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Original Research Article

EFFECTIVENESS OF AN EDUCATIONAL INTERVENTION ON BREAST CANCER-RELATED LYMPHEDEMA RISK REDUCTION AND PREVENTION AMONG ONCOLOGY NURSES IN BAHRAIN

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ABSTRACT

Background: To evaluate the effectiveness of an educational intervention in enhancing knowledge, awareness, and preventive practices related to breast cancer-related lymphedema (BCRL) among oncology nurses in Bahrain.

Methods and Materials: A quasi-experimental study with a one-group pre-test post-test design was conducted at the Bahrain Oncology Center, Kingdom of Bahrain, a specialized institution providing comprehensive cancer care, including prevention, diagnosis, treatment, and palliative services. The sample comprised 100 oncology nurses. The inclusion criteria consisted of oncology registered nurses, regardless of their years of experience, gender, age, education level, or nationality, while the exclusion criteria included nurses who were not involved in direct patient care or those who did not provide services related to breast cancer treatment. Data were collected using a digital data collection form in Microsoft. The questionnaire examined nurses' knowledge and self-reported practices across six core domains of lymphedema care: Understanding lymphedema as a disease and its etiology, Risk Factors and Symptoms, Diagnosis and Management, Treatment and Lifestyle Considerations, Referrals and Precautions, Protective Measures and Daily Living. Convenience sampling was used to recruit participants from the oncology nursing staff. A pre-test was conducted, followed by a teaching intervention on lymphedema management. After the teaching intervention, a post-test was conducted.

Results: Nurses demonstrated substantial knowledge deficits at baseline, particularly in diagnostic and lifestyle-related areas. After the educational intervention, significant improvements were observed across all items, with increases ranging from 8% to 53%. The mean post-test score was significantly higher than the pre-test score, with a mean difference of -6.97 (SD = 3.08). The paired samples t-test confirmed a highly significant enhancement in knowledge (t (99) = - 22.66, $p < 0.001$).

Conclusion: The educational program was highly effective in improving nurses' knowledge across all domains of lymphedema care. These findings underscore the importance of structured and ongoing educational initiatives to strengthen oncology nurses' competency, support early detection practices, and enhance patient education. Incorporating regular lymphedema training into professional development frameworks may contribute to improved long-term patient outcomes.

Keywords: Lymphedema, Oncology Nursing, Educational Intervention, Knowledge Assessment, Pre-test Post-test Study, Nursing Education, Cancer Survivorship.

INTRODUCTION

Breast cancer-related lymphedema (BCRL) is one of the most common and distressing complications following breast cancer treatment, particularly in patients who undergo axillary lymph node dissection (ALND) and/or radiotherapy. It is characterized by an abnormal accumulation of lymphatic fluid in the interstitial space, primarily in the upper limbs, causing pain, swelling, limited mobility, recurrent infections, and significant impairment in quality of life.[1,2]

Worldwide, the prevalence of BCRL ranges from 14.3% to 21.9% among breast cancer survivors, depending on the treatment modality, patient characteristics, and assessment method. [3] In a recent research in Israel, the prevalence of BCRL after axillary procedures was reported to be 18.5%, emphasizing the persistent burden of this condition even in advanced healthcare settings.[4]

The risk factors for BCRL are caused by multiple factors, including high body mass index (BMI), extent of lymph node dissection, postoperative seroma formation, radiation therapy, and chemotherapy.[5] Immediate postoperative radiotherapy and a higher number of dissected lymph nodes are particularly related with early onset lymphedema.[6] Additionally, evidence suggests that a lack of preventive strategies or delayed implementation leads to poor clinical outcomes.[7]

Preventive interventions, such as structured exercise, limb elevation, early physiotherapy, and the use of compression garments, have displayed efficacy in reducing the incidence and severity of BCRL.[8] Exercise enhances lymphatic drainage and reduces inflammation, especially when guided by trained professionals.[9] Timely patient education and surveillance using bioimpedance spectroscopy or arm circumference monitoring can lead to earlier detection and better outcomes.[10]

Despite the availability of efficient approaches, there is a notable gap in awareness and training among healthcare providers. A study held in Saudi Arabia identified that 70.4% of women with breast cancer had never received education about lymphedema prevention or management from their healthcare team.[11] This lack of education indicates systemic gaps that can be minimized by targeted interventions for oncology nurses.

