Development and Application of an Emergency Skills Training Program for Primary Care Nurses Based on the ADDIE Model in the Context of a Medical Consortium

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Abstract [**Objectives**] To develop an emergency skills training program for primary care nurses based on the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model and to validate its effectiveness within the context of a medical consortium. [**Methods**] A mixed-methods design was employed to develop the training program, incorporating a cross-sectional survey (n =318), semi-structured interviews (n =15), and a Delphi expert consultation (n =15). Besides, a quasi-experimental study design was adopted. A total of 126 primary care nurses from the medical consortium who met the eligibility criteria were enrolled. The six-month training program was implemented, and changes in emergency competence, self-efficacy, core competence, as well as first-aid knowledge and skills were compared before and after the training. [**Results**] The developed training program was comprised of five modules encompassing 23 core components. The expert authority coefficient (Cr) was 0.877, and the Kendall's coordination coefficient (W) was 0.362 (P <0.001). After the intervention, the nurses' total emergency competence score significantly increased from (90.12 ± 14.85) points to (118.67 ± 11.23) points (t = -18.742, P <0.001). Their self-efficacy score rose from (25.31 ± 5.67) points to (29.84 ± 4.12) points (t = -8.912, P <0.001). The total core competence score improved from (198.45 ± 28.34) points to (235.76 ± 22.15) points (t = -13.565, P <0.001). The pass rate for the first-aid theory assessment increased from 45.24% to 89.68% (χ^2 =55.632, P <0.001), and the pass rate for the operational skills assessment increased from 38.10% to 85.71% (χ^2 =61.274, P <0.001). [**Conclusions**] The training program constructed based on the ADDIE model can systematically improve the emergency competence, self-efficacy, and core competencies of primary care nurses, providing an actionable practical model for implementing standardized emergency training within the medical consortium.

Key words ADDIE (Analysis, Design, Development, Implementation, Evaluation) model, Primary case nurses, Emergency competence, Training program, Medical consortium

1 Introduction

With the progressive implementation of the hierarchical diagnosis and treatment system, the role of primary healthcare institutions in the emergency medical service system has become increasingly prominent. As the "first responders" in pre-hospital emergency care, primary care nurses' emergency competency directly influences the treatment outcomes and clinical prognoses of critically ill patients[1]. However, a substantial body of research[2] indicates that the emergency competency of primary care nurses in China remains generally inadequate, manifested primarily by delayed knowledge updates, non-standardized operational skills, and weak emergency response capabilities. One significant contributing factor to this situation is the lack of a systematic, standardized, and context-appropriate training system tailored to primary care settings. Instructional design models offer a theoretical framework for the development of such training programs. The ADDIE (Analysis, Design, Development, Implementation, Evaluation) model[3], as a classic systematic instructional design framework, emphasizes the primacy of needs analysis and ensures training effectiveness through closed-loop design and continuous evaluation. In the field of nursing education, the ADDIE model has been demonstrated to enhance the scientific rigor and practical effectiveness of training programs[4]. However, research on its systematic application to emergency competency training for primary care nurses, particularly within the organizational context of a medical consortium, remains scarce. This study, based on a county-level medical consortium platform and guided by the logical framework of the ADDIE model, aims to develop a context-specific emergency competency training program for primary care nurses and to empirically evaluate its implementation outcomes. The findings are expected to provide scientific evidence for improving emergency service capacity at the primary care level.

2 Data and methods

2.1 Research object We conducted a three-phase mixed-methods study. Phase I: We performed a cross-sectional survey using convenience sampling from December 2024 to February 2025, enrolling registered nurses from 13 primary care facilities within the Zizhong County People's Hospital medical consortium. Eligible participants had a valid nursing license, ≥1 year of work experience, and provided informed consent. Following sample size calculation, we distributed 336 copies of questionnaires and obtained 318 valid responses (response rate: 94.6%). Phase II:

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We then purposively selected 15 nurses to participate in semi-structured in-depth interviews, continuing until data saturation was achieved. Phase III: Finally, we employed a quasi-experimental pretest-posttest design. From the survey cohort, we used convenience sampling to recruit 126 nurses who volunteered and committed to completing the full training program.

