Demographic Changes: The Impact for Safe Blood Supply

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Summary

The population structure in most European countries is currently changing, with a shift from younger to older age groups. Only sparse data exist on the impact of these demographic changes on future blood demand and supply. Data on blood recipients are sparse and unconnected to data on blood donors. The first part of this review summarizes studies on the effect of the demographic change on blood supply and demand. With respect to studies in North America and Europe on the impact of demographic changes on future blood supply, the demographic trends will affect many regions in the Western world similarly. These effects are most pronounced in the new member states of the European Union where birth rates declined abruptly after 1989. Coordinated efforts will be required to prevent blood shortages based upon these demographic trends in Western societies. The second part of this review is an overview of methodological approaches to obtain data on the sociodemographic background of the blood donor population.

Schlüsselwörter

Spenderforschung · Blutversorgung · Demographie

Zusammenfassung

In der Bevölkerungsstruktur der meisten europäischen Ländern ist derzeit eine Veränderung mit einer Verschiebung von jüngeren hin zu älteren Altersgruppen zu beobachten. Bezüglich der Auswirkungen dieses demographischen Wandels auf den zukünftigen Blutbedarf und die Blutversorgung gibt es nur wenige Daten. Daten zu Blutempfängern sind ebenfalls rar und ohne Bezug zu denen der Blutspender. Der erste Teil dieses Reviews gibt eine Übersicht zu Studien, die sich mit dem Effekt des demographischen Wandels auf den Blutbedarf und die Blutversorgung befassen. Ausgehend von diesen nordamerikanischen und europäischen Studien ist davon auszugehen, dass sich die demographischen Trends in vielen Regionen der westlichen Welt in ähnlicher Weise auf die Blutversorgung auswirken werden. Diese Effekte sind in den neuen Mitgliedsstaaten der Europäischen Union aufgrund des abrupten Absinkens der Geburtenrate nach 1989 am ausgeprägtesten. Koordinierte Anstrengungen werden nötig sein, um in den westlichen Gesellschaften Blutengpässe, die aus diesen demographischen Trends resultieren, zu vermeiden. Der zweite Teil dieses Reviews ist eine Übersicht zu methodischen Ansätzen, um Daten über den soziodemographischen Hintergrund der Blutspenderpopulation zu erhalten.

Introduction

The population structure in most countries of the Western world is currently shifting from younger to older age groups. This is due to an increase in life expectancy, ageing of previous high birth rate cohorts, and a more recent decrease of

birth rates with stabilization at a current low level. Despite a decline in total population during the next decades, the demographic changes will nevertheless lead to an increase in absolute numbers of older patients and disproportionate increases of patients with malignancies and other chronic diseases [1]. Many antineoplastic chemotherapy protocols and major surgi-

cal interventions depend on sufficient blood supply, especially in the older patient in whom the tolerance for low hemoglobin levels is lower than in younger patients.

Adequate blood supply of a population requires a balanced ratio between the number of blood donations and the demand for blood transfusions. In Western societies, blood requirements have steadily increased over the past two decades, mainly due to therapeutic advances in hematology and oncology and increasing numbers of major surgical procedures. For example, allogeneic stem cell transplantation in Europe increased by a factor of 4.5 between 1990 and 2000 (from 4,234 to 19,136 procedures) [2], and open heart surgery using the heart lung machine in Germany increased by a factor of 2.3 between 1990 and 2008 (from 38,712 to 89,733 procedures) [3]. Both trends are further influenced by a significant extension of the eligibility of older patients for these procedures. In Germany, 12% of patients requiring open heart surgery in 1990 were between 70 and 80 years of age, and only 1% was above 80 years. By 2008, however, 36% of patients were 70–80 years old, and 10.3% were older than 80 years [3].

Blood supply can be defined as a transfer of blood from the population of donors to the population of recipients. These two groups differ considerably in their demographic structure. The donor population consists primarily of young, healthy individuals. In contrast, most patients requiring blood transfusion belong to the age groups above 60 years. This major difference of age distribution between the two groups render demographic trends important for future blood supply. The demographic change causes a double effect: reduction of the eligible donor population with a concomitant increase of patients requiring blood transfusions [4].

