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ORIGINAL RESEARCH

Application Efficacy of Nursing Interventions Guided by the Medication-Psychological-Nursing-Family-Support (MPNFS) Framework in Mitigating Cancer-Related Fatigue and Enhancing Pulmonary Function Among Lung Cancer Patients Undergoing Chemotherapy

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Objective: To investigate the efficacy of Medication-Psychological-Nursing-Family-Support (MPNFS) theory-based nursing interventions in lung cancer patients undergoing chemotherapy and their impact on cancer-related fatigue (CRF) and pulmonary function.

Methods: A retrospective analysis was performed on clinical data from 92 lung cancer patients receiving chemotherapy at our institution between October 2022 and December 2024. Patients were categorized into a control group (n=46, receiving conventional nursing) and an MPNFS group (n=46, receiving MPNFS-guided nursing plus conventional care). Outcomes were compared using validated scales for CRF (Cancer Fatigue Scale, CFS), negative emotions (Self-Rating Anxiety Scale, SAS; Self-Rating Depression Scale, SDS), quality of life (EORTC QLQ-C30), nutritional status (serum albumin, ALB; total protein, TP), pulmonary function (forced vital capacity, FVC; vital capacity, VC), and complication incidence.

Results: CRF: After 6 weeks, cognitive, emotional, and physical fatigue scores decreased in both groups, with greater reductions in the MPNFS group ($P<0.05$). Negative emotions: SAS and SDS scores decreased in both groups, with more pronounced improvements in the MPNFS group ($P<0.05$). Quality of life: Physical, social, emotional, and role functioning scores increased in both groups, with greater gains in the MPNFS group ($P<0.05$). Nutritional indicators: ALB and TP levels rose in both groups, with more significant increases in the MPNFS group ($P<0.05$). Pulmonary function: FVC and VC improved in both groups, with superior gains in the MPNFS group ($P<0.05$). Complications: The MPNFS group exhibited lower incidence rates of nausea/vomiting, myelosuppression, fatigue, and malnutrition ($P<0.05$).

Conclusion: Incorporating MPNFS theory-based nursing interventions alongside conventional care enhances CRF management, mitigates negative emotions, improves nutritional and pulmonary function, elevates quality of life, and reduces complication risks in lung cancer patients undergoing chemotherapy.

Keywords: MPNFS theory, nursing, lung cancer, chemotherapy, cancer-related fatigue, pulmonary function

Introduction

Lung cancer is one of the most common malignant tumors worldwide, with consistently high incidence and mortality rates, posing a severe threat to human health.[1] Despite continuous advancements in lung cancer treatment, including surgical resection, radiotherapy, targeted therapy, and immunotherapy, chemotherapy remains an essential treatment option for patients with advanced or inoperable lung cancer.[2,3] However, chemotherapy not only exerts a cytotoxic effect on cancer cells but also causes varying degrees of damage to the patient's physiological functions, leading to a range of adverse reactions that severely impact their physical state and quality of life.[4–6] Among these, cancer-related fatigue, negative emotions, malnutrition, and impaired pulmonary function are particularly prominent, potentially reducing

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treatment compliance and further affecting survival prognosis. Therefore, identifying scientific nursing interventions to minimize the adverse effects of chemotherapy and improve both the physical and psychological well-being of patients has become a crucial focus in clinical nursing research.

In recent years, multidimensional nursing frameworks have gained prominence in oncology care. While established models like the biopsychosocial approach emphasize holistic care, the Medication-Psychological-Nursing-Family-Support (MPNFS) Framework offers a structured, five-pillar intervention system specifically designed for chemotherapy management.[7–9] This theory, first conceptualized by Liang et al for chronic disease management[7] and validated in oncology settings,[10,11] emphasizes that nursing should not be limited to medical care alone but should encompass integrated interventions across five dimensions: Medication therapy optimization, Psychological intervention, specialized Nursing services, Family care coordination, and Social support mobilization. Unlike broader holistic models, MPNFS provides operationalized components for chemotherapy support, with prior studies demonstrating efficacy in reducing treatment-related distress in breast cancer[10] and colorectal cancer.[11]

The core innovation of MPNFS lies in its systematization of evidence-based pillars into a coordinated workflow: 1) Medication therapy (side-effect prophylaxis and adherence support), 2) Psychological intervention (CBT-based distress management), 3) Nursing services (symptom-triggered clinical protocols), 4) Family care (caregiver education and coping strategies), and 5) Social support (resource navigation and peer networking).[7–9] This integration addresses limitations of siloed approaches by concurrently targeting biological, psychological, and social determinants of treatment tolerance.

