future studies. The use of convenience sampling method was another limitation of the study.

Conclusion

In this study, a lymphedema self-management application was designed and evaluated for breast cancer surgery survivors with lymphedema. By using this application, people can get to know the causes, symptoms and skills to reduce lymphedema and manage their edema in a favorable way. They can also use this application to

monitor their condition, communicate with their peers, and ask the nurse questions. In this application, patients were taught to measure the circumference of the arm at five points using a tape and record it in a special table, and the changes in their lymphedema overtime were shown to them on the chart.

Findings showed that the usability of the application was in the optimal range, which indicates the usefulness of the application for all age groups of 30 years and above and with different educational levels. The highest usability score was obtained in the "screen" dimension and the lowest score was obtained in the "terminology and systems information" dimension. Therefore, we recommend using this application to manage the lymphedema of these patients. Moreover, we suggest revising terms used in application and simplifying the installation process in the next versions of the application. In addition, designing the offline version of the application will help to overcome the errors related to low speed of the internet. Furthermore, we suggest conducting qualitative studies to provide enrich data about users' experiences of application usability, and conducting clinical trials to investigate the effectiveness of the application in the improving the patients' outcomes.

Abbreviations

BCRL	Breast Cancer Related Lymphedema
CDT	Complex Decongestive Therapy
SPSS	Statistical Package for the Social Sciences
QUIS 5.5	Questionnaire for User Interaction Satisfaction version 5.5

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Author contributions

MH, ZKh and MR made substantial contributions to the conception and design of the study. Data was collected by MH. Data analysis and interpretation were done by ZKh and MH. MH conducted the intervention. ZKh and MH participated in drafting the manuscript. ZKh, MH and MR revised the manuscript critically for important intellectual content and final approval of the manuscript.

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Data availability

Data resource and statistical analysis outputs can be provided by the first author (Mehrvash Hemati) on reasonable request.