



OPEN Patient safety competency and its associated with teamwork and psychological safety among emergency nurses in Iran

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Patient safety competence, teamwork, and psychological safety are fundamental components in emergency patient care, as these elements can affect the quality of nursing care and patient safety. Therefore, the present study aimed to assess the level of patient safety competence and explore its correlations with teamwork and psychological safety among emergency department nurses in Iran. This cross-sectional descriptive-analytical study was conducted using stratified sampling proportional to the research community, involving 472 nurses from public hospitals affiliated with Mashhad University of Medical Sciences, Iran, in 2023. Data were collected using questionnaires on patient safety, teamwork, and psychological safety and analyzed with independent the Mann-Whitney U test, Pearson correlation, and linear regression analysis in SPSS-26 at a significance level of 0.05. Patient safety competence and teamwork among nurses were at a high level, while their psychological safety was at a moderate level. There was a significant inverse relationship between nurses' age and patient safety competence ($p = 0.04$). Patient safety competence varied significantly among nurses from different hospitals ($p < 0.001$). A direct and significant relationship existed between teamwork and psychological safety with patient safety competence, as well as between teamwork and psychological safety among nurses ($p < 0.001$). A multiple linear regression with teamwork, psychological safety, work experience and hospital type as independent variables explained 43.1% of the variance in patient safety competency ($R^2 = 0.431$). Regression analysis revealed that teamwork ($B = 0.169$, 95% CI 0.139, 0.199, $p < 0.001$) and psychological safety ($B = 0.252$, 95% CI 0.205, 0.299, $p < 0.001$) were significant positive predictors for patient safety competency. Patient safety competency in teaching hospitals was more than not-teaching hospitals ($B = 0.773$, 95% CI 0.052, 1.494, $p = 0.036$). Work experience did not have a significant association with patient safety competency ($p = 0.294$). The model explained 43.1% of the variance in patient safety competency ($R^2 = 0.431$). While nurses demonstrated high levels of patient safety and teamwork competence, their psychological safety was moderate, indicating the need to create a supportive work environment. So, increased teamwork and psychological safety can influence patient safety competence.

Keywords Patient safety, Psychological safety, Nurses

Patient safety is a fundamental and essential condition for healthcare services, as it prevents errors during care delivery and protects patients from potential harm^{1,2}. In every health system, hospitals play a crucial role in providing diagnostic and therapeutic care services, and patients are primarily concerned about their safety upon entering the hospital³. Among healthcare workers, nurses constitute a significant portion of the healthcare system's workforce and have the most frequent interactions with patients throughout the day. This makes nurses' activities highly influential on the outcomes of health systems⁴. Nurses play a vital role in ensuring patient safety

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through various means such as adhering to safety standards, education, error management, and collaboration with colleagues, making patient safety dependent on the presence of patient safety competence in nursing care³. Patient safety competence refers to the attitudes, skills, and knowledge that healthcare workers must possess to protect patients from unnecessary harm and injuries⁵. The core content of patient safety in nursing education includes competencies for preventing patient safety incidents (attitude), establishing patient safety competence (knowledge), and competencies for actions following errors (skills)⁶. Nursing errors and adverse events occur with significant frequency in hospitals^{5,7,8}. Among hospital departments, Emergency departments (EDs) play a vital role in healthcare systems worldwide, serving as the primary point of care for acute and urgent medical needs⁹. EDs is the service with the highest demand in a hospital, and this is continuously increasing, reaching a critical point¹⁰. EDs is particularly hazardous due to its unpredictable nature, the critical status of most patients, lack of teamwork, and high workload (due to insufficient nurse-to-patient ratios)^{5,7}. Effective communication among care staff can enhance their ability to care for patients and create a more efficient workflow¹¹. Effective teamwork improves team efficiency and patient safety, leading to a healthier and happier work environment while reducing burnout among healthcare professionals^{12,13}.

