

# Assessment of Doctors' Knowledge of the Management of Acute Blood Transfusion Reactions in a Tertiary Health Facility in North-Western Nigeria

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## Abstract

**Background:** Blood transfusion is lifesaving but may cause severe immunologic and non-immunologic reactions requiring prompt recognition and management. In low- and middle-income countries, including Nigeria, transfusion safety is compromised by underreporting and limited physician awareness, weakening haemovigilance systems. **Aim:** This study assessed doctors' knowledge of managing acute blood transfusion reactions in a tertiary health facility in North-Western Nigeria. **Materials and Methods:** A cross-sectional survey was conducted among doctors at Ahmadu Bello University Teaching Hospital (ABUTH), Zaria, using a structured, pretested, interviewer-administered questionnaire. Of the 654 eligible doctors, 242 were randomly selected and 205 valid responses analysed. Data were collected between April and July 2017 and analyzed using SPSS version 22. **Results:** Participants had a mean age of  $34.6 \pm 0.5$  and ranged 25–54 years with a male-to-female ratio of 2.5:1. Clinical experience ranged from <1 year (27.3%) to >20 years (8.3%). Years of practice were significantly associated with prior involvement in managing BTRs ( $p = 0.035$ ). Knowledge of first-line management, immediate cessation of transfusion and maintenance of intravenous access was high across experienced groups ( $p = 0.83$ ). While awareness of pre- and post-transfusion blood sampling was satisfactory, knowledge of urine-based investigations was poor, with a significant gender difference for post-transfusion urine sampling ( $p = 0.018$ ). Frontline notification was well recognized, awareness of laboratory and institutional reporting pathways was limited. **Conclusion:** Doctors showed good initial management knowledge but significant gaps in investigations and reporting, highlighting the need for improved haemovigilance training.

**Keywords:** assessment, knowledge, management, doctors, acute blood transfusion reactions

## Introduction

Blood transfusion is a critical component of modern medical practice and is frequently used in the management of acute blood loss, severe anaemia, and coagulopathies.<sup>[1,2]</sup> Despite its life-saving potential, blood transfusion is associated with adverse events, broadly classified as immunologic and non-immunologic reactions based on their underlying mechanisms.<sup>[3]</sup>

Clinical manifestations range from mild symptoms such as fever and urticaria to severe, life-threatening complications, including acute

haemolytic transfusion reactions and transfusion-related acute lung injury (TRALI).<sup>[4,5]</sup> The reported incidence of blood transfusion reactions in Nigeria is low; however, this is likely attributable to under recognition and underreporting rather than true rarity.<sup>[6,7]</sup> Similar low incidences have been reported in other low- and middle-income countries, such as Morocco (0.44%).<sup>[8]</sup> These findings highlight

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persistent gaps in haemovigilance systems, particularly in settings where reporting structures, documentation, and clinician awareness are suboptimal.

Immunologic transfusion reactions include febrile non-haemolytic transfusion reactions, allergic reactions, anaphylaxis, and haemolytic reactions, while non-immunologic reactions include transfusion-associated circulatory overload, bacterial contamination, and iron overload.<sup>[3,9]</sup> Although many reactions are mild, delayed recognition and inappropriate management can lead to serious outcomes such as renal failure, shock, prolonged hospitalization, or death.<sup>[3,10]</sup> Notably, non-immunologic causes have been reported as major contributors to acute transfusion reactions in studies from Nigeria and other regions.<sup>[7]</sup> In these settings, adverse event patterns often extend beyond classic immune-mediated reactions, and underdeveloped haemovigilance systems may obscure the full spectrum of contributing causes.<sup>[7]</sup>

Doctors play a pivotal role in transfusion safety and haemovigilance. Their responsibilities include prescribing blood, monitoring patients during and after transfusion, recognizing early warning signs of transfusion reactions, initiating immediate management, collecting appropriate samples, and ensuring timely reporting of adverse events.<sup>[3,11]</sup> However, haemovigilance reports and previous studies have consistently identified knowledge and practice gaps among physicians, particularly in resource-limited settings.<sup>[12,13]</sup> These deficiencies contribute to delayed intervention, incomplete investigations, and persistent underreporting, thereby compromising patient safety.

Given the significant clinical and systemic consequences of transfusion reactions, assessing doctors' knowledge of their management is essential for identifying gaps, guiding targeted training, and strengthening institutional haemovigilance frameworks. While some studies have assessed general transfusion practices among healthcare workers, there is a paucity of data specifically addressing doctors' knowledge of managing acute blood transfusion reactions in Nigeria, particularly in the North-Western region. This study aimed to assess the basic knowledge of

doctors regarding the management of acute blood transfusion reactions in North-Western Nigeria.