Oncology nurses are well positioned to educate patients, detect early signs of lymphedema, and implement preventive measures. Educational interventions focusing on nurses have been shown to significantly increase knowledge scores, improve patient counseling, and reduce the incidence of BCRL through timely intervention.[12]

In Bahrain, literature on BCRL remains limited. There is an urgent need to assess the fundamental knowledge of oncology nurses and implement evidence-based educational interventions aimed at risk reduction. Given their primary role in patient education, empowering oncology nurses with updated knowledge and skills regarding BCRL prevention may lead to improved survivorship care and better quality of life for patients.

Purpose of the study

Nurses support patients in the use of complex decongestive treatments, including limb elevation. Exercises, manual lymphatic drainage, pneumatic compression therapy, skin care, compression garments, and bandages are used to treat lymphedema. Nurses can provide more accurate information and better understand the treatment process for lymphedema. Therefore, nurses should be provided with knowledge and awareness, including preventive and therapeutic practices. Several studies have evaluated education, lymphedema prevention, and treatment. Most of their findings underscored the inadequate knowledge level and emphasized the need to improve lymphedema education and knowledge among breast cancer survivors.[13,14]

This study addresses the urgent need to empower nurses with the knowledge and tools necessary to reduce the burden of BCRL through early education and intervention, ultimately leading to better patient outcomes and quality of life.

Research question

Will the educational intervention enhance the knowledge, awareness, and preventive practices related to breast cancer-related lymphedema (BCRL) among oncology nurses in Bahrain?

MATERIALS AND METHODS

Study design

This study was a pre-experimental, one-group pre-test post-test design and quantitative in nature, to evaluate changes in knowledge among oncology nurses before and after the educational intervention.

Study Population

The sample included 100 registered oncology nurses who worked at the center. A Convenience Sampling technique was used in this study. The inclusion criteria consisted of oncology registered nurses, regardless of their years of experience, gender, age, education level, or nationality while exclusion criteria included nurses who were not involved in direct patient care or those who did not provide services related to breast cancer treatment.

Sample Size

The required sample size was calculated using the finite population formula. The analysis recommended a total sample size of 192. Although the total population of registered oncology nurses across the selected center was 383, the study recruited 100 participants based on feasibility, expected availability of nurses and time constraints for data collection within the clinical setting.

Data Collection Instrument

The self-administered structured questionnaire consists of two main sections:

A) Demographic data

B) Lymphedema Management Knowledge and Practice Questionnaire

A validated instrument developed by Özkan et al. (2024),[13] and used with the consent from the corresponding author, Dr. Yasemin Özkan.

The questionnaire items assessed the nurses' knowledge and practices across six major domains of lymphedema care:

1. General Knowledge – The awareness of lymphedema as a disease and its etiology
2. Risk Factors and Symptoms – The understanding of causative factors and clinical signs
3. Diagnosis and Management – The insight into diagnostic procedures and case management
4. Treatment and Lifestyle Considerations – The familiarity with treatment modalities and daily care
5. Referrals and Precautions – The relevant clinical pathways and multidisciplinary referral
6. Protective Measures and Daily Living – The preventative practices and patient education

Grading and Interpretation

Each correct answer was scored as one, and the incorrect answer as zero. The total score was 23.

The scores were interpreted as follows:

- >95% Highly adequate knowledge
- 60-95% Moderately adequate knowledge
- <60 Inadequate knowledge

Data Collection

The validated instrument used in this study was used with permission from the corresponding author. Tool reliability was obtained using Cronbach's alpha, and the score was 0.854. The tool was reliable for this study.

