

Application of the Theory of Planned Behavior in Patients with Breast Cancer-Related Lymphedema

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Abstract

Objective: To investigate the application effect of self-care intervention based on planned behavior theory in patients with breast cancer-related lymphedema.

Methods: Using convenience sampling method, 84 patients with breast cancer-related lymphedema from a tertiary Grade A hospital in Jingzhou City from June 2024 to December 2025 were selected as study subjects and divided into a control group and an experimental group, with 42 cases in each group. The control group received conventional health education, while the experimental group received planned behavior theory-based self-care intervention in addition to the control group's routine care. The intervention lasted for 3 months. The self-management efficacy, breast cancer lymphedema-related symptoms, and upper limb function scores were compared between the two groups before and after intervention. **Results:** A total of 84 patients completed follow-up, with 42 in each group. Following the intervention, the experimental group achieved better scores than the control group in self-management efficacy, lymphedema symptoms, and upper limb function ($P < 0.05$). **Conclusion:** This study indicates that a self-care intervention grounded in the theory of planned behavior improved self-management efficacy and symptom control in patients with breast cancer-related lymphedema. The follow-up period was limited to three months; whether these effects persist remains to be established.

Keywords

Breast Cancer, Lymphedema, Theory of Planned Behavior, Nursing Behavior, Management Efficacy

1. Introduction

Breast cancer is the most common malignancy among women worldwide [1]. Ad-

vances in diagnosis and treatment have improved survival, yet postoperative complications continue to affect quality of life. Breast cancer-related lymphedema (BCRL), among the most common of these complications, occurs in an estimated 20% - 50% of patients [2]. Presenting features include swelling, heaviness, and restricted movement of the affected limb; severe cases may be complicated by cellulitis or lymphatic leakage, adding considerably to the burden of disease [3].

No curative treatment exists for BCRL; lifelong self-management is therefore central to controlling disease progression. In practice, adherence to preventive behaviors is often poor, reflecting gaps in knowledge, limited self-efficacy, and weak family support. Ajzen's Theory of Planned Behavior (TPB) [4] proposes that attitudes, subjective norms, and perceived behavioral control jointly shape behavioral intentions, which in turn influence actual behavior. Although TPB has been applied extensively in health behavior research, its use in BCRL self-care interventions remains limited.

In this study, we developed a self-care intervention for BCRL using TPB as the guiding framework, with particular attention to its effects on self-management efficacy and symptom improvement, aiming to inform clinical nursing practice.

2. Subjects and Methods

2.1. Subject Investigated

Convenience sampling was employed to select patients with postoperative lymphedema after breast cancer surgery admitted to a tertiary Grade A hospital in Jingzhou City from June 2024 to December 2025 as study subjects. Inclusion criteria were: 1) Pathologically confirmed breast cancer with axillary lymph node dissection; 2) Compliance with the International Society for Lymphatic Diseases (ISL) diagnostic criteria for breast cancer-related lymphedema [5]; 3) Clear consciousness and normal communication ability; 4) Informed consent and voluntary participation in the study. Exclusion criteria included: 1) Bilateral breast cancer or bilateral upper limb edema; 2) Tumor recurrence or distant metastasis; 3) Severe cardiac, hepatic, or renal dysfunction; 4) Mental disorders or cognitive impairment. A total of 84 patients were enrolled, with 42 in the control group and 42 in the observation group.

2.2. Study Design and Grouping

This study used a quasi-experimental design. The control group included 42 patients admitted between June 2024 and February 2025 and given routine care. The experimental group comprised 42 patients admitted between March 2025 and December 2025; these patients received routine care plus a self-care intervention grounded in the Theory of Planned Behavior (TPB).

2.3. Intervention Method

2.3.1. Control Group

Patients in the control group received routine health education with self-management instruction from lymphedema therapists, including skin care, short-stretch

bandaging, self-manual lymphatic drainage, and exercise. Following discharge, home-based management continued through WeChat groups, with telephone follow-up at regular intervals.

2.3.2. Experimental Group

For the experimental group, routine care was supplemented by a three-month self-care intervention grounded in the Theory of Planned Behavior (TPB). The program addressed five interrelated components of TPB—behavioral attitudes, subjective norms, perceived behavioral control, behavioral intention, and behavior. The specific measures are as follows:

1) Establishment of a Theory of Planned Behavior experimental Group

The team comprised one international lymphedema therapist, one breast specialist, two senior nurses, and two graduate students. The physician reviewed the intervention protocol and responded to patient questions; senior nurses and graduate students handled literature review and drafted the initial protocol; the lymphedema therapist then revised this draft from a clinical standpoint. After group discussion finalized the protocol, all three roles participated in implementation, with data collection assigned to the nurses and graduate students.

