Health Technol Assess Action 2026;10(1):29-37
doi:10.18502/htaa.v10i1.21563
https://htainaction.tums.ac.ir

Health Technology Assessment in Action

Original Article

Prioritizing Competencies of Nurses by a New Fuzzy Method: A Case Study on Hospital Emergency Wards

Jahanara Mamikhani[1,2], **Shahram Tofighi**[3,4*], **Yasaman Alikhani**[3]

[1]Department of Economics, Faculty of Economics and anagement, Khomeinishahr Branch, Islamic Azad University, Khomeinishahr, Iran
[2]Iran Health Management Association, Tehran, Iran
[3]Health Insurance Research Center (HIRC), Tehran, Iran
[4]Academy of Medical Sciences of the Islamic Republic of Iran, Tehran, Iran

***Corresponding Author:** Shahram Tofighi, Email: shr_tofighi@yahoo.com

Abstract

Introduction: Core nursing competencies refer to the effective application of a person's combination of knowledge, skills, and judgment in job. This study aimed to determine the essential competencies of nurses working in hospital emergency wards, considering the characteristics of the emergency workplace, using a new approach.

Methods: A mixed-method study was conducted in 2023. Twenty-two experts were organized into two groups of five and two groups of six. Then, qualitative approaches were employed to collect data. Group brainstorming sessions identified the list of essential competencies and characteristics of the emergency workplace, while focus group discussions were used to finalize them. Ultimately, a fuzzy pairwise comparison matrix was applied using MATLAB 23.1 to weight and prioritize the competencies.

Results: Eleven key items emerged as the main characteristics of the workplace, while thirteen were identified as the essential competencies of nurses in the emergency ward. The "unpredictability of clients" and "high levels of team discipline and autonomy" were rated as the most important workplace features. In terms of nursing competencies, "high scientific abilities and skill capacities in managing diverse care situations from infancy to elderly" also received the highest score. When incorporating the workplace characteristics into the evaluation, "speed of action, professionalism, and coordination" notably ascended to the top rank, while "responsibility" dropped to fourth.

Conclusion: The characteristics of the workplace represented a more realistic rank of nurses' competencies. Accordingly, emergency department nurse staff should be selected and evaluated based on competencies adapted to the characteristics of the workplace.

Keywords: Clinical competence, Nurses, Hospital emergency services, Hospital, Workplace environment, Fuzzy logic, Iran

Received: October 2, 2025, **Revised:** November 1, 2025, **Accepted:** November 20, 2025 **ePublished:** Mar 29, 2026

Introduction

Despite substantial research into the clinical competencies of nurses, significant gaps persist in the literature. Remarkably, most studies have used traditional qualitative and quantitative methods to evaluate competencies without addressing the complex and dynamic demands of hospital emergency wards. Moreover, while fuzzy pairwise comparison methods have emerged as promising tools for decision-making, their application in prioritizing the nuanced competencies required for emergency nursing remains limited. Therefore, this study aims to bridge these gaps by introducing a novel fuzzy method that captures the multidimensional nature of clinical performance and contextualizes it within the high-pressure environment of emergency care.

The clinical competence of health-related professionals is now attracting more attention than ever before due to rapid advancements in health monitoring systems, the necessity to offer safe and cost-effective services, the growing awareness of individuals in the community regarding health-related matters, and the rising demand for high-quality services. Additionally, healthcare organizations are increasingly inclined to utilize skilled workforce, further emphasizing the significance of clinical competence in the field (1). Emergency nursing is a highly specialized field which involves providing specialized care to patients in the critical stages of illness or injury across various age groups. This type of nursing primarily focuses on the severity of the condition and the critical timing for interventions. It is noteworthy that emergency nursing has an episodic, primary, and usually acute nature. It is not limited to the emergency ward and can occur in various healthcare settings. Emergency nurses possess several key characteristics that set them apart in their field, including a significant level of autonomy, the capacity to take proactive measures and prioritize care, and the ability to effectively educate patients and their companions. In addition, emergency nurses demonstrate excellent collaboration with the treatment team (2). Taking into account the significant sensitivity and critical nature of work in emergency settings, numerous studies have explored effective strategies for compensating and

© 2026 Tehran University of Medical Sciences. This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International license (https://creativecommons.org/licenses/by-nc/4.0/). Noncommercial uses of the work are permitted, provided the original work is properly cited.

motivating emergency nurses. For example, Mamikhani et al examined various methods of compensation for this group of nurses (3).