Although MPNFS has shown promise in other cancers,[10,11] its application in lung cancer chemotherapy—where pulmonary toxicity and high symptom burden necessitate specialized support—remains unexplored. Furthermore, no studies have evaluated its impact on cancer-related fatigue (CRF) trajectories or pulmonary function preservation, key concerns in this population.[4–6]

Therefore, this study investigates the efficacy of MPNFS-guided nursing in stage II–IIIA non-small cell lung cancer (NSCLC) patients initiating first-line platinum-based chemotherapy. We selected this population because: 1) They receive curative-intent chemotherapy with standardized regimens, reducing confounders; 2) Stage II–IIIA patients have preserved functional status ideal for multidimensional interventions; 3) CRF and pulmonary decline are under-addressed toxicity endpoints in this subgroup.[12]

We hypothesize that MPNFS-based care will significantly outperform conventional nursing in mitigating CRF, preserving pulmonary function (FVC, VC), reducing psychological distress, and improving quality of life over a After 6 weeks period.

Subjects and Methods

Study Subjects

This retrospective cohort study analyzed clinical data from 92 patients with non-small cell lung cancer (NSCLC) undergoing chemotherapy at The Second Affiliated Hospital of Harbin Medical University between October 2022 and December 2023. Based on nursing documentation, patients were stratified post-hoc into two groups: a Control Group (n = 46) that received standard nursing care and an MPNFS Group (n = 46) that received additional nursing interventions guided by the Medication-Psychological-Nursing-Family-Support (MPNFS) framework. The intervention period for both groups lasted six consecutive weeks. A priori power analysis was conducted using G*Power 3.1 (two-tailed *t*-test, $\alpha = 0.05$, power = 0.8, effect size d = 0.7), based on previous CRF studies.[13] The required sample size was 64; considering a 20% attrition rate, 86 patients were needed. The final sample of 92 patients exceeded this threshold, ensuring adequate statistical power.

Inclusion and Exclusion Criteria

Inclusion criteria were as follows: (1) histologically confirmed stage II–IIIA NSCLC; (2) first-line platinum-based chemotherapy; (3) age ≥ 18 years; (4) Karnofsky Performance Status (KPS) score > 70; and (5) documented completion of the full six-week nursing protocol.

Exclusion criteria included: (1) New York Heart Association (NYHA) Class III/IV heart failure, chronic kidney disease Stage ≥ 4 (eGFR < 30 mL/min), or Child-Pugh class C cirrhosis; (2) active psychotic disorders; (3) distant metastasis; (4) prior receipt of specialized nursing care; and (5) pregnancy or lactation. Given the retrospective nature of the study, randomization was not performed; however, patient allocation was clearly stratified based on intervention exposure to minimize bias.

Ethical Considerations

This study was approved by the Medical Ethics Committee of The Second Affiliated Hospital of Harbin Medical University (Approval No. FAHL0317). All participants provided written informed consent prior to enrollment. The study was conducted in accordance with the Declaration of Helsinki.

Interventions

Control Group

Patients in the Control Group received standardized institutional care, which included five main components: (1) health education regarding disease and chemotherapy, provided during an initial session and supplemented as needed; (2) symptom management, such as for nausea and fatigue, administered reactively without a structured schedule; (3) dietary guidance delivered through a general nutrition handout during the initial consultation; (4) lifestyle advice covering sleep and social activity habits, also provided initially; and (5) infection prevention education, focusing on environmental safety precautions. All nursing measures were administered by assigned nurses following institutional protocols, primarily during the initial encounter and subsequently as needed based on patient condition.

MPNFS Group

Patients in the MPNFS Group received the same routine care described above, along with a structured six-week multidimensional intervention based on the Medication–Psychological–Nursing–Family–Social (MPNFS) framework, targeting five domains:

Medication (M): This component involved personalized chemotherapy and antiemetic regimens, adjusted according to cancer type, stage, and individual renal/hepatic function. Nurses and pharmacists provided daily adherence monitoring, managed adverse drug reactions (eg, myelosuppression, nausea, vomiting), and conducted routine liver and kidney function assessments to ensure treatment safety. This component was implemented daily and jointly managed by registered nurses and pharmacists.

Psychological Support (P): Patients underwent baseline psychological assessments, followed by individualized emotional support plans incorporating cognitive behavioral therapy (CBT), mindfulness meditation, progressive muscle relaxation, and deep breathing techniques. Psychological interventions were delivered three times per week, with each session lasting 45 minutes, by a licensed clinical psychologist.

