

Türkiye’de Hematologların Transfüzyon Tıbbı Uzmanlık Eğitim Hedeflerine Ulaşımının Öz Yeterlilik Anketi ile Değerlendirilmesi

Evaluation Of The Achievement Of Hematologists To Transfusion Medicine Education With Self-Assessment Questionnaire In Turkey

Funda Tayfun Kupesiz¹ (Orcid: 0000-0003-2513-7188)

Neslihan Andic² (Orcid: 0000-0003-0510-4733)

Melike Sezgin Evim³ (Orcid: 0000-0002-4792-269X)

Ibrahim Eker⁴ (Orcid: 0000-0002-1880-546X)

Fergun Yılmaz⁵ (Orcid: 0000-0001-5118-6894)

Gulen Tuysuz Kintrup⁶ (Orcid: 0000-0001-6613-5539)

Dilek Gurlek Gokcebay⁷ (Orcid: 0000-0001-8097-3950)

Melek Isik⁷ (Orcid: 0000-0002-7503-303X)

Yesim Oymak⁸ (Orcid: 0000-0002-6908-8309)

Berna Atesagaoglu⁹ (Orcid: 0000-0002-1662-8973)

Tugba Belgemen Ozer¹⁰ (Orcid: 0000-0001-5183-808X)

Isil Erdogan Ozunal¹¹ (Orcid: 0000-0002-5289-7134)

Utku Aygunes¹² (Orcid: 0000-0001-9903-2923)

Gul Ilhan¹³ (Orcid: 0000-0003-1616-6358)

Ersin Torel¹⁴ (Orcid: 0000-0002-6379-8326)

Ayşe Burcu Akinci¹⁵ (Orcid: 0000-0002-1662-8973)

Ozlem Tufekci¹⁶ (Orcid: 0000-0002-0721-1025)

Burcak Tatli Gunes¹⁷ (Orcid: 0000-0001-7080-2373)

Begum Sirin Koc¹⁸ (Orcid: 0000-0002-6127-3147)

Basak Unver Koluman¹⁹ (Orcid: 0000-0003-1106-5021)

Suheyla Ocak²⁰ (Orcid: 0000-0001-7479-7444)

Mustafa Duran²¹ (Orcid: 0000-0001-5937-235X)

Erol Gurpinar²² (Orcid: 0000-0002-5544-7040)

Deniz Ozel Erkan²³ (Orcid: 0000-0001-9221-5452)

Yesim Aydinok²⁴ (Orcid: 0000-0001-6194-6826)

Künye: Kupesiz F, Andic N, Evim M, Eker İ, Yılmaz F, Kintrup G ve ark. 9. Türkiye’de hematologların transfüzyon tıbbi uzmanlık eğitim hedeflerine ulaşımının öz yeterlilik anketi ile değerlendirilmesi. 2020;19(58):128-143

- ¹Department of Pediatrics, Division of Hematology and Oncology, University of Health Sciences Antalya Training and Research Hospital, Antalya, Turkey
- ²Department of Internal Medicine, Division of Hematology, Osmangazi University, Eskisehir, Turkey
- ³Department of Pediatrics, Division of Hematology and Oncology, Uludag University, Bursa, Turkey
- ⁴Department of Pediatrics, Division of Hematology and Oncology, Afyon Kocatepe University, Afyon, Turkey
- ⁵Department of Internal Medicine, Division of Hematology, Marmara University Pendik Training and Research Hospital, Istanbul, Turkey
- ⁶Department of Pediatrics, Division of Hematology and Oncology, Akdeniz University, Antalya, Turkey
- ⁷Department of Pediatrics, Division of Hematology and Oncology, University Of Health Sciences Ankara City Hospital, Ankara, Turkey
- ⁸Department of Pediatrics, Division of Hematology and Oncology, University of Health Sciences Dr. Behcet Uz Children's Training and Research Hospital, Izmir, Turkey
- ⁹Department of Internal Medicine, Division of Hematology, Balikesir State Hospital, Balikesir, Turkey
- ¹⁰Department of Pediatrics, Division of Hematology and Oncology, Medeniyet University Goztepe Training and Research Hospital, Istanbul, Turkey
- ¹¹Department of Internal Medicine, Division of Hematology, Medeniyet University Goztepe Training and Research Hospital, Istanbul, Turkey
- ¹²Department of Pediatrics, Division of Hematology and Oncology, University of Health Sciences, Konya Training and Research Hospital, Konya, Turkey
- ¹³Department of Internal Medicine, Division of Hematology, Mustafa Kemal University, Hatay, Turkey
- ¹⁴Department of Pediatrics, Division of Hematology and Oncology, Osmangazi University, Eskisehir, Turkey
- ¹⁵Department of Pediatrics, Division of Hematology and Oncology, 18 Mart University, Canakkale, Turkey
- ¹⁶Department of Pediatrics, Division of Hematology and Oncology, Dokuz Eylul University, İzmir, Turkey
- ¹⁷Department of Pediatrics, Division of Hematology and Oncology, University Of Health Sciences Tepecik Training and Research Hospital, Izmir, Turkey
- ¹⁸Department of Pediatrics, Division of Hematology and Oncology, Istanbul University Cerrahpasa Faculty of Medicine, Istanbul, Turkey
- ¹⁹Department of Internal Medicine, Division of Hematology, Pamukkale University, Denizli, Turkey
- ²⁰Department of Pediatrics, Division of Hematology and Oncology, Istanbul University Istanbul Faculty of Medicine, Istanbul, Turkey
- ²¹Department of Internal Medicine, Division of Hematology, University of Health Sciences, Konya Training and Research Hospital, Konya, Turkey
- ²²Department of Medical Education, Akdeniz University Faculty of Medicine, Antalya, Turkey
- ²³Statistics Consulting Unit, Akdeniz University, Antalya, Turkey
- ²⁴Department of Pediatrics, Division of Hematology and Oncology, Ege University, İzmir, Turkey

