ORIGINAL ARTICLE

Motivators and Challenges in Implementing Restrictive Red Blood Cell Transfusion in Intensive Care Unit Kelantan

Wei Yeng Chang[1], Hasmah Hussin[1], Sharifah Azdiana Tuan Din[1], Mohd Zulfakar Mazlan[2], Ahmad Arif Che Ismail[3]

[1] Department of Clinical Medicine, Advanced Medical and Dental Institute, Universiti Sains Malaysia, Pulau Pinang, Malaysia
[2] Department of Anaesthesiology, Hospital Universiti Sains Malaysia, Kelantan, Malaysia
[3] Department of Transfusion Medicine, Hospital Raja Perempuan Zainab II Kementerian Kesihatan Malaysia, Kelantan, Malaysia

ABSTRACT

Introduction: The overuse of red blood cell (RBC) transfusions is a rising concern. Restrictive transfusion is effective in reducing unnecessary transfusions. This study aimed to identify the motivators, challenges, and factors associated with challenges in implementing restrictive RBC transfusion in the intensive care unit in Kelantan. **Methods**: A cross-sectional study was conducted using a validated questionnaire, involving clinicians from the Department of Anaesthesiology at Hospital University Sains Malaysia and Hospital Raja Perempuan Zainab II in Kelantan from 1st November 2022 until 30th April 2023. Sample size was calculated using the single proportion formula. **Results:** The median scores of the motivators and challenges were used as cut-off points for agreement. Out of 99 participants, 54 had high agreement with the motivators (median score = 37.0), including knowledge, professionalism, beliefs about consequences, and capabilities. 52 participants showed high agreement with challenges (median score = 14.0), particularly social conflict and patient outcome expectancy. Logistic regression revealed that medical officers and master's students had significantly higher agreement with challenges compared to specialists or consultants (AOR 13.17, 95% CI:1.901-91.233, p=0.009 for medical officers and AOR 6.60, 95% CI:1.091-39.932, p=0.040 for master's students). Those with 10-14 years of practice were more likely to report high agreement with challenges compared to those with over 15 years of experience (AOR 12.46, 95% CI: 1.011–153.494, p=0.049). **Conclusion:** Less experienced clinicians and those in non-specialist roles perceived greater challenges in adopting restrictive transfusion practices. To enhance implementation, early training, interdisciplinary workshops, standardised protocols, and reduced staff workload are recommended.
Malaysian Journal of Medicine and Health Sciences (2025) 21(6):1-10. doi:10.47836/mjmhs.v21.i6.1404

Keywords: Red blood cell, Transfusion, Intensive care unit, Cross-sectional, Anaesthesiology

Corresponding Author:
Chang Wei Yeng, MMed Transfusion Medicine
Email:weiyeng@yahoo.com
Tel:+604-6532023

INTRODUCTION

Critically ill patients commonly receive transfusions of red blood cells (RBC) to treat anaemia (1). However, blood transfusion carries certain risks. The Annual Serious Hazard of Transfusion (SHOT) reported 3499 cases of serious adverse reactions or events with a total number of 2,224,834 blood components issued in 2022. There were 2908 cases of errors, which was equivalent to 83.1%. The non-preventable and possibly preventable serious adverse reactions were 9.4% and 7.5% respectively (2). In Malaysia, there were a total of 72.5 cases of adverse transfusion reaction reported per 10,000 blood components transfused in year 2018-2019 (3). There is also an increased risk of infection, length of hospital-stay, morbidity, and mortality (4,5).

Transfusion overuse is a rising concern too (4). An observational study was carried out in an adult intensive care unit (ICU) of a teaching hospital in India over a period of one year. A total of 200 patients were recruited. There were 332 transfusions among the subjects whereby 99.4% were RBC transfusions. Reports indicate that 10.8% of the transfusions were not necessary (6). This leads to wastage of healthcare expenses. If we could reduce unnecessary transfusions, the costs saved could be used for other vital resources to improve our healthcare services.

Furthermore, the availability of a continuous and sufficient blood supply has always been a challenge. In Malaysia, 2000 units of RBC are transfused per day (5). However, the blood donation rate in Malaysia is only 2.2 %, as compared to 3.5 – 5 % in the developed countries (3). Blood shortage was apparent during the COVID-19 pandemic. It is still a recurrent issue in Kelantan and other states that are affected by floods as the blood donation campaigns will have to be cancelled during the disaster.

All these problems have led to the realisation on the need to improve the current transfusion practices. The World Health Organization (WHO) suggested patient blood management (PBM) as a method to resolve these issues. A restrictive blood transfusion policy, which is part of the PBM is the most widely used strategy to reduce inappropriate RBC transfusion (7,8). For stable, non-bleeding patients, restrictive RBC transfusion applies a lower transfusion threshold of haemoglobin level of 7 g/dL (9). This strategy has successfully reduced RBC transfusion by 11% from 2002 to 2012 in severely ill patients who were admitted to the ICU (10). It has also significantly reduced the economic burden. The introduction of PBM in Hospital Serdang had reduced the usage of 930 units of RBC with a total cost savings of RM 465,000 from 2015 to 2017. Despite increased usage of intravenous iron therapy from 652 vials in 2015 to 3310 vials in 2017, the costs spent on purchasing iron therapy were only 10% of the total savings from reduced transfusion. This further strengthens the cost effectiveness of PBM (5). The Western Australian implemented single-unit policy in PBM programme. The programme showed positive results in improving patient outcomes, reducing the total numbers of blood transfusions, and a gross cost saving of AUD 80-100 million (11).

