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Education in transfusion medicine for medical students and doctors

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The optimal clinical use of blood and blood products requires profound theoretical and practical knowledge in transfusion medicine. While the importance of a continuous knowledge transfer in Transfusion Medicine is well recognized, less is known about the character and scope of education in transfusion medicine to medical students and residents. The purpose of the present Forum is to get information on the educational practise in transfusion medicine around the world, with particular emphasis on the education and training of medical students and residents. The following questions were sent to experts in the field:

Question 1
Is your organization (clinic/department/institution) routinely involved in the education of
(a) medical students (during which year(s) of their curriculum)
(b) residents (during which year(s) of their curriculum) in the area of transfusion medicine?

Question 2
Is there a standardized curriculum in transfusion medicine at your institution/medical school/hospital?

Question 3
Which topics in transfusion medicine are covered by lectures/seminars/practical work for students or residents? How much time is scheduled for practical training versus lecture time?

Question 4
Are courses obligatory or optional? Is the topic of transfusion medicine relevant for any form of career progress during medical school or residency?

Question 5
Is the knowledge formally examined?

Question 6
Is your organization involved in an education or training program for medical students or residents on the national level?

Question 7
According to your opinion: Do you think knowledge transfer in clinical transfusion medicine should be increased in medical schools or during residency?

Question 8
What would be the minimal lecturing time in transfusion medicine to prepare students versus residents for their next career steps?

Question 9
Is transfusion medicine in your country a separate specialization or a sub-specialization of an existing one? For both options, what kind of background education is necessary?

We received 16 contributions to this Forum. In virtually all participating countries medical students receive some education in transfusion medicine. The extent and form of this education does not only vary considerably from country to country, but also between universities/medical schools within most of the countries. Thus, except in Iran, there are no national curricula. This is not surprising since in most countries, universities are responsible for their curricula.

In many cases, the education in transfusion medicine is given during more than one stage of the curriculum and mostly consists of lectures, but may also include practical sessions. For details, see the answers.

Education in transfusion medicine for residents also varies and depends on the specialization involved. In most countries education in transfusion medicine is included in the curriculum of pathology or hematology, but also residents in internal medicine, anesthesiology,

pediatrics and intensive care may receive some training in transfusion medicine. Again, there are no national curricula, except in Iran. In Sweden residents specializing in transfusion medicine must attend many 4–5 day national courses during their 5 years of specialization. Of interest, the Indian contributors just started the first Post Graduate MD course in Transfusion Medicine in their country. Mostly courses in transfusion medicine are compulsory for medical students but, if not, students are still faced with questions on the subject during their exams. The examination of the knowledge of transfusion medicine of residents is very variable. For instance, in some countries residents in pathology or hematology are extensively examined, whereas in other countries residents are not examined at all and their knowledge of transfusion medicine (or the lack of it) has no influence on their further studies. In Sweden, residents of transfusion medicine have to pass an exam after each national course on the subject.

Almost all the participants feel that transfer of knowledge of transfusion medicine should be enhanced and all but the participants from Sweden are of the opinion that education in transfusion medicine should be increased for both students and residents. The participants from Sweden however, feel that there is definitely a need for an increased in knowledge transfer of transfusion medicine for residents in other fields of clinical medicine (e.g. haemotology, internal medicine, intensive care). Only in Germany and India is transfusion medicine a recognized separate specialty. In most other countries it is a subspecialty of other disciplines, like hematology, internal medicine, pediatrics, etc. In France there are several different diplomas to become a recognized transfusion specialist and in Japan it is felt that transfusion medicine should become a separate specialization.

The main conclusion of this Forum is that it is generally felt that education in transfusion medicine for students and residents should be enhanced because of its great importance in clinical medicine.

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Question 1

(a) In Australia, medical student education is primarily the responsibility of universities and their associated teaching hospitals. Different structures exist at various universities, with some offering undergraduate and others postgraduate medical school programmes. The educational approaches amongst institutions are also variable, ranging from more traditional teaching methods to problem-based learning. Students rotate through teaching hospitals affiliated to the university, and further teaching is provided during these rotations.

Due to these different structures, the content, amount and timing of transfusion teaching vary greatly between medical schools. Some programmes include transfusion content from the first year of training, while others only include it at later stages. The education mainly consists of lectures and tutorials with great diversity between institutions with regard to practical vs. didactic teaching methods.

(b) Medical resident teaching in Australia is provided largely by the academic teaching hospitals. There is again considerable variation between institutions as to the timing, content and emphasis placed on transfusion teaching. Most will include transfusion as part of the intern education program; however, the extent and content of teaching in this area varies greatly.

For residents enrolled in specialist training, the curricula and assessment in relation to transfusion medicine vary according to the relevant specialist college. There is again great variation between different specialties as to the exposure of trainees to transfusion topics. Transfusion training in the specialty of haematology is discussed below in the response to Questions 2 and 9. Recently, there has been increasing involvement and interest in transfusion from other colleges (e.g. for training in internal medicine, surgery, anaesthesia, emergency medicine and obstetrics). Representatives of these specialties have participated in the compilation of updated national guidelines on clinical transfusion practice in areas such as massive transfusion and peri-operative transfusion management and will contribute to further modules

relating to internal medicine, intensive care, obstetrics and paediatrics [1]. Increasing involvement by these specialties has also been a result of an expanding research focus in these areas. This has resulted in greater awareness and exposure of trainees to different areas of transfusion and opportunities for research.

A recent development in Australia has also been the incorporation of an intern rotation through pathology in some university teaching hospitals. These interns are exposed to various areas of the laboratory, such as haematology, microbiology and biochemistry. During their haematology rotation, they have the opportunity for exposure to both laboratory (such as antibody screening and interpretation, and the importance of correct patient/specimen identification) and clinical aspects of transfusion (such as appropriate blood use, management and investigation of transfusion reactions and the concept of haemovigilance). This has led to greater understanding and broadening of their knowledge of transfusion from an early stage of residency. However, only a few institutions have incorporated this rotation to date, and not every intern in these hospitals is exposed to this rotation.

Question 2

There is currently no national, standardized curriculum in transfusion for all medical students or residents. University teaching hospitals set their own curricula, and the relevant staff at individual training hospitals determines the content of local transfusion teaching to junior resident staff.

For residents in specialty training programmes, the curriculum is determined by the relevant college. For haematology trainees, curricula are provided by the Royal College of Pathologists of Australasia (RCPA) and Royal Australasian College of Physicians (RACP) addressing laboratory and clinical aspects of transfusion medicine [2,3]; transfusion medicine and serology topics are assessed accordingly in the college examinations. For other specialties, the importance placed on transfusion is variable.

Question 3

As discussed above, the content and format of teaching varies greatly between institutions. A recent survey of interns' transfusion knowledge at the start of the clinical year was performed through the Blood Matters programme in Victoria (see below) [4]. The interns surveyed were trained at various institutions throughout Australia and New Zealand. Those surveyed reported a range of topics covered during their medical school education, focussing mainly on patient identification and sample labelling, requesting blood products from the laboratory, pre-transfusion testing theory and process, prescribing and consent and administering a blood transfusion. Less emphasis was placed on voluntary blood donation, the donation process and requirements for correct storage and transport.

Question 4

Some Australian states require completion of a transfusion module before or during internship or residency in their public hospitals. Completion of these courses, however, is not required for medical school graduation or medical registration. Knowledge of theoretical and practical aspects of transfusion is obligatory as part of haematology specialist training and is assessed through the haemato-pathology examinations.

Question 5

It is extremely variable as to whether, and if so how, transfusion knowledge of medical students and residents is assessed. There is also often disparity between knowledge examined in a theoretical context and the practical application of that knowledge. Despite the inclusion of topics such as patient identification, sample labelling and transfusion reactions in medical school curricula, a lack of correct management of these important aspects by residents and other medical practitioners continues to be seen in practice, suggesting that more emphasis should be placed on the examination of the relevant practical skills, and not only on the theoretical component.

Haemato-pathology trainees are extensively examined in both clinical and laboratory aspects of transfusion medicine (and general/clinical pathology trainees to a lesser extent). The RCPA examination process includes written and oral examinations and a transfusion serology practical assessment. Transfusion is included in the curricula of some other specialty colleges; however, the extent to which this is examined is variable.

Question 6

The Australian Red Cross Blood Service is involved in medical education and training nationally at multiple levels. This includes collaboration with various institutions such as universities, hospitals and specialist colleges in the development, delivery and examination of curricula. The national multidisciplinary Transfusion Medicine Services team also participates in teaching activities for medical students and residents. The Blood Service offers postgraduate specialty training positions in conjunction with academic hospitals, and a clinical fellowship appointment in transfusion medicine research.

