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Assessing Malaysian Nurses' Knowledge of Blood Transfusion Procedures and Identifying Knowledge Gaps: A cross-sectional study

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Abstract
This cross-sectional study aimed to evaluate the knowledge of 316 nurses in a Malaysian public hospital regarding blood transfusion procedures. Convenience sampling was used to select nurses involved in patient care. Data collection employed a validated questionnaire with 33 questions across four sections. Descriptive analysis using SPSS revealed knowledge gaps, particularly in transfusion and adverse reaction management. Findings showed 56.3% with good knowledge, 42.7% with moderate knowledge, and 0.9% with insufficient knowledge. The study emphasizes the importance of targeted education and continuous training to enhance nurses' transfusion-related knowledge and ensure safe practices. Limitations include scope and self-reported data.

Keywords: blood transfusion; knowledge; nurses

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1.0 Introduction

Blood transfusions play a crucial role in medical practice, serving as a standard procedure in hospitals worldwide. They involve the administration of various blood components to increase the oxygen-carrying capacity of the blood, aiding in the treatment of conditions such as anemia, thrombocytopenia, and blood loss due to trauma or surgery (Booth et al., 2021; Spahn et al., 2019). The preparation of blood bags is a complex process that requires collaboration among medical professionals, including doctors, laboratory staff, and nurses (Wood et al., 2019). However, errors in this process can occur, necessitating careful monitoring and documentation to ensure accuracy and traceability (Wood et al., 2019).

Blood transfusion, if performed without adequate knowledge, can lead to fatal consequences and impose a significant financial burden on healthcare facilities (Allard & Contreras, 2015). Research conducted by Sazama et al. (1990) reported 131 deaths related to ABO-incompatible transfusions during the period from 1976 to 1985 (Manske, 2003). Lack of knowledge has been identified as the most common fatal mistake made by healthcare workers, particularly nurses, during blood transfusions (Beyazpınar Kavaklıoğlu, 2017).

In the context of a Malaysian public hospital, it is crucial to assess the knowledge of nurses regarding blood transfusion procedures to ensure safe and effective patient care. This cross-sectional study objective to evaluate the knowledge levels of nurses in a prominent public hospital in Kuala Lumpur, Malaysia, specifically focusing on areas such as preparation, patient care, and management of adverse

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reactions. By identifying any knowledge gaps or deficiencies that may exist, this study seeks to provide insights for targeted educational programs and training initiatives to enhance transfusion care and promote patient safety. Furthermore, the study investigated the associations between socio-demographic factors, such as gender, ages, experiences, education level and others.

2.0 Literature Review

Nurses, as healthcare workers (HCWs), hold a crucial role in blood transfusion procedures, with the responsibility to possess comprehensive knowledge in order to prevent negligence and malpractice (Bolton-Maggs, 2016). Their role is vital as they are the final link in delivering blood to the patient and are responsible for monitoring the transfusion's efficacy, including detecting any adverse reactions (Henneman et al., 2017).

Islami Vaghar, (2018) emphasized the importance of nurses being well-versed in blood transfusion procedures as the lives of patients who receive transfusions depend on their ability to anticipate, detect, and manage transfusion reactions. A study conducted in Malaysia highlighted the significance of nurses' readiness, particularly their knowledge, in determining the occurrence and response rates to blood errors in healthcare facilities (Noor et al., 2021). However, a previous study in Malaysia reported moderate knowledge among nurses due to factors such as lack of knowledge about blood groups, validity period of blood samples, proper pre-transfusion testing, patient identification, and more (Azdiana et al., 2016).

Similar findings were observed in a study among nurses in the Critical Unit of a Teaching Hospital in Uberlandia, Brazil, where only 52.8% demonstrated good knowledge of blood transfusion (Duarte et al., 2017). Noor et al. (2021) also found that overall knowledge among nurses in their study was at a moderate level, highlighting gaps in understanding ABO blood grouping, blood warming, transfusion rates, and potential complications. Similarly, a significant knowledge gap was identified among nursing students in various aspects of blood transfusion, including patient preparation, blood pack collection, post-transfusion care, and management of adverse reactions (Akhlak et al., 2019).

