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Effectiveness of web-based education program on knowledge, coping, burden, and quality of life among colorectal cancer caregivers in Vietnam: a quasi-experimental study

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Abstract

Background Web-based interventions have been acknowledged as a valuable resource in managing caregiving duties, enhancing coping abilities, and improving quality of life (QoL), thereby alleviating burden and mitigating stress. The aim of this study is to examine the effectiveness of a web-based education program on the knowledge, coping strategies, burden, and QoL of caregivers of patients with colorectal cancer.

Method A quasi-experimental design was conducted in two randomly selected hospitals. The experimental and control groups consisted of 62 and 65 participants, respectively. The experimental group underwent a web-based education program (WBEP) for 12 weeks and received regular care, and the control group received only regular care. Data were gathered at four intervals: baseline and then 3, 6, and 12 weeks from baseline. Generalized estimating equations were used to understand the effectiveness of the treatment.

Results Compared to the mean scores in the control group, those in the experimental group for dysfunctional coping significantly decreased at 6 (14.96 ± 6.57) and 12 weeks (13.92 ± 6.46); emotion-focused coping also significantly declined at 3 (20.52 ± 7.54), 6 (17.25 ± 8.91), and 12 weeks (15.91 ± 8.69); and burden scores were significantly lower at 12 weeks (16.01 ± 10.63).

Conclusions The WBEP demonstrated a positive effect on the experimental group in decreasing the use of emotion-focused coping, dysfunctional coping, and burden of care for caregivers but not on knowledge and QoL. The results indicate that healthcare professionals should recognize that a WBEP is an effective method by which medical professionals can engage with and provide support to the caregivers of cancer patients.

Keywords Web-based educational program, Colorectal cancer caregiver, Knowledge, Coping strategies, Burden, Quality of life

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Introduction

Colorectal cancer (CRC) ranks among the top five most prevalent malignancies worldwide, a finding that is similar to what is observed in Vietnam, a lower middle-income country, which, as of 2022 had 16,835 cases [1]. The incidence of CRC is decreasing in low- and middle-income countries [2], owing to advancements in early disease detection and changes in diet [3] as therapeutic interventions. Caregivers of patients with CRC assist patients with different aspects of their daily activities, providing instrumental, physical, emotional, social, and spiritual support [4]. Offering practical assistance to patients, particularly in the context of ostomy management, however, is a more formidable task for caregivers than for their counterparts who care for non-stoma patients [5]. Fatigue and alterations in bowel habits, such as diarrhea and urinary dysfunction, impose a significant burden on caregivers [6].

Family caregivers have consistently documented substantial burden in their caregiving roles, as evidenced in an integrative review from 15 related studies on cancer patients' caregivers' burden and quality of life (QoL) [7]. As a result, their self-assessed QoL typically falls within the low range [8]. Compared to the general public and relatives who provide care for individuals with other chronic illnesses, family caregivers of cancer patients report a lower QoL. Assessments of QoL within the realm of cancer caregiving, including CRC caregiving, have consistently yielded average ratings [9], but these scores decline during the caregiving journey [10].

The provision of cancer-related information has been identified as a valuable resource to aid caregivers in managing their caregiving responsibilities. Nevertheless, certain information requirements related to cancer often remain unaddressed, potentially leading to heightened burden [11]. Family caregivers employ predominantly emotion-focused coping (EFC) rather than problem-focused coping (PFC) strategies, leading to diminished psychological well-being and QoL [12–14].

Conventional educational programs can impose significant time and financial burdens on family caregivers [15]. Further, many healthcare professionals allocate limited time to patient and family interactions, often avoiding conversations about psychosocial concerns and failing to address the needs of patients and their families [16]. The COVID-19 pandemic in 2019 brought to light the shortcomings of traditional educational methods. These include disruptions to in-person education and reduced interaction between client and healthcare staff. Web-based approaches, however, have emerged as innovative solutions that effectively address caregiver requirements [16]. These web-based methods offer advantages such as accessibility, interactivity, and time efficiency; a broad geographic reach that overcomes geographical and physical constraints; anonymity; access to current information; personalized content; improved communication between family members and healthcare providers; and increased opportunities for individuals to engage in self-disclosure [17]. The use of web-based interventions results in higher levels of social support, enhanced coping abilities, reduced burden, mitigation of stress, leading to improved QoL [18].

Vietnam, like numerous developing countries, has recently observed a significant increase in colorectal cancer (CRC) cases, with more than 400,000 CRC cases within 2 years, from 2020 to 2022 [19] and an increasing number of family caregivers are caring for these patients at home [20]. Family caregivers frequently undertake caregiving responsibilities with minimal or inadequate prior training and without consideration of their available knowledge, resources, or skills [21]. However, web-based intervention programs have been shown as a viable method for enhancing the caregiving abilities. Web-based educational programs (WBEPs) have proven effective in enhancing caregiving abilities for cancer patients, addressing the limitations of traditional education. Nevertheless, such programs remain scarce in developing countries, such as Vietnam, especially for family caregivers of CRC patients [22–24]. Therefore, the purpose of this study is to assess the effectiveness of a WBEP among CRC family caregivers for enhancing their knowledge and coping strategies, lowering caregiver burden, and improving their QoL.

Method

Study design

A quasi-experimental two-group pretest-posttest design was conducted to understand the effectiveness of a WBEP on the burden and QoL of CRC caregivers in Vietnam.

Sample and setting

Based on cost considerations, large-scale cancer institutes were chosen according to two criteria: size and accessibility to researchers. The experimental and control groups were recruited from a separate hospital to avoid contamination, and each hospital was taken as a randomly selected unit. The inclusion criteria for caregivers included (1) primary caregivers aged 18 + years; (2) involvement in CRC patients diagnosed at least 1 month before enrollment; (3) ability to communicate in and comprehend Vietnamese; (4) having no cognitive impairment status; and (5) and having a smartphone, tablet, or computer and internet access. Exclusion criteria included (1) primary caregivers who did not agree by the cancer patient or (2) had vision or hearing problems.

