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# Implementation of Clinical Nursing Interventions and Risk Management During the Transport of Critically-Ill Emergency Patients

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**Abstract**

To investigate the effectiveness of a clinical nursing intervention combined with a risk prevention and control model in the transport of critically-ill emergency patients, a total of 220 critically-ill patients admitted to the Emergency Department of Deyang People's Hospital (a city-based tertiary hospital in southwestern China) between February and July 2025 who required intra-hospital or inter-hospital transport were selected as study subjects. Using a random number table, they were evenly divided into a control group and an observation group, with 110 patients in each one. The control group received traditional emergency transport care, while the observation group received care based on the clinical nursing intervention combined with a risk prevention and control model. The study compared the effects of the two transport care interventions on the incidence of transport-related complications, the incidence of transport-related adverse events, and nursing satisfaction among critically-ill emergency patients. Results showed that both the incidence of transport-related complications and the incidence of transport-related adverse events in the observation group were significantly lower than those in the control group ($P < 0.05$); and patient satisfaction in the observation group was significantly higher than that in the control group ($P < 0.05$). In conclusion, the combination of clinical nursing interventions and a risk prevention and control model could accurately identify high-risk factors for transport, significantly reduce the incidence of complications and adverse events during transport, such as hypotension, tube dislodgement, and falls, and effectively mitigate transport safety risks. At the same time, through refined nursing services, efficient emergency response, and standardized handover procedures, it could also substantially improve nursing satisfaction among patients and their families, making it worthy of clinical promotion and application.

**Keywords:** nursing care, critically-ill emergency patients, clinical nursing intervention, risk prevention and control, tiered transport

## 1. Introduction

The Department of Emergency serves as the frontline defense in safeguarding the lives of critically-ill patients. Due to the severity of their conditions and unstable vital signs, critically-ill emergency patients often require transport for in-hospital examinations, transfers to specialized departments, or inter-hospital referrals. Transport is a critical link connecting emergency care with subsequent precise diagnosis and treatment, and it represents a golden window of opportunity that determines patient outcomes (Liu et al., 2024). However, compared to general patients, the transport of critically-ill emergency patients is influenced by multiple factors such as fluctuating conditions, environmental changes, compatibility of medical equipment, and road vibrations (Li et al., 2022), making them prone to adverse events such as respiratory and circulatory failure, tube dislodgement, sudden deterioration, and accidental injuries (Ayalew et al., 2026). Relevant studies (Castillo-Angeles et al., 2019; Murata et al., 2022) have confirmed that the overall incidence of adverse events during in-hospital transport of critically-ill patients is 26.2%, while the mortality rate for inter-hospital transport is approximately 10.8%. Consequently, emergency transport has become a core challenge in current clinical nursing safety management.

Clinical nursing interventions span the entire process of emergency transport for critically-ill patients, including pre-transport assessment, in-transit monitoring, and post-transport handover, and serve as a vital means of identifying transport risks, stabilizing patient conditions, and responding to emergencies (Tran et al., 2023). Systematic risk prevention and control, in turn, provide the key support for reducing the incidence of adverse transport events and ensuring safety throughout the entire transport process (Brunsveld-Reinders et al., 2015). However, in current clinical practice, some transport teams do not place sufficient emphasis on risk assessment, relying on experience-based judgment rather than standardized tools (Markakis et al., 2006); nursing interventions lack specificity and fail to dynamically adjust monitoring priorities based on the patient's condition (Vila-Vidal et al., 2024); and multidisciplinary collaboration mechanisms are inadequate, leading to gaps in information transmission (Lyphout et al., 2018). Additionally, emergency response plans are often merely formalities, resulting in inefficient handling of unexpected situations (Ricca, 2016). These issues not only increase transport risks but may also compromise overall treatment outcomes. Therefore, establishing a scientific and standardized clinical nursing intervention system and strengthening end-to-end risk prevention and control capabilities have become key breakthroughs for improving the quality of transport for critically-ill emergency patients. To further standardize nursing care during the transport of critically-ill emergency patients and enhance transport safety and nursing quality, this study focuses on the transport scenarios of critically-ill emergency patients. By integrating evidence-based medicine with clinical experience, it systematically explores the implementation pathways of nursing interventions and risk control strategies. Through a comprehensive review of key nursing points across the entire process, including pre-transport assessment, dynamic monitoring during transport, and post-transport handover, the study proposes a tiered intervention model based on risk stratification. This model aims to provide a reference for optimizing clinical transport care protocols for critically-ill patients and ensuring patient safety during diagnosis and treatment.