Data on the impact of demographic changes on the blood supply are sparse. Research in transfusion medicine focused during the last decades primarily on safety issues of blood transfusion related to pathogen transmission. It is possible that the demographic change of the societies in the Western world poses a much higher risk for the safety of the blood supply – in terms of affected patients – than the risk of pathogen transmission ever had been. There is a risk that the demand to blood donation ratio is changing in a way which will threaten availability of sufficient amounts especially of red blood cell (RBC) concentrates. In this review we will summarize some of the data currently available on the impact of the demographic change on blood supply. Our main conclusion is that all available data support the assumption that the demographic change will likely be one of the biggest challenges for transfusion medicine in the next decades.

Studies on the Impact of Demographic Changes on the Blood Supply

Already in 1994 a study on forecasting future US blood requirements by Vamvakas and Taswell [5] estimated the de-

mand of RBC transfusions to increase by 64% from 1989 till 2030, due to overall population growth, particularly among the population over 65 years of age. The number of blood units collected was predicted to increase by only 12% over the same time period, suggesting a potential shortfall of nearly 4 million RBC units by 2030 in the USA. However, this projection was based on data obtained in one US county only, from which the RBC demand was extrapolated for the entire country [5, 6]. Further, these workers did not take into account age and gender trends in the donor population.

A more detailed study has been performed by Zou et al. [7] using the data base of the American Red Cross Blood Service to analyze changes in age distribution among blood donors between 1996 and 2005. They found donations by repeat donors of 50 years or older increased from 22.1% in 1996 to 34.5% in 2005, whereas the less than 50 years age groups that used to account for the majority of the repeat donors are shrinking in their share of the total donations from 59% in 1996 to 48% in 2005. After adjusting for general population trends, the effective number of donors decreased by more than 10% in repeat donors in the age group 20–49 years; and repeat donors in the age group 25–39 years even decreased by greater than 40%. An alarming signal of this study is that, despite an increased number of first time donors between 16 and 19 years had been recruited, this did not translate in an increased number of repeat donors for the same or older age groups as these donors were poorly retained. The authors predict a severe shortage of blood components in the foreseeable future unless the present trends are offset by significantly increased supply or reduced usage of blood and blood components.

Data on European blood donor populations are also sparse. It remains unclear whether this is related to underreporting of studies or whether also language issues are an important factor. Interestingly one of the most comprehensive nationwide studies on a blood donor population has been performed in Germany by the Robert Koch-Institut [8] (see below), but this study has been reported in German language and is therefore not generally available.

In 2004, for Wales, Currie et al. [9] calculated the future increase in blood demand based on the analysis of inpatients of two major hospitals in Wales based on the data of the year 1999. They found an increasing trend with age, with around 9% of inpatients over the age of 70 years requiring a transfusion compared to approximately 1% of patients under the age of 30. Patients aged >70 years used 46% of the blood supply, whereas patients aged <30 years used 10%. They predicted a rise in blood demand over the next 25 years, reaching a level of demand in year 2026 that is 29% higher than in 1999. The increase in blood demand will be primarily due to the overall increase in age groups with the highest rates of transfusion. Due to a considerably large proportion of children and young adults in the UK population, these authors projected almost no decrease in blood donations and concluded that the future supply/demand ratio (1:1.29) is likely to remain rather stable.

Fig. 1. Age group-specific transfusion rates of the University Hospital Greifswald per 100 persons of the respective age group living in the catchment area of the hospital. The University Hospital Greifswald is the only hospital in the city. Hence calculations approximately refer to the general population in the area.

The eastern part of Germany faces more pronounced demographic changes compared to other Western European regions. Reasons for the rapidly shifting demographics include: a sharp decline in birth rate by about 50% between 1989 and 2004, negative migration patterns (young people – primarily females – have left for Western Germany), and a sharp increase in life expectancy following reunification of Germany (mean increase of 5.1 and 4.8 years for men and women, respectively, since 1989) [10, 11]. As a consequence of these combined effects, the age structure of the population in Mecklenburg-Western Pomerania, which had been the youngest of all Federal States in Germany in 1989, took on the shape of the overall German age distribution structure within just 15 years. This region is therefore a model region in which the demographic change is particularly dynamic and consequences manifest earlier than in other regions in Europe and North America.

The Greifswald Studies

We started to analyze the demographic factors that will determine future blood demand in the area of Greifswald in Mecklenburg-Western Pomerania, a region in north-eastern Germany where detailed donor and recipient data are available from our transfusion medicine department which is a regionally integrated transfusion service managed by a single provider.

Using the data of the blood donors at the Greifswald Department of Transfusion Medicine and the data of the patients of the main catchment area of the University Hospital of Greifswald, we projected blood donation rates and blood demand rates to the year 2015 [4].

