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Effect of Educational Package on Oncology Nurses' Knowledge toward Fertility Preservation: A Quasi experimental study

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Abstract

Background:

Cancer treatments can significantly impair fertility, particularly among patients of reproductive age. Oncology nurses play a key role in fertility counseling; however, inadequate knowledge remains a challenge.

Aim:

To evaluate the effect of an educational package on oncology nurses' knowledge toward fertility preservation.

Methods:

A quasi-experimental one-group pre–posttest design was conducted among 108 oncology nurses in Jordan. Knowledge was assessed at three time points: pre-intervention, post-intervention, and follow-up.

Results:

Knowledge scores significantly improved from 61.30 ± 8.40 at baseline to 84.70 ± 6.90 post-intervention, with sustained improvement at follow-up (78.90 ± 7.60) ($p < 0.001$).

Conclusion:

The educational package effectively improved nurses' knowledge. Continuous training is recommended to sustain competency.

Introduction

Cancer remains a major global health challenge, with a steadily increasing incidence and improved survival rates due to advances in early detection and treatment modalities (World Health Organization, 2024; Bray et al., 2024). As a result, cancer is increasingly recognized as a chronic condition, shifting the focus of care toward long-term survivorship outcomes, including quality of life and reproductive health (Lehmann et al., 2024; Znaor et al., 2025). For patients of reproductive age, fertility is a critical concern, as many cancer treatments particularly chemotherapy and radiotherapy are associated with gonadotoxic effects that may lead to temporary or permanent infertility (Meistrich, 2023; Kelsey et al., 2022).

Fertility preservation (FP) has therefore emerged as an essential component of comprehensive cancer care. It encompasses a range of medical interventions aimed at safeguarding reproductive potential

prior to the initiation of gonadotoxic therapies, including embryo cryopreservation, oocyte freezing, and ovarian tissue preservation (Antonouli et al., 2023; Bedoschi & Oktay, 2013). International clinical guidelines, particularly those developed by the American Society of Clinical Oncology, strongly recommend that all patients of reproductive age be informed about the potential impact of cancer treatment on fertility and be offered timely counseling and referral for fertility preservation options (ASCO, 2023; ESHRE et al., 2020; Su et al., 2025).

Oncology nurses play a pivotal role in delivering patient-centered care, including education, counseling, and emotional support throughout the cancer trajectory (Oncology Nursing Society, 2022). Due to their close and continuous contact with patients, nurses are often in a unique position to initiate discussions about fertility preservation, clarify treatment-related risks, and facilitate referrals to fertility specialists. However, evidence suggests that many oncology nurses lack adequate knowledge and confidence to effectively address fertility-related issues in clinical practice (Kasaven et al., 2024; Zhang et al., 2023; Sindi et al., 2024). This knowledge gap may result in missed opportunities for timely fertility counseling and ultimately limit patients' access to appropriate preservation strategies.

Several studies have identified barriers that hinder effective fertility preservation counseling among healthcare providers, including insufficient training, limited awareness of available FP options, time constraints, and lack of institutional support (Dorfman et al., 2021; Xiao et al., 2024). In addition, sociocultural factors, particularly in low- and middle-income countries, may further complicate discussions around fertility, making education and awareness even more critical (Magdy Abd-Ellatif et al., 2024). Addressing these barriers requires targeted educational interventions that enhance healthcare providers' knowledge and preparedness.

Educational packages have been shown to be effective in improving healthcare professionals' knowledge and competencies in various clinical domains, including fertility preservation (El-Said Mansour & Hassan, 2021; Belal et al., 2023). Such interventions provide structured, evidence-based content and create opportunities for interactive learning, thereby facilitating knowledge acquisition and retention. The effectiveness of these interventions can be explained through the Knowledge–Attitude–Practice (KAP) model, which emphasizes that knowledge is a fundamental determinant of professional behavior (Rocha, 2025). Additionally, Kurt Lewin's Change Theory highlights the importance of structured educational interventions in promoting behavioral change by addressing existing gaps and reinforcing new knowledge (Coghlan, 2024).

Despite the growing global emphasis on fertility preservation, there remains limited evidence regarding the effectiveness of educational interventions targeting oncology nurses' knowledge in Middle Eastern contexts, including Jordan. Given the critical role of nurses in patient education and the potential consequences of inadequate fertility counseling, there is a clear need to evaluate strategies that enhance nurses' knowledge and competency in this area.

Therefore, this study aims to evaluate the effect of a structured educational package on oncology nurses' knowledge toward fertility preservation, with the goal of improving nursing practice and

supporting patient-centered cancer care.

Methods

Study design

A quasi-experimental one-group pre–posttest design was employed to evaluate the effect of a structured educational package on oncology nurses' knowledge toward fertility preservation. This design is appropriate for educational interventions conducted in real-world clinical settings where randomization is not feasible and allows for the assessment of change over time within the same group (El-Said Mansour & Hassan, 2021).

The study was conceptually guided by the KAP model, which posits that knowledge acquisition is a fundamental precursor to behavioral and practice change (Rocha, 2025). Additionally, Kurt Lewin's Change Theory informed the intervention process, emphasizing structured learning as a mechanism for facilitating change in professional behavior (Coghlan, 2024).

Setting

The study was conducted in the oncology department (Samih Darwazah Center) at Al Basheer Hospital in Amman, Jordan. The hospital is a major public tertiary healthcare institution providing comprehensive oncology services, including chemotherapy, radiotherapy, and supportive care. The oncology department includes a multidisciplinary team of healthcare professionals, offering an appropriate setting to evaluate educational interventions targeting oncology nurses.

Participants and sampling

A purposive sampling technique was used to recruit participants. A total of 108 oncology nurses were included in the study.