Despite the evidence-based guidelines on the benefits of restrictive RBC transfusion in the ICU, variation of transfusion practice still exists (12–14). A study involving 211 clinicians revealed that they made different decision for transfusion when given the same clinical scenario, despite the existing transfusion recommendation (14). The common challenges identified were lack of knowledge and resources, resistance to change, and the wrong perception that protocols affect clinicians' autonomy (15). A qualitative study in Canada supports the findings by identifying factors that influence the transfusion behaviour among anaesthesiologists. Ten anaesthesiologists were recruited as the subjects via a purposive sampling followed by the snowball sampling method. This was to ensure the subjects differed from the hospital setting (teaching and non-teaching hospitals) and geographical background. Six of the subjects felt that there was a lack of evidence for restrictive transfusion practice (lack of knowledge), five admitted they did not adhere to the transfusion guideline (resistance to change) (13) .
Hence, the purpose of the study aimed to determine the motivators and challenges in implementing restrictive RBC transfusion among anaesthesiologists in the ICU in Kelantan, as well as the association between the demographic characteristics and the challenges identified. The study findings could be utilised to create a focused behaviour modification technique to change the transfusion practice, and subsequently used to develop an institutional RBC transfusion guideline in the ICU Malaysia.

METHODS

This was a cross-sectional study that involved data collection via a structured, validated questionnaire of the clinicians in the Department of Anaesthesiology of Hospital Universiti Sains Malaysia (HUSM) and Hospital Raja Perempuan Zainab II (HRPZ II) in Kelantan from 1st November 2022 until 30th April 2023. Both hospitals are the largest tertiary centres in Kelantan with 950 and 979 beds consecutively. Thus this could represent a heterogeneous population of clinicians.

Sampling and data collection

To find out what motivated the clinicians to start implementing restrictive RBC transfusions in the ICU, the sample size was calculated using the single proportion formula-estimation. The accuracy was set at 10%, the confidence level at 95%, the significance level at 0.05, and there was a 10% dropout rate, giving a proportion of 36%. The final calculated sample size was 99. A convenient sampling method was applied.

The inclusion criteria were participants who were registered practitioner with the Malaysian Medical Council and involved in the Department of Anaesthesiology. The data collection excluded those who were on sabbatical or confinement leave.

A self-administered, validated structured questionnaire was used in this study. It was adapted with permission from a study in Canada that was published in year 2019. Soril et. al developed the "Facilitators and Barriers to Adopting a Restrictive RBC Transfusion Practice" questionnaire, which consisted of 14 items (16). However, only 13 items were utilised in this study. The item on the qualitative aspect was excluded due to limitation of time and expertise. There were two sections and all questions were in English. The first section consisted of questions on socio-demographic data (primary location of practice, professional status, number of years practising, and place of graduation). The second section consisted of 13 questions about the motivators and challenges in implementing restrictive RBC transfusion. The domains related to motivators are knowledge (Question 1-3), social or professional role and identity (Question 4-5), motivations and goals (Question 7), beliefs about consequences (Question 11-12), and beliefs about capabilities (Question 13). The domains related to challenges are motivations and goals

(Question 6) and social influences (Question 8-10). A five-point Likert Scale was used, where '5' would represent 'strongly agree' and '1' would represent 'strongly disagree'. Six anaesthesiologists participated in the pilot testing for clinical sensibility, face validity, and content validity. The quality, relevance, redundancy, ambiguity of each items were assessed. The duration required to complete the questionnaire was reported. The evaluation was repeated two weeks later. The test-retest reliability score for the questionnaire was 0.833 (good).

The study was conducted during Continuous Medical Education (CME) sessions. The questionnaires were distributed to the clinicians with individual consent taken. Clinicians then answered all the questions completely and the questionnaires were collected prior to the CME. The clinicians who did not attend the CME sessions were attended individually by the researcher for the questionnaires session after getting individual consent. The researcher received the completed questionnaires on the same day. The completion of questionnaires was on a voluntary basis with the identity and responses being kept anonymous. Clinicians were being assured that refusal to participate or failure to submit the questionnaire would not affect their services. Their responses would not be used as an assessment of competency. The response rate of the study was 82%.

Data analysis

The data was analysed using Statistical Package for Social Sciences (SPSS) software version 28. During the data analysis process, missing responses were carefully assessed to determine their extent and pattern. For cases where a significant portion of data was missing, the entire case was excluded from the analysis to preserve the integrity of the dataset. However, for instances where only isolated values were missing, the approach varied depending on the type and distribution of the data. In cases where the missing data were minimal and appeared to be randomly distributed, imputation was considered using the median for continuous variables and the mode for categorical variables. This method was chosen to reduce bias and maintain the robustness of the analysis.

To analyse the socio-demographic details, motivators and challenges in implementing restrictive RBC transfusion, descriptive analysis was used. Categorical data was presented as frequency and percentage while numerical data was presented as median and interquartile range (IQR). We applied normality tests (Kolmogorov-Smirnova and Shapiro-Wilk) to determine the data distribution of data and it was found to be non-normal.

