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ORIGINAL RESEARCH

Development and Evaluation of a Risk Prediction Model for Intrahospital Transport Adverse Events in Critically Ill Gynecological Patients

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Objective: To develop and evaluate a risk prediction model for intrahospital transport adverse events in critically ill gynecological patients, providing a scientific basis for early identification of high-risk individuals and optimization of transport decision-making.

Methods: A retrospective observational cohort study was conducted, including 650 patients who underwent intrahospital interdepartmental transport. Patients were randomly assigned in a 7:3 ratio to a model training set (455 patients) and an internal validation set (195 patients). Data collected included patient demographics, pre-transport condition assessment indicators, transport process parameters, and adverse event occurrences. Potential predictive variables were identified through univariate analysis and least absolute shrinkage and selection operator (LASSO) regression, followed by multivariate Logistic regression to construct the risk prediction model. Model discrimination was evaluated using the receiver operating characteristic (ROC) curve, calibration was assessed by the Hosmer-Lemeshow test, and clinical utility was evaluated via decision curve analysis (DCA).

Results: Baseline characteristics were comparable between the training and validation sets (all P>0.05). Multivariate analysis identified mechanical ventilation, Sequential Organ Failure Assessment (SOFA) score, Modified Early Warning Score (MEWS), and transport duration (minutes) as independent predictors of intrahospital transport adverse events in critically ill gynecological patients. Calibration curves demonstrated high consistency between predicted probabilities and observed outcomes, and the Hosmer-Lemeshow test indicated good calibration.

Conclusion: The developed risk prediction model for intrahospital transport adverse events in critically ill gynecological patients demonstrates good discrimination and calibration. This study may provide a quantitative tool to support safe intrahospital transport management.

Keywords: intrahospital transport, risk prediction model, mechanical ventilation, sequential organ failure assessment score, modified early warning score, transport duration

Introduction

Intrahospital transport of critically ill gynecological patients is a critical component of clinical care, and its high-risk nature has become a significant global concern in healthcare quality and safety management. Multiple studies, both domestic and international, have indicated that the incidence of adverse events during transport is significantly higher in critically ill gynecological patients than in general patients. Common adverse events include hemodynamic instability, respiratory failure, equipment malfunction, and accidental extubation, which can not only exacerbate the patient's condition but may also result in mortality.[1] Although several intrahospital transport guidelines have been issued worldwide, there remains a substantial gap between guideline recommendations and their implementation in clinical practice.

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Studies have shown that many healthcare institutions still rely on experiential judgment rather than standardized tools for transport decision-making, leading to inconsistent risk assessment and underreporting of transport-related adverse events.[2] This disconnect between guidelines and practice further amplifies safety hazards during the transport of critically ill gynecological patients.

Some studies have attempted to develop risk prediction tools to identify high-risk patients; however, these tools primarily focus on general critically ill populations and do not comprehensively account for gynecology-specific risk factors.[3,4] In addition, existing models are often limited by small sample sizes, incomplete variable selection, or inadequate validation methods, resulting in limited predictive performance and clinical applicability.[5] Therefore, developing a scientifically rigorous, quantifiable risk prediction model specifically for intrahospital transport adverse events in critically ill gynecological patients holds significant theoretical and practical value.

This study employed a retrospective observational cohort design, retrospectively collecting patient baseline characteristics, pre-transport condition assessment data, transport process records, and adverse event information from electronic medical records. By integrating multivariate statistical analysis methods, the study aimed to establish an efficient and reliable risk prediction tool to assist clinicians in early identification of high-risk individuals and implementation of targeted interventions, ultimately enhancing transport safety and healthcare quality for critically ill gynecological patients.

Methods

Study Design

This study employed a retrospective observational cohort design. Cases of intrahospital transport of critically ill gynecological patients meeting the inclusion criteria between February 2019 and June 2025 were systematically collected through the hospital electronic medical record system and transport record system. The study was approved by the Institutional Ethics Committee of Jiangsu Province Hospital on Integrated of Chinese and Western Medicine (Approval Number: 2021LWKYS-034). Patient identifiers such as name, address, and contact information were strictly anonymized and kept confidential, in accordance with the ethical principles of the Declaration of Helsinki. Given the retrospective nature of the study using only existing clinical data, the Ethics Committee granted a waiver of written informed consent for some patients.