## 2. Methodology

### *2.1 General Information*

This study is a prospective controlled study in which a total of 220 critically-ill patients admitted to the Emergency Department of our hospital between February 2025 and July 2025 who required intra-hospital or inter-hospital transport were selected as study subjects.

Inclusion criteria: (1) Patients meeting the criteria for critically-ill emergency patients (Chen et al., 2025) and required urgent transport for in-hospital examinations, transfer to or from a specialty department, or inter-hospital referral due to critical condition; (2) Acute Physiology and Chronic Health Evaluation (APACHE II) score (Huang et al., 2017) ≥ 15, with a confirmed critical condition; (3) Age ≥ 18 years and ≤ 80 years; (4) Patients whose family members are informed of the study details and have signed both the transport informed consent form and the study informed consent form; (5) Patients with complete clinical records who can undergo the entire transport process and data collection.

Exclusion criteria: (1) Patients with extremely unstable vital signs requiring immediate cardiopulmonary resuscitation or emergency intervention, rendering transport impossible; (2) Patients with severe cognitive impairment or psychiatric disorders who are unable to cooperate with clinical care or study observations; (3) Pregnant or lactating female patients; (4) Patients participating in other clinical studies that may interfere with the results of this study; (5) Patients with end-stage malignant tumors or multi-organ failure with an expected survival time of <24 hours. Thereafter, the emergency critically-ill patients to be included in the study were divided into a control group and an observation group using a random number table, with 110 patients in each one. Among them, the control group consisted of 64 males and 46 females; Age: 28–76 years, mean age (56.32 ± 8.45) years; primary conditions: 32 cases of cardiovascular or cerebrovascular emergencies, 25 cases of severe trauma, 20 cases of acute respiratory failure, 18 cases of severe infection, and 15 cases of acute abdomen; Transport type: 81 cases of in-hospital transport and 29 cases of inter-hospital transport; APACHE II score: 15–28 points, mean (20.16 ± 3.27) points; Transport time: 10–65 minutes, mean (28.45 ± 7.12) minutes. The observation group included 62 males and 48 females; Ages ranged from 30 to 78 years, with a mean age of (57.15 ± 8.62) years; Underlying conditions: 30 cases of cardiovascular and cerebrovascular emergencies, 26 cases of severe trauma, 21 cases of acute respiratory failure, 17 cases of severe infection, and 16 cases of acute abdomen; Transport type: 79 cases of in-hospital transport and 31 cases of inter-hospital transport; APACHE II score: 15–29 points, with a mean of (20.53 ± 3.41) points; Transport duration: 12–68 minutes, mean (29.06 ± 7.35) minutes. There were no statistically significant differences ($P > 0.05$) between the two groups in terms of general characteristics such as gender, age, underlying condition, type of transport, APACHE II score, and transport duration, indicating that the groups were comparable.

### *2.2 Research Methods*

The control group received traditional emergency transport care, with specific interventions as follows:

(1) Pre-transport preparation: 1 Patient assessment: The assigned nurse assessed the patient's vital signs using the GCS and NEWS scales, and recorded current symptoms such as pain, dyspnea, and medications currently being administered. 2 Preparation of equipment and medications: Transport equipment such as stretchers, oxygen sets, and manual resuscitators is prepared according to the department's standard checklist, and essential emergency medications such as epinephrine, atropine, and glucose are carried. 3 Communication: The transport time is confirmed by telephone with the receiving department, and the patient is informed of the need for transfer and the treatment measures already taken.

