

Developing a prehospital emergency competency framework for nursing students: A Delphi study based on the Dreyfus model



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ABSTRACT

This study aimed to develop a systematic, evidence-based framework for prehospital emergency competencies in nursing education, providing theoretical guidance and a practical reference for developing emergency skills among undergraduate nursing students. Guided by the Dreyfus skill acquisition model, a multi-method design was employed, including a systematic literature review, semi-structured interviews with frontline prehospital emergency nurses and nursing education experts, and two rounds of Delphi consultation with 23 experts. The preliminary framework was developed based on the literature, refined through interviews, and evaluated for importance and feasibility during the Delphi process. Expert consensus was assessed using expert engagement, authority coefficients, and Kendall's W coordination coefficients. The response rates for the two Delphi rounds were 85.19% and 95.65%, with authority coefficients of 0.94 and 0.92, respectively (>0.70). The coefficients of variation for importance ratings ranged from 0.003 to 0.080, indicating acceptable consistency among experts. The final framework comprised 4 first-level indicators, 9 second-level indicators, and 28 third-level behavioral indicators, covering theoretical knowledge, professional technical skills, professional competence, and personal qualities. The finalized competency framework is comprehensive and evidence-based and reflects current clinical demands. It provides a structured reference for undergraduate prehospital emergency nursing education, supports curriculum design, and lays the foundation for the future development of competency-based assessment tools.

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1. Introduction

With accelerating urbanization and increasingly diverse transportation methods in China, the demand for prehospital emergency services has grown substantially. Prehospital emergency settings are complex, urgent, and often involve critically ill patients, placing high demands on nurses' clinical judgment and rapid response abilities (Sun et al., 2024). Currently, undergraduate nursing education in China relies primarily on hospital-based clinical placements and classroom instruction, and systematic prehospital emergency training is often limited. Consequently, many graduates entering

emergency care roles require additional on-the-job training, prolonging the training cycles and increasing the institutional burden (Duchscher and Painter, 2021; Gu et al., 2025).

Internationally, prehospital emergency competencies are well integrated into undergraduate nursing curricula. Previous studies have emphasized that students should develop core competencies in emergency response, disaster management, and interprofessional collaboration (Dinh et al., 2023). Similarly, nursing programs in the UK and Australia highlight structured training in prehospital emergency knowledge and skills (Currie et al., 2018; Sjölin et al., 2019). Despite these advances, China lacks a standardized, competency-based framework for prehospital emergency nursing education.

The development of prehospital emergency nursing competence depends not only on knowledge and technical skills but also on clinical judgment, communication and coordination, humanistic care, and self-protection (Gugu et al., 2024; Guo et al.,

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2023; Nilsson and Lindström, 2016). The Dreyfus skill acquisition model, a classic framework for competency development, describes progression from rule-based behavior to intuitive decision-making through five stages: novice, advanced beginner, competent, proficient, and expert (Carraccio et al., 2008). This model provides a theoretical foundation for constructing and interpreting nursing competencies.

Recently, the Delphi technique has been widely used in nursing education to achieve expert consensus and develop indicator frameworks. For instance, Li et al. (2023) used two rounds of Delphi consultation to construct a scientific undergraduate nursing curriculum, while Xia et al. (2024) used the Delphi method to develop an evidence-based nursing curriculum framework, demonstrating the utility of expert consultation in educational research. Nevertheless, a competency-based framework specifically for undergraduate prehospital emergency nursing education remains lacking. Therefore, this study aims to develop a framework, informed by the Dreyfus model, a literature review, interviews, and a Delphi expert consultation, to support curricular reform and competency development.

2. Methods

2.1. Research team

The research team comprised five members: one graduate supervisor, one associate chief nurse, two senior nurses, and one doctoral nursing student. All members held at least a master's degree and had extensive experience in prehospital emergency nursing practice and education research. The team was responsible for literature retrieval, development of interview guides, expert selection, questionnaire design, and data analysis. To ensure consistency and methodological rigor, all members received formal training in the Delphi technique and qualitative interviewing.