Study Population

Inclusion and Exclusion Criteria

Inclusion criteria: (1) Female patients aged ≥18 years; (2) Critically ill gynecological patients requiring intra-hospital interdepartmental transport for diagnosis, examination, or treatment within the study period; (3) Patients meeting the definition of critically ill, with an Acute Physiology and Chronic Health Evaluation II (APACHE II) score ≥10 and/or a Modified Early Warning Score (MEWS) ≥4;[6] and (4) Complete transport records and documentation of key variables related to the transport process.

Exclusion criteria: (1) Patients transported for discharge, transfer to another facility, or direct home return due to treatment refusal; (2) Patients with severe missing clinical data preventing effective assessment.

Sample Size and Grouping

According to requirements for prediction model development (≥10 events per variable), approximately 15 candidate variables were expected, necessitating at least 150 outcome events. Based on previous studies,[7] the incidence of adverse events during transport was approximately 25%, resulting in a theoretical minimum sample size of ~600 patients. This study ultimately included 650 patients, meeting the required number of events for model construction.

All included cases were randomly assigned in a 7:3 ratio to a model training set (70%) and an internal validation set (30%). The training set was used to identify independent predictive factors and develop the risk prediction model, while the internal validation set was used for preliminary internal validation to assess the model's generalizability.

Data Collection

All data were retrospectively extracted from the hospital electronic medical record system, nursing assessment system, and transport record system. Variable definitions and extraction time points were standardized before study initiation. Data were independently extracted by two researchers and cross-checked for accuracy. Data collected included: (1) Patient demographics: Age, body mass index (BMI), primary gynecological diagnosis, and comorbidities, all obtained from the most recent pre-transport medical orders. (2) Pre-transport condition assessment: Standardized assessment data recorded within 30 minutes before transport initiation by the responsible nurse or attending physician. Physiological stability was assessed using the MEWS[8] and Glasgow Coma Scale (GCS);[9] organ function was evaluated using the Sequential Organ Failure Assessment (SOFA).[10] Medications and equipment used for therapeutic support were also documented. (3) Transport process data: Detailed records of transport purpose, destination, qualifications and number of accompanying medical personnel, and carried equipment. Total transport duration was calculated from the patient's departure from the ward to arrival at the destination and return to the ward. (4) Operational definition of intrahospital transport adverse events: Any unexpected clinical event occurring from the patient's departure from the ward to return to the ward during intrahospital transport that leads to or may lead to patient harm, including but not limited to: 1) Hemodynamic fluctuation: Systolic blood pressure <90 mmHg or >180 mmHg, heart rate <50 bpm or >130 bpm, or a 20% or more change in systolic blood pressure/heart rate from the pre-transport baseline, requiring clinical intervention (eg., vasoactive drug adjustment, fluid resuscitation); 2) Respiratory-related event: SpO2 <90% for more than 30 seconds, respiratory rate <10 bpm or >30 bpm, patient-ventilator asynchrony, accidental extubation, airway obstruction, or need for emergency tracheal intubation/ventilation adjustment; 3) Equipment-related event: Malfunction of medical equipment (ventilator, infusion pump, monitor, etc.), depletion of equipment power/oxygen supply, or loss of monitoring signals for more than 1 minute; 4) Other unexpected events: Unplanned treatment interruption (>5 minutes), falls, pressure injury, allergic reaction, or acute onset of other organ dysfunction. Handling of multiple adverse events: If a single patient experienced two or more types of adverse events during one transport process, the event was recorded as one adverse event occurrence in the primary outcome analysis (dichotomous variable: adverse event occurred=1, no adverse event=0), and all event types were documented for subgroup analysis of adverse event characteristics (Table S1). (5) Adverse event records: Types, frequency, and severity of adverse events during transport (including hemodynamic fluctuations, respiratory events, equipment-related events, unintended treatment interruptions, and other incidents) were retrospectively extracted from transport logs, nursing handover records, and the adverse event reporting system. Severity was independently determined by two blinded researchers, with discrepancies resolved by a third researcher.

For key variables with ≥10% missing data, the transport record was excluded. For missing values <5%, a complete-case analysis was performed, and missingness was reported.

