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ORIGINAL ARTICLE

Development and evaluation of the efficacy of a web-based education program among cancer patients undergoing treatment with systemic chemotherapy: a randomized controlled trial

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Abstract

Purpose The study aimed to develop a web-based education program among cancer patients undergoing treatment with systemic chemotherapy and to evaluate the efficacy of the program on symptom control, quality of life, self-efficacy, and depression.

Methods A web-based education program was prepared in line with patient needs, evidence-based guidelines, and expert opinions and tested with 10 cancer patients. The single-blind, randomized controlled study was conducted at a medical oncology unit of a university hospital. Pretests were applied to 60 cancer patients undergoing treatment with systemic chemotherapy, and the patients (intervention: 30, control: 30) were randomized. The intervention group used a web-based education program for 3 months, and they were allowed to communicate with researchers 24/7 via the website. The efficacy of a web-based education program at baseline and after 12 weeks was evaluated. The CONSORT 2010 guideline was performed.

Results In the first phase results of the study, it was found that most of the patients with cancer wanted to receive education about symptom management and the side effects of the treatment. Expert opinions on the developed website were found to be compatible with each other (Kendall's Wa = 0.233, $p = 0.008$). According to the randomized controlled study results, patients who received web-based education reported significantly fewer symptoms ($p = 0.026$) and better quality of life ($p = 0.001$), but there was no statistically significant difference in the self-efficacy and depression levels during the 3-month follow-up period ($p^{>}0.05$). The most frequently visited links in the web-based education program by the patients with cancer were the management of chemotherapy-related symptoms (62.6%).

Conclusion A web-based education program was found to be efficacy in remote symptom management and improving the quality of life of cancer patients.

Trial registration www.clinicaltrials.gov, NCT05076916 (October 12, 2021, retrospectively registered).

Keywords Cancer · Symptom management · Quality of life · Web-based education · Tele-nursing · Supportive care needs

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Introduction

Cancer is a life-threatening disease with negative physical, psychological, and socioeconomic effects [1, 2]. Many patients with cancer receive outpatient chemotherapy, often requiring them to manage the side effects of treatment at home, without the support of a healthcare professional. Patients with cancer and their families need to be supported not only in the hospital but also in the home environment [3]. Patients want to receive information about strategies for coping with symptoms or problems that they frequently encounter after treatment [4]. During treatment, many patients do not feel able to participate in self-management education in the clinical setting. As such, access to relevant and useful support is required [5].

Recently, health reforms and policies have emphasized that patients should be supported to take an active role in the management of their disease. It is stated that interactive health communication practices, which provide patients with education, equipment, and self-efficacy to better manage their diseases, play an important role in improving patient care [6]. Today, most adults have access to the Internet, and many patients use it as a primary source of information that is easily accessible [7–9]. Considering the increase in the number of patients with cancer, it is stated that a web-based education program can be used as a cost-effective tool to support them [10]. It is possible to reach a wide audience with web-based education programs, and the rate of individuals using web-based information has increased with the development of effective online education programs [9, 11]. With health education on the web, interactive, economical, efficient, and appropriate content can be provided to all users, such as patients, their families, and health professionals. In the chronic health setting, web applications have been used to improve communication between patients and health professionals, manage symptoms, provide health information, social interaction, and recovery using motivational games [9, 12–14]. It has also been reported that effective online communication can reduce anxiety and improve clinical patient outcomes [15].

Web-based education has been used with positive effects in several chronic diseases populations including diabetes, hypertension, stroke, respiratory diseases, cancer, and high-risk health problems, such as obesity, anxiety, and depression [5, 16–25]. The results of the studies in the literature have shown that web-supported education improves disease management and reduces symptom burden [6, 26, 27] and that there are improvements in the pain and depression symptoms of patients who have received web-based education [28]. Web applications can play an important role in the management of cancer treatment, symptoms, and providing cancer-related information [13].

Additionally, today's pandemic conditions have increased the need for web-based education for patients with cancer. It has been suggested that web-based programs should be planned for the needs of cancer patients. It has been reported that the usage rates and efficacy of web-based education programs designed in this way will be higher [29]. Delivering education and follow-up via the web may mitigate the challenges of social isolation and the risk of contracting COVID while attending in-hospital face-to-face appointments. The primary aim of the study is to develop a web-based education program for cancer patients undergoing treatment with systemic chemotherapy and to test the validity of this program. The secondary aim is to evaluate the efficacy of this web-based education program on symptom control, quality of life, self-efficacy, and depression in cancer patients undergoing treatment with systemic chemotherapy.