To determine our objectives, we applied Logistic Regression analysis. First, we conducted a Simple Logistic Regression (SLR) and selected variables with a p-value less than 0.25 or clinically important in the univariate analysis for further analysis. Then, a forward, backward, and manual methods were used to determine our final model. We also checked the fitness of our model using a crosstabulation table, the Hosmer-Lemeshow Test and Area Under the Curve analysis. Finally, we used the Multiple Logistic Regression (MLR) test to analyse the multivariate analysis. The tests met all their assumptions. Because the dependent variable was a binary number (high vs. low), we chose logistic regression for the analysis. The dependent variable was the level of agreement with the difficulties of limiting RBC transfusions (high vs low). Logistic regression is particularly suited for modelling relationships involving dichotomous outcomes, ensuring that the predictions are appropriately constrained within a probability range of 0 to 1. This makes it a more appropriate choice compared to linear regression, which is designed for continuous outcomes and could produce predictions outside the feasible range for binary variables. Furthermore, the p-value threshold of < 0.25 was employed during the initial univariate analysis to ensure that potentially relevant variables were not excluded prematurely. It is possible to find variables that are not important on their own, but may help make a more accurate and complete multivariate model when looked at with other factors because of this broader threshold. Variables comparison with a p-value less than 0.05 are considered as significant.

Ethical approval

Ethical approval was obtained from two ethical boards, which were Jawatankuasa Etika Penyelidikan (Manusia) of Universiti Sains Malaysia (JEPeM) with the code of USM/JEPeM/22080529, and National Medical Research Register (NMRR) with the code of NMRR ID-22-02295-WHI (IIR).

RESULT

Characteristics of clinicians in ICU Kelantan

Table I presents the characteristics of the clinicians' cohort and their corresponding outcomes. The cohort consisted of 99 participants, with 48.5% (n=48) from a teaching hospital and 51.5% (n=51) from a general hospital. The distribution of the participants' professional status was as follows: 34.3% (n=34) were medical officers, 41.4% (n=41) were master's students, and 24.2% (n=24) were specialists. Regarding the years of practice, 22.2% (n=22) had less than 5 years of working experience, 50.5% (n=50) had 5-9 years, 17.2% (n=17) had 10-14 years, and 10.1% (n=10) had more than 15 years. Additionally, 58.6% (n=58) of the participants graduated locally, while 41.4% (n=41) graduated overseas.

Summary of the survey

Figure 1 shows an overview of the Likert scale response survey. It shows in detail how participants answered in different areas related to restrictive RBC transfusion

Table I: Patient Characteristics and the Outcome (n=99)

Variables	n (%)
Location of practice	
Teaching hospital	48 (48.5)
General hospital	51 (51.5)
Professional status	
Medical officer	34 (34.3)
Master student	41 (41.4)
Specialist/ Consultant	24 (24.2)
Number of years practice	
<5	22 (22.2)
5-9	50 (50.5)
10-15	17 (17.2)
>15	10 (10.1)
Place of graduate	
Local	58 (58.6)
Oversea	41 (41.4)
Outcome	
Motivator score	
Median	37.0 (30.0-45.0)
IQR	5.0
Lower quartile	35.0
Upper quartile	40.0
Challenge score	
Median	14.0 (7.0-18.0)
IQR	3.0
Lower quartile	12.0
Upper quartile	14.0
Motivators	
Low agreement	45 (45.5)
High agreement	54 (54.5)
Challenges	
Low agreement	47 (47.5)
High agreement	52 (52.5)

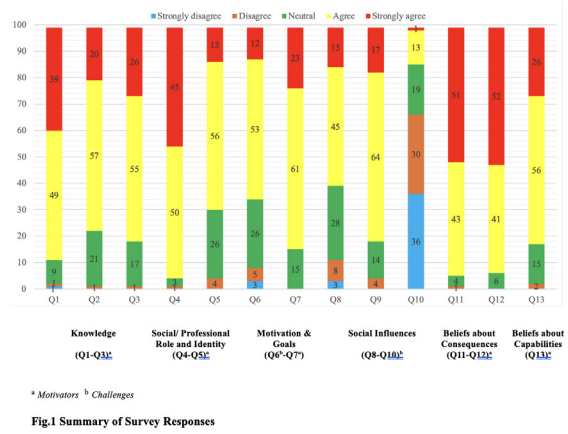

Fig.1 Summary of Survey Responses

Fig.1: Summary of Survey Responses

practice. Responses to questions 1 through 7 revealed that a significant proportion of participants agreed or strongly agreed with the statements presented. For instance, agreement was particularly strong for question 4, where 45 participants agreed and 40 strongly agreed, indicating a high level of acceptance regarding the importance of adhering to guidelines in delivering quality care. There were also neutral answers, especially to questions 3 and 5, which suggests that the clinicians may not be sure or agree with everything that the evidence says about restrictive transfusion strategies and the rules that come with them.