According to the study by Khameslou et al., teamwork in the emergency department can lead to increased levels of efficiency and safety in patient care¹⁴. Alongside this, one of the key components in improving teamwork is the psychological safety of staff. The study by Donovan showed that psychological safety is a determining factor for quality communication, which enhances teamwork and plays a significant role in healthcare teams¹⁵. The psychological safety of nurses increases patient safety and care quality, while lower levels of psychological safety lead to increased psychological stress, absenteeism, jeopardized patient safety, and reduced job satisfaction among nurses^{16,17}. The results of the study by Greene et al. indicated that the psychological safety of healthcare workers in the care environment affects teamwork, participation in quality improvement work, learning from failures, reporting adverse events, and patient safety competence¹⁷.

Investigating the relationships between patient safety competence, teamwork, and psychological safety in nurses is necessary in several ways, because these factors have a direct and indirect impact on the quality of patient care, employee health, and organizational performance^{5,18}.

Research on predictors of patient safety competency among emergency nurses is limited. In the study by Han et al., situation monitoring, psychological safety, and reporting of adverse patient safety events were identified as the main predictors of patient safety competency. They also suggested that these aspects need improvement⁵. Overall, findings from related studies indicate that enhancing patient safety competency, teamwork, and psychological safety among nurses is essential for improving care outcomes, promoting patient safety, and fostering a culture of safety and support in healthcare settings^{5,18}. Failure to prioritize patient safety and teamwork in healthcare can have significant negative consequences for patients, society, and healthcare organizations¹⁹. The present study, as one of the significant research efforts in the field of nursing, can serve as a strategy to improve the quality of healthcare services in hospital emergency departments.

The research gap identified is the lack of studies investigating the relationship between patient safety competency, teamwork, and psychological safety among emergency department nurses in Iran, particularly in hospitals affiliated with Mashhad University of Medical Sciences. While patient safety competency, teamwork, and psychological safety are recognized as critical factors in improving care outcomes and fostering a safety culture, there is limited research specifically exploring how these elements interact and influence one another in the context of emergency nursing in Iran. This study aims to address this gap by examining these relationships in a specific healthcare setting, providing insights that could inform strategies to enhance patient safety and teamwork in emergency departments.

Methodology

Study design, setting, and population

This cross-sectional, descriptive-analytical study was conducted on nurses working in the emergency departments of public hospitals in Mashhad, Iran, in 2023. A stratified sampling approach was used, with hospitals serving as the strata. Random samples were selected in proportion to the number of nurses employed at each hospital. Considering an error level of 0.05, a test power of 90%, a small effect size of 0.17, and the number of independent variables (8 independent variables) in the final model, the sample size based on multiple linear regression was determined to be 425. Accounting for a 10% sample loss, the final sample size was set at 472 nurses. Inclusion criteria were: holding a nursing degree, having at least 12 months of experience in the emergency department, and willingness to participate in the study. Exclusion criteria included unwillingness to continue participation and failure to complete more than 60% of the questionnaire.

Study tools

The data collection tools consisted of a demographic and professional information form for participants, a patient safety competency questionnaire, teamwork, and psychological safety.

Demographic information form

This information included hospital name, type of employment, age, length of service in the emergency department, retirement history, gender, and marital status.

Patient safety competency

The Patient Safety in Nursing Education Questionnaire serves as a validated instrument for evaluating safety competency⁶. The understanding of nurses regarding patient safety is assessed according to three categories: academic conditions, patient safety in clinical conditions, and patient safety competency. In nursing education, the third part of the safety questionnaire was utilized to evaluate patient safety competency. Langari et al. assessed

the validity and reliability of the third section of the Patient Safety in Nursing Education Questionnaire. Their exploratory factor analysis identified three key components of patient safety competence: creating patient safety competency (knowledge), responding effectively to errors (skill), and preventing safety incidents (attitude)²⁰. This section consisted of 14 questions across three dimensions: knowledge (4 questions), skills (4 questions), and attitude (6 questions). The questionnaire was scored on a four-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree). In this instrument, a higher score indicates a higher perception of patient safety competency (14–35 low, 35–45.5 moderate, 45.5–56 high). The validity and reliability of the Persian version of this questionnaire were confirmed and reported in a study by Habibi et al. using Cronbach's alpha of 0.9 and a content validity index (CVI) of 0.91¹⁸.

