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From Classroom to Blood Bank: Do Interns Possess the Skills for Safe Transfusion? - A KAP-Based Appraisal among Interns in a Rural Indian Medical College

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Abstract

Background: Blood transfusion is a high-risk clinical intervention requiring stringent adherence to safety protocols. Interns frequently initiate transfusions in emergency settings, yet formal training in transfusion medicine is inadequate in many institutions.

Objectives: To assess the knowledge, attitudes, and practices (KAP) of medical interns regarding blood transfusion; to identify training gaps; and to compare findings with similar Indian and Western literature.

Materials and Methods: A cross-sectional survey was administered to interns (n = 75) using a structured, prevalidated questionnaire comprising knowledge (15 items), attitude (6 items), and practice (6 items). Data were analyzed using descriptive statistics. Adequate knowledge and good practice were defined as ≥70% scores.

Results: Mean knowledge accuracy was 77.9% ± 10.8%, with strong performance in storage parameters and immunohematology (≥85%) but weaker procedural knowledge (65–75%). Only 20% had attended any transfusion-related workshop and 12% had received formal training. Attitude scores were highly positive (mean 4.55/5), yet practice compliance remained modest

(61%), with only 15% ever reporting transfusion reactions. Handling of cryoprecipitate and hemovigilance reporting were the weakest domains.

Conclusion: Interns exhibit good theoretical knowledge and positive attitudes but insufficient procedural competency—mirroring trends reported in Indian and Western studies. Structured training modules, supervised rotations, and simulation-based learning must be integrated into medical education to bridge the persistent knowledge–practice gap.

Keywords: Knowledge; Attitude; Practice; Blood Transfusion; Interns; Hemovigilance; Transfusion Safety

Introduction

Blood and blood component transfusion is an essential emergency therapy, supported by a complex chain of clinical and laboratory activities requiring trained personnel.[1] Inappropriate or excessive use of blood products increases costs and exposes patients to preventable complications, including transfusion reactions, alloimmunization, and transfusion-transmitted infections.

Although clinicians frequently decide on transfusions, many lack structured training in transfusion medicine (TM). Interns, who often initiate transfusion requests and participate in emergency care, are at particular risk of committing errors when insufficiently trained. Their competency directly influences transfusion appropriateness and patient safety.

Several KAP (Knowledge, Attitude, and Practice) studies among medical students, interns, residents, and clinicians have demonstrated persistent gaps in understanding and inconsistent practices, underscoring the need for focused education and regular audits.[2] However, only a few Indian studies have assessed the transfusion-related KAP of medical interns. [3–5]

Therefore, the present study was undertaken to evaluate the knowledge, attitudes, and practices of interns and residents regarding safe blood transfusion, identify gaps, and support the development of targeted training interventions.

Materials and Methods

Study Design & Setting

Cross-sectional survey conducted at BKL Walawalkar Rural Medical College, Sawarde, after Institutional Ethics Committee **(IEC approval number: BKLW/ RMC/LEC/134/2025).**

Participants

75 interns who submitted complete responses.

Instrument

A pre-tested questionnaire (demography + 15 knowledge + 6 attitude + 6 practice questions)

Scoring: Correct = 1; adequate knowledge ≥70%.

Data Collection and Data Analysis

Self-administered online Google Form distributed on 23-09-2025. Participation was voluntary.

Data analysis was performed using Excel/SPSS. Continuous variables expressed as mean ± SD; categorical variables as proportions.

Results

A Google form consisting of these four sections (Including demographic details) was developed and sent to interns through WhatsApp on 23-09-2025.

The correct response of each knowledge-based and practice/attitude-based question was assigned with one point, and separate scores were calculated for the knowledge and practice/attitude-based questions as knowledge scores (KS) and practice scores (PS), respectively. The KS again was divided into three categories, as ≤ 7 (out of 15 *i.e.*, below 50%) as poor (KC3); 8 - 11 as average (KC2), and; > 11 as good

(KC1). Those who had not even completed the knowledge-based questions were excluded from the study.