For questions 8 through 13, responses highlighted varying levels of agreement with the influence of social factors and beliefs about the consequences of restrictive transfusion practices. For example, a notable majority of participants agreed or strongly agreed with question 9, which assessed the influence of colleagues on transfusion practices, reflecting clinicians tend to make transfusion decisions based on common practice as a desire to fit with the norm. However, there was a diverse range of opinions in question 10, which explored the influence of patient families on transfusion decision. 36 participants disagreed, while 30 participants had neutral responses, indicating that the clinicians were not familiar with the core value of PBM, particularly its emphasis on patient-centred approach. Additionally, strong agreement was observed in questions 11 and 12, where participants recognized the potential benefits of restrictive transfusion strategies for reducing harm and saving resources. However, there was also a significant portion of neutral responses, particularly in question 10, which explored the influence of patient families on transfusion decisions, indicating a more diverse range of opinions in this area.

Identifying motivators and challenges

The motivators could be classified into the domains of knowledge, social or professional role and identity, beliefs about consequences, and beliefs about capabilities. As for the challenges, the domains concerned were motivation and goals, as well as social influences. The outcome measures included the motivation score and the challenge score, both presented as median and interquartile range (IQR). The median motivation score was 37.0 with an IQR of 5.0, while the challenge score had a median of 14.0 with an IQR of 3.0. The median score was used as the cut-off point to categorise high and low agreement with the motivators and challenges. Among the participants, 45.5% (n=45) exhibited low agreement with motivation, and 54.5% (n=54) exhibited high agreement. Similarly, 47.5% (n=47) of participants had low agreement with the challenges, while 52.5% (n=52) had high agreement. These results provide a detailed demographic and outcome overview of the cohort, setting the stage for further analysis and interpretation.

Factors associated with high agreement on challenges

The data in Table II shows some important results when looking at the factors that lead to high agreement on how hard it is to implement restrictive RBC transfusion practice. Possible confounding factors were taken into account in the analysis to make sure that the links seen between professional status, years of practice, and how hard people thought it would be to implement restrictive RBC transfusion practice were real. Multiple logistic regression (MLR) was employed to adjust variables such as the primary location of practice and the place of graduation. By including these variables in the model, we were able to isolate the independent effects of professional status and years of practice, ensuring that the reported associations were not influenced by these other factors. This approach allowed for a more accurate assessment of the true relationship between the key variables and the outcome of interest.

The MLR analysis identified the professional status of the participants as a significant predictor. Medical officers were significantly more likely to agree with the challenges compared to specialists, with an adjusted odds ratio (AOR) of 13.169 (95% CI: 1.901-91.233, p=0.009). Similarly, participants with a master's degree had a higher likelihood of agreeing with the challenges compared to specialists, with an AOR of 6.599 (95% CI: 1.091-39.932, p=0.040). Additionally, those with 10-14 years of practice were also significantly more likely to report high agreement with challenges compared to those with over 15 years of experience, with an AOR of 12.457 (95% CI: 1.011-153.494, p=0.049). These findings suggest that less experienced clinicians and those not in specialist roles perceived greater challenges in adopting restrictive transfusion practices.

Other factors, such as the primary practice location and the graduation location, did not significantly affect challenge agreement. For instance, participants from general hospitals were not significantly more likely to agree with the challenges than those from teaching hospitals, with a p-value of 0.626. Similarly, the place of graduation did not show a significant effect, with an AOR of 1.278 (95% CI: 0.572–2.853, p=0.550).

In the process of selecting variables for the final model, we employed a systematic approach to ensure that the model was both statistically robust and clinically relevant. Initially, each variable underwent univariate analysis, and those with a p-value of less than 0.25 were considered for inclusion in the multivariate model. This threshold was chosen to ensure that potentially significant variables were not excluded prematurely, allowing for a more comprehensive analysis. Following this, we used a combination of forward, backward, and manual selection methods to refine the model. The forward method involved adding variables one at a time

Table II: Factors Associated with High agreement with Challenge (n=99)

Variables	Low Agreement n (%)	High Agreement n (%)	Crude OR (95% CI)	*p*-value[a]	Adjusted OR (95% CI)	*p*-value[b]
Location of practice						
Teaching hospital	24 (51.1)	24 (46.2)	1			
General hospital	23 (48.9)	28 (53.8)	1.217 (.552, 2.683)	.626		
Professional status						
Medical officer	11 (23.4)	23 (44.2)	6.273 (1.946, 20.219)	.002	13.169 (1.901, 91.233)	.009
Master student	18 (38.3)	23 (44.3)	3.833 (1.262, 11.642)	.018	6.599 (1.091, 39.932)	.040
Specialist/ Consultant	18 (38.3)	6 (11.5)	1		1	
Number of years of practice						
<5	8 (17)	14 (26.9)	15.750 (1.675, 148.119)	.016	2.368 (.157, 35.618)	.533
5-9	23 (48.9)	27 (51.9)	10.565 (1.244, 89.756)	.031	2.611 (.195, 34.907)	.468
10-15	7 (14.9)	10 (19.2)	12.857 (1.314, 125.778)	.028	12.457 (1.011, 153.494)	.049
>15	9 (19.1)	1 (1.9)	1		1	

CONTINUE

Table II: Factors Associated with High agreement with Challenge (n=99) (cont.)

