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ASSESSMENT OF KNOWLEDGE OF BLOOD TRANSFUSION PROTOCOLS AND COMPLIANCE AMONG NURSES WORKING IN TERTIARY CARE HOSPITALS OF RAWALPINDI: A CROSS-SECTIONAL STUDY

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Abstract
This research was conducted to determine the level of knowledge of blood transfusion protocols among Pakistani nurses and to identify gaps in knowledge to reduce blood-related errors and improve patient safety. A descriptive cross-sectional research design was employed, and the study was conducted at two hospitals in Rawalpindi, with 176 nurses selected to complete a questionnaire based on the Delphi method. The knowledge of the nurses was evaluated by using the scoring <50%, 50–74%, or 75% of the knowledge was considered as poor, moderate, or high, respectively. The results revealed that the overall level of knowledge among nurses was moderate, with 55% of areas demonstrating moderate knowledge, 5% of areas showing high knowledge, and 40% of areas reflecting low knowledge. Regression analysis also showed that, education level, working experience and field of specialization enhanced the knowledge in some aspects such as the right temperature to store the RBC ($p = 0.035$) and patient watching ($p = 0.047$). Nevertheless, knowledge was not affected by marital status and employment type. The outcomes of the study also show that there is a need for education on pre-transfusion checks, monitoring and management of blood products. Thus, through such gaps, the health care institutions can contribute to the prevention of transfusion errors, and ensure that the practice is more consistent and better for the patient. This paper is significant in extending the knowledge on transfusion safety and provides a basis for action in nursing education and practice.

INTRODUCTION

Blood transfusion is a serious medical practice that has been generally used since the earlier twentieth century to re-establish the body's oxygen transport capability and replace lost blood components [1].It constitute an important management practice which is utilized globally but poses serious risks due to human mistakes that account for 70 percent of adverse effects [2].Although receiving blood has many advantages, patients must be aware of the hazards associated with transfusion. Unintentionally receiving the wrong unit of blood, contracting an infectious condition from the donor, or experiencing

any of several other consequences are among the possible hazards to the recipient [3]The healthcare system must ensure proper patient management and blood product availability through defined safe blood transfusion practice guidelines, ensuring a coordinated and monitored process. [4]. Five interconnected steps make up the transfusion process: blood grouping and cross-matching, patient preparation prior to blood bag collection, blood pack collection, pre-transfusion nursing responsibilities beginning, and post transfusion nursing care. Regular nursing practice is relevant to four of these phases. The expertise and abilities of nurses are consequently crucial to the safety and proper management of blood transfusions and blood products [4] In Pakistan , nursing education includes several degree programs such as, a Bachelor of Science in Nursing (BSN) (4 years), a Post-RN BSN (2 years), and a Master's in Nursing (2–4 years), with blood transfusion being an essential part of the curriculum. New trends in nursing research have focused on examining, assessing, training, and updating nurses' knowledge in order to develop evidence-based clinical practice. This is because nurses require knowledge to make informed decisions, and good knowledge is necessary to guarantee both high-quality patient care and blood transfusion safety. [5] [6]

In Pakistan, numerous researches have been carried out to evaluate nurses' understanding of blood transfusions. The study emphasizes how crucial it is to have the right training and follow safety procedures while performing transfusions [7] Studies from Malaysia showed that inadequate understanding and poor transfusion practices can lead to negative outcomes, including patient complications like transfusion reactions, infections and sometimes death [8] [9] Similarly studies in Pakistan emphasize the need for proper training and adherence to safety protocols to prevent such risks [10] By comparing these findings, this study aims to assess Pakistani nurse's current knowledge, identify gaps and emphasize the importance of continuous education to improve transfusion safety, aligning with best global practices.