Sample size

The sample size was calculated using G*Power software (version 3.1.9.2), with an estimated effect size of 0.6, a power of 0.80, and a significance level (α) of 0.05. Initially, 45 participants were required for each of the intervention and control groups. To account for a potential 30% attrition rate, the sample size was increased to 58 caregivers per group, ensuring adequate power for the study.

Development of the web-based educational program

Recent studies suggest that the development of an online educational website for caregivers should be grounded in a comprehensive understanding of users' knowledge, skills, behaviors, motivations, cultural context, and specific circumstances [25, 26]. Developing a WBEP included preparing a refined list of specific caregiver needs by conducting a qualitative study of the cancer caregiver. Oncology expert engagement included advising on evidence-based practices in reviewing educational materials.

Caregivers were consulted regarding their preferences for the website, including font styles, images, colors, and navigation functions. Experts provided their recommendations in terms of designing user-friendly interfaces. Overall, the WBEP was developed by a multidisciplinary team that comprised subject matter experts, web developers, graphic designers, and professionals skilled in program usability.

The WBEP underwent evaluation by a cohort of five oncology nurses, five specialist physicians, and 10 caregivers, all of whom affirmed its utility. Feedback from these evaluations was instrumental in tailoring and refining the website to better meet user needs.

Web-based education program

The WBEP is a 12-week, multicomponent content program. The design allowed participants to access the program on multiple devices and screen sizes (mobile devices, tablets, and computers) at their convenience (Table 1).

Caregivers were able to access the website directly through the provided link and searched for information based on their needs during the study period. If their information needs were not met, they were encouraged to submit questions on the website for further support. If users encountered any difficulties, they could contact the designated support personnel for assistance.

Prior to the commencement of the study, research assistants (RAs) received training to standardize instructions provided to caregivers at baseline (T_0) and to ensure consistency in subsequent interactions and feedback delivered via telephone or online throughout the intervention period. To enhance their engagement with the intervention, the research staff gave individual participants a brief introduction to the WBEP and assisted them in using the program. Further, we monitored, provided feedback, and supported individual participants using several methods. We also provided supportive researchers with a small reward post-test at each stage of the study. Once they completed each phase of study, a gift was provided. A letter was sent to caregivers in the intervention group at the beginning of the study to improve their adherence.

Procedure

This quasi-experimental study was conducted between February 2022 and December 2022 in the oncology departments of two selected hospitals in Ho Chi Minh city. The study was approved by the University Ethics Committee (IRB Number 373/HĐĐĐ-ĐHYD). The authors also received permission from the directors of each site before collecting data. The researcher used the inclusion and exclusion criteria to screen a list of potential caregivers. Caregivers were recruited using a simple random sampling method. Five numbers were initially selected from the provided list through a lottery approach. If the number of participants was insufficient to reach five, an additional five individuals were randomly selected from the remaining entries on the list. Interested caregivers were explained the aims and methods of this study by a trained RA. Clear operational definitions for all variables to minimize subjective interpretations were developed to be used in training. Pilot testing was conducted to identify and correct inconsistencies in instructions and data collection procedures. In addition, potential risks, participants' right to leave the study whenever they chose, their right to decline answering questions, and the method employed to ensure anonymity and confidentiality were explained. The experimental group participated in the WBEP, while the control group received only usual care (nursing care and health education information related to health issues encountered during the patient's treatment at the hospital).

The RA introduced the content presented on the website and provided instructions on how to navigate and search for the necessary information. The RA guided caregivers in practicing and locating the information they needed until they indicated that they were confident in performing the tasks independently. The RA followed up via messages and calls with the experimental group participants weekly for three weeks after baseline, two weeks after Week 3, and three weeks after Week 6 to assist them with any difficulties in locating relevant information while accessing the website. The follow-up process of the control group after the baseline assessment was conducted in a manner similar to that of the experimental group.

Table 1 Main content and subdomains of colorectal cancer on the caregiver website

Colorectal cancer		
Introduction	Risk and symptom Screening	
Cancer stage	Introduction	o Stage 1, Stage 2, Stage 3, Stage 4
		o Treatment
Treatment	Surgery	o Introduction
		o Surgery therapies
		o Wound and stoma
	Chemotherapy	o Introduction
		o Medication
		o Symptoms
	Radiation	o Introduction
		o Medication
		o Symptoms
	Complementary- alternative medicine	o Introduction
		o Medication
	Nutrition	o Chemo-radio therapy
		o Stoma: What to do and not to do
	Side effects	o Physical consequences
		o Pain management
		o Psychological-social consequences
		o Effect of cancer on family
Caregiver	Introduction	o Caregiver definition
		o What caregivers do
		o How to care for the cancer patient
Caring task	Surgery/chemo/radio therapy care	o Wound care-stoma care
		o Pain and symptom management
		o Medication management
		o Note on caring
Coping skill	Feelings	o Sadness, stress, and anxiety
		o Anger
		o Guilt bereavement
	Self-care	o Daily activity-work and diet
		o Family/children
		o Tips for caring
	Support group	o Healthcare
		o Family
		o Friends
		o Limitations and asking for help in time
Communication support	Communication with patient/family members	o How to communicate and share with patient
		o How to communicate and share with family members
	Communication Healthcare staff	o When you need support from healthcare staff
		o How to report to healthcare staff
	Sharing in group	o Caregiver group
Stress	Benefits of relaxation	o Introduction
	Relaxation techniques	o Yoga/Tai chi
		o Muscle relaxation
		o Breathing/meditation
Support	Link	o Link to local and national service
		o Link to related website
	Question	o Help button

Data collection

Single blinding was adopted; the RA was blinded to the experimental and control groups in this study. Data were collected four times. Baseline data (T_0) were collected at the hospital by the RA once caregivers agreed to participate. Participants received the questionnaires through a link in their mail or the Zalo app. Data at T_1 (3 weeks), T_2 (6 weeks), and T_3 (12 weeks) were collected through a link sent by the data collector via email or the Zalo app.

Measurement

The measurements used in this study included demographic data of family caregivers and scales related to coping with caregivers (Brief COPE), CRC awareness (Colorectal CAM), burden (Zarit Burden Interview; ZBI), and QoL (Cancer Caregiver QoL questionnaire).