Teamwork

The teamwork questionnaire, developed by Baker et al., was designed to identify individuals' attitudes toward teamwork²¹. This questionnaire includes 30 questions across 5 dimensions: structure, leadership, situation monitoring, mutual support, and communication, with each dimension consisting of six questions. The questions are measured on a 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). In this tool, higher scores indicate a higher perception of teamwork (30–90: low, 90–120: moderate, 120–150: high). Questions 41, 42, and 45 in the mutual support dimension and question 51 in the communication dimension are reverse-scored. The validity and reliability of this questionnaire were confirmed in Najafi's study, with a Cronbach's alpha of 0.80 and an intra-class correlation coefficient (ICC) of 0.82²².

Psychological safety

The psychological safety tool, developed by Edmondson, was designed to assess psychological safety in teamwork. This questionnaire includes 7 questions scored on a 7-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neutral, 5 = somewhat agree, 6 = agree, 7 = strongly agree). In this tool, questions 52, 54, and 56 are reverse-scored, and higher scores indicate a higher level of perceived psychological safety in teamwork (7–28: low, 28.5–38: moderate, 38.5–49: high)²³. The validity and reliability of the Persian version of this questionnaire were confirmed in Shams' study, with a Cronbach's alpha of 0.812²⁴.

Data collection

After obtaining the necessary approvals from the Research Deputy and the Ethics Committee of Mashhad University of Medical Sciences, researchers visited the target hospitals in person. Initially, the study objectives, methodology, and questionnaire content were explained to the nursing managers of the hospitals. Before distributing the questionnaires, written informed consent was obtained from all participants. Upon completing the consent form, participants were informed about the study's aim and procedures. Participants were also assured that their information would remain confidential. Additionally, they were informed that participation in the study was voluntary and that they could withdraw at any time. The questionnaire was then distributed to nurses who had provided written consent to participate. Data collection took place from April 15 to September 22, 2023.

Data analysis

Descriptive statistics, including measures of central tendency and dispersion such as the mean, standard deviation, median, and interquartile range, were used to describe the data. For univariate analysis, Spearman's correlation coefficient was used to assess the relationship between quantitative variables due to the non-normal distribution of variables. The Mann-Whitney U test was used to examine the distribution of patient safety competency scores across two-level variables. A multiple linear regression model was employed to concurrently investigate the relationships between explanatory variables (those with a p -value < 0.1 in univariate analysis) and patient safety competency. All statistical tests were performed at a significance level of 0.05 using SPSS version 26.

Results

In this study, 472 emergency department nurses were examined. The majority of participants were female (256 people, 54%), married (298 people, 63%), and had permanent employment status (334 people, 70.2%). The mean age was 32 ± 6 years, the mean retirement history was 5.76 ± 5.3 years, and the mean work experience in the emergency department was 5.51 ± 4.1 years. The demographic characteristics of the participants are shown in (Table 1).

Table 2 shows the mean scores of patient safety competency, teamwork, psychological safety, and their dimensions. The mean and standard deviation of patient safety competency, teamwork, and psychological safety among the studied nurses were 47.72 ± 4.91 , 121.69 ± 11.63 , and 35.99 ± 7.78 , respectively. Accordingly, patient safety competency and teamwork were determined to be at a high level, while psychological safety among nurses was at a moderate level.

Before data analysis, the normality of the quantitative variables was assessed using the Kolmogorov-Smirnov test. The results indicated that the data distribution for the variables under study was non-normal.

Table 3 shows the relationship between age, retirement history, work experience in the emergency department, teamwork, and psychological safety with patient safety competency. The results of the Spearman test revealed a significant inverse relationship between age and patient safety competency ($p = 0.04$, $r = -0.095$), indicating that as age increased, patient safety competency decreased. In examining the relationship between patient safety competency, teamwork, and psychological safety, the Spearman test results demonstrated a significant direct correlation between teamwork and psychological safety with patient safety competency ($p < 0.001$).

Variable	Number (%)	Mean \pm SD
Age	–	32 \pm 6
Work experience in ED	–	5.51 \pm 4.1
Retirement history	–	5.76 \pm 5.3
Gender		
Female	256 (54)	–
Male	216 (46)	–
Marital status		
Single	174 (37)	–
Married	298 (63)	–
Hospital type		
Teaching	285 (60)	–
Non-teaching	187 (40)	–
Employment type		
Permanent	334 (70.2)	–
Temporary	138 (29.8)	–

Table 1. Demographic characteristics of emergency department nurses ($N = 472$).