Inclusion criteria

- Registered nurses working in oncology units
- Minimum of six months of clinical experience in oncology care

Exclusion criteria

- Nurses who had previously received formal training in fertility preservation
- Nurses in administrative or managerial roles
- Nurses who were unable to attend all sessions of the educational intervention

Sample size calculation

The sample size was calculated using G*Power software (version 3.1) based on a paired-samples t-test. Assuming a medium effect size (d = 0.5), a significance level of α = 0.05, and statistical power of 80%, the minimum required sample size was 34 participants. However, to enhance statistical robustness, account for potential attrition, and ensure adequate representation across different oncology units, the final sample size was increased to 108 nurses, consistent with similar intervention studies (El-Said Mansour & Hassan, 2021).

Data collection instrument

Data were collected using a structured self-administered questionnaire developed after an extensive review of relevant literature (Hoffman et al., 2021; Kasaven et al., 2024; Zhang et al., 2023).

The questionnaire consisted of two main sections:

1. Demographic characteristics

Including age, gender, marital status, educational level, years of experience, and clinical specialty.

2. Knowledge toward fertility preservation

This section included 20 items assessing nurses' knowledge regarding:

- Definition and importance of fertility preservation
- Effects of cancer treatments on male and female fertility
- Available fertility preservation methods (e.g., oocyte and embryo cryopreservation)
- Ethical and legal considerations

Scoring system

Each correct response was scored as (1), and incorrect or "do not know" responses were scored as (0). The total knowledge score was converted into a percentage and categorized as:

- Poor (< 50%)
- Fair (50–75%)
- Good (> 75%) (Kim et al., 2019)

Validity and reliability

Content validity of the instrument was assessed by a panel of three experts in women's health and oncology nursing. Minor modifications were made to improve clarity and cultural relevance.

A pilot study was conducted on 10% of the sample (n = 11) to evaluate feasibility and clarity. The pilot participants were excluded from the final analysis.

Internal consistency reliability was assessed using Cronbach's alpha coefficient, which yielded a value of 0.87, indicating good reliability.

Educational intervention

The educational package was developed based on evidence-based guidelines and international recommendations, including those from the American Society of Clinical Oncology (2023) and the European Society of Human Reproduction and Embryology (2020).

The intervention consisted of four structured sessions, each lasting approximately 60–90 minutes, delivered over a two-week period.

Content of sessions

- Overview of cancer-related infertility
- Impact of chemotherapy and radiotherapy on fertility
- Fertility preservation methods and indications
- Ethical, legal, and cultural considerations
- Role of oncology nurses in fertility counseling

Teaching strategies included lectures, interactive discussions, and case-based scenarios to enhance engagement and knowledge retention.

Data collection procedure

Data collection was conducted in three phases:

1. 1. Pre-intervention: Baseline assessment of nurses' knowledge
2. 2. Post-intervention: Immediately after completion of the educational program
3. 3. Follow-up: Conducted three months after the intervention to assess knowledge retention

The same questionnaire was used across all phases to ensure consistency and comparability.

Ethical Considerations

Ethical approval

for this study was obtained from the Research Ethics Committee of the Faculty of Nursing at Mansoura University (Ref No: P.694). Official permission to conduct the study was also obtained from the administration of Al Basheer Hospital in Amman, Jordan.

All participants were informed about the purpose and procedures of the study, and written informed consent was obtained prior to participation. Confidentiality and anonymity were ensured by assigning

unique codes to the questionnaires instead of using participants' names. Participation was entirely voluntary, and participants were informed of their right to withdraw from the study at any time without any consequences.

All procedures were conducted in accordance with relevant ethical guidelines and regulations.

Data analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS), version 26. Descriptive statistics (mean, standard deviation, frequency, and percentage) were used to summarize participant characteristics and knowledge scores.

Inferential statistics were conducted using paired samples t-tests to compare knowledge scores across the three study phases (pre-intervention, post-intervention, and follow-up). Statistical significance was set at $p < 0.05$.

Results

Professional Characteristics and Demographic Data

Table 1 summarizes the demographic and professional characteristics of the oncology nurses.

Table 1
Demographic and Professional Characteristics of Oncology Nurses (N = 108)

Variable	Category	N	%
Age (years)	23–27	29	26.9
	28–32	44	40.7
	≥ 33	35	32.4
Gender	Male	21	19.4
	Female	87	80.6
Marital status	Single	38	35.2
	Married	60	55.6
	Divorced/Widowed	10	9.2
Residence	Urban	79	73.1
	Rural	29	26.9
Educational level	Diploma	22	20.4
	Bachelor's degree	68	63.0
	Master's or higher	18	16.6
Years of experience	< 1 year	19	17.6
	1–5 years	42	38.9
	> 5 years	47	43.5
Specialty	Medical/Clinical Oncology	46	42.6
	Surgical Oncology	39	36.1
	Other oncology units (outpatient clinics)	23	21.3

As shown in Table 1 most participants were aged 28–32 years (40.7%) and predominantly female (80.6%). Over half were married (55.6%), and the majority resided in urban areas (73.1%).

In terms of education, most nurses held a Bachelor's degree (63.0%), while 16.6% had a Master's degree or higher. Nearly half of the sample (43.5%) reported more than five years of oncology experience.

Regarding clinical setting, the largest proportion worked in medical/clinical oncology units (42.6%), followed by surgical oncology units (36.1%), and outpatient oncology clinics (21.3%).

Figure 1 presents the distribution of oncology nurses by specialty.

Distribution of Oncology Nurses According to Specialty (N = 108).

As illustrates in Fig. 1 the majority worked in medical/clinical oncology units (42.6%), followed by surgical oncology units (36.1%), while a smaller proportion were employed in outpatient oncology clinics (21.3%).

Figure 2 shows that the majority of oncology nurses had more than five years of experience

Distribution of Oncology Nurses According to Years of Experience (N = 108).

As shows in Fig. 2 the majority of oncology nurses had more than five years of experience (43.5%), followed by those with one to five years (38.9%), while a smaller proportion had less than one year of experience (17.6%).