2.2 Intervention methods

2.2.1 Program development phase. Based on the ADDIE model, the training program was developed through the following steps:

Analysis phase: A mixed-methods approach was employed. A cross-sectional survey was conducted using the General Information Questionnaire for Primary Care Nurses and the Clinical Emergency Competence Assessment Scale for Non-Emergency Department Nurses developed by Zhao Junzhu *et al.* [5] (Cronbach's α = 0.927). Concurrently, semi-structured interviews were carried out to identify training needs.

Design and development phase: Drawing on the analysis findings, a preliminary training framework was formulated and subsequently refined through two rounds of Delphi expert consultation (expert authority coefficient = 0.877). The finalized training program comprised five core modules: (i) Fundamentals of Emergency Theory and Assessment; (ii) Cardiopulmonary Resuscitation and Defibrillation; (iii) Management of Common Acute Conditions; (iv) Emergency Equipment and Team Collaboration; and (v) Psychological Response and Communication in Emergencies. A blended training model was adopted, consisting of online theory (24 credit hours), offline workshops (16 credit hours), and practical guidance (8 credit hours).

2.2.2 Program implementation phase. A standardized six-month training program was implemented for 126 participants. Organized by the lead hospital of the medical consortium, the training adopted a multimodal teaching approach: self-paced online modules were delivered via the "DingTalk" platform; monthly in-person workshops focused on hands-on skills and high-fidelity scenario simulations; practical guidance was provided through regular visits by lead trainers from the coordinating hospital to primary care facilities.

2.2.3 Quality control. A three-level verification system was implemented: learning progress was monitored daily by institutional nursing managers; the research team conducted weekly random checks of learning records; and an online assessment was held monthly. Individualized guidance was offered to participants who did not pass.

2.3 Observation indicators We assessed the intervention effects at two time points: prior to training (T0) and after its conclusion (T1).

2.3.1 Primary outcome indicators. Emergency competence: Assessed using the Chinese version of the Clinical Emergency Competency Assessment Questionnaire for Non-Emergency Nurses, adapted by Zhao Junzhu *et al.* [5]. This 28-item self-report instrument covers five domains: emergency knowledge (7 items: pathophysiology, identification, and management of common emergencies); emergency skills (7 items: CPR, defibrillation, airway management, *etc.*); emergency response (5 items: rapid assessment, priority setting, clinical judgment); communication and coordination (5 items: interaction with patients, families, and team members); and humanistic care (4 items: psychological support and empathy). Items are rated on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree), yielding a total score of 28 – 140, with higher scores reflecting greater overall emergency capability. Psychometric evaluation of the original scale showed strong reliability and validity: Cronbach's α = 0.927, test-retest reliability = 0.977, and dimension-total correlations ranging from 0.534 to 0.947.

2.3.2 Secondary Outcome Indicator. Self-efficacy: Measured using the Chinese version of the General Self-Efficacy Scale (GSES), translated and revised by Wang Caikang *et al.* [6]. This 10-item scale assesses an individual's overall confidence in coping with a wide range of challenging situations. A 4-point scoring system is adopted (1 = not at all true, 4 = exactly true), with total scores ranging from 10 to 40 points. A score $\geqslant$30 points indicates high self-efficacy, 20 – 30 moderate self-efficacy, and $<$20 low self-efficacy. The Chinese version of the scale has demonstrated good reliability and validity, with a Cronbach's α coefficient of 0.87.

Core competence: We used the Community Nurse Core Competence Scale, developed by Chen Yanyan *et al.* [7]. This 56-item scale comprises five dimensions: community nursing practice (28 items), communication and coordination (10 items), legal and ethical practice (8 items), critical thinking (5 items), and professional development (5 items). Each item is scored on a 5-point Likert scale (1 = no ability, 5 = high ability), with total scores ranging from 56 to 280. The scale has a content validity index of 0.812 and a Cronbach's α of 0.917, indicating strong validity and reliability. It is well-suited for assessing the comprehensive professional competence of primary care nurses.

Emergency knowledge level: Assessed with a standardized written examination developed in accordance with the *2020 American Heart Association Guidelines for CPR and Emergency Cardiovascular Care* and the course curriculum. The test was scored out of 100 and comprised 40 single-answer multiple-choice items (60 points) and 5 case-analysis questions (40 points), encompassing all key training modules. The passing score was established at 60 points.