Variable (score range)	Number of questions	Mean \pm SD	Level
Knowledge (1–4)	4	13.62 \pm 1.44	High
Skills (1–4)	4	13.61 \pm 1.68	High
Attitude (1–4)	6	20.49 \pm 2.46	High
Patient safety competency (1–4)	14	47.72 \pm 4.91	High
Team structure (1–5)	6	20.49 \pm 2.97	Moderate
Leadership (1–5)	6	25.68 \pm 3.15	High
Situation monitoring (1–5)	6	25.55 \pm 3.04	High
Mutual support (1–5)	6	21.85 \pm 3.66	Moderate
Communication (1–5)	6	23.99 \pm 2.83	Moderate
Teamwork (1–5)	30	121.69 \pm 11.63	High
Psychological safety (1–7)	7	35.99 \pm 7.78	Moderate

Table 2. Scores of patient safety competency, teamwork, psychological safety, and their dimensions.

Variable	Spearman correlation coefficient	p -value*
Age	–0.095	0.04
Retirement history	0.071	0.122
Work experience in ED	0.086	0.062
Teamwork	0.231	<0.001
Psychological safety	0.424	<0.001

Table 3. Relationship between age, retirement history, work experience, teamwork, and psychological safety with patient safety competency. *Spearman correlation test.

The results of the Mann-Whitney U test showed a statistically significant difference in patient safety competency scores based on the type of hospital ($p < 0.001$, effect size = 0.21), with the mean patient safety competency score being higher in teaching hospitals compared to non-teaching hospitals (Table 4).

Variables with a p -value less than 0.1 in the univariate analysis were included in the multiple linear regression model to simultaneously assess their relationship with patient safety competency.

Table 5 presents the results of the multiple linear regression model, showing that after adjusting for the effects of other variables, teamwork and psychological safety had a significant relationship with patient safety competency (adjusted $R^2 = 0.43$). Specifically, for every one-unit increase in the teamwork score, the patient safety competency score increased by 0.169 units ($p < 0.001$). Similarly, for every one-unit increase in the psychological safety score, the patient safety competency score increased by 0.252 units ($p < 0.001$). Additionally, hospital type was significantly associated with patient safety competency ($p = 0.036$), indicating that teaching hospitals had a greater positive impact on patient safety competency compared to non-teaching hospitals.

Variable	Mean ± SD	Test results*
Gender		
Male	47.7 ± 4.9	p = 0.964
Female	47.7 ± 4.8	
Marital status		
Single	47.8 ± 5.5	p = 0.202
Married	47.6 ± 4.4	
Hospital type		
Teaching	48.61 ± 4.2	p < 0.001
Non-teaching	46.37 ± 5.57	
Employment type		
Permanent	47.85 ± 4.53	p = 0.879
Temporary	47.42 ± 5.73	

Table 4. Relationship between nurses’ demographic variables and patient safety competency. *Mann-Whitney U test.

Variable	Regression coefficient (B)	Standard Error	95% CI* for B	<i>p</i> -value
Teamwork	0.169	0.015	(0.139, 0.199)	< 0.001
Psychological safety	0.252	0.024	(0.205, 0.299)	< 0.001
Work experience in ED	0.045	0.049	(−0.038, 0.127)	0.359
Hospital type				
Teaching	0.773	0.367	(0.052, 1.49)	0.036
Non-teaching	–	–	–	–

Table 5. Results of the multiple linear regression model to assess independent variables associated with patient safety competency. *Confidence interval.

Discussion

The present study aimed to determine patient safety competency and its relationship with teamwork and psychological safety among emergency department nurses in hospitals affiliated with Mashhad University of Medical Sciences in Iran.