These findings emphasize the need for targeted interventions, educational programs, and continuous training to enhance nurses' knowledge of blood transfusion procedures, ensuring safe and effective practices (Islami Vaghar, 2018). Improving knowledge in critical areas such as blood grouping, transfusion rates, and adverse reaction management is crucial to minimize errors and enhance patient safety.

3.0 Methodology

3.1 Design and sample

This cross-sectional quantitative survey was conducted between November 2022 and May 2023 at a prominent public hospital in Kuala Lumpur, Malaysia. Convenience sampling was employed to select nurses directly involved in patient care, including both registered nurses in contract and permanent positions. The minimum required sample size of 333 nurses was determined using Rao soft software, with a 95% confidence level and a 5% error margin. A high response rate of 95% (n=316) was achieved from nurses working on various wards, ensuring representation across diverse specialties. Exclusions encompassed nurses in top management roles and those not engaged in blood transfusion procedures.

3.2 Research tool, data collection and data analysis

Data collection relied on a validated questionnaire known as the routine blood transfusion knowledge questionnaire (RBTKQ), adopted from a previous study by Azdiana et al. (2016). The questionnaire consisted of 33 questions categorized into four sections, addressing socio-demographic factors and knowledge-related items. The first section focused on socio-professional factors, comprising eleven items. The second section consisted of seven items related to blood bag collection and patient preparation before transfusion. The third section included eight items assessing pre-transfusion nursing responsibilities. The fourth section encompassed seven items addressing during and post-transfusion nursing responsibilities and the management of adverse reactions. Instruments were validated for their reliability and validity among Malaysian nurses (Cronbach's alpha > 0.7) according to a prior study. Data collection took place from February to March 2023 using Google Forms distributed through the official WhatsApp group. Eligible nurses were instructed by the sister/matron on duty to complete the questionnaire and provide consent to participate. The questionnaire was administered in English and was designed to be concise, comprehensible, and sensitive to the nurses' needs, with an estimated completion time of 10 to 15 minutes. SPSS version 27 was employed for data analysis. Descriptive analyses, including frequency and percentage calculations, were conducted to analyse categorical variables. Bloom's cut-off point was used to categorize the knowledge level, with scores of 80% or higher indicating good knowledge, scores between 60% and 79% indicating moderate knowledge, and scores below 60% indicating low knowledge (Wahidiyat et al., 2021). Inferential tests, such as Chi-Square and Fisher's Test, were performed.

3.3 Ethical Consideration

The Ethical Approval was gained from Medical Research and Ethics Committee (MREC) – NMRR ID-22-02629-RFL, Hospital Directors with the Head of Department Nursing' (HKL/HCRC/AK-02-02) and the nurse’s consent.

4.0 Result

4.1 Socio-demographic data

The study included a total of 316 nurses, the majority of whom were female and aged between 21 and 30 years. These nurses had a work experience ranging from 5 to 10 years and held a diploma qualification. In terms of department distribution, the medical department constituted less than 20% of the overall demography, and fewer than 50% of the nurses had 5 to 10 years of experience in their respective departments. Regarding blood transfusion experience, less than half of the nurses reported receiving monthly transfusions in the previous year. The table shows that 69.6% of nurses reported sufficient training in "adverse responses and post-transfusion care." However, 66.1% expressed a need for additional training in the same area. It is noteworthy that a majority of the respondents were familiar with the blood transfusion policy, with 82.5% stating that they had read it.