## Materials and Methods

### Study setting and subjects

The study was conducted across various departments at Ahmadu Bello University Teaching Hospital (ABUTH) in Zaria, Kaduna State, located in Nigeria's northwest geopolitical zone. Established in 1967 as a teaching hospital for Ahmadu Bello University (ABU), which was one of the early universities in Nigeria. The hospital serves as a key clinical training center for medical students and healthcare professionals, while also functioning as a major healthcare provider for northern Nigeria, the nation, and neighboring countries.

The study populations were doctors working at different departments of the hospital with different working experiences. The doctors were selected using simple random sampling.

### Sampling

At the time of the study, a total of 654 doctors were employed across the various departments of ABUTH-Zaria.

### Sample calculation

Sample size was calculated using the formula for descriptive studies:<sup>14</sup>

$$n = \frac{Z^2 X p X (1-p)}{d^2}$$

Where the infinite sample size was  $\approx 384$

Because the doctors' **population (N = 654)** was not large relative to the initial sample size estimate, finite population correction was applied and the final adjusted sample size was  $\approx 242$  doctors.

### Sampling Method

The study employed a cross-sectional design, with participants selected through simple random sampling. Conducted between April and July 2017, the study initially targeted 242 doctors; however, 21 of the doctors were on leave, and 16 questionnaires were excluded for incomplete biodata. Consequently, the final sample comprised 205 doctors.

## Research Instrument

A structured, interviewer - administered questionnaire focusing on acute blood transfusion reactions was used to evaluate doctors' knowledge of their management.

The questionnaire used in this study was developed following a review of published literature, World Health Organization (WHO) recommendations, and standard transfusion medicine guidelines on the recognition and management of acute blood transfusion reactions. Relevant domains assessed included immediate management steps, investigation of transfusion reactions, notification pathways, and reporting practices.<sup>[15-18]</sup> The items were adapted to reflect the local clinical context and institutional practices within Nigerian tertiary healthcare settings.

Content validity was ensured through expert review by senior haematologists and transfusion medicine specialists at Ahmadu Bello University Teaching Hospital, who assessed the questionnaire for relevance, clarity, and completeness. Based on their feedback, ambiguous questions were reworded, and redundant items were removed to improve clarity and alignment with clinical practice. The questionnaire was pretested among a small group of doctors (10% of the sample size) who were not included in the final study sample. Pretesting focused on comprehension, wording, length, and ease of administration. Feedback from the pretest led to minor adjustments, including the simplification of technical terms and the reorganization of certain response options to enhance clarity and minimize misinterpretation.

The questionnaire was in English. The questionnaire was administered by the residents of the Haematology Department of ABUTH-Zaria. The Questionnaire consisted of two parts: socio-demographic characteristics and the survey. The survey consisted of 4 stem questions with sub-questions under them (a total of 16 questions). The questions were formatted as yes/no, with unanswered items recorded as "no response". Correct answers were scored 1 point, while incorrect or non-responses received 0 points. Knowledge levels were categorized as high (80–

100%), moderate/average (50–79%), and low/poor (<50%). The questionnaire was administered over a three-month period from April to July 2017.

## Ethical Consideration

Institutional ethical approval was obtained from ABUTH-Zaria for the conduct of the research with the number ABUTHZ/HREC/W10/2016, and informed consent was obtained from the participants. The participants were assured of confidentiality.

## Data Analysis

The data obtained from the questionnaires were entered and analysed using SPSS version 22.0 (Chicago, IL, USA). Categorical variables were summarized using frequencies and percentages, while continuous variables were summarized using means and standard deviations. Associations between categorical variables were assessed using the Chi-square test or Fisher's exact test where appropriate and a p-value  $\leq 0.05$  was considered statistically significant.

## Results

The study population consisted of 205 doctors who participated in the study. The age range of the doctors was 25 - 54 years with a mean of  $34.63 \pm 0.49$  years as shown in figure 1; and male-to-female ratio of 2.5:1. Their clinical experiences ranges from less than 1 year 56 (27.3%) to greater than 20 years 7 (8.3%) respectively as shown in figure 2. Association of knowledge of doctors on blood transfusion reactions (BTRs) and years of experience is shown in Table 1. Table 2 presents the association between knowledge of sample use in the investigation of BTR and gender, while Table 3 illustrates the association between knowledge of whom to notify during a BTR and gender.

