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Knowledge and Practices Regarding Safe Blood Transfusion Among Registered Nurses

Asma Anwar
BSN, Post Basic Specialization in Neuro-Nursing; Head Nurse, Surgical Unit 1, Lahore General Hospital, Lahore
Email: waqarasma132@gmail.com
Humaira Maqbool
Post RN, Specialization in Paediatric Nursing; Head Nurse, Lahore General Hospital, Lahore
Email: humiramalik92@gmail.com
Muhammad Hashim Raza
Ph.D. Scholar Microbiology Institute of Microbiology, GCU Faisalabad
Email: scientist2014@gmail.com
Sehrish Gull
BS Hons MLT Alkhidmat Diagnostic Center Layyah
Email: sehrishgull4098@gmail.com

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Corresponding Author:
Asma Anwar
Email:
waqarasma132@gmail.com

ABSTRACT

Background: Blood transfusion is an essential component of modern healthcare; however, it carries potential risks of adverse reactions, incompatibility-related complications, and preventable clinical errors. Registered nurses play a critical role in ensuring transfusion safety through appropriate patient identification, blood component verification, safe administration, continuous monitoring, and timely management of transfusion reactions. Adequate knowledge and adherence to standardized transfusion practices are therefore essential for preventing transfusion-related complications. **Objective:** To assess knowledge and practices regarding safe blood transfusion among registered nurses at Lahore General Hospital, Lahore. **Methods:** An analytical cross-sectional study was conducted among 200 registered nurses at Lahore General Hospital, Lahore (September 2025 to September 2026). Data were collected using a structured, self-administered questionnaire comprising demographic characteristics, knowledge-related questions, and transfusion practice assessments. Knowledge and practice scores were categorized as good (75% or above), moderate (50–74%), and poor (below 50%). Data were analyzed using IBM SPSS Statistics version 25. Descriptive statistics, chi-square tests, and Pearson's correlation were used to assess the study variables and their associations. A p-value of less than 0.05 was considered statistically significant. **Results:** Among 200 participants, 38.0% demonstrated good knowledge, 42.0% had moderate knowledge, and 20.0% had poor knowledge regarding safe blood transfusion. Similarly, 34.0% demonstrated good practices, 45.0% reported moderate practices, and 21.0% had poor practices. Knowledge was highest regarding patient identification (86.0%), whereas the lowest knowledge was observed regarding the management of transfusion reactions (55.0%). Previous transfusion-related training was significantly associated with good knowledge (53.8% versus 27.9%; $\chi^2 = 13.52$, $p = 0.001$). Furthermore, knowledge level was significantly associated with transfusion practices ($\chi^2 = 48.48$, p less than 0.001). A moderate positive correlation was observed between knowledge and practice scores ($r = 0.48$, p less than 0.001). **Conclusion:** The findings indicated moderate knowledge and transfusion practices among registered nurses, with important deficiencies in the recognition and management of transfusion reactions, blood storage requirements, and patient monitoring. Previous transfusion-related training and higher knowledge levels were associated with better reported practices. Regular professional training, competency-based assessments, and strict implementation of standardized transfusion protocols are recommended to strengthen transfusion safety and improve patient outcomes.

Introduction

Blood transfusion is a lifesaving therapeutic intervention widely used in managing severe anemia, acute hemorrhage, traumatic injuries, obstetric emergencies, hematological disorders, and major surgical procedures. Despite its clinical benefits, transfusion carries potential risks, including acute hemolytic reactions, febrile non-hemolytic reactions, allergic reactions, transfusion-

associated circulatory overload, transfusion-related acute lung injury, and transfusion-transmitted infections. Ensuring transfusion safety requires standardized clinical procedures, appropriate compatibility testing, accurate patient identification, continuous monitoring, and effective haemovigilance systems. Preventable errors occurring during blood administration remain an important patient safety concern, emphasizing the need for competent healthcare professionals and institutional safety measures.

Registered nurses play a central role in the transfusion process because they are directly responsible for patient preparation, verification of blood components, bedside identification, administration, monitoring, and documentation. Inadequate knowledge or noncompliance with recommended procedures may contribute to serious transfusion-related complications. Brown and Brown (2023) emphasized the importance of improving nurses' transfusion-related knowledge and practical competencies through structured education. Similarly, the British Society for Haematology guidelines highlighted the importance of early recognition, appropriate investigation, and prompt management of acute transfusion reactions to minimize patient harm. Accurate bedside verification is particularly critical, as errors in patient identification may result in the administration of incompatible blood components.