The patient safety competency among the studied nurses was at a high level. This finding is slightly higher than the results of previous studies in Iran, which indicated that patient safety competency among nurses was at a moderate level^{18,25}. Similarly, Han JH et al.⁵ and Kim et al.²⁶ reported that patient safety competency among nurses was approximately at a moderate level. This finding is consistent with the study by Jin J, which found that patient safety competency among nurses was at a relatively high level²⁷. In comparison to most similar studies, the patient safety competency in the present study was at a higher level and was generally assessed as desirable. This discrepancy in findings can be attributed, to some extent, to the increasing focus on patient safety, which has recently gained more attention from higher-level healthcare organizations. However, other factors may also be considered in this regard. For example, hospitals may have different policies and guidelines concerning patient safety. Additionally, the extent and quality of training provided to nurses may vary among hospitals, which in turn can influence nurses’ awareness and attitudes. Furthermore, differences in access to equipment and technologies may also affect patient safety competency scores.

The findings of the present study showed that all dimensions of patient safety competency (knowledge, skills, and attitudes) were at a high level. The results regarding the skills dimension were consistent with the study by Han JH⁵, and in terms of attitudes, they aligned with the study by Kim²⁶. However, they were inconsistent with the findings of Habibi Soola¹⁸, Kakemam²⁸, and Najafi²⁹, where the dimensions of knowledge, skills, and attitudes were reported at a moderate level. Overall, the dimensions of patient safety competency in this study were at a desirable level. Considering that the knowledge dimension was at a lower level in all similar studies compared to the present study, it appears that this area has been well covered through nursing programs. Therefore, it can be inferred that the high level of nurses’ competency in the knowledge domain is due to the effective utilization of learning opportunities provided in nurses’ in-service training programs.

According to the present study, age has a significant negative correlation with patient safety competency, as individuals’ age increases, their average patient safety competency decreases. The type of hospital had a significant impact on patient safety competency, with teaching hospitals having a significantly higher mean patient safety competency compared to non-teaching hospitals.

The findings of Habibi Soola’s study showed that patient safety competency had a significant positive correlation with age, job satisfaction, education level, employment type, emergency department type, patient safety training, experience in safety activities, and adverse events reported by others. Furthermore, patient safety competency had a significant negative correlation with the type of hospital¹⁸.

In the study conducted by Ismail et al. in 2022 in Malaysia, a significant relationship was reported between patient safety competency and various factors such as race, profession, education level, workplace hospital, department or unit, and weekly working hours. However, marital status and gender were not identified as significant determinants of patient safety competency, which aligns with our findings³⁰.

Kerfoot et al. study revealed significant differences in patient safety knowledge and competency levels according to years of training, degree, specialization, age, and gender. However, age and gender did not show a significant relationship with patient safety competency scores. Gender was found to be borderline significant in univariate analysis ($p = 0.05$) but not significant in multivariate models, which is in line with our findings regarding gender³¹.

According to the current study's findings, younger individuals tend to have higher patient safety competency scores because of their higher motivation and enthusiasm compared to older individuals. The significant increase in patient safety competency scores in teaching hospitals compared to non-teaching hospitals suggests that training and learning have a significant impact on nurses' patient safety competency. Younger individuals who have received the most up-to-date training and are more familiar with concepts related to patient safety competency may have a better understanding of patient safety.

In the present study, among the dimensions of teamwork, leadership and situation monitoring were at a high level, while team structure, mutual support, and communication were at a moderate level. However, the overall status of teamwork among the nurses studied was at a high level, which is consistent with the study by Keykha³², who examined attitudes and barriers to teamwork from the perspective of intensive care unit nurses during the COVID-19 pandemic. However, this does not align with the results of studies by Han JH⁵ and Habibi Soola¹⁸, where teamwork was reported at a moderate level. It seems that emergency nurses can enhance teamwork by facilitating communication, resolving conflicts within the team, clarifying roles and responsibilities, and encouraging other team members. Nurses can learn effective communication skills and promote teamwork among themselves and their colleagues. Nurses' perception of teamwork is associated with patient safety, and effective teamwork in healthy work environments leads to the delivery of high-quality healthcare services.

In the present study, the psychological safety of the nurses was at a moderate level. Compared to similar studies, in the study by Purdy et al., which investigated emergency department team performance and psychological safety among 410 nursing and medical staff in a tertiary care center in Australia, psychological safety was also at a moderate level, which aligns with the findings of the present study³³. This result is also consistent with the study by Han JH, where psychological safety was reported at a moderate level⁵. However, it does not align with the study by Habibi Soola, where psychological safety was at a low level¹⁸.