According to the International Council of Nurses, core nursing competencies encompass the proficient use of a combination of knowledge, abilities, and judgments related to one's daily practices or job performance (4, 5). The core competencies of emergency nurses, as defined by the American Emergency Nurses Association, include various skills and abilities, such as the provision of direct nursing care (the ability to provide actual nursing care), counseling (the ability to assess cases), and system leadership (creating conditions that enable individuals to reach their full potential). Other skills and abilities are collaboration (the ability to work effectively in a team), coaching (the ability to transfer knowledge to those who do not have it), research (the ability to contribute to the advancement of knowledge, concepts, management, and processes) and ethical decision making/ethical agency/ support (the ability to make ethical decisions or alleviate a challenging ethical predicament) (4). According to the framework presented by Lewandowski and Adaml, these competencies include (a) Overseeing the care management of patients with multiple issues and/or vulnerability, (b) providing instruction and assistance to staff members in various disciplines, and (c) Promoting innovations and facilitating changes within healthcare systems (6).

Bahreini et al have highlighted the competence of nurses in the judicious use of technical skills, communication, knowledge, clinical reasoning, emotions, and values within the clinical setting. According to this definition, a competent individual is deemed capable of fulfilling a position or a series of professional responsibilities at a suitable level, grade, and quality (7). Alexander and Runciman emphasized that nursing competency is a reflection of a combination of (1) knowledge, comprehension, and judgments, (2) a variety of cognitive, technical, or psychomotor and interpersonal skills, and (3) a range of personal characteristics and attitudes (8).

A quantitative and comparative study was performed in the United Kingdom to evaluate the clinical competence of 80 nurses who took part in two distinct training programs. The results revealed a statistically significant difference in clinical competence between these two groups right after graduation, as well as at the 6-month and 12-month marks (9). In a separate study conducted to explore potential factors influencing the competency levels of emergency nurses in China, it was revealed that emergency nurses who possessed work experiences and expressed job satisfaction achieved higher scores. These scores were found to be positively correlated with age, years of work, and the general self-efficacy scale (6).

By assessing the competence of nurses in various groups, Safadi et al recommended that nursing employment policies should prioritize individual competences rather than inherent characteristics (10).

Holanda et al established professional competency profile for emergency nurses by utilizing the Brazilian competency matrix aligned with current market trends, emergency nursing characteristics, previous studies, and the opinions of experts who evaluated the appropriateness of the measures taken for nurses' satisfactory performance in this field. They concluded that the detailed description of competence levels considerably aids nurses in attaining the desired level of excellence through practice (11).

Various studies have assessed clinical competencies, employing a self-assessment approach. Najafi Ghezeljeh et al investigated the competencies of emergency nurses in terms of patient safety and recommended regular evaluations of these competencies (12). Likewise, Lakanmaa et al identified the primary skills required by nurses in specialized care units in Finland, with collaboration being highlighted as the most crucial competency (13). The findings of another study conducted by Adib Hajbaghery and Eshraghi Arani revealed a positive correlation between the level of competency application and clinical competence (14). Furthermore, Khodadadi and Salehi reported a correlation between the level of clinical competence and the organizational commitment of nurses by means of self-assessment (15), while Bahreini et al utilized this approach to evaluate the competence of nurses in an educational hospital (7).

Similarly, Coll-Badell et al conducted a thorough analysis of nurses' qualifications in interpreting electrocardiograms. This examination involved a questionnaire that consisted of both theoretical and practical questions related to reading electrocardiograms. Based on their findings, there was no notable disparity between the experience of nurses and the type of hospital in terms of the scores obtained by emergency nurses. However, it was observed that nurses who had received training within the last year achieved significantly higher scores compared to those who had more than 5 years of training. Accordingly, it was recommended that refresher courses be organized for emergency nurses at least once every 5 years (16). Moreover, Noviyanti et al conducted an analytical observational study in the hospital emergency room to investigate the correlation between nurses' knowledge, skills, and pharmaceutical principles. The concluded that a significant number of emergency room nurses possessed commendable knowledge and skills in correctly applying the principles of drug administration. However, the majority of them faced challenges in accurately calculating medication dosages (17).

Numerous studies have utilized a questionnaire and a 5-part Likert-type scale to evaluate nurses' necessary skills and abilities in different domains. For instance, Kirpik and ÇETİN conducted a study aiming to establish a positive and significant linear correlation between communication and knowledge sharing levels, and the organizational ambidexterity levels of nurses. The findings, derived from working in several Turkish university hospitals, indicated that enhancing communication and information sharing can effectively promote organizational ambivalence behavior among nurses, thereby contributing to the improvement of organizational performance, service

quality, and the coordination of nursing staff with management (18).

Park et al assessed overall traits, communication abilities, self-efficacy, and job contentment, revealing a positive association among the targeted factors (19). In a comprehensive analysis, Sanjana et al scrutinized articles centered on the proficiency of nurses operating in pre-hospital emergency settings. These proficiencies were classified into knowledge, attitude, and skill groups, with corresponding topics identified for each category (20).