Table 1: Socio-demographic of the nurses and association with knowledge level (N=316)

Variables	n (%)	N (%)			P-value
		Low	Moderate	Good	
Gender					0.382[a]
Male	46 (14.6)	1 (2.2)	21 (45.7)	24 (52.2)	
Female	270 (85.4)	2 (0.7)	114 (42.2)	154 (57.0)	
Ages					0.518[a]
21-30 years	173 (54.7)	3 (1.7)	78 (45.1)	92 (53.2)	
31-40 years	121 (38.3)	-	48 (39.7)	73 (60.3)	
41-50 years	20 (8.3)	-	9 (45.0)	11 (55.0)	
Experiences					***0.010[a]***
< 1 year	12 (3.8)	-	9 (75.0)	3 (25.0)	
1-3 years	64 (20.3)	2 (3.1)	34 (53.1)	28 (43.8)	
3-5 years	18 (5.7)	-	4 (22.2)	14 (77.8)	
5-10 years	141 (44.6)	-	54 (38.3)	87 (61.7)	
>10 years	81 (25.6)	1 (1.2)	34 (42.0)	46 (56.8)	
Education level					0.773[a]
Diploma	257 (81.3)	3 (1.2)	111 (43.2)	143 (55.6)	
Post-basic	52 (16.5)	-	20 (38.5)	32 (61.5)	
Degree	7 (2.2)	-	4 (57.1)	3 (42.9)	
Transfused blood last year					0.533[a]
Never	40 (12.7)	-	16 (40.0)	24 (60.0)	
Daily	11 (3.5)	1 (9.1)	3 (27.3)	7 (63.6)	
Weekly	45 (14.2)	-	18 (40.0)	27 (60.0)	
Every two week	34 (10.8)	-	14 (41.2)	20 (58.8)	
Monthly	153 (48.4)	1 (0.7)	70 (45.8)	82 (53.6)	
Yearly	33 (10.4)	1 (3.0)	14 (42.4)	18 (54.5)	
Department currently working					***0.031[a]***
Urology and Nephrology (UN)	42 (13.3)	-	28 (66.7)	14 (33.3)	
Orthopaedics	43 (13.6)	-	14 (32.6)	29 (67.4)	
Medical	47 (14.9)	-	25 (53.2)	22 (46.8)	
Intensive care Unit (ICU)	44 (13.9)	1	14 (31.8)	29 (65.9)	
Surgical	24 (7.6)	-	13 (54.2)	11 (45.8)	
Operation Theatre (OT)	33 (10.4)	1 (3.0)	14 (33.3)	18 (54.5)	
Neurology	42 (13.3)	1 (2.4)	14 (33.3)	27 (64.3)	
Radiotherapy and Oncology (RT)	41 (13.0)	-	13 (31.7)	28 (68.3)	
Experiences in the current department					***0.006[a]***
< 1 year	21 (6.6)	-	13 (61.9)	8 (38.1)	
1-3 years	64 (20.3)	2 (3.1)	36 (56.3)	26 (40.6)	
3-5 years	22 (7.0))	-	5 (22.7)	17 (77.3)	
5-10 years	138 (43.7)	-	55 (39.9)	83 (60.1)	
>10 years	71 (22.5)	1 (1.4)	26 (36.6)	44 (62.0)	
Training in blood transfusion					0.865[a]
Blood bag and patient preparation	35 (11.1)	-	15 (42.9)	20 (57.1)	
Pre-transfusion	61 (19.3)	1 (1.6)	24 (39.4)	36 (59.0)	
Adverse responses and post-transfusion care.	220 (69.6)	2 (0.9)	96 (43.6)	122 (55.5)	
Insufficient training					0.470[a]
Blood bag and patient preparation	84 (26.6)	2 (2.4)	36 (42.9)	46 (54.8)	
Pre-transfusion.	23 (7.3)	-	12 (52.2)	11 (47.8)	
Adverse responses and post-transfusion care.	209 (66.1)	1 (0.5)	87 (41.6)	121 (57.9)	
Written policy blood transfusion					0.131[a]
Not sure	24 (7.6)	-	15 (62.5)	9 (37.5)	
Not	6 (1.9)	-	1 (16.7)	5 (83.3)	
Yes	286 (90.5)	3 (1.0)	119 (41.6)	164 (57.3)	
If yes, have you read the policy?					0.412[a]
Not	56 (17.7)	1 (1.8)	26 (46.4)	29 (51.8)	
Yes	260 (82.3)	2 (0.8)	109 (41.9)	149 (57.3)	