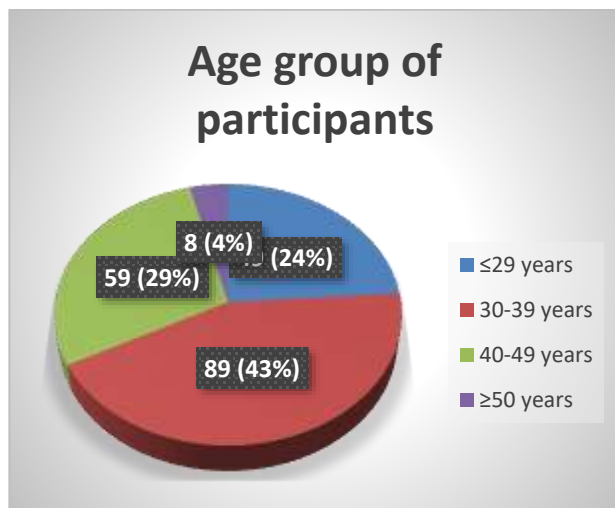


Figure 1: Age group of the participants

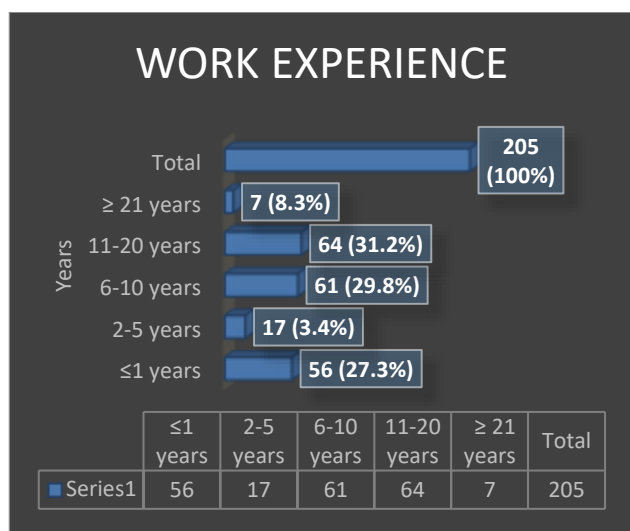


Figure 2: Work experience of the participants

Table 1: Association of knowledge of doctors and years of experience

Years of Experience	Responses			Total	Fisher's Exact	p-value
	Yes	No	No response			
1. Have you participated in the care of patient who has experience blood transfusion reaction?						
≤1 years	47	9	0	56	10.33	0.035
2-5 years	16	1	0	17		
6-10 years	49	12	0	61		
11-20 years	61	3	0	64		
≥21 years	7	0	0	7		
Total	180	25	0	205		
2. What is the first line of management of acute blood transfusion reaction are?						
a. Stop the transfusion and maintain the line with intravenous fluid.						
≤1 years	55	1	0	56	4.24	0.83
2-5 years	17	0	0	17		
6-10 years	59	1	1	61		
11-20 years	63	0	1	64		
≥21 years	7	0	0	7		
Total	201	2	2	205		
b. Continue transfusion and give iv hydrocortisone and promethazine						
≤1 years	12	38	6	56	9.27	0.32
2-5 years	2	12	3	17		
6-10 years	7	42	12	61		
11-20 years	6	52	6	64		
≥21 years	1	6	0	7		
Total	28	150	27	205		

c. Observe the patient only						
≤1 years	4	46	6	56	10.87	0.21
2-5 years	1	14	2	17		
6-10 years	8	42	11	61		
11-20 years	3	56	5	64		
≥21 years	2	5	0	7		
Total	18	163	24	205		
d. Give iv hydralazine						
≤1 years	1	48	7	56	11.12	0.20
2-5 years	3	11	3	17		
6-10 years	3	46	12	61		
11-20 years	1	57	6	64		
≥21 years	0	6	1	7		
Total	8	168	29	205		
e. Give iv adrenaline and pentasocine						
≤1 years	2	42	12	56	15.82	0.05
2-5 years	1	13	3	17		
6-10 years	8	37	16	61		
11-20 years	1	54	9	64		
≥21 years	1	6	0	7		
Total	13	152	40	205		

Table 2: Association of knowledge of sample use in investigation of BTR and gender