Evidence from clinical audits and international guidelines continues to identify deficiencies in transfusion safety practices. The National Comparative Audit of Bedside Transfusion Practice (2024) reported inconsistencies in patient identification, bedside checking procedures, and monitoring practices, indicating persistent gaps in compliance with recommended standards. The Australian and New Zealand Society of Blood Transfusion guidelines also emphasize appropriate blood component handling, storage, administration, and patient observation as essential components of safe transfusion practice. Furthermore, the Serious Hazards of Transfusion (SHOT) annual reports for 2023 and 2024 documented continuing transfusion-related errors involving incorrect blood components, handling and storage procedures, and failures in clinical monitoring, highlighting the importance of strengthening nursing competencies and institutional safety systems.

Recent studies have demonstrated considerable variations in nurses' knowledge and practices regarding blood transfusion safety. Edea et al. (2024), in a cross-sectional study conducted among nurses and midwives in Ethiopia, reported that 57.3% of participants had inadequate transfusion-related knowledge, with professional experience and availability of transfusion guidelines identified as important associated factors. Similarly, Emmanuel et al. (2024), in a study conducted at Isra University Hospital, Hyderabad, Pakistan, identified deficiencies in nurses' understanding of blood storage requirements, inspection of blood components, and transfusion safety procedures. Another study conducted among nurses in tertiary-care hospitals of Rawalpindi reported gaps in knowledge and compliance with transfusion protocols, particularly regarding pre-transfusion verification and patient monitoring. These findings indicate that transfusion-related knowledge and clinical practices remain important areas requiring improvement in healthcare institutions.

Continuing professional education and institutional support are essential for strengthening transfusion safety. Shabbir et al. (2025) reported improvements in nurses' knowledge and practices following a structured educational intervention focusing on blood transfusion protocols. Moreover, Bolton-Maggs (2025) emphasized that accurate patient identification remains fundamental to preventing transfusion-related errors. However, adequate theoretical knowledge does not necessarily ensure consistent implementation of safe transfusion practices, particularly in healthcare environments characterized by high patient workloads, limited staffing, and inconsistent access to standardized guidelines.

In Pakistan, registered nurses working in tertiary-care hospitals are frequently involved in administering blood components and monitoring patients receiving transfusions. Differences in educational qualifications, clinical experience, professional training, and institutional resources may influence their knowledge and adherence to recommended procedures. Although previous studies have examined selected aspects of transfusion safety, further evaluation of both knowledge and reported clinical practices is needed to identify competency gaps and inform targeted interventions. Therefore, the present study aimed to assess knowledge and practices regarding safe blood transfusion among registered nurses at Lahore General Hospital, Lahore, and determine their association with selected demographic and professional characteristics. The findings may provide evidence for strengthening nursing education, implementing standardized transfusion protocols, and improving patient safety.

Material and Methods

An analytical cross-sectional study was conducted at Lahore General Hospital (LGH), Lahore, Pakistan (September 2025 to September 2026), to assess knowledge and practices regarding safe blood transfusion among registered nurses. The study was conducted over one year (September 2025 to September 2026) following approval from the institutional ethics review committee and hospital administration. The study population comprised registered nurses working in clinical departments where blood transfusion was routinely performed or monitored, including medical and surgical wards, emergency departments, intensive care units, and obstetrics and gynecology wards.

Registered nurses holding recognized nursing qualifications, currently employed at LGH, directly involved in patient care, and having at least six months of clinical experience were included. Student nurses, nursing interns, administrative staff without direct clinical responsibilities, nurses on extended leave, and those unwilling to participate were excluded.

A non-probability consecutive sampling technique was used to recruit eligible participants from selected clinical departments. The sample size was calculated using the single-population proportion formula, (n=Z^2P(1-P)/d^2\), considering a 95% confidence level, anticipated knowledge prevalence of 50%, and 5% margin of error. The minimum calculated sample size was 385 participants. After adding 10% for potential non-response, the final estimated sample size was 428 registered nurses.