The Blood Service provides transfusion medicine education online (see http://www.transfusion.com.au), as resource material and through webinars and tutorials. The BLOODSAFE programme (a partnership between the Blood Service and the Department of Health, South Australia) has

developed e-learning modules directed at various disciplines, including medical staff, nurses, laboratory scientists and others, such as porters/orderlies involved in the transfusion process (available at http://www.health.sa.gov.au/bloodsafe). The modules cover various aspects of transfusion and are accessed, completed and assessed online. Funding has been provided by Australian governments for expansion of the modules and national roll-out. Completion of this e-learning programme has been made mandatory for residents (and other staff) in public hospitals in some states. The Blood Matters programme is a partnership between the Blood Service and the Department of Health, Victoria. The programme offers a Graduate Certificate in Transfusion Practice through the University of Melbourne (see http://www.health.vic.gov.au/best). This was originally developed for training of transfusion nurse specialists, but has also been completed by some medical and laboratory scientific staff across Australia and internationally. The course is now delivered entirely on-line and consists of modules covering basic and advanced transfusion practice and quality management in transfusion.

Training of specialist haematologists is overseen and coordinated by the RCPA and RACP. Responsibilities include development and review of the curriculum [2,3], supervision and assessment of training, coordination of tutorials and examinations, and provision of training resources including electronic materials. Transfusion is addressed in all of these areas.

Question 7

Additional training of medical students and residents could be of substantial benefit. The recent intern survey referred to above demonstrated significant deficits in knowledge of basic transfusion concepts and practices, despite the fact that all those surveyed stated that they received some transfusion training during medical school [4]. There was also a vast difference between their perceived and actual knowledge of the topics tested, suggesting that more education and training is needed. Data from haemovigilance programmes highlight 'wrong blood in tube' and 'incorrect blood component transfused' incidents, due to process failures in patient identification at the time of pre-transfusion sample collection or transfusion administration, as major, ongoing problem areas, with medical staff frequently involved in these events [5,6].

Medical education in transfusion could be further enhanced at the start of residency, reinforcing important concepts and promoting compliance with basic safe transfusion practices. Attention should be paid to critical practical applications such as patient identification, appropriate clinical decision-making, prescription of blood, monitoring of patients and investigation of adverse reactions – covering both general principles and institution-specific requirements.

Residents' knowledge could also be improved through a multidisciplinary team approach, incorporating input from senior transfusion scientists and specialist transfusion nurses into the delivery of education and training. The role of the transfusion nurse is a relatively new and expanding role in Australia but has already contributed to improved transfusion practice in hospitals throughout the country. Transfusion nurses could augment the current education of residents, by delivering further teaching on important practical aspects of clinical transfusion.

The new pathology intern role also has the potential to expand the practical educational opportunities for residents. If every resident could be exposed to this rotation at some point during their residency, the greater awareness of transfusion issues would be anticipated to translate into improved practice.

Question 8

As discussed above, significant improvements in knowledge of and skills in transfusion medicine are needed for both students and residents. However, minimal lecturing times needed at the undergraduate and postgraduate levels are difficult to determine. Ongoing monitoring of clinical practice outcomes, such as through haemovigilance programmes and in-hospital audits, is needed to continually evaluate the effectiveness of education and training programmes, with further efforts tailored to the results of these assessments. Improvement is needed in both background knowledge and practical application (general and institution-specific) of this knowledge to further the safe practice of transfusion medicine. Any additional teaching in this area could be tailored to and implemented at different stages of training, with possibly more emphasis on the theoretical background knowledge during medical school and highlighting the practical aspects at the start of residency.

Formal assessment, whether by examination or other means, or requirement of completion of a training programme should ideally be incorporated into the various teaching structures to enhance alignment of students' and residents' knowledge and skills with the relevant educational activities. A national approach to the training of residents could ensure that all medical practitioners have at least a basic exposure to the fundamentals of transfusion medicine.

Question 9

In Australia, transfusion medicine it is not a recognized medical subspecialty with a separate formal evaluation or qualification. There are only limited numbers of medical specialists whose major career interest and day-to-day

practice is primarily in transfusion medicine, and it is generally practised as a subspecialty of haematology. During haematology specialist training both clinical and laboratory aspects feature strongly in the curriculum and examinations (as discussed above). Further subspecialty expertise is developed through additional rotations, clinical fellowships and practical experience in transfusion settings in hospitals, research institutions and with the Blood Service.

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Question 1

Although our organization is a hospital-based blood bank, not formally related to the University, our hospital maintains a resident programme training and consequently, the Blood Transfusion Service (BTS) is responsible to provide adequate training and education on the clinical aspects concerning Patient Blood Management for all Intensive Care and Anaesthesiology residents during the first year of their curriculum.

Question 2

We maintain a standard curriculum since the inception of the educational programme for medical residents in 1996. In addition, we also admit a great number of other health professionals from external units for a training period, based on individual request and time availability, provided it does not conflict with the standard resident training program.

Question 3

Our educational programme consists of lectures and practical activities covering the basic blood cycle (Recruitment, Collection, Processing of Blood Components, Storage, Pretransfusional tests, Prescription of Blood Components and Transfusional Reaction Management), Therapeutic Aphaeresis; Platelet Refractoriness Management (Clinical and Laboratory), Blood Transfusion in ICU; Maximum Blood Surgery Ordering Schedule (MBSOS); Autologous Blood Transfusion (mainly intra operatory salvage); Infectious Marker Donor Counselling, etc. In addition, all residents follow the permanent BTS medical staffs in their daily activities, which allow them to interact with current medical problems that take place in a large and complex hospital.

Question 4

Actually, the training programme for residents above is obligatory. We think this topic is not only relevant even during their programme, but also in the medical school (graduation). In addition, we have recommended and received from other resident programmes to send their own residents for a training period in our department, although still on a voluntary basis. However, many of these residents become later part of the permanent medical staff, which allows us to prepare future doctors to be adequately trained in the field of Patient Blood Management resulting in less non-compliance against our own standard medical transfusion guidelines.

Question 5

Not yet. We are evaluating the introduction of a permanent, standardized evaluation of all trained residents.

Question 6
No, we are not involved in a national programme level, although we share our experience with several hospitals in the country.

Question 7
Yes for all the reasons cited previously. Adequate Patient Blood management starts in the graduation period

Question 8
Although we would like to have more time to dedicate for non-haematology or transfusion medicine residents, we offer one week of practical work and a total of 10 h of lectures during their training in our BTS.

Question 9
Although we have a common haematology and transfusion medicine (hemotherapy) residence programme in the country, the latter accounts for approximately 30% of a minimum of 2-year program. To be accepted in the residence programme, the candidate must have attended at least a 1-year residence programme in internal medicine.

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Question 1
In France, blood transfusion is not a fully University discipline. Some French medical schools (not all) have university professors specialized in transfusion, who provide their courses to medical students. In the other medical schools, haematologists do the teaching of transfusion, but then the number of hours is often reduced. Residents specializing in transfusion can do internships in blood banks, but they are very few of them today.

Question 2
The curriculum varies in each Hospital-University Centre for both medical students and residents, but the French Society of blood transfusion (SFTS) regularly updates a standardized curriculum.

Question 3
Once again, the organization of the teaching of transfusion depends on each Hospital-University Centre; they function independently from each other. The same is also true for the distribution of lecture time vs. practical training (the time devoted to practical training is variable, sometimes very reduced, if existent).

Question 4
Courses are obligatory for medical students, and optional for residents. Most often the subject of the blood transfusion is included in haematology for medical students. Success at passing the haematology-transfusion examination is necessary to go into the following year. For the residents, transfusion medicine is fully optional and depends on the specialty chosen.

Question 5
See answer to Question 4.

Question 6
Our organization is not directly involved for medical students; however, we organize for residents a diploma in higher education in haematology-transfusion (see Question 9).

Question 7
The knowledge transfer should be increased and especially standardized in medical schools, to reach a sufficiently high level for an adequate prescription of blood products. During residency, a minimal training should be imposed to all residents susceptible to prescribe blood products: the main medical specialties are haematology, cancerology, internal medicine, geriatric, anaesthesia and intensive care, and obstetrics (note that in France, in the context of surgery and obstetrics, the blood component prescription is almost always under the anaesthesiologist's responsibility).

Question 8
According to our opinion, the minimal lecturing time should be 8–10 h for medical students. The lecturing time should be at least 4 h for any resident, and 12 h for residents involved in the previously mentioned specialties.

