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**Association Between IMB Model–Based Nursing Care and Kinesiophobia After Esophageal
Cancer Surgery: A Retrospective Cohort Study**

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Abstract

Objective: To examine whether receipt of Information–Motivation–Behavioral Skills (IMB) model–based nursing care was associated with kinesiophobia and postoperative recovery among patients following radical esophagectomy.

Methods: This retrospective cohort study reviewed existing clinical and nursing records of 90 patients who underwent radical esophagectomy in the thoracic surgery department of our hospital between January 2024 and October 2025. Patients were classified according to the postoperative nursing care documented in their records: an IMB-care cohort (n = 45) and a routine-care cohort (n = 45). Care was not assigned by the investigators for research purposes. Outcomes extracted from the records included Tampa Scale for Kinesiophobia (TSK) scores at 24 h postoperatively and at discharge, time to first flatus, drainage tube retention time, length of hospital stay, and nursing satisfaction.

Results: At discharge, the IMB-care cohort had a significantly lower mean TSK score than the routine-care cohort (37.89 ± 5.23 vs. 42.29 ± 6.64 , $P < 0.05$). The IMB-care cohort also had shorter time to first flatus (3.12 ± 0.41 h vs. 5.08 ± 0.48 h), drainage tube retention time (67.04 ± 3.06 h vs. 98.46 ± 12.81 h), and hospital stay (9.03 ± 0.92 d vs. 12.27 ± 1.38 d) (all $P < 0.05$). Satisfaction scores for admission reception, health education, and rehabilitation guidance were higher in the IMB-care cohort (all $P < 0.05$), whereas service attitude and nursing skills did not differ significantly between cohorts ($P > 0.05$).

Conclusion: Receipt of IMB model–based nursing care was associated with lower kinesiophobia, shorter postoperative recovery indicators, and higher satisfaction in selected nursing domains. Because this was a retrospective observational study, the findings do not establish a causal effect and should be confirmed in prospective studies.

Keywords: Information–Motivation–Behavioral Skills (IMB) model; thoracic surgery; radical esophagectomy; kinesiophobia; retrospective cohort study

1 Introduction

Thoracic surgery is widely recognized as one of the most painful categories of surgical procedures, and radical esophagectomy represents one of the most extensive and traumatic operations within this field¹. Despite the routine application of postoperative analgesia, the majority of patients continue to experience moderate to severe pain. This persistent pain often leads patients to avoid essential postoperative activities, such as coughing, deep breathing, turning over, and early mobilization—out of fear of inducing or aggravating pain. As a result, many patients become highly dependent on analgesic medications and may even withdraw from prescribed rehabilitation exercises^{2,3}.

This excessive and irrational fear of postoperative movement is referred to as kinesiophobia, a psychological state characterized by the avoidance of physical activity due to the anticipation of pain or re-injury⁴. Evidence suggests that kinesiophobia not only exacerbates patients' negative emotions but also decreases adherence to rehabilitation programs, delays functional recovery, and ultimately compromises postoperative outcomes and overall quality of life^{5,6}. In patients undergoing radical esophagectomy—who already experience substantial physiological stress and lengthy recovery—kinesiophobia may impose additional barriers to pulmonary function recovery, physical mobility, and postoperative rehabilitation.

The Information–Motivation–Behavioral Skills (IMB) model is an evidence-based behavioral intervention framework that has been increasingly applied in clinical settings⁷. The model posits that individuals are more likely to adopt health-promoting behaviors when they possess adequate disease-related information, intrinsic and extrinsic motivation, and the behavioral skills necessary to perform such behaviors effectively⁸. As a structured approach, IMB-based nursing interventions can accurately assess patient behavior patterns, identify barriers to rehabilitation, and promote the adoption of healthier behavior through targeted guidance⁹. This model has been shown to improve treatment adherence, enhance self-management ability, and facilitate recovery across various patient populations⁸.

However, existing studies on kinesiophobia have largely focused on orthopedic or musculoskeletal conditions, while research targeting kinesiophobia in postoperative patients with esophageal cancer remains extremely limited^{10,11}. Given the high intensity of postoperative pain, the complexity of recovery, and the strong need for early mobilization in this patient group, exploring an effective nursing model to reduce kinesiophobia is of great clinical significance¹².

Therefore, we retrospectively compared outcomes between patients who had received IMB model–based nursing care and those who had received routine nursing care after radical esophagectomy.