Sorumlu Yazar: Funda Tayfun Kupesiz

University of Health Sciences Antalya Training and Research Hospital, Pediatric Hematology and Oncology

Varlık, Kazım Karabekir Street City, Postal code, Country: Antalya, 07100, Turkey

Fax: +9024224900-5496 Phone Number: +9024224900-5696 Cellular Phone: +905053216878

E-mail: fundatayfn@gmail.com

Anahtar Sözcükler:

tıp eğitimi, transfüzyon tıbbı,
öz yeterlilik anketi, hematolog

Keywords:

medical education, transfusion medicine,
self- assessment questionnaire, hematologist

Gönderilme Tarihi Submitted:

16.02.2020

Kabul Tarihi:

Accepted: 11.05.2020

ÖZET:

Giriş: Kan ve kan ürünlerinin uygun klinik kullanımı, transfüzyon tıbbı konusunda teorik ve pratik bilgi birikimini gerektirir. Türkiye’de Müfredat Geliştirme ve Standart Belirleme Sistemi Tıbbi Uzmanlık Kurulu tarafından, Hematoloji Uzmanlık Eğitimi Temel Müfredatı hazırlanmıştır. Bu çalışmada hematologların transfüzyon tıbbı müfredatı ile belirlenen öğrenme hedeflerine ulaşımını ve bu durumu etkileyen faktörleri belirlemeyi amaçladık.

Metot: 2013 yılından bu yana Türk Hematoloji Derneği üyesi olan hematologlara transfüzyon tıbbı için müfredatı esas alınarak hazırlanan anket “Survey Monkey” uygulaması ile uygulandı. Anket, Likert ölçeği ve teorik çoktan seçmeli bilgi soruları ile öz yeterlilik değerlendirmelerinden oluşuyordu.

Sonuçlar: 213 hematologdan 54’ü (%25) çalışmaya katılmıştır. Hematologların yeterlilik algıları klinik yetkinlik alanlarında ortalama $3,65 \pm 0,73$ (ortanca 3,60) olarak “Biliyorum ama yeterli düzeyde değil”; kan bankacılığı alanında ortalama $3,31 \pm 0,84$ (ortanca 3.5) puan ile “biliyorum ama yeterli düzeyde değil”; hemaferez ve transfüzyon tıbbı alanında ise ortalama $4,04 \pm 0,63$ (ortanca 4) “yeterli” olarak ölçüldü. Girişimsel işlemlerde hematologlar mesleki yeterliliklerinin ortalama $2,79 \pm 0,92$ (ortanca 2,93) “Bir fikrim var,

biliyorum ama yeterli değil” olarak ifade ettiler. 13 teorik sorunun doğru cevabı ortalama $6,96 \pm 1,89$ idi (ortanca 7). Kan bankası rotasyonu yapan hematologlar yapamayanlara göre kan bankacılığı $t(52) = -3.9, p < .001$, transfüzyon tıbbı ve girişimsel alanlarda $t(52) = -2.2, p = .04$ kendilerini çok daha yetkin hissediyordu. Kan bankacılığı alanında yeterli olduğuna inanan hekimler, transfüzyon tıbbında $r(54) = .67, p < .001$ ve girişimsel işlemlerin $r(54) = .85, p < .001$ yönetiminde de kendilerinden daha eminlerdi.

Tartışma: Bu çalışmada, hematologlar genellikle kan bankacılığı alanında yeterli bilgiye sahip olmadığını düşünürken transfüzyon tıbbı ve terapötik aferez gibi konularda kendilerini daha yetkin hissetmистirler. Hematologlar, uzmanlık yılları arttıkça transfüzyon tıbbı alanında kendilerine daha fazla güvenmeye başlarken, kan bankacılığı ve girişimsel yeterlilik alanlarında kendilerini hala yeterli donanımda hissetmiyorlardı. Mevcut sonuçlar, hematologların kan bankacılığı alanını içselleştirmediklerini, yetkinliklerinde güçlü olmadıklarını ve gerekli olmadıkça bu alanda çalışmak istemediklerini göstermiştir. Transfüzyon tıbbı müfredatının ve öğrenme hedeflerinin gözden geçirilmesi, kan merkezi rotasyonlarının içerik ve süresinin standartlaştırılması ve çevrimiçi uzaktan eğitim programları ile desteklenmesi hematoloji eğitimine olumlu katkılar sağlayabilir.

ABSTRACT:

Background: Proper clinical use of blood and blood products requires competent theoretical and practical knowledge of transfusion medicine. The Curriculum Development and Standard Determination System Medical Specialization Board is prepared Hematology Specialist Education Core Curriculum in Turkey. In this study, we aimed to determine the access of hematologists to the learning objectives defined by curriculum for the transfusion medicine and the factors affecting it.

Methods: Hematologists who have been members of Turkish Hematology Society since 2013 have been included in the study, The survey questions were prepared based on the curriculum for transfusion medicine. The study was applied to hematologists with “survey monkey” application. The questionnaire consisted of a competence self-assessment with Likert scale and theoretical multiple-choice knowledge questions.