Methods

Design and participants

In the first stage of the study, the needs of patients for web-based education were determined using a descriptive design, and in the second stage, the efficacy of a web-based education program was evaluated using a randomized controlled trial design, with the participants being single-blinded. A randomized controlled trial based on the Consolidated Standard of Reporting Trials—CONSORT 2010-guidelines was performed [30] (Supplementary File 1). In the second stage of the study, the sample size was calculated on the G*POWER software package based on an 85% power and a 95% confidence interval. A randomized controlled trial study was conducted with patients with cancer ($n = 60$), including 30 in the intervention and 30 in the control groups. The study consisted of patients who were over the age 18, received at least two cycles of systemic chemotherapy, had no verbal communication disorder, were literate, had Internet access, and use the Internet. Those with a diagnosis of a psychiatric disorder were excluded from the study. Data of both stages of the study were collected at a medical oncology unit of a university hospital between May 7, 2014, and February 17, 2016.

Ethics of the study

This study was conducted in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of University B (22.08.2013/23–5). The objective of the study was explained to the participants. Participants were assured of their right of refusal to take part in or to withdraw from the study at any stage with no negative consequences. The validity and reliability studies of all scales used in the study were conducted, and permission of the authors of the scales was obtained via e-mail.

Preparation of the website

In the first stage of the study, 30 patients with cancer were interviewed to determine their expectations regarding their needs for web-based education. The researchers developed a "Web-Based Education Needs Assessment Form for Patients with Cancer" based on a review of the literature [1, 3, 16, 26–28, 31] (Supplementary File 2). Quantitative questions were used to assess their Internet use for health, patient information needs about the disease and treatment, expectations and suggestions for web-based education needs, and the content they want to see on a website specific to cancer patients. The expectations and suggestions of the 30 patients with cancer, who were treated with systemic chemotherapy, regarding the need for web-based education, were evaluated with this form.

In line with the needs analysis and literature, the research team created a web-based education program. The Web site's quality was analyzed using DISCERN, a tool created by Charnock et al. in 1999 [32] to assess the quality of training materials that provide textual information about treatment alternatives for health problems. The overall score varies from 15 to 75 for the 16 items. Each item is scored on a scale of one to five. A 16th component is examined independently, and it gives a general assessment. Low DISCERN ratings indicate poor quality, whereas high values indicate excellent quality. Gokdogan translated DISCERN into Turkish in 2003 [33]. A group of 10 experts evaluated the content of the program separately, including three oncology physicians, four nursing faculty members, and three nurses. Experts rated the content 1 "inappropriate," 2 "partly appropriate," 3 "appropriate," or 4 "completely appropriate." After obtaining expert opinions, a pilot study was conducted with 10 different patients with cancer who met the sampling criteria. Patients with cancer included in the first stage of the study were excluded from the second stage. The intelligibility and usability of the program were tested in a pilot study.

The topics included in the developed website content were as follows: what is cancer?, causes of cancer, the most common types of cancer, cancer prevention, early diagnosis, and screening methods, cancer treatment, let's understand chemotherapy, problems/recommendations related to chemotherapy, nutritional recommendations, emergencies, preventive recommendations during chemotherapy, coping with stress, Department of Medical Oncology, complementary and supportive medicine practices, advice to family/caregivers in the cancer process, rights of cancer patients, information on health and social services, announcements, events, gallery, contact us. During the 3-month follow-up phase of the study, statistical information such as the usage rates of the website and the most read pages were regularly monitored by the membership to http://www.google.com/analytics/. Repeat visits to the website were considered new visits.

Procedures

The efficacy of a web-based education program on patient outcomes was analyzed by dividing the participants into groups through randomization. All patients with cancer who met the sampling criteria were assigned to the intervention and control groups through block randomization (1:1). The researchers used a randomization list created on a computer application (https://www.randomizer.org/). Pretest data of the study were collected from patients who consented to participate in the study by two independent researchers who were not involved in the implementation of the study. For assigning each patient to a group, the other team members were called by the same independent researcher, and the subjects were assigned to the groups according to the randomization list created. Two independent researchers conducted the assignment of the participants on the intervention and control groups and the evaluation of the outcome measurement data. Oncology patients were given verbal training by the oncology education nurses with manual education materials. It was mentioned that a study is being prepared to improve these instructional materials for cancer patients as part of the research's goal. The patients in the control group were given routine education by the oncology education nurses. In addition to the routine training, the website address of the study was given to the intervention group who received web-based education. The patients were blinded because they were unaware of their randomization status or the study hypotheses. Since the researchers conducted the interventions, they were not blinded.