2) Self-care Intervention Program Based on Planned Behavior Theory

The intervention spanned three months. Before it began, lymphedema therapists trained the senior nurses and graduate students in lymphedema nursing skills; the program commenced only after they passed the assessment. The intervention had two parts: an initial individualized assessment for each enrolled patient, then group-based instruction. Intervention location depended on whether patients returned for follow-up or were hospitalized, usually in a ward or demonstration classroom. A WeChat group was also set up for ongoing communication and follow-up. Face-to-face sessions took place weekly and lasted 30 to 60 minutes. Patients who missed a session received guidance by telephone or WeChat that day. Each session began with an assessment of the patient’s current status, followed by explanation of core content and live demonstration, and ended with assignment of home tasks and confirmation of the next follow-up time. The team also prepared a standardized manual for clinical use. A uniform record form was used throughout the study. Researchers checked these records every two weeks against the intervention protocol, noting any deviation and adjusting accordingly to keep the intervention intensity comparable across patients. Details are shown in **Table 1**.

Table 1. Self-care intervention program based on planned behavior theory.

Theoretical Elements	Intervention objective	Specific intervention content
Attitude Toward the Behavior	(Weeks 1 - 2)	① Explain the pathophysiological mechanism of lymphedema and the importance of self-management;
	Establish positive attitudes and	② Present video cases illustrating poor prognosis without self-management;
	awareness that	③ Invite recovered patients to share their self-management experiences;
	self-management is beneficial	④ Correct misconceptions (e.g., “just endure it”) and help patients develop positive beliefs toward self-management.

Continued

subjective norm	(Weeks 3 - 4) Strengthen social support and form the perception that significant others expect self-management	① Demonstrate manual lymphatic drainage and compression sleeve application, with patients practicing on-site under supervision; ② Invite primary caregivers to participate and explain key supportive strategies; ③ Establish a WeChat support group for peer communication among recovered patients; ④ Conduct multidisciplinary rounds with physicians and rehabilitation therapists to address medical and rehabilitation concerns.
	(Weeks 5 - 8) Enhance self-efficacy and strengthen confidence in performing self-management	① Deliver skills training in sequential sessions: manual lymphatic drainage, functional exercises, and complication recognition; ② Have patients perform simulated on-site practice with immediate feedback and encouragement from the nurse; ③ Provide tape measures and diaries, and instruct patients to record affected-limb circumference daily; ④ Identify common barriers (e.g., “I forget easily”) and negotiate tailored solutions with patients.
Behavioral Control	(Weeks 9 - 10) Stimulate behavioral motivation and form a commitment to self-management	① Conduct one-on-one motivational interviewing to elicit and reinforce self-management intentions; ② Collaboratively set 2 - 3 feasible home-based self-management goals with the patient (e.g., 10 min of manual drainage twice daily); ③ Jointly confirm the implementation plan and clarify mutual responsibilities between the nurse and the patient; ④ Simulate home-based scenarios to anticipate difficulties and develop coping strategies.
	(Weeks 11 - 12) Promote behavior consolidation and maintenance of healthy practices	① Have patients independently perform the complete self-management protocol while the nurse observes and provides feedback; ② Review self-management diaries, correct recording errors, and reinforce accurate tracking; ③ Collect problems encountered during home practice and facilitate group discussion of solutions; ④ Develop a post-discharge self-management plan and inform patients about follow-up schedules.

2.4. Evaluation Indicators

2.4.1. Symptoms of Lymphedema in Breast Cancer

Lymphedema symptoms were assessed with the Breast Cancer Lymphedema Symptom Index (BISL). The scale has two dimensions—edema-related symptoms and symptom-related distress—and 56 items, with Cronbach's α of 0.930 - 0.967. We used only the 24-item symptom dimension, reflecting the study's primary focus. Items were scored on a 5-point Likert scale from 0 (“none”) to 4 (“very severe”), for a total of 0 - 96; higher scores reflected greater symptom severity [6]. Patients were assessed at baseline and at three months.

2.4.2. Self-Management Efficacy

Self-management efficacy was measured with the Chinese version of the Cancer Self-Management Efficacy Scale (C-SUPPH), which captures patients' confidence in managing their condition. The scale has three dimensions: positive attitude, stress reduction, and decision-making, with 29 items rated on a 5-point Likert scale. Scores of 0 - 55 indicate low efficacy, 56 - 112 moderate efficacy, and above 112 high efficacy; higher scores reflect greater confidence. Cronbach's α was 0.879 [7]. Patients were assessed before and after the intervention.

