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# Effect of a Structured Psychosocial Prehabilitation Program on Postoperative Psychological Distress and Recovery Outcomes Among Women Undergoing Gynecologic Cancer Surgery: A Quasi-Experimental Study

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## Abstract

# Background

Women undergoing gynecologic cancer surgery frequently experience substantial psychological distress, which may negatively affect postoperative recovery, particularly in resource-limited settings. This study aimed to evaluate the effect of a structured psychosocial prehabilitation program on postoperative psychological distress, perceived social support, and clinical recovery outcomes.

# Methods

A quasi-experimental, controlled before-and-after study was conducted among 140 women undergoing gynecologic cancer surgery at Assiut University Hospital. Participants were non-randomly allocated via sequential enrollment into either a control group receiving routine perioperative care (n = 70) during the initial phase, followed by a psychosocial prehabilitation intervention group (n = 70). Primary outcomes included psychological distress (Depression Anxiety Stress Scale-21, DASS-21) and perceived social support (Multidimensional Scale of Perceived Social Support, MSPSS) assessed preoperatively (T1), 15 days postoperatively (T2), and at 30-day follow-up (T3). Secondary outcomes were postoperative pain, length of hospital stay (LOS), readmission, and re-exploration rates.

# Results

Baseline demographic characteristics were comparable between groups. At 30-day follow-up (T3), the intervention group demonstrated statistically significant and clinically meaningful reductions in anxiety (8.70 ± 2.37 vs. 14.41 ± 6.70, $p < 0.001$, Cohen's $d = 2.41$), depression (7.91 ± 3.45 vs. 14.09 ± 6.49, $p < 0.001$, Cohen's $d = 1.76$), and stress (9.19 ± 2.84 vs. 14.10 ± 7.12, $p < 0.001$, Cohen's $d = 2.63$). In multivariable ANCOVA models adjusting for baseline scores, age and cancer type, the intervention effect remained statistically significant across all psychological domains ($p < 0.001$). The intervention group also experienced lower postoperative pain scores ($p < 0.001$), shorter mean LOS (5.57 ± 1.81 vs. 11.30 ± 4.18 days, $p < 0.001$), and lower 30-day readmission (0% vs. 14.3%, $p < 0.001$) and re-exploration rates (1.4% vs. 15.7%, $p = 0.003$).

# Conclusion

Nurse-led psychosocial prehabilitation is associated with substantial improvements in postoperative psychological distress and clinical recovery parameters in women undergoing gynecologic cancer surgery. Given the non-randomized sequential design, causality cannot be definitively established, and findings should be confirmed in randomized controlled trials.

# Trial Registration:

ClinicalTrials.gov NCT07188662 (retrospectively registered the registration date '2025-09').

# 1. Introduction

Gynecologic cancers represent a major global health burden, accounting for significant morbidity and mortality worldwide. The diagnosis and surgical management of gynecologic malignancies are inherently traumatic experiences that frequently trigger severe psychological distress, characterized by high levels of anxiety, depression, and stress[1]. Preoperative anxiety and emotional distress in cancer patients stem from uncertainty regarding prognosis, fear of surgical mutilation, functional loss, altered body image, and anticipation of adjuvant chemotherapy or radiotherapy. Uncontrolled preoperative psychological distress is not merely an emotional burden; it adversely modulates neuroendocrine and immune pathways, amplifies postoperative pain perception, increases opioid consumption, prolongs hospitalization, and impairs overall quality of life [2,3].

Psychosocial prehabilitation has emerged as an essential component of multimodal perioperative care, seeking to optimize patients' psychological resilience before surgical stress. Structured prehabilitation programs typically incorporate psychoeducation, cognitive-behavioral therapy (CBT) skills, relaxation training, and structured counseling [4]. While evidence supporting prehabilitation in surgical oncology is expanding, data from low- and middle-income countries (LMICs)—where specialized psycho-oncology resources are severely restricted remain limited [5].

In resource-constrained healthcare environments, nurse-led psychosocial interventions offer a scalable, cost-effective approach to bridge the care gap. Therefore, this study aimed to evaluate the effectiveness of a nurse-led, structured psychosocial prehabilitation program in reducing postoperative psychological distress (anxiety, depression, and stress), enhancing perceived social support, and improving postoperative recovery metrics among women undergoing surgery for gynecologic malignancies.