Different studies have attempted to identify the competencies required by nurses worldwide. However, limited research has focused on the competency profiles of nurses in different work settings. According to previous research, the effective delivery of healthcare services and the transparency of nurses' competencies are global challenges in both developed and developing countries. Additionally, environmental and organizational factors (e.g., educational resources, practical training, supervision, and quality control) can influence the clinical competence of nurses. Some studies have shown a direct relationship between the level of clinical competence and the frequency of using clinical skills; in other words, a nurse with a higher level of clinical competence tends to exhibit superior performance when attending to patients at their bedside (21). In this study, a novel approach is presented for identifying the fundamental competencies required by nurses. More precisely, the study delves into the specific competencies that should be taken into consideration for nurses operating in the emergency department of hospitals while also acknowledging the unique attributes of the work setting.

Methods

This cross-sectional, descriptive, and applied study was conducted in 2023. The research sample was selected using purposive sampling from hospital managers, nursing managers, emergency nurses, and emergency medicine specialists working in teaching hospitals with a capacity of 200 beds or more. In addition, the inclusion criteria required participants to have at least 10 years of hospital work experience and to be actively employed at the time of the study. On the other hand, individuals who were unwilling to participate in the in-person meeting were excluded from the study, which resulted in a final sample of 22 participants. A total of 22 experts were divided into 4 homogeneous groups (two groups of 5 people and two groups of 6 people). Qualitative methods, including brainstorming and focus group discussions, were employed to develop the lists of "essential competencies of nurses" and "the features of the emergency workplace environment" and finalize them. Next, the fuzzy pairwise comparison matrix was used to weight and prioritize competencies.

Using the brainstorming technique, two groups discussed on the "characteristics of the hospital emergency workplace environment", and two groups focused on the "qualifications of nurses working in the emergency ward" for 1.5 hours; two lists were developed accordingly. Then, during a one-hour meeting using the focus group discussion technique, the initial list of competencies of emergency nurses and the initial list of hospital emergency features were reviewed and approved in the first and second groups, respectively (items with more than 80% agreement were included in the final lists).

Moving forward, the attendees individually completed the fuzzy pairwise comparison matrix, which determined the importance of factors included in the initial list for the competencies and features of the emergency environment. Several steps were taken to ascertain the weight and relative significance of each workplace characteristic and nurse competency in the emergency room:

Step 1: *Preparing the Matrix of Fuzzy Direct Relationships.* To analyze the internal relationships, experts were requested to conduct pairwise comparisons between the main factors, including the characteristics of the emergency workplace and the competencies of nurses in the emergency, individually. It should be noted that the comparisons were made based on the impact of factor *i*, with factor *j* being evaluated in the corresponding column. The positive phase numbers utilized for these comparisons are provided in Table 1. The primary objective of this initial step is to establish the primary direct relations matrix.

Step 2: *Forming the Normalized Matrix of the Direct Relations Matrix.* In this step, the CFCS method introduced by Aprikevich and Tzeng was used to normalize the direct relations matrix (22). The following relations were employed to form the normalized matrix of the direct relations matrix.

The triangular fuzzy number was considered $\tilde{w}_{ij}^{k} = (a_{1ij}^{k}, a_{2ij}^{k}, a_{3ijk}^{k})$ in which *K* is the expert.

$$xa_{1ij}^{k} = (a_{1ij}^{k} - \min a_{1ij}^{k}) / \Delta_{\min}^{\max}$$
$$xa_{2ij}^{k} = (a_{2ij}^{k} - \min a_{1ij}^{k}) / \Delta_{\min}^{\max}$$
$$xa_{3ij}^{k} = (a_{3ij}^{k} - \min a_{1ij}^{k}) / \Delta_{\min}^{\max}$$

$\Delta_{\min}^{\max} = \max a_{3ij}^{k} - \min a_{1ij}^{k}$ where

- Calculation of normal left (*ls*) and right (*rs*) values:

$$xls_{ij}^{k} = xa_{2ij}^{k} / (1 + xa_{2ij}^{k} - xa_{1ij}^{k})$$
$$xls_{ij}^{k} = xa_{3ij}^{k} / (1 + xa_{3ij}^{k} - xa_{2ij}^{k})$$

Table 1. Expression Variables and Corresponding Fuzzy Numbers

Expression Scale Values	Triangular Fuzzy Numbers
Very high impact	(0.75,1.0,1.0)
High impact	(0.5, 0.75, 1)
Equal impact	(0.25, 0.5, 0.75)
Low impact	(0, 0.25, 0.5)
Very low impact	(0, 0, 0.25)