Statistical Analysis

Statistical analyses were performed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA) and R version 4.2.0 (R Foundation for Statistical Computing, Vienna, Austria). Continuous variables were expressed as mean ± standard deviation or median (interquartile range), and categorical variables as count (percentage). Comparisons for continuous variables were performed using independent-samples *t*-test or Mann–Whitney *U*-test based on data distribution; categorical variables were compared using the chi-square test or Fisher's exact test. Variables with P<0.10 in univariate analysis were entered into the least absolute shrinkage and selection operator (LASSO) regression. LASSO was performed with 10-fold cross-validation, and the 1-standard-error (1-SE) criterion was used to select the most parsimonious model corresponding to the optimal λ to reduce overfitting. Variables entering multivariate Logistic regression were tested for collinearity, with variance inflation factor (VIF) <10 considered acceptable The final regression coefficients were used to construct the intrahospital transport adverse event risk prediction model, and a clinical visualization nomogram was developed. Model discrimination was assessed by the area under the receiver operating characteristic curve (AUC), calibration by Hosmer–Lemeshow test and calibration curves, and clinical net benefit by decision curve analysis (DCA). Model validation included internal validation using the training set, reserved validation set testing, and Bootstrap resampling with 1,000 iterations to assess stability. All tests were two-sided, with P<0.05 considered statistically

significant. To ensure the transparent and standardized reporting of the risk prediction model construction process, the TRIPOD checklist for the development and validation of clinical prediction models is provided in Table S2.

Results

Baseline Characteristics of Participants

A total of 650 critically ill gynecological patients were included and randomly assigned in a 7:3 ratio to the training set (n=455) and validation set (n=195). No significant differences were observed between the two sets in terms of demographic characteristics, primary diagnoses, comorbidities, or pre-transport condition scores (all P>0.05) (Table 1).

Adverse Events

During transport, 178 adverse events occurred among 650 patients (27.4%), with similar incidence between the training and validation sets (27.0% vs. 28.2%, P=0.759). The main types of adverse events were hemodynamic fluctuations (53.4%), respiratory-related events (25.3%), and equipment-related events (12.4%). No significant differences were observed between the two sets regarding event types or severity (all P>0.05) (Table 2).

Risk Factor Analysis

As shown in Table 3, univariate analysis identified nine candidate variables (P<0.10). LASSO regression (Figure 1) retained four predictors: mechanical ventilation, SOFA score, MEWS score, and transport duration. Multicollinearity assessment showed all variables had VIF <2. Multivariate Logistic regression indicated that all four factors were independent predictors of intrahospital transport adverse events (all P<0.01) (Table 4).

Model Development and Validation

Based on the multivariate Logistic regression results, the complete risk prediction model for intrahospital transport adverse events in critically ill gynecological patients was established with the logistic regression equation: Logit(P) = −11.986 + 0.794×MEWS score + 1.363×SOFA score + 1.130×Mechanical ventilation

Table 1 Baseline Characteristics of Study Participants

Characteristics	Total (n=650)	Training Set (n=455)	Validation Set (n=195)	t/Z/χ^2	P
Demographic characteristics					
Age (years)	58.26 ± 8.59	57.99 ± 8.85	58.91 ± 7.95	−1.260	0.208
BMI (kg/m^2)	23.34 ± 2.08	23.40 ± 2.07	23.19 ± 2.09	1.176	0.240
Gynecological Diagnosis Type, n (%)				0.604	0.739
Gynecological malignancy	391 (60.2)	278 (61.1)	113 (57.9)		
Pregnancy-related complications	143 (22.0)	97 (21.3)	46 (23.6)		
Benign/other	116 (17.8)	80 (17.6)	36 (18.5)		
Pre-Transport Condition Assessment					
MEWS score	4 (3, 6)	4 (3, 6)	4 (3, 5)	−0.910	0.363
GCS score	15 (14, 15)	15 (14, 15)	15 (14, 15)	−0.524	0.600
SOFA score	3 (2, 5)	3 (2, 5)	3 (1.5, 5)	−0.566	0.571
Use of vasoactive drugs, n (%)	156 (24.0)	112 (24.6)	44 (22.6)	0.315	0.575
Mechanical ventilation, n (%)	83 (12.8)	60 (13.2)	23 (11.8)	0.237	0.626
Transport Process Characteristics					
Transport duration (minutes)	45.33 ± 11.74	45.77 ± 12.46	44.31 ± 9.83	1.448	0.148
ICU staff as company, n (%)	525 (80.8)	372 (81.8)	153 (78.5)	0.955	0.328
Comorbidities, n (%)					
Hypertension	185 (28.5)	132 (29.0)	53 (27.2)	0.225	0.635
Diabetes	102 (15.7)	73 (16.0)	29 (14.9)	0.142	0.707

Abbreviations: BMI, body mass index; MEWS, Modified Early Warning Score; GCS, Glasgow Coma Scale; SOFA, Sequential Organ Failure Assessment.