2.4.3. Upper Limb Function Assessment Form

Upper limb function was evaluated with the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire. Beaton *et al.* developed the original in 2001 [8]; Chunli Liao *et al.* adapted it for Chinese use in 2014 [9]. The Chinese version has 30 items; reliability was 0.911 (Cronbach’s α) and test-retest reliability 0.882 (ICC). Both sections use a 5-point Likert scale. For daily living function, patients rate difficulty from 1 (“no difficulty”) to 5 (“unable to do”); for upper limb symptoms, severity is rated from 1 (“none”) to 5 (“extreme”). The final score is [(total points ÷ number of completed items) – 1] × 25, yielding a 0 - 100 scale on which higher values reflect greater dysfunction.

2.5. Data Collection Methods

General data and various evaluation indicators in this study were collected by two trained researchers using standardized instructions. Data collection was conducted through face-to-face distribution of paper questionnaires before and after intervention, with patients completing the forms independently and responses collected on-site. Patient self-care performance, such as the correctness of functional exercises, was evaluated and feedback provided.

2.6. Statistical Methods

Data were analyzed using SPSS 22.0 and Excel. Continuous variables were expressed as mean ± standard deviation ($\bar{x} \pm SD$). Between-group comparisons were performed using independent samples *t*-test or *Mann-Whitney U* test, and within-group comparisons were performed using paired *t*-test or Wilcoxon signed-rank test based on normality distribution. Categorical variables were expressed as frequency and percentage (*n*[%]), and compared using Chi-square test or Fisher’s exact test. Rank data were analyzed using rank sum test. A two-sided *P* < 0.05 was considered statistically significant.

3. Results

3.1. Comparison of General Characteristics between the Two Groups of Patients

No statistically significant differences were observed in baseline characteristics such as age and educational level between the two groups (*P* > 0.05), indicating comparability. Detailed results are presented in Table 2.

Table 2. Comparison of baseline characteristics between the two groups.

Variable	Classify	Control group (<i>n</i> = 42)	Experimental group (<i>n</i> = 42)	χ^2	<i>P</i>
Age (years)	18 - 44	10 (23.8)	8 (19.0)	1.11	0.574
	45 - 59	24 (57.1)	22 (52.4)		
	≥60	8 (19.0)	12 (28.6)		

Continued

BMI	<18.5	1 (2.4)	3 (7.1)	1.34 0.719
	18.5 - 23.9	18 (42.9)	16 (38.1)	
	24 - 27.9	20 (47.6)	21 (50.0)	
	≥28	3 (7.1)	2 (4.8)	
Degree of education	Junior high school and below	27 (64.3)	29 (69.0)	0.57 0.751
	High School/Technical Secondary School	10 (23.8)	10 (23.8)	
	College degree or above	5 (11.9)	3 (7.1)	
Health insurance type	Resident Medical Insurance	17 (40.5)	15 (35.7)	0.05 0.822
	Employee health insurance	25 (59.5)	27 (64.3)	
Monthly income	>3000	27 (64.3)	24 (57.1)	0.20 0.655
	≤3000	15 (35.7)	18 (42.9)	
Operative site	Right breast	20 (47.6)	22 (52.4)	0.48 0.827
	Left breast	22 (52.4)	20 (47.6)	
Dominant hand	the right hand	39 (92.9)	40 (95.2)	0.00 1.000
	the left hand	3 (7.1)	2 (4.8)	
Domicile	rural area	9 (21.4)	11 (26.2)	0.26 0.876
	County and town	14 (33.3)	13 (31.0)	
	city proper	19 (45.2)	18 (42.9)	
Operative mode	Farmer/Unemployed	14 (33.3)	15 (35.7)	0.09 0.957
	be on the job	18 (42.9)	18 (42.9)	
	retire	10 (23.8)	9 (21.4)	
Primary caregiver	sons and daughters	18 (42.9)	17 (40.5)	0.32 0.852
	spouse	21 (50.0)	23 (54.8)	
	father and mother	3 (7.1)	2 (4.8)	

3.2. Comparison of Self-Management Efficacy between the Two Groups before and after Intervention

Table 3. Comparison of scores on the Chinese version of cancer self-management efficacy scale before and after intervention between the two groups ($\bar{x} \pm s$).

Group	<i>n</i>	Before intervention	After intervention
Control group	42	65.33 ± 3.36	71.36 ± 6.01
Experimental group	42	64.90 ± 2.39	97.95 ± 8.05
<i>t</i>		0.674	18.245
<i>P</i>		0.502	<0.001

Before intervention, there was no statistically significant difference in the total scores of the Chinese version of Cancer Self-Efficacy Scale between the two groups

($P > 0.05$). After intervention, the total score of the Chinese version of Cancer Self-Efficacy Scale in the experimental group was higher than that in the control group, with a statistically significant difference ($P < 0.05$). See **Table 3** for details.