Notes: 80-100%; Good knowledge,60-79%; Moderate knowledge and <60%; Low knowledge

4.2 Knowledge of Blood Transfusion Procedure

The study findings revealed that a substantial proportion of nurses exhibited good knowledge regarding blood bags and patient preparation for transfusion. Notably, a high percentage of nurses demonstrated awareness of essential aspects related to blood transfusion. For instance, the majority of nurses were knowledgeable about the need for cross-testing of packed red blood cells (pRBC) (98.1%) and the use of Ethylenediaminetetraacetic Acid (EDTA) tubes for cross-matching (94.6%). They also recognized the storage duration of cross-match samples in the blood bank (75.6%) and the importance of physicians labelling blood samples at the patient's bedside (96.1%). Additionally, nurses displayed good understanding of handling blood collection boxes with appropriate ice pack placement (96.5%).

However, there were some areas where knowledge gaps were observed. Only a minority of nurses correctly identified the compatibility issue between O Rhesus Factor D (RhD) negative nurses and A RhD-positive pRBC (41.1%). Similarly, a considerable percentage of nurses lacked of knowledge regarding specific pre-transfusion nursing responsibilities, such as the time limit for a blood unit to be out of the fridge before transfusion (59.5%) and the necessity of following blood-checking procedures (35.1%). Moreover, there were gaps in understanding adverse reaction management, including the indication of a seizure as a transfusion reaction (73.4%) and the most significant risk of delayed blood transfusions being bacterial contamination (51.9%).

Table 2: Accuracy of knowledge responses analyzed (N=316)

Questionnaire		n (%)	
		Wrong	Correct
Blood bag understanding and preparation	Blood products need cross-matching test	6 (1.9)	310 (98.1)
	Sample for cross-matching test	17 (5.4)	299 (94.6)
	Stored GXM sample in blood bank	77 (24.4)	239 (75.6)
	Bedside labelling blood samples	10 (3.2)	306 (96.8)
	ABO and RhD compatibility	186 (58.9)	130 (41.1)
	Transporting pRBC	11 (3.5)	305 (96.5)
	Details checked during the collection of blood products	37 (11.7)	279 (88.3)
Pre-transfusion nursing duties comprehension	Handling of blood products at wards	127 (40.2)	189 (59.8)
	The necessity to pre-warm blood	122 (38.6)	194 (61.4)
	Pre-warm method	86 (27.2)	230 (72.8)
	Solution co-administered with blood	26 (8.2)	290 (91.8)
	Maximum delay at wards	128 (40.5)	188 (59.5)
	The sequence of blood transfusion	16 (5.1)	300 (94.9)
	Skipping blood-checking steps	205 (64.9)	111 (35.1)
	Use of filter	41 (13.0)	275 (87.0)
Knowledge towards Adverse Responses and post-transfusion care	The maximum time for pRBC transfusion	23 (7.3)	293 (92.7)
	Risk of exceeding recommended time	164 (51.9)	152 (48.1)
	Vital signs	134 (42.4)	182 (57.6)
	Transfusion reactions	84 (26.6)	232 (73.4)
	Managing transfusion reactions	19 (6.0)	297 (94.0)
	Transfusion-transmitted infections	64 (20.3)	252 (79.7)
	Primary fatal transfusion reaction cause.	123 (38.9)	193 (61.1)