Table 2 Distribution of Adverse Event Occurrence

Items	Total (n=650)	Training Set (n=455)	Validation Set (n=195)	χ^2	P
Adverse event occurrence, n (%)	178 (27.4)	123 (27.0)	55 (28.2)	0.094	0.759
Type of adverse event, n (%)	(n=178)	(n=123)	(n=55)	0.677	0.879
Hemodynamic fluctuation	95 (53.4)	67 (54.5)	28 (50.9)		
Respiratory-related event	45 (25.3)	30 (24.4)	15 (27.3)		
Equipment-related event	22 (12.4)	16 (13.0)	6 (10.9)		
Other unexpected events	16 (9.0)	10 (8.1)	6 (10.9)		
Severity, n (%)	(n=178)	(n=123)	(n=55)	0.449	0.799
Mild	102 (57.3)	69 (56.1)	33 (60.0)		
Moderate	58 (32.6)	42 (34.1)	16 (29.1)		
Severe	18 (10.1)	12 (9.8)	6 (10.9)		

Table 3 Univariate Analysis of Intrahospital Transport Adverse Events in Critically Ill Gynecological Patients

Variables	No Adverse Event Group (n=332)	Adverse Event Group (n=123)	t/Z/χ^2	P
Age (years)	57.5±8.79	59.3±8.89	−1.935	0.054
BMI (kg/m^2)	23.3±2.0	23.7±2.1	−1.726	0.085
Gynecological malignancy, n (%)	193 (58.1)	85 (69.1)	4.547	0.033
MEWS score	4 (3, 5)	6 (5, 6)	−11.902	<0.001
GCS score	15 (14, 15)	14 (13, 15)	−4.424	<0.001
SOFA score	2 (2, 3)	5.0 (5, 5)	−13.766	<0.001
Use of vasoactive drugs, n (%)	65 (19.6)	47 (38.2)	16.792	<0.001
Mechanical ventilation, n (%)	32 (9.6)	28 (22.8)	13.507	<0.001
Transport duration (minutes)	44.2±12.55	50.1±11.20	−4.558	<0.001
ICU staff as company, n (%)	277 (83.4)	95 (77.2)	2.312	0.128

(yes=1, no=0) + 0.041×Transport duration (minutes), where P represents the probability of intrahospital transport adverse events. The predicted probability of adverse events can be calculated by transforming the logit value: P = exp(Logit(P))/[1 + exp(Logit(P))]. The nomogram (Figure 2A) was developed based on the above coefficients. In the validation set (n=195), the model demonstrated good discrimination, with an AUC of 0.852 (95% CI: 0.799–0.904) (Figure 2B). At the optimal cutoff value of 0.047, sensitivity and specificity were 81.8% and 76.4%, respectively. The model showed good calibration, with the calibration curve closely aligned with the ideal diagonal (Figure 2C), and the Hosmer-Lemeshow test was not significant (P=0.511). DCA demonstrated that applying this model to guide clinical decisions provided a net clinical benefit across a wide threshold probability range of 1%–65% (Figure 2D).

Discussion

This study successfully constructed and preliminarily validated a risk prediction model for adverse events during intra-hospital transport in critically ill gynecological patients based on a retrospective observational cohort design. Multivariate analysis identified mechanical ventilation, SOFA score, MEWS, and transport duration as four independent predictors of adverse events during intra-hospital transport in this population. Internal validation results demonstrated excellent discriminatory power and good calibration of the model; DCA further confirmed its clinical utility. The risk prediction model developed in this study provides a scientific quantitative assessment tool for clinicians to accurately identify high-risk individuals for intra-hospital transport and optimize transport decision-making processes.

In terms of the model's operationalization within intra-hospital transport risk governance, the model integrates multiple key predictors to provide a quantitative transport risk score for each critically ill gynecological patient. Based on this score, healthcare professionals can rapidly stratify patients by risk and identify high-risk individuals, thereby