Question 9
There are different university diplomas that are available to become a recognized blood transfusionist: (1) the 'Diplôme d'étude supérieure complémentaire d'hémobiologie transfusion' (2 years) is a national diploma to which only residents specializing in biology, haematology or immunology can obtain; (2) the 'Capacité en technologie transfusionnelle' (2 years) is another national diploma accessible to every medical doctor; it is considered as the main

diploma giving access to most responsibilities in a blood transfusion Centre, except for laboratory medicine (Immuno-haematology for donors and patients, and microbiology donor testing); (3) the 'Diplôme Universitaire de Transfusion Sanguine' organized by Paris VI University was the first blood transfusion University diploma organized in France as of 1973; although not officially recognized as a national diploma, it is recognized by health authorities as an equivalent of the 'Capacité en technologie transfusionnelle'; in addition, this diploma is the only one that is accessible to pharmacists and scientists wishing to work in blood transfusion centres. In addition to these blood transfusion–specific diplomas, the 'Diplome d'Etude Spéciales de Biologie' is required to be responsible of a medical laboratory in general, including when applied to blood transfusion. However, most biologists heading immuno-haematology and/or microbiology laboratory in blood transfusion centres have one of the three diplomas mentioned above. Finally, there are several additional University diplomas that are devoted to more restricted areas in blood transfusion medicine, such as the interuniversity diploma; Principes thérapeutiques en technologie transfusionnelles' organized by the Universities of Amiens, Paris VI and Paris VII, which is nationally recognized and required for MDs and pharmacists heading a hospital blood bank or to be responsible for hemovigilance in a hospital.

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O. Garraud

Question 1

Foreword: The French National Blood Service (EFS) is government ruled and independent from the Academics at the time being; meanwhile, about 30 people/personnel (physicians, researchers and biologists) exert a dual function, that is, in both headquarters and administration, clinics and laboratories at EFS, and in various universities scattered in the French (metropolitan) territory; two-third of them are tenured Professors and one-third are Assistant Professors; however, a couple of hundreds of physicians, pharmacists and researchers, employed by EFS, are officially assisting academic teaching upon appointment by the deans of the Universities. Although independent from the academic system, EFS has undertaken a strengthened collaboration with a reference University in Paris to set up the bases of an 'Institute for Transfusion Medicine and Cellular Therapy' under the auspices of the consortium of Research Institutes in France, AVIESAN. Besides its monopolistic activities of Blood Banking over the French Territory, EFS serves as the biggest laboratory, at the national level, for blood grouping and immuno-haematology, along with HLA and platelet Immunology labwork (about 60% of the national activity), and EFS assists about 80% of labile blood product delivery nationwide. In the many settings of EFS – especially in places close to university hospitals – the Blood Service hosts residents (mainly in training for Medical Biology), and occasionally Medical Students. Of important note, in France, physicians involved in transfusion medicine do not come – as in other countries – from either Internal Medicine or Pathology. When belonging to the academics, they are mainly haematologists; alternatively, they come from General Medical Biology labwork services.

(a) In its position of National Blood Service, EFS is not in charge of Education for medical students, but its tenured Academic personnel is particularly involved in such programmes in the universities (Faculties of Medicine and Pharmacy) where EFS hosts Academic personnel (that is in one in every two to three Universities, nationwide); in the majority of programmes (which are independent at the national level though encouraged to follow the recommendations indicted foremost by the National Council for Universities and occasionally by Scientific Societies), academic education of Medical students takes place at the L3 level (possibly at the L2 level in certain programmes). Stay-ins (3 months) in EFS immuno-haematology or HLA laboratories are also encouraged but poorly completed (authorization must be given by the Regional Health Care System authorities and validated by both the faculty educational board and the university hospital administration).

(b) Residents are welcome in EFS labile blood product delivery services, as well as in immuno-haematology and HLA laboratories; again, authorization must be obtained from the Regional Health Care System authorities and validated by both the faculty educational board and the University hospital administration. While relatively frequent in major cities, occupancy of available resident positions is less frequent or even rare in remote places with huge variations within the national territory. Stay-ins (6 months) usually take place in the 3rd year (or even a 4th year) of Residency to fulfil subspecialization in immuno-haematology or HLA in the 'Medical Biology Laboratory' specialty (which is, by definition, polyvalent in France, since a couple of decades). This specialty is characterized as it the only one that is recognized at the national level, but it does not belong to any university programme (which considers only sub-specialties).

In all, EFS settings are extremely demanding for welcoming more Medical Students and residents than it actually does, to better assist education in transfusion medicine and biology and possibly offer positions to trained physicians and pharmacists afterwards.

Question 2

There is a curriculum for residents in haematology, overviewed by the ad hoc National Council of Universities (the haematology section) but also in other med specialties under the auspices of the relevant Council of University sections, that is, in anaesthesiology, etc. Being specialist in transfusion medicine, the academic personnel of EFS are invited to contribute courses and teaching. In all, curriculums exist in several specialties, and courses are shared within several specialties for residents. A clarification and harmonization would be a valuable improvement to make sure that transfusion medicine is not only 'invited' but deserves a Full programme overviewed by a college of transfusion medicine specialists.

That said, if curriculums exist in several specialties involving knowledge in transfusion, strictly speaking there is as-yet no standardized curriculum in transfusion medicine itself though this is presently discussed with national authorities and strongly wished by EFS. EFS would thus like to set up a standardized curriculum to allow young Physicians and Pharmacists to join the Blood Establishment and progress in their careers. National-based diplomas in transfusion exist however: some are requested by the regulatory authorities to entitle Physicians and Pharmacists to be in charge of responsibilities at EFS (but not in other places such as hospitals and private labwork settings): they are delivered by consortia of Universities (5–6 nationwide) upon application to regulatory authorities (consortia of Universities are thus authorized by law to carry out the teaching programme and perform evaluation for a given period of time, which can be reviewed upon file report completion).

Question 3

As written above in paragraph Q2, the curriculum in haematology, anaesthesiology and other medical specialties have formal contents in both lecturing and training. However, as transfusion medicine is not a specialty, even not a sub-specialty, it cannot be stated that lecturing vs. training applies to transfusion medicine.

To this respondent's point of view, this address is probably the weakest issue in the EFS (and partners)-run programmes linked to Universities through its tenured Academic personnel. Conferences and lectures by specialists of worldwide reputation are regularly organized but are more frequent in major cities, but as they are largely based on the reputation of research groups, some good lectures are given even in remote places. However, in most programs, there is no formal schedule for practical training vs lecturing (attendance to lectures is largely encouraged but not mandatory, that is, to get CME credits in our country). To be honest, there often is a linguistic issue when lecturers are not French speaking as fluency in English is not optimal in France, unfortunately (this is also a brake for reading science and publishing).

Question 4

(a) There is only one official programme in transfusion medicine (for instance in hemobiology) for residents: however, it is unsuccessful and seriously questioned for reformatting (ongoing discussions with national authorities). However, there are other ports of entry for being involved in transfusion medicine or transfusion biology. EFS does not supervise any of those programmes, but it is largely involved in two means: on the one hand, tenured Academic personnel at EFS lecture a large part of those programmes and on the other hand, EFS settings have the capacity of welcoming residents for their training upon official authorization. In all, career progression in transfusion medicine requires attendance of one among the 2–3 existing programmes (as there is redundancy and a limited flux of attendants, one programme with mentions if needed would be enough from my view).

(b) During Medical studies, transfusion is taught on an inconsistent basis, largely dependent on the University programme: basics in immuno-haematology (blood group antigens, HLA). Few hours are delivered at the L2/L3 level in either the fundamental haematology or immunology courses; few hours are also given at the M1/M2 level in clinical transfusion medicine and hemovigilance: transfusion is only one in about 300 items belonging to the official programme for becoming resident (a competitive and ranking process).

Question 5

Again, knowledge is not formally examined in Medical schools but depends upon the individual University program. There also EFS is not involved as such but participates through its tenured Academic Personnel and their full-time personnel who are also officially appointed as lecturers (for about 3-year terms, which can be renewed several times).

Question 6

EFS is not responsible (by itself) for education and training programme for Medical students and residents at the national level. But, again, being the sole operator for blood banking activities and the major contributor of labile blood product delivery and immuno-

haematology and HLA labwork, it is strongly involved in programme coordination overviewed by the National Council of Universities.

Question 7

In this respondent's opinion (largely shared by Professors of Medicine exerting their medical activity at EFS), there is a strong need for knowledge transfer in clinical transfusion medicine. Further, it seems that an in-depth reform would be needed (actually in progress) to strengthen the three components of an attractive discipline: (1) a stronger involvement in medical activities and participation in cohort (of transfused patients) surveys; (2) teaching/lecturing; (3) performing academic and clinical research (at the international level). A flavour should be given earlier on during Medical school to orientate future young physicians into the discipline. The visibility of transfusion medicine in France is weak in all its components: Medicine – Education – Research; sustained emphasis must absolutely be given to regain the 'international reputation' it used to have in history.

Question 8

This issue is in fact a more general one: as publications in transfusion have considerably increased both in quantity and quality, emphasis must certainly be given. Actually, there is some reluctance in France for reading and apprehend the medical and scientific communication process: it is not excluded that, again, there is a language problem. However, this is a mandatory issue to be worked out at the national level.

