

## Original Article

## The effectiveness of telephone and internet-based supportive care for patients with esophageal cancer on enhanced recovery after surgery in China: A randomized controlled trial



Yuan Yu<sup>a,\*</sup>, Min Li<sup>a</sup>, Ran Kang<sup>a</sup>, Xinzhe Liu<sup>a</sup>, Nuoxiaoxuan Wang<sup>a</sup>, Qingmiao Zhu<sup>a</sup>, Jun Cao<sup>a</sup>, Minghua Cong<sup>b</sup>

<sup>a</sup> Thoracic Surgery Department of National Cancer Center/National Clinical Research Center for Cancer/Cancer Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China

<sup>b</sup> Comprehensive Oncology Department of National Cancer Center/National Clinical Research Center for Cancer/Cancer Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China

## ARTICLE INFO

## Keywords:

Esophageal cancer  
ERAS  
Supportive care  
Quality of life

## ABSTRACT

**Objective:** The aim of this study was to establish a nurse-led supportive care program based on telephone and Internet support and evaluate its efficacy in comparison with conventional care on enhanced recovery after surgery.

**Methods:** The study was designed as an open-label, randomized controlled trial to value the efficacy of a nurse-led supportive care program in comparison with conventional care. A convenience sampling method was employed to recruit patients with esophageal cancer in a tertiary Grade A cancer center in Beijing from November 2018 to January 2019. Patients were assigned randomly (1:1) to one of the two groups (intervention group vs control group) via a web randomization system. The control group received conventional care. Patients from the intervention group received conventional care and one-on-one phone calls from nurses following their discharge assessments and education about nutrition and symptoms. Nurses also set up a WeChat group, which they invited patients to join in before discharge for better communication during follow-up. Statistical testing, including nutritional status, quality of life, the helpfulness of the follow-up service, and the patients' satisfaction with their care, was conducted 6 months after discharge to assess for differences between the two groups. The independent sample *t*, chi-squared, and Mann–Whitney tests were used to compare between the experiences of the intervention and control groups. The Spearman correlation analysis was used for the analysis of correlation of the nutritional index and quality of life.

**Results:** Finally, 168 patients were included in the study, with 86 patients in the intervention group and 82 in the control group. Significant differences between the intervention and control groups were found in the nutrition risk screening 2002 and simple diet self-assessment tool scores. The changes in blood albumin, prealbumin, and transferrin were also statistically significant. All (European Organization for Research and Treatment of Cancer Quality of Life Questionnaire) QLQ-C30 results of the intervention group were better than those of the control group. A significant positive correlation of the simple diet self-assessment tool (the higher, the better) and the scores for total health/quality of life were detected ( $r = 0.214, P = 0.005$ ). A significant negative correlation of the nutrition risk screening 2002 (the lower, the better) and the scores of total health/quality of life was detected ( $r = -0.446, P = 0.000$ ). The patients' scores on the helpfulness of the follow-up service and their satisfaction with it were both significantly higher in the intervention group than in the control group.

**Conclusions:** This study highlighted the important role of nurse-led supportive care based on telephone and Internet-based support for patients after enhanced recovery after surgery. The supportive care improved patients' nutritional status, elevated their quality of life, and improved their satisfaction with the care provided to them.

\* Corresponding author.

E-mail address: [zlyyyuyuan@163.com](mailto:zlyyyuyuan@163.com) (Y. Yu).

<https://doi.org/10.1016/j.apjon.2022.02.007>

Received 19 December 2021; Accepted 23 February 2022

2347-5625/© 2022 The Authors. Published by Elsevier Inc. on behalf of Asian Oncology Nursing Society. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## Introduction

Esophageal cancer is one of the most common malignant gastrointestinal tumors.<sup>1,2</sup> It is the seventh most commonly diagnosed type of cancer and the sixth leading cause of cancer-related death worldwide annually.<sup>3</sup> More than 50% of esophageal cancer cases occur in China, where it is the sixth most common type of cancer and the fourth leading cause of cancer-related death.<sup>4</sup> It has been estimated that esophageal cancer-related deaths in China account for approximately 52.7% of global esophageal cancer-related deaths.<sup>5</sup>

The main treatment for esophageal cancer is still surgery, combined with radiotherapy and chemotherapy.<sup>6</sup> Characterized by a generally late diagnosis,<sup>7</sup> only one-quarter of individuals with esophageal cancer are candidates for curative treatment,<sup>8</sup> and most undergo an extensive treatment regime of esophageal resection with or without neo-adjuvant therapy. The average hospital stay of patients after esophagectomy in China is 14.31 days.<sup>9</sup> However, stays are usually shorter in most tertiary Grade A hospitals in China due to the usage efficiency of health resources and the implementation of enhanced recovery after surgery (ERAS) for esophageal cancer surgical treatment.<sup>10</sup> After an esophagectomy, patients suffer from a variety of surgery-related problems that may contribute to a reduced quality of life, and a shorter stay may aggravate this situation. The overall prognosis after esophagectomy is poor, with a 5-year survival rate of under 25%.<sup>11</sup>

In brief, patients with esophageal cancer face problems related to eating, surgery-related symptoms, and psychological problems. In one study, 59% of the patients reported experiencing difficulties with eating after their operation.<sup>12</sup> The eating-related problems are characterized by dysphagia, appetite loss, and nausea/vomiting linked to anatomic changes and the reconfiguration of their upper gastrointestinal tract during surgery.<sup>13</sup> Furthermore, these issues can lead to postoperative malnutrition in more than 50% of the patients who have had an esophagectomy.<sup>14</sup> Malnutrition can prolong a patient's postoperative recovery time, reduce their quality of life,<sup>12,15</sup> and lower their tolerance to postoperative radiotherapy and chemotherapy.<sup>16</sup> Of all the surgery-related problems, 30% of patients reported fatigue/pain symptom cluster (pain, fatigue, insomnia, dyspnea), and 27% of patients reported reflux/cough cluster (dry mouth, taste changes, cough, reflux).<sup>17</sup> Moreover, large population-based cohort studies have shown that approximately 50% of surgically-treated patients with esophageal cancer report emotional problems 6 months following surgery,<sup>18</sup> with feelings of being depressed, lonely, and abandoned,<sup>19,20</sup> factors that may contribute to the reduced quality of life and are known to affect the patients' lives for a long time after surgery.<sup>21–24</sup> In a word, patients with esophagectomy are likely to encounter an arduous postsurgical recovery period, with eating-related problems, surgery-related symptoms, and psychological problems.<sup>25</sup> Evidence shows that the supportive care needs of patients with esophageal cancer are very high.<sup>26</sup>

Supportive care is defined as the services necessary to meet physical, emotional, social, psychological, informational, spiritual, and practical needs of patients with cancer.<sup>27</sup> During the post curative treatment of cancer, patients report high levels of unmet needs, especially in low- and middle-income Asian countries.<sup>28,29</sup> In China, approximately 95.2% of patients with esophagectomy were found to have more than one unmet need. Most of the top 10 identified moderate-to-severe unmet needs are in the health and information domains.<sup>10</sup> Several supportive care interventions have been developed to improve the quality of life of postsurgical patients with esophageal cancer.<sup>30–33</sup> Almost all studies that have evaluated interventions during postsurgical supportive care show an effect on cost and patient satisfaction, although some studies show no significant difference in the quality of life compared with regular follow-up care. Across these studies, supportive care was delivered by medical staff to patients with esophageal cancer via telephone or home visits. There are fewer studies of supportive care based on the combination of the telephone and Internet for esophageal patients, and objective indicators to evaluate nutritional status are lacking. Therefore,

the hypothesis underlying this study is that nurse-led telephone and Internet supportive care for patients after esophageal cancer surgery has the potential to improve patients' nutritional status, quality of life, and satisfaction.

## Methods

### Design

This study was designed as a two-armed randomized controlled trial with evaluations of the efficacy of nurse-led telephone and Internet-based supportive care after esophagectomy. Patients were assigned randomly (1:1) to one of the two groups (intervention group vs control group) via a web randomization system by an experimenter who was not involved in recruitment. The trial was open-label.

### Setting

The study was conducted at a tertiary Grade A cancer center in Beijing. The hospital is one of the best cancer centers in China, where approximately 1000 patients undergo esophagectomies annually. Enhanced recovery components have been practiced here for more than 3 years. The average length of stay at the hospital after surgery was 10–14 days.

### Patients

A convenience sampling method was employed to recruit patients with esophageal cancer from November 2018 to January 2019. The patient eligibility criteria were as follows: (1) the diagnosis of esophageal cancer and in the process of undergoing ERAS for esophageal cancer; (2) the ability to understand and communicate in Chinese; (3) age  $\geq 18$  years; (4) the absence of cognitive deficits according to medical assessment; and (5) having provided informed consent. Patients with any other type of cancer, another severe disease, a history of psychiatric disease, or taking psychiatric drugs at the time of enrollment were excluded. Following the classification of malignant tumors system,<sup>34</sup> patients with cancer in the cardia were classified as patients with esophageal cancer and were included in this study.