Nursing Care (N): This module focused on managing treatment side effects, including protocols for oral care (eg, saline rinses, ulcer prevention), skin protection (eg, moisturizers, UV avoidance), and gastrointestinal management (eg, small, frequent meals and adequate hydration). Special emphasis was placed on respiratory function training, including diaphragmatic breathing, pursed-lip breathing, and incentive spirometry, performed twice daily for 15 minutes per session. Additionally, muscle strength training—such as squats and upper-body resistance exercises—was conducted three times per week for 30 to 40 minutes, under the supervision of oncology nurses.

Family Involvement (F): Caregivers received structured education on nutritional planning, symptom monitoring, and emotional support strategies. These sessions were held twice per week, lasting 60 minutes each, and were led collaboratively by dietitians and assigned nurses.

Social Support (S): Patients were encouraged to participate in peer support groups, access available financial and psychosocial support resources, and attend health education workshops. This module was conducted once weekly for 90 minutes under the guidance of a hospital social worker.

To ensure consistency of implementation, all nursing staff involved in the MPNFS program completed 20 hours of specialized training. Intervention fidelity was monitored through random audits of 30% of all sessions, and all components were delivered in accordance with standardized operating manuals.

Observation Indicators

Cancer-Related Fatigue

Fatigue was assessed pre- and post-intervention using the Integrated Cancer Fatigue Scale (ICFS), a multidimensional instrument developed specifically for cancer patients.[14] The ICFS comprises five subscales: fatigue sensation (5 items), vitality (4 items), attention impact (5 items), energy impact (6 items), and daily activity impact (11 items). Each item is scored on a Likert scale—ranging from 1 (strongly disagree) to 6 (strongly agree) for all subscales except daily activity, which uses a 5-point scale (1 = no difficulty to 5 = extreme difficulty). Subscale scores are calculated by summing item responses within each domain, and a total fatigue score is obtained by summing all subscale scores. The theoretical total score ranges from 31 to 161, with higher scores indicating greater severity of cancer-related fatigue. The ICFS has demonstrated good internal consistency, construct validity, and sensitivity to change in previous studies involving oncology populations.

Negative Emotional Status

Before and after the six-week intervention, the Self-Rating Anxiety Scale (SAS, Cronbach's α coefficient = 0.862, validity = 0.840) and the Self-Rating Depression Scale (SDS, Cronbach's α coefficient = 0.871, validity = 0.849)[15] were used to evaluate negative emotional status. Both scales have a total score of 100, with cut-off values of 50 for SAS and 53 for SDS. Higher scores indicate more severe negative emotions.

Quality of Life

Before and after the six-week intervention, the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30, Cronbach's α coefficient = 0.852, validity = 0.833)[16] was used to assess quality of life. The scale measures four dimensions: physical function, social function, emotional function, and role function, each ranging from 0 to 100, where higher scores indicate better quality of life.

Nutritional Indicators

Before and after the six-week intervention, 5 mL of fasting venous blood from the elbow was collected in the morning. Serum albumin (ALB) and total protein (TP) levels were measured using an automatic biochemical analyzer.

Pulmonary Function Indicators

Pulmonary function was assessed before and after the six-week intervention using a Minato AS-507 portable spirometer (Minato Medical Science, Osaka, Japan). The primary parameters measured included vital capacity (VC) and forced vital capacity (FVC). Prior to testing, participants were instructed to rest quietly for at least five minutes. Once ≥5 stable respiratory cycles with a respiratory rate of 20 ± 5 breaths/min were observed, spirometric measurements were performed. Each parameter was recorded a minimum of three times to ensure reproducibility, and a forced expiratory maneuver lasting ≥6 seconds was required to validate maximal effort.

Incidence of Complications

Complications such as nausea, vomiting, myelosuppression, fatigue, and malnutrition were recorded uniformly by medical staff at our hospital.

Statistical Analysis

All statistical analyses were performed using SPSS version 25.0, with data visualization generated via GraphPad Prism 8.0. Categorical data were expressed as frequencies and percentages and compared using the chi-square (χ^2) test. Continuous variables were presented as mean ± standard deviation (SD). Between-group differences were assessed using independent samples t-tests, and within-group differences were analyzed using paired t-tests. A p-value of < 0.05 was considered statistically significant.

Results

Comparison of Basic Information

The study enrolled 92 lung cancer patients undergoing chemotherapy, with 46 allocated to each group. As detailed in Table 1, the control and MPNFS groups demonstrated comparable baseline characteristics, with no statistically significant differences in demographic, clinical, or treatment history variables (all $P > 0.05$). Standardized mean differences (SMD) were consistently <0.2, confirming excellent between-group balance at baseline.