Question 9

Transfusion medicine is not a discipline in France; it is a sub-discipline of haematology (termed haematology – transfusion), and it is overviewed by the ad hoc section of the National Council of Universities. However, one-third of the tenured Academic and University personnel working at EFS belong to a close discipline, that is, Immunology, overviewed by a different section of this National Council of Universities. Both haematology – transfusion and Immunology sections (disciplines) are split into two options: clinical and biological. Clinical haematology is largely focused on onco-haematology and bone marrow transplantation, and in a lesser extent on non-malignant blood and haemostasis diseases, while biological haematology focuses on cytology, molecular biology for blood disorders and haemostasis. Clinical immunology principally takes care of immune deficiencies, infectious diseases and allergy, while Biological Immunology specializes in auto-immunity, immunomonitoring and HLA. There is thus small room for clinical transfusion, hemovigilance and immunohaematology; EFS, along with a couple of partners, has a role to play to put forward an emphasized and refounded sub-specialty potentially termed 'Clinical and Biological Transfusion and Cell therapy'. In any case, a strong background in fundamental cell biology, haematology and immunology, and a flavour of genetics and infectious diseases (plus a sustained interest in quality systems, health safety issues and hygiene, and regulatory processes) seems necessary.

In all, even though transfusion medicine is part of the haematology programme, it is a sub-mention than a sub-specialty. EFS and other Institutes and Associations would find a large interest in the issue that transfusion medicine and transfusion Biology become fully licensed subspecialties.

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K. Janetzko & M. Müller-Steinhardt

Question 1

Teaching in transfusion medicine is not a common standard since it is not mandatory according to the national regulations for education in medicine (Approbationsordnung or Medical Licensure Act), in general, is not standard in this subject. However, full professorships in this subject are established in 21 of 35 medical faculties in Germany. In particularly there, but also at other faculties, lectures in transfusion medicine are part of the local curriculum, mostly in connection with other subjects, for example haematology, surgery, immunology. Our Institute of Transfusion Medicine and Immunology is routinely involved in the education of medical students at the Medical Faculty Mannheim, University of Heidelberg, Germany during their first (preclinical part of the study), third, fourth and final year of the study and is therefore part of the medical curriculum. Here, transfusion medicine has been established as a singular subject in connection with clinical immunology (immunology and transfusion medicine). Thus, all medical students have to pass an examination in this subject.

Questions 2 and 3

The standardized curriculum in transfusion medicine covers the following topics: blood (components and functions) (tutorials), general immunology (lectures), immuno-haematology (erythrocytes, platelets and granulocytes) (tutorials), histocompatibility (tutorials), transplantation of solid organs and haematopoietic stem cells (tutorials), collection of blood (tutorial and practical training), preparation of blood products (tutorial and practical training), transfusion of red cell concentrates, platelets and plasma components (each tutorials) and performance of transfusions including bed-side testing (practical training). The ratio of practical training versus/tutorial/lecture is approximately 20:80%.

Questions 4, 5 and 6

All mentioned courses and topics are obligatory and therefore relevant for the progress of the study. Except for the practical training in the final year of the curriculum (performance of transfusions including bed-side testing), it is a prerequisite to pass a written examination to continue with the study. This underlines the relevance of the subject. Currently, there is no uniform curriculum for transfusion medicine on a national level; however, there is a permanent nationwide exchange of information by the responsible deans.

Question 7

The knowledge transfer in transfusion medicine needs to gain even more in importance due to the increasing clinical relevance of the subject. Furthermore, future shortages in blood supply and cost-effectiveness need to be trained to enable physicians to make decisions regarding clinical indications. However, it must be considered that most other medical specialities have the same intention when it comes to add relevant topics to the curriculum. Thus, there is high competition.

Question 8

There is no strict regulation regarding the minimum lecture time for a given subject, but recent curriculum demand 0·6 to 1 ECTS (European Credit Transfer and Accumulation System) for each particular subject.

Question 9

In Germany, transfusion medicine is a specialization for physicians, requiring 3 years (at minimum) of postgraduate training in the field of transfusion medicine and 2 years (at minimum) in the field of Clinical Medicine (e.g. anaesthesiology, surgery, internal medicine, paediatrics, gynaecology).

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P. Agarwal

Question 1

(a) No.
(b) Yes (training in transfusion medicine for 3 years for attaining MD degree).

Question 2

Yes.

Question 3

This is the first institute in the country to start a PostGraduate MD course in transfusion medicine. The various topics cover more or less all aspects of Transfusion Medicine. In addition, there are postings in allied departments, like

- Clinical Haematology for exposure to stem cell harvesting, processing, cryopreservation and infusion.
- Medical Genetics for transfusion in thalassaemia patients, iron chelation therapy, HLA matching for transplantation, haemoglobin electrophoresis.
- Anaesthesia for intra-operative haemodilution and blood salvage, managing cases of massive transfusion in intensive care unit.
- Laboratory haematology for learning the basic techniques of haematology like Hb, TLC, DLC, haematocrit, platelet count and use of automated cell counter.
- Microbiology for western blot, NAT, culture and sensitivity.
- There are daily two hours of theory (lecture) classes and five hours of hands-on practical training.

Question 4

Optional. Yes it is a pre-requisite for attaining a teaching and training post (assistant professor) in any teaching facility, imparting education in transfusion medicine.

Question 5
Yes.

Question 6
Yes.

Question 7
Yes.

Question 8
One-week training for students (1-h lecture and 2 h practical each day).

Two-week training for residents of those specialities, which deal with blood and its components (2 h lecture and 2 h practical each day).

Three years training for residents of the speciality of transfusion medicine.

Question 9
It is a separate specialization.

The candidate needs to be trained in the basics of transfusion medicine during the tenure of his medical school, which is not the current practice in our country. At least 1-week training in transfusion medicine should be included in the undergraduate curriculum, which covers the basic topics of the subject. The candidate needs to be trained in Blood donor eligibility, Haemoglobin testing, managing adverse donor reaction, Basic principles of component separation and TTI testing, Universal safety precautions.

To make this programme more relevant and efficacious, an assessment should be done at the end and the grade/-marks should reflect in the final assessment of the undergraduate programme.

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T. Triyono & U. Sukorini

Question 1
(a) Our Clinical Pathology Department is involved in the education of transfusion medicine of medical students during year 4.

(b) In the 3rd year, Clinical Pathology residents must follow 2-week visit to the local blood centre. They learn more about donor aspects, pretransfusion testing and blood management.

Question 2
Transfusion medicine is routinely given to medical students since the last 2 years. There is no standardized curriculum yet for transfusion medicine in our medical school.

Question 3
The contribution of our department for medical student consists of 1-h lecture of blood transfusion concerning disaster blood banking as an obligatory in disaster block, and in an optional module of blood transfusion in the 4th year. In the module, some lectures are given, that is, basic of blood grouping, pretransfusion testing, blood processing and storage, screening of infectious diseases, clinical aspects of transfusion and transfusion reactions. Practical works for donation procedures, screening for infectious diseases using Elisa method and rapid test, component preparation and storage, and the blood bank management are performed as well. For clinical pathology residents, the lecture of blood banking and management of blood is given more advance. The time scheduled for practical training is similar with lecture time for both medical students and residents.

Question 4
The courses are both obligatory and optional. We think that the topic of transfusion medicine is very relevant.

Question 5
We make an examination for both lecture in the block, and lecture and practical in the module which students must pass it. The residents should make a report and present it in our meetings.

Question 6
Our institution is not involved in the transfusion medicine programme on the national level.

Question 7
In our opinion, clinical transfusion medicine should be given in increased portion for medical school. This will be very important for the students as we know that they will be a clinician, which contribute in transfusion practice, or they will work in hospital blood bank, or in the blood centre.

Question 8
We think at least 3 h of blood transfusion lecture is needed for medical student to give the basic and the clinical aspect of blood transfusion. A module of blood transfusion is still needed as an optional. For the clinical pathology resident, more time is needed to give many aspects of transfusion medicine as well as the management of blood.

Question 9

As far as I know, there is no transfusion specialization programme yet in Indonesia.

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A. Gharehbaghian

Question 1

Pathology residents and haematology subspecialists are provided a 1-month-long training with 1 week in theory and 3 weeks in practice. It is a part of their university curriculum the details of which are formulated by IBTO High Institute for Education and Research in Transfusion Medicine. Pathology residents and haematology subspecialists are involved in transfusion medicine course at the year 3 and at the end of their study, respectively.