Results: Of the 213 hematologists, 54 (25%) were included in the study. Hematologists rated their competences in the clinical competence areas as $3,65 \pm 0,73$ (median 3,60) as “I know but not t a sufficient level”. The participants ‘perception of competence was “I know, but not at a sufficient level”” with an average of 3.31 ± 0.84 (median3.5) in the blood banking field, while the average in hemapheresis and transfusion medicine was 4.04 ± 0.63 (median 4) as “enough”. In interventional procedures, hematologists stated that their vocational competences were $2,79 \pm 0,92$ (median 2,93) on average as “I have an idea- I know, but not enough”. The correct answer to 13 theoretical questions was an average of $6,96 \pm 1,89$ (median 7). Hematologists performing blood rotation felt significantly more competent than the physicians who could not do the rotation in the blood bank, blood banking $t(52) = -3.9, p < .001$, transfusion medicine and interventional competence $t(52) = -2.2, p = .04$. Physicians who believed that they are sufficient in the blood banking area, were more confident in transfusion medicine $r(54) = .67, p < .001$ and managing interventional procedures $r(54) = .85, p < .001$.

Conclusion: In this study, hematologists generally felt more competent in subjects such as transfusion and therapeutic apheresis, which they often think of as not having enough

knowledge in the area of blood banking. Hematologists have been more confident in the field of transfusion medicine as their years of expertise increased, but they did not feel better equipped in the fields of blood banking and interventional competence. The current results suggested that hematologists who are expected to be the blood bank supervisors do not internalize the area of blood banking, are not strong in their competence, and do not want to work in this area unless they are required.

In hematology education curriculum, positive revisions in education can be achieved by revising blood banking curriculum and learning objectives, standardizing blood center rotations with content and duration, and support from online distance education programs.

BACKGROUND

Transfusion medicine procedures are an integral part of nearly all medical and surgical specialties. Hematologists need continuous training to update their knowledge in this area. Education and training in transfusion medicine is still inadequate in developing countries, despite improvements over the past decade [1]. The World Health Organization (WHO) global database of blood safety has shown that only 72% of countries in the world are able to meet the educational needs to ensure the safety of local blood supplies [1]. Hematologists increasing their expertise and presence in the area of blood banking may lead to the implementation of more scientific and current blood blanking applications, the establishment of transfusion policies in hospitals, and the promotion of the rational use of blood products [2].

Educational approaches to transfusion medicine vary worldwide, and each country has created educational programs within the framework of its own health policies [1]. In Turkey, education and training in transfusion medicine, hemapheresis, and blood banking are provided

in the medical specialty or subspecialty training programs, through course programs of scientific associations, in certified training programs organized by the Ministry of Health, and recently in doctoral and post-graduate programs in Health-Sciences-Institutes.

For the hematology subspecialty, the Turkish Board of Medical Specialties Curriculum Development and Standardization System (TBMS-CDSS) established the Hematology Specialist Education Core Curriculum (HSECC) on June 4, 2013. In this curriculum, blood banking and transfusion medicine learning objectives were defined separately for clinical and interventional competency areas and learning outcomes were determined for each area.

Competence in the education of health professions is defined as an observable ability of health worker to integrate knowledge, skills, values, and attitudes [3]. In the clinical competency areas pertaining to transfusion medicine, the physician is expected to be able to diagnose and treat the patient or manage the treatment process after diagnosis, while in the interventional competency areas, the physician is expected handle emergencies as per guidelines or regulations or under supervision.

The objective of the present study was to determine hematologists' achievement of learning objectives defined by TBMS-CDSS in the field of transfusion medicine and the factors affecting it. Our aim was to provide suggestions for developing curricula and improving transfusion medicine policies in order to promote better quality and more scientific healthcare services.

Methods

This survey study included hematologists who were members of the Turkish Society of Hematology (TSH), completed their subspecialty training in 2013 or later, and volunteered to participate. The questionnaire

was prepared by expert lecturers based on the transfusion medicine curriculum, taking into account the clinical and interventional competence and learning outcomes defined in the HSECC introduced in 2013. The study was conducted between June and September 2018.

In the first part of the questionnaire, the participants were asked 15 questions about their training and blood banking experiences. The second part consisted of 20 questions about their perceived competency in transfusion medicine and blood banking, which were scored using a 5-point Likert-type scale. In the final section, participants were asked to answer 13 multiple-choice questions to assess their theoretical knowledge of transfusion medicine and blood banking. The suitability of the questionnaire was evaluated by the Akdeniz University Faculty of Education, Department of Evaluation and Assessment, and by the Faculty of Medicine, Medical Education Department.

Prior to the study, a pilot survey was conducted with 15 hematologists who met the study inclusion criteria to evaluate the comprehensibility of the questionnaire. An announcement was then posted on the TSH website inviting members to complete the questionnaire via the SurveyMonkey online survey platform, from which the response data were obtained.

Statistical analyses were performed using IBM SPSS v.23 statistical software with support from the Akdeniz University Statistical Consulting Unit. The chi-square was used as a parametric test and the Mann-Whitney U as a nonparametric test. The McNemar test was used to evaluate interdependent intergroup compatibility, and Mann-Whitney U test was used to evaluate the differences between the groups. $P < 0.05$ was accepted as significant.

Results

Of 213 hematologists who met the study inclusion criteria and were invited to participate,

54 (25.4%) responded to the questionnaire and were included in the study. Thirty participants (55%) were female and 24 (45%) were male; 25 (46%) were pediatric and 29 (54%) were adult hematologists. The data were analyzed in terms of the participants' education/training, self-rated clinical and interventional competences, the number of theoretical questions answered correctly, and factors that affect perceived competence among hematologists.

