

ORIGINAL ARTICLE

Transfusion medicine knowledge among clinicians at a teaching hospital in Malaysia

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Abstract

Introduction: Inappropriate use of blood and blood products has been well reported from many countries including Malaysia and may be due to a deficit of transfusion medicine (TM) knowledge. This study is aimed to assess TM knowledge among clinicians in a tertiary hospital. **Materials and Methods:** The validated exam developed by the BEST collaborative group was used to assess TM knowledge of doctors, from junior residents up to senior specialists. Scores of 42%, 62%, and 82%, corresponding to basic, intermediate, and expert levels of knowledge, respectively. Convenience sampling was done from eight blood-using departments at University Malaya Medical Centre. The Kruskal-Wallis test was used to compare the candidates' exam scores between different variables. **Results:** A total of 184 doctors were assessed. The overall mean score was 40.1% (SD 12.7%). The most senior doctors had a significantly lower mean score compared with resident trainees and specialists. Doctors from haematology, anesthesiology, and internal medicine had significantly higher scores (51%, 47.4%, and 46.4% respectively, $p < 0.05$). No correlations were found between the exam scores and the self-reported amount, or quality of prior TM teaching, nor with the year of postgraduate training. Participants did poorly on questions related to transfusion reactions, especially the question on transfusion-related acute lung injury. **Conclusion:** Inadequate transfusion medicine knowledge was found across all the departments and levels of appointment. It is concerning that the most senior decision-making doctors had especially poor knowledge. TM training is needed by all residents, and regular updates should be given to established specialists.

Keywords: Transfusion medicine knowledge, transfusion education, inappropriate blood transfusion, Malaysia

INTRODUCTION

Poor Transfusion Medicine (TM) knowledge among clinicians has been documented by many studies from different countries.¹⁻⁴ In Malaysian tertiary hospitals, a high incidence of inappropriate blood product usage has been reported.^{5,6}

Inappropriate transfusion practice is believed to be caused largely by lack of TM knowledge. When doctors are not equipped with evidence-based transfusion knowledge or guidance, they make transfusion decisions based on personal clinical experience, or the longstanding practice of their department or 'bosses'. Non-clinical factors that also influence the decisions include a desire to conform to the norm, and also the wish to avoid criticism by superiors, especially in a tertiary teaching hospital.⁷

The resulting misuse of blood may contribute to blood stock shortages, unnecessary costs to the hospitals and patients, and last but not least, unnecessary exposure of patients to transfusion complications, which may jeopardise their outcome.⁸ There is no published data on clinicians' TM knowledge from Malaysia. While TM examinations have been published to assess knowledge, most of these studies were not designed or validated using accepted psychometric techniques.^{9,10}

Additional formal TM education is proven to improve the level of knowledge, although knowledge alone appears insufficient to change practice.^{11,12} Nevertheless, addressing the knowledge deficit is a crucial initial step to bring about change in clinical practice.¹³

In 2014, the Biomedical Excellence for Safer Transfusion (BEST) collaborative

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group developed and extensively validated, a transfusion medicine examination, known as the 'BEST-TEST'.¹⁴ This assessment tool consists of 20 multiple-choice questions (MCQ) on transfusion chosen by a group of TM specialists using modified Delphi methods.¹⁵ These MCQ were then validated by Rasch analysis to make sure that they were able to differentiate different levels of TM knowledge. A further 23 questions were asked about the demographics and the perceived knowledge and attitudes of the participants. Haspel *et al.* and Lin *et al.* used the BEST TEST with internal medicine and haematology trainees respectively and found poor transfusion knowledge in both groups.¹⁶⁻¹⁷

Using the BEST-TEST as the tool, with the permission of Dr. Haspel, this study is aimed to assess the TM knowledge of Malaysian doctors working or training at a university hospital. At this time, the curricula of all postgraduate medical training programs are being reviewed in University of Malaya (UM). Ultimate goal for this study's result is to identify areas for improvement in the TM training for all postgraduate medical trainees, as well as the continuous professional development of clinical specialists across Malaysia.

MATERIALS AND METHODS

The exam developed by the BEST collaborative group was used to assess transfusion medicine knowledge.¹⁴ This assessment tool consists of 20 single-best answer multiple-choice questions on transfusion topics. Exam topics were determined by a modified Delphi method.¹⁵ Mean scores of 42%, 62%, and 82% were obtained by doctors who, according to their seniority and role, were expected to have basic, intermediate, and expert levels of TM knowledge, respectively.