A web-based education program was introduced to the patients with cancer in the intervention group during face-to-face interviews. They were asked to examine the program for at least 2 h a week for 3 months. During the follow-up period, the patients in the intervention group were called twice a week and reminded to use the education program. The researchers got in contact with the patients online via the website. During the follow-up period, the patients contacted the research team by calling or writing messages via the website 24/7. An e-mail account was created by the research team using the email system of the university, and it was shared with the patients. The clinical researchers of the team answered the patients' questions via this e-mail account. Within the scope of the study, a new cell phone number was purchased, and the researchers used it on a rotating basis to answer patients' questions as a phone response system. During the follow-up, patients' questions were answered on the phone. The control group received routine patient education and routine hospital follow-ups given by oncology education nurses during the 3-month follow-up period. In the third month, after the follow-up stage of the study was completed, the posttests were administered to the patients in the intervention and control groups who came to the hospital for follow-up or treatment. A flowchart of the study is given in Fig. 1.

Measures

Questions about the descriptive and disease characteristics of the patients included age, gender, marital status, education level, cancer type, stage, metastatic status, and treatment type. The outcome measures of the study were determined as the symptoms, quality of life, self-efficacy, and depression levels at baseline and 3 months.

i. The Rotterdam Symptom Checklist was used to evaluate the patient-reported side effects of treatment. The items on the scale are scored between 1 and 4 by using a Likert-type scoring system. The scale consists of 39 items and has 4 sub-dimensions: Physical Symptom Discomfort, Psychological Discomfort, Activity Level, and Quality of Life. The higher the scores obtained from the scale, the greater the distress. Cronbach's alpha value of the scale was determined as 0.88 [34].
ii. EORTC-QLQ-C30 Quality of Life Scale was developed to measure the quality of life of patients with cancer. It includes 30 questions and three sub-dimensions: General Well-Being, Functional Difficulties, and Symptom Control. The maximum score on the scale is 100, and the minimum is 0. High scores on the functional sub-dimension indicate good/healthy functional status, high scores on the symptom sub-dimension indicate high levels of symptoms and/or problems, and high scores on the global health status/