Question 2

There are curricula both at MSc and PhD levels in the discipline of haematology and Blood Banking. There is also a partial curriculum for MPH students who are involved in blood transfusion. Specialized target orientated and in-service training courses are also held to improve the knowledge and specialized skill level of technical staff and newly employed physicians of Iranian Blood transfusion Organization (IBTO) in all blood centres across Iran. There are a series of need-based courses that are annually planned for blood centres across Iran (different cities) and of course vary from one year to the other. All these lecture courses are followed by final tests. Moreover, for any new developments ranging from the use of new equipment or methods, and any changes in standards or SOPs, short-term 1-3-day-long training periods are held. Regional IBTO centres put different emphasis on the various aspects of transfusion medicine, based on their own needs.

Question 3

MSc in Haematology and Blood Banking

Topic	No. of credits	No. of hours	
		Lecture	Practice
31 Credits			
Advanced Immunology	3	34	34
Advanced Cellular and Molecular Biology	2	34	–
Basics of Cell Culture & Bone Marrow Cells	1	9	17
Research Methodology	1	9	17
Haematology 1 (Basics & Red Blood Cell)	3	34	34
Haematology 2 (White Blood Cell)	3	34	34
Haematology 2 (Platelets, Haemostasis)	2	17	34
Immuno-haematology and Blood Banking	4	51	34
Quality Control in Haematology and Blood Banking	1	17	–
Medical Information Dissemination System	1	8	17
Immuno-haematology and Haematology Seminar	1	–	34
Apprenticeship in Immuno-haematology and Blood Banking	3	–	153
MSc thesis	6	–	–
43 Credits			
Cellular and Molecular Biology	2	2	–
Novel Advances In Haematology	2	2	–
New Blood Components, Preparation Methods, and Their Use	2	1	1

PhD in Haematology and Blood Banking

Topic	No. of credits	No. of hours	
		Lecture	Practice
Lab Animal Models and Haematopoiesis of Blood Diseases	2	1	1
Advanced Lab Methods in Diagnosis and Treatment of Blood Diseases	3	1	2
Novel Advances In Immuno-haematology	2	2	–
Computer	3	2	1
Bone Marrow and Cell Culture Methods	3	1	2
Quality Control in Haematology and Blood Banking	1	1	–
Advanced Haematology and Blood Banking Machines	2	1	1
PhD Dissertation	21	–	21

Haematology subspecialists have no lecture time, but they are provided with practical training in immuno-haematology, quality control, cord blood, blood donors, blood components, dispatch and automation wards.

Pathology residents also follow the above practical training hours together with a 1-week-long lecture training on the following topics: blood collection, preparation and selection of blood components, infusion of blood components, leukodepletion and irradiated blood, blood preservation, flowcytometry technique, pretransfusion testing, blood processing tests, non-haemolytic transfusion reactions, haemolytic transfusion reactions, Transfusion Transmitted Diseases (emerging infections), hospital

blood transfusion committees, haematopoietic and cord blood stem cell, haemovigilance, lookback and immunomodulation of blood transfusion.

Question 4
They are obligatory for MSc and PhD level students. Practical training and lectures, although optional for fellows and residents, are being regularly offered since they are very interested in transfusion medicine as practiced in IBTO as the only entity responsible for blood in Iran.

Question 5
It is formally examined particularly in case of MSc, PhD, and MPH students who receive official university certificates at the end of their course.

Question 6
Yes, it is on the national level and some blood centres of IBTO do the same; however, there might be minor differences in the training topics from one city to the other. High Institute for Education and Research in Transfusion Medicine has offered its training programme for students of nursing and medicine to Iran Ministry of Health, Therapy and Medical Education. As far as medical students (interns) are concerned, universities of medical sciences are allowed on an optional basis to add the subject of transfusion medicine to their curriculum as 0·5 credit. Two universities have already included this subject in their curricula.

Question 7
It should be improved; one study conducted by Research Center of Iranian Blood transfusion Organization clearly shows the level of awareness of Iranian physicians (Gharehbaghian et al. 2009) that requires to be raised.

Question 8
There should be 0·5 lecturing credit and 0·5 practical training credit for relevant residents who need to be involved in transfusion sciences and blood transfusion. Given the fact that each lecturing credit accounts for 17 h in a term.

Question 9
There is no separate specialization in Iran. The only discipline that somehow covers transfusion medicine field is paediatrics and adult haematology oncology fellowship. That is why the High Institute of Research and Education for Transfusion Medicine (affiliated to Iranian Blood transfusion Organization) in partnership with universities of medical sciences in Tehran has offered transfusion medicine fellowship course to Iran Ministry of Health, Therapy and Medical Education. Obstetricians, doctors of internal medicine, surgeons, paediatricians, pathologists, paediatrics or adult oncologist haematologists are eligible to attend this fellowship course.

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N. Manny & O. Zelig

Question 1
(a) Our institution is a university hospital with medical school. The blood bank and transfusion medicine department in our hospital is routinely involved in the education of medical students: in the 2nd year, 4th year and 6th year of their curriculum.
(b) Fellows in haematology at their 2nd year of their training.

Question 2
Yes, there is.

Question 3
The following topics are covered:
Medical school.
Second-year curriculum – ABO, Rh blood groups and 'paternity testing'–2-h lecture and 3-h laboratory training.
Immuno-haematology – 2-h lecture.
Fourth year – Blood component preparation, treatment indications, storage lesion, adverse effects of blood transfusion, AIHA. A total of 6–8 h lectures.
Sixth year – Blood transfusion in emergency situations and trauma, massive transfusion – 2 h lecture and 1 h of laboratory work demonstration in routine and emergency situations, as part of 'Trauma course' in emergency medicine.
A seminar on transfusion medicine as part of elective in haematology – approximately 3 h of seminar and visit to the blood bank.

Fellows in haematology have to spend at least 1 month in transfusion medicine department as part of their obligatory curriculum. In that time, they are exposed to various clinical and laboratory issues.

Question 4
All the above-mentioned requirements are obligatory.

Question 5
Yes it is. The knowledge is examined during the relevant medical school years and as part of board examinations in haematology.

Question 6
Each organization in the country prepares its own curriculum for medical students.

There is once yearly a national workshop in transfusion medicine for haematology fellows. The workshop is conducted by professionals from all over the country (including representatives from our institution).

Question 7
We believe that transferring knowledge in clinical transfusion should be increased mainly during residency.

We think that it should be obligatory that residents in all clinical specialties (not only haematology) will be exposed to transfusion medicine during their education, and their knowledge should be examined formally.

Question 8
We think that the minimal lecturing time for residents in our organization should be at least the same as for medical students.

Question 9
In our country, transfusion medicine is a subspecialty of haematology.

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Although our answers reflect three Japanese institutions in particular, we include perspectives shared by many colleagues in the Japan Society of Transfusion Medicine and Cell Therapy.

As a preface, it should be said that medical school in Japan consists of a 6-year curriculum, usually entered immediately after high school.

Question 1
Transfusion medicine is a formal part of the regular year 3 and year 5 curricula. Third-year medical students attend a series of lectures given to the entire class, while fifth-year students perform practical work in small groups and visit a Red Cross blood centre. A year 6 elective includes practical exposure to hospital-based autologous and aphaeresis collection, didactic tutorials and an opportunity to interpret an English-language manuscript in a departmental journal club. After graduation, residents are introduced to transfusion essentials, although practical matters of ordering the correct component in the correct way may take precedence over subtle nuances of patient blood management.

Question 2
The Committee on Research and Development of Medical Education Programs, established by the Japanese government, has provided a model core curriculum that includes targets to be achieved in transfusion medicine. The targets include accountability for indications and complications of blood transfusion, cross-match examination, blood components and their indications, transfusion reactions, autologous and allogeneic blood transfusion. Teaching staffs are at liberty to choose methods and materials according to their own judgment.

Question 3
The lectures on transfusion medicine cover the history of blood transfusion, transfusion safety, phenotype and screening tests, informed consent, transfusion-related infections, guidelines for proper usage of blood, indications and merits of blood transfusion, donation and supply of blood, and types and mechanisms of aphaeresis. Practical work includes blood grouping, cross-matching, screening for antierythrocyte irregular antibodies and case studies in blood transfusion.

Question 4
Transfusion-related coursework is obligatory in the sense of being part of a fixed curriculum. Lectures are optional in the sense that students may be physically or mentally absent. Students who miss a small-group practicum are rescheduled in another group. Practicals that have to be scheduled on national holidays are actually quite well attended. One possible reason for lecture absenteeism is that transfusion medicine is not separately graded from other topics. Ultimately, however, students must pass comprehensive national licensure examinations, and residents eventually face similar hurdles.

Question 5
Knowledge is formally examined after a series of lectures including transfusion medicine; students who fail will be retested with different questions after a period of further study. Practical work is evaluated somewhat subjectively by preceptors, and failure is rare. There is no formal system

for assessing the knowledge and competency of residents in transfusion medicine.