Variables	Low Agreement n (%)	High Agreement n (%)	Crude OR (95% CI)	*p*-value[a]	Adjusted OR (95% CI)	*p*-value[b]
Place of graduate						
Local	29 (61.7)	29 (55.8)	1			
Oversea	18 (38.3)	23 (44.2)	1.278 (.572, 2.853)	.550		

[a] Simple Logistic Regression
[b] Multiple Logistic Regression
Constant = - 2.747
Backward LR was applied.
No multicollinearity and no interaction
Hosmer Lemeshow test, p-value= 0.707
Classification table 63.6% correctly classified.
Area under Receiver Operating Characteristics (ROC) curve was 69.0% (p=0.001)

based on their statistical significance, while the backward method started with all variables included, progressively removing the least significant ones. Additionally, the manual method was employed to check for interactions and multicollinearity, further refining the model to ensure its parsimony and robustness. The overall fitness of the model was assessed using the Hosmer-Lemeshow test, which yielded a p-value of 0.707, indicating that the model had a good fit. Additionally, the area under the Receiver Operating Characteristics (ROC) curve was 69.0% (p=0.001), demonstrating acceptable discriminatory power in distinguishing between those who agreed and did not agree with the challenges. Throughout this process, the variables of professional status and years of practice consistently demonstrated significance and clinical relevance, leading to their retention in the final model. This careful selection process made sure that the final model accurately showed the main factors that affected how hard clinicians thought it would be to implement restrictive RBC transfusion practice. To get more clinicians to practise restrictive transfusion, these results show how important it is to target interventions that meet the specific needs of clinicians with less experience and those who are not specialists.

DISCUSSION

Based on our study, two domains were identified as challenges, which were motivation and goals, and social influences. The agreement level or perception of challenges was associated with professional status and number of years of practice.

Anaemia is a public health issue whereby the haemoglobin concentration is below the normal level, which is less than 13.5 g/dL in men and less than 12 g/dL in women (17). It affects almost 95% of patients in the ICU. In fact, the longer the patient's stay in ICU, the more prevalent the anaemia is (18). A study reported that RBC transfusion occurred in 30-50% of patients admitted to the ICU (12). However, blood transfusion has always been an overused treatment (4,19). Hence the transfusion practice has shifted from liberal to restrictive (20).

Motivators

Our study found that knowledge was one of the motivators for implementing restrictive RBC transfusions. PBM (5,15,21,22). It is believed that a deficit of knowledge regarding restrictive transfusion leads to unnecessary transfusions (23). Brazil conducted a study to evaluate the transfusion medicine knowledge of 106 master's students. The mean score of the participants was 43.5%, indicating basic knowledge. The study found that most of the participants did not receive training in transfusion medicine during their undergraduate or postgraduate programme. Only students in haematology and transfusion medicine will receive a 30% of transfusion education in the two-year programme. The mean score of these students was 56%, which was slightly higher than those who had not received any form of training in transfusion (24). This emphasized the importance of knowledge as a motivator to improve transfusion practices.

Other motivators identified were social or professional role and identity, beliefs about consequences, and beliefs about capabilities. A Canadian study (16) identified the same domains as motivators. With regard to social or professional role and identity, the clinicians acknowledged the importance of referring to evidence-based findings as a guide in managing patients. They did not feel constrained by the recommended guidelines (13). In fact, clinicians agreed that adherence to guidelines was part of professionalism (16).

The participants of our study agreed that a restrictive RBC transfusion strategy could reduce the harm to patients and contribute to cost-savings (16). This falls under the domain of beliefs about consequences. Clinicians agreed that 'watch and wait' with thorough assessment instead of practicing liberal transfusions, could reduce the risk of infection and transfusion-related adverse events. This could contribute to cost savings in healthcare (13). This is supported by the PBM programme in Western Australia, showing a reduction of 28% in mortality, 21% in infection, 31% in acute myocardial infarction or stroke, and 15% in length of stay (12).

Nevertheless, the participants agreed that beliefs about capabilities was a motivator for implementing restrictive RBC transfusion. Clinicians felt confident that their ICU team had the capability to manage patients as per recommendations in the restrictive RBC transfusion guideline (13,16). This finding is similar to another study, which reflected that the beliefs and commitments of care personnel are motivators for PBM (25). Clinicians demonstrated a strong commitment to modifying their transfusion practices to enhance the quality of care for the patients. However, the need to uphold the reputation of one's own department could influence this perception.

The domain motivation and goals was found to be an exceptional factor. It could act as both a motivator and a challenge. The clinicians perceived it as a motivator as they felt that restrictive RBC transfusion is important in their daily practice. They were aware of the evidence-based transfusion guidelines and agreed that restrictive RBC transfusions could improve patient outcome. It was a quality assurance obligation to adhere to this transfusion practice to ensure patients' safety (25). However, this domain was also seen as a challenge as clinicians felt that restrictive RBC transfusions might cause a delay in recovery and timing of surgery (13,25).

Challenges

The challenges identified were in the domain of motivation and goals, as well as social influences. This is similar to the findings of a study in Canada whereby the same domains were also identified as challenges in implementing restrictive RBC transfusion. The study highlighted that the social conflict between clinical specialties contributed to the difficulty of restrictive RBC transfusion implementation in the ICU, as the patients who were admitted there required management from a multidisciplinary team. There might be a lack of uniformity in approach or transfusion practice among different teams or departments (16,25). Another study identified the presence of misunderstanding between different disciplines as a challenge (26). The transfusion decisions are affected by other teams or other members from the same team as a desire to conform to the norm in order to avoid criticism (13,23). This social conflict falls under the domain of social influences.