### Sample size

Based on an estimated effect size of  $\alpha = 0.05$  (two-tailed as the direction was hypothesized) and  $\beta = 0.20$  (one-tailed as the direction was hypothesized), we estimated that we would require a total of 78 participants per group. Therefore, we aimed to recruit 86 patients per group based on a 10% dropout rate.

### Nurses' training

Six thoracic surgery department nurses with more than 5 years' experience in the field were chosen to set-up a supportive care team. They were trained for 7 days before the intervention. The curriculum of their training is shown in Table 1.

### Control group

Conventional care was based on a clinical follow-up program, including outpatient clinic visits to the thoracic surgery department 1 month after discharge, and then once every 3 months for 2 years, once every 6 months in years 2–5, and once per year after 5 years. Before discharge, the patients received information from a nurse about diet, exercise, and other matters needing their attention. All patients had a telephone follow-up with the physician assistant once every 3 months to confirm the patients' situation and answer questions; no structured information was included in the telephone follow-up. The patients could contact the physician assistant at any time when needed.

**Table 1**  
Training for the supportive care nurses team.

Curriculum content	Trainer	Training time
All kinds of esophageal cancer operation	Esophageal surgeon	1 d
Enteral nutrition	Director of nutritional department	1 d
Parenteral nutrition	Professor of pharmacy intravenous admixture services (PIVAS)	1 d
How to use the simple diet self-assessment tool (SDSAT) <sup>35</sup>	Professor Cong (developer of SDSAT)	1 d
Common symptoms and management of postoperative patients with esophageal cancer	Nursing specialist in thoracic surgery	1 d
How to use nutrition risk screening 2002 (NRS 2002) <sup>36</sup> and European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30) <sup>37</sup>	Nursing teacher proficient in scales	1 d
How to follow-up and standardize terms	Nurse with rich follow-up experience	1 d

**Intervention group**

**Before discharge**

In addition to conventional care, the intervention group received nurse-led telephone and Internet-based supportive care. The

supportive care team provided intervention. The nurses sent a pamphlet to each patient to introduce the supportive care plan. The nurses would make telephone calls to the patients regularly. The Internet-based supportive care was performed by a WeChat group. Patients joined in the group before discharge and asked questions anytime they needed, and the nurses regularly answered the questions online every day.

**After discharge**

The nurse called each patient for a one-on-one discussion after discharge once a week in the first two months, twice a month in months 3–4, and once a month in months 5–6. The follow-up telephone call focused on the patients' nutritional status, symptoms after esophagectomy, and psychological issues. The patients' eating situation would be evaluated using the simple diet self-assessment tool (SDSAT), which nurses taught patients to use before discharge. This tool also was available on a poster displayed on the wall of the ward (Figure 1). Nurses would provide dietary guidance based on the results of the SDSAT. The SDSAT scores ranged from 1 to 5, with higher scores meaning a better diet. Patients who scored 5 points did not need a nutritional intervention. Patients who got 4 points would be advised to eat food rich in calories and protein and take nutritional supplements as needed. Patients who scored 3 points were instructed to take oral nutrition supplements high in calories and protein in addition to their normal diet. Patients who received 1 or 2 points were advised to go to the hospital's nutritional clinic for enteral or parenteral nutrition. These follow-up phone call took one afternoon per week.



Figure 1. The SDSAT poster displayed on the wall of the ward.

Nurses also asked about the patients' symptoms after surgery and answered their questions, for example, regarding pain, reflux, or cough. They recommended medical visits when necessary. The nurses asked patients if they had any psychological problems and provided counseling. Each of these telephone contacts lasted as long as the patients desired, usually between 20 and 30 min. The nurses managed the WeChat group, using it to answer patients' questions. For instance,

they organized and sent out answers to the most common 10 questions, information concerning common oral nutritional supplements (Figure 2), and articles related to postoperative rehabilitation and nutrition (Figure 3). The patients could upload pictures (Figure 4) and videos to the group and communicate with nurses and other patients. Different nurses were responsible for the WeChat group for a week in turn and answering questions at any time.

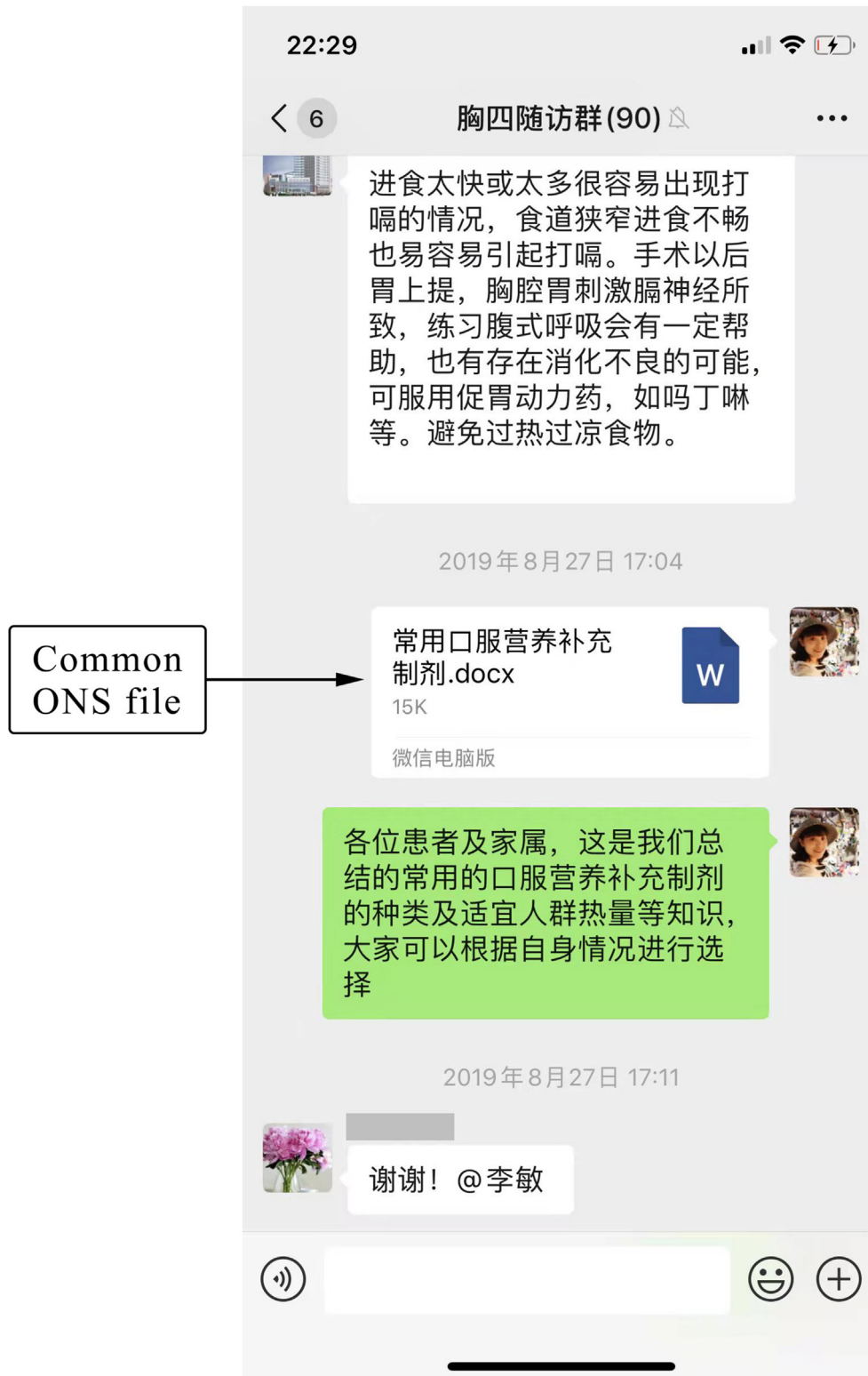


Figure 2. A nurse sent a common ONS file to the WeChat group. ONS, oral nutritional supplements.



Figure 3. A nurse sent links to articles about nutritional management at home.

*Data collection procedure*

All data were collected by two nurses who were not involved in the intervention to reduce outcome bias. Before randomization, baseline characteristics, such as age, sex, and type of surgery, were gathered from the patients' medical records. The investigators compared the nutrition status, quality of life, helpfulness of the follow-up service, and patient satisfaction between the two groups 6 months after discharge. The nutrition status was measured according to the patients' blood nutrition-related indicators (albumin, prealbumin, transferrin, hemoglobin), SDSAT scores, and nutrition risk screening 2002 (NRS 2002) scores.