2. Literature review:

Numerous studies show that healthcare practitioners have developed better understanding about blood transfusion methods yet they remain insufficiently educated about this practice which leads to life-threatening consequences. The mean knowledge score of Turkish nurses about blood transfusion stood at 42.86% during baseline assessment before specialized training but increased to 68.90% afterward which demonstrated a 26.04% knowledge improvement. Specialized educational programs prove effective for raising nursing staff competencies in safe transfusion practices. The World Health Organization recognizes that nurses occupy a vital position in transfusion therapy because incorrect blood group transfusions along with several other human mistakes frequently result in complications. Such evidence emphasizes ongoing learning and strict guideline compliance for healthcare professionals [11]

The blood-treatment period from bank dispatch to transfusion initiation exceeded two hours in 53.2% of cases according to Nepalese study results demonstrating prolonged blood delivery intervals. The assessment of patient vital signs during transfusion initiation proved to be worrying because less than 4% of cases performed this fundamental step. Results from another study showed that 80.6% of participants lacked knowledge about blood transfusion institutional guidelines while 67.35% performed sampling incorrectly. According to research findings 72% of participants neglected protocol requirements by not obtaining consent before starting blood transfusions highlighting a critical gap in compliance with protocols [12].Research at Qazvin hospital revealed that nursing staff scores demonstrated major differences because mean knowledge levels reached 9.58% but mean performance outcomes reached 38.96%. The research results emphasize there is an instant demand for better blood transfusion protocol training among medical professionals to ensure both quality patient care and safety standards [13]. Nurses working at Hospital Pulau Pinang show considerable gaps in their blood transfusion practice understanding according to research findings. The nurses displayed a moderate level of blood transfusion practice understanding through their

mean score of 70.44% with a standard deviation at 11.35%. The survey showed blood bag collection and patient preparation knowledge among 72.29% of nurses yet pre-transfusion nursing activity awareness reached 71.75% of participants. Most nurses (67.14%) maintained adequate understanding of their responsibilities before, during and after transfusions but this indicates a knowledge gap which could endanger patient safety [14].The northern Indian research showed equivalent knowledge test results between male and female nurses and the nursing population consisted mainly of females at 96% of respondents. Research indicates that gender by itself does not determine transfusion knowledge but the training and available resources influence a nurse's understanding. Research at Hayatabad Medical Complex Peshawar showed that 89.3% of nurses applied blood transport boxes properly and managed protocols correctly. Additionally, 77.18% demonstrated proficiency in understanding blood storage time without refrigeration but 92.7% received patient transfusion risk instruction yet 84.4% lacked comprehension of precise patient identification methods. The results showed that 86.8% possessing understanding of acute hemolytic reactions pointed to relevant knowledge gaps that put patients at safety risk [15]

3. Materials and Methods:

3.1. Study design:

A descriptive cross-sectional study was conducted where the registered nurses involved in blood trans fusion procedures and having a minimum of 6 months of experience were included from Rawal General and Dental Hospital and Benazir Bhutto Hospital Rawalpindi. A simple random sampling technique was done for this study [16]. A total of 176 nurses were involved in this study.

Table 1) The study included 176 nurses, with a 100% response rate, assessing their knowledge of blood transfusion protocols. Study results indicated moderate knowledge among most nurses particularly in recognizing O-ve as the universal blood donor and understanding blood donation happens every three months and RBC storage needs +2°C to +6°C as its temperature range (51.7%, 55.1%, 52.3%

3.2. Tool:

For this study, we used pre-validated questionnaire (Knowledge of protocol and hazards blood transfusion Questionnaire) [17]. The questionnaire consists of two parts, one is demographic questions which are independent variables and the second is knowledge protocol of blood transfusion questions which are dependent variables. Study variables are composed of knowledge and protocol based. It consisted of different multiple-choice questions along with single correct answer.

3.3. Data Analysis:

Data analysis were performed using the Statistical Package for Social Sciences (SPSS) version 27 software. All descriptive data were reported as percentages with a 95% confidence interval (CI). A p value of <0.05 defined as the level of statistical significance. A simple linear regression was performed to explore the associated factors between gender, qualification, training program, type of ward, working duration, frequency of performing blood transfusion, and mean knowledge score.

3.4. Ethical consideration:

Ethical approval was obtained from the Institutional Review Board (IRB) Rawal Institute of Health Sciences Islamabad (RIHS /IRB/22/2025). Participants had their consent confirmed before the study began with an additional assurance of their right to withdraw at any time [18] [19]. The project protected data confidentiality by securely storing information and through anonymization methods [20].