- Estimation of the final definite normal value:

$$x_{ij}^{k} = [xls_{ij}^{k}(1 - xls_{ij}^{k}) + xrs_{ij}^{k}\, xrs_{ij}^{k}] / [1 - xls_{ij}^{k} + xrs_{ij}^{k}]$$

- Computation of definite values:

$$w_{ij}^{k} = \min a_{1ij}^{k} + x_{ij}^{k}\Delta_{\min}^{\max}$$

- Combination of definite values:

$$\tilde{w}_{j} = \frac{1}{k}(\tilde{w}_{ij}^{1} + \tilde{w}_{ij}^{2} + \tilde{w}_{ij}^{3} + \ldots\ldots + \tilde{w}_{ij}^{k})$$

Step 3: *Forming the Matrix of the Overall Relationship*. After obtaining the matrix of the combination of individuals' opinions (w) in the last step, Matrix *X* is as follows:

$$X = k.A$$

$$k = \frac{1}{\max\limits_{1 \le i \le n} \sum_{j=1}^{n} a_{ij}}, \quad i, j = 1, 2, \ldots\ldots, n$$

The general relationship matrix *T* was also calculated using the following relationship, where *I* denotes an identity matrix.

$$T = X\,(1 - X)^{-1}$$

Step 4: *Calculating the Weight of the Components*. Vector D is the name given to the sum of the elements in each row of matrix T. It represents the combined direct and indirect effects of the i^{th} criterion on the other criteria. The total effects are considered a measure of the element's importance. Subsequently, a two-dimensional matrix consisting of the competences and characteristics of the workplace environment was prepared. This matrix was then provided to the expert panel members, who discussed and presented arguments to determine which characteristics were relevant to the emergency workplace environment. The agreement of 80% of the panel members was obtained, and the corresponding cell in the competency-characteristic matrix was marked as necessary. As a result, some cells remained unmarked.

Afterward, the relative weight of the importance of the competence was multiplied by the relative weight of the emergency environment feature in order to determine the adjusted relative weight of emergency nurses' competence based on the relative weight of workplace environment feature. A new row was added to the last row of the matrix, and the sum of the numbers in the columns was inserted into it. These numbers were then normalized. This final number represents the overall adapted competencies of nurses for the characteristics of the emergency room workplace environment.

Moving on to the fourth step, the final table was shared with the panel members for their approval. The obtained data were entered using Excel 2019 software, and calculations were performed using MATLAB software, version 23.1.

Results

The expert group comprised 13 females and 9 males, with a mean age of 38.5 years (ranging from 32 to 45 years). Their work experience varied between 10 years and 22 years, with a mean (standard deviation) of 14.2 years (3.3). In terms of education, 8 held a PhD, 7 had a master's degree, and 7 possessed a bachelor's degree.

After the focus group discussion, 11 key elements were identified as the main characteristics of the emergency nurses' working environment. Then, their relative importance was determined through the pairwise comparison, the results of which are summarized in Table 2. Notably, the "unpredictability of time, volume, and client types" received the highest score and relative weight, followed by the "high level of automatic team discipline," while the "diversity of cooperating units" was deemed the least important factor.

Similarly, a total of 13 essential competencies for emergency nurses were identified and assessed using the pairwise comparison (Table 3). The top competencies included a "high scientific and skillful ability in various care actions from infancy to old age" and rapid, effective communication with patients and their companions, whereas "physical ability" was considered the least important.

After normalizing the weights for both the environmental characteristics and competencies, a two-dimensional matrix analysis was performed to compare the attributes of the emergency workplace with the nurses' competencies. This analysis aimed to determine the significance of each competency in relation to specific environmental features. Normalized weights were obtained from Table 4, where the numbers in the cells reflect each competency's relative impact on the workplace environment characteristics. Competencies not considered essential for certain environmental aspects were marked with a small dash. Table 5 presents the adjusted weights of competencies with regard to the emergency workplace environment.

Table 5 also provides a comparison of the ranks of competencies before and after incorporating emergency workplace characteristics. The ranks of "speed of action, teamwork, and coordination", "responsibility", and "ability to do team work" changed from 9 to 1, from 10 to 4, and from 11 to 5, respectively, while those of "high speed and accuracy in correctly completing the patient's medical record with necessary and sufficient details" and "adequate physical ability" remained unchanged.