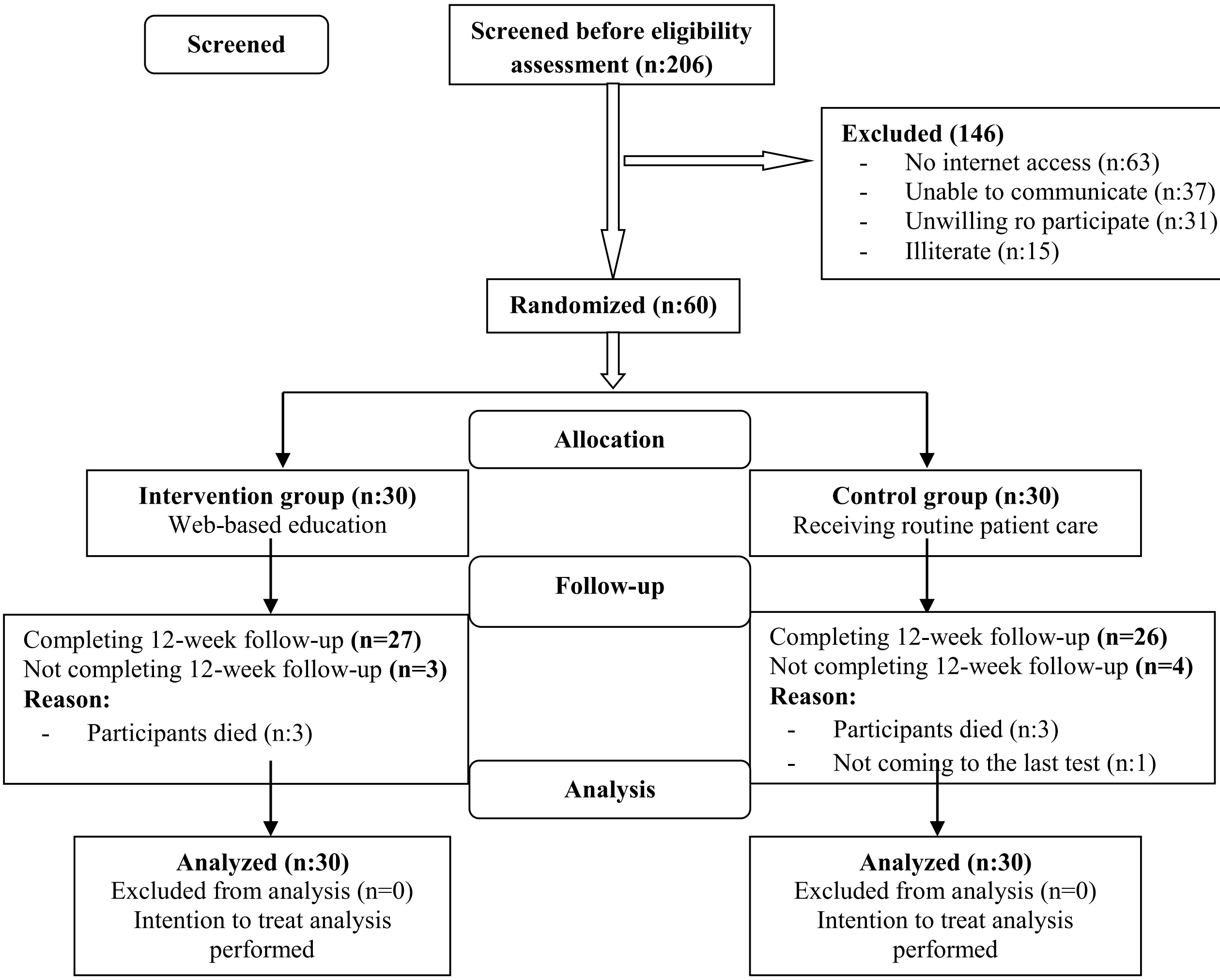

Fig. 1 Flow diagram of the randomized controlled study (CONSORT 2010)

quality of life sub-dimension indicate good quality of life [35].

iii. Strategies Used by Patients to Promote Health is used to assess the self-confidence of individuals in fulfilling the strategies they use to improve health. It consists of 29 items under 3 sub-dimensions, namely, coping with stress, decision-making, and positive behavior development. The scores that can be obtained from the scale range from 29 to 145, and increased scores indicate an increased level of self-efficacy. Cronbach's alpha value of the scale was found as 0.92 [36].

iv. Beck Depression Scale is a self-assessment scale that measures the symptoms of depression observed in physical, emotional, cognitive, and motivational areas. The purpose of the scale is not to diagnose depression but to objectively measure the severity of depressive symptoms. Each of the 21 items on the scale includes four statements numbered 0, 1, 2, and 3. Two of the items on the scale are reserved for emotions, eleven items for cognition, two items for behavior, five items for somatic symptoms, and one item for interpersonal symptoms. The total score that can be obtained from the scale varies between 0 and 63, and the scores are interpreted as follows: 0–9, no depression; 10–15, mild depression; 16–23, moderate depression; and 24–63, severe depression [37].

Statistical analysis

Statistical Package for Social Sciences 23.0 software was used in the analysis of the data obtained from the study. Percentages, arithmetic means, *t*-test, and one-way ANOVA tests were used in the analysis of the data obtained from the sample in the first stage of the study, and percentages, arithmetic means, *t*-test, one-way ANOVA, analysis of variance in repeated measures, chi-square tests, and intention-to-treat (ITT) analysis were used to evaluate the data obtained from the sample in the second stage of the study. Kendall's coefficient of concordance was used to determine the level of agreement between expert ratings for DISCERN and the website's content. Experts' mean scores were interpreted for quality and content evaluation. The level of significance was set as 0.05 in the entire study.

Results

In the first phase of the study, the expectations and suggestions of the 30 participants with cancer, who were treated with systemic chemotherapy, regarding the needs for web-based education, were evaluated with the "Web-Based Education Needs Assessment Form for Patients with Cancer" form. Most participants (76.7%) in the study used the İnternet to obtain health information. All of them wanted to receive education and counseling on possible risks after treatment through a web-based education program. Regarding the need for web-based education, the participants wanted to receive education about what to do in case of emergency when they had a problem at home (96.7%), learn knowledge about the illness (93.3%), the side effects of the treatment (86.7%), or complementary and supportive medicine practices from the Internet (50%). They also stated that they applied the information they obtained from health websites (50%), went to a health institution (76.7%), or called their physician (43.3%) when they experienced a problem at home about their illness and/or treatment. Regarding the web-based education program, 76.7% of the participants suggested phone communication and 73.3% of them favored an online meeting with the healthcare professional.

In line with the needs analysis and literature, the research team created a simple, understandable, and user-friendly web-based education program by discussing all the contents of the website one by one. The website design was commissioned by specialist software company. The website was designed to be mobile compatible so that it could be viewed on all desktop computers, tablets, and smartphones. After the website was designed, the content of the website was evaluated by 10 independent oncology and nursing professionals using the DISCERN Guidelines. The expert opinions were found to be consistent with one another, with no significant differences between them (Kendall's Wa = 0.233, $p = 0.008$). After pilot testing (n:10), minor revisions were made to symptom management on the website. The final version of the website was prepared after patient opinions, evidence-based guidelines, expert opinions, pilot study, and statistical methods that tested the comprehensibility of the website. After the study was completed, a web-based education program was made available to all patients on the university hospital's oncology department website.