# 2. Methods

### 2.1. Study Design and Setting

This study employed a quasi-experimental, controlled before-and-after design without individual randomization. The study was conducted at the Gynecologic Oncology Unit, Women’s Health Hospital, Assiut University, Egypt.

### 2.2. Sample Size Calculation

The required sample size was calculated prior to study initiation using G*Power software (version 3.1.9.7). Based on prior literature evaluating perioperative psychosocial interventions on DASS-21 anxiety and depression scores, an effect size (f) of 0.25 (medium effect size), an alpha error (α) of 0.05,

and a statistical power (1 - β) of 0.80 were assumed for primary outcomes. The minimum required sample size was determined to be 128 participants (64 per group). To account for an estimated 10% attrition rate during follow-up, 140 participants (70 per group) were recruited.

### 2.3. Participants and Eligibility Criteria

Participants were recruited from patients admitted for elective surgery.

Inclusion criteria: Women aged ≥ 18 years with histologically or radiologically confirmed newly diagnosed gynecologic cancer (endometrial, ovarian, cervical, vaginal, or vulvar) who were scheduled for elective cancer surgery and possessed the capacity to provide Written informed consent and complete assessment instruments. Patients were excluded if they presented with severe cognitive impairment, pre-existing major psychiatric disorders or active psychosis, a history of prior structured psycho-oncology interventions or required emergency surgical procedures.

### 2.4. Allocation and Bias Mitigation

Participants were non-randomly allocated using sequential allocation. To prevent cross-contamination between intervention and control arms, sequential temporal allocation was utilized:

1. Control Group (n = 70): Enrolled sequentially during the first phase of data collection and received routine perioperative hospital care.

2. Intervention Group (n = 70): Enrolled sequentially during the second phase following the full deployment of the psychosocial prehabilitation program.

Methodological Note on Allocation Bias: Because allocation occurred sequentially over time rather than through random assignment, causality cannot be definitively established. Residual selection bias and temporal bias (e.g., subtle shifts in surgical team composition or perioperative nursing care protocols over time) may persist despite baseline comparability between groups.

### 2.5. Psychosocial Prehabilitation Intervention

The structured intervention was developed by a multidisciplinary team (gynecologic oncologists, psychiatric nurses, and clinical psychiatrists) and delivered by trained oncology nurses under professional psychiatric supervision. The program consisted of four individual sessions (45–60 minutes each) distributed across the perioperative continuum:

• Session 1 (Preoperative, 2–3 days prior to surgery): Comprehensive psychoeducation regarding the specific gynecologic cancer type, surgical procedure, expected postoperative sensations, tubes/drains, and pain management pathways.

• Session 2 (Preoperative, 1 day prior to surgery): Cognitive-behavioral coping skills, reframing negative thoughts, guided deep-breathing exercises, and progressive muscle relaxation training to mitigate acute

surgical anxiety.

• Session 3 (Postoperative, Week 2 / Day 15): Evaluation of emotional adaptation, reinforcement of coping strategies, address of body image concerns, and psychological preparation for potential adjuvant chemotherapy/radiotherapy.

• Session 4 (Postoperative, Week 4 / Day 30): Reinforcement of social support utilization, stress management techniques, and counseling regarding functional recovery.

Participants in the intervention group were also provided with a structured, illustrated educational booklet to reinforce session content. Participants demonstrating severe psychological decompensation were referred to the institutional psychiatric service. The control group received routine preoperative and postoperative nursing care according to hospital standards.

### 2.6. Assessment Instruments and Outcome Measures

• Socio-demographic and Clinical Profile: Age, place of residence, educational level, employment, marital status, gynecologic cancer type and extent of surgical resection (debulking/staging).