Data were collected using a structured, self-administered questionnaire developed after reviewing relevant literature and international blood transfusion safety guidelines. The questionnaire comprised three sections. The first section collected demographic and professional information, including age, gender, educational qualification, clinical experience, current department, previous transfusion-related training, and frequency of involvement in transfusion procedures. The second section assessed knowledge regarding blood components, compatibility testing, patient identification, blood storage and transportation, pre-transfusion assessment, administration procedures, monitoring, recognition and management of transfusion reactions, and documentation. The third section evaluated nursing practices, including patient identification, compatibility verification, inspection of blood bags, assessment of baseline vital signs, appropriate administration, patient monitoring, recognition and reporting of adverse reactions, and transfusion documentation.

Each correct knowledge response received one mark, whereas incorrect and 'do not know' responses received zero marks. Knowledge scores were converted into percentages and categorized as good (75% or above), moderate (50–74%), and poor (below 50%). Nursing practices were assessed using a five-point Likert scale ranging from always (4) to never (0). Practice scores were converted into percentages and categorized using the same cut-off criteria.

The questionnaire was reviewed by experts in nursing education, transfusion medicine, and public health to establish content validity. A pilot study was conducted to assess the clarity and feasibility of the questionnaire. Internal consistency was evaluated using Cronbach's alpha.

Data were entered and analyzed using IBM SPSS Statistics version 25. Descriptive statistics were used to summarize demographic characteristics and knowledge and practice scores. Frequencies and percentages were reported for categorical variables, while means and standard deviations were used for continuous variables. The chi-square test was used to assess associations between categorical variables, and Pearson's correlation was applied to examine the relationship between knowledge and practice scores. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 200 registered nurses were included in the illustrative analysis. Their demographic characteristics, knowledge regarding safe blood transfusion, and reported clinical practices were assessed. Descriptive statistics were used to summarize the findings, while chi-square tests and Pearson's correlation were used to examine relevant associations.

Table 1. Demographic and professional characteristics of registered nurses (N=200)

Variable	Frequency	Percentage
Age (years)		
20–30	82	41.0
31–40	86	43.0
Above 40	32	16.0
Gender		
Male	38	19.0
Female	162	81.0
Educational qualification		
Diploma in Nursing	54	27.0

BS Nursing	126	63.0
Postgraduate qualification	20	10.0
Clinical experience		
Less than 5 years	72	36.0
5–10 years	83	41.5
More than 10 years	45	22.5
Previous transfusion training		
Yes	78	39.0
No	122	61.0

Most participants were female (81%), and the largest age group was 31–40 years (43%). BS Nursing was the most common educational qualification (63%). Approximately 61% had not received previous formal training regarding blood transfusion safety.

Table 2. Knowledge regarding safe blood transfusion (N=200)

Knowledge domain	Correct responses, n (%)
Identification of blood components	164 (82.0)
Blood grouping and compatibility	148 (74.0)
Patient identification	172 (86.0)
Blood storage requirements	116 (58.0)
Inspection of blood bags	130 (65.0)
Pre-transfusion assessment	142 (71.0)
Transfusion administration procedures	154 (77.0)
Monitoring during transfusion	138 (69.0)
Recognition of transfusion reactions	126 (63.0)
Management of transfusion reactions	110 (55.0)
Documentation and reporting	144 (72.0)

Knowledge was highest regarding patient identification (86%) and blood component identification (82%). However, comparatively lower knowledge was observed regarding the management of transfusion reactions (55%) and blood storage requirements (58%).

Table 3. Practices regarding safe blood transfusion (N=200)

Nursing practice	Always/usually, n (%)
Verification of patient identity	166 (83.0)
Checking blood component details	158 (79.0)
Inspection of blood bags	142 (71.0)
Checking expiry dates	150 (75.0)

Recording baseline vital signs	156 (78.0)
Using appropriate transfusion equipment	160 (80.0)
Monitoring during initial transfusion	132 (66.0)
Regular monitoring during transfusion	138 (69.0)
Reporting suspected transfusion reactions	124 (62.0)
Completing transfusion documentation	146 (73.0)

Most nurses reported usually or always verifying patient identity (83%) and using appropriate transfusion equipment (80%). However, comparatively lower adherence was reported for monitoring during the initial transfusion period (66%) and reporting suspected transfusion reactions (62%).

Table 4. Overall knowledge and practice levels (N=200)

Category	Knowledge n (%)	Practice n (%)
Good	76 (38.0)	68 (34.0)
Moderate	84 (42.0)	90 (45.0)
Poor	40 (20.0)	42 (21.0)
Total	200 (100)	200 (100)

Only 38% of nurses demonstrated good knowledge, whereas 42% had moderate and 20% had poor knowledge. Similarly, 34% demonstrated good transfusion practices, while 45% had moderate and 21% had poor practices.