Discussion

This study attempted to identify the essential competencies and abilities required for nurses in hospital emergency departments while considering the unique characteristics

Table 2. Features of the Workplace Environment of Emergency Nurses in Order of Importance

Row	Features of the Emergency Workplace Environment	Importance Score	Relative Weight (Normalized)
1	Unpredictability of time and volume and type of clients	7.07	10.31
2	High level of team discipline	6.81	9.93
3	Low level of security and safety	6.37	9.29
4	Intermittent disturbances in the emergency room	6.32	9.21
5	Short time intervals between diagnosis and action	6.16	8.98
6	High speed and depth of information exchange with patients and their companions	6.08	8.86
7	High diversity of emergency care and services	6.04	8.81
8	High mental pressure from clients	5.96	8.69
9	Presence of multiple rooms in the limited space of the emergency room	5.95	8.67
10	Permanent availability of essential emergency drugs and continuous replacement	5.94	8.66
11	Diversity of cooperating units with emergency	5.89	8.59
	Total	68.59	100

Table 3. Relative Weight of Essential Competencies of Emergency Nurses Before Considering Emergency Characteristics

Row	Competencies of Emergency Nurses	Importance Score	Relative Weight (Normalized)
1	High scientific abilities and skills in various cares from infancy to old age	11.90	8.01
2	Quick and effective communication with patients and their companions	11.89	8.00
3	Ability to cooperate and interact with other colleagues and doctors	11.79	7.93
4	Ability to keep the environment calm and manage crisis	11.64	7.83
5	Skills in performing high-quality diagnostic-therapeutic procedures	11.56	7.78
6	Toleration of stressful situations and controlling of emotions	11.54	7.76
7	Ability to manage risks and medical errors	11.48	7.72
8	Ability to recognize the correctness of the actions taken by colleagues	11.39	7.66
9	Promptitude in decision making, action, and coordination	11.29	7.60
10	Responsibility	11.22	7.55
11	Ability to work in a team	11.00	7.40
12	High speed and accuracy in correctly completing the patient's medical record with necessary and sufficient details	10.99	7.39
13	Appropriate physical ability	10.95	7.37
	Total	148.64	100

of the emergency work environment. A novel tool ranking these competencies based on their significance was introduced accordingly. To accomplish this process, a wide range of methods was employed, including literature reviews, expert panel discussions, job analyses, specialized interviews, focus groups, peer evaluations, competency framework development, objective structured clinical examinations, functional analyses, and adherence to professional standards (2, 5, 6, 18, 20, 22, 23, 24). Most previous studies focused on assessing those scientific and technical skills needed for direct patient care, which is considered the core of nursing competence. However, some research also emphasized that competence profiles can vary across different hospital environments (25). According to some studies, the characteristics of the workplace can influence work quality, motivation, and efficiency (25, 26, 27).

Meretoja et al found that operating room and emergency department nurses outperformed their counterparts in situation management, quality assurance, and helping roles, suggesting that the variety of admitted patients significantly impacts the need and frequency of specific nursing skills. They further indicated that the nature and use of essential competencies are shaped by the work environment (25).

To the best of our knowledge, this is the first study to identify and evaluate the unique features of the emergency workplace and then prioritize the necessary nursing competencies based on these characteristics. While earlier research relied on qualitative approaches to establish competency priorities, our study used a quantitative method (i.e., pairwise comparison) to determine the ranking and relative weight of each competency. In contrast to studies that examined the impact of the workplace merely by comparing self-evaluation scores, our approach compiled a comprehensive list of factors specific to the emergency department. Drawing on previous research performed by Tofighi et al using the Boyatzis method for health and treatment managers in military units, we adapted a similar strategy to assess competencies relative to different environmental features (28). By multiplying the relative weight of each competency by that of the

Table 4. Correlation Matrix Between the Main Competencies of Emergency Nurses According to the Characteristics of the Emergency Workplace Environment