In 2002, approximately 73% of the population were between 18 and 69 years old. This proportion will decrease to 69% by 2015. The most pronounced decrease will occur in the age group 20–24 years, with a projected decrease of 60%. In 2004 the highest percentage of RBCs in Greifswald was pro-

vided by donors between 20 and 24 years of age. The population decrease in the age group 20–24 years by 2015 will be the major determinant for the decrease in donation of blood units which is expected to be as high as 30%.

The population in the main catchment area of the University Hospital Greifswald will decrease by 14% between 2002 and 2015. This will, however, by no means result in a decrease of the demand for RBC transfusion as the population decrease affects the younger age groups only. The proportion of people 70 years of age and older will increase from 11 to 19%. Based solely on the projected demographic changes and all other determinants assumed constant, the demand for RBC units from 2004 to 2015 will therefore increase by 12%. In 2015 patients 70 years and older will require 50% of all RBCs compared to 40% in 2004. However, it is likely that this forecast underestimates the true increase in transfusion demand. When we retrospectively analyzed the changes in transfusion rates per age group at the University Hospital in Greifswald over one decade, we found the number of transfusions to substantially increase by +78.9% in the age groups ≥ 65 years from 31.9% of all transfusions in 1997 to 57.1% of all transfusions in 2007 (fig. 1).

This increase of RBC demand cannot be explained solely by a numerical increase of individuals in this age group by demographic changes. The disproportionate increase in RBC demand in this age group is most likely caused by the medical progress allowing more major – transfusion dependent – therapeutic interventions in older patients. At least for the last 10 years the ‘medical progress’ did not lead to a decrease in RBC requirement in the elderly patient population but rather to an increase. This effect will have a major effect on the future demand of RBCs and indicates that most present studies likely underestimate the true increase in RBC demand [12]. Unlike the demographic changes, the consequences of medical progress on future blood demands cannot be modeled reliably. Hence in this review we focus on the demographic deter-

Fig. 2. Estimate of absolute number of units of blood demand and supply until 2015 in the area covered by the University Hospital Greifswald using two models. In the first model (black line) the migration rates were assumed to be constant at the level of 2002 (demand, supply); in the second model (grey line) the negative migration rate was assumed to be 10% lower than in 2002, taken from [12].

minants – while being aware that all estimates provided ignore other determinants that will likely be important also in quantitative terms.

Taking both demographic developments together, the population decrease in the age groups most blood donors belong to and the population increase in the age groups of the majority of blood recipients, this will result to a projected shortfall of RBCs in 2015 between 32 and 35% in the catchment area of the University Hospital Greifswald. A major and unexpected finding of the study was that the expected decrease in blood donations that results from a relative decrease in the younger donor population will have a higher impact on the blood supply than the increase of blood demand by an increase in the older age groups (fig. 2).

The same trend as in Greifswald has been found in Magdeburg, the capital of the Federal State of Saxonia-Anhalt. In this city the population percentage of the age group 18–68 years, which is the age group of potential blood donors will decrease from 72 to 65% within 10 years [13].

Next we extended our study to an entire federal state in Germany, Mecklenburg-Western Pomerania, by analyzing all in-hospital blood recipients and all blood donors in this state for the year 2005. This cross-sectional study comprehensively covers transfusion demand and blood donation rates in a defined population of approximately 1.7 million people. In the federal state Mecklenburg-Western Pomerania two types of institutions are in charge of blood transfusion services, the Red Cross Blood Donation Service, which serves the entire state, and smaller, regional, hospital-based blood donation services. RBC recipients were identified from the registries of all hospitals in the state. Each transfused RBC was counted as one event. Characteristics of the blood donors were obtained from the blood donation services in Mecklenburg-Western Pomerania. Each donation was counted as one event.

Preliminary data of this analysis showed that about 120,000 RBCs were donated in a total population of 1.2 million in the age groups eligible for blood donation (18–68 years). The distribution of the donor population had two peaks at 20–24 years and at 40–44 years (each contributing to approximately 15% of all blood donations). Blood donors donating at the Red Cross Blood Donation Service had a median age of about 42 years while the blood donors donating at the hospital-based donation services had a median age of 28 years.

An interesting conclusion can be drawn from these data. Obviously the different blood donor services complement each other by recruiting different age groups for blood donation. This advantage of a diversified blood donation system with several institutions recruiting blood donors may provide one option for securing sufficient blood supply in the future as the different institutions seem to have different strategies of donor recruitment which attract different age groups of the general population.