4. Results:

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respectively). The findings revealed that nurses showed high awareness regarding written orders because 73.9% of them understood that correct orders must contain information about blood unit, number of units, time and duration. A moderate level of knowledge was observed in nurses when they identified transmissible blood-borne illnesses like Hepatitis and HIV but achieved it by only 56.3% accuracy.

Nurses showed unsatisfactory performance during pre-transfusion verification along with monitoring steps. The correct verification of patient identity and blood group and MR number before transfusion was performed by 41.5% of nurses along with the correct vital sign monitoring every 15 minutes during the first transfusion hour by 38.1% of nurses. Knowledge deficits became apparent regarding transfusion reaction causes between ABO incompatibility and human error because only 44.9% of nurses understood these concepts yet another 44.9% knew patients need at least four observations during transfusion. A substantial 61.9% chose the correct answer to monitor patients throughout transfusion yet only 38.1% answered properly when given an indication of 30-minute administration time while 37.5% agreed delayed blood should not be refrigerated again.

The research findings demonstrate the necessity to develop specific training that fills the gaps in blood product pre-transfusion evaluations and regular patient monitoring practices and product management protocols. The improvement of nursing expertise in these areas allows healthcare organizations to boost transfusion security while achieving better patient results.

Table 1: Knowledge of Protocol and Hazards Blood Transfusion (n= 176)

Variable	n	%
Which is a universal blood group donor?		
O+ve	56	31.8%
O-ve	91	51.7%
AB+ve	25	14.2%
AB-ve	4	2.3%
The frequency of blood donation could be every _____ month.		
1 Month	21	11.9%
2 Months	32	18.2%
3 Months	97	55.1%
4 Months	26	14.8%
In the blood bank, at what temperature are RBCs stored?		
+2°C to +6°C	92	52.3%
-2°C to -6°C	55	31.3%
+7°C to +8°C	26	14.8%
+9°C to +10°C	3	1.7%
Should the assigned nurse ensure that written orders include the blood unit, number of units, time, and duration of transfusion?		
Yes	130	73.9%
No	24	13.6%
Sometimes	13	7.4%
Not known	9	5.1%
Which diseases can be transferred by blood transfusion?		
Dengue Fever	12	6.8%
Hepatitis A, B, C, E Virus	48	27.3%
HIV	17	9.7%
All of the above	99	56.3%
Before starting a blood transfusion, what should be checked?		
Right Patient, MR #, Blood Group	73	41.5%
Vital signs	34	19.3%

Variable	n	%
A, B	66	37.5%
Obtain small-bore IV access	3	1.7%
Should blood products be visually inspected by a nurse before transfusion?		
Yes	123	69.9%
No	14	8.0%
Sometimes	28	15.9%
Not known	11	6.3%
How closely should the patient be monitored during the first _____ minutes of transfusion?		
5 minutes	23	13.1%
15 minutes	96	54.5%
10 minutes	38	21.6%
30 minutes	19	10.8%
During the first hour, how often should the nurse monitor vital signs?		
Every 15 minutes	67	38.1%
Every 30 minutes	60	34.1%
Every hour	41	23.3%
Not known	8	4.5%
What is the most common cause of a blood transfusion reaction?		
ABO Incompatibility	42	23.9%
Human error	32	18.2%
Improper identification	23	13.1%
All of the above	79	44.9%
What precautions should be taken before starting a transfusion?		
Inappropriate transfusions	11	6.3%
Identification error	28	15.9%
Right Patient, MR #, Blood Group	124	70.5%
Not known	13	7.4%
During a blood transfusion, what will you monitor?		
Before transfusion	36	20.5%
After 15 min	69	39.2%
Periodic observation	30	17.0%
Signs of reaction	41	23.3%
How many times do you monitor the patient during blood transfusion?		
1 time	17	9.7%
2 times	63	35.8%
4 times	79	44.9%
8 times	17	9.7%
After issuance of blood from the blood bank, how soon should it be given to the patient?		
Start Immediately	47	26.7%
Within 15 minutes	42	23.9%
Within 30 minutes	67	38.1%