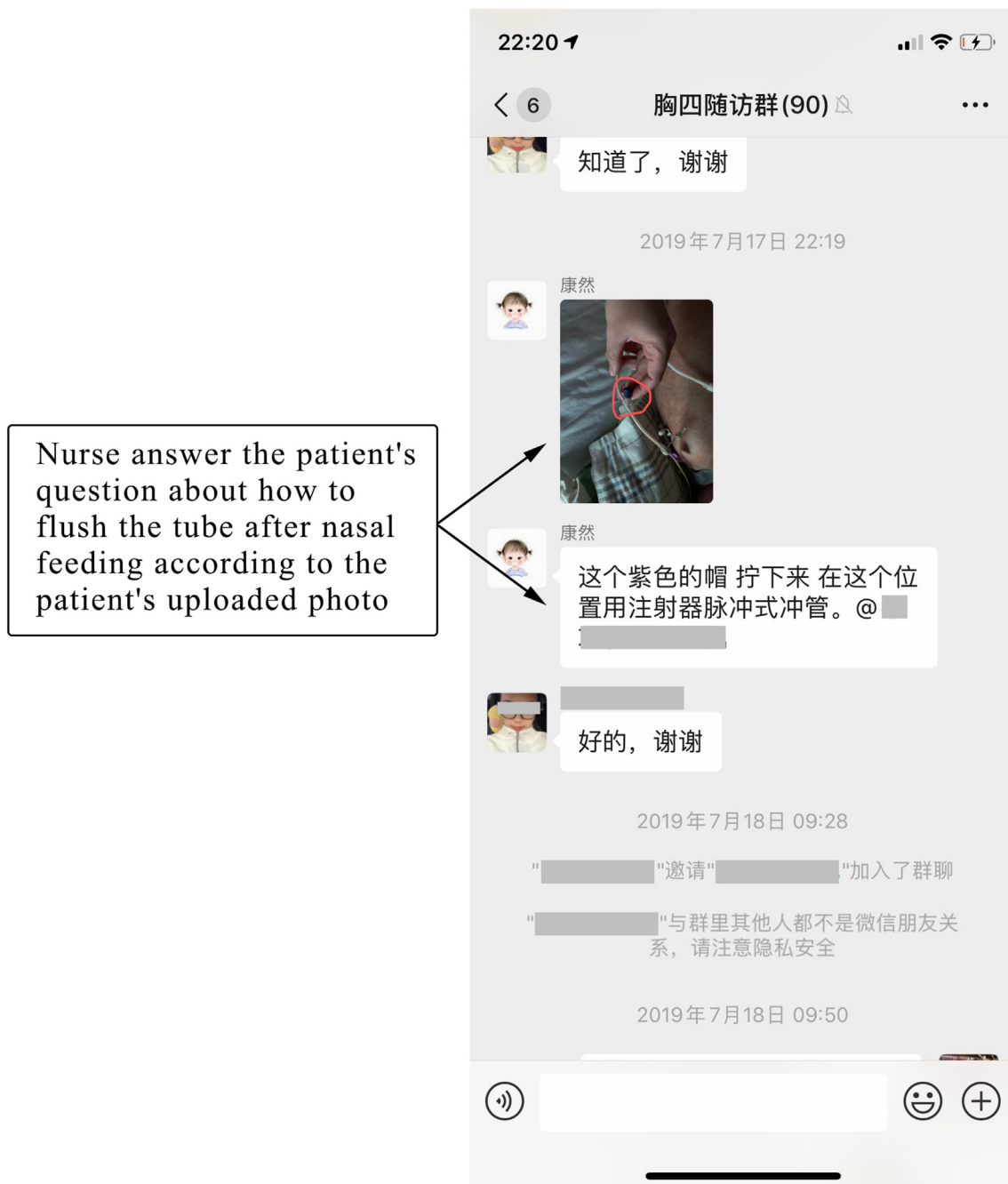
Quality of life was measured according to the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30). The blood test results were collected through the hospital information system. The investigators tested the helpfulness of the follow-up service and the patients' satisfaction using a self-made questionnaire. The nurses asked the patients these questions over the phone.

*Instruments*

*Demographic and clinical characteristics questionnaire*

The self-designed demographic and clinical characteristics





Nurse answer the patient's question about how to flush the tube after nasal feeding according to the patient's uploaded photo

Figure 4. Communication between a nurse and a patient in the WeChat Group.

questionnaire consisted of age, gender, marital status, educational background, and employment status. The demographic characteristics were provided by the patients, and the clinical data (e.g., tumor type, tumor stage, NRS 2002 score) were obtained by the investigator from the patients' medical records.

#### SDSAT

Based on their previous studies and clinical experience, Cong et al. developed the SDSAT. The results identified five patterns for patients with cancer. In the first pattern, patients could have only a liquid diet, such as soup, juice, milk, and soy milk. This is a common diet for patients in the early postoperative stage. These patients usually consume less than 300 kcal in one day. In the second pattern, the patients rarely eat meat. These patients' energy intake is usually between 300 kcal and 600 kcal. In the third pattern, patients can have one full meal and two semi-liquid

meals per day. Patients can sometimes eat 50 g of meat or an egg. The total energy consumed is typically between 600 kcal and 900 kcal. In the fourth pattern, patients can have two full meals per day, with only one liquid or semi-liquid meal. Some meat (usually 50–100 g) and a small amount of fat are consumed by patients. The range of energy intake is usually 900–1200 kcal. In the fifth pattern, patients can have three full meals per day. They consume enough staple foods (250–300 g), meat (15 g), fat, eggs, milk, and fruits. According to the five dietary patterns, patients' diet can be estimated using a five-point Likert scale ranging from 1 to 5, with 1 = less than 300 kcal, 2 = 300–600 kcal, 3 = 600–900 kcal, 4 = 900–1200 kcal, and 5 = more than 1200 kcal. Considering the nuances of eating habits in different regions, we designed three versions of the instrument, including versions for the North, Northwest, and South regions. For example, the common staple foods in the Northwest and South regions are flour and rice, respectively, whereas the staple food in

the North region is flour or rice. To make this easier to understand, each version was presented in the form of a food map, in which the common local foods were listed according to each dietary pattern. It usually takes 5–10 min to estimate patients’ dietary intake, which provides considerable practical value. The SDSAT has demonstrated good reliability and validity among patients with head and neck cancer.<sup>38</sup>

**EORTC QLQ-C30**

The EORTC QLQ-C30 contains five functional scales (physical, role, cognitive, emotional, and social functioning), a global Quality of Life (QoL) scale, three symptom scales (fatigue, nausea and vomiting, and pain), and six single items (appetite loss, diarrhea, dyspnea, constipation, insomnia, and financial impact). The questionnaire has a 1-week time frame and uses a four-point response format, except for the global QoL scale, which has a seven-point response format. The scores are transformed linearly to a score between 0 and 100.<sup>39</sup> For the functioning and the global QoL scales, a higher score indicates better health. For the symptom scales, a higher score indicates a higher symptom burden. The QLQ-C30 summary score is calculated as the mean of the combined 13