2.2. Framework development based on the Dreyfus model

A systematic literature search was conducted in PubMed, Web of Science, Cochrane Library, CNKI, Wanfang, and VIP databases up to June 2024 using the following keywords: "undergraduate nursing students," "prehospital emergency care," "competency framework," and "Dreyfus model." The inclusion criteria were as follows: (1) studies involving undergraduate nursing students or relevant educational populations; (2) studies on prehospital emergency competency development, curriculum design, or evaluation; (3) journal articles, expert consensus statements, guidelines, or systematic reviews; and (4) publications in English or Chinese. The exclusion criteria were as follows: (1) duplicate or low-relevance publications; (2)

inaccessible full texts; and (3) non-empirical studies, such as commentaries or case reports.

2.3. Semi-structured interviews

Purposeful sampling was used to recruit five prehospital emergency nurses, three emergency physicians, and seven nursing managers. Semi-structured interviews (20–30 min) were conducted to explore core competency elements for undergraduate students before entering prehospital emergency roles. Interviews focused on the following: (1) required core competencies; (2) common gaps or risks encountered during emergency placements; (3) new requirements posed by public health emergencies such as COVID-19; and (4) competency targets aligned with Dreyfus model stages. Audio recordings were transcribed within 24 h and analyzed thematically using NVivo 11.0 to extract key competency elements. Initial codes were grouped into themes, which were subsequently used to draft the first-round Delphi questionnaire.

2.4. Preliminary draft

Based on the literature review and thematic analysis of interviews, the research team categorized competencies according to the Dreyfus five-stage model (novice, advanced beginner, competent, proficient, and expert). Drawing on existing undergraduate emergency curricula and clinical practice, a preliminary framework comprising 4 first-level indicators, 12 second-level indicators, and 38 third-level behavioral indicators was drafted. These indicators formed the basis for the first-round Delphi questionnaire.

2.5. Delphi expert consultation

Experts were purposively sampled according to the following criteria: (1) bachelor's degree or higher, holding intermediate or senior professional titles; (2) ≥10 years of experience in prehospital emergency care, nursing education, management, or research; (3) affiliation with tertiary hospitals or nursing schools; and (4) willingness to participate in two rounds of consultation. A total of 23 experts from 22 tertiary hospitals and universities in Guangdong Province were recruited, representing clinical practice, nursing management, nursing education, and nursing research. One institution contributed two experts with different professional backgrounds, while the remaining institutions each contributed one expert, thereby ensuring diverse expertise and balanced institutional representation.

2.6. Questionnaire design

The Delphi questionnaire included the following: (1) a preamble describing research objectives, context, and instructions; (2) evaluation of third-level indicators using a five-point Likert scale for

importance, with optional space for comments; and (3) collection of expert demographic and professional background information, including years of experience and familiarity with prehospital emergency care.

2.7. Delphi procedure

Two rounds of Delphi consultation were conducted between November 2024 and May 2025, using both online and face-to-face methods to maximize expert participation. In the first round, 27 questionnaires were distributed, and 23 valid responses were returned (response rate: 85.19%). In the second round, questionnaires were sent only to experts who completed the first round ($n = 23$), and 22 valid responses were received (response rate: 95.65%). Indicators were retained if the mean importance score was >3.5 and the coefficient of variation (CV) was <0.25 .

2.8. Statistical analysis

Interview data were coded and analyzed thematically using NVivo 11.0. Quantitative data were analyzed using SPSS 21.0. Descriptive statistics summarized expert demographics. Kendall's W was used to assess agreement among experts. Expert consensus was evaluated using the active coefficient, the authority coefficient ($Cr = (Ca + Cs)/2$), and Kendall's W coordination coefficient. Authority coefficients >0.70 and P-values <0.05 indicated acceptable consensus. All CV values are reported to three decimal places; values previously listed as 0.00 indicate extremely low variability due to highly concentrated ratings.