After receiving approval from the RMS Institution Review Board (RMS-BOC/IRB/ 2025 – 964), Bahrain Defence Force, Royal Medical Services, dated June 12, 2025, a one-group pre-test post-test design was conducted. The researchers designed an electronic survey questionnaire and emailed it to nurses and respective unit managers. The participants received an explanation of the study objectives prior to data collection. The right to secrecy and anonymity, the opportunity to contact the researcher with any queries, and the right to withdraw from the study were all guaranteed by informed consent from each participant. The next part of the questionnaire could not be accessed without clicking the agree button to indicate the participant's approval and signature.

Hundred nurses received the questionnaire link through email and WhatsApp. The participants submitted their pre-test responses within two days. After the pre-test, the participants received hybrid educational sessions on Lymphedema Management. After the educational intervention, the participants were requested to submit the same post-test responses.

Data Analysis

The data were coded, analyzed, and reported using SPSS software version 26 (IBM Corp., 2019). Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to describe demographic variables and knowledge scores. Inferential statistics, including paired t-tests, were used to compare pre and post-test knowledge scores. The chi-square test was used to assess the association between knowledge levels and selected demographic variables. Statistical significance was set at $p < 0.05$.

RESULTS

A total of 100 nurses participated in this study (response rate of 100%). No questionnaires were excluded as no missing data were identified. Of these 100 participants, most were aged 30-35 years (35%), followed by 35-40 years (23%) and 25-30 years (19%). The majority were female (99%) and married (72%). Nearly all participants held a Bachelor of Nursing degree (98%), and most had substantial oncology experience, with 35% having 5-10 years and 27% having 3-5 years of experience. Most nurses worked as Staff Nurses (76%), with representation from various specialty areas, including Medical Oncology (34%), Palliative Care (23%), BMT (12%), Surgical Oncology (11%), and others. A large proportion (88%) had previous exposure to patients with lymphedema, while 4% reported a personal or family history of lymphedema. Sources of lymphedema knowledge included continuing professional education (92%), formal education (52%), and other supplementary sources.

Table 1: Demographic and Professional Characteristics N =100

Characteristics	n (%)
Age	
20-25	15 (15)
25-30	19 (19)
30-35	35 (35)
35-40	23 (23)
>40	8 (8)
Sex	
Male	1 (1)
Female	99 (99)
Marital Status	
Single	26 (26)
Married	72 (72)
Other	2 (2)
Education	
Bachelor of Nursing	98 (98)

Master's	2 (2)
Years of experience in Oncology Unit	
Days to week	0 (0)
<1 year	15 (15)
1-2 years	12 (12)
3-5 years	27 (27)
5-10 years	35 (35)
>10 years	11 (11)
Current Position	
Unit Manager	2 (2)
Team Leader	22 (22)
Staff Nurse	76 (76)
Work area	
Medical Oncology	34 (34)
Hematology	7 (7)
Palliative	23 (23)
Surgical Oncology	11 (11)
Pediatric oncology	6 (6)
BMT	12 (12)
Oncology DCU	2 (2)
Oncology OPD	4 (4)
Oncology Home Care	1 (1)
Previous exposure to lymphedema patient	
Yes	88 (88)
No	12 (12)
You or a family member have a history of lymphedema	
Yes	4 (4)
No	96 (96)
Source(s) of prior lymphedema knowledge	
Formal education	52 (52)
Continuing professional education	92 (92)
Social media	11 (11)
Colleagues	19 (19)
Scientific publications	21 (21)
Other	9 (9)

Table 2 shows the item-wise enhancement in the knowledge level of the nurses regarding lymphedema. The post-test findings demonstrated a marked improvement in nurses' knowledge of lymphedema care across all domains. General knowledge increased substantially, particularly regarding the risk of developing lymphedema following chemotherapy (+42%). Awareness of key symptoms, such as rashes, also improved (+36%). Diagnostic knowledge showed significant gains, with increases ranging from 19% to 35%. The most notable improvements were observed in treatment and lifestyle practices, including diet, massage, compression therapy, and skin care with enhancements reaching up to 53%. Knowledge of precautionary and protective measures likewise improved, especially in the preference for closed-toe footwear (52%) and understanding safe grooming practices. Overall, the educational program produced consistent and meaningful knowledge advancement across all assessed items.