Gender	Responses			Total	Fisher's Exact	p-value
	Yes	No	No response			
The sample use in investigation of blood transfusion reactions include the following:						
a. Pre transfusion blood sample						
Male	114	25	8	147	3.66	0.16
Female	41	9	8	58		
Total	155	34	16	205		
b. Saliva sample						
Male	8	107	32	147	1.69	0.43
Female	5	37	16	58		
Total	13	144	48	205		
c. Post transfusion blood sample						
Male	135	6	6	147	0.89	0.64
Female	54	1	3	58		
Total	189	7	9	205		
d. Pre transfusion urine sample						
Male	26	92	29	147	0.93	0.63
Female	10	33	15	58		
Total	36	125	44	205		
e. Post transfusion urine sample						
Male	90	45	12	147	8.04	0.018
Female	38	9	11	58		
Total	128	54	23	205		

Note: BTR= Blood Transfusion Reaction

Table 3: Association of knowledge of who to inform when there is BTR and gender

Gender	Responses			Total	Fisher's Exact	p-value
	Yes	No	No response			
Who needs to be informed of a presumed reaction, at the time of the reaction?						
a. doctor on call						
Male	143	0	2	147	2.58	0.26
Female	56	1	1	58		
Total	201	1	3	205		
b. The haematologist						
Male	132	7	8	147	2.98	0.23
Female	47	4	7	58		
Total	179	11	15	205		
c. The histopathologist						
Male	10	108	29	147	6.23	0.04
Female	2	35	21	58		
Total	12	143	50	205		
d. The chemical pathologist						
Male	41	88	18	147	9.08	0.00
Female	15	25	18	58		
Total	56	113	36	205		
e. The nurse on duty						
Male	125	9	13	147	3.97	0.14
Female	43	4	11	58		
Total	168	13	24	205		
f. Chief medical director						
Male	21	99	27	147	5.68	0.05
Female	6	32	20	58		
Total	27	131	47	205		

Note: BTR= Blood Transfusion Reaction

## Discussion

This study assessed doctors' knowledge of the recognition, investigation, and reporting of acute blood transfusion reactions (BTRs) rather than actual clinical competence or real-world practice. While knowledge is fundamental to transfusion safety, it does not necessarily translate into appropriate bedside action, particularly in emergency settings where institutional protocols, workload, and system-level factors influence response.

The majority of doctors were aged 30–39 years, reflecting a relatively young workforce likely in the early to mid-stages of their medical careers. This age range typically corresponds to the period after medical school and residency, during which physicians have gained practical experience and are actively engaged in clinical practice or specialist training. Previous studies have similarly shown that healthcare personnel in many low- and middle-income countries, including Nigeria, often fall within this age bracket due to increasing medical school outputs and the aging out or migration of older practitioners.<sup>[19,20]</sup>

The predominance of male doctors in this study reflects the persistent gender imbalance within the medical workforce in Nigeria and many other low- and middle-income countries. This pattern aligns with previous studies that have reported male predominance in the medical profession, particularly in specialties such as surgery, internal medicine, and emergency care, which are often considered physically or time-demanding.<sup>[21,22]</sup>

In this study, most respondents had 11–20 years of work experience, suggesting a professionally active workforce in the mid-stage of their careers. This category of professionals is often considered to be at a point where they have gained significant clinical expertise, are more confident in decision-making, and have typically transitioned into more stable roles in practice or administration.<sup>[23]</sup> Previous study have shown that healthcare professionals within this experience bracket often exhibit higher levels of competence and adherence to clinical protocols due to accumulated training, mentorship, and hands-on exposure, and blood transfusion management is no exception.<sup>[19]</sup>

Years of experience were significantly associated with prior participation in the care of patients with transfusion reactions, suggesting that increased clinical exposure improves familiarity with BTRs. However, this exposure did not consistently translate into comprehensive knowledge of investigation and reporting pathways, underscoring persistent gaps within haemovigilance systems. Encouragingly, knowledge of first-line management, defined as immediate cessation of transfusion and maintenance of intravenous access, remained high across all experience groups, reflecting effective dissemination of core transfusion safety principles.<sup>[17]</sup>

Despite this, important misconceptions were identified regarding inappropriate management options, including observation alone or continuation of transfusion with medications. These gaps highlight the tendency to conflate management of allergic reactions with broader acute transfusion reaction protocols and reinforce the distinction between theoretical knowledge and real-world response documented in Nigerian and other LMIC studies.<sup>[24,25]</sup>