The mean age of the participants in the intervention group who received web-based education was 52.47 ± 10.57 years, and it was 55.57 ± 10.14 years in the control group. Of the participants in the intervention group, 56.7% were male, and 90% were married. In the control group, 56.7% of the participants were female, and 80% were married. Also, 36.7% of the participants in the intervention and control groups were diagnosed with gastrointestinal system cancer. The comparison of the descriptive and disease characteristics of the participants with cancer in the intervention and control groups in the study indicated that they had statistically similar characteristics ($p > 0.05$) (Table 1). The outcome measures of the study were tested as the symptoms, quality of life, self-efficacy, and depression levels at baseline and the results were found to be similar (Table 2, Table 3, Table 4, Table 5).

According to our results, participants who received web-based education reported significantly fewer

Table 1 Descriptive and disease characteristics of the patients in the intervention and control groups included in the study (pretest)

Descriptive and disease characteristics	Intervention		Control		Test	
	n	%	*n*	%	*t*	*p*
Age (mean ± SD)	52.47 ± 10.57		55.57 ± 10.14		2.354	0.072
Gender						
Female	13	43.3	17	56.7	1.067	0.302
Male	17	56.7	13	43.3		
Marital status						
Single	3	10.0	6	20.0	1.176	0.278
Married	27	90.0	24	80.0		
Education level						
Primary school	9	30.0	11	36.7	0.840	0.657
High school	9	30.0	6	20.0		
Undergraduate and above	12	40.0	13	43.3		
Type of cancer						
Breast	6	20.0	9	30.0	3.800	0.803
Lung	3	10.0	2	6.7		
Gastro-intestinal	11	36.7	11	36.7		
Gynecological	3	10.0	2	6.7		
Tumor in tongue	4	13.4	1	3.3		
Bladder	1	3.3	3	10.0		
Prostate	1	3.3	1	3.3		
Other	1	3.3	1	3.3		
Stage						
Stage I	3	10.0	6	20.0	5.609	0.132
Stage II	5	16.6	11	36.7		
Stage III	11	36.7	6	20.0		
Stage IV	11	36.7	7	23.3		
Metastasis status						
No	11	37.9	18	62.1	3.270	0.071
Yes	19	62.1	12	37.9		
Type of treatment						
CT	8	26.7	12	40.0	2.467	0.481
CT + RT	4	13.3	3	10.0		
CT + surgical	5	16.7	7	23.3		
CT + RT + targeted therapy	13	43.3	8	26.7		

symptoms ($F = 5.252$, $p = 0.026$), fewer physical discomfort ($F = 8.838$, $p = 0.004$), fewer psychological discomfort ($F = 6.981$, $p = 0.011$), and fewer activity problems ($F = 6.218$, $p = 0.016$). It was determined that the difference between the changes in symptom level of the two groups was statistically significant during the 3-month follow-up period from the beginning to the end of the study (Table 2).

It was found that participants who received web-based education stated significantly fewer cognitive problems ($F = 6.917$, $p = 0.011$). It was determined that the difference between the changes in functional status ($F = 6.753$, $p = 0.012$), symptom status ($F = 13.375$, $p = 0.001$), emotional functions ($F = 7.701$, $p = 0.008$), and total quality of life ($F = 11.875$, $p = 0.001$) of the two groups was statistically significant during the 3-month follow-up period from the beginning to the end of the study (Table 3).

According to the results, it was found that the health promotion strategies used by the participants who received web-based education were not statistically significant ($p > 0.05$) (Table 4). Also, there was no statistically significant change in the depression levels of the intervention group who received web-based education during the 3-month follow-up period ($p > 0.05$) (Table 5).

It was determined that the participants logged into the developed website 1707 times. The most frequently visited links in the web-based education program by the participants in the intervention group were the management of chemotherapy-related symptoms (62.6%). The symptoms and management pages have been visited a total of 2336 times, and

Table 2 Compensating for the difference between the mean of the Rotterdam Symptom Checklist scores