The second part of the assessment tool includes 23 questions on demographics, perceived TM knowledge, and the participants' amount of, and attitude towards, transfusion education received during their medical school and post-graduate training so far. Question number two, which asks for their most 'advanced degree' was changed to 'level of appointment' (the categories were: house officer, service medical officer, Master's trainee [i.e., resident], specialist/lecturer, and consultant/senior lecturer/professor), to fit the study population in this survey. Most residency programs in Malaysia comprise four years of hospital-based training. Participants were also requested to state the medical school from which they had graduated.

The permission to use the BEST test is given with a condition not to distribute any soft or hard copy of the BEST test. To avoid participants taking out the exam questions, the survey and exam questions were prepared in a Microsoft PowerPoint presentation and projected it onto a screen for them to see. Candidates were given an optical mark recognition (OMR) sheet and pencil to fill in their answers. Ten minutes were spent explaining the survey and for the participants to answer the 23 demographic questions, as well as obtaining consent from the participants for their willingness. Another 20 minutes were given for the 20 exam questions. After the last question, candidates were allowed to request to go back to any question if they feel they did not have enough time to read or answer that particular question. After the OMR answer sheets were collected, the answer for this 'exam' is given and discussed with the participants, as a learning opportunity.

The main study involved eight clinical departments at the University Malaya Medical Centre (UMMC): Emergency Medicine, Orthopaedics, Surgery, Internal Medicine, Paediatrics, Obstetrics and Gynecology (ObGyn), Anesthesiology, and Clinical Haematology. These departments were selected as the highest users of blood and blood products within the hospital. This study was conducted over a period of six months from May to October 2017. Convenient sampling was done as this survey, because the given opportunity to engage most doctors is only during their departmental CME. The calculated sample size is 279. All medical doctors working or currently trained in this hospital are included for this study, from house officer, medical officer, Master's trainee, specialist, lecturer to consultant. Medical students, staff nurses, supporting staff as well as doctors who are not directly under this teaching hospital will be excluded. Since this same questionnaire had been used to assess the latest batch of post graduate trainees during their orientation week, they are also not allowed to participate. This study was approved by the Research Ethics committee of UMMC (MREC ID NO: 2017218-4923).

Data analysis

All statistical analysis was performed using SPSS version 20 (IBM Corporation, 2011). Only completed exams were included for data analysis. Descriptive statistical analysis was used to describe the demographics, perceived knowledge, and amount of transfusion education

received. The exam score for each candidate was calculated as a percentage of correct answers for the 20 questions. Each question was also analyzed for the percentage of correct answers. The Kruskal-Wallis test was used to compare the candidates' exam scores between different: levels of appointment; age groups; medical specialties; years of postgraduate training; and amount of prior TM education received.

RESULTS

Demographics of participants

One hundred-and-ninety-seven doctors from UMMC participated in the sessions, and 184 of them completed the survey and had their data analysed for this study. The number of participants is slightly lower than the calculated sample size due to the limitations in this study. For more details of their demographics, see Table 1.

One hundred and one (60.3%) of the participants graduated from a Malaysian medical school and the remaining 73 (39.7%) from an overseas medical school. Of the local graduates, 59 (53.2%) attended a government university and 52 (46.8%) of them attended a private university. Both the local and overseas medical graduates reported a median of two hours of TM education session during undergraduate training.

Only 115 (62.8%) of respondents reported at least 2 hours of transfusion education during medical school. Of those who had received any TM education during medical school, only 30 (18.9%) of these stated that this teaching was 'very' or 'extremely' helpful. More than one-third of Master's trainees (37%, 47 out of 127) reported no transfusion teaching at all during their postgraduate training. For those who had received any TM teaching during postgraduate training, only 18 (22.6%) of them rated it 'very'

Table 1: Characteristics of participants

| | Number | Percentage |
|------------------------------|--------|------------|
| Sex | | |
| Male | 96 | 52.2 |
| Female | 77 | 41.8 |
| Age | | |
| 21-25 | 4 | 2.2 |
| 26-30 | 38 | 20.8 |
| 31-35 | 114 | 62.3 |
| 36-40 | 13 | 7.1 |
| >40 | 14 | 7.7 |
| Department | | |
| Haematology | 5 | 2.7 |
| Emergency Medicine | 10 | 5.4 |
| Paediatrics | 14 | 7.6 |
| Anesthesiology | 25 | 13.6 |
| Surgery | 27 | 14.7 |
| ObGyn | 29 | 15.8 |
| Internal Medicine | 36 | 19.6 |
| Orthopaedics | 38 | 20.7 |
| Level of appointment | | |
| House officer | 14 | 7.6 |
| Service medical officer | 10 | 5.4 |
| Masters' trainee | 127 | 69.0 |
| Specialist / Lecturers | 17 | 9.2 |
| Consultant / Senior lecturer | 15 | 8.2 |
| Masters' Trainee Year | | |
| 1 | 17 | 13.4 |
| 2 | 19 | 15.0 |
| 3 | 50 | 39.4 |
| 4 | 37 | 29.1 |
| >4 | 4 | 3.1 |

or 'extremely' helpful. One hundred sixteen (63.4%) of them stated they would find additional TM education 'very' or 'extremely' helpful.