Considering the items assessed in psychological safety, it appears that improving quality and encouraging staff to speak up about mistakes can enhance the psychological safety of nurses.

Another finding of the present study showed a statistically significant and direct relationship between patient safety competency, teamwork, and psychological safety. Additionally, there was a significant and direct relationship between teamwork and psychological safety. The results from the multiple linear regression model revealed that, after adjusting for the effect of other variables, there was a significant relationship between teamwork and patient safety competency. This suggests that enhancing collaboration and coordination among nurses can directly impact patient safety. Patient safety, quality of care, employee satisfaction, and patient satisfaction are all impacted by the emergency department's organized and effective teamwork. A team with a well-organized teamwork structure is able to anticipate the needs of its members^{13,34}. The regression model also demonstrated a significant association between psychological safety and patient safety competency. This finding suggests that when nurses work in a psychologically safe environment (i.e., they can ask questions, report errors, and offer ideas without fear of humiliation or punishment), their patient safety performance improves significantly. Recently, psychological safety has emerged as a crucial element in understanding phenomena like teamwork, team learning, and organizational learning^{35,36}. These results are consistent with the findings of studies by Han JH⁵, Habibi Soola¹⁸, Salih³⁷, and Greene¹⁷. Both teamwork and psychological safety are important predictors of patient safety competence, but psychological safety has a stronger effect. These findings suggest that to improve patient safety, technical training alone is not enough, but special attention should be paid to team culture and a supportive psychological environment in healthcare settings. Educational programs and organizational policies should be designed to foster collaboration among nurses and provide a safe space for expressing concerns and learning from mistakes. Studies have shown that when nurses feel psychologically safe, they are more comfortable sharing their problems and concerns with colleagues, which improves decision-making and reduces errors³³. Effective teamwork and the presence of psychological safety in the workplace help nurses better manage psychological pressures and work-related stress³⁸. Strong psychological safety and teamwork foster a sense of trust among team members. Trust between healthcare professionals not only enhances their efficiency but also helps them collaborate better in critical situations, thereby preventing potential problems³⁹.

Conclusion

The findings of this study indicate that despite high levels of patient safety and teamwork competence in nurses, their psychological safety is at an average level. These findings indicate that nurses may be technically and professionally competent, but the work environment is not psychologically safe and supportive enough for them. Low psychological safety can lead to reduced job satisfaction, increased burnout, and ultimately negatively impact the quality of patient care. Neglecting psychological safety can harm the overall performance of the health system in the long term. Managers should focus on improving the psychological work environment to both protect the health of nurses and improve the quality of patient care. In addition to fostering open communication through regular team meetings and feedback sessions, training programs focusing on communication skills and conflict resolution can reduce nurses' concerns about expressing errors and mistakes.

Research limitations

There are some limitations to our research that may affect the results and should be considered when interpreting our findings. First, safety in a hospital is influenced by various factors such as hospital workload, number of staff, type of hospital, severity of patients' illness, which can affect nurses' patient safety competency scores. Therefore, further studies are needed to evaluate other factors affecting patient safety competency. Second, due to the fact that we used our reports to measure all variables, our results may have a responsive response bias. The use of a cross-sectional design in the current study makes it impossible to resolve causal relationships between variables.

Data availability

All data generated or analyzed during this study are included in this published article.