Regarding motivation and goals, clinicians perceived a potential conflict between a restrictive RBC transfusion strategy and other goals, such as slow progress or the patient's need for surgical procedures (13,25). An Australian study supports this, identifying pressure for surgery among anaesthesiologists. They need to ensure patients were able to undergo the operation on the planned date without delaying or cancelling the surgery (27). If the anaesthesiologists were to follow restrictive transfusion practice, it would take a longer time to optimise the patient pre-operatively and lead to delay of the planned operation. Therefore, it was a challenge to implement a restrictive transfusion strategy.

Associating factors with challenges

A high level of agreement with the difficulties of implementing restrictive RBC transfusion in the ICU was linked to the demographic factors. Medical officers and master's students saw more difficulties than a specialist or consultant. Our finding is conflicting with a Malaysian study which revealed that consultants or senior lecturers and clinicians aged more than 40 had the lowest score when being assessed regarding transfusion medicine knowledge, as compared to master's students, medical officers, and house officers. Due to their professionalism in their respective disciplines, consultants and senior lecturers are mostly the ones who made the final transfusion decisions (23). However, a poor score in transfusion knowledge might indicate poor adherence to restrictive transfusion practice (23,24). This could be due to transfusion decisions among the seniors being based on habitual practice (21).

On the other hand, our finding is comparable to a study in Israel, which also reported that senior physicians had better knowledge and familiarity with restrictive blood transfusion practice as compared to the residents (21). However, the study did not look into the influence of working experience on professional status. A master's student or resident could have been working for a longer period of time before enrolling in the master's or residency programme. Our study explored the number of years of practice and found a significant difference in the agreement with challenges. When we controlled for professional status, the agreement with challenges increased among clinicians with less working experience. Our finding is similar to a recent study that revealed that a less experienced clinician might have lower self-efficacy and familiarity with guidelines, hence resulting in less adherence to the recommended transfusion practice (28).

The correlation between graduation places and agreement with challenges was explored. This is due to the transfusion education varying with different medical schools. It is believed that the inappropriate transfusion practice and transfusion decision making are due to a lack of transfusion knowledge and training during medical school. A Malaysian teaching hospital conducted a study to evaluate the transfusion knowledge of its clinicians. Out of the 184 clinicians involved, 60.3% graduated from local universities while 39.7% graduated from overseas. Only 62.8% reported at least two hours of transfusion education during medical school. However, the study showed transfusion knowledge is not affected by the graduation place, regardless of whether the participant received transfusion education during medical school (23). The findings were similar to our study, in which there was no difference found in the agreement with challenges based on graduation place. An Israeli study also reported no difference between graduation place and knowledge of restrictive RBC transfusion, which supports the finding of our study (21). This could be because medical students only study the major subjects they will be tested on in their final examinations and house officer training. Transfusion education during medical school could be too brief and insufficient to make an impact on transfusion practice (24).

Furthermore, our study revealed no significant difference between the location of practice and the level of agreement regarding challenges. This is contrary to our expectations, as a teaching or university hospital is an academic medical centre where the services include patient care, education, and research. We anticipate that clinicians, due to their regular involvement in teaching medical students, will have a greater familiarity with the latest recommended guidelines, which should lead to a lower level of agreement on challenges. Besides, the perceived challenges varies as the transfusion practice might be different due to different infrastructures and resources (26). A study in Australia reported there is a correlation between the location of practice (private vs public hospitals) and challenges in implementing restrictive RBC transfusion. The contributing factors were differences in infrastructure, staffing, equipment and other resources (27). However, a study in Italy reported no difference in hospital performance between

teaching hospitals and general hospitals, which supports the finding of our study (29). This could be due to the implementation of a restrictive RBC transfusion being achievable by utilizing the existing resources in the hospitals.

Our study highlighted the knowledge-behaviour gap in restrictive RBC transfusion strategy. Despite a high agreement level on the motivators, the lack of agreement between disciplines and the outcome expectancy hinder its implementation. The neutral responses from the survey also indicate that the clinicians were uncertain about the effectiveness of this transfusion strategy. Based on behaviour modification technique, these barriers could be overcome by education and dissemination of teaching materials (15).

To ensure rational use, we should teach transfusion medicine in a systematic approach with a minimum number of hours and well-defined learning objectives (24). The training should start in medical school to ensure junior doctors are familiar with the recommended transfusion guidelines. We should organise interdisciplinary workshop to train the clinicians on restrictive RBC transfusion strategy. The workshop should focus on the alternatives to blood transfusion and the availability of these medications. We should educate clinicians to prioritise goals and balance the risks and benefits of transfusions (13). Therefore, RBC transfusion should not be used as the sole method to optimise haemoglobin prior to discharge or surgical procedures. Sharing of knowledge among PBM champions could strengthen the commitment of staff from different departments (25). Active learning from these PBM experts could be used as a tool to encourage clinicians to practice this transfusion strategy. Apart from educating the clinicians, we should engage our patients in informed decision-making. Clinicians should educate the patient why a transfusion may or may not be necessary. This could encourage patient empowerment while minimizing unnecessary transfusions.