Table 1 summarizes the training received by the hematologists that participated in the study. Of the 54 participants, 18 (33%) did a blood center rotation (ranging in length from 1 week to 3 months) during their subspecialty training, and only 9 (16%) worked in the blood center full-time during their rotation.

Self-assessment of clinical competence:

Mean self-rated competence in the clinical competency areas was 3.65 ± 0.73 (median 3.60), equivalent to "I know, but not at a sufficient level" (Table 2). The hematologists rated themselves as "I know, but not at a sufficient level" with a mean score of 3.31 ± 0.84 (median 3.5) for blood banking, while the mean score for hemapheresis and transfusion medicine was 4.04 ± 0.63 (median 4), corresponding to "adequate" competence.

Regarding transfusion medicine, 85% of hematologists rated themselves as "adequate" or "definitely sufficient," especially in terms of knowing the characteristics of the blood products and indications for their use, recognizing complications during and after transfusion of blood products, and treating complications. This rate was 41% for knowing the procedure to be followed in the event of blood product contamination.

In terms of hemapheresis, the hematologists rated their competence as "adequate" or "definitely sufficient" at rates of 68% for knowing what the plasma exchange procedure was and how it was performed and 61% for

knowing what stem cell apheresis was and how it was performed, while this rate was lowest for erythrocytapheresis, at 50%.

The participants rated themselves least competent in blood center organization, quality management, and biosecurity. Only 21% of the hematologists rated themselves as "adequate" or "definitely sufficient" in this area. While 50% of hematologists considered themselves "adequate" or "definitely sufficient" in interpreting blood group and cross-comparison tests, which are among the most basic tests, this rate decreased to 30% for interpreting antibody screening and identification tests.

Self-assessment of interventional competence:

For interventional procedures, hematologists rated their occupational competence as a mean of 2.79 ± 0.92 (median 2.93), representing "I have some idea" to "I know, but not at a sufficient level" (Table 2).

Regarding hemapheresis, 34% of hematologists rated themselves as "adequate" or "competent" in terms of plasma exchange, this rate decreased to 26% in leukocytapheresis and 19% in erythrocytapheresis.

In the area of blood banking, 20% considered their competency as "adequate" or "definitely sufficient" to manage the stages of whole blood collection and dissociation. In the blood banking and blood cross-screening tests, which are the most fundamental tests, 33% and 11% of the participants rated themselves as "adequate" or "definitely sufficient" in antibody screening and identification tests.

Evaluation of theoretical knowledge:

The mean number of correct answers to the 13 multiple-choice questions was 6.96 ± 1.89 (median 7). The correct response rate for each question is presented in Table 3. Questions about blood banking were answered correctly at rates of 52–54%. Although hematologists did not feel competent about screening and identifying

antibodies, 68% knew the clinical significance of alloantibodies. In parallel with their low self-rated competence in erythrocytapheresis, their correct response rate in questions about this area was 28%. Although recognizing and managing transfusion complications was one of the areas in which the participants considered themselves the most competent, the correct response rates to questions about two common complications of transfusion were 54% and 56%. While we expected the hematologists to correctly answer questions related to areas with higher self-rated competence, this association was valid only for massive transfusion ($\kappa=0.242$).

Factors affecting perceived competence and scores for theoretical knowledge:

Higher perceived competence in interventional procedures was reported by adult hematologists $t(52) = 3.2, p = .02$ and participants working in centers in which hematologists are responsible for the blood bank $t(52) = 3.1, p = .003$

Physicians who worked at university hospitals $t(52) = 3.5, p = .01$ and in centers in which hematologists are responsible for the blood bank $t(52) = 3.3, p = .002$ after completing their subspecialty training reported higher competency in blood banking.

Hematologists who did rotations in a blood bank during their subspecialty training rated themselves as more competent in blood banking $t(52) = -3.9, p < .001$ transfusion medicine $t(52) = -2.2, p = .04$ and interventional procedures $t(52) = -2.2, p = .04$ compared to physicians who did not do blood bank rotation.

There were positive correlations between number of years since completing subspecialty training and self-rated competence in transfusion medicine $r(53) = .43, p = .001$ and scores in theoretical questions about this area $r(53) = .42, p = .001$. There was no relationship between the level of proficiency in the occupational year in the areas of blood banking and interventional competence.

Participants who rated themselves as competent in the area of blood banking had higher mean scores in theoretical questions about blood banking $r(54) = .95, p = .009$. These hematologists also reported higher competency in transfusion medicine $r(54) = .67, p < .001$ and managing interventional procedures $r(54) = .85, p < .001$.

As expected, participants with higher self-rated competence in the field of transfusion medicine had higher scores for the theoretical questions on this subject $r(54) = .45, p = .001$.

Conclusion

Hematology and transfusion medicine cover a wide range of knowledge and skills including hematological disorders [4].

The proper use of blood and its components may be life-saving, while inappropriate clinical use may result in serious morbidity or mortality. Most physicians working in hematology and transfusion medicine notice problems with blood products and transfusion services. For this reason, there is constant emphasis on the role of the hemovigilance system in recognizing preventable errors in transfusion medicine.

In general, the results of surveys conducted to measure the knowledge of transfusion medicine among physicians, residents, and undergraduate medical students have demonstrated the need for additional training in this field [5-9]. It is widely accepted that transfusion training should be improved in order to improve transfusion practice. Transfusion training should be evidence-based and measurable in terms of content, assessment, and long-term results.