Competencies of Emergency Nurses Characteristics of the Workplace Environment	High Scientific Abilities and Skills in Various Cares From Infancy to Old Age	Quick and effective communication With Patients and Their Companions	Ability to Cooperate and Interact With Other Colleagues and Doctors	Ability to Keep the Environment Calm and Manage Crisis	Skills in Performing High-Quality Diagnostic-Therapeutic Procedures	Toleration of Stressful Situations and Controlling of Emotions	Ability to Manage Risks and Medical Errors	Ability to Recognize the Correctness of Actions Taken by Colleagues	Promptitude in Decision Making, Action, and Coordination	Responsibility	Ability to Work in a Team	High Speed and Accuracy in Correctly Completing the Patient's Medical Record With Necessary and Sufficient Details	Appropriate Physical Ability
Unpredictability of time and volume and type of clients	84.13	-	-	-	81.73	81.59	-	-	79.82	-	-	-	77.42
High level of team discipline	81.04	-	80.29	-	-	-	-	77.57	-	76.41	74.91	-	-
Low level of security and safety	75.80	75.74	-	-	-	73.51	73.13	72.55	71.92	-	-	-	69.75
Intermittent disturbances in the emergency room	-	-	-	73.56	-	72.93	72.55	-	71.35	-	69.52	-	-
Short time intervals between diagnosis and action	73.30	73.24	72.63	-	71.21	-	70.72	70.16	69.55	69.12	67.76	67.70	-
High speed and depth of information exchange with patients and their companions	72.35	72.29	-	70.77	-	-	-	-	-	-	-	66.82	-
High diversity of emergency care and services	71.88	-	71.21	-	69.82		69.34	68.80	68.19	67.77	66.44	66.38	66.14
High mental pressure from clients	-	70.86	-	69.37	-	68.78	-	-	-	-	-	65.50	-
Presence of multiple rooms in the limited space of the emergency room	-	-	70.15	69.26	68.78	-	68.31	-	67.18	66.76	65.45	-	-
Permanent availability of essential emergency drugs and continuous replacement	70.69	-	70.03	-	-	-	-	-	67.06	66.65	-	-	-
Diversity of cooperating units with emergency	-	-	69.44	-	-	-	-	-	66.50	66.09	64.79	-	-
The sum of competencies' scores	529.19	292.14	433.75	282.97	291.54	296.81	354.04	289.08	561.56	412.78	408.87	266.40	213.31

Table 5. Comparison of Competency Ratings Before and After Considering the Characteristics of the Emergency Workplace Environment

Row	Competencies of Emergency Nurses	Before		After	
		Weight (Before)	Rank (Before)	Weight (After)	Rank (After)
1	High scientific abilities and skills in various cares from infancy to old age	8.01	1	11.42	2
2	Quick and effective communication with patients and their companions	8.00	2	6.31	8
3	Ability to cooperate and interact with other colleagues and doctors	7.93	3	9.36	3
4	Ability to keep the environment calm and manage crisis	7.83	4	6.11	11
5	Skills in performing high-quality diagnostic-therapeutic procedures	7.78	5	6.29	9
6	Toleration of stressful situations and controlling of emotions	7.76	6	6.41	7
7	Ability to manage risks and medical errors	7.72	7	7.64	6
8	Ability to recognize the correctness of actions taken by colleagues	7.66	8	6.24	10
9	Promptitude in decision making, action, and coordination	7.60	9	12.12	1
10	Responsibility	7.55	10	8.91	4
11	Ability to work in a team	7.40	11	8.83	5
12	High speed and accuracy in correctly completing the patient's medical record with necessary and sufficient details	7.39	12	5.75	12
13	Appropriate physical ability	7.37	13	14.60	13

Note. *Weight (before/after) indicates normalized/adjusted relative weights of competencies, respectively. **Rank (before/after) reflects the ranking of competencies based on the corresponding weights.

corresponding workplace characteristic, we derived a competency weight for emergency nurses, a metric that, to our knowledge, has not been explored previously.

Notably, the prioritization of competencies dramatically changed when workplace factors were taken into consideration. Initially, the most critical competency was only about 1% higher in weight than the least important one; however, after incorporating environmental characteristics, this difference increased to over 300%. In essence, accounting for the workplace environment has significantly sharpened the distinction between nursing competencies. As a result, some competencies, such as quick response, agility, and effective coordination, now rank at the top, while scientific expertise, patient communication, and routine job skills are less emphasized. Feedback from experts indicated that "speed of work" is especially vital in the emergency room, highlighting the need for nurses who can make swift decisions, act promptly, and coordinate effectively. Hence, this element should be prioritized in performance assessments and selection processes for emergency nursing roles. With the rising demand for high-quality healthcare services, a sharper focus on clinical competence has become essential, driving increased attention from human resources in healthcare systems.

In summary, this study presented an innovative approach to identifying competencies that align with the distinct features of the emergency work environment. This method is particularly valuable in organizations where professionals with similar expertise perform diverse functions, as it enables a more strategic selection process and a more accurate evaluation of personnel performance.

Since the meetings were conducted in person, fewer experts could participate than initially expected. However, a major strength of this study was its innovative approach to determine the competencies of emergency nurses.

Conclusion

Evaluating nurse qualifications without considering the unique features of the workplace environment blurs the distinction between essential and less critical competencies. This oversight also increases the risk of selecting or promoting individuals who may technically meet qualification standards yet struggle to adapt to the specific demands of their work setting. Our proposed fuzzy method offers a refined approach that prioritizes competencies aligned with the distinctive characteristics of the workplace, thereby ensuring a more effective match between a nurse's skills and the environmental demands of the hospital emergency ward.