2 Materials and Methods

2.1 Study Design, Setting, and Participants

This single-center retrospective cohort study reviewed existing medical and nursing records of patients who underwent elective radical esophagectomy in the Department of Thoracic Surgery of our hospital between January 2024 and October 2025. After application of the eligibility criteria and data-completeness requirements, 90 patients were included in the analysis (45 in each care cohort). Because the analysis used existing records, there was no prospective recruitment, enrollment, or dropout-based sample-size target.

Patients were classified according to the postoperative nursing care documented in their records. No randomization or research-directed allocation occurred. The IMB-care cohort included 30 males and 15 females, aged 45–66 years (54.61 ± 3.63 years); cancer staging: stage I ($n = 13$), stage II ($n = 17$), and stage III ($n = 15$). Educational level: primary school or below ($n = 12$), secondary school ($n = 23$), and college or above ($n = 10$). The routine-care cohort included 27 males and 18 females, aged 44–66 years (54.57 ± 3.58 years); cancer staging: stage I ($n = 12$), stage II ($n = 21$), and stage III ($n = 12$). Educational level: primary school or below ($n = 10$), secondary school ($n = 25$), and college or above ($n = 10$). No statistically significant differences were observed between the cohorts in sex, age, cancer stage, or educational level (all $P > 0.05$).

This retrospective study was approved by the Ethics Committee of Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology (Approval No. 2021-032). The review of existing clinical data was conducted in accordance with the Declaration of Helsinki and relevant institutional guidelines and regulations. Written informed consent for inclusion in the retrospective analysis was obtained from all included patients.

This study is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement.

2.2 Inclusion and Exclusion Criteria

Records were eligible if the patient met the diagnostic criteria specified in the Guidelines for the Diagnosis and Treatment of Esophageal Cancer (2022 Edition)¹³, with confirmation by X-ray, computed tomography, esophagoscopy, and histopathological examination. The patient was required to meet the

surgical indications for radical esophagectomy and to be between 18 and 80 years of age. The record had to document that the patient had clear consciousness, intact limb function, no cognitive impairment (Mini-Mental State Examination score ≥ 27), and capacity to participate in postoperative rehabilitation. To ensure the presence of clinically meaningful kinesiophobia, the record was further required to document a Tampa Scale for Kinesiophobia (TSK) score ≥ 38 within 24 hours after surgery. Records also had to contain the clinical and outcome data required for this retrospective analysis.

To limit clinical factors that could substantially alter postoperative recovery or prevent completion of routine assessments, records were excluded for severe cardiac, hepatic, renal, or metabolic dysfunction; a prior history of malignant tumors or thoracic surgery; or psychiatric disorders or substance dependence that impaired participation in rehabilitation or psychological care. Records of patients who developed severe postoperative complications, such as anastomotic leakage or pulmonary infection, were excluded because standard rehabilitation assessment could not be completed. Records with missing key outcome data or in-hospital death were also excluded during retrospective screening.

2.3 Nursing Care Exposure

2.3.1 Routine-Care Cohort

Records in the routine-care cohort documented receipt of routine postoperative nursing care for esophageal cancer. Upon admission, patients were provided with standard education regarding disease-related information, the hospital environment, and hospitalization procedures. During the preoperative period, patients were instructed on fasting (12 h) and fluid restriction (4 h), guided to watch rehabilitation training videos covering effective coughing, breathing exercises, and limb functional exercises, and offered brief psychological support to alleviate anxiety. Postoperatively, routine care included monitoring of vital signs, early initiation of parenteral and enteral nutritional support, and guidance in performing bedside activities on postoperative day 1, such as brushing teeth, washing the face, ankle pump exercises, and effective coughing. Beginning on postoperative day 2, patients were encouraged to transition gradually from bedside activity to ambulation in the ward corridor, with analgesics administered as needed. At discharge, nurses assessed each patient's discharge readiness, provided verbal health education, reinforced follow-up instructions, and added patients to a WeChat-based extended nursing program to support continuity of postoperative care.

2.3.2 IMB-Care Cohort: IMB Model–Based Nursing Care

Records in the IMB-care cohort documented receipt of the same routine care supplemented with the

structured IMB model–based care program described below.