(2) Care During Transport: 1 Positioning and Restraint: Position the patient in a supine or semi-recumbent position based on their condition; use restraints for patients exhibiting severe agitation. 2 Monitoring and Documentation: Use a portable monitor to track ECG, $SpO_2$, and non-invasive blood pressure; observe consciousness, respiration, heart rate, and blood pressure every 5–10 minutes, and promptly document any abnormal vital signs. 3 Emergency Response: In the event of a sudden emergency during transport, immediately notify the physician and perform resuscitation interventions according to standard protocols as directed.

(3) Post-Transport Care: Complete the "Emergency Transport Record Form," which includes the patient's basic information, transport time, peak vital signs during transport, and medication history.

The observation group implemented targeted clinical nursing interventions combined with measures to prevent and control transport risks. The specific interventions are as follows:

Precise assessment of transport risks using standardized tools:

(1) Core assessment tools and timing:

30 minutes prior to transport: The Modified Early Warning Score (NEWS) (Mitsunaga et al., 2019) was used to score patients across three dimensions, vital sign stability, level of consciousness, and body temperature, while the Acute Physiology and Chronic Health Evaluation (APACHE II) score was used to assess overall critical condition. Every 15 minutes during transport: Re-evaluate the NEWS score. If the patient exhibits fluctuations in vital signs, such as systolic blood pressure <90 mmHg or oxygen saturation <93%, immediately initiate a specialized risk reassessment. For patients with indwelling catheters, additionally use the Catheter Risk Assessment Form (Tang, 2020) to assess transport risk.

(2) Assessment Content and Criteria: 1 Airway Risk: Assess airway patency, secretion retention, and the effectiveness of artificial airway fixation; a GCS score ≤ 8 is classified as high airway risk; 2 Circulatory Risk: Assess blood pressure, heart rate, urine output, and peripheral circulation; systolic blood pressure < 90 mmHg or mean arterial pressure < 65 mmHg is classified as high circulatory risk; 3 Catheter-related risk: Assess the number, fixation status, and patency of catheters such as intravenous lines, drainage tubes, and oxygen tubes; the presence of two or more high-risk catheters (e.g., central venous catheters, endotracheal tubes) is classified as high catheter-related risk; 4 Clinical condition risk: Assess for active bleeding, risk of seizures, multi-organ failure, etc.; the presence of one or more critical complications is classified as high clinical condition risk.

Assessment of Instrument and Equipment Status: Conduct a comprehensive inspection of emergency, life support, and monitoring equipment prior to transport:

(1) Life support equipment: Ensure the ventilator has completed its self-test, set appropriate transport parameters, verify that the air supply and battery power are sufficient, and have a backup manual resuscitator on hand; calibrate the monitoring module of the ECG monitor, enable alarm functions, and ensure the battery is fully charged; use a dual-cylinder oxygen system as a backup and verify that the pressure meets standards.

(2) Emergency Equipment: Defibrillators must complete charge tests and be on standby; negative pressure suction devices must be adjusted to the appropriate suction level, with all suction consumables prepared; infusion or syringe pumps must have flow rates calibrated, with a backup pressure device available.

(3) Auxiliary Equipment: Calibrate portable monitors and ensure all testing consumables are stocked; verify the expiration dates and dosages of emergency medications.

(4) Securing and Contingency Planning: Secure all equipment firmly in place and organize tubing to prevent snagging; implement a "One Primary, One Backup" policy for core equipment, perform secondary power-on self-tests, and ensure all equipment operates normally throughout the transport.

Tiered Clinical Nursing Interventions Based on Risk Level:

Based on NEWS scores, patients are classified into three tiers—low risk (0–3 points), moderate risk (4–8 points), and high risk (≥8 points)—and receive tailored interventions.

(1) Transport of Low-Risk Patients: 1 Pre-transport preparation: Stabilize vital signs, such as maintaining blood pressure within ±20% of baseline and oxygen saturation at ≥95%; inspect and secure all tubing, label tubing names and confirm patency; prepare basic transport supplies including a portable monitor, manual resuscitator, and emergency medication kit. 2 In-transport care: Accompanied by a nurse with at least 2 years of emergency nursing experience; Monitor vital signs every 15 minutes, with particular attention to level of consciousness and peripheral circulation; maintain a stable transport environment, avoid severe jolts, and promptly clear airway secretions. 3 Post-transport handover: Conduct both written and verbal handover with the receiving department's nursing staff, emphasizing the results of the risk assessment and key intervention points.