• Psychological Distress (DASS-21): The 21-item Depression Anxiety Stress Scale was used. Items are rated on a 4-point Likert scale ranging from 0 (did not apply to me at all) to 3 (applied to me very much or most of the time). Subscale scores (Anxiety, Depression, Stress) are calculated by summing item scores and multiplying by 2 to calculate equivalent full-scale DASS-42 scores. Internal consistency (Cronbach's α) in the study sample was 0.88 for depression, 0.82 for anxiety, and 0.87 for stress[6,7]

• Perceived Social Support (MSPSS): The 12-item Multidimensional Scale of Perceived Social Support was used, evaluated on a 7-point Likert scale (1 = strongly disagree to 7 = strongly agree). Cronbach's α values were 0.88 (family), 0.85 (friends), and 0.90 (significant others) [8,9].

• Postoperative Pain: Evaluated immediately postoperatively and daily using a standardized 10-cm Visual Analogue Scale (VAS) ranging from 0 (no pain) to 10 (worst imaginable pain)[10].

• Clinical Recovery Metrics: Recorded from official electronic medical records, including total length of hospital stay (LOS in days), 30-day readmission rate, and 30-day surgical re-exploration rate.

### 2.7. Data Collection Timeline

Assessments were performed at three standardized time points:

• T1 (Baseline): Preoperative assessment upon admission.

• T2 (Early Postoperative): 15 days postoperatively during surgical follow-up.

• T3 (Late Postoperative/Follow-up): 30 days (4 weeks) postoperatively via outpatient clinic visit or standardized phone interview.

### 2.8. Statistical Analysis

Data were analyzed using IBM SPSS Statistics for Windows, Version 28.0. Continuous variables were expressed as mean ± standard deviation (Mean ± SD), and categorical variables as frequencies and percentages (n, %). Baseline comparability between groups was assessed using independent sample t-tests for continuous variables and Pearson's Chi-square ($\chi 2$) or Fisher's exact tests for categorical variables. Within-group changes across T1, T2, and T3 were evaluated using Repeated Measures ANOVA with Bonferroni post-hoc adjustments. Between-group comparisons at 30-day follow-up (T3) were conducted using Analysis of Covariance (ANCOVA) adjusting for baseline scores (T1), age and cancer type, . Cohen's d effect sizes were calculated for continuous psychological outcomes (interpreted as: small d = 0.20, medium d = 0.50, large d ≥ 0.80). All p-values were two-tailed, and $p < 0.05$ was considered statistically significant.

## 3. Results

### 3.1. Baseline Demographic and Clinical Characteristics

A total of 140 participants completed the study (70 in the intervention group and 70 in the control group). As shown in Table 1, baseline socio-demographic parameters were well-balanced between groups with no statistically significant differences regarding age ($p = 0.122$), residence ($p = 0.274$), occupation ($p = 1.000$), educational level ($p = 0.163$), or marital status ($p = 1.000$). Clinical distribution of gynecologic cancer types was also comparable ($p = 0.079$), with endometrial cancer (48.6% vs. 30.0%) and ovarian cancer (31.4% vs. 51.4%) representing the majority of cases in both groups.[**Table 1]**

### 3.2. Psychological Distress Outcomes Across Time

Preoperatively (T1), baseline psychological distress scores were comparable between groups for anxiety (18.19 ± 3.84 vs. 17.06 ± 4.15, $p = 0.097$), depression (16.23 ± 2.96 vs. 15.29 ± 4.36, $p = 0.136$), and stress (18.99 ± 2.90 vs. 18.17 ± 3.40, $p = 0.129$) .At 15 days postoperatively (T2), the intervention group demonstrated significantly lower depression scores compared to controls (11.16 ± 2.31 vs. 13.16 ± 4.88, $p = 0.002$). At the 30-day follow-up (T3), marked statistical superiority was observed across all domains in the intervention group compared to controls: anxiety (8.70 ± 2.37 vs. 14.41 ± 6.70, $p < 0.001$), depression (7.91 ± 3.45 vs. 14.09 ± 6.49, $p < 0.001$), and stress (9.19 ± 2.84 vs. 14.10 ± 7.12, $p < 0.001$) **[Table 2].**

### 3.3. Within-Group Longitudinal Changes and Effect Sizes

Repeated-measures ANOVA within the intervention group revealed significant continuous reductions in anxiety, depression, and stress across T1, T2, and T3 ($p < 0.001$ for all pairwise comparisons) . Perceived social support also demonstrated significant improvement over time ($p = 0.007$).[**Table 3]**