3. Results

3.1. Expert demographics

Among the 23 experts, 18 were female (78.26%), and five were male (21.74%). The age distribution was as follows: ≤ 40 years, 7 (30.43%); 41–50 years, 11 (47.83%); and ≥ 51 years, 5 (21.74%). The educational background was as follows: bachelor's degree, 17 (78.26%); master's degree, 4 (21.74%); and doctorate, 0. The professional titles were as follows: intermediate, 5 (21.74%); associate senior, 14 (69.57%); and senior, 2 (8.70%). Work experience was as follows: <10 years, 1 (8.70%); 10–20 years, 13 (56.52%); and >20 years, 7 (34.78%). The fields of expertise were as follows: nursing management, 16 (73.91%); education, 2 (8.70%); clinical, 3 (13.04%); and research, 2 (4.35%).

3.2. Expert engagement and authority

In the first round, 27 questionnaires were distributed, and 23 valid responses were received (response rate: 85.19%). In the second round, questionnaires were sent only to the experts who

completed the first round ($n = 23$), and 22 valid responses were returned (response rate: 95.65%).

3.3. Consensus and coordination

The mean importance scores ranged from 4.45 to 4.82 in round 1 and from 4.66 to 4.90 in round 2. The full-score percentages were 91.6%–100% and 94.2%–100% in rounds 1 and 2, respectively. The variation coefficients ranged from 0.004 to 0.090 in round 1 and from 0.003 to 0.080 in round 2, indicating a relatively high level of agreement in importance ratings.

3.4. Findings from semi-structured interviews

Semi-structured interviews were conducted to identify the core competency requirements for prehospital emergency nursing. Thematic analysis revealed three key themes, which informed the initial development of the competency framework and the drafting of items for the subsequent Delphi study (Table 1).

Theme 1: Theory–practice gap in situational application during prehospital care: Most participants highlighted a gap between theoretical knowledge acquired during undergraduate training and its application in dynamic, unpredictable prehospital settings. A nurse manager explained that students often “freeze” when confronted with real-life emergencies, such as traffic accidents or traumatic injuries. These observations indicate that undergraduate education does not always adequately prepare students for real-world decision-making. This emphasizes the need to incorporate competencies related to situational awareness and contextual judgment into the framework.

Theme 2: Requirement for automaticity in technical skills under environmental constraints: The interviewees emphasized that core emergency procedures must be performed accurately and automatically, even in physically and environmentally challenging conditions. An emergency physician reported that although students can recall the procedural steps of cardiopulmonary resuscitation (CPR), they often fail to maintain adequate compression depth in unstable environments, such as inside an ambulance. These findings underscore the importance of procedural automaticity and environmental adaptability when performing technical skills under pressure.

Theme 3: Deficiencies in structured interprofessional communication during high-stress situations: Several participants reported difficulties in effective communication among healthcare providers during high-acuity scenarios. Students often struggled to convey patient conditions clearly and systematically using standardized tools such as SBAR. A senior nurse illustrated this issue: “If the nurse cannot report the rhythm clearly during ventricular fibrillation, the physician cannot deliver defibrillation in time.”

This highlights the need to strengthen structured communication and interprofessional coordination

competencies within the framework, particularly in time-critical situations.