Knowledge of recommended investigations showed mixed results. Awareness of pre- and post-transfusion blood sampling was high, consistent with transfusion guidelines and previous Nigerian studies.<sup>[3,7]</sup> In contrast, knowledge of urine-based investigations was poor, with significant gaps particularly for pre-transfusion urine sampling. This finding is clinically relevant, as omission of urine testing may delay recognition of acute haemolytic reactions and contribute to underreporting.<sup>[9]</sup>

With respect to notification pathways, respondents showed strong awareness of the need to inform frontline clinical staff, including the doctor on call and the nurse on duty. However, awareness of notifying laboratory specialists and institutional authorities was limited, reflecting uncertainty about multidisciplinary and institutional reporting chains. This pattern mirrors findings from Nigerian and other LMIC haemovigilance surveys, where incomplete reporting and weak coordination between clinicians and laboratories persist.<sup>[6,24,26]</sup>

Overall, the findings highlight a consistent **disconnect between theoretical knowledge and operational haemovigilance practice**. Addressing these gaps requires system-level interventions, including standardized notification algorithms, clearer institutional reporting structures, and regular haemovigilance-focused training, rather than reliance on individual clinician knowledge alone.

## Conclusion

Doctors demonstrated reasonable theoretical knowledge of the recognition and initial management of acute blood transfusion reactions; however, **significant gaps persist in investigation and reporting pathways**. Misconceptions regarding inappropriate management options, limited awareness of urine-based investigations, and poor understanding of multidisciplinary notification chains underscore the disconnect between knowledge and effective haemovigilance practice.

To enhance transfusion safety, focus should be placed on establishing clear institutional protocols, implementing standardized reporting systems, and conducting regular transfusion-reaction drills. Continuous haemovigilance education and

simulation-based training are essential to strengthen real-world response, enhance coordination among clinical and laboratory teams, and ensure timely reporting of transfusion reactions.

## Limitation:

1. The data were collected in 2017, and although core principles of transfusion reaction management remain unchanged, training practices may have evolved; however, similar gaps reported in recent studies suggest ongoing relevance.
2. As a single-centre study, the results may not be generalizable to other settings.
3. Despite random sampling, the non-participation of some eligible doctors may have introduced selection bias.
4. The study assessed only self-reported knowledge and did not include observational or outcome-based measures, limiting conclusions about actual clinical practice.
5. The use of an interviewer-administered questionnaire may have introduced interviewer and social desirability bias, potentially leading to overestimation of knowledge. Although the questionnaire underwent face and content validation, though the calculation of Cronbach's alpha coefficient, was not performed, which may affect the internal consistency of the findings.