In this study 62% of all RBCs were transfused to patients ≥ 65 years. When we used these data to project the shortfall of RBCs, we again found that the increased demand for blood coincides with a significant reduction in blood donations, resulting in an overall shortfall of $>30\%$ until the year 2020 [14].

The Study of the Robert Koch-Institute [8]

The Robert Koch-Institute provided a comprehensive analysis of the demography of blood donors in Germany based on the data on blood donors annually reported by all blood donation services in Germany. The analysis is based on data for the year 2006. In 2006 the German population in the age groups eligible for blood donation according to national regulations, i.e. 18–68 years, was 56.3 million. Overall about 4% of this population donated blood in 2006, which resulted in

4,702,384 whole blood donations. Of those the vast majority, 4,284,413 units (91.1%), were donated by 2,224,382 repeat time donors (corresponding to 3.95% of the population in the donor age group).

Blood donor populations were separately analyzed for first time donors and for repeat time donors. Not unexpectedly, both groups differed in their structure. First time donors primarily belong to the younger age groups. More than half of the first time donors were in the age group 18–24 years while only 3.3% of first time donors were older than 55 years. Of the repeat time donors, most (50.9%) were in the age groups 35–44 years and 45–54 years. An important finding of this study was that 18% of blood donors were 55 years of age or older and will therefore likely leave the pool of blood donors within the next 10 years. With the exception of the 55 years and older age group, the age group distribution of blood donors was similar to the age group distribution of the general population.

Women are more motivated to donate blood compared to men as shown by the fact, that 61.1% of those willing to donate for the first time were women. However, the gender distribution of those who actually donated blood as first time donors was very similar between women and men (50.8 vs. 49.2%). In repeat time donors the percentage of men was even higher (54.1%). This likely reflects the higher deferral rate of women, most likely due to a higher prevalence of iron deficiency in females. Like in the Greifswald study, the donation frequency per 1,000 population of the same age group was highest for women in the age group 18–24 years (51 donors/1,000 population) with a remarkable decrease in donation frequency in the age group of the 25–34-year-old donors. This age group has the second lowest donor rate (37.8 donors/1,000 population) after the age group 55 years and older (28.7 donors/1,000 population).

In the context of the demographic change these data clearly indicate that the overproportional increase in the older age groups which will occur over the next two decades will cause a shortfall in blood supply if age-specific blood donation and blood transfusion rates remain stable. Especially younger blood donors in the age group of 25–34 years need to be motivated to donate blood more frequently. In our view this will only be possible if these individuals can also be motivated to donate blood when they are in the age group 18–24 years. A potential approach to increase the frequency of blood donations in the younger population is to find out why young women who have the highest motivation rate for blood donation in the population when they are 18–24 years old, rather soon show the lowest donation rate when they reach the age group 25–34 years. This might be related to pregnancy, family and work, factors which are difficult to ‘compensate’ for. However, this shift might also be caused by insufficient iron supplementation causing iron deficiency which could easily be counteracted, e.g. by providing young women with iron supplementation after blood donation.

Blood Donor Research: Potential Use and Possible Methods

One approach to counterbalance the threat of a shortfall in blood supply is to increase the percentage of those who donate blood in all age groups. This will require motivation campaigns, specific advertisement and identification of those groups in the population who might be addressed most efficiently. However, very little is currently known about the social background and motivation of blood donors. Even more striking is the nearly complete lack of information of the reasons why those who would be eligible for blood donation do not donate. Well planned and scientifically valid donor studies have the potential to provide meaningful data based on which future activities can be planned – in particular, how donor recruitment strategies can be designed.

The following section does address how a representative analysis of the blood donor population in regard to their social background and motivation could be designed and analyzed in the context of the regional population. This section summarizes a more extensive publication on this topic recently published elsewhere [15] and exemplifies the different strategies by recent blood donor studies.

The regional context of such analyses is of major importance as it is very unlikely that the same criteria and strategies apply for those living in major urban areas as well as for those living in smaller cities or in villages. Designing interventions to increase the number of blood donors requires information about the characteristics of those who donate blood and those who do not. The most accurate approach would be a population representative survey in the target region. This survey should address the blood donating behavior and, additionally, those variables which are supposed to be relevant to the design of interventions. However, as the proportion of blood donors in the population is low (usually <5%), the sample investigated in such a survey must be very large to achieve sufficient statistical power. Therefore, population representative surveys which are specifically designed for assessing the differences between people who donate blood and those who do not are probably too costly. Alternative approaches are either questioning blood donors in the context of the blood donating procedure only or including additionally data from a general population representative survey performed in the region where the respective blood donating center is located.