Emergency skills: Assessed using an objective structured clinical examination (OSCE). Five stations were established: cardiopulmonary resuscitation (CPR) and automated external defibrillator (AED) use; adult airway management and oxygen therapy; wound hemostasis, bandaging, and immobilization; intravenous access establishment and emergency medication administration; and comprehensive scenario simulation (management of a patient with chest pain). Each station employed a standardized scoring sheet (100-point system), and evaluations were conducted

by trained examiners based on operational procedure, standardization, and timeliness. A score of 80 points was set as the passing standard.

2.4 Statistical method We analyzed the data using SPSS version 22.0. Continuous variables were expressed as mean ± standard deviation and compared between pre- and post-training time points using paired *t*-tests. Categorical variables were presented as frequencies and percentages and analyzed with the *chi*-square test. A *P*-value less than 0.05 was considered statistically significant.

3 Results and analysis

3.1 Results of training program construction A systematic training program was developed through two rounds of Delphi expert consultation. The positive coefficient of experts was 100%, the authority coefficient was 0.877, and after the second round of consultation, Kendall's coefficient of concordance was 0.362 ($\chi^2 = 145.632$, $P < 0.001$), indicating that expert opinions had reached a high level of consensus and coordination. The finalized training program consisted of 5 core modules and 23 specific training items, as detailed in Table 1.

Table 1 Training program for emergency competence of primary care nurses based on ADDIE Model

Phase	Core module	Main contents	Credit hours	Form	Evaluation methods
Online theory	Module 1: First Aid Basics	Recognition of common emergencies, primary assessment, first aid principles	8	PPT → Video Lectures, PPT	Online test
	Module 2: Core Skills	CPR, defibrillation, airway management, hemostasis & bandaging	10	Animated Demonstrations, Case Analysis	Unit test
	Module 3: Emergency Management	Team collaboration, communication skills, psychological adjustment	6	Scenario Videos, Audio Narration	Case study report
Offline workshop	Skills Practice	Hands-on practice: CPR & defibrillation, IV line establishment, team drills	12	Manikin Training, Role-Playing	Operation assessment list
	Comprehensive Scenario Simulation	Management of comprehensive scenarios (chest pain, stroke, trauma, *etc.*)	4	High-Fidelity Simulation, Group Discussion	OSCE assessment
Practical guidance	Clinical Shadowing	Emergency department observation, case discussions, bedside teaching	8	Preceptorship, Bedside Teaching	Clinical supervisor evaluation

3.2 Comparison of indicators before and after intervention A total of 126 nurses completed the full training and assessment. Changes in first aid capability, self-efficacy, and core competencies are shown in Table 2. After the training, the total score and all subscale scores of first aid capability, self-efficacy score, and total score of core competencies increased significantly compared with those before the training ($P < 0.001$). The pass rates of both the theoretical examination and skills assessment in first aid were significantly higher after the training than before ($P < 0.001$), as presented in Table 3.

Table 2 Comparison of first aid capability, self-efficacy, and core competency scores before and after training ($n = 126$)

Indicator	Before training (T0)	After training (T1)	t	P
Total score of first aid competency	90.12 ± 14.85	118.67 ± 11.23	−18.742	<0.001
First aid knowledge dimension	17.23 ± 3.45	24.56 ± 2.78	−19.234	<0.001
First aid skill dimension	16.89 ± 3.67	25.12 ± 2.89	−20.145	<0.001
Emergency response dimension	18.45 ± 3.12	24.78 ± 2.45	−17.892	<0.001
Communication and coordination dimension	19.23 ± 3.45	23.45 ± 2.67	−12.345	<0.001
Humanistic care dimension	18.32 ± 3.21	20.76 ± 2.34	−7.234	<0.001
Self-efficacy score	25.31 ± 5.67	29.84 ± 4.12	−8.912	<0.001
Total score of core competencies	198.45 ± 28.34	235.76 ± 22.15	−13.565	<0.001

Table 3 Comparison of pass rates of the theoretical and skills assessments in first aid before and after training [n(%)]