Received: 22 December 2024; Accepted: 8 May 2025

Published online: 13 May 2025

References

- Aktaş, M. İ. Patient safety and health management world countries examples. *J. Acad. Social Sci.* **3** (20), 15–20 (2015).
- Janghorban, A., Moghri, J., Ghavami, V., Raesi, R. & Tabatabaee, S. S. Understanding the relationship between care quality perception and patient safety culture. *Open. Nurs. J.* **19**, (2025).
- Karaca, A., Semiha, A. & Seren, A. K. H. The relationship between perceived quality of care and the patient safety culture of Turkish nurses. *J. Nurs. Res.* **30** (4), e223 (2022).
- Arab, M. Patient safety culture status in general hospitals affiliated to Tehran university of medical sciences. *Hakim J.* **16** (3), 243–250 (2013).
- Han, J. H. & Roh, Y. S. Teamwork, psychological safety, and patient safety competency among emergency nurses. *Int. Emerg. Nurs.* **51**, 100892 (2020).
- Tella, S. et al. Learning to ensure patient safety in clinical settings: comparing Finnish and British nursing students' perceptions. *J. Clin. Nurs.* **24** (19–20), 2954–2964 (2015).
- Gustafsson, N., Leino-Kilpi, H., Prga, I., Suhonen, R. & Stolt, M. Action-CA15208 RxC: missed care from the patient's perspective—A scoping review. *Patient Prefer. Adherence* 383–400 (2020).
- Tabatabaee, S. S., Ghavami, V., Javan-Noughabi, J. & Kakemam, E. Occurrence and types of medication error and its associated factors in a reference teaching hospital in Northeastern Iran: a retrospective study of medical records. *BMC Health Serv. Res.* **22** (1), 1420 (2022).
- Mostafa, R. & El-Atawi, K. Strategies to measure and improve emergency department performance: a review. *Cureus* **16** (1), (2024).
- Cusidó, J., Comalrena, J., Alavi, H. & Lluñas, L. Predicting hospital admissions to reduce crowding in the emergency departments. *Appl. Sci.* **12** (21), 10764 (2022).
- Rosen, M. A. et al. Teamwork in healthcare: key discoveries enabling safer, high-quality care. *Am. Psychol.* **73** (4), 433 (2018).
- Hwang, J.-I. What are hospital nurses' strengths and weaknesses in patient safety competence? Findings from three Korean hospitals. *Int. J. Qual. Health Care.* **27** (3), 232–238 (2015).
- Costello, M., Russell, K. & Coventry, T. Examining the average scores of nursing teamwork subscales in an acute private medical ward. *BMC Nurs.* **20** (1), 84 (2021).
- Ajri-Khameslou, M., Abbaszadeh, A., Borhani, F. & Farokhnezhad Afshar, P. Contributing factors to nursing error in emergency department: A qualitative study. *Hayat* **23** (1), 17–32 (2017).
- O'Donovan, R. & McAuliffe, E. Exploring psychological safety in healthcare teams to inform the development of interventions: combining observational, survey and interview data. *BMC Health Serv. Res.* **20**, 1–16 (2020).
- Grailey, K., Murray, E., Reader, T. & Brett, S. The presence and potential impact of psychological safety in the healthcare setting: an evidence synthesis. *BMC Health Serv. Res.* **21** (1), 1–15 (2021).
- Greene, M. T., Gilmartin, H. M. & Saint, S. Psychological safety and infection prevention practices: results from a National survey. *Am. J. Infect. Control.* **48** (1), 2–6 (2020).
- Habibi Soola, A., Ajri-Khameslou, M., Mirzaei, A. & Bahari, Z. Predictors of patient safety competency among emergency nurses in Iran: a cross-sectional correlational study. *BMC Health Serv. Res.* **22** (1), 547 (2022).
- Moukarzel, A. et al. Burnout syndrome among emergency department staff: prevalence and associated factors. *Biomed. Res. Int.* **2019** (1), 6462472 (2019).
- Langari, M. N. M., Tella, S., Smith, N.-J. & Turunen, H. Self-assessment of patient safety competence: a questionnaire survey of final year British and Finnish pre-registration nursing students. *Int. J. Caring Sci.* **10** (3), 1212 (2017).
- Baker, D. P., Amodeo, A. M., Krokos, K. J., Slonim, A. & Herrera, H. Assessing teamwork attitudes in healthcare: development of the teamstepps teamwork attitudes questionnaire. *Qual. Saf. Health Care.* **19** (6), e49–e49 (2010).
- Najafi, M., Keshmiri, F., Najafi, M. & Shirazi, M. Assessment of validity and reliability of team stepps teamwork attitudes questionnaire (T-TAQ) in Iran. *Payavard Salamat.* **7** (5), 389–398 (2014).
- Edmondson, A. Psychological safety and learning behavior in work teams. *Adm. Sci. Q.* **44** (2), 350–383 (1999).
- Khalijian, S., Shams, G., Pardakhtchi, M. H. & Mirkamali, S. M. A study of the relationship between secure base leadership and schools' staff happiness: mediating role of psychological safety. *School Adm.* **5** (2), 1–21 (2018).
- Hafezi, A., Babaii, A., Aghaie, B. & Abbasinia, M. The relationship between patient safety culture and patient safety competency with adverse events: a multicenter cross-sectional study. *BMC Nurs.* **21** (1), 292 (2022).
- Kim, M. J. & Kim, J. K. A study on the relationships among perception about patient safety culture, patient safety competence, and safety nursing activities of emergency room nurses. *J. Korea Contents Association.* **17** (10), 268–279 (2017).
- Jin, J. & Yi, Y. J. Patient safety competency and the new nursing care delivery model. *J. Nurs. Adm. Manag.* **27** (6), 1167–1175 (2019).
- Kakemam, E. et al. Nurses' perceptions of patient safety competency: a cross-sectional study of relationships with occurrence and reporting of adverse events. *Plos One* **19** (1), e0297185 (2024).
- Keyvanloo, N. A. J. A. F. I. G. T., Mohammadbeigi, S. S. & Haghani, T. S. Patient safety competency in emergency nurses in educational-medical centers of Iran University of Medical Sciences, (2020).
- Ismail, A. & Khalid, S. N. M. Patient safety culture and its determinants among healthcare professionals at a cluster hospital in Malaysia: a cross-sectional study. *BMJ Open.* **12** (8), e060546 (2022).
- Kerfoot, B. P., Conlin, P. R., Trivison, T. & McMahon, G. T. Patient safety knowledge and its determinants in medical trainees. *J. Gen. Intern. Med.* **22**, 1150–1154 (2007).
- Keykha, A., Ramezani, M. & Heydari, A. Attitude and barriers of teamwork in intensive care unit from the perspective of nurses in COVID-19 pandemic. *J. Military Med.* **23** (4), 329–337 (2022).
- Purdy, E. et al. Psychological safety and emergency department team performance: a mixed-methods study. *Emerg. Med. Australasia.* **35** (3), 456–465 (2023).