	Measurements		Comparison	*F*	*p*
	Pretest Mean ± SD	Posttest Mean ± SD			
Physical symptom discomfort					
Intervention	15.93 ± 10.18	10.59 ± 9.52	**Time**	8.838	**0.004**
Control	18.06 ± 11.83	13.50 ± 12.93	**Group**	0.855	0.359
			Time × group	0.143	0.707
Psychological discomfort					
Intervention	6.23 ± 4.54	4.22 ± 4.98	**Time**	6.981	**0.011**
Control	6.03 ± 4.75	4.46 ± 5.20	**Group**	0.025	0.875
			Time × group	0.008	0.929
Activity level					
Intervention	16.40 ± 7.23	20.00 ± 3.33	**Time**	6.218	**0.016**
Control	16.06 ± 6.37	18.38 ± 5.57	**Group**	0.375	0.543
			Time × group	1.321	0.256
Quality of life					
Intervention	2.97 ± 1.54	2.30 ± .0.87	**Time**	0.924	0.341
Control	3.10 ± 14.03	2.77 ± 1.42	**Group**	1.321	0.256
			Time × group	0.924	0.341
Total					
Intervention	41.53 ± 13.08	37.11 ± 12.91	**Time**	5.252	**0.026**
Control	43.26 ± 14.03	39.12 ± 17.48	**Group**	0.365	0.549
			Time × group	0.018	0.893

SD, standard deviation; *F*, multivariate analysis

the education programs on the website have been visited a total of 3734 times. It was found that the average stay was 1 h and 19 min in each session.

Discussion

Recently, the number of web-based education programs and applications in the field of health has increased in parallel with the developments in technology. In the first stage of our study, a needs analysis was conducted for cancer patients undergoing treatment with systemic chemotherapy for a web-based education program design. The results of the study indicated that the vast majority of the participants used the Internet to obtain health information, wanted to receive education about symptom management and the side effects of the treatment. Additionally, half of the participants stated that they applied the information they obtained from health websites. In a study, it was found that the most common source of information used by participants other than healthcare professionals was the Internet [38]. Internet users prefer the Internet for obtaining information about diseases, treatments, seeking new or alternative treatment options, or searching for support groups [13, 31, 39]. It was determined that surviving patients with oral cancer wanted to get information, especially about symptom management, and were willing to use a web-based education program to increase their quality of life [17]. Tele-health applications are a promising method for the future of self-management [5]. Symptoms of the disease and its treatment are common in oncology patients. Patients' adherence to treatment and quality of life are thought to be influenced by how well they control their symptoms. Patients require information about treatment side effects and symptom management, and they prefer to obtain it through the use of web technology. These findings reveal the importance of web-based education programs and the necessity of developing and disseminating websites that contain evidence-based information. The need for seeking information and symptom management online has increased, especially due to pandemic-related fear, anxiety, and social isolation worldwide. Web-based education, in line with technological advancements, can help health professionals promote remote symptom management.

In our study, the symptom distress of participants who received web-based education was found to be significantly fewer than those of the control group participants. In a systematic review and meta-analysis study, web-based symptom management interventions were most effective in reducing overall physical symptoms in people with advanced cancer. Physical access barriers, transportation, and due to rapid changes in our environment, such as the COVID-19 pandemic, new technologies have been proposed to support the

Table 3 Comparison of the difference between the mean scores of the EORTC QLQ-C30 Quality of Life Scale

	Measurements		Comparison	*F*	*p*
	Pretest Mean ± SD	Posttest Mean ± SD			
Functional score					
Intervention	27.16 ± 10.03	22.33 ± 5.85	**Time**	6.753	**0.012**
Control	28.66 ± 9.54	24.76 ± 8.98	**Group**	1.048	0.311
			Time × group	0.300	0.587
Symptom score					
Intervention	23.43 ± 6.17	19.29 ± 5.65	**Time**	13.375	**0.001**
Control	24.50 ± 7.27	21.50 ± 6.38	**Group**	0.811	0.352
			Time × group	1.334	0.254
Global health score					
Intervention	9.53 ± 2.91	10.48 ± 2.59	**Time**	0.444	0.508
Control	8.97 ± 2.70	9.64 ± 2.75	**Group**	1.268	0.266
			Time × group	0.227	0.639
Physical functioning					
Intervention	9.97 ± 4.38	8.15 ± 2.57	**Time**	2.801	0.100
Control	10.10 ± 3.76	9.00 ± 3.49	**Group**	0.302	0.585
			Time × group	1.077	0.304
Role functioning					
Intervention	3.37 ± 2.13	2.48 ± 0.80	**Time**	2.413	0.127
Control	3.20 ± 1.79	2.81 ± 1.63	**Group**	0.021	0.884
			Time × group	1.861	0.179
Emotional functioning					
Intervention	7.23 ± 2.88	5.78 ± 2.85	**Time**	7.701	**0.008**
Control	7.47 ± 2.94	6.42 ± 2.86	**Group**	0.623	0.789
			Time × group	0.072	0.734
Cognitive functioning					
Intervention	2.97 ± 1.10	2.78 ± 0.85	**Time**	0.744	0.392
Control	3.73 ± 1.57	3.35 ± 1.38	**Group**	6.917	**0.011**
			Time × group	0.241	0.629
Social functioning					
Intervention	3.63 ± 1.85	3.15 ± 1.29	**Time**	4.017	0.050
Control	4.17 ± 1.80	3.19 ± 1.70	**Group**	0.322	0.573
			Time × group	0.492	0.486
Total score					
Intervention	60.13 ± 12.89	52.11 ± 10.53	**Time**	11.875	**0.001**
Control	62.13 ± 14.36	55.54 ± 12.98	**Group**	0.748	0.391
			Time × group	0.466	0.489