Demographics of caregivers included caregiver age, gender, relationship to the patient, race, religion, education, care hours per day, employment, education, health status, living status with the cancer patient, family income, patient's cancer stage/treatment, and patient's activities of daily living (ADLs).

ADLs were assessed by the Barthel Index [27, 28], for which scores varied from 0 (high dependence) to 100 (high independence); higher scores represent higher levels of activities. The Vietnamese Barthel Index version, which was validated in earlier research, was used in this study [28]. The reliability of the Barthel Index scale in this study was 0.94.

CRC knowledge was assessed using a modified colorectal CAM questionnaire. Knowledge of the warning signs and symptoms of CRC were tapped by nine close-ended questions, with a total score range of 0–9. Knowledge of the risk factors for CRC was assessed using 10 closed-ended questions. The scores ranged from 0 to 10. The reliability of the colorectal CAM in this study was 0.80.

Caregiver coping was measured with the Brief-COPE, which consists of 28 items that use a 4-point Likert scale (scores of 1 to 4). The minimum and maximum scores are 28 and 112, respectively. The three subscales are problem-focused coping (PFC), emotional-focused coping (EFC), and dysfunctional coping [29]. In earlier research, the reliability of the Vietnamese Brief COPE version was 0.78 [30].

Caregiver burden was assessed by the ZBI, a 5-point Likert scale that comprises 22 items rated from 0 to 4. The total scores range from 0 to 88, with higher scores as indicating greater burden. Score less than 20 indicate no burden; 21–40, mild to moderate burden; 41–60, moderate to severe burden; and more than 60, severe burden. The reliability of the Vietnamese version of the ZBI was 0.89 in a previous study [31].

Cancer caregiver QoL was measured by CQOL-C, which comprises 35 items, each of which uses a 5-point Likert-type response from 0 (not at all) to 4 (very much). The total score is computed by summing the individual item scores. Higher scores indicate better QoL, and the highest score is 140. In a previous study, the reliability of the Vietnamese version of the CQOL-C was 0.78 [31].

Data analysis

All data were coded and analyzed using SPSS Windows 22.0. Prior to data analysis, all variables were reviewed for data entry accuracy and missing values. Differences in caregiver and patient characteristics between the experimental and control groups were determined using independent sample *t*-tests and chi-square tests. Differences in knowledge, coping, burden, and QoL between the experimental and control groups at four time points were analyzed using an independent *t*-test. Generalized estimating equations were used to explore longitudinal changes in each variable between the control and WBEP groups. The statistical significance level was set at $p < .05$.

Results

A total of 62 and 65 participants were recruited for the experimental and control groups, respectively. Figure 1 shows the initial recruitment to the experimental and control groups, as well as attrition. During the 12-week intervention period, 38% of the caregivers in the control group and 16% in the experimental group dropped out. Caregivers dropped out of the study due to what they described as overwhelming caregiving (18%), worsening patient conditions (2.5%), being too busy (3%), and difficulty with answering the question (4%).

The mean age [standard deviation] of family caregivers in the experimental group (41.79 [12.20] years) was notably higher than in the control group (37.7 [9.8] years) ($p = .04$). Caregivers in the experimental (59.7%) and control group (44.6%) took care of cancer patients who underwent surgery and chemotherapy, and more than one-third of the patients were in advanced stages of cancer (III and IV) (Table 2).

The mean scores for knowledge of risk and symptoms of CRC in the experimental group were significantly lower than for caregivers in the control group after 6 weeks (t = -7.21, $p < .001$; t = -7.21, $p < .001$) and 12 weeks (t = -8.42, p <.001; and t = -13.0, $p < .001$). More family caregivers in the control group selected dysfunctional coping strategies, leading to a significantly higher mean score for dysfunctional coping in the control group ($p < .001$). The biggest differences were at Week 12, when caregivers who participated in the WBEP group used less dysfunctional coping than did family caregivers who did not engage in the WBEP (13.92 ± 6.46 and 24.23 ± 8.18, t = -18.47, $p < .001$) (Table 3). Dysfunctional coping and EFC were not sufficient to overcome complicated cancer problems in either the WBEP or control groups. Lower