Scoring

Knowledge: Each correct response = 1; total converted to percentage. Adequate knowledge defined as ≥70%.

Attitude: Likert scale scored and summed; positive attitude defined as score ≥70% of maximum.

Practice: Self-reported correct actions scored and considered "appropriate" if ≥70.

Participant characteristics/Demographic Data

Total Participants 77

Two Google Form responses were found to be incomplete; therefore, only **75** completed responses were included for further evaluation.

Figure 1: shows age distribution of intern respondents.

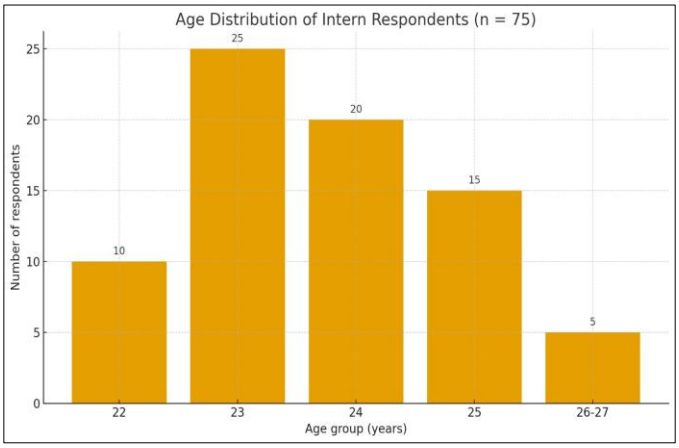

Figure 1 Age distribution of intern respondents (n = 75)

The majority of interns were between 23 and 25 years of age, with a mean age of 24.1 ± 1.3 years, indicating that most participants were in their early twenties with relatively low variation in age.

Among them, males were 52% and females 48%, as seen in Figure 2.

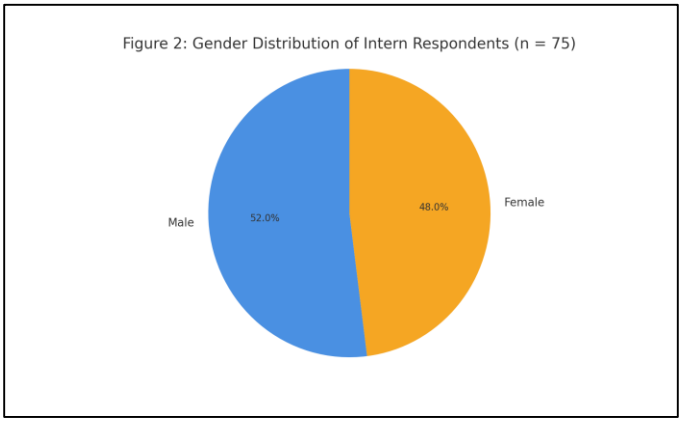

Figure 2: Gender distribution (n = 75)

The distribution of interns across departments (Fig) showed that the interns posted in the Medicine department had the highest participation, followed by Surgery and Obstetrics & Gyn ecology. Moderate representation was seen from Pediatrics, while fewer interns posted in Community Medicine / PSM and Orthopedics / ENT / Ophthalmology / Anesthesia had participated.

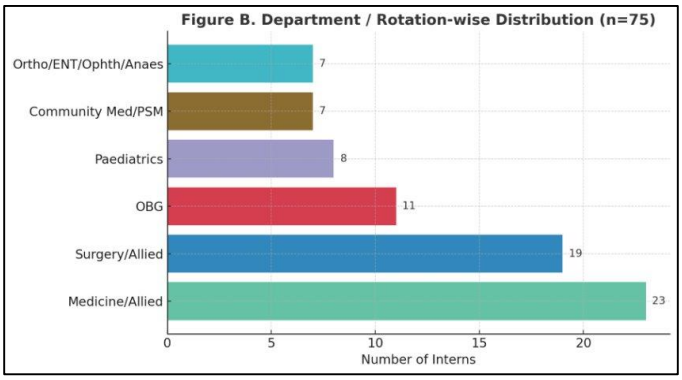

Figure 3: Department /rotation-wise distribution of respondents.