Variable	n	%
Within 1 hour	20	11.4%
Should patients be under close observation during a blood transfusion?		
Yes	109	61.9%
No	28	15.9%
Sometimes	27	15.3%
Not known	12	6.8%
Can delayed administration of blood be refrigerated again within 30 minutes of issuance?		
Yes	62	35.2%
No	66	37.5%
Sometimes	28	15.9%
Not known	20	11.4%
Should transfusion always be fast for the patient?		
Yes	57	32.4%
No	74	42.0%
Sometimes	28	15.9%
Not known	17	9.7%
Should informed consent be taken before a blood transfusion?		
Yes	118	67.0%
No	25	14.2%
Sometimes	21	11.9%
Not known	12	6.8%
What should you do if there is a cloudy/foamy appearance in the blood bag?		
Start transfusion	38	21.6%
Return to the blood bank	108	61.4%
Allow completion within 4 hours	14	8.0%
Not known	16	9.1%
What should you do if you double puncture the blood bag and it starts leaking?		
Start transfusion	33	18.8%
Return to the blood bank	108	61.4%
Allow completion within 4 hours	15	8.5%
Not known	20	11.4%

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Table 2) The regression analysis revealed key factors influencing nurses' understanding of blood transfusion procedures. The nurses who had completed higher education achieved better understanding of healthcare concepts especially regarding universal blood group donors (p = 0.005). Older nurses displayed superior skills which included proper identification of RBC storage temperature (p = 0.035) as well as complete documentation of essential written orders (p = 0.030). Female nurses showed better performance than male nurses when it came to correct temperature storage understanding

(p = 0.026) and continuous patient observation during transfusions (p = 0.047). According to the study patients received more regular checks from nurses with greater experience (p = 0.036).
Specialization among nurses boosted their recognition of the requirement to distribute blood within thirty minutes of issue (p = 0.030). Not all

research variables demonstrated statistical importance in their effects. Nurses who are married or single or with various years of experience and employment positions did not show different levels of knowledge when it came to treating leaking blood bags or understanding disease transfer through transfusions. Both education level and gender distribution failed to impact comprehension of blood donation schedules and storage temperature requirements among nursing staff.

Table 2: Associated factors of knowledge score by Simple Linear Regression model (n = 176).

Variable	b[a] (95% CI)	p-Value
Which is a universal blood group donor?		
Age of respondent	-0.115 (-0.293, 0.063)	0.203
Gender of respondent	-0.062 (-0.264, 0.140)	0.543
Educational Level of respondent	0.224 (0.068, 0.381)	0.005
Marital Status of respondent	0.130 (-0.151, 0.411)	0.363
Work Experience of respondent	0.016 (-0.131, 0.164)	0.826
Employment Status of respondent	0.099 (-0.065, 0.264)	0.235
Area of Specialty of respondent	-0.012 (-0.033, 0.009)	0.261
The frequency of blood donation could be every _____ month.		
Age of respondent	-0.014 (-0.230, 0.203)	0.900
Gender of respondent	-0.005 (-0.250, 0.240)	0.968
Educational Level of respondent	-0.007 (-0.197, 0.183)	0.940
Marital Status of respondent	-0.129 (-0.471, 0.212)	0.456
Work Experience of respondent	0.134 (-0.045, 0.313)	0.142
Employment Status of respondent	0.097 (-0.103, 0.297)	0.340
Area of Specialty of respondent	0.004 (-0.022, 0.030)	0.777
In the blood bank, at what temperature are RBCs stored?		
Age of respondent	0.204 (0.014, 0.394)	0.035
Gender of respondent	0.245 (0.030, 0.461)	0.026
Educational Level of respondent	0.004 (-0.163, 0.171)	0.962
Marital Status of respondent	-0.062 (-0.362, 0.238)	0.684
Work Experience of respondent	0.081 (-0.076, 0.238)	0.307
Employment Status of respondent	0.037 (-0.138, 0.213)	0.675
Area of Specialty of respondent	-0.013 (-0.036, 0.009)	0.248
Should the assigned nurse ensure that written orders include the blood unit, number of units, time, and duration of transfusion?		
Age of respondent	0.225 (0.022, 0.428)	0.030
Gender of respondent	0.202 (-0.028, 0.432)	0.085
Educational Level of respondent	-0.082 (-0.260, 0.096)	0.366
Marital Status of respondent	-0.175 (-0.496, 0.146)	0.284
Work Experience of respondent	0.071 (-0.097, 0.239)	0.403
Employment Status of respondent	0.177 (-0.011, 0.365)	0.065
Area of Specialty of respondent	0.004 (-0.020, 0.028)	0.749
Which diseases can be transferred by blood transfusion?		