Oncology Nurses' Knowledge Toward Fertility Preservation

Table 2 demonstrates a significant improvement in oncology nurses' knowledge across all items following the educational intervention.

Table 2
Correct Responses of Oncology Nurses Regarding Fertility Preservation Knowledge Across Pre-Intervention, Post-Intervention, and Follow-Up Measurements (N = 108)

Items	Pre-intervention No (%)	Post-intervention No (%)	Follow-up No (%)
Definition of fertility	92 (85.2)	104 (96.3)	101 (93.5)
Significance test	$\chi^2 = 6.51$, $P_1 = 0.010$	$\chi^2 = 4.62$, $P_2 = 0.032$	$\chi^2 = 4.19$, $P_3 = 0.041$
Causes of fertility impairment	81 (75.0)	98 (90.7)	92 (85.2)
Significance test	$\chi^2 = 8.32$, $P_1 = 0.004$	$\chi^2 = 5.32$, $P_2 = 0.021$	$\chi^2 = 4.31$, $P_3 = 0.038$
Effects of cancer treatment on female fertility	78 (72.2)	95 (88.0)	90 (83.3)
Significance test	$\chi^2 = 8.87$, $P_1 = 0.003$	$\chi^2 = 5.63$, $P_2 = 0.018$	$\chi^2 = 4.78$, $P_3 = 0.029$
Effects of cancer treatment on male fertility	74 (68.5)	93 (86.1)	88 (81.5)
Significance test	$\chi^2 = 10.52$, $P_1 = 0.001$	$\chi^2 = 6.28$, $P_2 = 0.012$	$\chi^2 = 5.12$, $P_3 = 0.024$
Factors affecting fertility during treatment	83 (76.9)	97 (89.8)	91 (84.3)
Significance test	$\chi^2 = 7.63$, $P_1 = 0.006$	$\chi^2 = 4.97$, $P_2 = 0.026$	$\chi^2 = 4.26$, $P_3 = 0.039$
Correct definition of fertility preservation	89 (82.4)	102 (94.4)	98 (90.7)
Significance test	$\chi^2 = 6.37$, $P_1 = 0.011$	$\chi^2 = 4.51$, $P_2 = 0.034$	$\chi^2 = 4.09$, $P_3 = 0.043$
Knowledge of fertility preservation options	71 (65.7)	96 (88.9)	89 (82.4)
Significance test	$\chi^2 = 14.92$, $P_1 < 0.001$	$\chi^2 = 9.84$, $P_2 = 0.002$	$\chi^2 = 5.45$, $P_3 = 0.019$
Benefits of fertility preservation	69 (63.9)	97 (89.8)	91 (84.3)
Significance test	$\chi^2 = 16.44$, $P_1 < 0.001$	$\chi^2 = 11.63$, $P_2 = 0.001$	$\chi^2 = 5.96$, $P_3 = 0.015$
Disadvantages of fertility preservation	58 (53.7)	90 (83.3)	84 (77.8)

Note. P_1: Pre-intervention vs post-intervention; P_2: Pre-intervention vs follow-up; P_3: Post-intervention vs follow-up. Chi-square test was used. Significance level: $p < .05$.

Items	Pre-intervention No (%)	Post-intervention No (%)	Follow-up No (%)
Significance test	$\chi^2 = 20.71$, $P_1 < 0.001$	$\chi^2 = 13.56$, $P_2 < 0.001$	$\chi^2 = 6.45$, $P_3 = 0.011$
Ethical considerations of fertility preservation	54 (50.0)	88 (81.5)	79 (73.1)
Significance test	$\chi^2 = 22.33$, $P_1 < 0.001$	$\chi^2 = 14.08$, $P_2 < 0.001$	$\chi^2 = 6.03$, $P_3 = 0.014$
Legal considerations of fertility preservation	49 (45.4)	84 (77.8)	76 (70.4)
Significance test	$\chi^2 = 24.68$, $P_1 < 0.001$	$\chi^2 = 16.41$, $P_2 < 0.001$	$\chi^2 = 5.58$, $P_3 = 0.018$

Note. P_1: Pre-intervention vs post-intervention; P_2: Pre-intervention vs follow-up; P_3: Post-intervention vs follow-up. Chi-square test was used. Significance level: $p < .05$.

As presents in Table 2 correct responses increased from 45.4%–85.2% at baseline to 77.8%–96.3% post-intervention, and remained relatively high at follow-up (70.4%–93.5%). The greatest improvements were observed in legal considerations (45.4% to 77.8%), ethical considerations (50.0% to 81.5%), and disadvantages of fertility preservation (53.7% to 83.3%). All differences were statistically significant across the three phases ($p < .05$), with a slight decline at follow-up that remained above baseline levels.

Figure 3 shows the awareness cancer treatment affects fertility across study phases

Note

Values are presented as percentage correct ± SD. Chi-square test: $p < .001$.

Figure 3

Awareness that Cancer Treatment Affects Fertility across Study Phases (N = 108)

As illustrates in Fig. 3a marked improvement in nurses' awareness of the impact of cancer treatment on fertility, increasing from 53.7% at baseline to 98.1% post-intervention ($p < .001$), with a slight decline at follow-up (94.4%) that remained significantly higher than baseline ($p = .018$).

Table 3 shows a marked improvement in oncology nurses' knowledge scores following the educational intervention.

Table 3
Average scores of oncology nurses' knowledge toward fertility preservation across study phases (N = 108)

Nurses' Knowledge Score	Pre intervention Mean ± SD	post intervention Mean ± SD	follow up intervention Mean ± SD
Total knowledge score	61.30 ± 8.40	84.70 ± 6.90	78.90 ± 7.60
Significance test (t test)	t (P_1) = 18.42, P_1 < 0.001	t (P_2) = 2.41, P_2 = 0.018	t (P_3) = 15.76, P_3 < 0.001
Notes: P_1 = Pre-intervention vs post intervention. P_2 = Pre-intervention vs follow up intervention. P_3 = post intervention vs follow-up intervention. Statistical significance was considered at $p < 0.05$.			