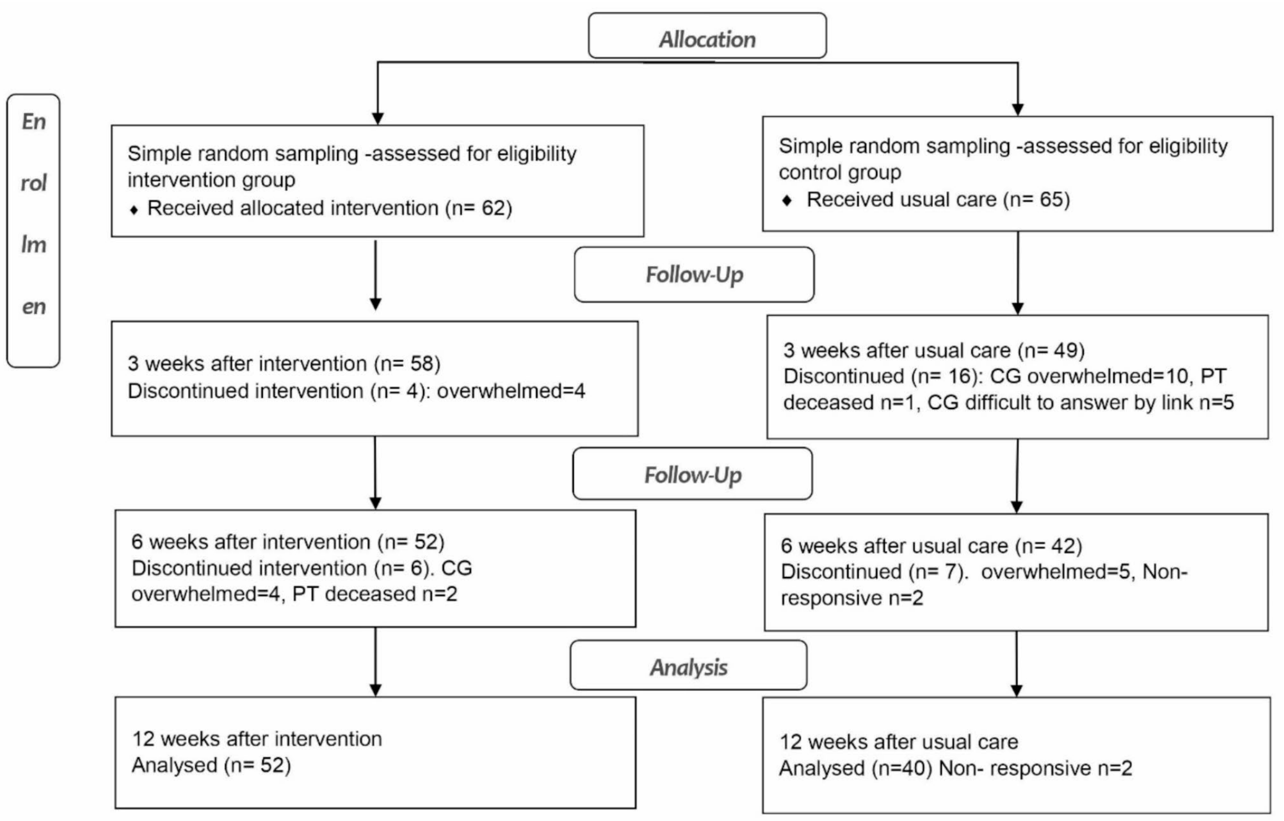

Fig. 1 CONSORT flow diagram

mean scores for PFC were found among family caregivers in the WBEP group in comparison to caregivers in the control group, as follows: 13.81 ± 5.54–15.41 ± 4.83, t = -4.03, $p < .001$ at Week 3; and 11.05 ± 5.37–14.95 ± 4.77, t = -10.03, $p < .001$ at Week 6; and 14.25 ± 8.13–16.67 ± 4.64, t = -4.71, $p < .001$ at Week 12 (Table 3).

The mean score for burden in the WBEP group ranged from 16.01 to 18.39, indicating no burden, a score that was lower than that of the control group (range of 25.85 to 35.01). The caregivers in the control group had a high burden mean score that was twice that of the caregivers in the WBEP group at Week 12, with 35.01 ± 17.27 and 16.01 ± 10.63, $p < .001$, respectively (Table 3).

The QoL of the caregivers in the WBEP group had a high mean score at the baseline assessment, but the score decreased significantly at Weeks 6 and 12. The mean score at baseline (90.94 ± 13.07) in the WBEP group was higher than that (84.49 ± 15.47) in the control group (t = 6.04, $p < .001$). For the WBEP group, the mean score at a later time point (T_2) also was slightly higher; however, no significant difference was observed (Table 3).

Compared to the control group, the mean scores of the experimental group for dysfunctional coping from baseline decreased significantly at Week 6 (β = -0.28, p = .01, 95% CI -0.50, -0.06) and Week 12 (β = -0.15, p = .03, 95% CI -2.34, -0.03). EFC also significantly declined at Week 3 (β = -0.15 p = .03, 95% CI -0.29, -0.12), Week 6 (β = -0.28, p = .001, 95% CI -0.45, -0.11) and Week 12 (β = -0.41, $p < .001$, 95% CI -0.59, -0.23). Caregiver burden scores in the experimental group likewise were significantly lower at Week 12 (β = -0.48, $p < .001$, 95% CI -0.77, -0.19). The intervention did not affect the caregivers' knowledge, PFC, or QoL (Table 4).

Discussion

Our study findings show that the risk and symptom knowledge of CRC among cancer family caregivers in the experimental group did not increase after 6 and 12 weeks. This result was different from that of previous studies [32, 33], in which the experimental group had a better score on CRC knowledge. Many studies report that knowledge regarding CRC risks and symptoms is relatively low [34, 35]. A possible explanation for this finding is that caregivers with a lower level of education may not benefit as much from knowledge through the internet. Research indicates that individuals with lower educational attainment may possess limited digital skills and access to the internet, which can diminish the effectiveness of web-based interventions [36, 37]. Another reason could be that some older family caregivers were not used to searching for and reading web-based information. Further study is suggested to compare the effectiveness of

Table 2 Demographic characteristics of experimental and control groups

Characteristic	**Intervention group** *n* = 62		**Control group** *n* = 65		**t/χ2 (*p*)**
Caregiver					
Age (mean ± SD)	41.79(12.20)		37.7(9.8)		2.07(0.04)[a]
Gender (n, %)					0.004(0.95)[b]
Male	28	45.2	29	44.6	
Female	34	54.8	36	55.4	
Race (n, %)					0.032(1.00)[b]
Kinh	55	88.7	57	87.8	
Other	7	11.3	8	12.3	
Education (n, %)					0.001(1.00)[b]
High school or under	24	38.7	25	38.5	
College or above	38	61.3	40	61.5	
Job status (n, %)					0.12(0.81)[b]
Employed	52	83.9	53	81.5	
Temporary/unemployed	10	16.1	12	18.5	
Illness (n, %)					1.98(0.19)[b]
No	51	82.3	59	90.8	
Yes	11	17.7	6	9.2	
Care hour a day (mean ± SD)	9.65(8.08)		7.53(6.64)		1.60(0.11)[a]
Live with patient (n, %)					1.44(0.29)[b]
No	17	27.4	12	18.5	
Yes	45	72.6	53	81.5	
Relationship with patient (n, %)					0.44(0.81)[b]
Spouse	17	27.4	19	29.2	
Children	37	59.7	40	61.5	
Others	8	12.9	6	9.2	
Family income (n, %)					0.89(0.64)[b]
<=10 million VND	20	32.3	24	36.9	
11- <20 million VND	24	38.7	20	30.8	
> 20 million VND	18	29.0	21	32.3	
Patient					
Treatment (n, %)					43.53(< 0.001)[b]
Surgery	32	51.6	2	3.1	
Chemotherapy	5	8.1	27	41.5	
Sur + Chemo + Radiation/ No	25	40.3	36	55.4	
Cancer stage (n, %)					3.55(0.47)[b]
Unknown	19	30.6	14	21.5	
1	12	19.4	9	13.8	
2	8	12.9	11	16.9	
3	20	32.3	23	36.9	
4	3	4.8	5	10.8	
ADL (mean ± SD)	85.80(25.98)		80.80(24.56)		1.26(0.21)[a]