SD, standard deviation; *F*, multivariate analysis

symptom management of cancer patients [40]. It was determined that a 12-week individualized education program with online support was effective in preventing cancer-induced fatigue, reducing anxiety, and increasing health-related quality of life [41]. It has been shown that follow-ups conducted with web support reduce the symptom burden [6, 26, 27], and psychological symptoms of patients [28]. Along with the web-based education programs, the e-mail communication forum with a clinical nurse specialist in cancer was valued as the most useful, most easy to understand, and having the highest quality of information to meet individual needs [42]. In a study examining the effects of standard education and telemonitoring on patient outcomes, it was stated that standard education was effective in symptoms such as pain, anxiety, and depression only in the first week and that education and telemonitoring provided more and long-term improvement in patient outcomes [43]. In patients with advanced non-small-cell lung cancer treated with chemotherapy, 3 months of web-based health education provided a significant reduction in the first 10 important symptoms according

Table 4 Comparison of the difference between the mean scores of Strategies Used by Patients to Promote Health

Group	Measurements		Comparison	*F*	*p*
	Pretest Mean ± SD	Posttest Mean ± SD			
SUPPH-stress					
Intervention	33.27 ± 10.42	34.89 ± 9.10	**Time**	0.253	0.617
Control	33.20 ± 9.17	34.96 ± 9.37	**Group**	0.001	0.075
			Time × group	0.011	0.919
SUPPH-decision					
Intervention	11.03 ± 4.14	11.89 ± 3.71	**Time**	1.578	0.215
Control	11.53 ± 3.09	12.48 ± 2.90	**Group**	0.209	0.650
			Time × group	0.171	0.681
SUPPH-positive attitude					
Intervention	61.30 ± 13.35	60.63 ± 14.99	**Time**	0.302	0.585
Control	59.63 ± 13.00	62.90 ± 12.00	**Group**	0.218	0.642
			Time × group	0.302	0.585
SUPPH-total					
Intervention	105.60 ± 25.17	107.41 ± 26.17	**Time**	0.010	0.621
Control	104.37 ± 23.45	107.60 ± 22.52	**Group**	0.042	0.839
			Time × group	0.163	0.688

SD, standard deviation; *F*, multivariate analysis

Table 5 Comparison of the difference between Beck Depression Scale mean scores

Group	Measurements		Comparison	*F*	*p*
	Pretest Mean ± SD	Posttest Mean ± SD			
Beck Depression Scale					
Intervention	10.23 ± 6.40	7.93 ± 9.65	**Time**	2.236	0.141
Control	12.10 ± 6.97	9.72 ± 8.89	**Group**	1.294	0.261
			Time × group	0.116	0.735

SD, standard deviation; *F*, multivariate analysis

to the Symptom Distress Scale [21]. Considering that cancer patients experience various treatment-related symptoms and their daily life activities are negatively affected. It is thought that the symptom management skills of the patients should be improved. Web-based education is an easily accessible and economical tool for supporting and empowering cancer patients. As a result, it is critical to spread web-based education to support symptom management of cancer patients.

It was determined that participants who received web-based education stated significantly better quality of life and there was a significant difference between the intervention and control groups in terms of quality of life. In a web-based study by Ruland et al. [6], the self-efficacy and health-related quality of life scores of patients in the control group decreased over time. Web-based education was found to affect increasing the quality of life in patients with breast cancer [20], and a web-based health education implemented for 3 months had a significant effect on global quality of life and emotional functions in patients with lung cancer receiving chemotherapy treatment [21]. It is clear that web-based education programs positively affect the quality of life of cancer patients. To improve their quality of life and functional status, cancer patients need programs that they can access quickly and easily whenever they experience symptoms, gain evidence-based information, and maintain symptom self-management.

It was found that there was no difference between the intervention and control groups according to the self-efficacy status during the 3-month follow-up period. Some studies have shown that the self-efficacy levels of patients with breast cancer do not change before and after chemotherapy treatment [44], and 30–60% of them have high levels of distress for 6 months after the completion of their treatment [45]. Different factors, such as the chronic characteristics of cancer, disease, treatment-related symptom burden and psychological problems, and low socioeconomic status, have affected the level of self-efficacy [44]. To increase the level of self-efficacy in cancer patients, it can be recommended to develop and expand online programs that allow online interviews with health professionals within the scope of web-based education. In the diagnosis and difficult treatment processes of cancer patients, it can be considered to enrich applications such as online peer group interviews that can encourage and strengthen them in their cancer journey.