As shows in Table 3 the mean score increased from 61.30 ± 8.40 at baseline to 84.70 ± 6.90 post-intervention, with a slight decline at follow-up (78.90 ± 7.60) that remained higher than pre-intervention levels. The differences across the three phases were statistically significant ($p < .001$).

Figure 4 shows the knowledge scores across the three study phases, with statistically significant differences between the measurements

Mean Knowledge Scores Across the Three Study Phases, with Statistically Significant Differences between the Measurements.

As shows in Fig. 4a marked improvement in oncology nurses' knowledge scores following the educational intervention.

Table 4 shows a clear improvement in oncology nurses' knowledge levels following the educational intervention.

Table 4
Classification of Oncology Nurses' Knowledge Level Toward Fertility Preservation Across Study Phases (N = 108)

Measurement Phase	Mean Score	Knowledge Level
Pre-intervention	61.30 ± 8.40	Fair
Post-intervention	84.70 ± 6.90	Good
Follow-up	78.90 ± 7.60	Good
Note. Knowledge levels were classified as follows: poor (< 50%), fair (50–75%), and good (> 75%) of the maximum possible score.		

As presents in Table 4 the mean score at baseline reflected a fair level of knowledge (61.30 ± 8.40), which improved to a good level post-intervention (84.70 ± 6.90) and was maintained at follow-up (78.90 ± 7.60). Figure 5 shows the levels of oncology nurses' knowledge toward fertility preservation across study phases

Levels of Oncology Nurses' Knowledge Toward Fertility Preservation Across Study Phases (N = 108).

As illustrates in Fig. 5a marked improvement in oncology nurses' knowledge levels following the educational intervention. The proportion of nurses with good knowledge increased from 15.0% at baseline to 75.0% post-intervention and remained stable at follow-up, while poor knowledge decreased from 76.7% to 13.3%.

Table 5 shows the relationship between characteristics of the studied oncology nurses and their knowledge scores toward fertility preservation across study phases

Table 5
Relationship Between Characteristics of the Studied Oncology Nurses and Their Knowledge Scores Toward Fertility Preservation Across Study Phases (N = 108)

Characteristics	Items	No	Average Knowledge Score (Mean ± SD)		
			Pre	Post	Follow-up
Age (years)	< 25	28	60.5 ± 8.6	84.1 ± 6.9	78.0 ± 7.5
	25–<35	42	61.7 ± 8.2	85.2 ± 6.7	79.3 ± 7.2
	35–<45	24	62.3 ± 8.3	84.6 ± 6.8	78.7 ± 7.4
	≥ 45	14	63.0 ± 7.9	85.0 ± 6.6	79.1 ± 7.1
Significance test			F = 1.02, P = 0.388	F = 0.94, P = 0.422	F = 0.88, P = 0.456
Educational level	Diploma	26	58.4 ± 8.9	82.3 ± 7.1	76.4 ± 7.8
	Bachelor	58	61.7 ± 8.1	84.9 ± 6.8	79.0 ± 7.4
	Postgraduate	24	65.2 ± 7.4	86.3 ± 6.5	80.2 ± 7.0
Significance test			F = 6.21, P = 0.003	F = 2.18, P = 0.118	F = 2.01, P = 0.139
Years of oncology experience	≤ 5 years	34	59.2 ± 8.6	83.5 ± 7.0	77.4 ± 7.8
	6–10 years	46	61.5 ± 8.2	84.8 ± 6.7	78.8 ± 7.5
	> 10 years	28	64.1 ± 7.6	86.0 ± 6.4	80.1 ± 7.1
Significance test			F = 4.09, P = 0.019	F = 1.74, P = 0.181	F = 1.63, P = 0.201
Prior FP training	Yes	32	65.8 ± 7.5	87.1 ± 6.2	81.0 ± 6.9
	No	76	59.4 ± 8.4	83.7 ± 7.0	77.9 ± 7.7
Significance test			t = 3.12, P = 0.002	t = 2.36, P = 0.020	t = 2.21, P = 0.029

As shows in Table 5 knowledge scores differed significantly at baseline by educational level (p = .003), years of oncology experience (p = .019), and prior fertility preservation training (p = .002), with higher scores among nurses with postgraduate education, greater experience, and prior training. No significant differences were observed by age (p = .388).

Discussion

The present study evaluated the effect of a structured educational package on oncology nurses' knowledge toward fertility preservation and demonstrated a statistically significant improvement following the intervention, with sustained knowledge retention at follow-up. These findings highlight the effectiveness of targeted educational interventions in addressing knowledge gaps among oncology nurses and improving their readiness to provide fertility-related counseling.

The significant improvement in knowledge scores observed in this study is consistent with previous research indicating that oncology nurses often have inadequate baseline knowledge regarding fertility preservation (Kasaven et al., 2024; Zhang et al., 2023). Similarly, El-Said Mansour and Hassan (2021) reported a marked increase in nurses' knowledge following the implementation of an educational package, supporting the role of structured training in enhancing clinical competencies. The findings are also aligned with studies conducted in different healthcare settings, which emphasize that educational interventions significantly improve healthcare providers' understanding of fertility risks and available preservation options (Ali et al., 2024; Sindi et al., 2024).

From a theoretical perspective, the results of this study can be interpreted through the KAP model, which suggests that knowledge acquisition is a fundamental step toward improving professional practice (Rocha, 2025). The observed increase in knowledge following the educational intervention indicates that structured learning effectively enhances cognitive readiness among nurses, which may subsequently influence their attitudes and clinical behaviors. In addition, the findings are consistent with Kurt Lewin's Change Theory, where the educational intervention functions as an "unfreezing" mechanism that challenges existing knowledge gaps, followed by a "change" phase characterized by improved understanding and competency (Coghlan, 2024).