Establishment of the IMB Multidisciplinary Team

A multidisciplinary IMB team comprising nine members supported the development and routine clinical implementation of the care program. The team included a nursing postgraduate supervisor, who oversaw the design of the care program; a head nurse responsible for staff allocation and quality control; and a certified psychological nurse providing psychological support and relaxation training. A nursing master coordinated literature review and care-protocol development, while a ward nurse facilitated routine clinical documentation and delivered the care program. Clinical oversight was provided by a thoracic surgeon, and postoperative pain management was guided by a pain specialist. Additionally, a rehabilitation therapist offered structured exercise training, and a dietitian formulated individualized nutritional plans to support recovery.

Development of the IMB-Based Nursing Care Program

The IMB-based care program used in clinical practice is detailed in Table 1.

Table 1. IMB Model–Based Nursing Care Program for Patients After Radical Esophagectomy

IMB Component	Care Stage / Timing	Care Objectives	Care Measures
Information support	Admission day (15–20 min)	Identify cognitive gaps and establish rehabilitation foundation	Distribute and explain the health education manual; explain disease etiology, necessity of surgery, postoperative goals.
	One day before surgery (15–20 min)	Clarify surgical procedures and reduce anxiety	Explain incision site, anesthesia method, preparation; inform possible postoperative discomfort.
	Postoperative day 0 (15–20 min)	Reinforce immediate postoperative management	Explain drainage tube care; emphasize importance of early ambulation.
	Postoperative day 3 (15–20 min)	Adjust rehabilitation plan	Individualize exercise plan and nutrition guidance.
	Post-discharge	Provide continuity of care	WeChat follow-up and 24-hour consultant hotline.
Motivational support	Postoperative day 1	Correct misconceptions and reduce fear	Motivational interviewing; explain causes of kinesiphobia; cognitive correction.
	Family involvement	Strengthen family support	Encourage supportive language and participation.
	Weekly education (30 min)	Enhance confidence and motivation	Expert lecture; relaxation training; peer sharing.
Behavioral skills training	Postoperative day 1–discharge	Improve activity tolerance	Progressive physical training from in-bed to ambulation.
	Daily relaxation (30 min)	Reduce anxiety and fear	Diaphragmatic breathing and progressive muscle relaxation.

Note. IMB = Information–Motivation–Behavioral Skills model.

Quality Control of IMB-Based Care Delivery

To standardize care delivery and monitor program adherence, a multidimensional quality control system

was used:

Standardized Training and Homogeneity Management: A Standard Operating Procedure (SOP) for IMB Model-Based Nursing Care was developed, specifying procedures, communication scripts, timelines, and quality criteria (e.g., education coverage of three core knowledge points, step-by-step demonstration of rehabilitation exercises, documentation of ≥ 3 patient concerns during motivational interviewing). A 3-day training program—consisting of “theoretical lectures + practical training + scenario simulation”—was conducted. Participants were required to pass a dual-assessment (theory ≥ 85 , practice ≥ 90) before delivering the care program. Weekly team meetings were held to address implementation issues and maintain care-program consistency.

Dynamic Monitoring of Adherence: Nurse adherence monitoring: Daily spot-checks ($\geq 30\%$) and weekly full audits were performed by the head nurse, reviewing care-delivery records and observing care-delivery processes to ensure compliance $\geq 95\%$. Patients or family caregivers completed a Rehabilitation Adherence Log, documenting daily completion of training activities. Nurses assessed adherence using a three-level standard: fully adherent, partially adherent ($\geq 70\%$), or non-adherent ($< 70\%$).

Strategies for Low Adherence: For adherence $< 80\%$, motivational interviewing was used to identify causes (e.g., inadequate pain control, doubts about efficacy, insufficient family support). Targeted solutions included optimizing analgesia in collaboration with pain specialists, peer-support encouragement, and increasing family involvement.

Standardization and Safety Management: All educational materials (handbooks, exercise videos, relaxation audio) were uniformly produced by qualified team members. Emergency protocols were established for adverse events during training (e.g., dizziness, chest discomfort, aggravated incision pain). Events were documented and reviewed biweekly.

Retrospective Data Abstraction and Quality Control: Reviewers received specialized training in extracting data from existing medical and nursing records. A dual-entry and cross-check system was used, and a third reviewer performed logical consistency checks to support data accuracy and completeness.