Approximately 20% of the interns had attended a CME or workshop related to transfusion medicine and only 12% reported prior to formal training as depicted in Fig. 4 and Fig. 5 respectively.

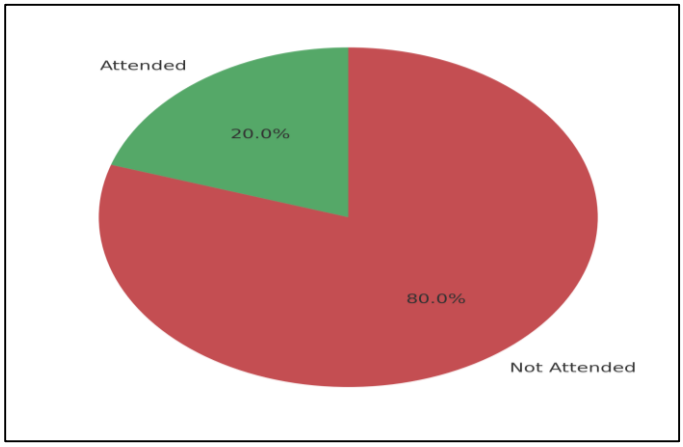

Figure 4: CME / workshop exposure (n = 75)

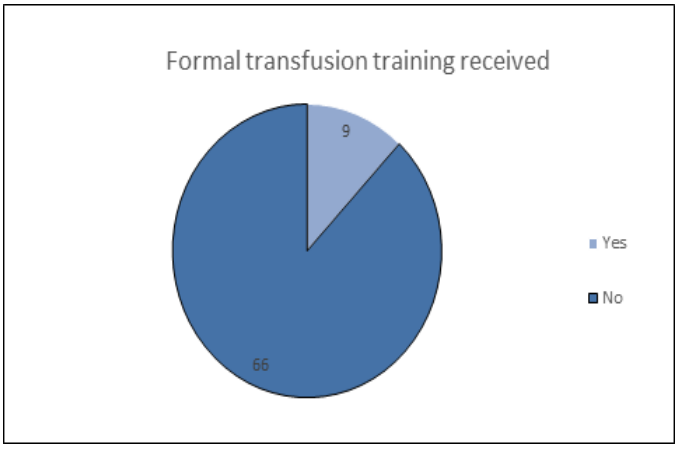

Figure 5: Prior to transfusion services training. (n = 75)

Knowledge Data Analysis

Item-wise Knowledge Question Analysis (n = 75), as noted from Table 1, revealed that the overall mean item-wise accuracy among interns was 77.9 % ± 10.8 %, indicating a generally satisfactory level of knowledge regarding various aspects of transfusion medicine, though with noticeable variability across specific items.

Table 1**:** Item-wise Knowledge Question Analysis (n = 75)

Q No.	Question Focus	Correct Answer %	Interpretation / Comment
Q 1. Storage period of whole blood	"35 days"	87 %	The majority correctly identified 35 days; only 13 % confused with 14 days or 7 days.
Q 2. Storage temperature of fresh frozen plasma (FFP)	"–20 °C or lower"	94 %	Excellent awareness; nearly all interns knew the correct FFP storage temperature.
Q 3. Storage temperature of platelet concentrate	"20–24°C with agitation"	83 %	Good understanding; a few (17 %) selected 2–6 °C (RBC storage).
Q 4. Plasma protein content it n one unit of plasma	"1–1.5 g/dL"	78 %	Moderate; confusion with 3–4 g/dL observed in ~22%.
Q 5. Pre-transfusion bedside check	"Expiry date / Crossmatch / Identification"	65 %	Weakest among storage items; some neglected expiry or identity verification.
Q 6. Minimum hemoglobin required for donation	"≥ 12.5 g/dL"	72 %	Reasonable; a quarter underestimated the minimum acceptable value.
Q 7. Shelf-life of packed RBCs	"35 days (at 2–6 °C)"	90 %	Very good; most responded correctly.
Q 8. Volume of blood in a standard unit	"≈ 350 mL (±10 %)"	80 %	Satisfactory; minor variation seen in 20%.