Table 1: Qualitative themes and derived competency domains

Theme	Key issues identified	Representative evidence	Derived competency domain
Theory–practice gap in situational application	Difficulty in applying theoretical knowledge in real-life emergency situations; “freezing” behavior	Students often freeze when encountering real-life emergency scenes (nurse manager)	Situational awareness and contextual decision-making
Requirement for automaticity in technical skills	Inconsistent performance of CPR and other procedures under environmental stress	Failure to maintain compression depth in unstable ambulance conditions (emergency physician)	Environmental adaptability and procedural automaticity
Deficiencies in structured communication	Ineffective use of SBAR and poor clarity in critical communication	Cannot report rhythm clearly during ventricular fibrillation (senior nurse)	Structured interprofessional communication

3.5. Delphi results

The Delphi consultation demonstrated acceptable consistency among experts regarding the proposed competency framework. As shown in Table 2, all first- and second-level indicators received high importance ratings, with mean scores ranging from 4.66 to 4.94. At the first level, Professionalism and Reflective Growth (D) received the highest importance rating (4.94 ± 0.22), followed by Collaboration, Communication, and Coordination (C) (4.87 ± 0.27), Professional Knowledge and Situational Awareness (A) (4.71 ± 0.59), and Clinical Judgment and Technical Skills (B) (4.66 ± 0.44). The full-score rates for first-level indicators ranged from 94.2% to 100%, and the CVs ranged from 0.026 to 0.080, indicating a relatively high concentration of expert ratings. At the second level, all subdomains were rated highly, with mean scores ranging from 4.86 to 4.90. Condition Analysis and Decision-making (A2) and Emergency Psychological Adjustment (D1) had the highest mean scores (4.90), while Life-support and Operational Skills (B1) and Information Communication and Task Coordination (C2)

achieved full-score rates of 100%. CVs for second-level indicators ranged from 0.003 to 0.080, indicating low variability in expert ratings.

3.6. Mapping of competencies based on the Dreyfus model

Based on the Dreyfus skill acquisition model, the competency indicators identified in this study were further mapped onto five developmental stages (novice to expert) (Table 3). Undergraduate nursing students are primarily expected to achieve competencies in the novice-to-competent stages. Early-stage competencies primarily involve rule-based knowledge application and basic skill execution, whereas higher-level competencies reflect the development of clinical judgment, coordination, and adaptive decision-making abilities. The mapping of competency indicators to the Dreyfus stages was conducted by the research team as a theory-driven interpretation based on each indicator's characteristics and was not part of the Delphi expert rating process.

Table 2: Results of the second round of expert consultation

First level	Second level	Importance (x±s)	Full-score (%)	CV
A	Professional knowledge and situational awareness	4.71 ± 0.59	96.2	0.041
A1	Basic assessment and risk judgment	4.86 ± 0.34	98	0.030
A2	Condition analysis and decision-making	4.90 ± 0.34	99	0.030
B	Clinical judgment and technical skills	4.66 ± 0.44	95.6	0.003
B1	Life-support and operational skills	4.89 ± 0.34	100	0.030
B2	Trauma and emergency management	4.86 ± 0.37	98	0.045
C	Collaboration, communication, and coordination	4.87 ± 0.27	94.2	0.026
C1	Teamwork and role awareness	4.87 ± 0.34	99	0.045
C2	Information communication and task coordination	4.89 ± 0.37	100	0.045
D	Professionalism and reflective growth	4.94 ± 0.22	100	0.080
D1	Emergency psychological adjustment	4.90 ± 0.34	98	0.030
D2	Humanistic care and ethics	4.86 ± 0.35	99	0.035
D3	Self-directed learning and reflection	4.87 ± 0.36	100	0.041

Table 3: Mapping of prehospital emergency competencies to the Dreyfus skill acquisition model

Dreyfus stage	Characteristics	Corresponding indicators in the framework
Novice	Rule-based performance; relies on protocols; limited situational awareness	A1: Identify hazards; assess environment safety; collect patient information; prioritize risks B1: Perform BLS; recognize arrest; follow resuscitation procedures
Advanced beginner	Recognizes meaningful aspects of situations; begins to apply knowledge in context	A2: Identify critical signals; apply assessment models B2: Manage common emergencies; execute interventions under supervision
Competent (core level for undergraduates)	Able to plan, prioritize, and make decisions; improved organization	A2: Develop interventions and determine priorities B1/B2: Evaluate outcomes and adjust procedures C1: Clarify roles; cooperate with team members C2: Use SBAR; coordinate tasks
Proficient	Holistic understanding; perceives situations intuitively; flexible decision-making	A2: Adjust decisions dynamically C2: Adjust task allocation based on the situation C1: Provide risk alerts and support team workflow
Expert	Intuitive, experience-based performance; reflective and adaptive	D1–D3: Psychological adjustment; humanistic care; reflection; continuous learning and improvement