Our study investigating self-perceived competence of hematologists showed that they do not consider themselves to be sufficiently knowledgeable in the field of blood banking. On the other hand, they felt more competent in transfusion and therapeutic apheresis, which they frequently applied during their training. In a survey of 149 hematologists from 17

countries (USA and Europe), Lin et al. asked hematologists how they perceived their ability to manage transfusion complications and found that only 27% of hematologists rated themselves as competent, while 56% rated their knowledge as moderate [7]. American hematologists were at significantly lower levels compared to hematologists in Europe in both self-rated competence and knowledge. However, these American hematologists also gave lower scores for the quality and duration of the transfusion medicine education they received. Lin et al. attributed this finding to the fact that hematology and oncology education is given together in the US and therefore benign hematology, especially transfusion medicine training, is given less attention compared to malignant diseases. In addition, although transfusion procedures have an important place in both oncology and hematology, the authors stated based on the significantly lower knowledge levels of the American hematologists that learning through clinical practice could not replace formal, structured training [2]. In our study, we also observed that pediatric hematologists had lower self-rated competence compared to adult hematologists. These similar findings may be explained by the combination of pediatric hematology and oncology as one subspecialty in Turkey, unlike with adult hematology. Although 85% of the hematologists who participated in our study felt more competent in the field of transfusion medicine, only half of them were able to correctly answer the theoretical questions in this area.

There was no general correlation in our study between hematologists' self-perceived competence and their theoretical knowledge in the same area, suggesting that hematologists' perceptions of what they know may not be accurate. Hematologists who were members of a hospital transfusion committee demonstrated better knowledge of blood banking. Based on this, serving on a transfusion committee could

be considered a part of continuing medical education.

Hematologists who worked in university hospitals after their subspecialty training and those who worked in the blood bank of the hospital in which they work rated themselves as more competent in the field of blood banking. Adult hematologists and those responsible for the blood bank in the hospitals they work in rated themselves as more competent in interventional procedures compared to the other participants. It is likely that blood banks in universities are predominantly staffed by hematologists, particularly adult hematologists, and therefore these participants had a more active role in this field.

Based on information provided by the participants, the implementation and duration of blood bank rotation showed striking differences between institutions, with lengths varying from 1 week to 3 months. In addition, most blood bank rotations were not full-time. This interinstitutional variability is consistent with reports regarding centers elsewhere in the world [1, 10]. Theoretical education such as courses or seminars during subspecialty training had no effect on the participants' self-rated competence or their success in answering theoretical questions. However, those who had the opportunity to do a blood bank rotation felt more competent in managing interventional procedures as well as in blood banking and transfusion medicine. Considering that confidence and self-sufficiency are important factors for success in scientific and professional practice, we believe that placing hematologists in positions of responsibility in the blood bank is important to strengthen their knowledge, experience, and feelings of competence in blood banking during their subspecialty training.

As years of experience in their subspecialty increased, the hematologists felt more competent in the field of transfusion medicine, but did not feel better equipped in blood

banking. This suggested that hematologists did not have strong motivation to increase their competence in blood banking and did not become involved in this field unless obligated. As participants involved in the transfusion committee demonstrated better theoretical knowledge, we believe that participating in this committee also makes a valuable contribution to their vocational training.

Since advances in transfusion medicine practices are an integral part of numerous medical and surgical fields, hematology specialists need continuous training to update their knowledge in this area [3]. In developing countries, there is a lack of basic and continuing education on transfusion medicine for healthcare providers. Therefore, in order to establish scientific transfusion policies, some nations have determined the minimum curriculum for transfusion medicine in undergraduate and graduate education and organized structured training programs in blood centers for transfusion specialists. For example, based on national policies created in China, the high workload of health workers, and the lack of sufficient time for training, the government organized hospital-based clinical transfusion training instead of central training programs [1]. The program has been successfully implemented since 2009 by the Shanghai Blood Center. The training program is designed to improve professional knowledge, administrative skills, and business development skills of the management team, which is intended to be responsible for blood services. Although physicians in the Caribbean who want to advance in the field of transfusion medicine have to study in other countries, positive developments have been achieved with the successful implementation of international online distance education programs [11]. Similarly, full-time courses and distance learning programs have been created and implemented successfully in Africa [1].

Although the educational models, certified

courses, and seminars structured within the blood bank make a significant contribution to education, participation in these training programs may be limited due to factors such as physicians' workload, lack of time, and the need to travel for the trainings. For hematologists who are expected to be primarily responsible for the blood banks in Turkey, training programs can be organized to increase their professional knowledge, administrative skills and business development skills in the field of blood banking and transfusion medicine, as demonstrated by successful examples in other countries [4, 12, 13]. These programs can be standardized by implementing structured blood center training in their hospitals during subspecialty education. Based on the results of our study, especially findings of low perceived competence and insufficient theoretical knowledge among hematologists in the areas of blood banking and interventional competency, focused training programs in these areas may be a good starting point for transfusion medicine education. For physicians with intensive workload and time constraints, distance learning programs may be a good option to address information gaps.

Hematologists who have greater mastery and say in the field of blood banking may promote more scientific and current blood banking applications, establishment of hospital transfusion policies, and more widespread use of rational blood products. Facilitating perceptions of sufficient training and professional competence among hematologists may encourage them to take more responsibility in this area.

Positive developments in education can be achieved by revising the blood banking curriculum and learning objectives in the education of hematologists who are expected to be responsible for blood banks and standardizing structured blood center rotations in terms of content and duration. If these are achieved, we believe that more hematologists will contribute to scientific activities, in-service training,

and current transfusion practices by working actively in this field.