Q No.	Question Focus	Correct Answer %	Interpretation / Comment
Q 9. Indications for platelet transfusion	"Thrombocytopenia < 20,000/µL or bleeding"	68 %	Moderate; needs improvement—many could not recall threshold criteria.
Q 10. First step when a transfusion reaction is suspected	"Stop transfusion immediately."	77 %	Fairly good, but some confusion with "send sample to lab first."
Q 11. Universal donor group	"O negative"	95 %	Excellent; nearly all answered correctly.
Q 12. Universal recipient group	"AB positive"	91 %	Excellent; high awareness.
Q 13. Cross-matching purpose	"Compatibility testing between donor & recipient"	88 %	Good comprehension.
Q 14. Component therapy	"Transfusion of specific blood components"	74 %	Moderate; some equated with "whole blood transfusion."
Q 15. Indication for FFP transfusion	"Deficiency of clotting factors / DIC"	64 %	Weak; several incorrectly linked FFP to volume expansion.

Figure 6 illustrates the distribution of knowledge scores across specific thematic domains.

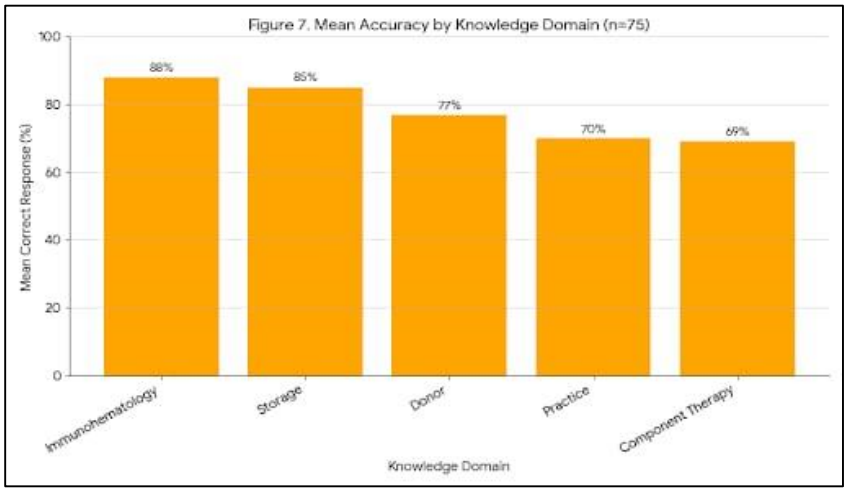

Figure 6: distribution of knowledge scores across specific thematic domains.

Storage knowledge (Questions 1–4, 7) showed consistently strong performance, with over 80 % accuracy. In contrast, procedural knowledge (Questions 5, 9, 10, 15) demonstrated weaker performance, averaging around 65–75 %. Knowledge of immunohematology fundamentals (Questions 11–13) was excellent (> 85 %), suggesting a clear understanding of blood grouping and compatibility concepts. However,

performance in component therapy and reaction management (Questions 14–15) was moderate.

Attitude Data Analysis

The 5-point Likert scale used for assessing attitude responses ranged from 1 (Strongly Disagree) to 5 (Strongly Agree), allowing quantification of participants' perceptions and agreement levels regarding transfusion practices.

Each item reflected a statement on transfusion safety, reporting, or confidence in practice. Responses were scored as follows:

5 – Strongly Agree

4 – Agree

3 – Neutral

2 – Disagree

1 – Strongly Disagree

This scoring method enabled the calculation of mean attitude scores per item and across the domain, providing both direction (positive or negative) and intensity of opinion. Higher mean values (≥ 4.0) indicated a positive and supportive attitude, while lower means highlighted areas requiring reinforcement or practical exposure.