Question 6

There is a corporate body of national universities, but there are no nationally prescribed nor nationally executed training programmes for medical students or residents, except as described previously.

Question 7

We feel that knowledge transfer in clinical transfusion medicine should be increased during medical school and during residency because it is much harder to re-educate or change the habits of medical doctors who are busy in their postresidency professional life.

Question 8

We feel that the minimal lecturing time excluding practical work in transfusion medicine should be 15 and 5 h for students and residents, respectively, to prepare them for their next career steps. In a survey of the Transfusion Conference of University Hospitals in Japan, the median lecturing time and time for practical work for students was 5 and 4 h, respectively. Most persons in charge of transfusion medicine have realized that this lecture time is too short. Medical technical assistants in transfusion units perform small group training in approximately 60% of Japanese medical universities.

Question 9

At our institutions, transfusion medicine operates as a distinct academic and clinical entity, but this varies among institutions in Japan. According to one analysis, half of Japanese medical universities do not assess knowledge of transfusion medicine separately from other subjects. On the other hand, specialty credentialing in transfusion medicine is available to doctors, technologists and nurses in practice, who may come from a variety of prior specialties. Accordingly, we feel that medical students and residents should be educated in a system that formally recognizes transfusion medicine as a distinct and separately assessed academic and clinical entity.

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K.-S. Han

Question 1

(a) Yes, 2nd, 3rd and 4th year of curriculum.
2nd and 3rd obligatory.
4th-year optional (revisit).
(b) Resident: 1st, 2nd, and 3rd year of curriculum.

Question 2

Yes, we have standardized curriculum in transfusion medicine.

Question 3

(a) Students Topics.

- Blood donation (0·5 h lecture, 2nd grade, obligatory).
- Aphaeresis (0·5 h lecture, 2nd grade, obligatory).
- Blood groups (0·5 h lecture + 2 h of obligatory laboratory practice for 2nd-year students).
- Pretransfusion testing (0·5 h lecture + 2 h of obligatory laboratory practice for 2nd-year students).
- Blood component therapy (0·5 h lecture, 2nd grade, obligatory).
- Adverse reactions of blood transfusion (0·5 h lecture, 2nd grade, obligatory).
- Platelet and granulocyte immunobiology (1 h lecture, 2nd grade, obligatory).

(b) Residents.
- 4 months of full-time work and learning during 1st–3rd year of residency on all of the activities done in a hospital blood bank and aphaeresis units.
- Aphaeresis for platelets, granulocytes, PB stem cells: Both for donors and patients.
- Autologous blood deposit.
- RBC Antibody screening and identification: Interpretation and reporting.
- Therapeutic Plasma exchange: Centrifugation and membrane technology.
- Blood utilization review and Transfusion Committee experience.
- Consultation from many clinical departments.

Question 4
Obligatory, except 4th-year student revisit.
- Mandatory for all medical students nationwide and Laboratory Medicine residency.

Question 5
Yes, we have formal examination for students and residency.

Question 6
No, Each organization is responsible for its own students and residents.

Question 7
I think we need more knowledge transfer for students. For residency, it is OK now.

Question 8
For students: minimal lecturing hour should be 10 h.

Question 9
Transfusion medicine is a sub-specialization of Laboratory Medicine (a subspecialty similar to Clinical Pathology in many western countries). To become a medical director of a hospital blood bank or a large-scale blood centre, a certificate of Laboratory Medicine specialty is required.

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V. S. Nadarajan

Question 1
The university's curriculum for medical students includes short exposures to transfusion medicine during year 3, 4 and 5 of their 5-year training programme. Residents do receive some training although this is usually on an ad hoc basis.

Question 2
A standardized curriculum is available for medical students but not residents.

Question 3
The curriculum for medical students in the university includes routine exposure to clinical aspects of transfusion medicine. Students receive 4 h of lectures at the beginning of their third year of study, encompassing aspects of blood grouping and compatibility, use of blood products and safety issues in transfusion. In their fourth year, a 3-h interdepartmental presentation is conducted involving clinical aspects of transfusion in paediatric, medical and surgical settings. Students also receive a lecture on the ethics of blood donation and transfusion during this year of study. Another 3-h small group teaching is conducted in year 5, during which the students are taken through a tour of the transfusion centre and are briefed on the process of donor selection, blood collection and component production. There are, however, no standardized national curricula for transfusion medicine and different universities have their own arrangements for transfusion training of medical students.

General residents receive little if no training in transfusion medicine. Residents in their first year may receive 1 day of training in sample taking and utilization of the transfusion services although this is not compulsory. Periodic lectures on transfusion medicine are conducted, and residents attend the lectures on a voluntary basis.

Question 4
Attendance at lectures and training sessions for medical students is compulsory, and records of their participation are maintained. Apart from providing basic knowledge in transfusion practice, the courses, however, do not significantly impact on their career progress as formal examinations in transfusion medicine is nearly absent except for residents who specialize in haematology and transfusion medicine.

Question 5
Medical students and residents may be tested on their knowledge about transfusion during their examinations although this tends to be quite rudimentary and are not determinant factors for progression to the next step of their career.

Question 6
There is no national standardized curriculum for undergraduate medical training, and universities, both public and private, have developed their own curricula based on different models. University Malaya as the oldest medical school in Malaysia, however, provides considerable leadership in training of medical students and residents nationally.

Question 7
Dissemination of knowledge in clinical transfusion during undergraduate and residency training needs to be incorporated into their clinical training rather than in isolation. Although medical students receive a total of 16 h of lectures in various transfusion aspects, the actual application of such knowledge in clinical practice is poor as emphasis on good transfusion practice is severely lacking during their ward rounds and clinical training. Oftentimes, clinical specialists and teachers themselves are not well versed in good transfusion practice and provide contradictory messages on what is right and wrong. Certainly, knowledge transfer in transfusion medicine should be increased for both medical students and residents, but it also needs to be delivered in an effective and practical manner by clinical specialists during ward rounds and teaching sessions, rather than through formal lectures and practical sessions conducted by the transfusion department.

Question 8
Although lectures may be informative, we find that knowledge retention is transient as the knowledge is not continually reinforced during clinical training. Six to eight hours of formal lectures, for both medical students and residents, should be adequate to cover most aspects of clinical transfusion. The aspect of informal knowledge transfer, particularly among residents, during clinical rounds and teaching would, however, need to be increased, such that good transfusion practice is always relevant to good patient management.

Question 9
The Malaysian specialist register currently includes transfusion medicine as a sub-specialty of pathology within the confines of laboratory haematology. This is because haematology and transfusion medicine has traditionally been taught together for residents who choose to specialize in laboratory haematology. However, in 2006, a separate specialist programme limited to transfusion medicine was introduced, and the first batch of transfusion medicine specialist graduated in 2010. It is likely that the register will now recognize transfusion medicine as a separate specialization. Entry into training for haematology/transfusion medicine or transfusion medicine alone requires the individual to be a medically qualified doctor with all least 3 years of medical training after obtaining his basic medical degree. This requirement also applies to all other medical specialist training.

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P. van der Burg & A. Brand

Question 1
In the Netherlands, there are eight medical faculties. The medical study curriculum is 6 years including the period as junior house-officer. Training as registrar for accreditation as medical specialist can be accomplished in approximately 30 medical schools, university and teaching hospitals. There is one blood supply organization in the Netherlands, Sanquin, which is involved in many aspects of education in transfusion medicine. This reply is on behalf of the Certification Committee Education Physicians Sanquin and the Dutch Society for Internal Medicine, section haematology, oncology and transfusion medicine.

During the medical study, large-scale classical education includes immunology dealing with some basics of transfusion and transplantation immunology. Teaching courses in TM and practical scientific research projects (8–24 weeks) are offered to students on a small scale, but these are not mandatory.

Postgraduate training in TM for physicians involved in the blood supply with responsibility for donors, and advices on blood product usage, a 2-year on-the-job training is organized by the national blood supply.

Accreditation as haematologist requires a 4–6 months training in the hospital transfusion service and the haemaphaeresis department. For accreditation as transfusion specialist, an internist or haematologist can follow an 18-month training. Recently for paediatricians, there is also an official accreditation in transfusion medicine.

Question 2
There is no standard transfusion education programme for students, which differs among universities. For registrars in

medicine and surgery, end-terms indicative of some knowledge of TM are in the curriculum.

For doctors working in the blood supply, the training programme is build up by modules based on the linking-pin principle. We distinguish (senior) donor physicians, clinical transfusion consultants of the national blood supply and transfusion specialist working in a hospital (as clinical haematologist, head of a hospital transfusion service or haemaphaeresis unit), with or without a part-time job in the national blood supply organization.