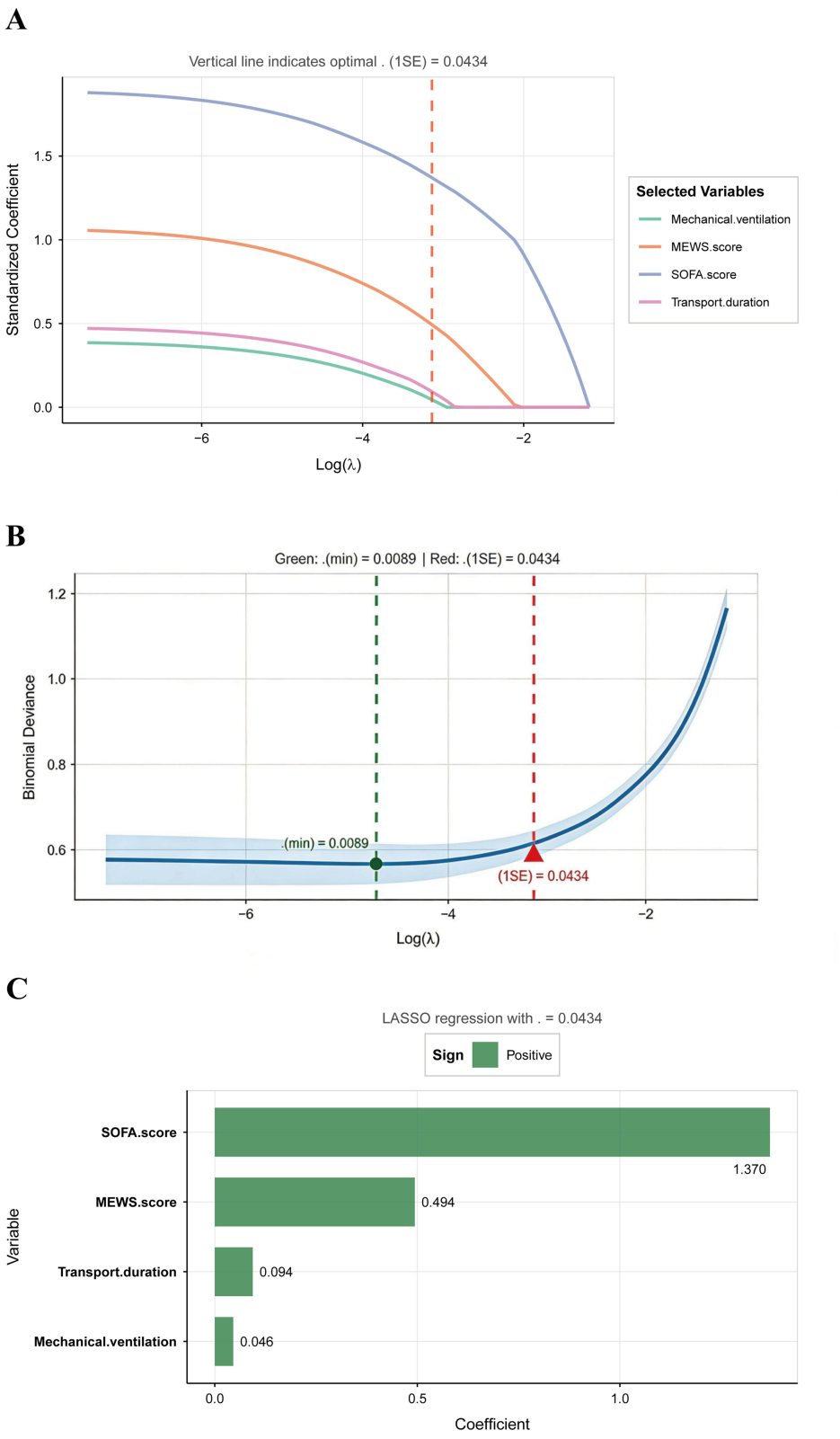

Figure 1 LASSO regression for selection of adverse event predictive variables. (**A**) LASSO coefficient regularization path; (**B**) Cross-validation error curve; (**C**) Standardized coefficients of selected variables.

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Table 4 Multivariate Logistic Regression Analysis of Intrahospital Transport Adverse Events in Critically Ill Gynecological Patients

Variables	β	S.E.	Wald χ^2	OR	95% CI	P
Constant item	−11.986	1.363	77.314	0.000	–	<0.001
MEWS score	0.794	0.187	18.109	2.213	1.535–3.190	<0.001
SOFA score	1.363	0.158	74.412	3.907	2.867–5.325	<0.001
Mechanical ventilation	1.130	0.491	5.287	3.094	1.181–8.105	0.021
Transport duration	0.041	0.014	8.592	1.042	1.014–1.071	0.003

implementing more refined pre-transport preparations and monitoring measures. For instance, for high-risk patients, an experienced transport team can be arranged in advance, and necessary emergency equipment and medications can be prepared to ensure a smooth transport process. Furthermore, the model's application will promote a more scientific and standardized intra-hospital transport decision-making process. Healthcare professionals can utilize the model for rapid risk assessment, combining the patient's specific condition and transport needs to develop personalized transport plans. For high-risk patients, non-urgent transport can be delayed, or more proactive interventions can be taken before transport to reduce risks. Simultaneously, the model can serve as an important reference for transport decisions, minimizing transport risks resulting from subjective judgments.