Self-perceived level of TM knowledge, and knowledge of practical transfusion issues within their hospital

There were nine questions in the second part of the survey in which respondents were asked to rate their ability to make blood transfusion decisions regarding different blood products (e.g. red cells, plasma, platelets, etc) on a 5-point Likert scale (1=poor to 5= excellent). To analyse the level of self-perceived competency, the composite response score of all 9 items was calculated for each individual. The mean response for the whole group was between 'fair' and 'good' (2.89). The Department of Surgery reported the highest self-rated score for ability to make transfusion decision on red cell, plasma, platelets, and cryoprecipitate (3.8, 3.5, 3.6, and 3.2, respectively). However, the difference is not statistically significant for between departments comparison, except for the department of O&G (2.9, 2.2, 2.5, and 2.0, respectively). The level of participants' knowledge about their hospital's transfusion service is shown in Table 2.

Objective TM Knowledge: The 20-MCQ Exam results

The mean exam score was 40.1% (SD 12.7%; range 10% to 80%). A comparison of the mean score for all departments is shown in Figure 1.

Consultants/senior lecturers had the lowest mean exam score (30%, $p < 0.01$) (see Figure 2). Similarly, candidates with age more than 40 years had a lower-than-average score (28.9%) compared to age groups 31-35 years (score 41.2%) and 36-40 years (score 44.2%), (p value = 0.002 and 0.007 respectively).

No correlation was found with the exam score to the amount/quality of TM education received during medical school or postgraduate training, year of postgraduate training, and self-perceived TM knowledge.

The two knowledge questions with the lowest scores were related to the identification and prevention of transfusion-associated acute lung injury (TRALI) (5.4% and 6.5% correct). Other questions with less than 33% correct answers included: warfarin reversal, massive transfusion, and other transfusion reaction questions (septic, transfusion-associated circulatory overload (TACO) and allergic). Participants showed better knowledge on topics related to fluid management in acute blood loss, indication for irradiated blood

Table 2: Background transfusion knowledge

| Question | n (%) |
|--|--------------|
| Does your hospital have transfusion guidelines? | |
| Yes | 134 (73.6) |
| No | 5 (2.7) |
| Don't know | 43 (23.6) |
| Do you know how to contact blood bank? | |
| Yes | 167 (91.3) |
| No | 16 (16.0) |
| Do you know how to contact a transfusion medicine specialist? | |
| Yes | 172 (95.6) |
| No | 8 (4.4) |
| I would rate my knowledge of TM as: | |
| No knowledge | 4 (2.2) |
| Beginner | 73 (39.9) |
| Intermediate | 98 (53.6) |
| Advanced | 8 (4.4) |
| Expert | 0 |

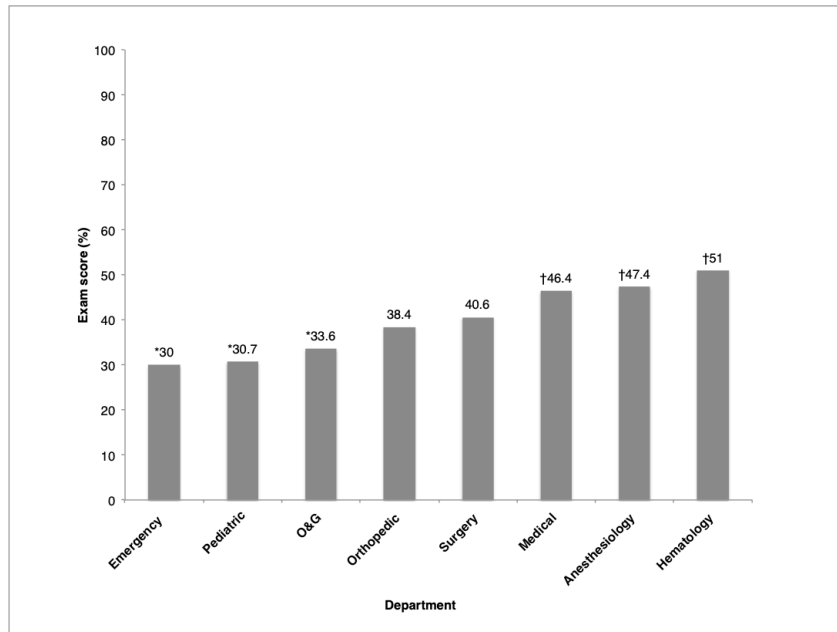


FIG. 1: Mean exam score according to different departments.
 *Significantly lower; †significantly higher (cf overall mean, 40.1%)

products, and haemolytic transfusion reaction (see Table 3).