This innovative approach not only refines the selection and assessment of emergency nurses by incorporating the unique characteristics of the emergency workplace but also holds significant promise for broader application across various healthcare settings. For instance, adapting this method to intensive care and surgery departments or outpatient clinics can enable tailored competency frameworks that reflect each unit's specific demands, leading to improved patient outcomes. Moreover, nursing education programs can integrate these environment-specific competencies into curricula and clinical simulations, thereby better preparing graduates for the real-world challenges of diverse healthcare environments. Eventually, this method offers a valuable template for continuous quality improvement and can inspire further research aimed at validating and expanding its use across the healthcare spectrum.

Study Limitations

One limitation of this study was the inclusion of hospitals with only 200 beds or more. Thus, this exclusion of smaller hospitals may have limited the generalizability of our findings.

Authors' Contribution

Conceptualization: Jahanara Mamikhani, Shahram Tofighi
Data Curation: Jahanara Mamikhani, Yasaman Alikhani
Formal Analysis: Jahanara Mamikhani
Funding Acquisition: Shahram Tofighi
Investigation: Jahanara Mamikhani, Yasaman Alikhani
Methodology: Jahanara Mamikhani, Shahram Tofighi
Project Administration: Jahanara Mamikhani
Resources: Shahram Tofighi
Software: Yasaman Alikhani
Supervision: Shahram Tofighi
Validation: Jahanara Mamikhani, Shahram Tofighi
Visualization: Jahanara Mamikhani
Writing–Original Draft: Jahanara Mamikhani
Writing–Review & Editing: Shahram Tofighi, Yasaman Alikhani

Competing Interests

While we agree that we have provided funding grant details from the National Center for Health Insurance, we want to ensure full transparency in disclosing any possible conflict of interests. It should be noted that we have thoroughly reviewed our affiliations and financial interests to verify if there is any conflict that needs to be disclosed. After careful considerations, the authors confirm there is no conflict of interests related to this manuscript.

Data Reproducibility

The data analyzed during the current study are available upon reasonable request from the corresponding author.

Ethical Approval

All experts' identities and opinions were treated as strictly confidential. In addition, the study received ethical approval from the Medical Ethics Committee of Tehran University of Medical Sciences and Health Services (IR-TUMS.SPH.REC.1402.146).

Funding

The study was financially supported by the National center for health insurance Research =NCHIR.