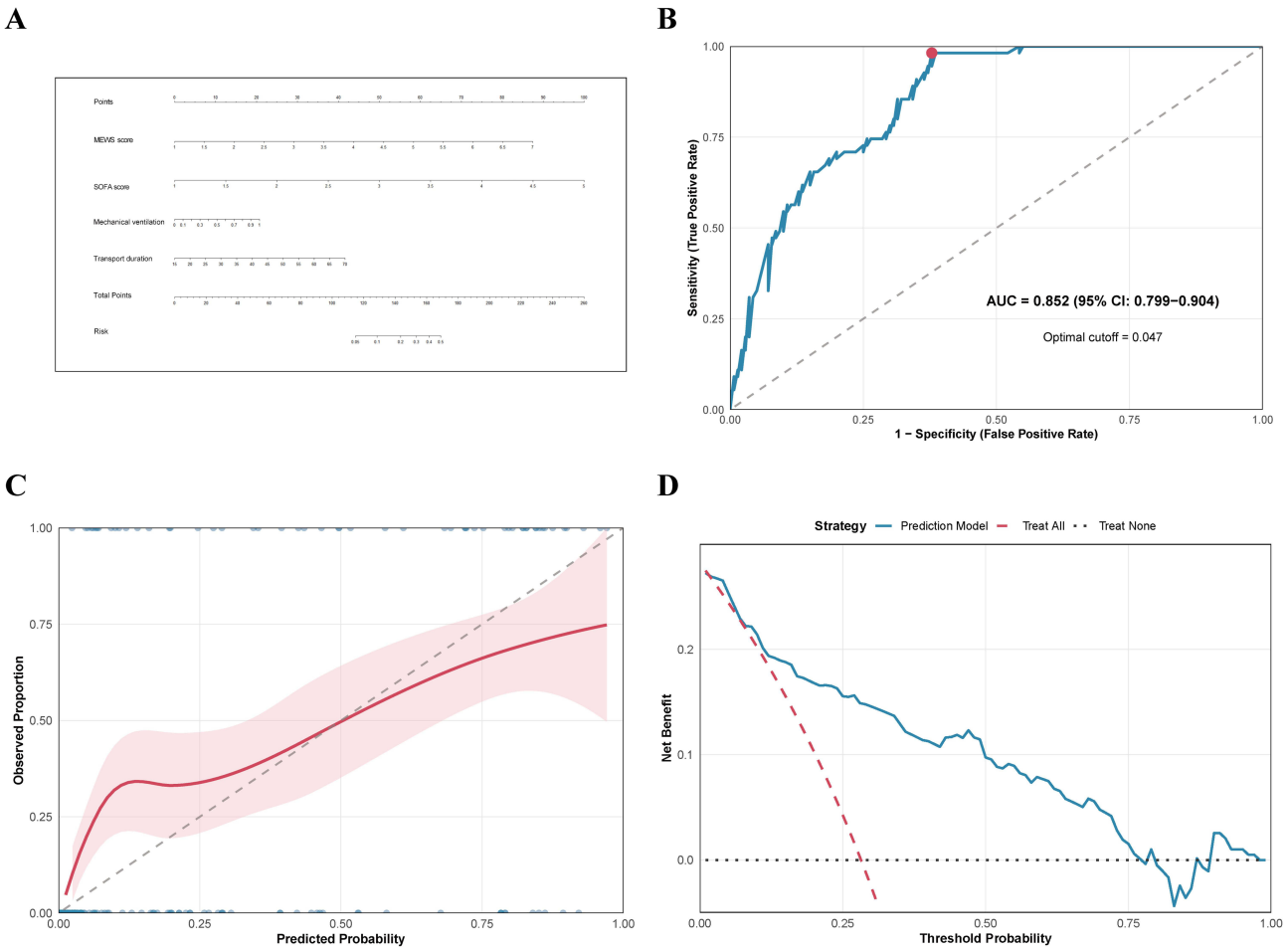

Figure 2 Development and validation of the intrahospital transport adverse event prediction model in critically ill gynecological patients. (**A**) Nomogram for adverse event prediction; (**B**) ROC curve (validation set); (**C**) Calibration curve (validation set); (**D**) DCA (validation set).