Although knowledge levels remained significantly higher at follow-up compared with baseline, a slight decline was observed compared to immediate post-intervention results. This pattern is consistent with the concept of knowledge decay over time, particularly in the absence of continuous reinforcement or practical application (Magdy Abd-Ellatif et al., 2024). Similar findings have been reported in previous studies, suggesting that while educational programs are effective in the short term, ongoing training and refresher sessions are necessary to sustain knowledge gains (Belal et al., 2023).

The improvement in knowledge across different domains including fertility risks, preservation methods, and ethical considerations indicates that the educational package was comprehensive and effective in addressing multiple aspects of fertility preservation. This is particularly important given that fertility preservation is a complex and multidisciplinary field requiring not only clinical knowledge but also

awareness of ethical, legal, and psychosocial dimensions (ESHRE, 2020; ASCO, 2023). Furthermore, international guidelines emphasize that healthcare providers should be adequately informed to ensure timely and appropriate counseling for patients at risk of infertility (Su et al., 2025).

Despite these positive findings, the study also reflects broader challenges identified in the literature. Previous research has highlighted that insufficient knowledge among healthcare providers is a major barrier to effective fertility preservation counseling (Dorfman et al., 2021; Xiao et al., 2024). In addition, systemic barriers such as limited access to fertility services, lack of institutional protocols, and time constraints may hinder the translation of knowledge into practice (Njiru et al., 2025). Therefore, improving knowledge alone may not be sufficient to ensure optimal implementation of fertility preservation in clinical settings.

In the Middle Eastern context, cultural and social factors may further influence fertility-related discussions and decision-making. Fertility is often closely linked to social identity and family expectations, making fertility preservation a sensitive and important aspect of cancer care (Magdy Abd-Ellatif et al., 2024). The findings of this study provide valuable evidence supporting the need for context-specific educational interventions that consider cultural factors and healthcare system limitations.

From a practical perspective, the findings underscore the importance of integrating fertility preservation education into both undergraduate and continuing nursing education programs. Oncology nurses, as frontline healthcare providers, are uniquely positioned to initiate fertility-related discussions, provide accurate information, and facilitate timely referrals to specialists (Oncology Nursing Society, 2022). Enhancing their knowledge is therefore essential for improving patient-centered care and ensuring that patients are fully informed about their reproductive options.

Strengths and limitations

This study has several strengths, including the use of a quasi-experimental design and multiple assessment points, which allowed for the evaluation of both immediate and sustained effects of the intervention. Additionally, the study addressed an important and under-researched topic within the regional context.

However, certain limitations should be acknowledged. The use of a single-group design without a control group may limit the ability to attribute changes solely to the intervention. The study was also conducted in a single healthcare setting, which may affect the generalizability of the findings. Furthermore, the study focused on knowledge outcomes and did not assess actual changes in clinical practice or patient outcomes.

Implications for practice and research

The findings of this study have important implications for nursing practice and healthcare policy. Educational interventions should be integrated into routine professional development programs to ensure sustained knowledge and competency in fertility preservation. Healthcare institutions should also

develop clear guidelines and referral pathways to support nurses in implementing fertility preservation practices.

Future research is recommended to evaluate the long-term impact of educational interventions on clinical practice and patient outcomes, as well as to explore the effectiveness of interdisciplinary and system-level strategies in overcoming barriers to fertility preservation.

Conclusion

This study demonstrated that a structured educational package had a significant positive effect on oncology nurses' knowledge toward fertility preservation. Nurses showed substantial improvement in knowledge immediately following the intervention, with knowledge levels remaining significantly higher at follow-up compared to baseline. These findings confirm that targeted, evidence-based educational interventions are effective in addressing existing knowledge gaps among oncology nurses.

The results highlight the critical role of education in enhancing nurses' preparedness to provide accurate fertility-related information and support to patients of reproductive age undergoing cancer treatment. Given the increasing importance of fertility preservation in oncology care, improving nurses' knowledge is essential for promoting patient-centered care and ensuring that patients are adequately informed about their reproductive options.

However, the slight decline in knowledge at follow-up indicates that knowledge retention may decrease over time without reinforcement. Therefore, continuous education and ongoing professional development are necessary to sustain knowledge gains and ensure long-term competency in fertility preservation counseling.

Recommendations

Based on the findings of this study, several recommendations are proposed:

1. Educational recommendations

- Integrate fertility preservation content into undergraduate and postgraduate nursing curricula.
- Implement continuous in-service training programs and refresher courses for oncology nurses.
- Utilize interactive and case-based learning approaches to enhance knowledge retention and practical application.

2. Clinical practice recommendations

- Develop standardized protocols for fertility preservation counseling within oncology settings.
- Encourage oncology nurses to actively participate in fertility-related discussions with patients.
- Strengthen interdisciplinary collaboration between oncology teams and fertility specialists.

3. Organizational and policy recommendations

- Establish institutional guidelines and referral pathways for fertility preservation services.
- Promote administrative support to facilitate the integration of fertility preservation into routine oncology care.
- Advocate for policies that improve access to fertility preservation services, particularly in resource-limited settings.

4. Research recommendations

- Conduct longitudinal studies to assess long-term knowledge retention and sustainability of educational interventions.
- Investigate the impact of educational programs on actual nursing practices and patient outcomes.
- Explore the effectiveness of combined educational and system-level interventions in overcoming barriers to fertility preservation.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Research Ethics Committee of the Faculty of Nursing at Mansoura University (Ref No: P.694). Official permission to conduct the study was also obtained from Al Basheer Hospital in Amman, Jordan. Written informed consent was obtained from all participants prior to participation. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The author declares that there are no competing interests.

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Authors' contributions

The author was responsible for the study conception and design, data collection, analysis and interpretation of data, and manuscript preparation.