References

1. Bagheri-Nesami M, Rafiee F, Parvizi S, Esmaeili R. Concept analysis of competency in nursing: Qualitative research. Journal of Mazandaran University of Medical Sciences 2008;18(67):35-42.
2. South African Nursing Council. Competencies for Emergency Nursing. South African Nursing Council. Accessed July 15, 2022. Available from: https://www.sanc.co.za/wp-content/uploads/2020/06/SANC- Competencies-Emergency-Nurse.pdf
3. Mamikhani J, Tofighi S, Sadeghifar J, Heidari M, Hossieni Jenab V. Prioritizing the compensation mechanisms for nurses working in emergency department of hospital using fuzzy DEMATEL technique: a survey from Iran. Glob J Health Sci 2013;6(2):86–93. doi:10.5539/gjhs.v6n2p86
4. Clark M, Raffray M, Hendricks K, Gagnon AJ. Global and public health core competencies for nursing education: A systematic review of essential competencies. Nurse Educ Today 2016;40:173–80. doi:10.1016/j.nedt.2016.02.026
5. Fukada M. Nursing Competency: Definition, Structure and Development. Yonago Acta Med 2018;61(1):1–7. doi:10.33160/yam.2018.03.001
6. Li X, Zhou M, Wang H, Hao W. Factors associated with core competencies of emergency-room nurses in tertiary hospitals in China. Jpn J Nurs Sci 2020;17(3):e12337. doi:10.1111/jjns.12337
7. Bahreini M, Moattari M, Kaveh M, Ahmadi F. Self assessment of the clinical competence of nurses in a major educational hospital of Shiraz University of Medical Sciences. Pars of Jahrom University of Medical Sciences 2010;8:28–36. doi:10.29252/jmj.8.1.28
8. Alexander MF, Runciman PJ. ICN framework of competencies for the generalist nurse: Report of the development process and consultation. International Council of Nurses; 2003.
9. Bartlett HP, Simonite V, Westcott E, Taylor HR. A comparison of the nursing competence of graduates and diplomates from UK nursing programmes. J Clin Nurs 2000;9(3):369–79. doi:10.1046/j.1365-2702.2000.00331.x
10. Safadi R, Jaradeh M, Bandak A, Froelicher E. Competence assessment of nursing graduates of Jordanian universities. Nurs Health Sci 2010;12(2):147–54. doi:10.1111/j.1442-2018.2009.00507.x
11. Holanda FLd, Marra CC, Cunha ICKO. Professional competency profile of nurses working in emergency services. Acta Paulista de Enfermagem 2015;28(4):308–14. doi:10.1590/1982-0194201500053
12. Najafi Ghezeljeh T, Keyvanloo Shahrestanaki S, Mohammadbeigi T, Haghani S. Patient Safety Competency in Emergency Nurses in Educational-Medical Centers of Iran University of Medical Sciences, 2020. Iran Journal of Nursing 2022;34(134):60–73. doi:10.32598/ijn.34.6.5
13. Lakanmaa RL, Suominen T, Ritmala-Castrén M, Vahlberg T, Leino-Kilpi H. Basic Competence of Intensive Care Unit Nurses: Cross-Sectional Survey Study. Biomed Res Int 2015;2015:536724. doi:10.1155/2015/536724
14. Adib-Hajbaghery M, Eshraghi Arani N. Assessing Nurses' Clinical Competence from Their Own Viewpoint and the Viewpoint of Head Nurses: A Descriptive Study. Iran Journal of Nursing 2018;31(111):52–64. doi:10.29252/ijn.31.111.52
15. Khodadadei N, Rezaei B, Salehi S. Relationship between organizational commitment and nurses' clinical competency. Quarterly Journal of Nursing Management 2018;7(1):18–28. doi:10.29252/ijnv.7.1.18
16. Coll-Badell M, Jiménez-Herrera MF, Llaurado-Serra M. Emergency Nurse Competence in Electrocardiographic Interpretation in Spain: A Cross-Sectional Study. J Emerg Nurs 2017;43(6):560–70. doi:10.1016/j.jen.2017.06.001
17. Noviyanti L, Junianto A, Ahsan A. A cross-sectional study of the knowledge, skills, and 6 rights on medication administration by nurses at emergency department. Healthcare in Low-resource Settings 2023;11(s1). doi:10.4081/hls.2023.11177
18. Kırpık G, Çetin Y. Examining the Relationship Between Communication and Information Sharing and Organisational Ambidexterity: A Study on Nurses in TRC1 Region. Sosyoekonomi 2023;31(55):11–35. doi:10.17233/sosyoekonomi.2023.01.01
19. Park MS, Jeoung Y, Lee HK, Sok SR. Relationships among communication competence, self-efficacy, and job satisfaction in Korean nurses working in the emergency medical center setting. J Nurs Res 2015;23(2):101–8. doi:10.1097/jnr.0000000000000059
20. Sanjana IW, Widyandari NM, Agustini NLP. Nursing Competencies in Ambulance Needs at Prehospital: A Scoping Review. Jurnal Info Kesehatan 2023;21(2):212–25. doi:10.31965/infokes.Vol21.Iss2.960
21. Bahreini M, Shahamat S, Hayatdavoudi P, Mirzaei M. Comparison of the clinical competence of nurses working in two university hospitals in Iran. Nurs Health Sci 2011;13(3):282–8. doi:10.1111/j.1442-2018.2011.00611.x
22. Bench S, Crowe D, Day T, Jones M, Wilebore S. Developing a competency framework for critical care to match patient need. Intensive Crit Care Nurs 2003;19(3):136–42. doi:10.1016/s0964-3397(03)00030-2

23. Ličen S, Plazar N. Identification of nursing competency assessment tools as possibility of their use in nursing education in Slovenia---a systematic literature review. Nurse Educ Today 2015;35(4):602–8. doi:10.1016/j.nedt.2014.12.023
24. Meeker J, Perry A, Dolan C, Emary C, Golden K, Abla C, et al. Development of a competency framework for the nutrition in emergencies sector. Public Health Nutr 2014;17(3):689–99. doi:10.1017/s1368980013002607
25. Meretoja R, Leino-Kilpi H, Kaira AM. Comparison of nurse competence in different hospital work environments. J Nurs Manag 2004;12(5):329–36. doi:10.1111/j.1365-2834.2004.00422.x
26. Parashakti RD, Fahlevi M, Ekhsan M, Hadinata A. The influence of work environment and competence on motivation and its impact on employee performance in health sector. In3rd Asia Pacific International Conference of Management and Business Science (AICMBS 2019) 2020 Apr 13 (pp. 259-267). Atlantis Press.
27. Sutaguna INT, Yusuf M, Ardianto R, Wartono P. The Effect Of Competence, Work Experience, Work Environment, And Work Discipline On Employee Performance. Asian Journal of Management, Entrepreneurship and Social Science 2023;3(1):367–81. doi:10.63922/ajmesc.v3i01.263
28. Tofighi Sh, Nazari Manesh L. Assessment of leadership and management competencies among healthcare and medical managers in a military unit. Internal report. Tehran: Baqiyatallah University of Medical Sciences.