4. Discussion

4.1. Theoretical knowledge

Prehospital emergency care is a knowledge-intensive and time-sensitive environment that requires rapid recognition of clinical cues and prompt decision-making. Indicators such as identifying critical signs, interpreting changes in vital signs, and quickly screening for life-threatening conditions were rated highly by experts, highlighting the importance of knowledge that can be readily applied in clinical decision-making rather than passively memorized. This finding aligns with previous research demonstrating that the ability to translate knowledge into immediate action is a key determinant of successful basic life-support (BLS) and advanced life-support (ALS) training (Allen et al., 2013).

Unlike traditional knowledge-oriented curricula, which focus primarily on content acquisition, the developed framework emphasizes the functional application of knowledge to support clinical judgment. According to the Dreyfus skill acquisition model, undergraduate nursing students are typically in the novice to advanced beginner stages, where structured, rule-based knowledge is essential for fostering early clinical reasoning and supporting the development of prehospital emergency competencies.

4.2. Integration with the Dreyfus model

The Dreyfus skill acquisition model served not only as a theoretical framework but also as a lens for interpreting the progression of prehospital emergency competencies in this study. The identified competency structure clearly aligns with the staged characteristics of skill acquisition. Specifically, basic assessment and procedural execution competencies correspond to the novice and advanced beginner stages respectively, whereas competencies related to prioritization, team coordination, and structured communication align with the competent stage.

This staged progression aligns with previous research indicating that clinical competency evolves from rule-based performance to integrated, context-sensitive decision-making. Moore et al. (2026) developed a competency progression rubric for nurse practitioners based on staged skill acquisition, emphasizing the need to align competency expectations with learners' developmental levels. Similarly, Gilliland (2025) reported that skill acquisition among birth doulas progresses from task-oriented performance to intuitive, experience-based practice, supporting the applicability of the Dreyfus model across diverse healthcare roles.

Competencies related to adaptive decision-making and dynamic task coordination reflect progression toward proficiency, whereas reflective learning and professional development indicate the trajectory toward expertise. Given the educational level of undergraduate nursing students, the

framework primarily targets the novice-to-competent stages. The inclusion of higher stages reflects the developmental direction of competency acquisition rather than expected outcomes, thereby ensuring both theoretical completeness and practical relevance.

4.3. Professional technical skills

Evidence from randomized controlled trials indicates that structured skills training, including BLS, ALS, and trauma assessment, substantially improves learning outcomes (Issleib et al., 2021; Koyuncu et al., 2024). However, unlike existing studies that treat technical proficiency as an isolated outcome, the developed framework integrates technical skills with decision-making and situational awareness, reflecting a more comprehensive competency structure.

According to the Dreyfus skill acquisition model, undergraduate nursing students have not yet reached intuitive performance. Therefore, structured practice combined with timely feedback is essential to progress toward competence. These findings suggest that prehospital emergency education should extend beyond repetitive skills training to include integrated simulation-based learning that combines technical execution with contextual decision-making.

The implementation of low-discrepancy simulation scenarios and short-cycle feedback is consistent with international recommendations and may accelerate skill acquisition. Conversely to traditional curricula that emphasize procedural repetition, the developed framework emphasizes the application of technical skills within complex clinical contexts, promoting the development of clinical reasoning, adaptability, and decision-making under realistic conditions.