DISCUSSION

Using the extensively validated exam tool developed by BEST, TM knowledge among doctors in a Malaysia’s tertiary hospital had been assessed and published for the first time.

On average, respondents feel they have an intermediate level of confidence in managing most of the transfusion-related issues as judged by the composite score for self-rated ability to handle nine different transfusion scenarios (2.89

out of 5.00). However, the mean exam score was 40.1%, which suggests only a basic level of TM knowledge. In fact, medical Masters’ trainees (residents) in this study scored slightly better (46.2%), comparing well with the score of 45.7% that Haspel *et al.* obtained in internal medicine trainees across nine international sites.¹⁶ Of some concern is that the most senior doctors, who perhaps set policies, and make final transfusion decisions in some cases, had the lowest exam scores. This finding is supported by Salem *et al.* who found lower knowledge scores among attending physicians compared to

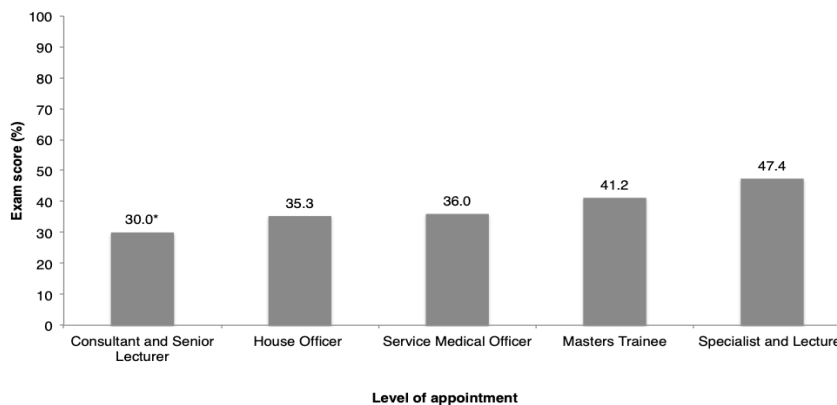


FIG. 2: Mean exam score according to different level of appointment.
 * Significant in-between group comparison with Master’s trainees and specialist/lecturer (p <0.01 for both comparisons)

Table 3: Question score by topic

| Topic | % Correct |
|---|-----------|
| Recognising TRALI | 5.4 |
| Prevention of TRALI | 6.5 |
| Warfarin reversal | 12.0 |
| Septic transfusion reaction | 13.6 |
| Reporting for TRALI | 14.1 |
| TACO | 15.2 |
| Massive transfusion | 17.9 |
| Allergic transfusion reaction | 28.8 |
| Red cell transfusion in symptomatic anaemia | 34.2 |
| Plasma transfusion for procedure | 37.5 |
| Red cell transfusion threshold | 38.0 |
| Prophylaxis platelet transfusion | 47.8 |
| Transfusion transmitted infection | 49.5 |
| Platelets transfusion threshold for surgery | 52.2 |
| Reporting for febrile transfusion reaction | 63.0 |
| Platelets transfusion for procedure | 63.6 |
| Haemolytic transfusion reaction | 66.8 |
| Cause of haemolytic transfusion reaction | 69.6 |
| Irradiated products | 73.4 |
| Fluid resuscitation in acute blood loss | 91.8 |

Abbreviation: TRALI, Transfusion-related acute lung injury; TACO, Transfusion-associated circulatory overload

residents.⁷ Doctors in the category of consultant/senior lecturer, and those more than 40 years old, performed the poorest in the exam, with mean exam scores of 30% and 28.9% respectively. This could be due to their continuous professional development being focused only within their own specialty.

Comparing departments, Emergency Medicine, Paediatrics, and ObGyn had scores significantly lower than the mean (30%, 30.7%, and 33.6% respectively). Internal Medicine, Anesthesiology, and Clinical Haematology had significantly higher mean scores (46.4%, 47.4%, and 51% respectively). It is expected that haematologists should score well in this exam, although the mark of 51% is still less than ideal for these clinicians who are, or who are training to be, specialists in this area.