Nevertheless, policy makers should develop local consensus to standardise transfusion practice. Adherence to restrictive RBC transfusion could be set as one of the indicators for accreditation. The allocation of funding is crucial in implementing this transfusion strategy too. We should maximise the use of fully automated laboratory tests to improve blood bank management. We should invest in diagnostic tools to aid transfusion decision. We should improve our electronic system by integrating Blood Bank Information System into Hospital Information System. This could allow communication across departments, prevent redundancy in blood request, and limit unnecessary transfusions. Our stakeholders should look into the matter of the workload of hospital staffs. We need to improve the clinician-to-patient ratio so that clinicians could focus on patient blood management and ultimately improve patient safety.

Limitations

Recognising the limitations of this study is important. First, this study was purely based on clinicians' perspective. No data were collected on clinical practices or fieldworks. Temporal factors, such as blood stock and patient load, may influence the perception. Second, there aren't many studies that look into what drives people to use restrictive RBC transfusion and what problems they face. As a result, a limited questionnaire was chosen as a research tool. Third, this study was carried out in Kelantan and may not represent the general population of anaesthesiologists in Malaysia. Fourth, we should interpret the results of our study cautiously due to its cross-sectional nature and small sample size. Hence, an interventional study with a larger sample size is required for a more reliable result. Future studies could investigate the factors that strengthen implementation strategies, the sustainability of restrictive RBC transfusion practices, their impact on blood availability, donation rates, and adverse events associated with transfusions.

CONCLUSION

This study revealed how anaesthesiologists in Kelantan perceived restrictive RBC transfusion. Despite adequate knowledge about restrictive transfusions, awareness of the recommended restrictive transfusion practice, and belief in the facilities available for coping with the transfusion practice, challenges still exist. Motivation, goals, and social influences are the key challenges. Less experienced clinicians and those who were not specialists perceived more challenges.

Hence, transfusion medicine should be given greater emphasis in medical school. PBM workshops should involve clinicians from all departments to promote collaboration and reduce variability in transfusion practice. Policy makers should improve our healthcare infrastructure and reduce staff workload to enhance its implementation. There is no formula to implement restrictive RBC transfusion practice. It requires engagement and commitment from all parties to make the implementation a success.

ACKNOWLEDGEMENTS

The authors would like to thank Dr Muhammad Radzi, the Director General of Health Malaysia for his permission to publish this article. We would also like to express our sincere gratitude to the Department of Anaesthesiology in Hospital Universiti Sains Malaysia, Kelantan and Hospital Raja Perempuan Zainab II, Kelantan for their commitment and support during the study. The authors have no conflict of interest to disclose.