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Figures

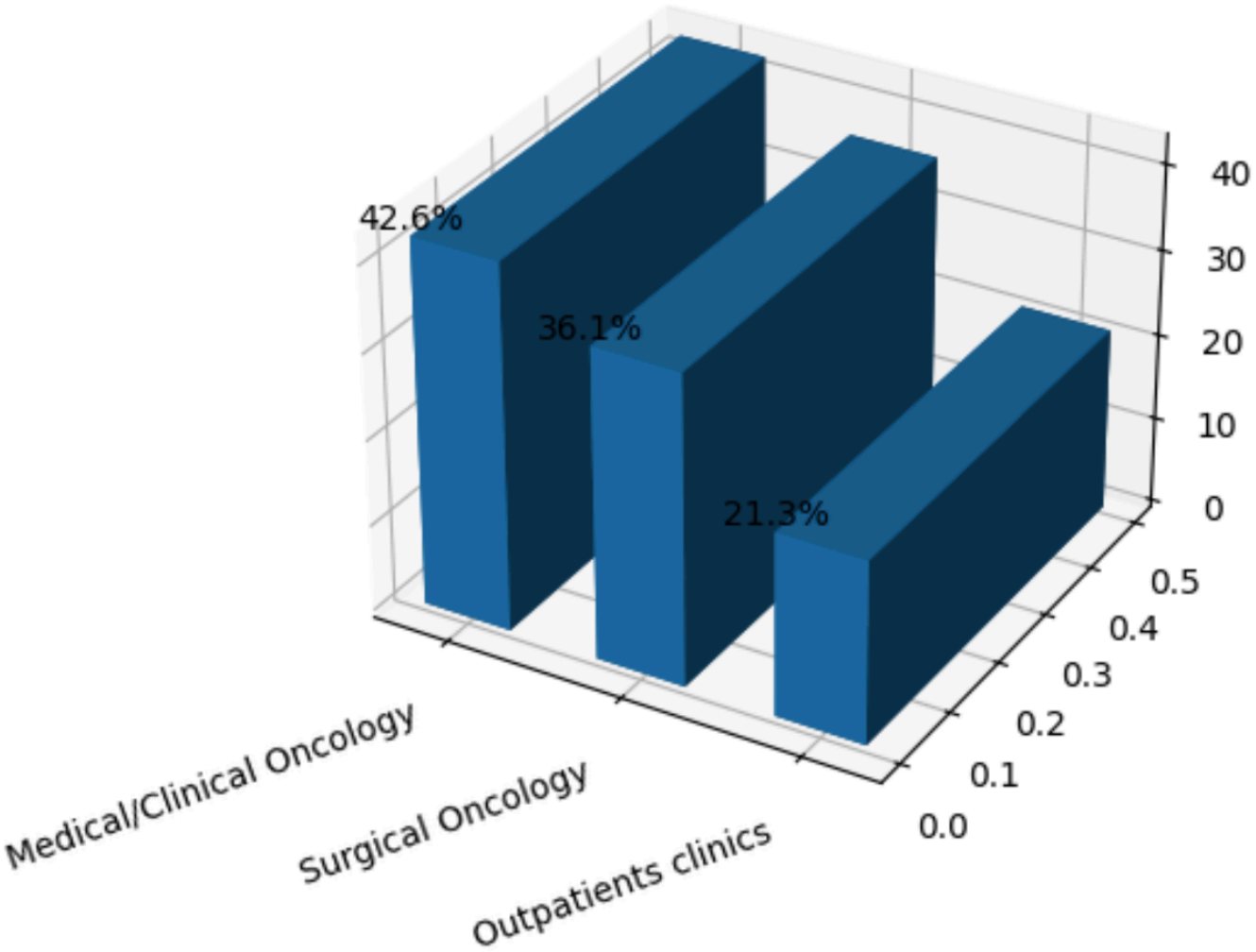


Figure 1

Distribution of Oncology Nurses According to Specialty (N = 108).

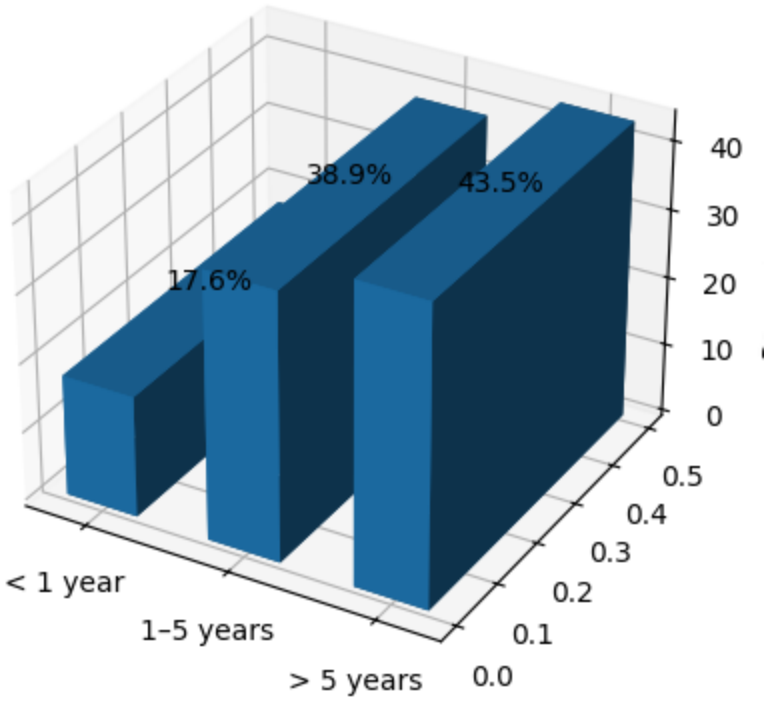


Figure 2

Distribution of Oncology Nurses According to Years of Experience (N = 108).