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## Conflict of interest

There are no conflicts of interest

## References

1. Yadav SK, Hussein G, Liu B, Vojjala N, Warsame M, Labban M El, et al. A Contemporary Review of Blood Transfusion

- in Critically Ill Patients. *Medicina (B Aires)*. 2024;60(1247):1–15.
2. Hofer S, Schlimp CJ, Casu S, Grouzi E. Management of Coagulopathy in Bleeding Patients. *J Clin Med*. 2022;11(1):1–17.
  3. Suddock JT, Crookston KP. Transfusion reactions. [Updated 2023 Aug 8]. In: StatPearls [Internet] Treasure Island (FL) [Internet]. Statpearls publishing; 2023. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK482202/>
  4. Lotterman S, Sharma S. Blood transfusion. In: StatPearls [Internet] Treasure Island (FL) [Internet]. Statpearls publishing; 2023. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK499824/>
  5. Gwaram BA, Borodo MM, Dutse AI, Kuliya-gwarzo A. Pattern of acute blood transfusion reactions in Kano , North-Western Nigeria. *Niger J Basic Clin Sci*. 2012;9(1):27–32.
  6. Oreh A, Agala V, Darlington-Woke J, Funso-Adebayo F, Fapohunda J, Mgbachi I, et al. Don't Ask Don't Tell – The Status, Barriers, and Opportunities for Hospital Transfusion Committees (HTCs) in Rivers State, Nigeria: Mixed Methods Research on Hemovigilance. *Niger J Clin Pract*. 2025;28:1010–9.
  7. Aneke J, Chigbo C, Emeh P, Ifediata F, Efobi C, Chilaka U, et al. Blood Transfusion Reactions and Institutional Hemovigilance Protocols: A 2-Year Retrospective Single Center Audit. *Int J Heal Sci Heal Dev*. 2023;28(2):150–5.
  8. Lemssahli I, Benajiba M, Belmekki A. Review of haemovigilance at Rabat regional blood centre in Morocco (2017-2021). *Pan Africa Med J*. 2024;47(60).
  9. Ackfeld T, Schmutz T, Guechi Y, Terrier C Le. Blood Transfusion Reactions — A Comprehensive Review of the Literature including a Swiss Perspective. *J Clin Med*. 2022;11:1–19.
  10. De La Vega-Méndez F, Estrada M, Zuno-Reyes E, Gutierrez-Rivera C, Oliva-Martinez A, Díaz-Villavicencio B, et al. Blood transfusion reactions and risk of acute kidney injury and major adverse kidney events. *J Nephrol*. 2024;27(4):951–60.
  11. Torres R, Tormey CA. Diagnosis, treatment, and reporting adverse effects of transfusion. *Lab Med*. 2012;43(5):217–31.
  12. Barnes LS, Stanley J, Bloch EM, Pagano MB, Ipe TS, Eichbaum Q, et al. Status of hospital-based blood transfusion services in low-income and income countries : a cross-sectional international survey. *Br Med J*. 2022;12:1–10.
  13. Samaranayaka A, Bournemouth TR. Knowledge, attitudes, and practices of hemovigilance among doctors in a Sri Lankan tertiary care center. *Asian J Transfus Sci*. 2023;(September).
  14. Areoye M. Subjects Selection in Research Methodology with Statistics for Health and Social Sciences. 1st Editio. Ilorin: Nathadex; 2004. 115–120 p.
  15. NHS. Guidelines for the identification and treatment of acute transfusion reactions [Internet]. England; 2013. Available from: [blood.co.uk](http://blood.co.uk)
  16. Al-Riyami A, Al-Hashmi S, Al-Arimi Z, Wadsworth L, Al-Rawas A, Al-Khabori M. Recognition, Investigation and Management of Acute Transfusion Reactions: Consensus guidelines for Oman. *Sultan Qaboos Univ Med J*. 2014;14(3):350–5.
  17. WHO. A guide to establishing a national haemovigilance system [Internet]. 2016. Available from: [https://www.who.int/publications/b/31380?utm\\_source=chatgpt.com](https://www.who.int/publications/b/31380?utm_source=chatgpt.com)
  18. Basavaraju S V, Lohrke B, Pitman JP, Pathak SR, Shiraishi RW, Wilkinson R, et al. Knowledge and barriers related to reporting of acute transfusion reactions among healthcare workers in Namibia. *Transfus Med Hemotherapy*. 2015;23(5):367–9.
  19. WHO. Global strategy on human resources for health : Workforce 2030 [Internet]. World Health Organization. 2016. p. 1–64. Available from: <https://www.who.int/publications/i/item/9789241511131>
  20. Adebayo O, Labiran A, Emerenini CF, Omoruyi L. Human Resources for Health in Nigeria: Challenges and Policy Options. *African J Heal Econ*. 2020;9(1):1–13.

21. Eze BI, Okoye OI, Maduka-Okafor FC, Aguwa EN. Factors Influencing Choice of Medical Specialty of Preresidency Medical Graduates in Southeastern Nigeria. *J Grad Med Educ.* 2011;3(3):367–71.
22. Ezegwui CO, Nwaze CE, Magboh VO, Olusoji EB, Lawal TA. Preferences of choice of future specialty: Insights from final year medical students in Ibadan, Nigeria. *Ann Ibadan Postgrad Med* [Internet]. 2022;20(2):108–14. Available from: <https://www.ajol.info/index.php/aipm/article/view/250709>
23. Adeloye D, David RA, Olaogun AA, Auta A, Adesokan A, Gadanya M, et al. Health workforce and governance: The crisis in Nigeria. *Hum Resour Health.* 2017;15(1):1–9.
24. Ram S, Indushree T, Meghana D, Yohini G. Hemovigilance : knowledge , attitude and practice among postgraduates and interns of a tertiary care hospital. *Int J Basic Clin Pharmacol.* 2024;13(1):64–8.
25. Shivgunde P, Besekar S, Bhojwani K, Bhojwani D. Knowledge, attitude and practice of haemovigilance amongst healthcare professionals in Nashik, Maharashtra, India. *Int J Basic Clin Pharmacol.* 2018;7(5):986–91.
26. Meher R, Krishner A, Patidar G. Knowledge, attitude, and practice studies on hemovigilance in India: A critical appraisal. *Transfus Med.* 2025;35(6):531–8.