Limitations of the study:

Hematologists answered the questionnaire online with a time limitation and no advanced preparation. In order to increase the survey response rate, we preferred to keep the number of questions limited. Therefore, we could ask only one question for each area in the section about self-rated competence. As reported in a survey study by Piassi et al. evaluating blood transfusion knowledge, attitudes, and practice

in transfusion medicine education in Brazil, clinical skills in blood management cannot be measured with a questionnaire [14].

Our primary aim was not to determine levels of theoretical knowledge, but to evaluate how hematologists perceive themselves in this area. Analyzing responses on the TSH Proficiency Exam would be more appropriate to determine the attainment of theoretical learning objectives among Turkish hematologists. This would provide a more comprehensive sample than that in our study.

Tables

Table 1. Information regarding the hematologists' education and current employment

		Number	(%)
Gender	Female	30	55
	Male	24	45
Principal Branch Specialization	Pediatrics	25	46
	Internal medicine	29	54
Specialty training	Training & Research Hospital (TRH)	17	31
	University Hospital	33	61
	University of Health Sciences TRH	4	8
Subspecialty training	Training & Research Hospital	7	13
	University Hospital	41	77
	University of Health Sciences TRH	5	10
End of subspecialty training (years)	2013	5	10
	2014	17	32
	2015	9	17
	2016	7	13
	2017	12	22
	2018	3	6
Who responsible for blood center during subspecialty training	Hematologist	37	69
	Other	17	31
Who responsible for blood center in current place of employment	Hematologist	26	48
	Other	28	52
Current place of employment	Training & Research Hospital	20	40
	University Hospital	16	32
	University of Health Sciences TRH	7	14
	Public Hospital	5	10
	Private	2	4
Duty in transfusion committee	Yes	22	41
	No	32	59
Blood banking training	Yes	17	32
	No	37	68

Table 2. Results of self-assessment transfusion medicine clinical competency and interventional competency areas

Area	Question	1-2 1(n) / 2(n) (%)	3 3(n) (%)	4-5 4(n) / 5(n) (%)	Mean±SD
Blood Banking clinical competency	Blood donor and safety	2 / 7 (17%)	14 (26%)	23 / 8 (55%)	3.52± 1.02
	Blood type and cross match	4 / 4 (15%)	19 (35%)	20 / 7 (50%)	3.41± 1.06
	Antibody screening and identification	5 / 9 (26%)	24 (44%)	10 / 6 (30%)	3.06± 1.09
	Blood center organization	10 / 11 (80%)	21 (39%)	11 / 1 (21%)	2.67± 1.06
Hemapheresis clinical competency	Plasma exchange	1 / 3 (8%)	13 (24%)	31 / 6 (68%)	3.70± 0.82
	Stem cell apheresis	6 / 2 (15%)	13 (24%)	22 / 11 (61%)	3.56± 1.19
	Erythrocytapheresis	5 / 6 (20%)	16 (30%)	20 / 7 (50%)	3.33± 1.13
Transfusion Medicine clinical competency	Blood products and indications	1 / 0 (2%)	6 (12%)	29 / 18 (86%)	4.17± 0.77
	Identification of transfusion complications	1 / 0 (2%)	5 (11%)	32 / 15 (87%)	4.11± 0.74
	Treatment of transfusion complications	2 / 0 (4%)	5 (9%)	31 / 16 (87%)	4.09± 0.85
	Properties of specially processed (filtered, washed, irradiated) products and indications for their use	2 / 0 (4%)	13 (24%)	26 / 13 (72%)	3.89± 0.90
	Massive transfusion method	1 / 8 (7%)	11 (20%)	22 / 12 (63%)	3.67± 1.05
	Procedure to be followed in even of contamination of blood product	4 / 8 (22%)	20 (37%)	15 / 7 (41%)	3.24± 1.10
Blood Banking interventional competency	Blood type and cross match	7 / 16 (43%)	15 (28%)	13 / 3 (33%)	2.80 ± 1.12
	Donor apheresis operation	7 / 11 (33%)	21 (39%)	12 / 3 (28%)	2.87 ± 1.08
	Whole blood collection and component preparation	8 / 14 (41%)	21 (39%)	8 / 3 (20%)	2.70 ± 1.08
	Antibody screening and identification	10 / 15 (46%)	23 (43%)	3 / 3 (11%)	2.52 ± 1.04
Hemapheresis interventional competency	Plasma change	4 / 8 (22%)	24 (44%)	10 / 5 (34%)	3.19 ± 1.10
	Leukocyte Apheresis	8 / 10 (33%)	22 (41%)	9 / 5 (26%)	2.87 ± 1.15
	Erythrocytapheresis	10 / 18 (51%)	16 (30%)	6 / 4 (19%)	2.56 ± 1.14

Table 3. Information measurement results in the field of Blood Banking, Hemapheresis and Transfusion Medicine

Area	Question	Correct answer n (%)
Organization	Blood Service Units	38 (70%)
	Undesired effect and case notification guide	38 (70%)
Blood Banking	Reasons for temporary donor rejection	29 (54%)
	Indirect antiglobulin test usage areas	29 (54%)
	Leukofiltration efficacy	28 (52%)
Hemapheresis	Therapeutic plasma exchange	35 (65%)
	Erythrocytapheresis indication	15 (28%)
	Hematopoietic stem cell storage	39 (72%)
Transfusion Medicine	Clinical importance of alloantibodies	37 (68%)
	Blood product with which febrile non-hemolytic reaction is most commonly seen	29 (54%)
	Risk of transfusion-associated acute lung injury	30 (56%)
	Massive transfusion complications	22 (41%)
	Fresh frozen plasma/cryoprecipitate usage	11 (20%)