(2) Transport of Moderate-Risk Patients: 1 Pre-transport Preparation: In addition to low-risk interventions, develop specific risk contingency plans, e.g., prepare suction devices for airway risks and ensure vasopressors are available for circulatory risks. Communicate in advance with the receiving department to confirm bed availability and monitoring equipment configuration to ensure seamless handover. Have the head nurse review the transport plan to verify supplies and staffing. 2 In-transit care: Assign two nurses—one responsible for monitoring and one responsible for tubing management and emergency response. Monitor vital signs every 10 minutes, with particular attention to airway patency and tubing integrity. If minor fluctuations in vital signs occur, immediately adjust the fluid administration rate or

administer short-acting medications as ordered to stabilize the patient's condition. Document all nursing interventions and changes in the patient's condition throughout the transport. 3 Post-Transport Handover: In addition to the standard handover, submit the "Transport Risk Assessment and Intervention Record Form," clearly specifying key monitoring parameters for the following 24 hours.

(3) Transport of High-Risk Patients: 1 Pre-transport Preparation: Form a transport emergency team (including one emergency specialty nurse and one physician) and perform advanced life support pre-procedures, such as confirming the cuff pressure (25–30 $cmH_2O$) for intubated patients, confirming unobstructed blood return and secure fixation of central venous catheters; switching patients receiving continuous infusion of vasoactive drugs to portable micro-infusion pumps; carrying advanced emergency equipment such as portable ventilators, defibrillators, and advanced airway management kits; and initiating the emergency coordination mechanism with the receiving department 30 minutes in advance to reserve resuscitation beds and equipment. 2 In-transit care: The emergency team accompanies the patient throughout the transport; a physician provides on-site guidance for clinical management; vital signs are monitored every 5 minutes, with a focus on key indicators such as airway pressure, central venous pressure, and urine output; if a sudden deterioration occurs, the emergency response protocol is immediately activated while continuing advanced life support; risk levels are dynamically reassessed throughout the transport, and interventions are adjusted based on the results. 3 Post-Transport Handover: Conduct a synchronized handover with the receiving department's resuscitation team and submit a complete "Transport Nursing Record," clearly outlining the priorities for subsequent resuscitation and nursing care.

Key Adjustments to Individualized Monitoring Based on Clinical Status During Transport:

(1) Principles for Dynamic Adjustment of Monitoring Parameters: 1 Patients with respiratory failure: Focus on monitoring oxygen saturation, respiratory rate, and airway pressure; if oxygen saturation is <90%, immediately increase oxygen flow or adjust ventilator settings. 2 Patients with shock: Focus on monitoring blood pressure, heart rate, urine output, and central venous pressure; accelerate fluid resuscitation or administer vasoactive medications as directed by the physician. 3 Patients with traumatic brain injury: Focus on monitoring the Glasgow Coma Scale (GCS) score, pupil changes, and intracranial pressure; if anisocoria or a decrease in GCS score of $\geq$ 2 points occurs, immediately halt transport and notify the physician. 4 Tubing-dependent patients: Closely monitor the patency and securement of tubing. If there is a risk of tubing dislodgement, immediately reinforce or replace the securing dressing.

(2) Standardization of monitoring records: Use a form-free narrative recording format to document monitoring results, interventions, and patient responses in detail at specific time points, ensuring completeness and logical clarity. Complete a progress note every 15 minutes and record emergencies immediately.

*2.3 Observation Criteria*

Incidence of Complications During Transport:

Record the incidence of complications such as arrhythmia, drop in blood pressure, decrease in oxygen saturation, and cardiac or respiratory arrest in both groups of patients during transport. A lower incidence of complications during transport indicates more effective nursing interventions.

Incidence of Adverse Events During Transport:

Record the incidence of adverse events such as patient falls, equipment malfunctions, and tube dislodgement during the transport process for both groups of patients. A lower incidence of adverse events during transport indicates more effective nursing interventions.