Note: SD standard deviation

[a] Independent samples t-test

[b] Chi-square test

Table 3 Knowledge, coping, burden and quality of life by group at baseline, 1 weeks, 3 weeks, 6 weeks and 12 weeks

Variable	**Intervention group**		**Control group**		**t(*p*)**[1]
	Mean	**SD**	**Mean**	**SD**	
Knowledge					
Symptom					
Baseline	4.58	2.27	4.77	2.24	-1.12 (0.27)
3 weeks	4.47	2.57	4.83	2.80	-1.77 (0.08)
6 weeks	3.98	2.41	6.11	2.81	-7.21 (0.00)
12 weeks	4.61	2.87	6.85	3.17	-8.42 (0.00)
Risk					
Baseline	5.15	2.37	4.97	3.21	0.84 (0.40)
3 weeks	5.16	2.75	5.27	3.55	-0.46 (0.64)
6 weeks	4.78	3.03	6.54	3.36	-7.21 (0.00)
12 weeks	4.61	2.87	6.85	3.17	-13.00 (0.00)
Coping subscale					
Dysfunction					
Baseline	17.14	5.38	20.31	7.41	-6.61 (0.00)
3 weeks	15.46	6.05	19.93	7.53	-8.67 (0.00)
6 weeks	14.96	6.57	22.19	7.87	-13.14 (0.00)
12 weeks	13.92	6.46	24.23	8.18	-18.47 (0.00)
Emotional focused					
Baseline	23.09	6.68	21.88	5.97	2.54 (0.01)
3 weeks	20.52	7.54	23.20	7.33	-4.74 (0.00)
6 weeks	17.25	8.91	22.28	6.79	-8.25 (0.00)
12 weeks	15.91	8.69	23.99	6.18	-13.90 (0.00)
Problem focused					
Baseline	15.62	5.00	16.09	4.90	-1.28 (0.20)
3 weeks	13.81	5.54	15.41	4.83	-4.03 (0.00)
6 weeks	11.05	5.37	14.95	4.77	-10.03 (0.00)
12 weeks	14.25	8.13	16.67	4.64	-4.71 (0.00)
Burden					
Baseline	18.39	11.76	26.09	16.19	-7.35 (0.00)
3 weeks	18.90	15.05	25.85	16.16	-5.88 (0.00)
6 weeks	17.42	11.15	30.93	18.10	-11.95 (0.00)
12 weeks	16.01	10.63	35.01	17.29	-17.58 (0.00)
Quality of Life					
Baseline	90.94	13.07	84.49	15.49	6.04 (0.00)
3 weeks	83.16	25.26	82.42	15.66	0.45 (0.66)
6 weeks	77.22	31.89	77.11	17.37	0.06 (0.96)
12 weeks	75.81	34.25	75.59	17.29	0.10 (0.92)

Note: SD standard deviation; Coping subscales = mean subscale scores on the Brief COPE; Knowledge = mean scores on the Colorectal Cancer Awareness Measure;

Burden = mean scores on the Zarit Burden Interview, Quality of life = mean scores on the The Caregiver Quality of Life Index- Cancer

[1] Independent samples t-test

web-based learning on individuals with different levels of education, in developed and developing countries, to understand how educational attainment influences digital health intervention efficacy in diverse socioeconomic contexts.

This study demonstrated that dysfunctional coping and EFC in the experimental group were considerably lower

Table 4 Effect of web-based education program on participants'knowledge, coping, burden and quality of life at 3, 6, and 12 - weeks

Variable	β	SE	χ2	*p*
Knowledge				
3 weeks x group	0.08	0.12	0.50	0.48
6 weeks x group	-0.39	0.10	13.13	< 0.001
12 weeks x group	-0.27	0.10	6.33	0.01
Coping subscale				
Dysfunction				
3 weeks x group	-0. 07	0.09	0.01	0.43
6 weeks x group	-0.28	0.11	0.01	0.01
12 weeks x group	-1.19	0.04	0.59	0.04
Emotional focused				
3 weeks x group	-0.15	0.07	4.51	0.03
6 weeks x group	-0.28	0.09	10.60	0.001
12 weeks x group	-0.41	0.09	20.61	< 0.001
Problem focused				
3 weeks x group	0,005	0.08	0.004	0.95
6 weeks x group	-0.19	0.11	2.85	0.09
12 weeks x group	-0.22	0.08	9.11	0.008
Burden				
3 weeks x group	0.06	0.17	0.11	0.74
6 weeks x group	-0.05	0.26	0.03	0.86
12 weeks x group	-0.48	0.15	10.51	< 0.001
Quality of life				
3 weeks x group	-0.10	0.05	2.1	0.15
6 weeks x group	-0.12	0.07	3.57	0.06
12 weeks x group	-0.10	0.07	2.26	0.13

Coping subscales = mean subscale scores on the Brief COPE; Knowledge = mean scores on the Colorectal Cancer Awareness Measure;

Burden = mean scores on the Zarit Burden Interview, Quality of life = mean scores on the The Caregiver Quality of Life Index- Cancer

Group: 0 = control group (reference group); 1 = intervention group

than in the control group after 3, 6, and 12 weeks. The burden score of family caregivers in the WBEP group also was lower than that of the control group. Family caregivers engaged in the WBEP group may have a better understanding of the cancer process and were better able to find solutions for caregiving tasks, relax, and improve communication with patients and family members. Some caregivers, however, appear to use negative coping strategies and have less knowledge about cancer [38].