Supplementary Material

Simple survey:

1. Do you provide informed consent to use your responses in our study?

2. Please mark your gender:

- Female
- Male

3. Your year of graduation from medical school:

4. What is your principal branch?

- Pediatrics
- Internal medicine

5. In what type of institution did you complete your specialty training? (Please write the name of your institution [optional])

- Training & Research Hospital (TRH)
- University Hospital

• University of Health Sciences TRH

6. In what type of institution did you complete your subspecialty training? (Please write the name of your institution [optional])

- Training & Research Hospital
- University Hospital
- University of Health Sciences TRH

7. In which year did you complete your subspecialty training?

2013	2014	2015	2016
2017	2018		

8. In what type of institution do you currently work?

- University Hospital
- Training & Research Hospital

- Public Hospital
- Private Hospital
- University of Health Sciences TRH
- Other:

9. Who was in charge of the blood center at the institution where you completed your subspecialty training?

- Adult Hematologist
- Pediatric Hematologist
- Clinical Microbiologist
- Infectious Diseases Specialist
- Other
- Don't know

10. Who is in charge for the blood center at your current institution?

- Adult Hematologist
- Pediatric Hematologist
- Clinical Microbiologist
- Infectious Diseases Specialist
- Other
- Don't know

11. Did you do a blood center rotation during your subspecialty training?

- Yes
- No

If you answered yes to Question 11, please answer Questions 12 and 13.

12. How long was your blood center rotation?

13. Did you continue to work on the ward during your blood center rotation?

- Yes
- No

14. Do you have a blood banking and transfusion medicine certificate?

- Yes
- No

15. Have you received training in blood banking since completing your subspecialty training?

- Yes
- No

16. Have you been involved in the transfusion committee?

- Yes
- No

17. Please rate your level of proficiency in the areas specified below between 1 and 5 as follows:

- 1: Very low
- 2: I have some idea
- 3: I know, but not at a sufficient level
- 4: Adequate
- 5: Definitely sufficient

17.1 My knowledge about blood center organization, quality management, and biosafety;

17.2 My knowledge about who can be blood donors, what should be considered in donor evaluation, and donation safety;

17.3 My knowledge about the properties of blood products and indications for their use;

17.4 My knowledge about interpreting blood group (forward and reverse) and cross-comparison tests;

17.5 My knowledge about interpreting antibody screening and identification tests;

17.6 My knowledge about the procedure I should follow when I detect diseases transmitted by blood transfusion in my patient;

17.7 My knowledge about recognizing complications that may develop during and after blood transfusion;

17.8 My knowledge about treating complications that may develop during and after blood transfusion;

17.9 My knowledge about the situations to be

considered in massive transfusion management;

17.10 My knowledge about the properties and indications for use of specially processed (washed, irradiated, and filtered) products;

17.11 My knowledge on what plasma exchange is and how it is done;

17.12 My knowledge on what erythrocytapheresis is and how it is done;

17.13 My knowledge on what stem cell erythrocytapheresis is and how it is done;

18. Please rate your ability to perform the following tasks and procedures (with guidance or supervision in the event of an emergency) between 1 and 5 as follows:

1: Very low

2: I have some idea

3: I know, but not at a sufficient level

4: Adequate

5: Definitely sufficient

18.1 Managing the stages of collecting and separating whole blood;

18.2 Performing blood group (forward and reverse) and cross-comparison tests;

18.3 Performing antibody screening and identification tests;

18.4 Managing the initiation and completion of an effective and safe donor apheresis process;

18.5 Managing therapeutic plasma exchange process;

18.6 Managing therapeutic leukocytosis process;

18.7 Managing therapeutic erythrocytapheresis process.

Please mark the correct answer in questions 19-32.

19. Which of the following completely state the order of the Blood Service Units?

a) Local Blood Center, Blood Donation Center.

b) Blood Donation Center, Therapeutic Apheresis Center, Local Blood Center.

c) Local Blood Center, Therapeutic Apheresis Center.

d) Therapeutic Apheresis Center, Transfusion Center.

e) Local Blood Center, Blood Donation Center, Transfusion Center.

20. Which of the following is not one of the reasons to temporarily reject someone who wants to become a whole blood donor?

a) Tetanus vaccine for prevention purposes

b) Pregnancy

c) Having been tattooed in the last 1 year

d) Giving whole blood a month ago

e) Hepatitis B vaccination due to risky contact

21. Which of the following is not a use of fresh frozen plasma or cryoprecipitate?

a) Together with PCC in reversing the effect of warfarin

b) To keep fibrinogen above 100 mg/dl in DIC

c) To keep fibrinogen above 200 mg/dl in obstetric bleedings

d) During plasmapheresis in thrombotic thrombocytopenic purpura

e) Bleeding due to thrombolytic treatment

22. Which of the following does not work with indirect antiglobulin testing?

a) Antibody screening

b) Antibody identification

c) Cross-match

d) Weak D test

e) ABO blood group assay - forward grouping

23. Which of the following conditions is false

in relation to the alloantibodies that occur following stimulation with a foreign protein antigen in a human?