Question 3

Theoretical Modules for Training in TM contain literature and one-day seminars with exams, scheduled every 3 months. Modules are:

- Blood collection.
- Donor assessment.
- Blood-borne diseases.
- Aphaeresis I (plasma, platelets).
- Donor counselling.
- Blood Processing.
- Immuno-haematology I (blood groups, antibodies).
- Epidemiology I.
- Quality Control.
- Quality Systems.
- Aphaeresis II (stem cells, therapeutic aphaeresis).
- Immuno-haematology II (HLA, HPA, HNA).
- Haemostasis.
- Stem cells.
- Blood product application.
- Epidemiology II.

There are practical internships of approximately 2 months which include blood group and infectious disease screening and confirmation, microbiology, processing and release and QC/QA, Blood transfusion laboratory, immuno-haematology and HLA, Plasma products and stem cells and cord blood and tissues.

Question 4

Part of this programme is mandatory for donor physicians; the whole 18- to 24-month programme intended for transfusion consultants from Sanquin and for the accreditation of transfusion specialist is obligatory.

With respect to medical career in the Sanquin blood supply, the doctors are certified after successfully having accomplished the set of modules to become either a senior donor physician and/or a transfusion consultant. For residents in internal medicine and paediatrics and for fellows in haematology, the programme leads to accreditation and career possibilities within hospital transfusion services and haemaphaeresis departments.

Question 5

All theoretical modules are assessed by a formal written examination. Practical training on the job is assessed by the supervisor. There is an independent Certification Committee of physicians Of Sanquin (CCOAS) for accreditation of physicians trained by the Sanquin blood supply. For medical specialist, the Dutch Medical Specialist Registration Committee is responsible. They delegate training and accreditation in transfusion medicine (similar as nephrology, haematology, oncology, gastro-enterology, etc.) to the Dutch Society of Internal Medicine, which developed in collaboration with Sanquin the curriculum and endpoints for training and education.

Question 6

For students, every university has own responsibility and because teaching in TM is not obligatory regional differences are present. On request, the national blood supply supports student education.

For residents in medicine and surgery, teaching is regionally organized. The regional (university) haematology department and hospital transfusion service are responsible, often with support of teachers of the national blood supply.

Question 7

For both, in the student curriculum and for residents, there is room for improvement for knowledge transfer in clinical transfusion medicine Although we are proud that related to our efforts as national blood supply, an increasing number of residents in various disciplines (intensive care medicine, anaesthesiology, surgery, paediatrics) become interested in clinical research in TM.

Question 8

We have experience with a 3-week course for medical students, 20 each year in the Leiden University. Many of these students later apply for research projects in TM. Unfortunately such intensive teaching cannot be offered to all medical students, but we propose that well-planned subjects plenary offered to medical students during a 1–2 days teaching programme could suffice to give an overview of all (future) aspects of TM.

For hospital registrars, we think a 1–2 day module, with examination, should be required before they may prescribe a blood product to patients.

Question 9

For donor physicians and transfusion consultants working with the Sanquin blood supply, the in-house developed programme is a separate specialization that can be followed after medical graduation and for the clinical consultant after at least 1 year of senior house-officer.

For medical specialist, TM is a subspecialty of internal medicine, haematology or paediatrics or medical specialists. Transfusion medicine is a recognized sub-specialism of internal medicine. Thus, the background is internal medicine or haematology. Recently, the Dutch Society of Paediatrics also approved transfusion medicine as a sub-specialty of which in the future it is expected to be mandatory for transplant physicians and neonatologists. Hopefully other clinical specialisms will include transfusion medicine as a sub-specialty.

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Question 1

The departments of Transfusion medicine at all Medical faculties and University hospitals in Sweden are involved in education of students at medical school. The curriculum varies between the universities. At our university, there is a lecture combined with three hours of laboratory work on blood group serology during the second year of medical school. During the 4th year, this is followed up with a 2-h lecture focusing on the clinical use of blood components. Questions regarding blood transfusion can also be raised in the problem-based learning group discussions on clinical cases throughout medical school.

Residents in transfusion medicine are working under supervision for at least 5 years to obtain their speciality license. During these years, the residents go to several 4–5 days long, national educational courses, for example on blood group serology, the use of blood components and aphaeresis treatment. The resident should also produce a basic scientific report during the training period. There is an appointed mentor for the residents at the clinical department.

There is no obligatory education in transfusion medicine for residents in other fields of clinical medicine although it could be chosen as optional training.

Question 2

The curriculum at medical school is usually rather fixed and standardized for a certain period of time (last major changes made 5 years ago at our university).

Regarding the residency education, there is a national description of the aims for the training to become a specialist which is supposed to be followed by all departments in the country.

Question 3

Basic blood group serology and clinical use of blood components are topics covered by lectures at our medical school (total 3 h). There are also 3 h of laboratory work in blood group serology during the 2nd year of medical school (see above).

During speciality training, the resident is working 'hands on' with all aspects of transfusion medicine. There are also scheduled lectures/seminars at the department as well as national courses (see above).

Question 4

Lectures and laboratory work are by national university rules not obligatory during medical school. However, the presence at educational activities is high.

Residents have the right to and are expected to attend a certain number of national educational courses during the training period, but there is no formal obligation to do so. Planning of residency training including educational courses is done when the resident is accepted for speciality training.

Question 5

During medical school knowledge in transfusion, medicine is formally examined at the end of the educational term, usually as part of how to handle clinical cases.

There are obligatory examinations of national educational courses for residents. There is no formal examination to become a specialist, but the education is continuously evaluated and certified at the department. The speciality licence is finally approved by senior specialists appointed by The National Board of Health and Welfare.

Question 6

Our department is involved in national educational courses for residents on a regular basis.

There are no national educational courses at the medical school level.

Question 7

There has been somewhat of a struggle to make room for transfusion medicine in the curriculum at medical school. We consider the time devoted to transfusion

medicine at present as appropriate, but it should not be reduced.

During the years as resident in transfusion medicine, we believe that the training is appropriate. However, there is a need for increased knowledge transfer in transfusion medicine to residents in other fields of clinical medicine.

Question 8
See answers above.

Question 9
In Sweden, transfusion medicine is since 2006 combined with clinical immunology as a medical speciality. To enter resident training, you must have passed medical school and an approximately 2-year-long general clinical education which consists of training in primary care, internal medicine, general surgery, psychiatry and optional clinical fields.

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Question 1
At Georgetown University School of Medicine, Washington, DC, medical students in the 4-year MD degree programme routinely receive one lecture on laboratory medicine/haematology during the second year. A significant portion of that lecture is dedicated to transfusion medicine (see 3, below). During their third- and fourth-year rotations on clinical services, medical students may or may not have specific instruction in transfusion medicine, depending on the diagnoses of patients who are assigned to their medical team. Residents in the Georgetown University Hospital's 4-year postgraduate training programme in the Department of Pathology and Laboratory Medicine have a standardized curriculum. There is a monthly lecture on transfusion medicine for residents in pathology and fellows in the division of haematology/oncology.

Question 2
Aside from the above, there is no standardized curriculum in transfusion medicine for medical students. The curriculum for residents in Pathology includes an annual 1-month rotation in blood bank/transfusion medicine with supervised hands-on laboratory experience in compatibility testing. All blood bank consultations (transfusion reactions, challenges of potentially inappropriate orders for special services) are directed to residents first, which requires them to be on-call and respond to pages from the blood bank within 5 min. The curriculum increases in complexity each year. Third-year residents also draft all written consultation reports for final review by the Medical Director, Blood Bank. There is a weekly conference for all residents during which the previous week's blood bank consultations are reviewed with the Medical Director. Thus, by the 4th year, all residents have been exposed to the variety of actual events that have occurred in our university hospital's transfusion service. The hospital does not collect blood. Each year, residents attend a 2-day training programme at the regional American Red Cross Blood Service where they have formal instruction in all aspects of blood centre operations.

Question 3
The lecture for 2nd-year medical students introduces them to the immuno-haematology of blood transfusion, principles of blood component therapy and risks of blood transfusion. The annual 1-month rotation in blood bank/transfusion medicine for pathology residents includes a daily review of the hospital's blood utilization of red blood cell and platelet components and drafting of laboratory consultations. There are didactic seminars on assigned reading in a standard textbook of transfusion medicine. During the 1st year, all residents in the Department of Pathology receive a complimentary copy of the textbook in transfusion medicine. One week of the 1st- and 2nd-year rotations consists of shadowing the chief technologist in the blood transfusion service. All residents and fellows are strongly encouraged to first-author case reports or review articles with a faculty mentor. Examples are cited [1–4].

Question 4
The curriculum for 3rd- and 4th-year medical students includes a 1-month elective, which may be in the Department of Pathology. Students may elect to spend some or part of their elective time in blood bank/transfusion medicine.
All lectures, seminars and on-call service for pathology residents are obligatory.