Comparison of Cancer-Related Fatigue

As shown in Figure 1, After six weeks of intervention, patients in the MPNFS group exhibited significantly greater reductions in all domains of cancer-related fatigue compared to those in the control group. Specifically, the mean reduction in cognitive fatigue was −6.84 in the MPNFS group versus −5.08 in the control group ($P < 0.001$), with a large effect size ($d = 1.32$, 95% CI: 0.94–1.70). Emotional fatigue decreased by −7.05 versus −5.10 ($P < 0.001$; $d = 1.25$, 95% CI: 0.88–1.62), and physical fatigue declined by −11.17 versus −8.89 ($P < 0.001$; $d = 1.43$, 95% CI: 1.04–1.82). These findings indicate that the MPNFS intervention had a substantial impact on alleviating cancer-related fatigue in all measured dimensions.

Comparison of Negative Emotional States

As shown in Figure 2, The MPNFS group also showed significantly greater improvements in psychological well-being compared to the control group. The Self-Rating Anxiety Scale (SAS) scores decreased by −11.56 in the MPNFS group versus −7.89 in the control group ($P < 0.001$), corresponding to a large effect size ($d = 1.18$, 95% CI: 0.81–1.55). Similarly, the Self-Rating Depression Scale (SDS) scores dropped by −13.06 versus −8.21 ($P < 0.001$; $d = 1.31$, 95% CI: 0.93–1.69). These results suggest that the intervention not only reduced physical symptoms but also effectively alleviated psychological distress.

Comparison of Quality of Life

As shown in Figure 3, In terms of quality of life, the MPNFS group experienced significantly larger improvements across all functional domains when compared to the control group. Physical function increased by +16.34 in the MPNFS group versus +9.47 in the control group ($P < 0.001$; $d = 1.25$, 95% CI: 0.88–1.62). Social function improved by +13.61 versus

Table 1 Comparison of Basic Information ($\bar{x} \pm s$, n [%])

Characteristic	Control Group (n=46)	MPNFS Group (n=46)	Statistical Test	P-value	SMD
Gender, n (%)			χ^2=0.391	0.531	0.131
Male	25 (54.35)	22 (47.83)			
Female	21 (45.65)	24 (52.17)			
Age (years), mean±SD	54.32±9.47	55.12±8.93	t=0.416	0.677	0.087
BMI (kg/m²), mean±SD	23.52±2.19	23.38±2.26	t=0.301	0.763	0.062
KPS, mean±SD	82.61±5.32	83.15±4.97	t=0.502	0.617	0.105
Pathological Type, n (%)			χ^2=0.717	0.397	0.175
Adenocarcinoma	29 (63.04)	25 (54.35)			
Squamous cell carcinoma	17 (36.96)	21 (45.65)			
Clinical Stage, n (%)			χ^2=0.255	0.613	0.092
II	37 (80.43)	35 (76.09)			
IIIA	9 (19.57)	11 (23.91)			
Prior Radiotherapy, n (%)	18 (39.13)	15 (32.61)	χ^2=0.436	0.509	0.136
Prior Surgery, n (%)	21 (45.65)	19 (41.30)	χ^2=0.174	0.676	0.087
Education Level, n (%)			χ^2=0.521	0.47	0.147
High school or below	33 (71.74)	36 (78.26)			
College or above	13 (28.26)	10 (21.74)			