However, apparent differences in TM knowledge between departments may not be entirely valid, as the sample size and seniority distribution for each department were different. The opportunity to conduct this study was given as one of the CME sessions in each department. Efforts had been made to encourage participation by early email and text notification in groups,

however, the attendance is beyond control. Most of the doctors who attended these departmental CME were Master's trainees. House officers (interns) have separate teaching sessions conducted at the hospital level; hence the number of house officers is also less than ideal. In addition, the BEST exam contains mostly adult-based clinical scenario questions, which might be unsuitable for use with paediatricians.

Several of the questions which were answered poorly relate to TRALI (Table 3). Generally, candidates have poor knowledge about transfusion reactions (including septic transfusion reactions, allergic transfusion reactions, and TACO), as well as massive transfusion. These findings are similar to the two published studies using the BEST-TEST in internal medicine and haematology trainees at different international sites.^{16,17}

The poor performance in the warfarin reversal question may have an explanation. The correct answer for the scenario presented was oral vitamin K. However oral vitamin K is not available in this hospital (although the IV preparation can be given orally, and this is often done). Many participants answered, 'IV vitamin

K', but because 'Oral vitamin K' was one of the available answers, only 'Oral vitamin K' was accepted as the correct answer.

Surprisingly, a large number of participants were not aware that the local massive transfusion policy (MTP) uses Group O RhD positive red cells instead of RhD negative, due to the low incidence of RhD negativity in Malaysia.¹⁸ TM education should pay more attention to improving the poor knowledge about transfusion reactions and MTP.

Many of the participants reported at least two hours of TM education during medical school but very few of them had found it even moderately helpful. It is expected that more senior Master's trainees (residents) would show better exam scores than their juniors, but this was not seen in this study. Perhaps this may be attributed to the lack of formal TM teaching in most programs. There is no timetabled TM teaching in our postgraduate programs, except in Internal Medicine and Haematopathology. At least one-third of trainees appear to have received no formal transfusion teaching, whereas the vast majority of them state they would find additional TM education very helpful. These results show that we need to re-evaluate the quantity and quality of our TM education to medical students and postgraduate trainees. It is felt that the Master's trainees in all blood-using specialties (and that's most of them!) should receive at least two hours of TM education each year.

There is a need to look into the best way to deliver the teaching. A recent development at UMMC is that all Master's candidates now attend an induction course before embarking on their postgraduate training. Candidates attend three full days of lectures, with several TM lectures delivered to them back-to-back. However, this 'brain overload' method of teaching/learning is doubted to be very effective.¹⁹

While conducting this survey, many departments expressed interest in specialty-specific TM education. For example, the ObGyn department has requested additional lectures on massive transfusion, and Emergency Medicine has requested TM input to a resuscitation workshop. Some surgeons expressed interest in education on direct oral anticoagulants. Almost all the participants, as well as the specialty training coordinators, stated they would welcome more TM training in the future. Instead of delivering lectures, which tend to be rather mind-numbing, there should be an improvement of the effectiveness and the method of teaching.

Incorporation of different methods of teaching/learning is needed to maximise their effect. Simulated clinical scenarios, interactive case studies, electronic learning modules, and blood bank tours/attachments could be considered in the planning of a new curriculum.^{20,21}

There are some limitations to this study. Even though an extensively validated questionnaire was adopted, some questions may not be valid in the Malaysian setting. The sample size and study population are also not fully representative of UMMC doctors, and especially not the most senior ones who generally stayed away from our sessions. By projecting the questions onto a screen via a PowerPoint presentation, some of the participants might not have kept up, although participants were allowed to go back to any particular question if they felt more time was needed.

Despite the limitations, useful results have been gathered that are comparable with the two other studies published using BEST-TEST. A deficit of doctors' TM knowledge appears to be a universal problem. The results of this study should help in the development of a Malaysian 'cross-cutting' TM postgraduate training module for use across all specialties that utilise blood products, as well as guide the development of the undergraduate TM curriculum.

Acknowledgments: We would like to thank Dr. RL Haspel for his kind permission to use the BEST-TEST exam. Our grateful thanks also extend to Associate Professor Veera Sekaran and staff of the Transfusion Medicine Department UMMC for their support in this project. Last but not least, we wish to acknowledge Professor Adeeba Kamarulzaman, Dean of this medical school, for her inspiration and unstinting support for this research.

Authors' contributions: KY POH conceived the study, carried out the assessment session, collated and analyzed the data and wrote the paper. N JACKSON supervised the project, guided the development of the study, and co-wrote the paper. Both authors have read and approved the final manuscript.

Conflict of interest: The authors declared no conflict of interest.

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