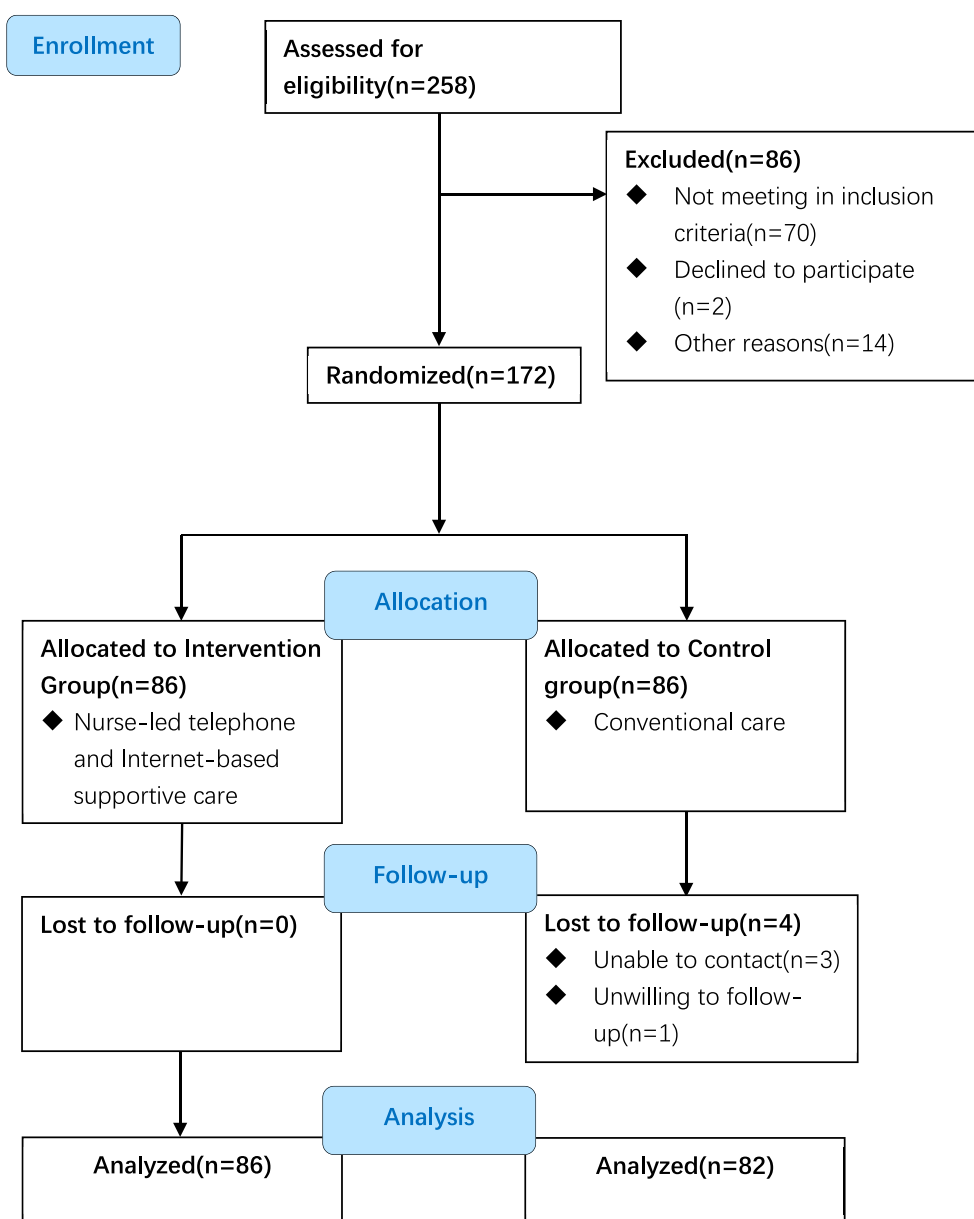
QLQ-C30 scale and item scores (excluding global QoL and financial impact), with a higher score indicating a better QoL.<sup>40,41</sup> The summary score was calculated only when all the required 13 scale and item scores were available.

**NRS 2002**

The NRS 2002 is a preferred tool recommended by the European Society of Parenteral Enteral Nutrition and the Chinese Parenteral Enteral Nutrition Association for NRS in hospitalized patients. It assesses three main aspects: nutrition score (0–3), disease score (0–3), and age score ( $\geq 70$  years, 1 score;  $< 70$  years, 0 score). The total score (0–7 points) is the sum of these three parts, and patients with  $\geq 3$  points have a nutritional risk, whereas those with  $< 3$  points do not.

**Self-made questionnaire**

To shorten the duration of asking and reduce the disturbance to the patients, the questions were designed simply to be scored on five-point Likert scales ranging from 1 to 5 to test the helpfulness of the follow-up service and the patients’ satisfaction.<sup>42</sup> For helpfulness, 1 = no help at



**Figure 5.** Flowchart of patients in the study. Flow diagram of the study showing enrolment, randomized allocation to intervention group (n = 86) or control group (n = 86), 6-month follow-up and analysis (n = 168).

all, whereas 5 = a lot of help; the higher the score, the more helpful the patients felt the service was. For satisfaction, 1 = very dissatisfied, whereas 5 = very satisfied; the higher the score, the more satisfied the patients.

**Data analyses**

The data analysis was performed with SPSS 19.0 (IBM Corp., Armonk, NY, USA). The measurement data were expressed as mean ± standard deviation. The chi-squared and Mann–Whitney tests were used for comparisons between the intervention and control groups. The Spearman correlation analysis was used for the analysis of correlation between the nutritional index and quality of life. A *P* value of < 0.05 was considered statistically significant.

**Ethical considerations**

Ethical approval of this study was approved by the Ethics Committee of the National Cancer Center before conducting the study. Each potential participant was informed about the purpose of the study, what his/her involvement would entail, confidentiality and anonymity issues, voluntary involvement, and the right to withdraw at any time without repercussions (Approval No. NCC2018M045). All participants who consented to participate were asked to sign a consent form.

**Results**

*General data of patients*

In total, 172 patients were enrolled in this study. Four patients in the control group did not complete the study. Finally, 168 patients were included in the study, with 86 patients in the intervention group and 82 in the control group. Figure 5 presents a flow chart. The general information of the two groups is shown in Table 2. No statistically significant differences were present between the two groups, indicating their comparability.

*Nutritional status and hematologic examination*

After adopting different modes of care (control group: conventional care; intervention group: supportive care based on Internet and

**Table 2**  
Baseline characteristics of patients in the intervention group (*n* = 86) and control group (*n* = 84).

Variables		Intervention group [ <i>n</i> (%)]	Control group [ <i>n</i> (%)]	Statistic value	<i>P</i> value
Gender	Male	71 (82.6)	68 (82.9)	1.000	0.556 <sup>b</sup>
	Female	15 (17.4)	14 (17.1)		
Age (years)	≤50	11 (12.8)	7 (8.5)	3448.000	0.804 <sup>b</sup>
	51–60	27 (31.4)	29 (35.4)		
	61–70	40 (46.5)	37 (45.1)		
	>70	8 (9.3)	9 (11.0)		
Marital status	Married	82 (97.6)	80 (97.6)	0.682	0.364 <sup>b</sup>
	Single	4 (2.4)	2 (2.4)		
Education level	Primary school and below	15 (18.3)	14 (16.3)	1.949	0.583 <sup>b</sup>
	Junior middle school	25 (30.5)	34 (39.5)		
	High school or technical secondary school	19 (23.2)	20 (23.3)		
	College degree or above	23 (28.0)	18 (20.9)		
Employment status	Unemployed/retired	21 (24.4)	25 (30.5)	0.393	0.239 <sup>b</sup>
	Employed	65 (75.6)	57 (69.5)		
Present body mass index (kg/m <sup>2</sup> )	<18.5	1 (1.2)	4 (4.9)	2.481	0.289 <sup>b</sup>
	18.5–23.9	39 (45.3)	40 (48.8)		
	>24	46 (53.5)	38 (46.3)		
Tumor histology	Squamous cell carcinoma	59 (68.6)	56 (68.3)	0.965	0.549 <sup>b</sup>
	Adenocarcinoma	27 (31.4)	26 (31.7)		
Cancer stage <sup>a</sup>	I	35 (40.7)	21 (25.6)	4.675	0.197 <sup>b</sup>
	II	13 (15.1)	17 (20.7)		
	III	32 (37.2)	35 (42.7)		
	IV	6 (7.0)	9 (11.0)		

<sup>a</sup> TNM Classification of Malignant Tumors.

<sup>b</sup> Mann–Whitney test.

**Table 3**

Comparison of NRS 2002, SDSAT, and laboratory data between the intervention and control groups in the 6 months after discharge.

Item	Intervention group ( <i>n</i> = 86)	Control group ( <i>n</i> = 82)	Statistic value	<i>P</i> value
NRS 2002	1.90 ± 0.91	3.20 ± 1.04	−8.731*	0.001 <sup>a</sup>
SDSAT	3.92 ± 0.80	2.40 ± 0.97	−11.221*	0.001 <sup>a</sup>
Albumin (g/L)	44.58 ± 5.33	42.94 ± 4.40	2.176*	0.031 <sup>b</sup>
Prealbumin (mg/dL)	21.42 ± 3.72	19.82 ± 5.40	2.279*	0.024 <sup>b</sup>
Transferrin (mg/dL)	214.54 ± 38.38	193.15 ± 49.13	3.142*	0.002 <sup>b</sup>
Hemoglobin (g/L)	130.73 ± 14.81	129.15 ± 16.26	0.666	0.506 <sup>b</sup>

\**P* < 0.05 was considered statistically significant.

<sup>a</sup> Mann–Whitney test.

<sup>b</sup> Chi-squared test.

telephone) in the 6 months after discharge, we identified significant differences in NRS 2002 and SDSAT scores between the two groups (Table 3). Table 3 also shows that the differences in albumin, prealbumin, and transferrin levels were statistically significant. We did not find a significant difference in hemoglobin concentration between the two groups.

*Quality of life*

The mean scores and standard deviations of each item of the EORTC QLQ-C30 are shown in Table 4. According to the results of the scale, after 6 months' intervention, all the differences between the intervention and control groups were significantly different for all the functions and items. The scores of the functional scales for the intervention group were higher than those of the control group (100 = best). The scores of symptom scales for the intervention group were all lower than those of the control group (0 = best).