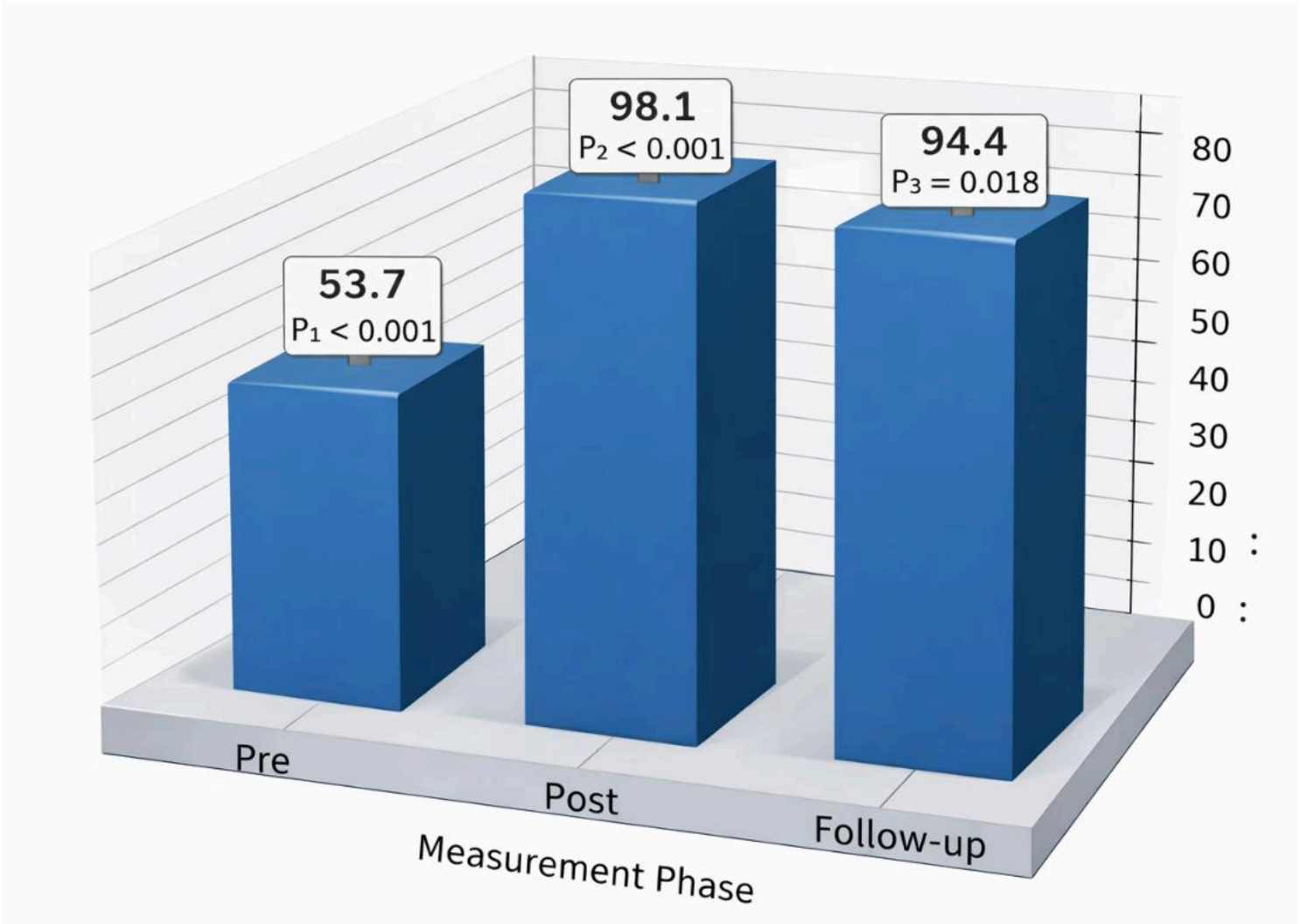


Figure 3

Awareness that Cancer Treatment Affects Fertility across Study Phases (N = 108)

Note. Values are presented as percentage correct ± SD. Chi-square test: p < .001.