4.3 Knowledge towards Blood Transfusion procedure

The findings of the study revealed that a significant number of nurses (n=223, 70.6%) had knowledge about blood bank bag collection and pre-transfusion patient preparation. However, when it came to their understanding of pre-transfusion care, the majority of nurses (n=175, 55.4%) had only a moderate comprehension, while a smaller proportion (n=82, 25.4%) demonstrated explicit knowledge. In terms of nursing responsibilities before and after transfusion and the management of adverse reactions, slightly more than half of the nurses (n=178, 56.3%) demonstrated a suitable level of understanding, while slightly less than half (n=178, 56.3%) had a moderate level of comprehension. When assessing the overall understanding of blood transfusions, it was found that a majority of nurses (n=178, 56.3%) had a good understanding, while less than half (n=135, 42.7%) fell into the category of shared knowledge. Only a small proportion of respondents (n=3, 0.9%) expressed a need for clarification.

Table 3: Level of knowledge towards Blood Transfusion procedure (N=316)

Knowledge	Low	Moderate	Good
Blood bag and patient preparation	3 (0.9)	90 (28.5)	223 (70.6)
Pre-transfusion	59 (18.7)	175 (55.4)	82 (25.9)
Adverse responses and post-transfusion care	39 (12.3)	141 (44.6)	136 (43.0)
Level of knowledge toward Blood Transfusion procedure.	3 (0.9)	135 (42.7)	178 (56.3)

Notes: 80-100%; Good knowledge,60-79%; Moderate knowledge and <60%; Low knowledge

4.4 Association between social demographic with knowledge of blood transfusion

The study identified significant associations between social demographic factors and knowledge of blood transfusion. Work experience (p-value = 0.010), the current department of employment (p-value = 0.031), and experiences in the current department (p-value = 0.006) showed a significant association with the level of knowledge regarding blood transfusion procedures.

5.0 Discussion

5.1 Level of knowledge of blood transfusion procedure

The nurses' knowledge of the blood transfusion procedure in this study was categorized as follows: 56.3% had high knowledge, 42.7% had moderate knowledge, and only 0.9% had low knowledge. These findings indicate that the majority of nurses possess good to moderate knowledge regarding blood transfusion procedures, which represents an improvement compared to previous research conducted in Malaysia (Akhlak et al., 2019; Azdiana et al., 2016; Noor et al., 2021).

Yami et al. (2021) highlighted that many nurses have limited knowledge due to factors such as the absence of a supervision policy, lack of dedicated courses on blood transfusion, and insufficient mechanisms for ongoing education. However, contrary to their study, a significant proportion of nurses in this survey (90.5%) were aware of a blood transfusion policy, with 82.3% having read it. These findings suggest that compared to global studies conducted by Abd Alsemia Elewa and Abd Elshahed Ahmed Elkattan (2017) and Haza' a et al. (2021), the nurses in this study demonstrated higher levels of knowledge.

For example, Elhy (2017) found that only 38.8% of 286 nurses had adequate knowledge, while the majority (61.2%) had poor knowledge. In contrast, the present study reported a higher percentage of nurses with good knowledge. Moreover, when comparing the results with student nurses who receive comprehensive training and education during their schooling, the findings of this study are more favorable (Akhlak et al., 2019). However, it is important to note that variations in findings across studies may be attributed to the use of different questionnaires. Researchers who adopted the questionnaire from a previous study (Azdiana et al., 2016) based on the original questionnaire (Hijji et al., 2012) may or may not obtain similar results compared to other researchers who use the same questionnaire (Akhlak et al., 2019; Bediako et al., 2021; Noor et al., 2021).

5.2 Inadequate knowledge of blood transfusion

This study revealed certain knowledge gaps among nurses regarding blood transfusion procedures. In comparison to a study by Dasaraju and Subraya (2017), most nurses in our study demonstrated a better understanding of blood bags and patient preparation. Similarly, our findings were consistent with Azdiana et al. (2016). The study emphasized on the knowledge of ABO and RhD compatibility, and it was observed that more than half of the participants who answered incorrectly lacked this knowledge. However, our results were not as favorable as those reported by Jogi et al. (2021), who found a higher percentage of nurses (62.01%) were aware of universal recipient blood groups for ABO and RhD compatibility.