*The correlation of nutritional index and quality of life*

Results of the correlation analysis of quality of life with SDSAT and NRS2002 of all the participants (*n* = 168) are presented in Table 5. A significant positive correlation of the SDSAT (the higher the better) and the scores of total health/quality of life was detected (*r* = 0.214, *P* = 0.005). A significant negative correlation of the NRS2002 (the lower the



better) and the scores of total health/quality of life was detected ( $r = -0.446, P = 0.000$ ).

**Helpfulness and satisfaction**

The mean scores and standard deviations of each item of the self-made questionnaire are shown in Table 6. According to the results, the helpfulness and satisfaction scores of the intervention group were both significantly higher than those of the control group.

**Discussion**

A lot of research has shown that implementing ERAS protocols leads to better patient outcomes, shorter hospital stays, and fewer complications for patients with esophageal cancer. Few studies, however, have focused on post-discharge care for patients. Shorter hospital stays can lead to many problems, such as patients' lack of self-care knowledge, anxiety, and symptoms related to the operation. This study was conducted as a randomized control trial to test the effect of nurse-led supportive care based on telephone and Internet support following ERAS for esophageal cancer. The findings showed that the supportive care program positively affected patients' nutritional status, quality of life, and satisfaction.

*Effect of supportive care on nutritional status*

The supportive care discussed in this study primarily addressed the patients' nutrition problems. The measures included nutritional screening, assessment of eating difficulties, a calculation of calorie intake, individualized guidance, many forms of nutritional education, and psychological nursing. At 6 months after discharge, the NRS 2002 and SDSAT scores for the intervention group were significantly higher than those for the control group. Blood tests showed that the albumin, prealbumin, and transferrin contents of the intervention group were also significantly higher than those of the control group. Although the difference was not significant, the hemoglobin concentration of the intervention group was higher than that of the control group.

Semi-structured interviews indicated that patients felt that the embodied sensations of eating after esophagectomy were misaligned.<sup>25</sup> This required adjustment to new sensations when chewing/swallowing, to the changed taste and smell of food, and an absence of satiety often resulting in a negative effect. Consequently, appetite loss is significantly more frequent in esophagectomy patients 3 years post-surgery than in the general population,<sup>21</sup> with symptoms such as diarrhea and reflux

**Table 4**  
Comparison of quality of life between the intervention and control groups after intervention.

Item	Mean (SD)		Statistic value	P value	
	Intervention group (n = 86)	Control group (n = 82)			
Functional scales (100 = best)	Physical function	92.13 ± 5.82	79.84 ± 18.2	46.027*	0.000 <sup>a</sup>
	Role function	88.58 ± 14.12	73.58 ± 22.52	13.266*	0.000 <sup>a</sup>
	Emotional function	97.19 ± 6.27	90.04 ± 17.39	42.263*	0.000 <sup>a</sup>
	Cognitive function	100 ± 0	91.26 ± 15.10	125.859*	0.000 <sup>a</sup>
	Social function	85.77 ± 16.00	74.59 ± 17.02	-4.125	0.000 <sup>a</sup>
	Total health/quality of life	81.93 ± 12.58	65.55 ± 16.76	13.214*	0.000 <sup>a</sup>
Symptom scales (0 = best)	Fatigue	19.1 ± 11.24	37.67 ± 19.58	15.933*	0.000 <sup>a</sup>
	Nausea and vomit	25.28 ± 14.01	39.63 ± 18.08	147.953*	0.000 <sup>a</sup>
	Pain	6.74 ± 12.74	14.84 ± 21.91	8.068*	0.005 <sup>a</sup>
	Dyspnea	12.36 ± 18.38	24.39 ± 26.73	9.506*	0.002 <sup>a</sup>
	Insomnia	4.12 ± 11.03	20.73 ± 28.03	73.186*	0.000 <sup>a</sup>
	Appetite loss	9.36 ± 17.4	19.51 ± 27.19	21.175*	0.000 <sup>a</sup>
	Continued constipation	3.37 ± 11.29	9.76 ± 19.94	26.152*	0.000 <sup>a</sup>
	Diarrhea	20.22 ± 18.54	44.72 ± 29.73	43.031*	0.000 <sup>a</sup>
	Financial difficulties	16.85 ± 24.16	27.64 ± 22.1	5.053*	0.026 <sup>a</sup>

\*P < 0.05 was considered statistically significant.

SD: Standard deviation.

<sup>a</sup> Chi-squared test.

**Table 5**  
Correlation of nutritional index and quality of life in all the patients (n = 168).

	Scores of total health/quality of life	
	r	P value
SDSAT	0.214*	0.005 <sup>a</sup>
NRS2002	-0.446*	0.000 <sup>a</sup>

\*P < 0.05 was considered statistically significant.

<sup>a</sup> Spearman correlation analysis.

**Table 6**  
Comparison of helpfulness and satisfaction between the two groups.

Item	Intervention group (n = 86)	Control group (n = 82)	Statistic value	P value
Helpfulness	2.93 ± 0.29	2.56 ± 0.50	149.123*	0.000 <sup>a</sup>
Satisfaction	4.80 ± 0.64	4.62 ± 0.71	7.420*	0.007 <sup>a</sup>

\*P < 0.05 was considered statistically significant.

<sup>a</sup> Mann-Whitney test.

remaining significantly worse at 3 years than at baseline.<sup>22</sup> In a qualitative study with longer-term survivors, eating was reported to no longer be a source of pleasure, now requiring planning and organization.<sup>43</sup> Weight loss is common; two-thirds of the patients in one study reported a 10% loss in body weight 6 months after surgery.<sup>44</sup> Before providing nutritional guidance, it is very important to understand the patients' eating status. To the best of our knowledge, this is the first study to select SDSAT as a guidance tool for supportive care for patients with esophageal cancer. According to European Society of Clinical Nutrition and Metabolism guidelines, after esophagectomy, patients should consume 30 kcal/kg calories and 1.5 g/kg protein every day. However, these guidelines are abstract and difficult to apply for patients and their caregivers.<sup>45</sup> The SDSAT is an easy-to-use, quick, and simple dietary intake assessment tool. It can help nurses to determine the patients' dietary range and standardize nutrition guidance quickly. We made pioneering use of the SDSAT to assess patients' eating status and provide targeted guidance. This also confirmed the applicability of the SDSAT to patients with esophageal cancer.

*Effect of supportive care on quality of life*

Our results showed a significant difference in the quality of life after the implementation of supportive care in the intervention group. All the results of the functional and symptom dimensions of the intervention group were significantly better than those of the control group. These

results were quite like to the findings of Maryam et al.,<sup>46</sup> who conducted a self-care education program among patients with esophageal cancer to improve their quality of life. The two studies are similar in that nutritional assessment and education were incorporated into the interventions.

Because patients with esophageal cancer could not recover their physical function after discharge and solve their health problems independently, they often showed suboptimal fitness and lower physical activity levels, and they needed to acquire rehabilitative information about medical care and self-management to increase their ability to function physically.<sup>47,48</sup> The quality of life of patients with esophageal cancer has been reported to recover between 6 and 12 months post-surgery and may return to a comparable level to the general population.<sup>22</sup> Therefore, we designed the supportive care in this study to be offered in the 6 months after discharge.

According to the results of the correlation analysis between the nutrition status and quality of life of all the 168 patients involved in this study, there was a positive correlation of the SDSAT (the higher the better) and the scores of total health/quality of life ( $r = 0.214, P = 0.005$ ) while there was a negative correlation of the NRS2002 (the lower the better) and the scores of total health/quality of life ( $r = -0.446, P = 0.000$ ). In a word, the quality of life improved when the patients achieved a better nutritional status. The quality of life of patients with esophageal cancer after the operation is closely related to their nutritional status and operation-related symptoms. Furthermore, malnutrition is associated with adverse postoperative outcomes, including immune suppression, increased infection rate, and increased morbidity, including pulmonary complications, delayed wound healing, muscle wasting, and increased healthcare costs.<sup>49–53</sup> Therefore, the early identification of malnutrition and appropriate nutritional support lead to improved nutritional status and quality of life.<sup>54–61</sup> Moreover, nutrition can support the patients and help them to heal from cancer-related fatigue, which also influences their quality of life. Good nutritional status can easily provide the nourishment necessary to support the adenosine-triphosphate production and potentially increase energy levels.<sup>62</sup>

In this study, nurses not only implemented nutritional assessment and education via telephone but also pushed various forms of nutrition-related knowledge through a WeChat group, which helped address patient problems and improve their nutrition-related knowledge. Furthermore, nurses asked about the patients' common symptoms related to surgery, such as pain, reflux, or cough, and gave them instructions (e.g., how to use analgesics, methods for preventing reflux). They also asked patients if they had psychological problems and provided counseling. Thus, the patients' quality of life was improved when their symptoms were alleviated.