REFERENCE

1. Lasocki S, Pène F, Ait-Oufella H, Aubron C, Ausset S, Buffet P, et al. Management and prevention of

anemia (acute bleeding excluded) in adult critical care patients. Vol. 10, Ann. Intensive Care. 2020. p. 97. doi: 10.1186/s13613-020-00711-6.
2. Serious Hazards of Transfusion (SHOT) Steering Group. The 2022 annual SHOT report. 2023. Available from: https://doi.org/10.57911/wz85-3885
3. National Haemovigilance Coordinating Centre PDN. Haemovigilance report 2018-2019 national transfusion service in Malaysia. 2020 Oct. Available from: https://www.moh.gov.my/moh/resources/Penerbitan/Laporan/Umum/HAEMOVIGILANCE_REPORT_2018-2019_PDN.pdf
4. Society For The Advancement Of Blood Management. Transfusion overuse exposing an international problem and patient safety issue. 2019. Available from: https://www.sabm.org/assets/pdfs/SABM-Transfusion-Overuse-2019.pdf
5. Sathar J. Implementing patient blood management in hospitals across Malaysia. 2019. Available from: https://www.pbmsia.com/Implementing-Patient-Blood-Management-in-Hospitals-Across-Malaysia-Combined.pdf
6. Mathew SC, Bhatia G, Kaur R, Mathai AS. Appropriateness of red cell transfusion practices in an intensive care unit: a prospective observational study. Indian J Anaesth. 2022 Nov 1;66(11):796–9. doi: 10.4103/ija.ija_1027_21.
7. World Health Organization. Educational Modules on Clinical Use of Blood. 2021. Available from: https://iris.who.int/bitstream/handle/10665/350246/9789240033733-eng.pdf?sequence=1
8. World Health Organization. The urgent need to implement patient blood management: policy brief. 2021. Available from: https://www.who.int/publications/i/item/9789240035744
9. Carson JL, Stanworth SJ, Guyatt G, Valentine S, Dennis J, Bakhtary S, et al. Red blood cell transfusion: 2023 AABB international guidelines. Vol. 330, JAMA. 2023. p. 1892–902. doi: 10.1001/jama.2023.12914.
10. De Bruin S, Scheeren TWL, Bakker J, Van Bruggen R, Vlaar APJ. Transfusion practice in the non-bleeding critically ill: an international online survey-the TRACE survey. Crit Care. 2019;23:309. doi: 10.1186/s13054-019-2591-6.
11. Leahy MF, Hofmann A, Towler S, Trentino KM, Burrows SA, Swain SG, et al. Improved outcomes and reduced costs associated with a health-system-wide patient blood management program: a retrospective observational study in four major adult tertiary-care hospitals background: patient blood management (PBM). Transfusion (Paris). 2017;57:1347–58. doi: 10.1111/trf.14006.
12. Cable CA, Razavi SA, Roback JD, Murphy DJ. RBC transfusion strategies in the ICU: a concise review. Vol. 47, Crit Care Med. 2019. p. 1637–44. doi: 10.1097/CCM.0000000000003985.
13. Islam R, Tinmouth AT, Francis JJ, Brehaut JC, Born J, Stockton C, et al. A cross-country comparison of intensive care physicians' beliefs about their transfusion behaviour: A qualitative study using the theoretical domains framework. Implementation Sci. 2012 Sep 21;7(1). doi: 10.1186/1748-5908-7-93.
14. Willems SA, Kranenburg FJ, Le Cessie S, Marang-van de Mheen PJ, Kesecioglu J, van der Bom JG, et al. Variation in red cell transfusion practice in the intensive care unit – an international survey. J Crit Care. 2020 Feb 1;55:140–4. doi: 10.1016/j.jcrc.2019.10.003.
15. Delaforce A, Duff J, Munday J, Hardy J. Overcoming barriers to evidence-based patient blood management: a restricted review. Implement Sci. 2020 Jan 17;15(1). doi: 10.1186/s13012-020-0965-4.
16. Soril LJJ, Noseworthy TW, Stelfox HT, Zygun DA, Clement FM. Facilitators of and barriers to adopting a restrictive red blood cell transfusion practice: a population-based cross-sectional survey. CMAJ Open. 2019 Apr 23;7(2):E252–7. doi: 10.9778/cmajo.20180209.
17. Warner MA, Hanson AC, Frank RD, Schulte PJ, Go RS, Storlie CB, et al. Prevalence of and recovery from anemia following hospitalization for critical illness among adults. JAMA Netw Open. 2020 Sep 24;3(9). doi: 10.1001/jamanetworkopen.2020.17.
18. Juárez-Vela R, Andrés-Esteban EM, Gea-Caballero V, Sánchez-González JL, Marcos-Neira P, Serrano-Lázaro A, et al. Related factors of anemia in critically ill patients: a prospective multicenter study. J Clin Med. 2022 Feb 2;11(4):1031. doi: 10.3390/jcm11041031.
19. The American Medical Association. Proceedings from the National Summit on Overuse. 2012. Available from: https://portaldeboaspraticas.iff.fiocruz.br/wpcontent/uploads/2019/12/National_Summit_Overuse.pdf
20. Vlaar AP, Oczkowski S, De Bruin S, Wijnberge M, Antonelli M, Aubron C, et al. Transfusion strategies in non-bleeding critically ill adults: a clinical practice guideline from the European society of intensive care medicine. Intensive Care Med. 2020;46:673–96. doi: 10.1007/s00134-019-05884-8.
21. Rahav Koren R, Suriu C, Yakir O, Akria L, Barhoum M, Braester A. Physicians' lack of knowledge - a possible reason for red blood cell transfusion overuse? Isr J Health Policy Res. 2017 Dec 12;6(1). doi: 10.1186/s13584-017-0173-0.
22. Revel-Vilk S, Naamad M. Patient blood management programs: how to spread the word. Vol. 7, Israel Journal of Health Policy Research. BioMed Central Ltd.; 2018. doi: 10.1186/s13584-018-0204-5.
23. Poh KY, Jackson N. Transfusion medicine knowledge among clinicians at a teaching hospital

in Malaysia. Malays J pathol. 2023;45(2):187–94. Available from: https://www.mjpath.org.my/2023/v45n2/transfusion-medicine-knowledge.pdf
24. Vaena MM de V, Alves LA. Assessment of the knowledge and perceptions of Brazilian medical residents on transfusion medicine. Hematol Transfus Cell Ther. 2019 Jan 1;41(1):37–43. doi: 10.1016/j.htct.2018.06.002.
25. Hofmann A, Spahn DR, Holtorf AP, Isbister J, Hamdorf J, Campbell L, et al. Making patient blood management the new norm(al) as experienced by implementors in diverse countries. BMC Health Serv Res. 2021 Dec 1;21(1). doi: 10.1016/j.htct.2018.06.002.
26. Chegini A, Jamalian A, Abolhassani MR, Alavi AB. A review of issues and challenges of implementation of patient blood management. Asian J Transfus Sci. 2022;17(1). doi: 10.4103/ajts.ajts_128_21.
27. Pearse BL, Keogh S, Rickard CM, Fung YL. Barriers and facilitators to implementing evidence based bleeding management in Australian cardiac surgery units: a qualitative interview study analysed with the theoretical domains framework and COM-B model. BMC Health Serv Res. 2021 Dec 1;21(1). doi: 10.1186/s12913-021-06269-8.
28. Liao YH, Tang KP, Chou CY, Kuo CF, Tsai SY. Assessment of factors influencing physicians' intention to prescribe transfusion using the theory of planned behavior. BMC Health Serv Res. 2023 Dec 1;23(1). doi: 10.1186/s12913-023-09946-y.
29. Nuti S, Grillo Ruggieri T, Podetti S, Sabina Nuti P. Do university hospitals perform better than general hospitals? A comparative analysis among Italian regions. BMJ. 2016 Aug 9;6(8):e011426. doi: 10.1136/bmjopen-2016.