At 30-day follow-up (T3), calculations of Cohen's d demonstrated large effect sizes for the intervention group across all psychological distress measures: anxiety (d = 2.41, 95% CI: 1.94–2.87), depression (d =

1.76, 95% CI: 1.38–2.13), and stress (d = 2.63, 95% CI: 2.13–3.13). Corresponding effect sizes in the control group were negligible to small (d = 0.10 to 0.18).[**Table 4]**

### 3.4. Adjusted Analysis (ANCOVA)

Multivariable ANCOVA models were executed to test the independent association of the intervention with psychological distress at T3, controlling for baseline (T1) psychological scores, age, and cancer type (Table 5). After statistical adjustment, the intervention group assignment remained a highly significant predictor of reduced stress ($F = 28.45$, $p < 0.001$, Partial $\eta 2 = 0.182$), reduced anxiety ($F = 31.12$, $p < 0.001$, Partial $\eta 2 = 0.198$), and reduced depression ($F = 24.89$, $p < 0.001$, Partial $\eta 2 = 0.165$). Age and cancer type did not show significant main or interaction effects ($p > 0.05$).Although large effect sizes were observed, the quasi-experimental design may have contributed to inflation of observed treatment effects.[**Table 5]**

### 3.5. Clinical Recovery Outcomes

Postoperative clinical recovery metrics demonstrated substantial improvements in the intervention group (Table 6). Patients receiving psychosocial prehabilitation experienced significantly lower postoperative pain severity (68.6% mild pain vs. 18.6% in controls, $p < 0.001$). Mean length of hospital stay was halved in the intervention group (5.57 ± 1.81 vs. 11.30 ± 4.18 days, $p < 0.001$). Furthermore, 30-day readmissions (0% vs. 14.3%, $p < 0.001$) and surgical re-explorations (1.4% vs. 15.7%, $p = 0.003$) were significantly lower in the intervention group.[**Table 6]**

## 4. Discussion

This quasi-experimental study demonstrates that a structured, nurse-led psychosocial prehabilitation program is associated with significant reductions in postoperative anxiety, depression, and stress, along with improved clinical recovery parameters in women undergoing gynecologic cancer surgery. These findings contribute valuable evidence from a resource-constrained LMIC setting, demonstrating that structured psychological preparation can be effectively operationalized within standard gynecologic oncology pathways.

### 4.1. Psychological Distress and Temporal Adaptation

High preoperative distress levels observed across both cohorts underscore the psychological burden inherent to gynecologic oncology, where surgical risks intersect with threats to fertility, sexual identity, and fear of malignancy. Our findings demonstrate a progressive attenuation of distress in the prehabilitation arm, reaching clinical and statistical significance at 30-day follow-up with large effect sizes ($d > 1.7$). Notably, while depression improved by day 15, anxiety and stress reductions achieved statistical significance primarily at the 30-day mark. This temporal sequence suggests a delayed adaptation trajectory: cognitive-behavioral coping tools and relaxation techniques require active practice and internalization during the recovery phase before translating into structural reductions in generalized

anxiety and autonomic stress activation. These observations align with findings by Bharathi et al. and Adamakidou et al.[11,12], who reported that psychological benefits of psycho-oncological support unfold progressively post-surgery.

### 4.2. Clinical Recovery, Pain Modulation, and Physiological Pathways

The substantial reductions in postoperative pain intensity and length of hospital stay (5.57 vs. 11.30 days) in the intervention group represent major clinical findings. Psychological distress amplifies nociceptive processing through hypothalamic-pituitary-adrenal (HPA) axis hyperactivation and sympathetic drive, which elevate pro-inflammatory cytokines and lower pain thresholds. By mitigating autonomic stress responses through structured breathing and cognitive reframing, psychosocial prehabilitation may attenuate central sensitization, leading to decreased reported pain, earlier bed mobilization, and accelerated functional discharge. Similar reductions in hospital stay following prehabilitation in advanced ovarian cancer surgical cohorts were reported by Diaz-Feijoo et al [13,14].However, the magnitude of difference in hospital stay, readmission (0% vs. 14.3%), and re-exploration (1.4% vs. 15.7%) must be interpreted with caution. While psychosocial readiness promotes therapy compliance, early oral intake, and pulmonary hygiene, surgical complication rates and readmissions are intrinsically multifactorial. Differences in surgical complexity, staging distributions, or unmeasured comorbid conditions between sequential cohorts may have contributed to these clinical disparities.The observed reduction in LOS should be interpreted cautiously because LOS is strongly influenced by surgical complexity and perioperative complications.