#### *Effect of the follow-up service based on telephone and internet*

According to the results, the patients in the intervention group found the follow-up service more helpful and were more satisfied with their medical care than the patients in the control group. This indicates that supportive care based on telephone and Internet support can help patients meet their needs. We designed the helpfulness and satisfaction questionnaire for only 2 Likert questions to reduce the patients' workload of answering questions. Marlene et al. found that the dropout rate during data collection was high.<sup>33</sup> The main reason given by patients was feeling too tired to answer the instruments irrespective of whether they had recurrent illness. To balance the effectiveness and the simplicity of the assessment tools is a dilemma for all follow-up medical staff. More effective and easy tools should be developed in the future.

Telephone counseling and problem-solving support first emerged in 1985 and have become some of the main ways of delivering cancer-related information.<sup>63</sup> Nurse-provided telephone follow-up care is not hindered by national or geographic limitations or transportation issues. Telephone follow-up counseling services can be easily and discreetly

accessed by homebound or physically challenged patients, and these services also offer an affordable and readily available means of counseling.<sup>64</sup> Telephone follow-up calls take a lot of time, as nurses can communicate with only one patient at a time. Nevertheless, telephone follow-up care still has a special significance because the nurses who call the patients are the medical staff familiar to the patients and hearing their voices can make the patients feel safe and provide them psychological comfort.

The Internet-based supportive care was performed via the WeChat group in this study. Patients joined in the nurses–patients' group before discharge and stayed connected with each other. In contrast, the rate of loss to follow-up care by telephone is highly related to many factors, such as patients changing their phone numbers or inconvenience during the period of the follow-up. In recent years, the wide adoption of mobile technology (e.g., smartphones and mobile apps) has offered a promising platform for efficient and accessible intervention delivery.<sup>65</sup> Using a mobile health system on a mobile platform may be ideal for patients who have difficulty in making frequent follow-up visits to a hospital, which can be particularly challenging in China, as hospitals are situated in city centers. As 98.5% of people aged 50–80 years old in China use the WeChat application,<sup>66</sup> supportive care via WeChat would reach a substantial percentage of the patients with esophageal cancer. In this study, the WeChat group could provide the patients with not only voice communication but also text, image, and video. Furthermore, all the information could be stored on the phone and reviewed repeatedly when the patients forgot what they had learned, such as the video on the enteral nutrition process. This mode of communication is more convenient for both nurses and patients, as they can ask and answer questions any time they want to in the WeChat group. Additionally, the cost of supportive care based on the Internet is lower than that of care delivered over the phone or by returning to the clinic. The labor cost was also low because one nurse could answer many patients' questions at one time in the group. Hence, it did not add too much work for the nurses and required less time. Furthermore, all the patients in the group had undergone esophageal surgery and had shared similar experiences, so they could comfort and encourage each other.

Several supportive care interventions have been developed to improve the quality of life of patients with postsurgical esophageal cancer but have shown no effect on the patients' quality of life. This could be because they used only a single approach to provide supportive care, such as home visiting, telephone follow-up calls, or health education.<sup>30,32,67</sup> Therefore, the supportive care in this study adopted a combination of telephone and Internet support. The two modes complemented each other and made up for their deficiencies, which not only improved the patients' quality of life but also improved the work efficiency. The combination of the two supportive care modes also reduced the rate of loss to follow-up. In this study, the rate of loss to follow-up of the control group was 4.65% (4/86), whereas that of the intervention group was 0% (0/86).

In the future, mobile applications or programs dedicated to supportive care should be developed. Dai et al. found that patient-reported outcome-based symptom management showed a lower symptom burden and fewer complications than usual care for lung cancer post-discharge.<sup>68</sup> The patient-reported outcome system may be applied in symptom management for esophageal patients' post-discharge in the future because patients find it to be more understandable. The patients may receive various forms of information, which could be searched and stored. They also could make video calls to nurses and communicate with other patients. The nurses could manage patients electronically. After inputting scientific and reliable knowledge, the application could automatically send information according to the patients' situation and provide intelligent feedback based on the patients' self-assessment. In other words, should supportive care be standardized, both the patients' quality of life and the nurses' work efficiency would be improved.

## Effect of the nurse-led supportive care

In this study, nurse-led supportive care showed a significant effect on increasing patients' nutritional status, quality of life, and satisfaction. Nurses play an essential role in supporting patients with cancer by managing disease-related complications, monitoring patients' responses to the healthcare system's interventions, and coordinating patient care. They also frequently engage in communication regarding patients' psychosocial concerns, with patients expressing feelings of worry, depression/anxiety, and disappointment,<sup>69</sup> and specialist nurses make a key contribution in renegotiating the balance of follow-up care with physical symptom management.<sup>70</sup> Information provision is also involved; one study found that, although some patients (10%) felt they had difficulty in understanding the disease and treatment-related information provided by the physician, none felt they had problems understanding what they were told by the nurse.<sup>69</sup>

Despite the advantages of nurse-led supportive care, many factors still restrict its development in China. China has fewer nurses per capita than developed countries and even fewer clinical nurse specialists in esophageal cancer. In most hospitals, nurses are busy with clinical work, and there are no full-time supportive care nurses. Most nurses do not have specific training in supportive care and do not have enough equipment specifically for supportive care, such as telephones, computers, or specialized supportive care applications. Policy support is also insufficient. There is no corresponding fee pricing and supporting medical insurance policies, so the value of the nurses' labor is neither recognized officially nor compensated adequately.

## Limitations

This study has some limitations, such as the small sample size and the fact that it was a single-center investigation performed in a tertiary Grade A cancer center. In the future, we can expand supportive care into other areas and increase the sample size to increase the credibility of the research. Telephone interviews were used in this study to evaluate the helpfulness of the care and the patients' satisfaction with that care. Although the interviewers and the intervenors were not the same people, patients may give high scores while withholding their true feelings because they were not anonymous.

## Conclusions

This study highlighted the importance of nurse-led supportive care based on telephone and Internet-based support for patients after ERAS. The supportive care improved patients' nutritional status, elevated their quality of life, and improved their satisfaction.

## Acknowledgments

The authors would like to acknowledge the funding support of the Beijing Hope Run Special Fund of Cancer Foundation of China. The authors also thank the patients who participated in this study.

## Declaration of competing interest

None declared.

## Financial support and sponsorship

This study was supported by Beijing Hope Run Special Fund of Cancer Foundation of China [Grant No. LC2018C03].