Table 2: Item-wise enhancement in knowledge level of the Nurses regarding Lymphedema

Statements	Response (%)		
	Pre-test	Post-test	Enhancement
Questions related to General Knowledge about Lymphedema			
Lymphedema is a disease of the lymphatic system.	91	100	9
Lymphedema may develop after chemotherapy.	54	96	42
Lymphedema does not develop after radiotherapy	71	98	27
Lymphedema is related to previous surgery.	73	98	25
The type of surgical operation applied does not affect the severity of lymphedema	73	96	23
Questions related to Risk Factors and Symptoms			
Rash on the extremities is one of the symptoms of lymphedema	49	85	36
Questions related to Diagnosis and Management			
Magnetic resonance imaging is useful in the diagnosis of lymphedema	64	99	35
Computed tomography is useful in the diagnosis of lymphedema	68	96	28
Lymphoscintigraphy is useful in the diagnosis of lymphedema	80	99	19
Questions related to Treatment and Lifestyle Considerations			
Protein-rich diet reduces lymphedema	44	97	53
Low-fat diet increases lymphedema.	69	99	30
Drinking plenty of water increases lymphedema	79	99	20
Extremity with lymphedema can be massaged.	47	97	50
Bandages can be used to treat lymphedema	68	96	28
Warm treatments can be applied to the arm with lymphedema	54	96	42

A compression garment can be worn in the treatment of lymphedema	67	95	28
Skin care should be done with moisturizers suitable for the extremity or body part with lymphedema.	83	99	16
Normal soaps can be used for skin cleansing	31	81	50
Questions related to Referrals and Precautions			
When lymphedema is suspected, a multidisciplinary approach is required	90	98	8
Surgery can be used in the treatment of lymphedema	54	91	37
Exercise can be performed with extremities with lymphedema	81	98	17
Questions related to Protective Measures and Daily Living			
Manicures and pedicures should not be performed on an extremity with lymphedema	71	93	22
Shoes with closed toe cap should be preferred.	42	94	52

Table 3 shows that before the educational intervention, 66% of the participants demonstrated moderate knowledge, 33% had inadequate knowledge, and only 1% had adequate knowledge of lymphedema. Following the intervention, 71% achieved adequate knowledge, 29% remained at a moderate level, and none had inadequate knowledge. This indicates that the structured educational intervention was effective in significantly enhancing oncology nurses' knowledge regarding lymphedema prevention and management.

Table 3: Classification of respondents based on knowledge level in pre-test and post-test regarding Lymphedema

Aspect	Classification & Grade	Respondents N=100			
		Pre-test		Post-test	
		Number	Percent%	Number	Percent%
Knowledge level	Inadequate - Grade 1	33	33%	0	0%
	Moderate - Grade 2	66	66%	29	29%
	Adequate - Grade 3	1	1%	71	71%
	Total	**100**	**100%**	**100**	**100%**

Table 4 indicates a significant difference between the pre and post-test teaching sessions on Lymphedema Knowledge and Practice. A paired samples t-test was conducted to determine whether there was a significant difference between pre and post-test knowledge scores. The results showed a statistically significant improvement following the educational intervention. The mean post-test score was significantly higher than the pre-test score, as indicated by a mean difference of -6.97 (SD = 3.08). The 95% confidence interval for the difference ranged from -7.58 to -6.36, confirming that the increase in scores was consistent and reliable. The difference was statistically significant ($p < 0.001$) indicating that the educational program had a strong and meaningful effect on improving nurses' knowledge.