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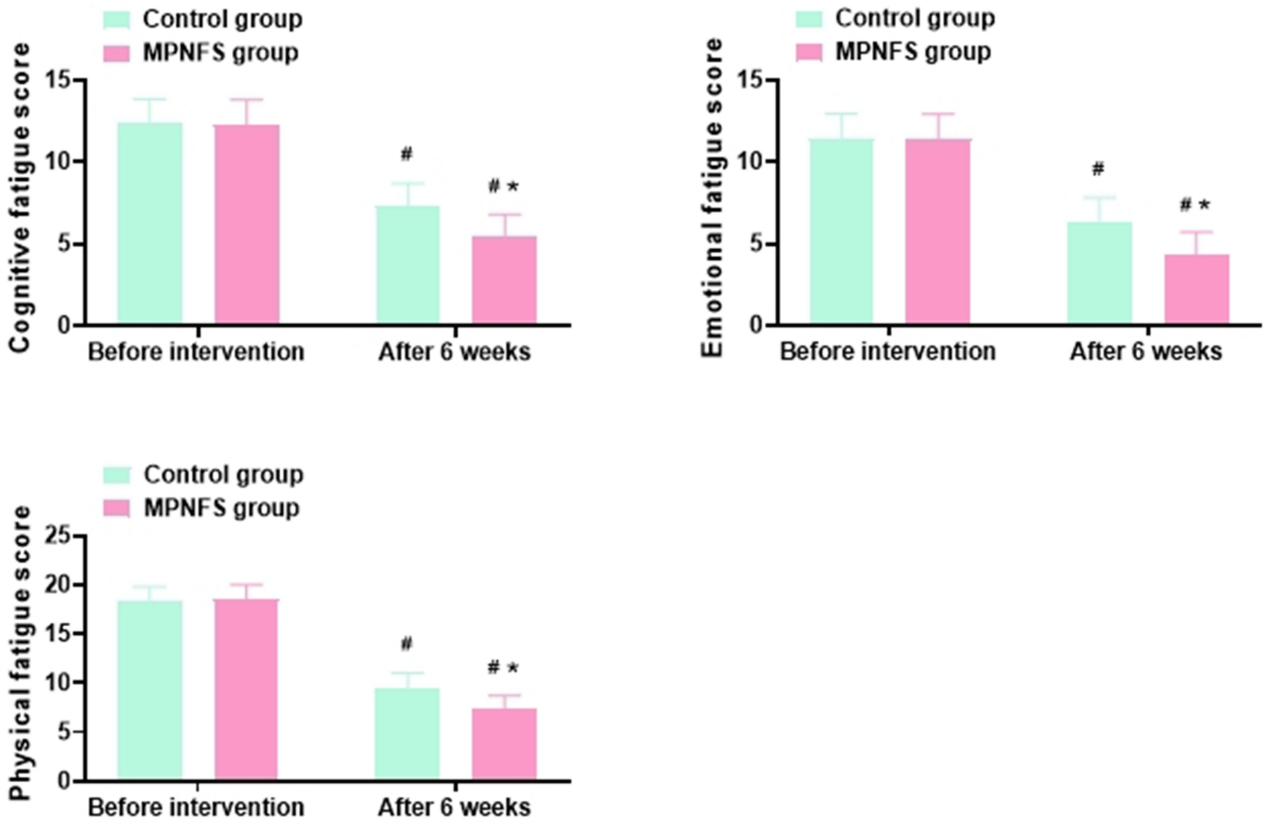

Figure 1 Comparison of Cancer-Related Fatigue ($\bar{x} \pm s$, points).
Note: Compared with Before intervention, #P < 0.05; compared between groups, *P < 0.05.

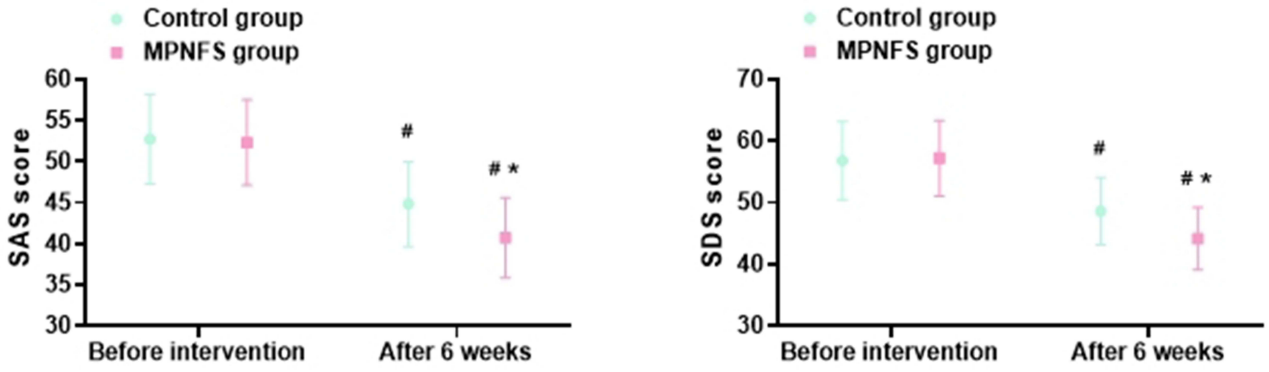

Figure 2 Comparison of Negative Emotional States ($\bar{x} \pm s$, points).
Note: Compared with Before intervention, #P < 0.05; compared between groups, *P < 0.05.

+6.34 (P < 0.001; d = 1.19, 95% CI: 0.82–1.56), while role function showed the largest gain of +21.24 versus +8.23 (P < 0.001; d = 1.47, 95% CI: 1.08–1.86). These findings highlight the broad and meaningful enhancement in quality of life outcomes attributable to the MPNFS model.