Patient Satisfaction with Transport:

A department-developed patient satisfaction survey was administered to patients in both groups. This questionnaire assessed patients' satisfaction with nursing care during transport, nurses' professional competence and service attitude, the transport environment and logistical support, and post-transport handover procedures. The survey is scored out of 100 points, with higher scores indicating greater patient satisfaction.

*2.4 Statistical Methods*

SPSS 26.0 statistical software was used to analyze the data in this study. The significance level was set at $\alpha = 0.05$; $P < 0.05$ was considered statistically significant, and $P < 0.01$ was considered highly statistically significant. Continuous variables, such as age, transport time, and patient satisfaction scores, were found to follow a normal distribution after normality tests and are presented as mean ± standard deviation ($\bar{x} \pm s$). Intergroup comparisons were performed using the independent samples t-test. Categorical variables, such as gender, the incidence of transport-related complications, and the incidence of transport-related adverse events, are presented as frequency and percentage (n, %). Intergroup comparisons were performed using the chi-square ($\chi^2$) test. If the theoretical frequency in the chi-square test was <1 or the total sample size was < 40, Fisher's exact test was used for correction to ensure the accuracy and reliability of the statistical results.

## 3. Results

When comparing the incidence of transport-related complications between the two groups, the incidence in the observation group was significantly lower than that in the control group ($P < 0.05$), as shown in Table 1.

Table 1. Incidence of transport-related complications in the two groups: [n, (%)]

| Group | Number of Cases | Arrhythmia | Hypotension | Decreased Oxygen Saturation | Cardiac Arrest | Incidence of Related Complications |
|---|---|---|---|---|---|---|
| Control group | 110 | 12(10.91) | 13(11.82) | 15(13.64) | 5(4.55) | 35(31.82) |
| Observation group | 110 | 2(1.82) | 1(0.91) | 2(1.82) | 0(0.00) | 5(4.55) |
| $\chi^2$ | | 7.628 | 10.985 | 10.774 | 5.116 | 27.500 |
| $P$ | | 0.006 | 0.001 | 0.001 | 0.024 | 0.000 |

A comparison of the incidence of adverse events during transport between the two groups revealed that the incidence in the observation group was significantly lower than that in the control group ($P < 0.05$); see Table 2.

Table 2. Incidence of adverse events during transport in the two groups: [n, (%)]

| Group | Number of Cases | Falls from bed | Equipment malfunction | Tube dislodgement | Incidence of related adverse events |
|---|---|---|---|---|---|
| Control group | 110 | 4(3.64) | 18(16.36) | 9(8.12) | 31(28.18) |
| Observation group | 110 | 0(0.00) | 3(2.73) | 1(0.91) | 4(3.64) |
| $\chi^2$ | | 4.074 | 11.845 | 6.705 | 24.769 |
| $P$ | | 0.044 | 0.000 | 0.010 | 0.000 |

A comparison of satisfaction levels between the two groups after the intervention revealed that satisfaction among patients in the observation group was significantly higher than that among patients in the control group ($P < 0.05$); see Table 3.

Table 3. Comparison of satisfaction scores between the two groups after the intervention ($\bar{x} \pm s$): points

| Group | Number of Cases | Satisfaction Rating |
|---|---|---|
| Control group | 110 | 87.88±3.65 |
| Observation group | 110 | 94.26±2.68 |
| $t$ | | 14.777 |
| $P$ | | 0.000 |

## 4. Discussion

### *4.1 Targeted Clinical Nursing Interventions Combined with Transport Risk Control Measures Could Effectively Reduce the Incidence of Transport-Related Complications in Critically-Ill Emergency Patients*