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Among the predictors, SOFA score exhibited the strongest risk effect (OR=3.907), with each 1-point increase nearly tripling the risk. As the gold standard for evaluating multi-organ dysfunction, high SOFA scores objectively reflect limited organ functional reserve.[11] Transport represents a strong physiological stressor that can readily precipitate or exacerbate circulatory failure, metabolic disorders, and other adverse events in such patients.[12] Mechanical ventilation was another significant predictor (OR=3.094). Patients receiving mechanical ventilation not only have severe baseline conditions, but leaving the controlled monitoring environment during transport increases the risk of patient-ventilator asynchrony, leading to hypoxemia or hypercapnia.[13] Positive-pressure ventilation itself can reduce venous return and suppress myocardial contractility, amplifying hemodynamic fluctuations under transport stress.[14] In addition, artificial airway complications such as accidental extubation, obstruction, or leakage are more likely during transport,[15] collectively increasing the risk of transport-related adverse events in mechanically ventilated patients.

Each 1-point increase in MEWS score was associated with a 1.2-fold increase in risk (OR=2.213). By integrating key physiological parameters including heart rate, blood pressure, and respiratory rate, MEWS effectively evaluates disease severity and deterioration risk. Abnormal values indicate that homeostatic compensation is near exhaustion. Stress stimuli during transport exacerbate catecholamine release, increasing myocardial oxygen demand and respiratory muscle fatigue, while decreased consciousness elevates the risk of aspiration and impairs timely clinical assessment.[16] Thus, high MEWS scores serve as an objective marker of low tolerance to transport stress in critically ill gynecological patients. Transport duration was also independently associated with risk, with each additional minute increasing the risk by approximately 4.2% (OR=1.042). Longer transport duration exposes patients to a non-ICU-standard environment for extended periods, delaying access to advanced life support. Prolonged exposure to motion and environmental changes increases physiological stress and oxygen consumption, while equipment such as ventilators and infusion pumps may face risks of battery depletion or insufficient oxygen supply.[17,18] Therefore, optimizing transport processes to minimize duration is a key modifiable factor for reducing adverse event risk.

Compared with prior models developed for general critically ill populations, this model is population-specific, tailored for critically ill gynecological patients. It incorporates pathophysiological characteristics unique to this population, including pelvic anatomical changes, hormonal fluctuations, and pregnancy-related physiological alterations, all of which may influence hemodynamic stability and organ reserve. Although gynecologic malignancies and pregnancy-related complications did not emerge as independent predictors in multivariate analysis, their statistical significance in univariate analysis suggests that gynecology-specific factors merit further investigation regarding their association with transport risk.

The application of this model in intra-hospital transport risk governance will significantly enhance transport safety and medical quality. By implementing risk management strategies based on the model, healthcare professionals can pay greater attention to every detail during transport, strengthening key monitoring and timely interventions to effectively reduce the occurrence of adverse events. Additionally, the model contributes to promoting the standardization and normalization of intra-hospital transport management, enhancing overall medical quality. All steps of model development and validation in this study were conducted in accordance with the TRIPOD checklist (Table S2) to ensure methodological rigor. However, several limitations exist. First, the retrospective design inherently carries risks of missing data and selection bias. Second, being a single-center study, the sample source is relatively homogeneous, potentially limiting external generalizability. Third, factors such as nutritional status, physical environment of transport routes, and qualifications of medical staff were not included, which may affect model comprehensiveness. Fourth, only internal validation was performed; external validation in independent cohorts is needed to confirm generalizability. Ultimately, interventional studies should verify whether transport strategies guided by the model can effectively reduce the incidence of adverse events, thereby advancing the standardized and precise development of intra-hospital transport safety management for critically ill gynecological patients.

Conclusions

We developed and internally validated a risk prediction model for intrahospital transfer adverse events in critically ill gynecological patients, identifying mechanical ventilation, SOFA score, MEWS score, and transfer duration as independent predictors. The model demonstrated excellent discrimination and calibration, with decision curve analysis

confirming its robust clinical utility across diverse threshold probabilities. External validation and prospective evaluation are warranted to verify its generalizability and long-term impact on transfer outcomes. Ultimately, integrating this model into clinical pathways may optimize transfer decisions and improve the safety of critically ill gynecological patients during intrahospital transport.

Ethics Statement

The study was approved by the Institutional Ethics Committee of Jiangsu Province Hospital on Integrated of Chinese and Western Medicine (Approval Number: 2021LWKYS-034). Patient identifiers such as name, address, and contact information were strictly anonymized and kept confidential, in accordance with the ethical principles of the Declaration of Helsinki. Given the retrospective nature of the study using only existing clinical data, the Ethics Committee granted a waiver of written informed consent for some patients.

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Disclosure

Tifang Qin and Qian Zhou are regarded as co-first authors for this study. The authors report no conflicts of interest in this work.