Figure 1. Distribution of knowledge levels

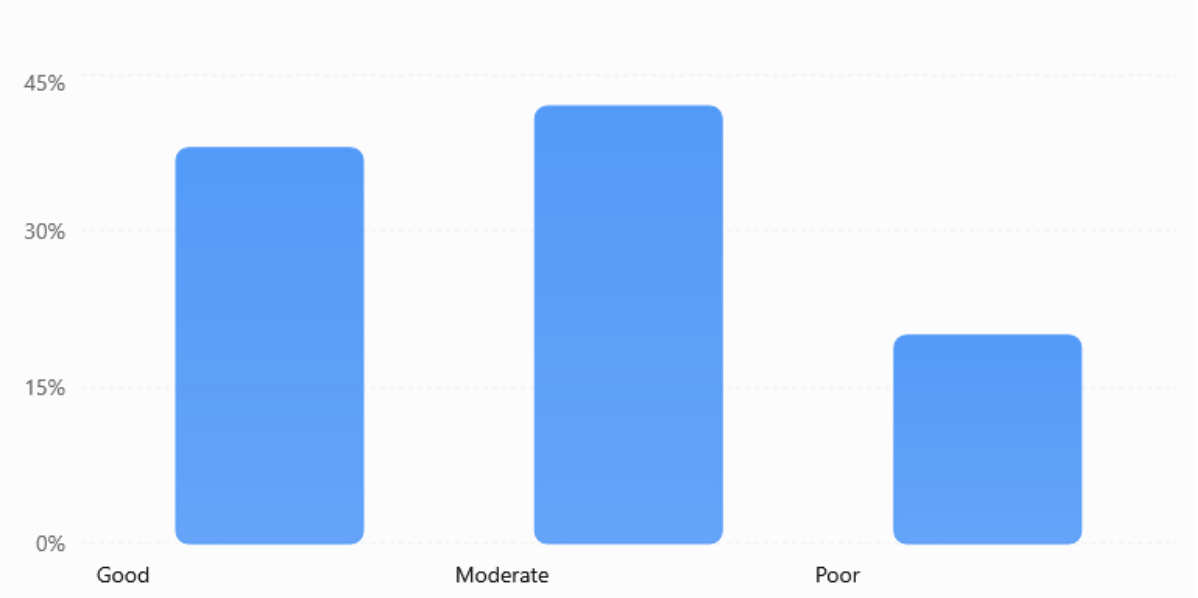


Figure 2. Distribution of transfusion practices

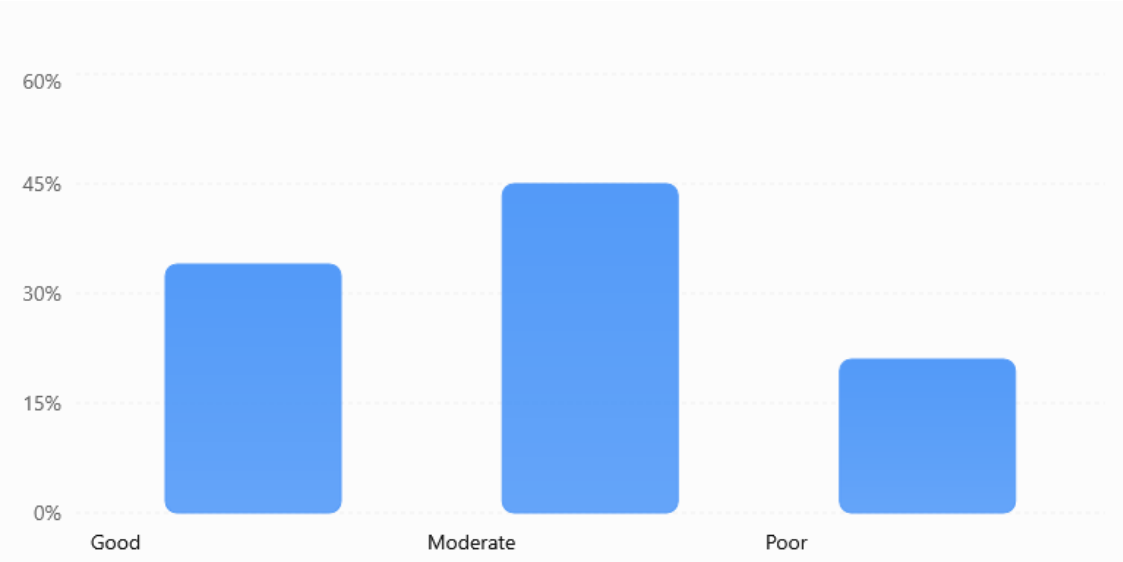


Table 5. Association between previous transfusion training and knowledge level

Previous training	Good knowledge	Moderate/poor knowledge	Total
Yes	42 (53.8%)	36 (46.2%)	78
No	34 (27.9%)	88 (72.1%)	122
Total	76	124	200

chi-square result: $\chi^2 = 13.52$; p = 0.001.

Nurses who had previously received transfusion-related training demonstrated a higher proportion of good knowledge (53.8%) compared with those without previous training (27.9%). The illustrative association was statistically significant.

Table 6. Association between knowledge and practice levels

Knowledge level	Good practice	Moderate practice	Poor practice	Total
Good	40	28	8	76
Moderate	24	47	13	84
Poor	4	15	21	40
Total	68	90	42	200

chi-square result: $\chi^2 = 48.48$; p less than 0.001.

Good clinical practices were more frequent among nurses with good knowledge (52.6%) than among those with moderate (28.6%) or poor knowledge (10.0%). The illustrative association was statistically significant.

Figure 3. Relationship between knowledge and practice levels



Table 7. Correlation between knowledge and practice scores

Variables	Correlation coefficient (r)	p-value
Knowledge score and practice score	0.48	less than 0.001

A moderate positive correlation was observed between knowledge and practice scores in the illustrative analysis, indicating that higher knowledge scores were associated with better reported transfusion practices.

Discussion

The present study assessed knowledge and practices regarding safe blood transfusion among registered nurses at Lahore General Hospital, Lahore. The findings demonstrated that most nurses had moderate knowledge (42.0%) and moderate transfusion practices (45.0%), whereas only 38.0% demonstrated good knowledge and 34.0% reported good clinical practices. Furthermore, 20.0% of participants had poor knowledge and 21.0% demonstrated poor practices. These findings suggest that although registered nurses possessed a basic understanding of transfusion safety, considerable gaps remained in the consistent application of recommended clinical procedures. The difference between knowledge and reported practices also highlights the importance of translating theoretical understanding into appropriate bedside nursing performance.