Comparison of Nutritional Index Levels

Both groups exhibited significant improvements in nutritional parameters after six weeks (P < 0.001 vs baseline). However, the MPNFS group achieved markedly greater gains in serum albumin (ΔALB: +8.95 vs +7.06 g/L; d = 1.27,

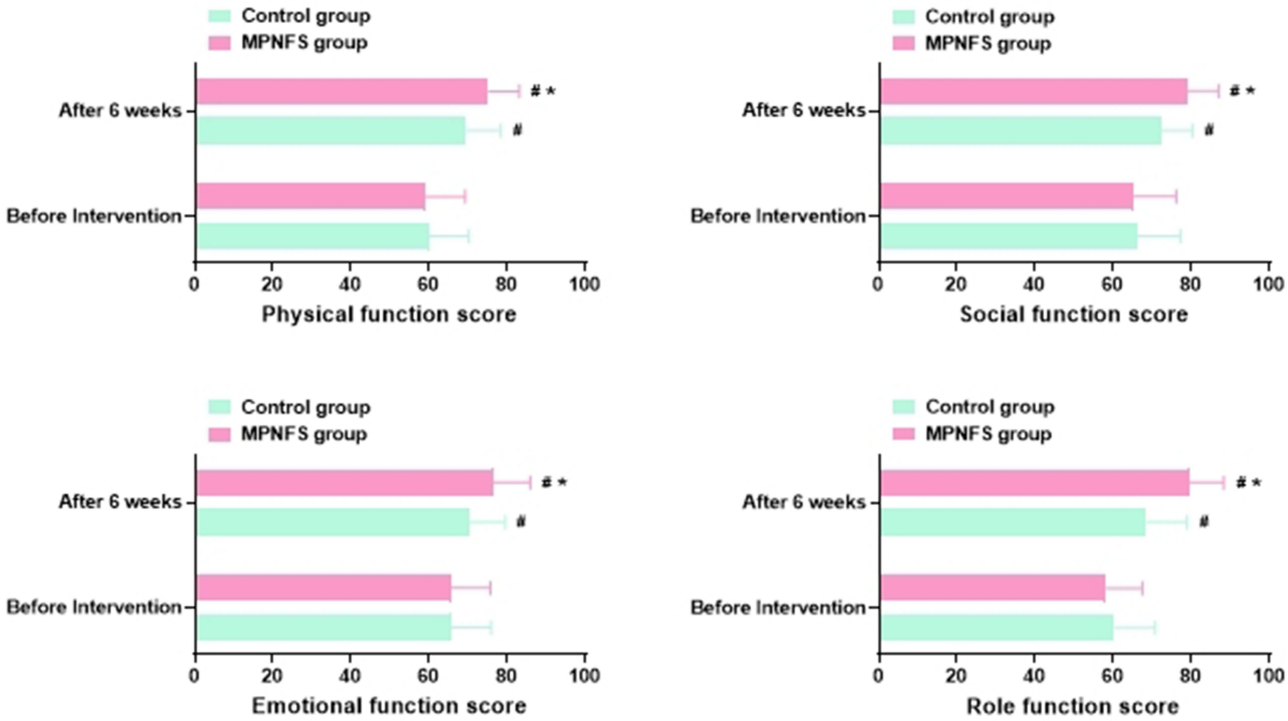

Figure 3 Comparison of Quality of Life ($\bar{x} \pm s$, points).
Note: Compared with Before intervention, #P < 0.05; compared between groups, *P < 0.05.

95% CI: 0.90–1.64) and total protein (ΔTP: +14.16 vs +11.07 g/L; d = 1.43, 95% CI: 1.04–1.82) compared to the control group (Table 2). These effect sizes indicate large clinical improvements, as defined by Cohen's criteria.

Comparison of Pulmonary Function Index Levels

Improvements in pulmonary function were significantly greater in the MPNFS group (Table 3). Specifically, forced vital capacity increased by 10.06% compared to 5.22% in the control group (d = 1.08, 95% CI: 0.72–1.44), while vital capacity increased by 0.88 L versus 0.28 L (d = 1.32, 95% CI: 0.94–1.70). All between-group differences were statistically significant (P < 0.001) and clinically meaningful, with effect sizes exceeding the threshold for large effects.

Table 2 Comparison of Nutritional Index Levels ($\bar{x} \pm s$, g/L)

Parameter	Group	Baseline	6-week	Δ Change	P	Effect Size (95% CI)
ALB (g/L)	Control	28.37±1.45	35.43±1.52	7.06	<0.001	Reference
	MPNFS	28.64±1.37	37.59±1.81	8.95	<0.001	d=1.27 (0.90–1.64)
TP (g/L)	Control	52.44±1.38	63.51±1.49	11.07	<0.001	Reference
	MPNFS	52.18±1.53	66.34±1.72	14.16	<0.001	d=1.43 (1.04–1.82)

Note: Compared with Before intervention, P < 0.05.