Ineffective coping scores and burden perception decreased gradually in the experimental group but increased in the control group, whereas knowledge and effective coping were not significantly better than at baseline in experimental group. In particular, QoL scores in both groups decreased dramatically after 12 weeks. Previous findings have shown that effective coping is associated with better QoL. Caregivers in the experimental group used less effective coping during follow-up, as reflected in QoL scores that did not increase [39, 40]. This may be because the intervention time was not long enough to make a significant change in coping strategies or because the assessment was performed during the most distressing time for the family caregiver [41]. Interestingly, the PFC score was similar between the two groups at baseline, but scores in both decreased after 3 and 6 weeks and then increased again at 12 weeks. This finding suggests that further studies that focus on longer time periods to enhance problem-solving skills through a WBEP are needed.

Research has shown that the more family caregivers utilize dysfunctional coping and EFC strategies, the more they perceive the care burden and develop psychological distress and depressive symptoms [14]. The WBEP demonstrated, however, a positive effect, as seen in the decrease in the use of dysfunctional coping and EFC during the follow-up period. Many family caregivers choose to engage in activities to take their minds off cancer and rely fully on authority, hope, and religion [42]. Participants benefited from the information from the WBEP, which helped them to find potential solutions and decrease their risk of mental health problems.

The WBEP did not affect problem-coping strategies. Certain web content aimed at enhancing problem-solving skills among family caregivers [43]; however, the symptoms of cancer management were challenging. Thus, future research should investigate changes in coping style during the cancer process. PFC decreased after 3 and 6 weeks and then increased after 12 weeks. When the patient's cancer condition deteriorates or the patient receives treatment, physical health worsens, and more symptoms develop. As such, caregivers have increased opportunities to utilize coping skills for symptom management and may perceive these skills as effective in helping them to manage and control symptoms [44]. Greater use of PFC helps caregivers to reduce the burden of caring, lessen psychological consequences, improve QoL [45], and increase caring ability [12]. Further research on web-based education should focus on the instruction of PFC content as early as possible, particularly in the advanced stages of cancer.

This study revealed the effect of a WBEP on caregiver burden perception. Caregivers who participated in the WBEP reported their burden score decreased gradually and no burden by the end of the program (T_3). In contrast, the control group demonstrated mild burden at all four time points, and the burden score increased sharply after 6 and 12 weeks. This result is consistent with previous studies [46, 47]. Caregivers perform multiple roles while performing caring tasks for their loved one and face extensive cancer problems that need to be addressed [48]. The multiple components of the WBEP were beneficial for alleviating the associated care burden [7].

The WBEP did not show effectiveness in improving QoL among caregivers. QoL declined in both groups, and the QoL scores after 6 and 12 weeks were much lower than those at baseline. Previous studies on web-based treatments have shown significant improvements in QoL [45, 49]. Our result could be related to a decline in PFC, which has been shown to improve QoL [47]. The study included a high percentage of patients with Stage III and IV CRC (37.1% in the experimental group, 47.7% in the control group), which requires more support and effort from the caregiver, resulting in insufficient time to care for themselves and lower QoL [33, 47]. Further research with larger sample sizes and specific stages of cancer are needed to better understand the effectiveness of the WBEP on QoL.

The mean age of cancer caregivers in this study was similar to an earlier observation study conducted in Vietnam [30] and China [50] and lower than caregivers in developed countries, such as Korea (51.53 ± 14.56) [51], and the United States (51.10 ± 10.24) [38]. The results indicated that more than 60% of caregivers had an educational background above college level, which is consistent with previous studies in South Vietnam [30] and other countries [52]. Younger age and higher educational level were advantageous in overcoming the digital issues of usage and adherence to web-based education. Older or less educated people may experience more difficulties with the use of eHealth [18, 33]. Further, a high attrition rate was observed in the control group; however, this rate was within the acceptable range seen in many previous studies (0–65.8%) [53]. The lower attrition rate in the experimental group also showed that caregivers in the WBEP group were more engaged than those in the control group.

Strengths and limitations

Caregivers can access educational materials on the internet at any time and from any location, allowing them to learn at their own pace, revisit information as needed, and accommodate varying schedules without disrupting their caregiving responsibilities. The significant retention rate among caregivers in the intervention group suggests a genuine interest in the WBEP.

This study did not account for patients with stomas, a factor known to increase the caregiving burden on family members. Incorporating this variable in subsequent studies would provide a more comprehensive understanding of the challenges faced by caregivers. The WBEP is a flexible intervention; its duration was not prescribed to the participants, and the frequency of its usage was not captured. Cancer family caregivers' frequency and duration of WBEP use may have influenced the impact of the intervention; thus, they should be captured in future research.

Conclusion

The WBEP showed a positive effect on dysfunctional coping, EFC, and the burden of care. Interventions should prioritize coaching caregivers in problem-focused coping strategies, as these approaches have been shown to alleviate caregiver burden and enhance QoL over time. Healthcare staff can utilize a WBEP to deliver customized information and support tailored to individual caregiver needs, thereby potentially enhancing caregivers' effectiveness in managing their responsibilities.

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Author contributions

Hien Thi Nguyen: Conceptualization; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Resources; Software; Supervision; Roles/Writing - original draft; Writing - review & editing. Hsiu-Hsin TSAI: Conceptualization; Data curation; Formal analysis; Methodology; Supervision; Roles/Writing - original draft; Writing - review & editing. Hong Thuy Phuong HUYNH: Conceptualization; Data curation; Formal analysis; Methodology; Roles/Writing - original draft; Tuan Anh LE and Thuy Khanh Linh TRAN: Data curation; Investigation; Methodology; Roles/Writing - original draft; Li-Chueh WENG, Ching-Yu CHENG, Pei-Kwei TSAY, Wann-Yun SHIEH and Chia-Yih LIU: Conceptualization; Methodology; Writing - review & editing.