## References

- Nasr JY, Schoen RE. Prevalence of adenocarcinoma at esophagectomy for Barrett's esophagus with high grade dysplasia. *J Gastrointest Oncol*. 2011;2(1):34–38. <https://doi.org/10.3978/j.issn.2078-6891.2010.027>.
- Jabbour SK, Thomas Jr CR. Radiation therapy in the postoperative management of esophageal cancer. *J Gastrointest Oncol*. 2010;1(2):102–111. <https://doi.org/10.3978/j.issn.2078-6891.2010.013>.
- Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries [published correction appears in *CA Cancer J Clin*. 2020 Jul;70(4):313] *CA Cancer J Clin*. 2018;68(6):394–424. <https://doi.org/10.3322/caac.21492>.
- He F, Wang J, Liu L, et al. Esophageal cancer: trends in incidence and mortality in China from 2005 to 2015. *Cancer Med*. 2021;10(5):1839–1847. <https://doi.org/10.1002/cam4.3647>.
- Duan J, Tan Y, Yang N, et al. International comparison analysis of China's cancer incidence and mortality. *Chin J Front Med Sci*. 2016;8(7):17–23. <https://doi.org/10.3969/j.issn.1674-7372.2016.07.005>.
- Hu Y, Ma Y, Wang J, Zhu ZH. Early enteral infusion of traditional Chinese medicine preparation can effectively promote the recovery of gastrointestinal function after esophageal cancer surgery. *J Thorac Dis*. 2011;3(4):249–254. <https://doi.org/10.3978/j.issn.2072-1439.2011.09.08>.
- Rothwell JF, Feehan E, Reid I, Walsh TN, Hennessy TP. Delay in treatment for oesophageal cancer. *Br J Surg*. 1997;84(5):690–693.
- Coupland VH, Lagergren J, Lichtenborg M, et al. Hospital volume, proportion resected and mortality from oesophageal and gastric cancer: a population-based study in England, 2004–2008. *Gut*. 2013;62(7):961–966. <https://doi.org/10.1136/gutjnl-2012-303008>.
- National Health Commission. *China Health Statistics Annual*. Beijing, BJ: Beijing Union Medical University Press; 2018.
- Ren JY, Zhong JD, Yuan J, Zhang JE, Li CZ, Wei WJ. Unmet supportive care needs and associated factors among Chinese discharged patients with esophageal cancer after esophagectomy: a cross-sectional study [published online ahead of print, 2020 May 21] *Eur J Oncol Nurs*. 2020;46:101767. <https://doi.org/10.1016/j.ejon.2020.101767>.
- Allum WH, Stenning SP, Bancewicz J, Clark PI, Langley RE. Long-term results of a randomized trial of surgery with or without preoperative chemotherapy in esophageal cancer. *J Clin Oncol*. 2009;27(30):5062–5067. <https://doi.org/10.1200/JCO.2009.22.2083>.
- Djävär T, Blazeby JM, Lagergren P. Predictors of postoperative quality of life after esophagectomy for cancer. *J Clin Oncol*. 2009;27(12):1963–1968. <https://doi.org/10.1200/JCO.2008.20.5864>.
- Sun V, Kim J, Kim JY, et al. Dietary alterations and restrictions following surgery for upper gastrointestinal cancers: key components of a health-related quality of life intervention. *Eur J Oncol Nurs*. 2015;19(4):343–348. <https://doi.org/10.1016/j.ejon.2015.01.008>.
- Baker M, Halliday V, Williams RN, Bowrey DJ. A systematic review of the nutritional consequences of esophagectomy. *Clin Nutr*. 2016;35(5):987–994. <https://doi.org/10.1016/j.clnu.2015.08.010>.
- Lighthart-Melis GC, Weijs PJ, te Boveldt ND, et al. Dietician-delivered intensive nutritional support is associated with a decrease in severe postoperative complications after surgery in patients with esophageal cancer. *Dis Esophagus*. 2013; 26(6):587–593. <https://doi.org/10.1111/dote.12008>.
- Wang H, Lin M, Lin Z, et al. Patient self-administration of enteral nutrition feeding via jejunostomic tube is beneficial for the postoperative recovery after minimally invasive oesophagectomy: a comparative study. *Interact Cardiovasc Thorac Surg*. 2016;23:i34–i35. <https://doi.org/10.1093/icvts/ivw260.125>.
- Wikman A, Johar A, Lagergren P. Presence of symptom clusters in surgically treated patients with esophageal cancer: implications for survival. *Cancer*. 2014;120(2): 286–293. <https://doi.org/10.1002/cncr.28308>.
- Hellstadius Y, Lagergren P, Lagergren J, Johar A, Hultman CM, Wikman A. Aspects of emotional functioning following oesophageal cancer surgery in a population-based cohort study. *Psycho Oncol*. 2015;24(1):47–53. <https://doi.org/10.1002/pon.3583>.
- Malmström M, Ivarsson B, Johansson J, Klefsjård R. Long-term experiences after oesophagectomy/gastrectomy for cancer—a focus group study. *Int J Nurs Stud*. 2013; 50(1):44–52. <https://doi.org/10.1016/j.ijnurstu.2012.08.011>.
- Olsson U, Bergbom I, Bosaeus I. Patients' experiences of the recovery period 3 months after gastrointestinal cancer surgery. *Eur J Cancer Care (Engl)*. 2002;11(1): 51–60.
- Djävär T, Lagergren J, Blazeby JM, Lagergren P. Long-term health-related quality of life following surgery for oesophageal cancer. *Br J Surg*. 2008;95(9):1121–1126. <https://doi.org/10.1002/bjs.6293>.
- Lagergren P, Avery KN, Hughes R, et al. Health-related quality of life among patients cured by surgery for esophageal cancer. *Cancer*. 2007;110(3):686–693. <https://doi.org/10.1002/cncr.22833>.
- Olsson U, Bosaeus I, Svedlund J, Bergbom I. Patients' subjective symptoms, quality of life and intake of food during the recovery period 3 and 12 months after upper gastrointestinal surgery. *Eur J Cancer Care (Engl)*. 2007;16(1):74–85. <https://doi.org/10.1111/j.1365-2354.2006.00709.x>.
- Viklund P, Wengström Y, Rouvelas I, Lindblad M, Lagergren J. Quality of life and persisting symptoms after oesophageal cancer surgery. *Eur J Cancer*. 2006;42(10): 1407–1414. <https://doi.org/10.1016/j.ejca.2006.02.005>.
- Wainwright D, Donovan JL, Kavadas V, Cramer H, Blazeby JM. Remapping the body: learning to eat again after surgery for esophageal cancer. *Qual Health Res*. 2007; 17(6):759–771. <https://doi.org/10.1177/1049732307302021>.
- Graham L, Wikman A. Toward improved survivorship: supportive care needs of esophageal cancer patients, a literature review. *Dis Esophagus*. 2016;29(8): 1081–1089. <https://doi.org/10.1111/dote.12424>.
- Fitch MI. Supportive care framework. *Can Oncol Nurs J*. 2008;18(1):6–24. <https://doi.org/10.5737/1181912x181614>.