By converting ordinal responses into quantitative values, the Likert scale facilitated objective comparison of attitude trends as seen in Table 2.

Table 2: Likert Scale Analysis (n = 75)

No.	Statement	Mean ± SD
1	Blood transfusion is a life-saving procedure.	4.8 ± 0.5
2	I feel confident prescribing a blood component.	3.9 ± 0.8
3	Patient consent should be mandatory for every transfusion.	4.7 ± 0.6
4	Transfusion-related errors are preventable with proper training.	4.6 ± 0.7
5	Transfusion medicine should be a core part of the MBBS curriculum.	4.9 ± 0.4
6	Component therapy is more rational than whole blood transfusion.	4.4 ± 0.7

The mean overall attitude score of 4.55 ± 0.6 indicates a strongly positive attitude toward safe transfusion practices among interns. More than 85% of participants expressed agreement or strong agreement with most statements. The only relatively weaker domain was confidence in prescribing blood components (Q2), where agreement was lower (≈78 %). The figure 7 gives details about attitude responses.

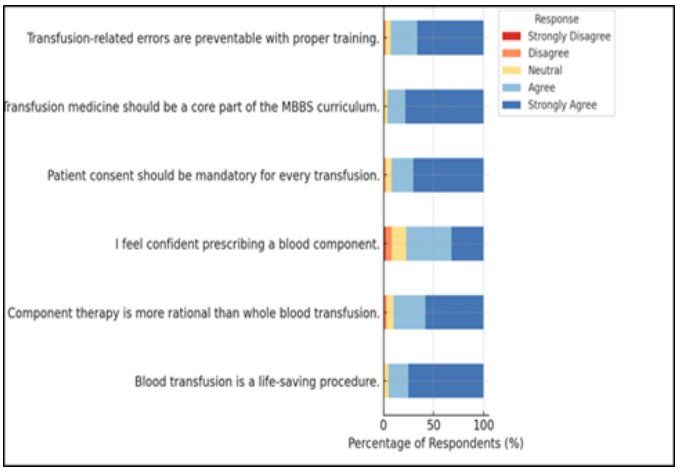

Figure 7: Distribution of Attitude responses Likert Scale

Discussion

The present study shows that interns possess good theoretical knowledge of transfusion medicine (mean accuracy 77.9% ± 10.8%), with storage and immunohematology concepts being the strongest domains. However, practical application remains suboptimal, particularly in bedside verification, reaction management, and correct indications for FFP. Similar trends have been identified across Indian studies as shown in table 3 by Monisha et al.,[3] Date et al.[10], and Ram et al.[4], which consistently report high theoretical knowledge but weaker procedural competency.

Table 3: Comparison of Attitude in various KAP studies

Author / Year	Study Population	Location	Mean Knowledge Score (%)	Key Findings / Remarks
Present study (2025)	Interns (n = 75)	Western Maharashtra, India	77.9 ± 10.8	Strong theoretical knowledge; weaker procedural and clinical application; poor awareness of FFP indications and bedside verification.
Monisha et al., (2021) [3]	Interns	Tamil Nadu, India	72	Adequate knowledge of storage and grouping; weak pre-transfusion checks and hemovigilance awareness.
Date et al., (2023)[10]	Postgraduates & Interns	Nagpur, Maharashtra	68.4	Good basic understanding; low procedural awareness; poor reporting of transfusion reactions.
Ram et al., (2024)[4]	Interns	Karnataka, India	75	High scores for theoretical aspects; low scores for component therapy and adverse reaction management.
Oluwatosin et al., (2020)[11]	Medical interns	Nigeria	70.2	Similar to Indian studies, weak hemovigilance practice and reporting.
Tynan et al., 2019)[12]	Undergraduate medical students	Ireland	82	High accuracy; structured transfusion medicine module improved knowledge and confidence.
Stevens et al., 2018(13)	Interns & residents	United Kingdom	>80	CME participation linked to better transfusion reaction identification and safer practice.