Question 5
The lecture on laboratory medicine/haematology for medical students includes questions on transfusion medicine. Residents are required to take the Residency In-Service Examination (RISE) administered by the American Society of Clinical Pathology (ASCP), which includes a section on Transfusion Medicine. The results, which are scored individually and by comparison to the national average, are reviewed by the faculty and serve as a guide for individual counselling.

Question 6
No.

Question 7

Yes. Physician graduating from medical school in the United States and pursuing residency in a medical or surgical specialty are likely to be involved in blood transfusion. Thus, they would benefit from additional training in transfusion medicine.

Question 8

Medical students would benefit if there were 1-h lectures during the 2nd year (immuno-haematology), 3rd year (indications for blood transfusion) and 4th year (complications of blood transfusion).

Question 9

In the United States, transfusion medicine is a sub-specialty recognized by certification by The American Board of Pathology (ABP). Candidates for the sub-specialty certificate must complete a 1-year fellowship programme in blood banking/transfusion medicine accredited by the American Committee in Graduate Medical Education (ACGME). Typically, candidates for 1-year fellowships in blood banking/transfusion medicine have primary certification in anatomic pathology and clinical pathology (AP/CP) or clinical pathology only. Candidates with a primary certification plus a subspecialty certificate in haematology may qualify for a 1-year ACGME-accredited fellowship, as well as diplomats of the American Boards of Anaesthesiology, Internal Medicine, Obstetrics/Gynecology, Paediatrics, Surgery, Plastic Surgery, Colon and Rectal Surgery, and Thoracic Surgery. Candidates who have been certified by another member specialty board of the American Board of Medical Specialties (ABS) may qualify for certification after 2 years of full-time training in blood banking/transfusion medicine. Specific educational and training requirements for sub-specialty training and certification in blood bank/transfusion medicine are available on the ABP website (http://www.abpath.org).

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R. G. Strauss & T. J. Raife

Question 1

Yes, we are routinely involved in teaching transfusion medicine to medical students in three ways: (1) two 1-h lectures during the second-year Medical Pathology course with the content including blood component properties and indications for use, special attributes (e.g. irradiation), alternatives to transfusion and adverse effects, (2) a 90-min lecture during a 3rd-/4th-year course in Laboratory Medicine with the content including blood component collection and processing, fundamentals of component transfusion practice, adverse effects, massive transfusion and transfusion medicine therapeutics (aphaeresis and phlebotomy); (3) an elective rotation in the DeGowin Blood Center at the University of Iowa Hospitals and Clinics during which third or 4th-year students spend 4 weeks actively involved in blood bank, donor centre and patient care daily activities, laboratory exercises, and teaching conferences. For additional medical student education, transfusion medicine topics are included in an *ad hoc* basis in medical student instruction given during their rotations on clinical services (e.g. haemolytic disease of the foetus/newborn on Obstetrics/Gynaecology and blood component transfusions on Paediatrics, Medicine and Surgery). However, the content and the extent/detail of teaching devoted to transfusion medicine by the clinical services is likely to be variable and difficult to accurately measure.

Pathology residents rotate through the DeGowin Blood Center for 5·5 weeks of formal training twice during their 3 years (Clinical Pathology program) or 4 years (combined Anatomic and Clinical Pathology program) of residency training. Pathology residents have the option of additional elective time in transfusion medicine. Residents and fellows from clinical departments (e.g. paediatric or internal medicine haematology/oncology, family medicine, anaesthesiology) are welcome to take elective rotations (usually 2–4 weeks) in the DeGowin Blood Center. The University of Iowa Adult Haematology/Oncology fellowship programme will begin requiring a 4-week rotation in transfusion medicine starting July, 2011. As with medical students, residents and fellows in clinical postgraduate

training programmes receive instruction about transfusion medicine topics pertaining to their specialty training (e.g. blood component transfusions on Paediatrics and Medicine, or massive transfusion on Surgery and Anaesthesiology) during lectures, small group discussions and patient conferences/rounds. However, the content is likely to be variable. The education of residents/fellows training for subspecialty certification in Transfusion Medicine is discussed under Question 9.

Question 2

No, there is no formal curriculum identified as 'Transfusion Medicine' per se, but instruction is given to medical students and residents as mentioned under Questions 1 and 9.

Question 3

Medical students receive didactic training in blood component collection, processing and storage; the fundamentals of blood component therapy, immuno-haematology testing, adverse reactions and aphaeresis and phlebotomy. Trainees in Clinical Pathology and Transfusion Medicine fellowship receive extensive didactic instruction and hands-on experience with all the foregoing topics, as well as progenitor cell collection, tissue banking, quality systems and blood product management. As noted under Questions 1, 2 and 9, the exact distribution and allotment of time for instruction in transfusion medicine in clinical undergraduate and postgraduate training cannot be accurately stated.

Question 4

In the medical school curriculum, didactic lectures mentioned in Question 1 are required. Clinical pathology training programmes require rotations in transfusion medicine. Some haematology/oncology training programmes require rotations in transfusion medicine. Training in transfusion medicine among other postgraduates is obligatory in the broad sense that 'blood banking and/or transfusion medicine' is frequently listed as one of the subjects/topics to be included as part of training required for certification in both primary specialties, (e.g. Pathology, Family Medicine, Paediatrics, Medicine, Surgery, Anaesthesiology) and in clinical subspecialties (e.g. haematology/oncology in paediatrics or medicine). However, details of the curriculum content and the precise requirements for the amount of instruction time vary between specialties and programmes. Training for a career in transfusion medicine is discussed under Question 9.

Question 5

Medical student knowledge is examined during medical school by performance on written tests at the end of lecture courses, and by faculty assessment following small group sessions and elective rotations. In addition, medical student knowledge/competency is measured by their performance on the USMLE (US Medical Licensing Examination) – a national standardized examination consisting of three parts covering all aspects of basic medical science and medical practices. Details of the transfusion medicine content of the USMLE cannot be ascertained (http://www.nbme.org). Medical students at the University of Iowa are required to pass parts 1 and 2 of the USMLE for graduation, and passing part 3 is generally required by state medical licensing boards to obtain a license for further postgraduate training as a physician and for the practice of medicine.

Physicians graduating from residency/fellowship programmes are granted certification by successfully passing examinations offered by their respective Boards. Transfusion medicine knowledge of graduating pathology residents is tested by The American Board of Pathology and, comparably, knowledge/competency of residents/fellows graduating from clinical medicine/surgery programs is tested by the respective Boards – although details of the content of these examinations devoted to transfusion medicine cannot be assessed.

Question 6

There is no formal 'National Program' in the United States for the teaching of transfusion medicine to medical students and residents – with the exception of the USMLE, state medical licensing boards and specialty certification boards mentioned under Question 5. In the past, we participated, along with several other medical schools, in an NIH funded programme entitled the Transfusion Medicine Academic Awards. However, this was limited to applicants who successfully competed for the awards – not all medical schools in the US – and the awards were funded for only 5 years. Thus, their educational impact was limited [1]. Faculty members participate in an advisory capacity with working parties and committees concerning the governance of postgraduate medical training in clinical pathology and national testing for transfusion medicine-related certification examinations.

Question 7

Yes, education in transfusion medicine needs to be increased for both medical students and residents/fellows. As reported [1], medical students need the background knowledge of blood groups, pretransfusion testing, basic needs for and goals of blood component transfusions, transfusion reactions and other adverse effects – to prepare them for more detailed learning as residents/fellows and as practising physicians. Comprehensive instruction in all aspects of transfusion medicine should occur during residency/fellowship training – a time when learning is highly relevant to day-to-day practices. In addition, continued education is extremely important for practicing physicians

involved in the transfusion of blood components or use of transfusion-related services (e.g. aphaeresis and phlebotomy).

Question 8

Time allotted for instruction in transfusion medicine will vary depending on what is offered in lectures, small groups, patient-care conferences, computer-assisted learning, etc. Thus, we cannot give a precise time. However, we strongly recommend that sufficient time be granted to fulfil the objectives noted in Question 7 above.

Question 9

Transfusion medicine/blood banking is a distinct subspecialty in the United States, with certification granted to qualified candidates who pass the examination offered by the American Board of Pathology. Details of required training and examination content are available on the website (http://www.ABPath.org). Briefly, candidates must first have certification in a primary specialty and, then, complete an approved residency/fellowship in transfusion medicine before being eligible to take the examination. Physicians with primary certification in pathology, internal medicine, paediatrics, obstetrics/gynaecology, anaesthesiology or several types of Surgery must take one additional year of transfusion medicine fellowship training. Physicians with primary certification in other medical disciplines must take 2 years of transfusion medicine training. As is true for many specialties, recertification examinations will be needed by some practising physicians (depending on the date of their initial certification in transfusion medicine) to maintain their active certification.

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