References

1. Warren J, Fromm RE Jr, Orr RA, Rotello LC, Horst HM. American college of critical care M. guidelines for the inter- and intrahospital transport of critically ill patients. *Crit Care Med*. 2004;32(1):256–262. doi:10.1097/01.CCM.0000104917.39204.0A
2. Murata M, Nakagawa N, Kawasaki T, et al. Adverse events during intrahospital transport of critically ill patients: a systematic review and meta-analysis. *Am J Emerg Med*. 2022;52:13–19. doi:10.1016/j.ajem.2021.11.021
3. Kress JP, Hall JB. ICU-acquired weakness and recovery from critical illness. *N Engl J Med*. 2014;370(17):1626–1635. doi:10.1056/NEJMra1209390
4. Evans L, Rhodes A, Alhazzani W, et al. Surviving sepsis campaign: international guidelines for management of sepsis and septic shock 2021. *Intensive Care Med*. 2021;47(11):1181–1247. doi:10.1007/s00134-021-06506-y
5. Williams P, Karuppiah S, Greentree K, Darvall J. A checklist for intrahospital transport of critically ill patients improves compliance with transportation safety guidelines. *Aust Crit Care*. 2020;33(1):20–24. doi:10.1016/j.aucc.2019.02.004
6. Singer M, Deutschman CS, Seymour CW, et al. The third international consensus definitions for sepsis and septic shock (sepsis-3). *JAMA*. 2016;315(8):801–810. doi:10.1001/jama.2016.0287
7. Riley RD, Snell KI, Ensor J, et al. Minimum sample size for developing a multivariable prediction model: PART II - binary and time-to-event outcomes. *Stat Med*. 2019;38(7):1276–1296. doi:10.1002/sim.7992
8. Subbe CP, Duller B, Bellomo R. Effect of an automated notification system for deteriorating ward patients on clinical outcomes. *Crit Care*. 2017;21(1):52. doi:10.1186/s13054-017-1635-z
9. Teasdale G, Jennett B. Assessment of coma and impaired consciousness. A practical scale. *Lancet*. 1974;304(7872):81–84. doi:10.1016/s0140-6736(74)91639-0
10. Vincent JL, Moreno R, Takala J, et al. The SOFA (Sepsis-related organ failure assessment) score to describe organ dysfunction/failure. on behalf of the working group on sepsis-related problems of the european society of intensive care medicine. *Intensive Care Med*. 1996;22(7):707–710. doi:10.1007/BF01709751
11. Vincent J-L, Ince C, Bakker J. Clinical review: circulatory shock - an update: a tribute to Professor Max Harry Weil. *Crit Care*. 2012;16(6):239. doi:10.1186/cc11510
12. Seymour CW, Liu VX, Iwashyna TJ, et al. Assessment of clinical criteria for sepsis: for the third international consensus definitions for sepsis and septic shock (sepsis-3). *JAMA*. 2016;315(8):762–774. doi:10.1001/jama.2016.0288
13. Merola R, Iacovazzo C, Troise S, et al. Timing of tracheostomy in ICU patients: a systematic review and meta-analysis of randomized controlled trials. *Life*. 2024;14(9). doi:10.3390/life14091165
14. Kue R, Brown P, Ness C, Scheulen J. Adverse clinical events during intrahospital transport by a specialized team: a preliminary report. *Am J Crit Care*. 2011;20(2):153–161. doi:10.4037/ajcc2011478. quiz 162.
15. Li P, Sun Z, Xu J. Unplanned extubation among critically ill adults: a systematic review and meta-analysis. *Intensive Critical Care Nurs*. 2022;70:103219. doi:10.1016/j.iccn.2022.103219
16. Smith GB, Prytherch DR, Meredith P, Schmidt PE, Featherstone PI. The ability of the national early warning score (NEWS) to discriminate patients at risk of early cardiac arrest, unanticipated intensive care unit admission, and death. *Resuscitation*. 2013;84(4):465–470. doi:10.1016/j.resuscitation.2012.12.016
17. Schwebel C, Clec'h C, Magne S, et al. Safety of intrahospital transport in ventilated critically ill patients: a multicenter cohort study*. *Crit Care Med*. 2013;41(8):1919–1928. doi:10.1097/CCM.0b013e31828a3bbd
18. Severino F, Gallani M-C, Mercier E, et al. Effect of strategies to improve interhospital transports of critically ill patients on safety and costs: protocol for a systematic review and meta-analysis. *BMJ Open*. 2025;15(7):e094452. doi:10.1136/bmjopen-2024-094452