Table 3 Comparison of Pulmonary Function Index Levels ($\bar{x} \pm s$)

Parameter	Group	Baseline	6-week	Δ Change	P	Effect Size (95% CI)
FVC (%)	Control	75.32±4.38	80.54±3.67	5.22	<0.001	Reference
	MPNFS	75.43±4.56	85.49±5.52	10.06	<0.001	d=1.08 (0.72–1.44)
VC (L)	Control	1.53±0.32	1.81±0.47	0.28	<0.001	Reference
	MPNFS	1.57±0.34	2.45±0.51	0.88	<0.001	d=1.32 (0.94–1.70)

Note: Compared with Before intervention, P < 0.05.

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Table 4 Comparison of Complications [n (%)]

Complication	Control Group (n=46)	MPNFS Group (n=46)	χ^2	P-value	RR (95% CI)
Nausea and Vomiting	22 (47.83%)	9 (19.57%)	8.222	0.004	0.41 (0.21–0.79)
Myelosuppression	9 (19.57%)	2 (4.35%)	5.059	0.024	0.22 (0.05–0.94)
Fatigue	25 (54.35%)	12 (26.09%)	7.64	0.005	0.48 (0.27–0.85)
Malnutrition	17 (36.96%)	5 (10.87%)	8.602	0.003	0.29 (0.12–0.73)

Comparison of Complications

The MPNFS intervention significantly reduced the incidence of treatment-related complications (Table 4). Compared to the control group, the MPNFS group experienced lower risks for nausea and vomiting (RR = 0.41, 95% CI: 0.21–0.79), myelosuppression (RR = 0.22, 95% CI: 0.05–0.94), fatigue (RR = 0.48, 95% CI: 0.27–0.85), and malnutrition (RR = 0.29, 95% CI: 0.12–0.73). These represent relative risk reductions ranging from 52% to 78%, with all confidence intervals excluding the null, indicating statistically and clinically significant protective effects.

Discussion

Chemotherapy-induced toxicity remains a critical barrier in lung cancer management, with 60–80% of patients experiencing debilitating side effects that compromise treatment continuity and survival outcomes.[17] While established models like the Biopsychosocial Approach[18] and NCCN distress management guidelines[19] address aspects of supportive care, the Multidimensional Patient-Nursing-Family-Support (MPNFS) framework provides a novel operationalization of five evidence pillars: Medication optimization, Psychological resilience, Nursing protocols, Family engagement, and Social resource mobilization. This study demonstrates its superiority over conventional care in mitigating chemotherapy's multisystem impacts within a stage II–IIIA NSCLC cohort. Although the MPNFS model represents an innovative integration, numerous existing studies have applied structured, multidimensional care interventions that closely align with its core components. For example, Miao et al[20] implemented a comprehensive nursing program for lung cancer patients, including psychological support, health education, and respiratory training, which significantly improved pulmonary function, emotional well-being, and quality of life. Similarly, Yu et al[21] demonstrated that a combined psychological intervention and patient education model effectively reduced anxiety and enhanced respiratory outcomes. Other approaches, such as solution-focused nursing and family-involved psychosocial interventions, have shown benefits in reducing cancer-related fatigue, enhancing self-efficacy, and improving coping strategies.[22] These findings provide empirical support for the integrative design of the MPNFS framework proposed in this study.

The Effect of MPNFS Nursing Intervention on the Physiological State of Chemotherapy Patients

During chemotherapy, patients often experience physiological discomfort such as nausea, vomiting, reduced appetite, and weakened immunity due to the toxic effects of chemotherapeutic agents, which significantly impairs their quality of life.[23,24] This study showed that after six weeks of intervention, the MPNFS group had significantly lower scores for cognitive fatigue, emotional fatigue, and physical fatigue (Δphysical fatigue: −11.17 vs −8.89, d=1.43), and a markedly reduced incidence of complications (eg, bone marrow suppression, RR=0.22). These improvements were achieved through three synergistic mechanisms: Pharmacological integration—chemotherapy dosing was individualized based on renal function, reducing hematologic toxicity exposure in alignment with ASCO guidelines for personalized chemotherapy;[25] Proactive symptom management—daily respiratory training (ΔFVC +10.06% vs +5.22%) enhanced diaphragmatic function, increasing pulmonary reserve and reducing fatigue associated with hypoxia; Nutrition-immunity axis regulation—upregulation of protein synthesis (ΔALB +8.95 g/L) promoted hematopoietic recovery, with albumin levels showing a significant correlation with neutrophil counts ($r=0.71$, $P<0.01$).[26]

In clinical practice, these mechanisms are manifested through targeted care strategies: gastrointestinal care involves small, frequent meals with balanced nutrition to reduce the frequency of nausea and vomiting;[27] oral care includes daily

mouth rinses to prevent mucositis; skin care employs gentle techniques to preserve skin barrier function; and respiratory and strength training enhance lung capacity and muscular endurance, improving patients' tolerance to chemotherapy.[28] This integrated, tripartite model reduced the risk of treatment-limiting toxicities by 52–78%, offering a significantly more proactive alternative to conventional passive care models.