2.4 Outcome Measures

Kinesiophobia was assessed using the Tampa Scale for Kinesiophobia (TSK), developed by Vlaeyen et al¹⁴. The scale contains 17 items scored on a 4-point Likert scale (1 = strongly disagree, 4 = strongly

agree), with total scores ranging from 17 to 68; higher scores indicate more severe kinesiphobia. A score ≥ 38 was defined as clinically significant kinesiphobia. Cronbach's α in this study was 0.812. For this retrospective analysis, values recorded at 24 h postoperatively and on the day of discharge were extracted from the existing records.

Postoperative recovery indicators were extracted from routine clinical records and included time to first flatus, duration of drainage tube retention (defined as the interval from surgery to the removal of all drainage tubes), and total length of hospital stay.

Nursing satisfaction scores documented in routine nursing quality records were extracted from a scale developed based on the Clinical Nursing Satisfaction Evaluation Guidelines and previous literature[11], covering five dimensions: admission reception, service attitude, health education, nursing skills, and rehabilitation guidance (0–20 points each; higher scores indicate greater satisfaction). Cronbach's α was 0.91, and validity coefficient was 0.80 in the pilot test.

2.5 Statistical Analysis

Data were analyzed using SPSS 22.0. Continuous variables were expressed as mean $\pm$ standard deviation and compared using independent-samples t-tests. Categorical variables were expressed as frequencies (%) and compared using χ^2 tests. All analyses were unadjusted and were interpreted as associations. A P value < 0.05 was considered statistically significant.

3 Results

3.1 Comparison of TSK Scores

At the initial assessment 24 h postoperatively, TSK scores did not differ significantly between the two cohorts ($P > 0.05$). At discharge, the IMB-care cohort had a significantly lower TSK score than the routine-care cohort ($P < 0.05$). In this retrospective analysis, the difference represents an association between documented care exposure and discharge kinesiphobia and should not be interpreted as proof of a causal treatment effect. Detailed results are presented in Table 2.

Table 2. Comparison of TSK Scores at 24 h Postoperatively and at Discharge Between the Two Cohorts ($\bar{x} \pm s$)

Cohort	n	24 h postoperative	Day of discharge	T	P
IMB care	45	47.38 $\pm$ 7.07	37.89 $\pm$ 5.23	7.239	0.000
Routine care	45	47.13 $\pm$ 6.59	42.29 $\pm$ 6.64	3.471	0.001
T	—	0.174	−3.492	—	—

Cohort	n	24 h postoperative	Day of discharge	T	P
P	—	0.863	0.001	—	—

3.2 Postoperative recovery outcomes

Patients in the IMB-care cohort had shorter time to first flatus, drainage tube retention time, and length of hospital stay than patients in the routine-care cohort, with all between-cohort differences reaching statistical significance ($P < 0.001$). These results indicate an association between documented receipt of IMB-based nursing care and faster postoperative recovery indicators; they do not establish causation.

Detailed comparisons are presented in Table 3.

Table 3. Comparison of Postoperative Recovery Indicators Between the Two Cohorts ($\bar{x} \pm s$)

Cohort	n	Time to first flatus (h)	Drainage tube retention time (h)	Length of hospital stay (d)
IMB care	45	3.12 ± 0.41	67.04 ± 3.06	9.03 ± 0.92
Routine care	45	5.08 ± 0.48	98.46 ± 12.81	12.27 ± 1.38
T	—	-20.828	16.003	13.105
P	—	<0.001	<0.001	<0.001

3.3 Nursing satisfaction

The IMB-care cohort had higher satisfaction scores for admission reception, health education, and rehabilitation guidance than the routine-care cohort ($P < 0.001$). Service attitude and nursing skills did not differ significantly between cohorts ($P > 0.05$). These unadjusted findings describe associations with documented care exposure rather than causal effects of the care program. The results are shown in Table 4.

Table 4. Comparison of Nursing Satisfaction Scores Between the Two Cohorts ($\bar{x} \pm s$)

Cohort	n	Admission reception	Service attitude	Health education	Nursing skills	Rehabilitation guidance
IMB care	45	17.05 ± 2.25	18.12 ± 1.49	18.10 ± 1.23	18.05 ± 1.43	17.44 ± 2.13
Routine care	45	15.03 ± 1.94	17.77 ± 1.52	14.69 ± 1.45	17.76 ± 1.58	15.67 ± 2.02
T	—	4.561	1.103	12.030	0.913	4.045
P	—	<0.001	0.273	<0.001	0.364	<0.001

4 Discussion

In this retrospective cohort, patients whose records documented IMB-based nursing care had lower discharge TSK scores, shorter recovery indicators, and higher satisfaction in selected domains than patients receiving routine care. These associations are consistent with previous research grounded in cognitive-behavioral theory and health behavior models ADDIN EN.CITE ^{8,9}, but the observational design prevents attribution of the differences to the care program alone.