4.4. Collaboration and communication

All indicators within the collaboration and communication domain were rated as highly important and demonstrated acceptable consensus among experts, underscoring the central role of teamwork, communication, and coordination in prehospital emergency care. This finding aligns with existing evidence indicating that non-technical skills contribute as significantly as technical skills to clinical performance outcomes (Herzberg et al., 2019).

Unlike previous frameworks that consider communication as a supplementary competency, this study emphasizes collaboration and communication as core components of prehospital emergency competence. According to the Dreyfus skill acquisition model, progression to the competent stage requires managing multiple variables and coordinating tasks effectively, which is contingent on well-developed communication skills.

The integration of structured communication tools, such as SBAR, further enhances the practical

applicability of the framework (Randmaa et al., 2014). Rather than providing general communication training in isolation, this framework embeds communication within task coordination and clinical workflow, reflecting real-world practice demands. These findings support incorporating teamwork and communication training into core undergraduate nursing curricula rather than treating them as optional elements.

4.5. Personal qualities

Indicators related to psychological adjustment, humanistic care, and reflective learning were rated highly by experts, indicating that prehospital emergency competence encompasses not only technical and cognitive skills but also professional identity development and self-regulation. Previous studies have emphasized that emotional regulation and ethical awareness are critical upstream factors that influence safe clinical practice (Chatzidimitriou et al., 2025; Kharatzadeh et al., 2020).

Unlike traditional competency frameworks that emphasize observable technical skills, the developed framework explicitly incorporates reflective and affective dimensions, highlighting their importance for long-term professional development. The Dreyfus skill acquisition model suggest that progression from novice-to-competent involves not only skill acquisition but also the cultivation of self-regulation and informed clinical judgment.

Therefore, integrating structured reflection and after-action review (AAR) into training programs is essential. Empirical evidence indicates that mandatory AAR following simulation exercises improves risk recognition and decision-making in subsequent scenarios (Copper et al., 2020; Guerrero et al., 2022). By embedding these elements, the framework extends beyond immediate performance outcomes and supports sustained development of prehospital emergency competencies.

4.6. Limitations

This study has some limitations. First, all experts were recruited from tertiary hospitals in Guangdong Province, China, which may limit the generalizability of the findings to other regions and healthcare settings. Second, the composition of the expert panel was uneven, with a predominance of nursing management experts, which may have influenced the emphasis on certain indicators. Furthermore, the mapping of competency indicators to the Dreyfus stages was a theory-driven interpretation rather than based on expert consensus, which may introduce subjectivity.

5. Conclusion

Based on the Dreyfus model, literature review, interviews, and a two-round Delphi consultation, this study constructed a competency framework for

undergraduate prehospital emergency nursing encompassing the following:

- Professional knowledge and situational awareness
- Clinical judgment and technical skills
- Collaboration, communication, and organizational coordination
- Professionalism and reflective growth

The framework comprises 4 first-level, 9 second-level, and 28 third-level behavioral indicators, demonstrating high content validity and practical applicability for curriculum integration. Future studies should develop quantitative assessment tools, conduct psychometric validation, and implement multicenter intervention trials to further examine the generalized ability of the framework.

List of abbreviations

AAR	After-action review
ALS	Advanced life support
BLS	Basic life support
CNKI	China National Knowledge Infrastructure
CPR	Cardiopulmonary resuscitation
Cr	Authority coefficient
CV	Coefficient of variation
SBAR	Situation, background, assessment, recommendation
SPSS	Statistical package for the social sciences
VIP	Chinese science and technology journal database

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Compliance with ethical standards

Ethical considerations

This study was approved by the Ethics Committee of the Ethics Review Committee of St. Paul University Manila (Approval No.2026-054-IDA-CNAHS). All participants were informed of the purpose and procedures of the study, and written informed consent was obtained prior to participation. Participation was voluntary, and confidentiality and anonymity were ensured throughout the study process.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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