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Data availability

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Declarations

Ethics approval and consent to participate

The study was approved by the University of Medicine and Pharmacy at Ho Chi Minh City Ethical Committee (IRB Number 373/HĐĐĐ-ĐHYD). All the procedures were conducted in accordance with the principles of the Declaration of Helsinki. The caregivers were fully informed and consented before the data were collected.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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References

1. Global Cancer Observatory. Vietnam. Cancer Today. Available from https://gco.iarc.who.int/media/globocan/factsheets/populations/704-viet-nam-fact-sheet.pdf. Accessed February 2, 2025.
2. Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, Jemal A. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. Cancer J Clin. 2024;74(3):229–63.
3. Siegel RL, Torre LA, Soerjomataram I, Hayes RB, Bray F, Weber TK, Jemal A. Global patterns and trends in colorectal cancer incidence in young adults. Gut. 2019;68(12):2179–85.
4. Langenberg SMCH, Poort H, Wymenga ANM, de Groot JW, Muller EW, van der Graaf WTA, Prins JB, van Herpen CML. Informal caregiver well-being during and after patients' treatment with adjuvant chemotherapy for colon cancer: a prospective, exploratory study. Support Care Cancer. 2021;29(5):2481–91.
5. Mosher CE, Adams RN, Helft PR, O'Neil BH, Shahda S, Rattray NA, Champion VL. Family caregiving challenges in advanced colorectal cancer: patient and caregiver perspectives. Support Care Cancer. 2016;24(5):2017–24.
6. Lange MM, van de Velde CJ. Urinary and sexual dysfunction after rectal cancer treatment. Nat Rev Urol. 2011;8(1):51–7.
7. Akter J, Konlan KD, Nesa M, Ispriantari A. Factors influencing cancer patients' caregivers' burden and quality of life: an integrative review. Heliyon. 2023;9(11):e21243.
8. Guerra-Martín MD, Casado-Espinosa MDR, Gavira-López Y, Holgado-Castro C, López-Latorre I, Borrallo-Riego Á. Quality of life in caregivers of cancer patients: A literature review. Int J Environ Res Public Health. 2023;20(2).
9. Lin Y, Luo X, Li J, Xu Y, Li Q. The dyadic relationship of benefit finding and its impact on quality of life in colorectal cancer survivor and spousal caregiver couples. Support Care Cancer. 2021;29(3):1477–86.
10. Maziyya N, Rahayuwati L, Yamin A. Quality of life of family caregiver of cancer patient: A literatur review. J Nurs Care. 2018;1(3):226–37.
11. Greenwood N, Pound C, Brearley S, Smith R. A qualitative study of older informal carers' experiences and perceptions of their caring role. Maturitas. 2019;124:1–7.
12. Coppetti LC, Girardon-Perlini NMO, Andolhe R, Silva L, Dapper SN, Noro E. Caring ability, burden, stress and coping of family caregivers of people in cancer treatment. Rev Bras Enferm. 2019;72(6):1541–6.
13. Litzelman K, Kent EE, Rowland JH. Interrelationships between health behaviors and coping strategies among informal caregivers of cancer survivors. Health Educ Behav. 2018;45(1):90–100.
14. Teixeira RJ, Applebaum AJ, Bhatia S, Brandão T. The impact of coping strategies of cancer caregivers on Psychophysiological outcomes: an integrative review. Psychol Res Behav Manage. 2018;11(null):207–15.
15. Applebaum AJ, Breitbart W. Care for the cancer caregiver: a systematic review. Palliat Support Care. 2013;11(3):231–52.
16. Kaltenbaugh DJ, Klem ML, Hu L, Turi E, Haines AJ, Lingler JH. Using web-based interventions to support caregivers of patients with cancer: a systematic review. Oncol Nurs Forum. 2015;42(2):156–64.
17. Kuijpers W, Groen WG, Aaronson NK, van Harten WH. A systematic review of web-based interventions for patient empowerment and physical activity in chronic diseases: relevance for cancer survivors. J Med Internet Res. 2013;15(2):e37–37.
18. Luo X, Gao L, Li J, Lin Y, Zhao J. A critical literature review of dyadic web-based interventions to support cancer patients and their caregivers, and directions for future research. Psycho-oncology. 2020;29:38–48.
19. American Cancer Society. Global Cancer Facts & Fig. 5th Edition. Atlanta: American Cancer Society; 2024.
20. Sun V, Raz DJ, Kim JY. Caring for the informal cancer caregiver. Curr Opin Support Palliat Care. 2019;13(3):238–42.
21. American Cancer Society. Caregiver resourse guide: caring for a loved one with cancer. No013002. American Cancer Society, Inc; 2019.
22. Gong J, Hu C, Chen M, Cao Q, Li Q. Interventions to improve self-efficacy in colorectal cancer patients and/or caregivers: a systematic review and meta-analysis. J Oncol. 2021;2021:4553613.
23. Zhang M, Xue Y, Shao M, Yang Y, Yu L, Ma B, Li D, Zhou H, Wang K, Chen C, et al. The effects of a psychoeducational intervention on caregivers of colorectal cancer patients: A meta-analysis of randomized controlled trials. Eur J Oncol Nurs. 2025;74:102739.
24. Cooke S, Nelson D, Green H, McPeake K, Gussy M, Kane R. Rapid systematic review on developing web-based interventions to support people affected by cancer. BMJ Open. 2022;12(9):e062026.
25. Yardley L, Morrison L, Bradbury K, Muller I. The person-based approach to intervention development: application to digital Health-Related behavior change interventions. J Med Internet Res. 2015;17(1):e30.
26. Laidsaar-Powell R, Giunta S, Butow P, Keast R, Koczwara B, Kay J, Jefford M, Turner S, Saunders C, Schofield P, et al. Development of Web-Based education modules to improve carer engagement in cancer care: design and user experience evaluation of the e-Triadic oncology (eTRIO) modules for clinicians, patients, and carers. JMIR Med Educ. 2024;10:e50118.
27. Serrano-Aguilar PG, Lopez-Bastida J, Yanes-Lopez V. Impact on health-related quality of life and perceived burden of informal caregivers of individuals with Alzheimer's disease. Neuroepidemiology. 2006;27(3):136–42.
28. Truong QT, Beattie E, Sullivan K. Perceived burden and quality of life of dementia caregivers in Hanoi, Vietnam in 2011. Vietnam J Med Pharm (Khoa Hoc Va Doi Song). 2014;4(1):50–8.
29. Long NX, Ngoc NB, Phung TT, Linh DTD, Anh TN, Hung NV, Thang NT, Lan NTM, Trang VT, Thuong NH, et al. Coping strategies and social support among caregivers of patients with cancer: a cross-sectional study in Vietnam. AIMS Public Health. 2021;8(1):1–14.
30. Nguyen HT, Do PM, Nguyen PTN, Cuong NV, Trang HTT. Coping strategies and the quality of life among cancer caregivers at one hospital in Vietnam. Vietnam Med J. 2022;519:222–31.
31. Nguyen HT, Nguyen PTN, Lin C-K, Do PM. Association between quality of life and burden of cancer caregivers: an example in a low and middle income country. Eur J Oncol Nurs. 2024;70:102596.
32. Abuadas F, Abuadas M. An interventional study to improve colorectal cancer screening knowledge and health perceptions among Jordanians' average risk population. Open Nurs J. 2019;13:237–48.
33. Slev VN, Mistiaen P, Pasman HR, Verdonck-de Leeuw IM, van Uden-Kraan CF, Francke AL. Effects of eHealth for patients and informal caregivers confronted with cancer: A meta-review. Int J Med Inf. 2016;87:54–67.
34. Adeoti ML, Oguntola, SA, Olugbenga-Bello AI, Oladimeji, OJ, Jegede SO. Colorectal cancer: knowledge and risk factors among adults in a suburban Nigerian community. J Med Sci Clin Res. 2016;4(9):12478–91.
35. Wong MC, Hirai HW, Luk AK, Lam TY, Ching JY, Griffiths SM, Chan FK, Sung JJ. The knowledge of colorectal cancer symptoms and risk factors among 10,078 screening participants: are high risk individuals more knowledgeable? PLoS ONE. 2013;8(4):e60366.
36. Reinwand DA, Crutzen R, Elfeddali I, Schneider F, Schulz DN, Smit ES, Stanczyk NE, Tange H, Voncken-Brewster V, Walthouwer MJ, et al. Impact of educational level on study attrition and evaluation of web-based computer-tailored interventions: results from seven randomized controlled trials. J Med Internet Res. 2015;17(10):e228.
37. Polukhin NV, Ekkert NV. Predictive factors for online health information-seeking behavior among adults in the Russian federation. Iran J Public Health. 2022;51(9):2034–40.
38. Badr H, Lipnick D, Diefenbach MA, Posner M, Kotz T, Miles B, Genden E. Development and usability testing of a web-based self-management intervention for oral cancer survivors and their family caregivers. Eur J Cancer Care (Engl). 2016;25(5):806–21.
39. Akpan-Idiok PA, Ehiemere IO, Asuquo EF, Chabo JAU, Osuchukwu EC. Assessment of burden and coping strategies among caregivers of cancer patients in sub-Saharan Africa. World J Clin Oncol. 2020;11(12):1045–63.