Variable	b[a] (95% CI)	p-Value
Age of respondent	-0.181 (-0.438, 0.077)	0.168
Gender of respondent	-0.089 (-0.381, 0.203)	0.549
Educational Level of respondent	0.085 (-0.141, 0.311)	0.458
Marital Status of respondent	-0.023 (-0.430, 0.383)	0.910
Work Experience of respondent	-0.133 (-0.346, 0.080)	0.218
Employment Status of respondent	0.102 (-0.136, 0.340)	0.397
Area of Specialty of respondent	-0.005 (-0.036, 0.026)	0.755
Before starting a blood transfusion, what should be checked?		
Age of respondent	-0.016 (-0.248, 0.216)	0.893
Gender of respondent	0.004 (-0.259, 0.267)	0.978
Educational Level of respondent	0.133 (-0.071, 0.336)	0.201
Marital Status of respondent	-0.242 (-0.609, 0.124)	0.193
Work Experience of respondent	0.156 (-0.035, 0.348)	0.109
Employment Status of respondent	0.017 (-0.197, 0.232)	0.874
Area of Specialty of respondent	-0.018 (-0.045, 0.010)	0.213
Should blood products be visually inspected by a nurse before transfusion?		
Age of respondent	0.225 (-0.012, 0.461)	0.063
Gender of respondent	-0.050 (-0.319, 0.218)	0.711
Educational Level of respondent	0.135 (-0.072, 0.343)	0.200
Marital Status of respondent	0.071 (-0.303, 0.445)	0.707
Work Experience of respondent	-0.030 (-0.226, 0.165)	0.760
Employment Status of respondent	0.182 (-0.036, 0.401)	0.101
Area of Specialty of respondent	0.016 (-0.012, 0.045)	0.257
How closely should the patient be monitored during the first _____ minutes of transfusion?		
Age of respondent	-0.023 (-0.230, 0.183)	0.823
Gender of respondent	0.237 (0.003, 0.471)	0.047
Educational Level of respondent	0.128 (-0.053, 0.310)	0.164
Marital Status of respondent	-0.077 (-0.403, 0.249)	0.642
Work Experience of respondent	0.092 (-0.079, 0.262)	0.290
Employment Status of respondent	-0.169 (-0.360, 0.022)	0.082
Area of Specialty of respondent	0.003 (-0.022, 0.028)	0.813
During the first hour, how often should the nurse monitor vital signs?		
Age of respondent	-0.072 (-0.292, 0.148)	0.518
Gender of respondent	0.297 (0.048, 0.546)	0.020
Educational Level of respondent	0.142 (-0.051, 0.334)	0.149
Marital Status of respondent	0.190 (-0.157, 0.536)	0.282
Work Experience of respondent	0.113 (-0.068, 0.294)	0.221
Employment Status of respondent	-0.046 (-0.249, 0.157)	0.654
Area of Specialty of respondent	0.017 (-0.009, 0.044)	0.191