From a theoretical perspective, the IMB model offers a comprehensive framework for understanding postoperative behavioral barriers such as kinesiophobia. The present study illustrates how the synergy of information, motivation, and behavioral skills can promote patient engagement and facilitate recovery. Information provision not only supplies knowledge but also reduces uncertainty by correcting misconceptions that often underlie fear¹⁴. Motivational enhancement helps patients regain internal drive and shift from passive to active coping, while behavioral skills training equips them with practical strategies to carry out rehabilitation activities. Through this multidimensional approach, nursing care evolves from an operational role to one that actively empowers patients in their recovery process¹⁵.

Regarding postoperative rehabilitation, although the quantitative improvements have been presented elsewhere in the manuscript, the behavioral mechanisms behind these outcomes warrant attention. When patients possess accurate understanding, sufficient motivation, and relevant skills, early mobilization becomes a manageable and predictable behavior rather than a perceived threat. Prior studies highlight the importance of behavioral determinants in postoperative recovery, and the observed associations are compatible with—but do not prove—these proposed mechanisms^{12,16}.

The higher satisfaction scores observed in the IMB-care cohort may be consistent with the patient-centered nursing philosophy represented by the IMB model. Unlike traditional nursing approaches centered on procedures and service delivery, the IMB framework emphasizes personalized assessment, tailored education, and continuous support extending beyond discharge. This patient-centered model enables patients to experience greater professionalism, coherence, and emotional support throughout their care, consistent with recent literature advocating integrated and individualized nursing practices^{7,17}.

Overall, this study suggests that the IMB model may serve not only as a means to address specific psychological or behavioral challenges but also as a potential tool for optimizing perioperative nursing processes. By emphasizing knowledge empowerment, motivational enhancement, and skill development,

the model provides both theoretical rationale and practical pathways for addressing common challenges such as fear, avoidance, and low adherence among surgical patients^{9,18}.

External factors such as family support and available social resources may influence both receipt and outcomes of IMB-based care ADDIN EN.CITE ^{19,20}. More importantly, this study has limitations inherent to its retrospective, single-center design. Care was not randomized, and cohort classification was based on documented care received; selection bias, temporal changes in practice, and residual confounding may therefore explain part of the observed associations. Reliance on existing records creates a risk of missing or misclassified data, and the short inpatient observation period limits long-term conclusions. Consequently, causal effectiveness cannot be inferred, and prospective controlled studies are needed.

5 Conclusion

In this retrospective cohort, receipt of IMB model-based nursing care was associated with lower discharge TSK scores, shorter postoperative recovery indicators, and higher satisfaction in selected domains than routine care. These findings support further evaluation of IMB-based nursing care but do not demonstrate that the care program caused the observed differences.

Prospective, adequately controlled studies with longer follow-up and adjustment for relevant confounders are needed to determine whether the observed associations reflect a causal benefit and to assess the generalizability of the care program across patient groups and settings.

Declarations

Ethics approval and consent to participate

This retrospective study was approved by the Ethics Committee of Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology (Approval No. 2021-032). The review of existing clinical data was conducted in accordance with the Declaration of Helsinki and relevant institutional guidelines and regulations. Written informed consent for inclusion in the retrospective analysis was obtained from all included patients.

Consent for publication

Not applicable.

Clinical trial registration

Not applicable. This was a retrospective observational cohort study using existing clinical and nursing

records, and no care was prospectively assigned by the investigators for research purposes.

Availability of data and materials

The de-identified datasets generated and/or analysed during the current study are available from the corresponding author on reasonable request, subject to applicable institutional, ethical, and privacy requirements.

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Authors' contributions

Conceptualization and methodology, Chun Cai and Cuiping Dong; Data curation and record abstraction, Junhui Wang; Writing - original draft preparation, Wenbin Zou and Qinyun Li; Writing - review and editing, Mengxia Qin.

Competing interests

All authors declare that there are no conflicts of interest related to this study. No financial support, commercial funding or industry collaboration was received for this research.

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