Assessment item	Before training (T0)	After training (T1)	χ^2	P
Pass the theoretical examination	57 (45.24)	113 (89.68)	55.632	<0.001
Pass the skill examination	48 (38.10)	108 (85.71)	61.274	<0.001

4 Discussion

4.1 The training program based on the ADDIE model demonstrates systematicity and scientific rigor This study strictly followed the five phases of the ADDIE model to develop a systematic training program[8]. During the analysis phase, a combination of quantitative and qualitative methods was used to accurately identify the core problems in grassroots nurses' first aid capabilities, namely "weak skills and insufficient emergency response," and their genuine needs, specifically "desire for hands-on training and need for continuous support," thereby ensuring the targeted nature of the training. This aligns with the principle of prioritizing needs assessment emphasized by Sun Haolin *et al.*[9]. In the de-

sign and development phase, two rounds of Delphi expert consultations were conducted to ensure that the program content not only conformed to international first aid guideline standards but also closely matched the actual work scenarios at the grassroots level. The expert authority coefficient reached 0.877, and the coordination coefficient was significant ($P<0.001$), indicating high content validity and a high degree of expert consensus for the program. The final three-phase blended training model of "theory-practice-application" effectively integrated multiple teaching methods, catering to the characteristics of adult learning and the realities of grassroots work[10].

4.2 The training program comprehensively enhances the overall competence of grassroots nurses This study shows that the training program based on the ADDIE model significantly improves grassroots nurses' first aid capability, self-efficacy, and core competencies. The total score of first aid capability increased significantly, with the most notable improvements in the previously weak dimensions of "first aid skills" and "emergency response". This is mainly attributed to the high proportion of hands-on practice and high-fidelity scenario simulation sessions in the program. Through repeated skill training and near-real emergency scenario drills, nurses' procedural accuracy, decision-making speed, and teamwork abilities were effectively honed, which aligns with the findings of Al-Ghareeb *et al.*[11] that simulation training significantly improves clinical skills.

The simultaneous improvement in self-efficacy and core competencies is a key finding of this study. Self-efficacy is the intrinsic motivation driving behavioral change[12]. The significant increase in self-efficacy after training may be closely related to nurses' experiences of successfully managing complex cases and receiving positive feedback during simulation training[13]. In addition, the overall enhancement of core competencies, particularly in communication, coordination, and professional development, indicates that this program not only cultivates nurses' "hard skills" but also strengthens their "soft power" as professionals, which is consistent with the trend in modern nursing education that emphasizes comprehensive competency development.

4.3 The medical consortium model provides critical support for training implementation This study was carried out within the framework of a county-level medical consortium, which contributed to training implementation in three key ways. First, it enabled resource integration: central hospitals shared experienced instructors, simulation equipment, and pedagogical management expertise, thereby ensuring training consistency and quality. Second, it facilitated top-down coordination: an online platform overcame geographic and scheduling limitations, while periodic in-person follow-up guidance resolved field-level difficulties, thereby establishing an integrated "learning-practice-application" continuum. Third, it fostered sustainability: by incorporating the training program into the consortium's standing agenda, a durable professional development mechanism for grassroots nurses was created[14]. This model answers the national initiative to redirect premium medical resources to community settings and presents a transferrable strategy for other localities[15].

4.4 Limitations and prospects of this study As a single-center quasi-experimental investigation, this study was limited by the absence of a randomized controlled design and the lack of long-term outcome data. Subsequent research should consider multi-center randomized controlled trials with prolonged follow-up to assess the enduring efficacy of the intervention. In addition, the development of incentive structures that integrate training achievements into performance evaluation and promotion pathways warrants further investigation, in order to sustain and enhance professional competencies over time.

5 Conclusions

This study successfully developed a systematic and scientifically grounded first aid training program for grassroots nurses operating within a medical consortium, following the ADDIE instructional design model. The empirical results demonstrated significant gains in the participants' first aid capability, self-efficacy, and core competencies. The study thus confirms the viability and efficacy of a blended learning approach, informed by systematic instructional design and implemented within a medical consortium framework. It contributes both theoretical and practical foundations for the standardized cultivation of first aid professionals in primary healthcare institutions and carries positive implications for strengthening community-level emergency response systems.

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