Table 4: Comparison of Pre-test and Post-test Knowledge Score

Paired Samples Test								
	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre-test – Post-test	-6.97000	3.07632	.30763	-7.58041	-6.35959	-22.657	99	< 0.001

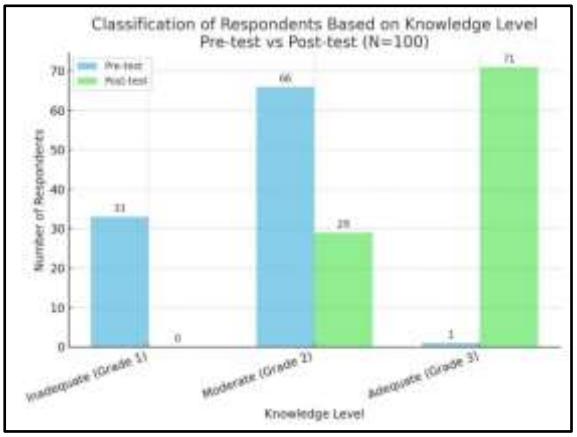

Figure 1: Classification of Respondents Based on Knowledge Level

DISCUSSION

In this study, most of the nurses were between 30-35 years (35%), predominantly female (99%), and working mainly as staff nurses (76%), reflecting that oncology nursing in this setting is largely conducted by young, female, front-line clinical nurses. A similar predominance of female nurses was reported in the Turkish study by Ozkan, who also showed that gender and unit of practice significantly influenced lymphedema teaching behaviours, with nurses in the surgical and oncology unit demonstrating higher preventive behaviour scores.[13]

The relatively young age profile of the current sample may also contribute to higher motivation to acquire new clinical competencies, consistent with Ozkan's

findings that younger nurses with fewer years of experience were more active in-patient teaching.

Most participants were married (72%) and held a Bachelor of Nursing degree (98%). Wilson,[15] similarly noted that healthcare personnel participating in lymphedema education in her study were predominantly nurses with bachelor's degree and were practicing in oncology areas. This suggests that oncology nurses with undergraduate training represent the principal workforce who encounter patients at risk for lymphedema and therefore require structured and continuous educational support.

Regarding professional experience, half of the participants had more than five years of experience, and the majority reported relying primarily on continuing professional education as their main source of lymphedema-related knowledge. These findings support previous studies that indicated that lymphedema information is not routinely emphasized in undergraduate nursing programs and is mostly obtained during clinical practice or after employment.[14,15] This trend underscores the need for ongoing structured training, as routine clinical exposure alone may not adequately address key knowledge gaps.

Most participants worked in medical oncology (34%), palliative care (23%) and surgical oncology (11%). Ozkan found that nurses working in surgical and oncology settings reported more frequent encounters and teaching related to lymphedema, highlighting how work area directly influences preventive teaching behaviour.[13] Importantly, 88% of the nurses reported previous exposure to a patient with lymphedema, which is consistent with Wilson's emphasis that clinical exposure heightens awareness of risk factors and prevention needs.[15] However, only 4% of the participants reported a personal or family history, indicating that most clinical encounters were professional rather than personal.

The findings of this study demonstrated a substantial improvement in nurses' knowledge of lymphedema following the educational intervention. The paired t-test revealed a statistically significant increase in post-test scores compared to pre-test scores, indicating that the program was highly effective in enhancing nurses' understanding of lymphedema care. The large mean difference (-6.97, $p < 0.001$) further reflects a meaningful learning gain and suggests that the training produced both immediate and measurable benefits.

Structured teaching was effective in enhancing understanding of general knowledge, risk factors, symptoms, diagnostic methods, and management strategies. These observations are supported by previous research emphasizing the importance of structured education in improving healthcare providers' knowledge of lymphedema. Natarajan et al. reported that educational sessions led to a significant increase in nurses' knowledge regarding breast cancer-related lymphedema prevention and risk reduction measures, highlighting the necessity of standardized training for nursing personnel.[14]

Similarly, Wilson found that healthcare personnel who received lymphedema education achieved higher knowledge scores than those who did not, although the difference did not reach statistical significance due to the small sample size.[15]

The current study also aligns with the literature describing widespread knowledge gaps among nurses and other health care professionals. Abu Sharour found that the majority of oncology nurses demonstrated insufficient knowledge regarding lymphedema assessment, prevention and management with nearly all nurses reporting a lack of continuing education on the topic.[16] This supports the need for structured and repeated educational interventions, as demonstrated in the present study.