40. Akpınar N, Yurtsever S. Care burden and quality of life of family members caring for cancer outpatients. 2019.
41. Ahn S, Romo RD, Campbell CL. A systematic review of interventions for family caregivers who care for patients with advanced cancer at home. Patient Educ Couns. 2020;103(8):1518–30.
42. Asiedu GB, Eustace RW, Eton DT, Radecki Breitkopf C. Coping with colorectal cancer: a qualitative exploration with patients and their family members. Fam Pract. 2014;31(5):598–606.
43. Winger JG, Rand KL, Hanna N, Jalal SI, Einhorn LH, Birdas TJ, Ceppa DP, Kesler KA, Champion VL, Mosher CE. Coping skills practice and symptom change: a secondary analysis of a pilot telephone symptom management intervention for lung cancer patients and their family caregivers. J Pain Symptom Manag. 2018;55(5):1341–e13491344.
44. Porter LS, Keefe FJ, Garst J, Baucom DH, McBride CM, McKee DC, Sutton L, Carson K, Knowles V, Rumble M, et al. Caregiver-assisted coping skills training for lung cancer: results of a randomized clinical trial. J Pain Symptom Manag. 2011;41(1):1–13.
45. Northouse L, Schafenacker A, Barr KL, Katapodi M, Yoon H, Brittain K, Song L, Ronis DL, An L. A tailored web-based psychoeducational intervention for cancer patients and their family caregivers. Cancer Nurs. 2014;37(5):321–30.
46. DuBenske LL, Gustafson DH, Namkoong K, Hawkins RP, Atwood AK, Brown RL, Chih MY, McTavish F, Carmack CL, Buss MK, et al. CHESS improves cancer caregivers' burden and mood: results of an eHealth RCT. Health Psychology: Official J Div Health Psychol Am Psychol Association. 2014;33(10):1261–72.
47. Jadalla A, Page M, Ginex P, Coleman M, Vrabel M, Bevans M. Family caregiver strain and burden: a systematic review of evidence-based interventions when caring for patients with cancer. Clin J Oncol Nurs. 2020;24(1).
48. Muliira JK, Kizza IB, Nakitende G. Roles of family caregivers and perceived burden when caring for hospitalized adult cancer patients: perspective from a low-income country. Cancer Nurs. 2019;42(3):208–17.
49. Scott K, Beatty L. Feasibility study of a self-guided cognitive behaviour therapy internet intervention for cancer carers. Aust J Prim Health. 2013;19(4):270–4.
50. Cui P, Yang M, Hu H, Cheng C, Chen X, Shi J, Li S, Chen C, Zhang H. The impact of caregiver burden on quality of life in family caregivers of patients with advanced cancer: a moderated mediation analysis of the role of psychological distress and family resilience. BMC Public Health. 2024;24(1):817.
51. Ahn S-H, Kim SH. Distress, family resilience, and quality of life among family caregivers of cancer patients undergoing chemotherapy: the moderating role of family resilience. Korean J Adult Nurs. 2022;34(2):225–32.
52. Atreya CE, Kubo A, Borno HT, Rosenthal B, Campanella M, Rettger JP, Joseph G, Allen IE, Venook AP, Altschuler A, et al. Being present: A single-arm feasibility study of audio-based mindfulness meditation for colorectal cancer patients and caregivers. PLoS ONE. 2018;13(7):e0199423.
53. Fu F, Zhao H, Tong F, Chi I. A systematic review of psychosocial interventions to cancer caregivers. Front Psychol. 2017;8:834.

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