Regarding demographic characteristics, the majority of participants were female (81.0%), and 63.0% held a BS Nursing qualification. Most nurses had between 5 and 10 years of clinical experience (41.5%). However, 61.0% had not received previous formal training regarding blood transfusion. This finding is particularly important because transfusion procedures require specific technical knowledge and clinical competencies that may not be adequately maintained through routine clinical exposure alone. Edea et al. (2024), in their cross-sectional study involving 278 nurses and midwives in public hospitals in Ethiopia, identified important deficiencies in transfusion-related knowledge and demonstrated the relevance of professional and institutional factors in determining nurses' knowledge levels. These findings emphasize the importance of structured educational opportunities and regular competency assessments among nursing professionals.

The assessment of individual knowledge domains revealed that patient identification was the strongest area, with 86.0% of nurses providing correct responses, followed by identification of blood components (82.0%). Knowledge regarding transfusion administration procedures was also relatively satisfactory (77.0%). Nevertheless, knowledge regarding the management of transfusion reactions was relatively low (55.0%), followed by blood storage requirements (58.0%) and recognition of transfusion reactions (63.0%). These deficiencies are clinically important because inadequate recognition and delayed management of transfusion reactions may expose patients to preventable complications. Soutar et al. (2023), in the British Society for Haematology guideline, emphasized prompt recognition, clinical assessment, investigation, and management of acute transfusion reactions. Therefore, nursing education should place particular emphasis on identifying early clinical manifestations and implementing appropriate emergency responses.