The intra-hospital and inter-hospital transport of critically-ill emergency patients is a high-risk, complex, and critical process within the emergency medical system (Hashemian et al., 2023). The occurrence of transport-related complications is associated not only with the patients' critical condition and unstable vital signs but also with factors such as procedural oversights, inadequate nursing interventions, and a lack of risk assessment (Eiding et al., 2022). Research (Williams et al., 2020) indicates that implementing comprehensive transport nursing interventions for critically-ill patients can effectively reduce the incidence of transport-related complications. In this study, targeted clinical nursing interventions combined with transport risk prevention and control measures, through the synergistic effects

of individualized, precise management and systematic, end-to-end prevention also confirmed this view, The primary reason lies in the fact that targeted clinical nursing interventions abandon a one-size-fits-all model. Instead, they develop differentiated care plans centered on the patient's condition, etiology, and physiological status, implementing precise interventions for high-risk issues such as airway obstruction and circulatory fluctuations. This enables rapid correction of critical conditions such as hypoxia, hypotension, and arrhythmias, effectively blocking the progression of complications such as respiratory failure and shock triggered by the specific nature of the patient's condition. Meanwhile, transport risk prevention and control measures establish a comprehensive risk management system covering pre-transport, during transport, and post-transport phases. Through closed-loop management, including preoperative risk screening and grading, standardized preparation of emergency equipment and medications, specialized division of labor among transport personnel, dynamic monitoring during transit and activation of emergency protocols, and standardized post-transport handover, the system systematically eliminates external risk factors such as road turbulence, operational errors, equipment malfunctions, and handover oversights. The combined application of these two approaches achieves an organic integration of precise, individualized patient care with systematic process-based risk control during transport. Targeted nursing addresses the patient's specific pathophysiological risks, while risk control compensates for management gaps in the transport process. This approach not only addresses the oversight of process risks inherent in single-dimensional nursing interventions but also resolves the shortcomings of risk control measures that fail to adequately adapt to individual patient conditions. Ultimately, it forms a comprehensive safety net covering condition assessment, nursing procedures, process management, emergency response, significantly reducing the incidence of various complications, including cardiovascular, respiratory, catheter-related, and trauma-related issues during the transport of critically-ill emergency patients. This provides a core safeguard for the safe transport of critically-ill patients, a finding consistent with the research by Ling et al. (2022).

### *4.2 Targeted Clinical Nursing Interventions Combined with Transport Risk Prevention and Control Measures Could Effectively Reduce the Incidence of Transport-Related Adverse Events Among Critically-Ill Emergency Patients*

During the transport of critically-ill emergency patients, falls from the stretcher, equipment malfunctions, and tube dislodgement are nursing adverse events with high incidence rates and significant harm. These events not only interrupt emergency treatment and cause secondary injury to patients but also directly exacerbate transport safety risks (Kumari & Kumar, 2014). The targeted clinical nursing interventions combined with transport risk control measures in this study can block the causes of adverse events from three core dimensions, i.e. process control, individual adaptation, and detailed protection, thereby achieving precise prevention and control of bed falls, equipment malfunctions, and tube dislodgement. For bed falls, risk control measures involve conducting preemptive risk assessments of the patient's level of consciousness, agitation, and mobility. Targeted nursing interventions implement differentiated restraint and positioning management based on the patient's individual condition, with enhanced continuous monitoring for high-risk patients who are confused or

agitated. Timely correction of positional shifts eliminates the risk of bed falls through nursing practices. For adverse events related to equipment malfunctions, transport risk prevention and control establishes standardized pre-transport procedures, including equipment performance verification, preparation of backup devices, and ensuring sufficient power supplies and consumables to eliminate hardware risks at the source. Targeted clinical nursing interventions assign dedicated personnel to monitor and operate equipment, who can skillfully address equipment abnormalities based on the patient's condition. These two interventions work in tandem to build a preventive and emergency-response equipment safety system, thoroughly preventing failures caused by equipment malfunction or improper operation. For adverse events involving tube dislodgement, risk prevention and control, establish a closed-loop management system featuring categorized tube fixation, conspicuous labeling, and dual-person handover verification before and after transport. Targeted nursing interventions adopt individualized fixation methods based on the characteristics of different tubes, such as endotracheal tubes, intravenous lines, and drainage tubes to prevent tube traction or compression during position adjustments in transit, dynamically monitor fixation status, and promptly secure any loose tubes. Consequently, targeted clinical nursing interventions focused on refining care procedures to account for individual patient differences, while transport risk prevention and control addressed management gaps in the transport process. This effectively achieved comprehensive, gap-free control over the entire process, including equipment management, safety protection, and tubing care, which fundamentally reducing the incidence of adverse events such as equipment malfunctions, falls from beds, and tubing dislodgement during the transport of critically-ill emergency patients in the observation group.

