

Development and pilot study of a cancer rehabilitation smartphone application for cancer survivors

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Abstract

The purpose of this study is to develop a cancer rehabilitation program for cancer survivors in the form of a smartphone application and to confirm the effectiveness through Pilot study. The contents of the application consisted of health records, lab-test records, and health information, and the information recorded by the patient was graphically checked for changes over time on my page. 7 subjects who ended acute treatment and were undergoing follow-up were asked to use the application for 4 weeks, and then changes in variables (uncertainty, e-health literacy, self-efficacy, and cancer rehabilitation) were confirmed. It was confirmed that e-health literacy and self-efficiency increased significantly over time after using the application. In addition, the level of cancer rehabilitation was found to increase significantly over time. The application for cancer rehabilitation developed in this study needs to be expanded to improve the quality of life of cancer survivors.

Keywords: Cancer, Rehabilitation, Smartphone application, Survivor

1. INTRODUCTION

Efforts for health management of cancer survivors are required as long-term cancer survivors accumulate due to the development of cancer treatment and the continuous increase in cancer occurrence [1]. Many cancer patients experience considerable physical, psychological, and social difficulties even after a considerable amount of time has passed since the treatment was over [2]. Therefore, raising the level of cancer rehabilitation, including the return of cancer survivors to daily life, needs to be emphasized as an important aspect of nursing [3].

The journey of life as a cancer patient can be explained by dividing it into an acute stage of receiving various treatments after diagnosis of cancer, an extended survival stage in which treatment of the disease is completed, and a long-term survival stage in which recurrence of cancer is significantly reduced [4]. Cancer patients under follow-up after treatment have rehabilitation needs such as psychological relief, daily activity promotion, physical function promotion, and fatigue reduction, and previous studies have suggested work intervention as a way to address these demands [5]. However, it is difficult to comprehensively meet the individualized education required by cancer survivors in the long-term survival stage, screening for cancer recurrence, and information requests on cancer's work ability, so it is necessary to develop a cancer rehabilitation program that contains comprehensive content [6].

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In previous studies[7], the resilience of cancer patients and family support were identified as factors that promote the rehabilitation of cancer survivors. Therefore, it is expected that self-efficacy and health information power, which are central elements of resilience, can act as positive factors for cancer survivors' return to daily life, that is, rehabilitation by lowering uncertainty about disease.

Recently, the development of IT technology and the wide spread of smart devices have created an environment in which personalized healthcare programs can be operated using applications [8]. Previous studies suggested that cancer patients undergoing treatment can use this aspect to record symptoms and side effects such as pain by using an application and link them with the hospital system to induce quality improvement of medical services [9]. In the same context, programs using application can be effectively used for cancer patients under follow-up observation who have to independently manage their health and return to their daily lives.

Based on the above description, this study intends to develop a cancer rehabilitation program for cancer survivors through processes such as literature review and expert group review. In addition, the effect of the developed program on cancer survivors' uncertainty, e-health literacy, self-efficacy, and cancer rehabilitation level is verified through pilot study to provide evidence for the need to expand the program to help cancer survivors rehabilitate into daily life.

2. METHOD

2.1 Study design

This study is a methodological study to develop a cancer rehabilitation program for cancer survivors, and a primitive experimental design study attempted to verify the availability through preliminary investigation.

2.2 Study instrument

2.2.1 Cancer rehabilitation program applications

In this study, we reviewed the contents of a recent study [10] that after the end of acute treatment, cancer patients feel lacking systematic and reliable information and that there is a demand for a personalized support program for complete adaptation to daily life. In addition, detailed requirements such as diet, exercise, and symptom management were identified and applied through in-depth interviews with three cancer patients under long-term follow-up observation to determine the initial contents of the application. The composition of the developed application was verified through consultation with two oncologists, two oncology advanced practice nurses, and two nursing professors. Development, including the detailed design of the application, was carried out in consultation with a professional development agency. The developed application was installed by transmitting the Uniform Resource Locator (URL) of educational materials to an individual's mobile phone, and cancer survivors could self-manage cancer rehabilitation programs at home through the individual's mobile phone.

2.2.2 Uncertainty

The uncertainty of cancer survivors was measured using a tool modified and supplemented by Kim and Tae [11] after translating the tool developed by Michelle [12] into Korean. The tool consists of a 5-point Likert scale ranging from 0 points (not at all) to 4 points (really so). There are eight opposite directional questions among the questions, so the larger the sum of the scores obtained by inversely converting the scores of the

question, the higher the uncertainty. In the study of Kim and Tae [11], the reliability of the tool was .84 (Cronbach's α) and .89 in this study.