#### Adjusted Effects and Robustness of Findings

Importantly, the observed improvements in psychological outcomes remained statistically significant after adjustment for baseline scores, age, and cancer type. This strengthens the validity of the findings and suggests that the effect of psychosocial prehabilitation is independent of these key confounders. The consistency of results across unadjusted and adjusted analyses, combined with large effect sizes, supports the robustness of the intervention’s impact.

#### Relevance to Low- and Middle-Income Settings

A key strength of this study lies in its applicability to low- and middle-income countries (LMICs), where access to specialized psycho-oncology services is often limited. The intervention developed in this study was nurse-led, structured, and low-cost, making it highly scalable and feasible for integration into routine clinical practice .In resource-constrained settings, where surgical care often receives priority over supportive care, the incorporation of psychosocial prehabilitation represents an important step toward holistic cancer management. This approach aligns with global health priorities emphasizing patient-centered, cost-effective, and sustainable interventions to improve cancer

### 4.3. Strengths and Methodological Limitations

The main strengths of this study include its prospective design, structured nurse-led framework tailored for lmics, pre-calculated statistical power, multivariable ANCOVA control, and multi-timepoint evaluation using validated metrics, prospective design,validated tools power calculation, multi-time-point assessment and first psychosocial prehabilitation study from upper Egypt.

Several methodological limitations must be explicitly acknowledged:

1. Non-Randomized Sequential Design: Allocation was non-random and sequential over time (control cohort recruited first, followed by intervention cohort). Consequently, residual selection bias and temporal bias (e.g., subtle changes in institutional nursing standards or surgical personnel) cannot be completely excluded, and causal inference cannot be definitively established.

2. Absence of Surgical Complexity Scoring: Detailed objective surgical complexity parameters (e.g., operative time, intraoperative blood loss, precise FIGO staging sub-classification, and residual disease status) were not captured in the analytical model.

3. Single-Center Setting: Conducted at a single tertiary hospital, which may restrict generalizability to secondary regional centers.

4. Trial Registration Timing: Protocol registration on ClinicalTrials.gov (NCT07188662) occurred retrospectively following enrollment initiation.

# 5. Conclusion

A nurse-led, structured psychosocial prehabilitation program is associated with significant, sustained reductions in postoperative anxiety, depression, and stress, along with reduced pain intensity, shorter hospitalization, and lower readmission rates among women undergoing gynecologic cancer surgery. In resource-limited settings, such nurse-led interventions represent a highly scalable and impactful strategy to optimize perioperative supportive care. Multi-center randomized controlled trials incorporating objective surgical complexity measures are warranted to confirm causality and evaluate long-term oncological and quality-of-life outcomes.

# Declarations

**Ethics Approval and Consent to Participate:** The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board of the Faculty of Nursing, Assiut University, Egypt (Approval No. 1120240746). written  informed consent was obtained from all participants prior to enrollment.

**Consent for Publication:** Not applicable.

**Availability of Data and Materials:** The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

**Competing Interests:** The authors declare that they have no competing interests.

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**Authors' Contributions:** . Hisham A Abou-Taleb contributed to the conception , execution of the study ,approved the final version of the publication and corresponding author , Aya M. Abdelhafez analyses the results; Aziza M. Mohammed authored, edited, and write the manuscript . Nadia H Ismail and Walaa H. Ibrahim, revise the final version of the manuscript. All writers concur with the manuscript's accuracy and integrity. All writers reviewed and endorsed the final manuscript.

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## Tables

Tables 1 to 6 are available in the Supplementary Files section.

## Supplementary Files

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