Similarly, the findings concerning nursing practices demonstrated comparatively better adherence to patient identification (83.0%) and appropriate transfusion equipment use (80.0%). Checking blood component details (79.0%) and recording

baseline vital signs (78.0%) were also frequently reported. However, monitoring during the initial transfusion period was reported by only 66.0% of participants, while 62.0% reported always or usually reporting suspected transfusion reactions. These findings indicate potential weaknesses in continuous patient surveillance and adverse-event reporting. Early monitoring is particularly important because severe acute transfusion reactions may develop shortly after transfusion initiation. The Serious Hazards of Transfusion (SHOT) 2023 annual report documented 3,833 transfusion-related reports, with 83.1% associated with errors, highlighting the continuing importance of patient identification, correct blood component administration, and staff competency. The 2024 SHOT annual report also identified persistent handling, storage, and transfusion process errors, reinforcing the need for strict adherence to institutional transfusion protocols.

An important finding was the association between previous transfusion-related training and knowledge levels. Nurses who had received previous training demonstrated a higher proportion of good knowledge (53.8%) compared with those without previous training (27.9%). This association was statistically significant (χ^2 = 13.52, p = 0.001). The finding suggests that structured educational interventions may contribute to improved understanding of transfusion safety requirements. Shabbir et al. (2025), in a quasi-experimental study conducted in Lahore, reported significant improvements in nurses' knowledge and practical performance following a structured educational intervention focusing on blood transfusion protocols. These findings support the incorporation of regular transfusion-related training, refresher courses, simulation-based exercises, and competency assessments into hospital nursing education programs.

The relationship between knowledge and clinical practices was another important aspect of the study. Nurses with good knowledge demonstrated a higher proportion of good practices (52.6%) compared with those with moderate knowledge (28.6%) and poor knowledge (10.0%). The association was statistically significant (χ^2 = 48.48, p less than 0.001). Furthermore, a moderate positive correlation was observed between knowledge and practice scores (r = 0.48, p less than 0.001). These findings indicate that better theoretical understanding was associated with more frequent adherence to recommended transfusion safety procedures. However, the relationship was not absolute, suggesting that knowledge alone may not guarantee appropriate clinical performance. Institutional workload, staffing limitations, availability of transfusion guidelines, supervision, and access to appropriate equipment may also influence nursing practices. Dehghan Nayeri et al. (2022), in a systematic review addressing blood transfusion safety, highlighted the importance of strengthening clinical procedures, identification systems, and institutional safety measures to minimize transfusion-related errors. Consequently, interventions should address both individual competency and organizational factors affecting transfusion safety.

The findings have important implications for nursing practice and hospital administration at Lahore General Hospital. Regular in-service training should be organized to improve nurses' understanding of blood compatibility, storage requirements, bedside verification, recognition of transfusion reactions, and emergency management procedures. Standardized transfusion checklists should be made readily available in clinical departments, while periodic clinical audits and competency assessments may help identify deficiencies in actual bedside practices. Furthermore, strengthening incident reporting and haemovigilance mechanisms could improve institutional monitoring of transfusion-related adverse events and near misses.

This study also has certain limitations. Its cross-sectional design would limit the ability to establish causal relationships between training, knowledge, and clinical practices. Furthermore, self-reported practice assessments may be influenced by recall and social desirability bias and may not accurately represent actual bedside behavior. Conducting the study at a single tertiary-care hospital may also limit the generalizability of findings to other healthcare institutions. Future studies could incorporate direct observation of transfusion procedures, larger multicentre samples, and intervention-based designs to evaluate the effectiveness of structured educational programs.

In conclusion, the illustrative findings suggest that registered nurses demonstrated moderate knowledge and practices regarding safe blood transfusion, with important deficiencies in transfusion reaction management, blood storage, initial patient monitoring, and adverse-event reporting. Previous transfusion-related training was associated with better knowledge, while higher knowledge levels were significantly associated with better reported clinical practices. Strengthening continuing nursing education, implementing standardized transfusion protocols, and conducting regular competency assessments may improve transfusion safety and reduce preventable transfusion-related complications.

Conclusion

The present study indicated that registered nurses demonstrated moderate knowledge and practices regarding safe blood transfusion, with notable deficiencies in the management of transfusion reactions, blood storage requirements, initial patient monitoring, and adverse-event reporting. Previous transfusion-related training was significantly associated with better knowledge, while higher knowledge levels were positively associated with safer reported transfusion practices. These findings highlight the importance of strengthening nursing competencies through regular in-service training, continuing professional development, standardized transfusion protocols, and periodic competency assessments. Hospital administration should also

improve adherence to bedside verification procedures and strengthen haemovigilance and incident-reporting systems. Such measures may help minimize preventable transfusion-related errors, enhance patient safety, and improve the quality of nursing care.

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