Variable	b[a] (95% CI)	p-Value
What is the most common cause of a blood transfusion reaction?		
Age of respondent	-0.043 (-0.358, 0.273)	0.791
Gender of respondent	0.052 (-0.306, 0.409)	0.775
Educational Level of respondent	-0.093 (-0.370, 0.184)	0.509
Marital Status of respondent	-0.166 (-0.665, 0.332)	0.511
Work Experience of respondent	0.082 (-0.178, 0.343)	0.534
Employment Status of respondent	0.119 (-0.173, 0.411)	0.422
Area of Specialty of respondent	0.002 (-0.036, 0.039)	0.927
What precautions should be taken before starting a transfusion?		
Age of respondent	-0.122 (-0.289, 0.044)	0.148
Gender of respondent	0.096 (-0.093, 0.284)	0.319
Educational Level of respondent	-0.047 (-0.193, 0.099)	0.523
Marital Status of respondent	0.035 (-0.227, 0.298)	0.791
Work Experience of respondent	0.040 (-0.098, 0.177)	0.570
Employment Status of respondent	0.111 (-0.043, 0.265)	0.157
Area of Specialty of respondent	-0.001 (-0.021, 0.019)	0.898
During a blood transfusion, what will you monitor?		
Age of respondent	0.057 (-0.211, 0.325)	0.675
Gender of respondent	-0.041 (-0.345, 0.263)	0.791
Educational Level of respondent	0.077 (-0.158, 0.312)	0.519
Marital Status of respondent	-0.059 (-0.483, 0.364)	0.783
Work Experience of respondent	0.047 (-0.175, 0.268)	0.678
Employment Status of respondent	-0.160 (-0.407, 0.088)	0.206
Area of Specialty of respondent	0.009 (-0.023, 0.041)	0.574
How many times do you monitor the patient during blood transfusion?		
Age of respondent	0.003 (-0.193, 0.200)	0.972
Gender of respondent	0.111 (-0.112, 0.334)	0.328
Educational Level of respondent	-0.093 (-0.266, 0.080)	0.289
Marital Status of respondent	-0.314 (-0.625, -0.004)	0.047
Work Experience of respondent	0.174 (0.011, 0.336)	0.036
Employment Status of respondent	-0.018 (-0.200, 0.164)	0.844
Area of Specialty of respondent	0.014 (-0.010, 0.038)	0.241
After issuance of blood from the blood bank, how soon should it be given to the patient?		
Age of respondent	0.112 (-0.133, 0.356)	0.369
Gender of respondent	0.136 (-0.142, 0.413)	0.335
Educational Level of respondent	-0.149 (-0.363, 0.066)	0.174
Marital Status of respondent	-0.095 (-0.482, 0.291)	0.626
Work Experience of respondent	-0.126 (-0.328, 0.077)	0.222

Variable	b[a] (95% CI)	p-Value
Employment Status of respondent	0.029 (-0.197, 0.255)	0.802
Area of Specialty of respondent	0.032 (0.003, 0.062)	0.030
Should patients be under close observation during a blood transfusion?		
Age of respondent	0.257 (0.018, 0.496)	0.035
Gender of respondent	0.084 (-0.187, 0.354)	0.541
Educational Level of respondent	-0.080 (-0.290, 0.129)	0.451
Marital Status of respondent	-0.066 (-0.443, 0.311)	0.731
Work Experience of respondent	0.054 (-0.144, 0.251)	0.592
Employment Status of respondent	0.158 (-0.063, 0.378)	0.160
Area of Specialty of respondent	0.010 (-0.018, 0.039)	0.487
Can delayed administration of blood be refrigerated again within 30 minutes of issuance?		
Age of respondent	-0.041 (-0.283, 0.202)	0.742
Gender of respondent	0.224 (-0.051, 0.499)	0.110
Educational Level of respondent	0.115 (-0.098, 0.328)	0.288
Marital Status of respondent	-0.197 (-0.580, 0.187)	0.313
Work Experience of respondent	0.146 (-0.055, 0.346)	0.153
Employment Status of respondent	0.151 (-0.073, 0.376)	0.185
Area of Specialty of respondent	0.015 (-0.014, 0.044)	0.308
Should transfusion always be fast for the patient?		
Age of respondent	0.166 (-0.067, 0.400)	0.162
Gender of respondent	0.089 (-0.176, 0.354)	0.507
Educational Level of respondent	0.101 (-0.104, 0.307)	0.331
Marital Status of respondent	-0.179 (-0.549, 0.190)	0.339
Work Experience of respondent	0.042 (-0.151, 0.236)	0.666
Employment Status of respondent	-0.037 (-0.253, 0.179)	0.737
Area of Specialty of respondent	0.009 (-0.019, 0.037)	0.509
Should informed consent be taken before a blood transfusion?		
Age of respondent	0.101 (-0.131, 0.334)	0.390
Gender of respondent	0.137 (-0.126, 0.400)	0.306
Educational Level of respondent	0.199 (-0.004, 0.403)	0.055
Marital Status of respondent	0.034 (-0.333, 0.400)	0.857
Work Experience of respondent	0.094 (-0.098, 0.286)	0.336
Employment Status of respondent	0.065 (-0.149, 0.280)	0.548
Area of Specialty of respondent	-0.003 (-0.031, 0.025)	0.822
What should you do if there is a cloudy/foamy appearance in the blood bag?		
Age of respondent	-0.138 (-0.341, 0.066)	0.184
Gender of respondent	-0.002 (-0.232, 0.229)	0.988
Educational Level of respondent	0.152 (-0.027, 0.331)	0.095
Marital Status of respondent	-0.021 (-0.342, 0.301)	0.899