The item-wise gains observed in this study, particularly in diagnostic methods, treatment strategies, lifestyle modifications, and protective measures, are noteworthy. The literature emphasizes that nurses must be able to educate patients regarding risk factors, precautionary behaviours, and early detection practices. Thomas MacLean et al,[17] and Honnor,[18] both cited in Natarajan et al., reported that inadequate provider knowledge leads many patients to seek information from non-professional resources and may delay early identification of lymphedema symptomatology.[14] The improved knowledge in the current study strengthens nurses' capacity to deliver accurate patient education and support early intervention.

Moreover, Wilson emphasized that early education and prevention are central to lymphedema management and that healthcare providers play a critical role in reducing complications through patient education and ongoing assessment.[15] The significant knowledge improvement demonstrated in this study suggests that nurses are better equipped to fulfill this role.

Overall, the findings are consistent with all referenced studies and highlight the critical importance of integrating lymphedema education into ongoing nursing training. Enhanced knowledge among nurses is likely to improve patient outcomes by supporting early detection, risk reduction practices, and appropriate referral to lymphedema specialists. Given the documented global gaps in lymphedema knowledge, continued training and reinforcement are essential to sustain these improvements and ensure high quality oncology care.

CONCLUSION

This study demonstrated that a structured educational intervention significantly improved nurses' knowledge of lymphedema, including its risk factors, early symptoms, diagnostic approaches, and prevention strategies. The marked increase in post-test scores indicates that targeted training can effectively address existing knowledge gaps among oncology nurses. These findings highlight the need

for continuing education to strengthen healthcare professionals' competencies in lymphedema care.

Inadequate knowledge among healthcare providers is a recurring barrier to effective lymphedema management and patient education. This study reinforces the value of implementing structured and periodic training programs in oncology settings. Strengthening nurses' understanding enhances their capacity to deliver accurate patient education and contributes to earlier detection and better long-term outcomes for individuals at risk of lymphedema.

Overall, the findings support the integration of standardized lymphedema education into routine professional development and institutional training policies to ensure sustained improvements in clinical practice and the quality of patient care.

Implications of the study

Significant improvement in nurses' knowledge after the educational intervention indicates several important implications for clinical practice, nursing education and policy development.

First, these findings reinforce the need for structured and regular lymphedema training programs in oncology units.

Second, this could be achieved by incorporating lymphedema-specific content into orientation, competency assessments, and continuing professional development programs to ensure that nursing staff currently maintain evidence-based practices. The observed knowledge gaps prior to training suggest that existing educational resources may be insufficient, underscoring the importance of standardized curricula and regular refresher courses in this field.

Third, the results support the integration of interdisciplinary collaboration, as improved nurses' knowledge enhances communication between oncology teams, physiotherapists, and lymphedema specialists. Strengthening these connections can facilitate earlier referrals and more coordinated care.

Finally, the findings may guide administrators and policymakers in allocating resources toward educational initiatives and developing institutional guidelines for lymphedema prevention and management. By implementing these measures, consistent practice standards can be promoted and variability in patient care can be reduced.

Limitations of the study

This study had several limitations that should be considered when interpreting the findings.

First, the study used a single-group pre-test – post-test design that did not include a control group. As a result, improvements in knowledge cannot be attributed solely to the intervention, as external factors may have contributed to this. Second, the study relied on self-administered questionnaires, which may have caused response bias, such as social desirability or overestimation of knowledge. Third, the sample was drawn from one setting, which may limit the generalizability of the findings to other institutions or nursing populations in the future. Additionally, the post-test was conducted shortly after the educational intervention, which measures immediate knowledge gain but not long-term retention. Follow-up assessments over time are necessary to determine whether the knowledge improvement is sustained.

Despite these limitations, this study provides important insights into the effectiveness of structured education in improving nurses' knowledge of lymphedema.

Declarations

Conflict of Interest: The authors declare no conflicts of interest with respect to this research.

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