2.2.3 e-Health literacy

The e-health literacy scale (eHEALS) of cancer survivors was measured using a tool translated by Lee et al. [13] developed by Norman and Skinner [14]. The tool consists of 8 questions on the 5-point Likert scale. The higher the score of the entire question, the higher the level of e-health literacy. In the study of Lee et al. [13], the reliability of the tool was .88 (Cronbach's α) and .90 in this study.

2.2.4 Self-efficacy

The self-efficacy of cancer survivors was measured using a tool developed by Foster et al. [15] that verified the validity of the cancer survivors' self-efficiency scale (CSSES) in the Korean version by Kim et al. [16]. The tool consists of 10 questions on the 10-point Likert scale, and the larger the score, the higher the self-efficacy. In the study of Kim et al. [16], the reliability of the tool was .92 (Cronbach's α) and .97 in this study.

2.2.5 Cancer rehabilitation

The level of cancer rehabilitation was measured using a tool developed by Jung [17]. The tool consists of 40 questions and has a range of 0-120 points on a 4-point Likert scale of 0-3 points. There are 22 negative questions in the tool, which means that the higher the score calculated by reversing the question, the better the cancer rehabilitation condition. In the study of Jung [17], the reliability of the tool was .81 (Cronbach's α) and .78 in this study.

2.3 Pilot study

In order to verify the availability and effectiveness of the cancer rehabilitation application developed in this study, 7 subjects who ended acute treatment and were undergoing follow-up were asked to use the application for 4 weeks, and then changes in variables (uncertainty, e-health literacy, self-efficacy, and cancer rehabilitation) were confirmed. Participants were asked to use the application for at least 30 minutes every day during the study. Prior to the start of data collection, it was approved by the institutional review board (IRB no: 2021-04-010). Data were collected for eight weeks from August 23 to October 18, 2021. The subject questionnaire was completed immediately after the consent form for participation in the study was prepared (preliminary survey), two weeks after the application was used, and four weeks after the application was used (post survey). The collected data were confirmed to be not normally distributed and analyzed by the Friedman test, a nonparametric statistics method.

3. RESULTS

3.1 A smartphone application for cancer rehabilitation

The application developed for cancer rehabilitation was named "Candy" with the meaning of "Cancer Dictionary". The application was developed for use in android-based smartphones. The contents of the application consisted of health records, lab-test records, and health information, and the information recorded by the patient was graphically checked for changes over time on my page. Information included in health

information was organized through various literature, and was developed in the form of linking released video data. In addition, it was designed including a test session so that patients could check their emotional state, symptom level, and quality of life through questionnaire preparation (Figure 1).