Variable	b[a] (95% CI)	p-Value
Work Experience of respondent	0.036 (-0.132, 0.205)	0.670
Employment Status of respondent	0.054 (-0.134, 0.242)	0.572
Area of Specialty of respondent	0.000 (-0.025, 0.024)	0.969
What should you do if you double puncture the blood bag and it starts leaking?		
Age of respondent	-0.046 (-0.256, 0.165)	0.670
Gender of respondent	0.136 (-0.103, 0.375)	0.262
Educational Level of respondent	0.083 (-0.102, 0.268)	0.375
Marital Status of respondent	-0.139 (-0.472, 0.194)	0.412
Work Experience of respondent	0.073 (-0.101, 0.247)	0.411
Employment Status of respondent	0.158 (-0.037, 0.353)	0.112
Area of Specialty of respondent	-0.007 (-0.032, 0.019)	0.603

5. Discussion:

The study's findings, which assessed Pakistani nurses' understanding of blood transfusion protocols, revealed a moderate level of understanding with notable gaps in crucial areas. There were significant deficiencies in patient monitoring and pre-transfusion evaluations, despite the fact that most nurses could correctly identify the universal blood group donor (O-ve, 51.7%) and the red blood cell storage temperature (+2°C to +6°C, 52.3%). For example, just 41.5% of nurses verified the patient, MR number, and blood category before to transfusion, and only 38.1% of nurses knew that vital signs should be monitored every 15 minutes for the first hour following transfusion. These findings highlight the need for specialized training to fill these gaps and improve transfusion safety.

According to other research conducted in Pakistan [17] and throughout the world, nurses generally have low levels of expertise, especially when it comes to pre- and post-transfusion monitoring. These findings are consistent with those findings. Similar findings in studies conducted in Ethiopia [21] and Malaysia [5] have shown the universality of these issues by revealing gaps in nurses' comprehension of transfusion procedures. This survey did reveal some progress, though, as seen by the 69.9% of nurses who correctly answered that blood products should be visually examined prior to transfusion, indicating that recent training programs may be improving the situation.

The results highlight how crucial education and experience are in growing nurses' expertise. Higher educational attainment and more job experience were linked to a better comprehension of transfusion procedures, according to regression analysis. This implies that funding higher education and specialized training might greatly improve the safety of transfusions. Furthermore, older nurses showed greater expertise in specific areas, underscoring the importance of clinical experience in enhancing competency.

The study has limitations in spite of these findings. The results' generalizability may be impacted by the sample's restriction to two Rawalpindi hospitals. Additionally, self-reported data may add bias, and the cross-sectional design restricts the capacity to demonstrate causal links. Future studies should examine the efficacy of focused training programs in enhancing nurses' knowledge and practices and use bigger, more varied sample sizes.

6. Conclusion:

The study discovered that 45% of nurses had inadequate understanding in crucial areas like pre-transfusion checks and patient monitoring, while 50% of nurses exhibited intermediate knowledge in areas like managing blood products and universal blood type donors. To improve transfusion safety, these gaps highlight the necessity of focused training and ongoing education. Healthcare organizations may enhance patient outcomes, guarantee uniform

procedures, and promote a safer atmosphere for blood transfusions throughout the healthcare system by resolving these gaps.

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