Examining pre-transfusion nursing responsibilities, it was found that only a small proportion of nurses (25.9%) demonstrated a high level of knowledge, while a larger percentage (55.4%) had a moderate level of knowledge. Specific areas that required attention included immediate initiation of transfusion, the pre-warming requirement for packaged pRBC, and the duration for which a unit of blood can be taken out of the blood bank refrigerator. Only a minority of nurses (35.1%) were aware of the necessity for blood checking with each transfusion. However, our study indicated that a higher percentage of hospital nurses required additional knowledge compared to the findings of Elhy (2017).

In terms of nursing responsibilities during and after transfusions and adverse reaction management, approximately 43.0% and 44.5% of respondents demonstrated a high and moderate understanding, respectively. Despite some deficiencies in their comprehension, a small proportion of nurses (12.5%) expressed the need for education, healthcare, and training. Our findings were showed higher percentage compared to those of previous studies conducted by Elhy (2017), and Dasaraju & Subraya (2017) in terms of nurses' knowledge of post-transfusion concerns and responsibilities.

The survey revealed that nurses had knowledge of important aspects such as the maximum duration for pRBC, transfusion reactions, management of transfusion reactions, transfusion-transmitted infections, and the common causes of fatal transfusion reactions. However, there were certain gaps in knowledge, as some nurses were unaware of the risks associated with exceeding the recommended time and the fact that saturation of peripheral oxygen (SPO_2) is not a vital sign during blood transfusion procedures. These findings contrasted with previous studies conducted by Karim et al. (2021) and Azdiana et al. (2016), which reported different levels of awareness among nurses. It is worth noting that the National Blood Centre, Ministry of Health Malaysia (National Blood Centre, 2016) had recommended monitoring blood pressure, pulse rate, temperature, respiration rate, and pain assessment during blood transfusions.

5.3 Association between social demographic with knowledge blood transfusion

The study findings demonstrate significant associations between nurses' knowledge of blood transfusion and factors such as work experience, the current department of employment, and experiences in the current department. These results contradict with previous studies by Haza' a et al. (2021), and Azdiana et al. (2016), which highlighted the influence of training courses, policy availability, and age on knowledge levels. Consistent with Jogi et al. (2021), the study reveals that longer work experience is linked to better knowledge. Surprisingly, the level of education does not significantly impact knowledge, contradicting Aneke et al. (2017).

Regarding the frequency of performing blood transfusions, no significant association with knowledge was found, aligning with Yami et al. (2021). In contrast, Elhy (2017) reported a significant association between performing blood transfusions more than nine times

and having strong knowledge. In terms of department-wise knowledge levels, the study highlights higher knowledge levels in Radiotherapy/Oncology, Orthopedics, special wards, and neurology departments, while urology and nephrology departments exhibit lower knowledge levels, contrasting with Azdiana et al. (2016) who found higher levels in emergency and ENT departments.

6.0 Conclusion and Recommendation

In conclusion, the present cross-sectional study aimed to assess the knowledge of Malaysian nurses regarding blood transfusion procedures and identify potential knowledge gaps. The findings revealed that while nurses demonstrated good knowledge about blood products and patient preparation, there were notable gaps in their understanding of pre-transfusion nursing responsibilities, transfusion nursing responsibilities, and adverse reaction management. The study highlights the importance of providing additional training and knowledge enhancement opportunities to ensure safe and effective blood transfusions. It is crucial to emphasize that the study focused solely on assessing knowledge and did not evaluate actual nursing practice. Moreover, the sample size of nurses was limited, warranting the need for future research with larger cohorts to obtain more comprehensive insights. This study is not funded by any organization, and there is no conflict of interest.

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Paper Contribution to Related Field of Study

These findings have significant implications for healthcare education and the professional development of nursing practitioners. Addressing the identified knowledge gaps through targeted training programs and continuous education initiatives can enhance nurses' competency in blood transfusion procedures and ultimately contribute to improved patient safety.

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