3.3. Comparison of Lymphedema Symptoms between the Two Groups before and after Intervention

Before the intervention, there was no statistically significant difference in breast cancer-related lymphedema symptom scores between the two groups ($P > 0.05$). After the intervention, the symptom scores in the experimental group were significantly lower than those in the control group ($P < 0.05$). See **Table 4** for details.

Table 4. Comparison of breast cancer-related lymphedema symptom scores before and after intervention between two groups ($\bar{x} \pm s$).

Group	Number of cases	Before intervention	After intervention
Control group	42	45.36 $\pm$ 6.47	25.40 $\pm$ 5.65
Experimental group	42	48.98 $\pm$ 10.07	13.95 $\pm$ 5.60
<i>Z</i>		−0.720	−5.823
<i>P</i>		0.472	<0.001

3.4. Comparison of Upper Limb Function Scores between the Two Groups before and after Intervention

Before intervention, there was no statistically significant difference in upper limb function scores between the two groups ($P > 0.05$). After intervention, the experimental group showed superior upper limb function scores compared to the control group, with all differences being statistically significant ($P < 0.05$). Details are presented in **Table 5**.

Table 5. Comparison of upper limb function scores between the two groups ($\bar{x} \pm s$).

Group	Number of cases	Before intervention	After intervention
Control group	42	23.57 $\pm$ 2.39	15.24 $\pm$ 4.35
Experimental group	42	24.00 $\pm$ 2.89	9.02 $\pm$ 4.59
<i>t</i>		−0.741	6.854
<i>P</i>		0.461	<0.001

4. Discussion

4.1. Relationship between TPB-Based Self-Care Intervention and Self-Management Efficacy

Post-intervention, the experimental group scored higher than the control group on the C-SUPPH total score ($P < 0.05$). This suggests that the intervention was associated with improved self-management efficacy, a finding consistent with prior applications of TPB to chronic disease self-management [10]. Within TPB, attitudes, subjective norms, and perceived behavioral control jointly shape behavioral

intention [11]. Our intervention unfolded in three stages. Early on, disease education and risk visualization helped patients recognize the benefits of self-management. Midway through, family involvement and peer support made patients aware of expectations from both clinicians and family. Toward the end, skills training and scenario-based practice built their confidence in managing self-care. Together, these three elements moved patients from intention to action. Daily self-monitoring and periodic follow-up reinforced these behaviors, helping sustain self-management habits.

4.2. Relationship between TPB-Based Self-Care Intervention and Lymphedema-Related Symptoms

Post-intervention, the experimental group had lower BISL scores than the control group ($P < 0.05$). Impaired lymphatic return underlies symptom development; sustained self-care interrupts this process [12]. Manual drainage, pressure therapy, and exercise were built into the intervention, with WeChat follow-up and telephone reminders to promote adherence. Combining theory with practice, this model helped patients move from knowledge to action, reducing fluid accumulation and easing swelling and pain [13]. Lymphedema symptoms are, however, shaped by tumor stage, surgical extent, and other factors. Without stratified analysis, we cannot rule out that the observed improvement reflects these confounders rather than the intervention alone.

4.3. Relationship between TPB-Based Self-Care Intervention and Upper Limb Function

Post-intervention, the experimental group outperformed the control group on DASH scores ($P < 0.05$), a result also reported by Armer *et al.* [14] in their study of comprehensive lymphedema rehabilitation. Recovery of upper limb function depends on consistent, structured exercise. Yet breast cancer patients often move the affected limb less because of pain, fear, or inadequate guidance, which results in joint contracture and loss of muscle strength [15]. We targeted perceived behavioral control, using a staged exercise program—early isometric contraction, then joint mobilization, finally resistance training—along with live demonstration to help patients rebuild command of the affected limb. Manual drainage and pressure therapy reduced tissue fibrosis, improving soft tissue conditions for joint movement. Mindfulness guidance also eased pain-related anxiety, which increased exercise adherence and, in turn, contributed to functional recovery [16].

5. Conclusion

We tested a TPB-based self-care intervention in patients with breast cancer-related lymphedema. After three months, these patients showed gains in self-management efficacy, symptom control, and upper limb function. The quasi-experimental design and non-random assignment limit the strength of any causal claims. Multicenter randomized trials, longer follow-up, and objective measures such as

limb circumference and bioelectrical impedance would strengthen these findings. Smart tools for long-term follow-up deserve attention as well.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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