34. Boamah, S. Linking nurses' clinical leadership to patient care quality: the role of transformational leadership and workplace empowerment. *Can. J. Nurs. Res.* **50** (1), 9–19 (2018).
35. O'Donovan, R., Van Dun, D. & McAuliffe, E. Measuring psychological safety in healthcare teams: developing an observational measure to complement survey methods. *BMC Med. Res. Methodol.* **20**, 1–17 (2020).
36. Parker, H. & Du Plooy, E. Team-based games: catalysts for developing psychological safety, learning and performance. *J. Bus. Res.* **125**, 45–51 (2021).
37. Salih, S. A., Reshia, F. A. A., Bashir, W. A. H., Omar, A. M. & Elwasefy, S. A. Patient safety attitude and associated factors among nurses at Mansoura university hospital: A cross sectional study. *Int. J. Afr. Nurs. Sci.* **14**, 100287 (2021).
38. Vévoda, J. et al. The relationship between psychological safety and burnout among nurses. *Occup. Medicine/Pracovní Lékarství* **68**, (2016).
39. O'Donovan, R. & McAuliffe, E. A systematic review of factors that enable psychological safety in healthcare teams. *Int. J. Qual. Health Care* **32** (4), 240–250 (2020).

Acknowledgements

The authors of this article wish to express their gratitude to the Vice Chancellor for Research at Mashhad University of Medical Sciences, as well as the heads and staff of the participating hospitals, and the esteemed participants.

Author contributions

Authors NT and SST designed the study. JM and SST participated in the conception of the study. AJ and NT participated in the data collection. VGh managed and conducted the statistical analyses and interpreted the data. RR and SST wrote the first draft and RR and JM revised it to make the final manuscript. All authors have read and approved the final manuscript.

Declarations

Competing interests

The authors declare no competing interests.

Ethics approval and consent to participate

The Ethics Committee of Mashhad University of Medical Sciences approved the study protocol (IR.MUMS.FHMPM.REC. 1401.225) following the acquisition of the necessary research permit. The participants gave their written informed consent and were guaranteed confidentiality. All procedures conducted in studies involving human participants adhered to the ethical standards set by the institutional research committee and complied with the 1964 Helsinki Declaration.

Additional information

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