28. Harrison JD, Young JM, Price MA, Butow PN, Solomon MJ. What are the unmet supportive care needs of people with cancer? A systematic review. *Support Care Cancer*. 2009;17(8):1117–1128. <https://doi.org/10.1007/s00520-009-0615-5>.
29. Molassiotis A, Yates P, Li Q, et al. Mapping unmet supportive care needs, quality-of-life perceptions and current symptoms in cancer survivors across the Asia-Pacific region: results from the International STEP Study [published correction appears in *Ann Oncol*. 2019 Mar 1;30(3):493] *Ann Oncol*. 2017;28(10):2552–2558. <https://doi.org/10.1093/annonc/mdx350>.
30. Malmström M. *Quality of Life and Supportive Care after Oesophageal Cancer Surgery. Long-Term Experiences and Evaluation of a Telephone Based Nurse-Led Supportive Care programme* (Doctor thesis). Sweden: Media-Tryck, Lund University; 2013.
31. Polinder S, Verschuur EM, Siersema PD, Kuipers EJ, Steyerberg EW. Cost comparison study of two different follow-up protocols after surgery for oesophageal cancer. *Eur J Cancer*. 2009;45(12):2110–2115. <https://doi.org/10.1016/j.ejca.2009.03.021>.
32. Zhang XD, Zhao QY, Fang Y, et al. Perioperative comprehensive supportive care interventions for Chinese patients with esophageal carcinoma: a prospective study. *Asian Pac J Cancer Prev*. 2013;14(12):7359–7366. <https://doi.org/10.7314/apjcp.2013.14.12.7359>.
33. Malmström M, Ivarsson B, Klefsgård R, Persson K, Jakobsson U, Johansson J. The effect of a nurse led telephone supportive care programme on patients' quality of life, received information and health care contacts after oesophageal cancer surgery-A six month RCT-follow-up study. *Int J Nurs Stud*. 2016;64:86–95. <https://doi.org/10.1016/j.ijnurstu.2016.09.009>.
34. Edge SB, Compton CC. The American Joint Committee on Cancer: the 7th edition of the AJCC cancer staging manual and the future of TNM. *Ann Surg Oncol*. 2010;17(6):1471–1474. <https://doi.org/10.1245/s10434-010-0985-4>.
35. Cong MH, Shi HP. The invention of a simple diet self-assessment tool for cancer patients. *Electron J Metab Nutr Cancer*. 2018;5. <https://doi.org/10.16689/j.cnki.cn11-9349/r.2018.01.002>, 11–3. (in Chinese).
36. Kondrup J, Rasmussen HH, Hamberg O, Stanga Z, Ad Hoc ESPEN Working Group. Nutritional risk screening (NRS 2002): a new method based on an analysis of controlled clinical trials. *Clin Nutr*. 2003;22(3):321–336. [https://doi.org/10.1016/s0261-5614\(02\)00214-5](https://doi.org/10.1016/s0261-5614(02)00214-5).
37. Aaronson NK, Ahmedzai S, Bergman B, et al. The European Organization for Research and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use in international clinical trials in oncology. *J Natl Cancer Inst*. 1993;85(5):365–376. <https://doi.org/10.1093/jnci/85.5.365>.
38. Jin S, Cong M, Zhang L, Wang Y, Qin D, Lu Q. Validation of a simple diet self-assessment tool (SDSAT) in head and neck cancer patients undergoing radiotherapy. *Eur J Oncol Nurs*. 2020;44:101702. <https://doi.org/10.1016/j.ejon.2019.101702>.
39. Cocks K, King MT, Velikova G, Martyn St-James M, Fayers PM, Brown JM. Evidence-based guidelines for determination of sample size and interpretation of the European Organisation for the Research and Treatment of Cancer Quality of Life Questionnaire Core 30. *J Clin Oncol*. 2011;29(1):89–96. <https://doi.org/10.1200/JCO.2010.28.0107>.
40. Giesinger JM, Kieffer JM, Fayers PM, et al. Replication and validation of higher order models demonstrated that a summary score for the EORTC QLQ-C30 is robust. *J Clin Epidemiol*. 2016;69:79–88. <https://doi.org/10.1016/j.jclinepi.2015.08.007>.
41. Gundy CM, Fayers PM, Groenvold M, et al. Comparing higher order models for the EORTC QLQ-C30. *Qual Life Res*. 2012;21(9):1607–1617. <https://doi.org/10.1007/s11336-011-0082-6>.
42. Kavak Akelma F, Altınsoy S, Arslan MT, Ergil J. Effect of favorite music on postoperative anxiety and pain. *Wirkung von Lieblingsmusik auf postoperative Angst und Schmerz*. *Anaesthesist*. 2020;69(3):198–204. <https://doi.org/10.1007/s00101-020-00731-8>.
43. Clarke C, McCorry NK, Dempster M. The role of identity in adjustment among survivors of oesophageal cancer. *J Health Psychol*. 2011;16(1):99–108. <https://doi.org/10.1177/1359105310368448>.
44. Martin L, Lagergren J, Lindblad M, Rouvelas I, Lagergren P. Malnutrition after oesophageal cancer surgery in Sweden. *Br J Surg*. 2007;94(12):1496–1500. <https://doi.org/10.1002/bjs.5881>.
45. Weimann A, Braga M, Carli F, et al. ESPEN practical guideline: clinical nutrition in surgery. *Clin Nutr*. 2021;40(7):4745–4761. <https://doi.org/10.1016/j.clnu.2021.03.031>.
46. Pool MK, Nadrihan H, Pasha N. Effects of a self-care education program on quality of life after surgery in patients with esophageal cancer. *Gastroenterol Nurs*. 2012;35(5):332–340. <https://doi.org/10.1097/SGA.0b013e3182605f86>.
47. Gannon JA, Guinan EM, Doyle SL, Beddy P, Reynolds JV, Hussey J. Reduced fitness and physical functioning are long-term sequelae after curative treatment for esophageal cancer: a matched control study. *Dis Esophagus*. 2017;30(8):1–7. <https://doi.org/10.1093/dote/dox018>.
48. Henselmans I, Jacobs M, van Berge Henegouwen MI, de Haes HC, Sprangers MA, Smets EM. Postoperative information needs and communication barriers of esophageal cancer patients. *Patient Educ Couns*. 2012;88(1):138–146. <https://doi.org/10.1016/j.pec.2011.12.004>.
49. Markides GA, Alkhaffaf B, Vickers J. Nutritional access routes following oesophagectomy—a systematic review [published correction appears in *Eur J Clin Nutr*. 2011 Aug;65(8):984. Al-Khaffaf, B [corrected to Alkhaffaf, B]] *Eur J Clin Nutr*. 2011;65(5):565–573. <https://doi.org/10.1038/ejcn.2010.292>.
50. Middleton MH, Nazarenko G, Nivison-Smith I, Smerdely P. Prevalence of malnutrition and 12-month incidence of mortality in two Sydney teaching hospitals. *Intern Med J*. 2001;31(8):455–461. <https://doi.org/10.1046/j.1445-5994.2001.00109.x>.
51. Edington J, Boorman J, Durrant ER, et al. Prevalence of malnutrition on admission to four hospitals in England. The Malnutrition Prevalence Group. *Clin Nutr*. 2000;19(3):191–195. <https://doi.org/10.1054/clnu.1999.0121>.
52. Filip B, Scarpa M, Cavallin F, et al. Postoperative outcome after oesophagectomy for cancer: nutritional status is the missing ring in the current prognostic scores. *Eur J Surg Oncol*. 2015;41(6):787–794. <https://doi.org/10.1016/j.ejso.2015.02.014>.
53. Rey-Ferro M, Castaño R, Orozco O, Serna A, Moreno A. Nutritional and immunologic evaluation of patients with gastric cancer before and after surgery. *Nutrition*. 1997;13(10):878–881. [https://doi.org/10.1016/s0899-9007\(97\)00269-4](https://doi.org/10.1016/s0899-9007(97)00269-4).
54. McClave SA, Taylor BE, Martindale RG, et al. Guidelines for the provision and assessment of nutrition support therapy in the adult critically ill patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.). *J Parenter Enteral Nutr*. 2016;40(2):159–211. <https://doi.org/10.1177/0148607115621863>.
55. Weimann A, Braga M, Harsanyi L, et al. ESPEN guidelines on enteral nutrition: surgery including organ transplantation. *Clin Nutr*. 2006;25(2):224–244. <https://doi.org/10.1016/j.clnu.2006.01.015>.
56. Braga M, Gianotti L, Nespoli L, Radaelli G, Di Carlo V. Nutritional approach in malnourished surgical patients: a prospective randomized study. *Arch Surg*. 2002;137(2):174–180. <https://doi.org/10.1001/archsurg.137.2.174>.
57. Gianotti L, Braga M, Nespoli L, Radaelli G, Beneduce A, Di Carlo V. A randomized controlled trial of preoperative oral supplementation with a specialized diet in patients with gastrointestinal cancer. *Gastroenterology*. 2002;122(7):1763–1770. <https://doi.org/10.1053/gast.2002.33587>.
58. Senkal M, Zumtobel V, Bauer KH, et al. Outcome and cost-effectiveness of perioperative enteral immunonutrition in patients undergoing elective upper gastrointestinal tract surgery: a prospective randomized study. *Arch Surg*. 1999;134(12):1309–1316. <https://doi.org/10.1001/archsurg.134.12.1309>.
59. Waitzberg DL, Saito H, Plank LD, et al. Postsurgical infections are reduced with specialized nutrition support. *World J Surg*. 2006;30(8):1592–1604. <https://doi.org/10.1007/s00268-005-0657-x>.
60. Takeuchi H, Ikeuchi S, Kawaguchi Y, et al. Clinical significance of perioperative immunonutrition for patients with esophageal cancer. *World J Surg*. 2007;31(11):2160–2167. <https://doi.org/10.1007/s00268-007-9219-8>.
61. Antoun S, Rey A, Bachmann P. Malnutrition, inflammation: which parameter is interesting to detect in planned oncologic surgery? *World J Surg*. 2009;33(12):2728–2729. <https://doi.org/10.1007/s00268-009-0235-8>.
62. Vermeesch Amber. *Integrative Health Nursing Interventions for Vulnerable Populations*. 1st ed. Switzerland: Springer press; 2021. <https://doi.org/10.1007/978-3-030-60043-3>.
63. Frasure-Smith N, Prince R. The ischemic heart disease life stress monitoring program: impact on mortality. *Psychosom Med*. 1985;47(5):431–445. <https://doi.org/10.1097/0006842-198509000-00003>.
64. Marcus AC, Garrett KM, Kulchak-Rahm A, Barnes D, Dortch W, Juno S. Telephone counseling in psychosocial oncology: a report from the Cancer Information and Counseling Line. *Patient Educ Couns*. 2002;46(4):267–275. [https://doi.org/10.1016/s0738-3991\(01\)00163-x](https://doi.org/10.1016/s0738-3991(01)00163-x).
65. Fiordelli M, Diviani N, Schulz PJ. Mapping mHealth research: a decade of evolution. *J Med Internet Res*. 2013;15(5):e95. <https://doi.org/10.2196/jmir.2430>. Published 2013 May 21.
66. Smith C. *Amazing WeChat Statistics and Facts (2020) DMR*; 2021. <https://expande-dramblings.com/index.php/wechat-statistics/>. Accessed August 25, 2021.
67. Verschuur EM, Steyerberg EW, Tilanus HW, et al. Nurse-led follow-up of patients after oesophageal or gastric cardia cancer surgery: a randomised trial. *Br J Cancer*. 2009;100(1):70–76. <https://doi.org/10.1038/sj.bjc.6604811>.
68. Dai W, Feng W, Zhang Y, et al. Patient-reported outcome-based symptom management versus usual care after lung cancer surgery: a multicenter randomized controlled trial [published online ahead of print, 2022 Jan 7] *J Clin Oncol*. 2022; <https://doi.org/10.1200/JCO.21.01344>.
69. Viklund P, Wengström Y, Lagergren J. Supportive care for patients with oesophageal and other upper gastrointestinal cancers: the role of a specialist nurse in the team. *Eur J Oncol Nurs*. 2006;10(5):353–363. <https://doi.org/10.1016/j.ejon.2006.01.009>.
70. Moore S, London and South East Lung Cancer Forum for Nurses. Guidelines on the role of the specialist nurse in supporting patients with lung cancer. *Eur J Cancer Care (Engl)*. 2004;13(4):344–348. <https://doi.org/10.1111/j.1365-2354.2004.00488.x>.