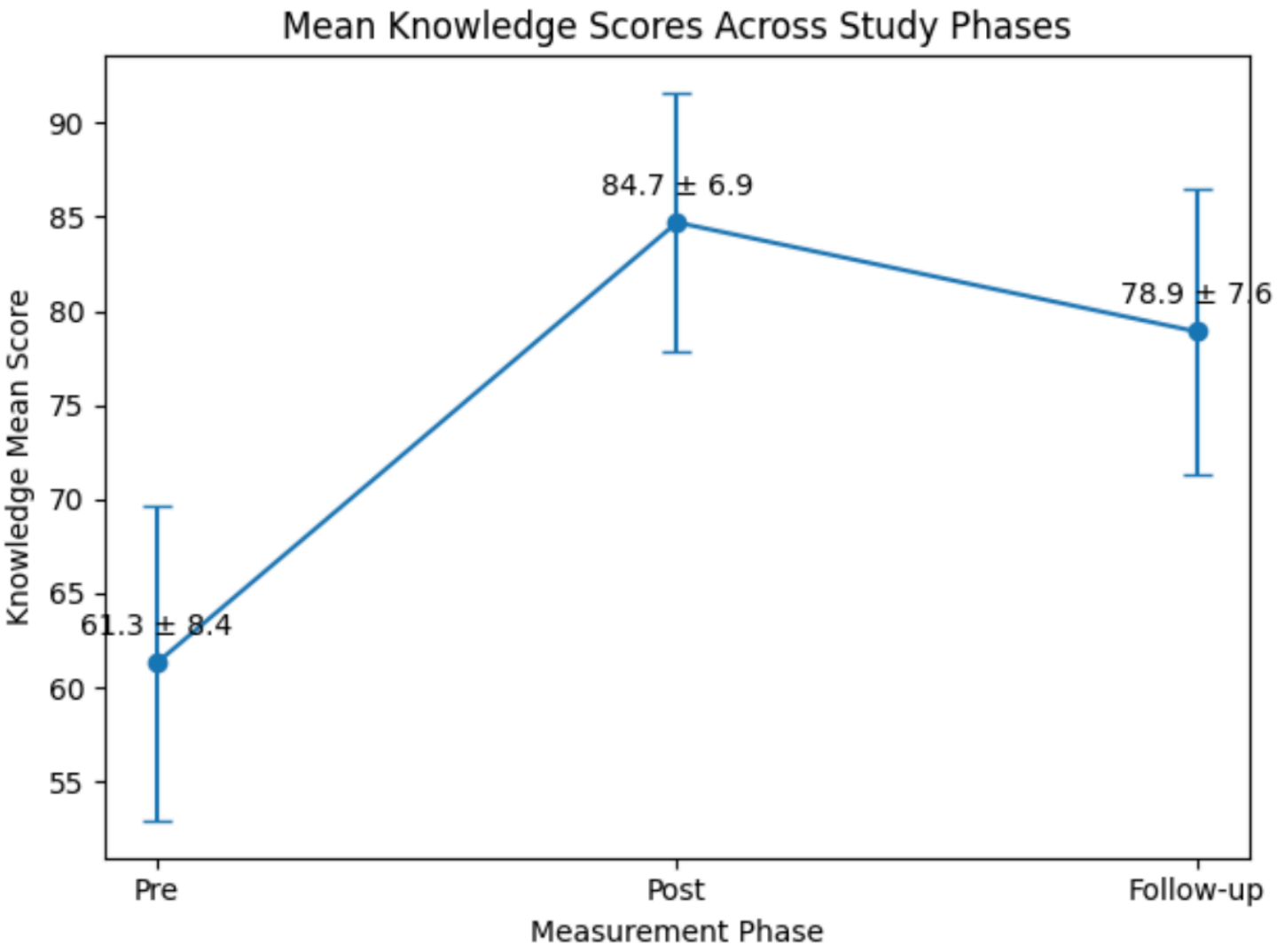


Figure 4

Mean Knowledge Scores Across the Three Study Phases, with Statistically Significant Differences between the Measurements.

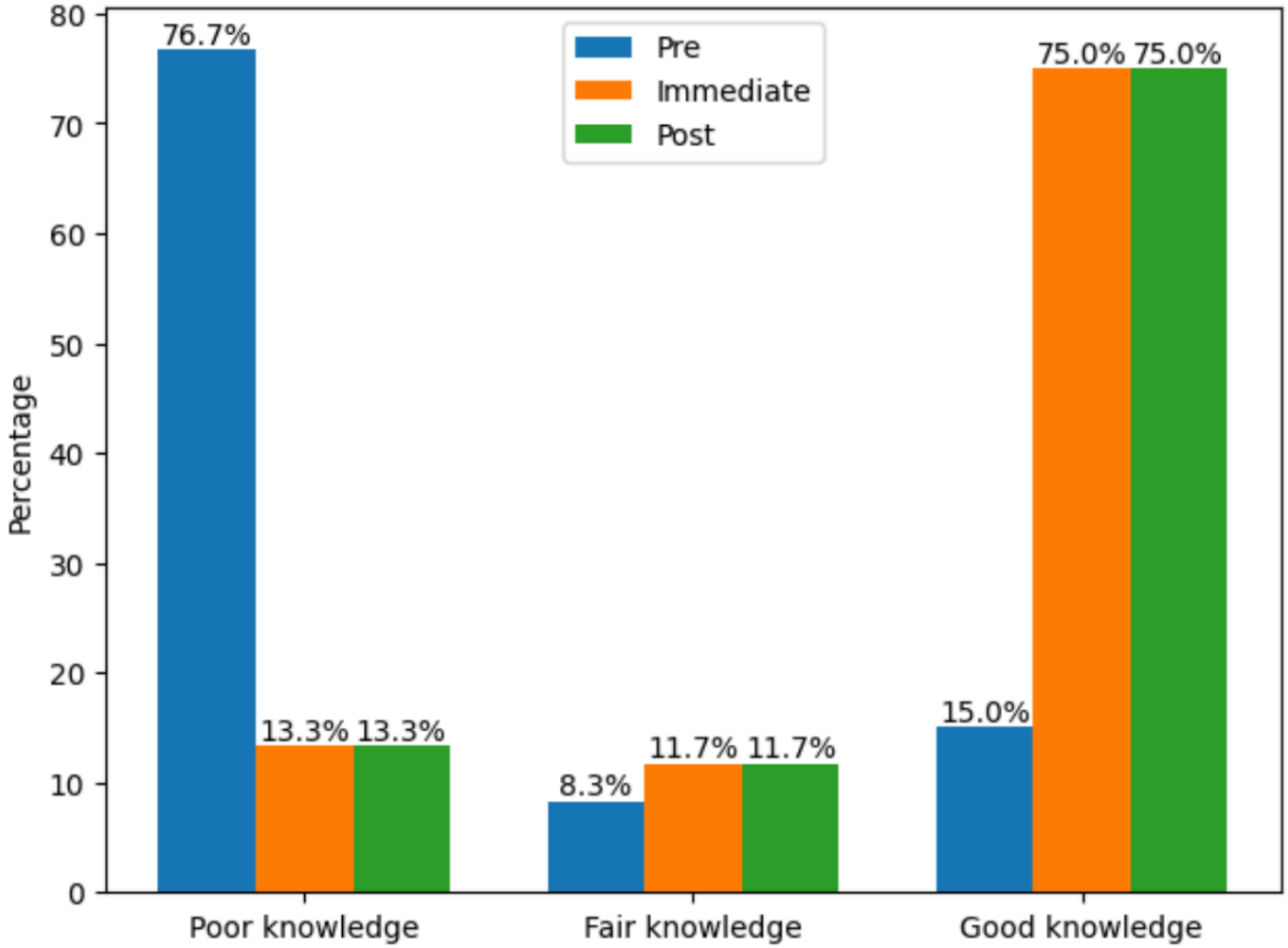


Figure 5

Levels of Oncology Nurses' Knowledge Toward Fertility Preservation Across Study Phases (N = 108).