- a) Alloantibodies may not always cause clinically major problems
- b) Alloantibodies may cause problems in cross-match
- c) Transfusion reactions associated with alloantibodies may be negligible
- d) Detection of alloantibodies (ligand) antigen is necessary for proper blood searching
- e) Amount of stimulus to generate alloantibodies is different in every person

24. Blood transfusion related undesirable effects and events according to which guidelines should we report?

- a) Guidelines for national standards for blood service units
- b) National hemovigilance guideline
- c) Guideline for preparation, usage and quality assurance of national blood and blood components
- d) Guideline for quality management system in blood service units
- e) Guideline for total quality management in blood services

25. Which is most likely to cause a febrile non-hemolytic reaction?

- a) Fresh whole blood
- b) Red cell suspension
- c) Fresh frozen plasma
- d) Platelet suspension
- e) Granulocyte suspension

26. Which recipient is least at risk for transfusion-associated acute lung injury?

- a) Male patient receiving fresh frozen plasma from female donor with 3 children
- b) Female patient receiving a platelet suspension from a male donor with a history of transfusion
- c) Female patient receiving red cell suspension

from male donor

- d) Female patient in intensive care unit receiving platelet suspension from female donor
- e) Male patient with massive blood transfusion after trauma

27. Which of the following is incorrect with regard to massive transfusion?

- a) Replacing the entire blood volume within 24 hours
- b) Transfusion of more than 10 U of red cell suspension within 24 hours
- c) Giving more than 4 U of red cell suspension in 1 hour
- d) Replacing half of the entire blood volume within 3 hours
- e) Massive transfusion is needed if blood loss is >100 ml/hour

28. What is the maximum leukocyte count per unit that can be found in leukocyte-filtered red cell suspension?

- a) 1×10^5
- b) 1×10^6
- c) 1×10^7
- d) 1×10^8
- e) 1×10^9

29. How many total plasma volumes of plasma exchange are performed in each session during therapeutic plasma exchange?

- a) 1-1.5
- b) 1.5-2
- c) 2-2.5
- d) 2.5-3
- e) 3.5-4

30. Which of the following are absolute indications for erythrocyte apheresis?

- a) ABO incompatible allogeneic stem cell transplantation
- b) AIHA warm Type
- c) AIHA cold Type
- d) ABO incompatible transfusion
- e) CO Intoxication

31. In what environment can the hematopoietic stem cell product be stored for the longest time?

- a) Room temperature
- b) +4°C
- c) -80°C mechanical freezer
- d) Liquid/vapor nitrogen system
- e) 37°C carbon dioxide incubator

References

1. Eichbaum Q, Shan H, Goncalvez TT, Duits AJ, Knox P, Reilly J, et al. Global health and transfusion medicine: education and training in developing countries. *Transfusion*. 2014;54(7):1893-8.
2. Lin Y, Timmouth A, Mallick R, Haspel RL. BEST-TEST2: assessment of hematology trainee knowledge of transfusion medicine. *Transfusion*. 2015/09/25 ed2016. p. 304-10.
3. Zeller MP, Sherbino J, Whitman L, Skeate R, Arnold DM. Design and Implementation of a Competency-Based Transfusion Medicine Training Program in Canada. *Transfusion medicine reviews*. 2016;30(1):30-6.
4. Maiolino A, Spector N. Challenges for medical residency in hematology and transfusion medicine in Brazil. *Revista brasileira de hematologia e hemoterapia*. 2012;34(5):321-2.
5. Gharehbaghian A, Javadzadeh Shahshahani H, Attar M, Rahbari Bonab M, Mehran M, Tabrizi Namini M. Assessment of physicians knowledge in transfusion medicine, Iran, 2007. *Transfus Med*. 2009;19(3):132-8.
6. Arinsburg SA, Skerrett DL, Friedman MT, Cushing MM. A survey to assess transfusion medicine education needs for clinicians. *Transfus Med*. 2012;22(1):44-9; quiz 9-51.
7. Haspel RL, Lin Y, Mallick R, Timmouth A, Cid J, Eichler H, et al. Internal medicine resident knowledge of transfusion medicine: results from the BEST-TEST international education needs assessment. *Transfusion*. 2015;55(6):1355-61.
8. Graham J, Grant-Casey J, Alston R, Baker P, Pendry K. Assessing transfusion competency in junior doctors: a retrospective cohort study. *Transfusion*. 2014;54(1):128-36.
9. Rock G, Berger R, Pinkerton P, Fernandes B. A pilot study to assess physician knowledge in transfusion medicine. *Transfus Med*. 2002;12(2):125-8.
10. Panzer S, Engelbrecht S, Cole-Sinclair MF, Wood EM, Wendel S, Biagini S, et al. Education in transfusion medicine for medical students and doctors. *Vox sanguinis*. 2013;104(3):250-72.
11. Hotz GA, Moyenda ZB, Bitar J, Bitar M, Ford HR, Green BA, et al. Developing a trauma critical care and rehab hospital in Haiti: a year after the earthquake. *American journal of disaster medicine*. 2012;7(4):273-9.
12. Liu Y, Lin J, Zhong L, He Y, Yang J, Wu Y, et al. Blood transfusion practice: a survey in Sichuan, China. *Transfusion and apheresis science : official journal of the World Apheresis Association : official journal of the European Society for Haemapheresis*. 2015;52(1):105-11.
13. Lin Y, Cserti-Gazdewich C, Callum J. Evaluation of "Transfusion Camp," a postgraduate transfusion medicine education program using the BEST-TEST knowledge assessment tool. *Transfusion*. 2015;55(8):2049-51.
14. Piassi FCC, Delbone de Faria RM, Eloi-Santos SM. Brazilian medical training in Transfusion Medicine: a KAP survey to assess knowledge, attitudes and practice in blood transfusion. *Transfus Med*. 2019;29(1):72-4.