It was found that there was no difference between the intervention and control groups according to the depression levels during the 3-month follow-up period. While there was a mild level of depression in the intervention and control group participants at the beginning, the symptoms of depression decreased during the follow-up period. It was determined that there was no significant difference between emotional functions, social functions, depression, and fatigue levels in the initial, 6th-month, and 12th-month measurements of the effect of web-based interventions in patients with cancer [46]. It was found that a web-based cognitive rehabilitation intervention in patients with cancer did not yield a significant effect on distress, quality of life, and perception of illness during the 3-month follow-up period [24]. In the systematic review of randomized controlled trials, which evaluated the effect of technology-based interventions on depression in patients with cancer, five of the nine studies found no significant effect on depression [47]. It is known that cancer patients experience depression even after the recovery period for different reasons, such as the fact that cancer is a chronic disease, the duration of symptoms, and the inadequacy of individual coping strategies. It can be recommended to consider applications such as psychological counseling or peer group interviews within the scope of web-based education programs for cancer patients and to evaluate depression in the long term.

In our study, it was determined that the most frequently visited links on the website by the participants in the intervention group were chemotherapy-related symptoms and their management. These results revealed that patients receiving chemotherapy use cancer-related websites at home to obtain health information and that patients with cancer should support symptom management at home. It is thought that patients frequently access these links to get information about the management of the symptoms that they frequently experience. In the study by Wiljer et al. [48] to determine the information needs of patients with lung cancer, it was found that approximately half of the patients wanted to obtain information about the stage of the disease and symptoms. About a quarter of emergency department visits of patients with advanced cancer receiving palliative care are potentially preventable, and proactive efforts have been recommended to improve communication with patients and support [49]. It was observed that cancer survivors frequently examined web modules on diet, fatigue, returning to work, anxiety, depression, and physical activity in the web-based program [46]. It is thought that patients with cancer need to get information about treatment and symptom management at every stage of their disease and treatment and to communicate with health professionals. For this purpose, in our study, questions asked by the participants were sent directly to the e-mail address of the research team 24/7 via the question and answer interface of the web-based education software, and the clinical staff in the study answered immediately. While participants with cancer are given web-based education, they can also be given online support to help them handle their treatment and care more effectively.

Since there are negative effects of cancer and chemotherapy on patients' quality of life and self-efficacy, healthcare providers should focus on designing psychosocial interventions to improve self-care, self-efficacy, and quality of life and support the cancer patients throughout their illness and chemotherapy. An online education program is an important tool to help cancer patients and their families better manage their illness, reduce symptom distress and depression, and improve self-efficacy. Also, this program may be the type of patient-centered support system highly needed to educate, equip, and empower patients to better manage their illness, improve the quality of life, and reduce needs and depression for costly specialist care. This project can serve as a guide for developing symptom management knowledge in cancer patients, and self-care strength to the disease.

Limitations

The participants of this study were literate patients with cancer, who were treated with systemic chemotherapy, and had Internet access; the results cannot be generalized to all patients with cancer treated with chemotherapy. One of the limitations of this study was the small sample size. Additionally, a web-based education program applied for 12 weeks was not enough to describe the long-term efficacy of the study. Future studies include patients with cancer undergoing different treatment modalities, and the longer-term impact of web-based education be assessed.

Conclusion

Along with the developing technology, web-based education programs are easily accessible and they involve low-cost tools that can support patients with cancer in symptom management, improving the quality of life, and coping with the disease. Considering the factors, such as the pandemic in the world today, the increase in the number of patients diagnosed with cancer and receiving treatment every day, and hospital-associated infections, it is necessary to increase the number of web-based applications for efficacy web-based symptom management, strengthening self-care and improving the quality of life of patients with cancer. The patient should be supported through remote symptom management as a health system in their cancer journey. It is recommended to increase studies on the evaluation of the efficacy of web-based education programs and to create health policies in which these practices can be implemented in health institutions.

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Author contribution All authors contributed to the study's conception and design. Material preparation, data collection, and analysis were performed by HB, HSC, FA, KO, AT, YK, MGS, EY, and SK. The first draft of the manuscript was written by HB and all authors commented on previous versions of the manuscript. All authors have read and approved the final manuscript.

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Data availability Anonymized data is securely stored with the lead author.

Declarations

Ethical approval Ethical approval has been obtained.

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

Consent for publication All authors have reviewed the manuscript and agree to its publication.

Competing interests The authors declare no competing interests.

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