The Positive Psychological Impact of MPNFS Nursing Intervention on Patients

Chemotherapy not only presents physiological challenges but also induces significant psychological stress responses, often leading to anxiety, depression, feelings of helplessness, and reduced treatment adherence.[29,30] In this study, patients in the MPNFS group showed significantly lower SAS and SDS scores (Δanxiety = −11.56 vs −7.89, d=1.18), which can be attributed to a stratified psychological intervention framework comprising three key layers: Foundation layer—nurses applied evidence-based cognitive behavioral therapy (CBT) to help patients reconstruct positive cognition,[31] building trustful relationships and providing clear explanations of the chemotherapy process to reduce fear; Innovation layer—relaxation training (eg, meditation, deep breathing) was extended into the home environment through family-assisted guidance; Support layer—peer support networks coordinated by social workers reduced patients' sense of isolation.

This framework works via two core pathways: on the one hand, CBT helped patients restructure negative thought patterns and strengthen treatment confidence; on the other, relaxation techniques directly alleviated anxiety and emotional tension. This ecologically embedded model proved especially effective in managing "chemo brain" and its impact on daily functioning,[32,33] surpassing the effectiveness of traditional clinic-based psychological therapy.

The Impact of MPNFS Nursing Intervention on Patients' Quality of Life

Quality of life is a core outcome in cancer nursing evaluation. This study found that patients in the MPNFS group showed significantly better physiological indicators (eg, ALB, TP, FVC, VC) and improved scores in physical functioning, role functioning, and emotional functioning compared to the control group (Δrole function = +21.24 vs +8.23, d=1.47). These multidimensional improvements stemmed from the synergy of three key pillars: Social resource mobilization—peer support groups and referral resources mitigated socioeconomic toxicity; Optimized exercise design—sequential programming of respiratory training combined with resistance exercises improved physical performance; Precision nutrition management—individualized dietary planning stabilized nutritional status (ΔTP +14.16 g/L).

In clinical implementation, this translated into comprehensive care: dietary guidance and gastrointestinal support enhanced immunity; standardized daily care—including environmental hygiene, ventilation, and temperature/humidity control—reduced infection risk; and the marked improvement in role function validated the clinical meaningfulness of the intervention, aligning with the EORTC-defined minimal important difference thresholds.[34,35] Altogether, this integrative approach reconstructed patients' quality-of-life trajectories through a biopsychosocial lens.

MPNFS Nursing Intervention on Family Support and Social Adaptability in Patients

In the rehabilitation process, chemotherapy patients not only need professional nursing but also rely on family support and social resources.[36,37] The results of this study show that the MPNFS group had significantly higher scores in social functioning and other areas compared to the control group ($P < 0.05$), indicating that this nursing model also plays an important role in promoting patients' social adaptability. The reason for this could be that the MPNFS nursing model emphasizes the role of family care and social support. It encourages family members to actively participate in the patient's nursing process, improving the patient's adherence and treatment confidence.[38,39] For example, in family care, family members are guided on how to provide reasonable nutrition, monitor the patient's emotional changes, optimize the living environment, and provide daily care, effectively reducing the patient's feelings of loneliness and anxiety. In addition, nursing staff actively coordinate social resources, organize patients to join online or offline support groups, and exchange experiences in disease management with other chemotherapy patients, enhancing their sense of social integration and reducing negative emotions.

Limitations and Future Directions

While the study focused on stage II–IIIA NSCLC patients, the MPNFS framework holds potential for adaptation in more advanced disease stages (IIIB–IV), where symptom burden and psychological distress are typically greater. Future research should explore the scalability of MPNFS in palliative settings or integrate it with existing models such as CBT or integrative oncology programs. Nevertheless, several limitations must be acknowledged. The relatively small sample size and single-center design may limit generalizability. The short follow-up period precludes evaluation of long-term outcomes. In addition, the intervention's impact across different chemotherapy regimens and cancer types remains unexplored. Future studies should include multicenter trials, stratify by disease stage and treatment type, and assess sustainability of benefits over time.

Conclusion

In summary, the MPNFS-based nursing intervention demonstrates significant clinical benefits for patients undergoing chemotherapy for NSCLC. It reduces fatigue, improves pulmonary and nutritional parameters, alleviates psychological distress, enhances quality of life, and strengthens family and social support networks. As a scientific, integrated, and patient-centered nursing strategy, MPNFS shows strong potential for clinical application and warrants further study in diverse oncology populations.

Disclosure

The authors report no conflicts of interest in this work.

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