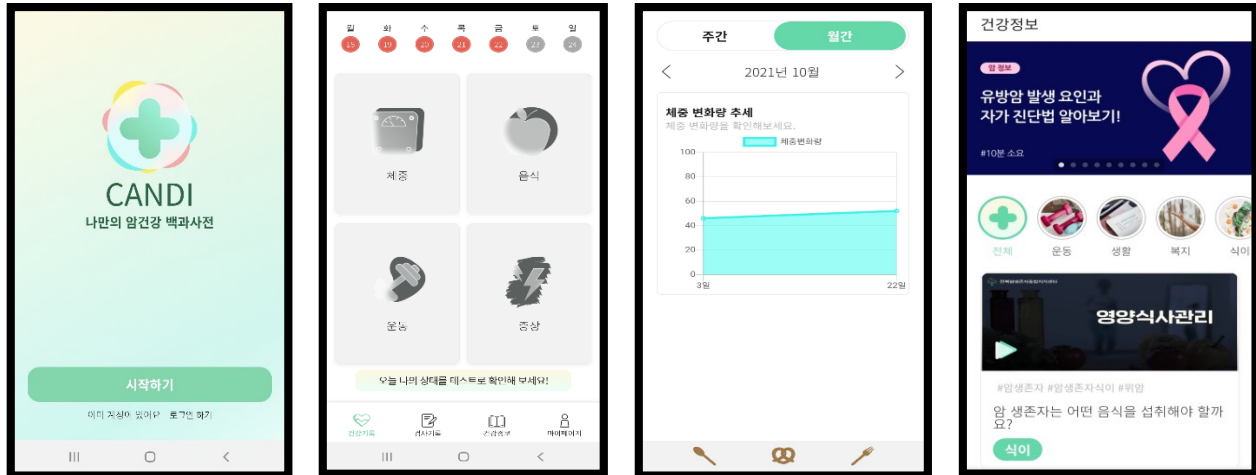


Figure 1. Cancer rehabilitation application

3.2 Effectiveness of applications for cancer rehabilitation

All participants in the pilot study in this study were breast cancer patients and were women. Most of them had spouses (85.7%), and all of their educational backgrounds were high school graduates or higher. The second stage of cancer was the most common with 4 people (57.1%). The average age was 46.14 ± 7.80 years, and the period after treatment was 12.71 ± 9.30 months on average (Table 1).

The uncertainty of cancer survivors gradually decreased after using the application, but there was no statistical significance. It was confirmed that e-health literacy and self-efficiency increased significantly over time after using the application. In addition, the level of cancer rehabilitation was found to increase significantly over time (Table 2).

Table 1. Characteristics of participants (n=7)

Characteristics	Categories	n (%)
Spouse	Yes	6 (85.7)
	No	1 (14.3)
Education level	High school	3 (42.9)
	College or higher	4 (57.1)
Stage of cancer	I	2 (28.6)
	II	4 (57.1)
	III	1 (14.3)

Table 2. Effectiveness of applications for cancer rehabilitation (n=7)

Variables	Pre-test (M ± SD)	Post-test (2 wks) (M ± SD)	Post-test (4 wks) (M ± SD)	χ^2	<i>p</i>
Uncertainty	33.50 ± 11.70	31.25 ± 10.78	29.25 ± 8.50	1.71	.519
e-Health literacy	24.50 ± 3.51	26.00 ± 4.62	30.75 ± 6.99	7.60	.009
Self-efficiency	70.00 ± 25.81	72.00 ± 23.66	75.50 ± 20.62	6.00	.028
Cancer rehabilitation	67.50 ± 9.61	70.75 ± 6.85	75.75 ± 8.81	8.00	.005

4. DISCUSSION

In this study, a cancer rehabilitation program was developed in the form of a smartphone application. Using smartphone applications has a higher possibility of utilization than previous studies [18][19][20] that operated face-to-face programs operated in a limited time and space. In addition, it is thought that the effect of enhancing self-efficacy has been confirmed as cancer survivors can freely use the program on their own.

In the pilot study results of this study, it was confirmed that the level of e-Health literacy and Cancer regeneration can be increased through application utilization. These results support the report that breast cancer survivors who participated in a self-efficacy enhancement program have improved their level of preparation for health management along with solving psychosocial problems [18]. However, since the effectiveness verification in this study was confirmed as a pilot study for 7 participants, it is necessary to secure the objectivity of the results through additional confirmation of more large-scale subjects.

Many cancer survivors have ended treatment and are monitoring the progress at various institutions distributed nationwide. In order for these survivors to access and utilize cancer rehabilitation applications, a systematic supply method must be prepared. In addition, the program developed in this study does not include a function to interact with users. In this respect, support for personnel who add and manage factors that can respond to the individual requirements of the subject should be considered. Previous studies [21] conducted on returning to work, an important factor in cancer rehabilitation, suggested that it is necessary to change the perception that cancer survivors can work healthy. In a similar context, rehabilitation of cancer survivors is not automatically created, but it is necessary to improve the perception that efforts and support should be received to ensure that the best return to daily life is achieved. This study has limitations in that only the effect on a small number of subjects was confirmed and the effect on a limited factor was verified.

5. CONCLUSION

This study attempted to develop a smartphone application that allows patients to manage their own health status so that cancer survivors who have terminated acute cancer treatment can achieve effective cancer rehabilitation, including returning to daily life, and to present the effect through pilot study. In the results of the study, it was confirmed that the use of cancer rehabilitation applications had a positive effect on the subject's e-health literacy, self-efficiency, and cancer rehabilitation level. The application developed through this study needs to be linked and cooperated with cancer hospitals so that a wide range of subjects can use it immediately after the end of acute treatment, which has the highest demand for information for cancer rehabilitation. Further research is suggested to verify the effectiveness of cancer rehabilitation applications after applying cancer rehabilitation applications to more cancer patients on a large scale.

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