### *4.3 Targeted Clinical Nursing Interventions Combined with Transport Risk Prevention and Control Measures Could Effectively Improve Satisfaction with Transport Among Critically-Ill Emergency Patients*

Due to the critical nature of their condition and severe physical discomfort, critically-ill emergency patients are prone to experiencing negative emotions such as fear, anxiety, and agitation during transport. Their families, concerning about the safety of transport and changes in the patient's condition, also have high expectations regarding the safety, professionalism, and humanistic care of nursing services (Bergman et al., 2020). In this study, the implementation of targeted clinical nursing interventions combined with transport risk prevention and control measures effectively improved the satisfaction of patients in the observation group with the transport process, whose primary reason lies in the fact that the transport risk prevention and control measures. Combined measures like comprehensive safety management throughout the entire process, standardized and efficient transport procedures, and professional and meticulous risk management, thoroughly eliminated safety hazards such as equipment malfunctions, falls from the bed, and tube dislodgement. This established a robust safety barrier for patient transport, significantly alleviated family members' concerns regarding transport safety, and built a foundation of trust between nurses and patients. At the same time, the combined application of these two nursing interventions achieved professional and refined nursing services. Nursing staff had clear divisions of labor

and followed standardized procedures; they proactively informed patients of the transport process and precautions before transport, closely monitored patients' conditions and responded promptly to their needs during transport, and completed standardized handover and health guidance after transport. This formed a closed-loop of efficient, transparent, and compassionate nursing care throughout the entire process, ensuring medical safety during transport while conveying the humanistic warmth of nursing care, thereby comprehensively improving the transport experience for patients and their families. Consequently, patients in the observation group reported significantly higher satisfaction with the transport process than those in the control group.

## 5. Summary and Outlook

This study addressed the risk characteristics associated with the in-hospital transport of critically-ill emergency patients by establishing an integrated clinical nursing intervention and risk prevention model that combines standardized risk assessment, tiered nursing interventions, dynamic monitoring and adjustment, and efficient emergency response. A comparison with conventional transport care confirmed that this intervention model could accurately identify high-risk factors during transport, implement individualized and standardized nursing measures, and significantly reduce the incidence of complications and adverse events such as hypotension, catheter dislodgement, and falls from beds during transport, effectively mitigating safety hazards. Additionally, through refined nursing services, efficient emergency response, and standardized handover procedures, it substantially improves patient and family satisfaction with care. The study indicates that targeted nursing interventions based on standardized assessment tools and risk stratification align with the emergency care needs of critically-ill patients during transport. They ensure the safety and continuity of the transport process, providing a scientific and feasible nursing practice protocol for the safe transport of critically-ill emergency patients, and hold significant value for clinical implementation. However, as this study is a single-center clinical controlled trial, future research should expand the sample size and conduct multicenter, prospective studies to further validate the applicability and effectiveness of this nursing intervention model across hospitals of different levels and for the transport of various types of critically-ill patients in different regions, thereby refining the intervention procedures and process. Furthermore, future efforts should integrate smart healthcare technologies to develop an intelligent risk assessment system for the transport of critically-ill emergency patients and the real-time vital signs monitoring and early warning platform. By combining standardized assessment tools with digital devices, this approach would enable automatic identification of transport risks and provide intelligent alerts for key monitoring parameters, thereby enhancing the intelligence and efficiency of transport care. Finally, as the duration of this study was relatively short, future research could extend the observation period to investigate the impact of this nursing intervention model on patients' long-term rehabilitation outcomes and quality of prognosis if possible, which would further enrich the evaluation indicator system for the transport of critically-ill emergency patients, while optimizing the simplified intervention process for promotion to primary healthcare institutions, thereby comprehensively improving the safety of transporting critically-ill emergency patients within the region.

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Obtained.

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The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

**Data sharing statement**

No additional data are available.



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