Only 20% of interns had attended any transfusion-related CME, and this subgroup demonstrated slightly better knowledge and practice scores—aligning with observations from Kakkar et al., where structured CME significantly improved performance. The gap between conceptual understanding and hands-on competence reflects limited exposure to blood bank procedures during internship. Comparison with Western literature (Tynan et al., Stevens et al.)[12] shows that structured transfusion-medicine curricula and simulation-based learning lead to higher confidence and safer practice (>80%). The present findings therefore emphasize the

need for integrating formal transfusion education within CBME, supported by supervised rotations, case-based learning, and simulation modules.

Overall, the study confirms a persistent knowledge–practice gap, driven largely by low exposure to practical transfusion medicine, inadequate hemovigilance participation, and limited training opportunities.

Practice

Self-reported practice compliance (≈61%) indicates adequate but inconsistent adherence to transfusion protocols. Strengths included timely initiation of PRBC transfusions (82%) and appropriate monitoring during platelet transfusion (73%). However, only 15% had reported a transfusion reaction, underscoring poor hemovigilance awareness. Handling of cryoprecipitate (56%) also remained a weak area, reflecting limited procedural exposure.The table 4 gives comparison of practice scores with other KAP Studies

Table 4: Comparison of Practice Scores and Key Observations in KAP Studies on Blood Transfusions.

Author / Year	Study Population	Location	Mean Practice Score (%)	Key Observations / Remarks
Present Study (2025)	Interns (n = 75)	Western Maharashtra, India s	61	Adequate but not optimal compliance; strong in timing and monitoring; poor hemovigilance reporting (15%) and weak cryoprecipitate handling.
Chaudhari et al., (2019)[14]	Interns & Residents	Maharashtra, India	58	Under-reporting of adverse reactions (<20%); limited awareness of hemovigilance; weak documentation practices.
Raturi & Kumar, (2021)[15]	Resident Doctors	Uttarakhand, India	62	Good theoretical awareness; poor adherence to reaction management and reporting protocols.
Kakkar et al., (2020)[16]	Postgraduates	Delhi, India	64 (Pre-CME) / 86 (post-CME)	Significant improvement (+22%) after hands-on training; emphasized CME impact on transfusion safety.
Ram et al., (2024)[4]	Interns	Karnataka, India	60	Good awareness of timing and monitoring; low confidence in reaction documentation and component therapy.
Date et al., (2023)[10]	Postgraduates & Interns	Nagpur, Maharashtra	65	Adequate basic practice; poor hemovigilance and component-specific knowledge.
Oluwatosin et al., (2020)[11]	Medical Interns	Nigeria	60.5	Comparable to Indian studies; low reporting culture; need for structured transfusion training.
Tynan et al.,	Undergraduate	Ireland	>80	High compliance due to inclusion of transfusion

Author / Year	Study Population	Location	Mean Practice Score (%)	Key Observations / Remarks
(2019)[12]	Students			modules and simulation-based learning.
Stevens et al., (2018)[13]	Interns & Residents	United Kingdom	82	Strong practical skills; frequent CME participation and formal transfusion medicine curriculum.

Comparison with other Indian and African KAP studies demonstrates similar trends of moderate protocol adherence but inadequate reaction reporting and component-specific proficiency. In contrast, Western studies report much higher practice scores, owing to structured training and frequent simulations.

To strengthen practice, mandatory blood-bank postings, reaction-management workshops, and case-based hemovigilance sessions are recommended.

Limitations

1. Single-centre study limits generalizability.
2. Cross-sectional design does not assess longitudinal improvement.
3. Limited hands-on exposure during internship may have influenced perceived competence.

Conclusion

Interns demonstrate strong theoretical knowledge and positive attitudes but lack adequate procedural skills in transfusion medicine. The findings emphasize an urgent need for structured, competency-based training that incorporates hands-on procedures, simulation exercises, and formal teaching modules in transfusion medicine. Multi-center and interventional studies may offer deeper insights into enhancing transfusion safety among trainees.

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