Applying Data only from Blood Donors

A survey performed with the blood donors in the course of the blood donating process should fulfil three conditions:

- i) The survey should last 1 year. This is important because there might be seasonal variations in the behavior of the blood donors as well as in the activities of the blood donation center. With a survey interval of 1 year most of these variations will level out.

- ii) People enrolling for donating blood should be approached for study participation in constant intervals over the whole time the donation center is open. The counting should start at the first day of the survey and should be continued from one day to the next. This is important because different groups of people might prefer different times for donating blood, e.g. those donating during morning hours might represent a different subgroup of the population than those donating after regular working hours. It is therefore important that everybody has the same chance to participate in the study.
- iii) For each participant the number of blood donations given within the study year must be recorded. This is important because this is one central information for determining those features which are associated with the tendency of donating blood.

The resulting data set contains information about frequent donors as well as about sporadic donors. Those characteristics which discriminate between people who donate often and those who donate only once or twice over the index year are candidates that may also discriminate between people who donate and those who do not.

Veldhuizen et al. [16] in 2009 used this approach to study the contribution of demographic factors to the donor career to gain insight into the demographic profile of active versus resigned donors, and frequent versus occasional donors. For this they analyzed all registered Dutch whole blood donors for a 1-year period (2004; $n = 370,470$). Demographic characteristics included population data on urbanization level, socioeconomic status and ethnicity. Like in the US and the German studies, the proportion of donors adhering to donation was smaller among women as compared to men (odds ratio (OR) 0.73, 95% confidence interval (95% CI) 0.72–0.75). Other factors reducing the risk to resign from blood donation were an age above 24 years, a high income, living in less urbanized areas or areas with relatively few ethnically diverse people. The authors also found that men were five times more often frequent donors than women (OR 5.27, 95% CI 5.15–5.39) and that these frequent donors are more likely to live in urbanized areas and have a higher income than occasional donors.

The Interdisciplinary Approach Including Geographical and Population Census Data

Comparison of the more regional data in Mecklenburg-Western Pomerania and the general data of Germany, which have been discussed in the previous sections, provides further important information. The donation rate for RBCs in Mecklenburg-Western Pomerania was about 100 RBCs per 1,000 inhabitants in the eligible age groups for blood donation, which is considerably higher than the overall whole blood donation rate in the country (83/1,000 eligible population). Thus analyzing blood donor characteristics in comparison to the general regional population may provide information about which group of the population should be primarily addressed

by motivation campaigns and where resources of blood donation services should be allocated.

The transfusion medicine research group at McMaster University, Hamilton, ON, Canada, together with the Department of Geography and Earth Sciences used a geographic approach to correlate sociodemographic information and the frequency of blood donation [17]. They used geo-coded blood donor and donor clinic data. Geo-coded data are data on the sociodemographic structure in a defined geographic area. This type of information is frequently used by companies for designing advertisement campaigns or for the decision process were to allocate a new facility or store. The McMaster group obtained the numbers of blood donors together with the postal zip codes from the data base of the Canadian Blood Service for the years 2006–2007. This information was matched with social and economic characteristics as well as descriptors of city size and geographical location and accessibility of the donation clinic. Canada is performing a regular population census in which detailed information of social and economic characteristics of small regionally defined areas is collected. The investigators merged this information with the postal code-derived area of the donation clinic and the geographic coordinates of the places of work and residence of the blood donors. Applying methodologies developed for the analysis of geographic data, the authors identified several factors that influence the number of blood donations in urban areas. Factors significantly associated with a higher donation rate were: areas with a higher proportion of younger residents, good English language skills, a low proportion of people with immigrant status, higher education levels in the area and easy accessibility of the donation clinic.

This study shows how the combination of existing data and the involvement of knowledge from nonmedical areas, especially from geography and marketing specialists, can be used to strategically position blood donor campaigns and the location of donor clinics.

Taking Advantage of a Population Representative Survey in the Same Region

This approach is feasible in regions where a population representative survey has been performed. Such a survey must fulfil three further conditions in addition to the three conditions described above under (see ‘Applying Data only from Blood Donors’ above):

- i) The blood donor survey must include, at least partly, the same questions as the population representative survey.
- ii) The information which was relevant to the recruitment procedure of the population representative survey must also be obtained for the blood donors. In most cases, this is information concerning gender, age and residence. Gender and age are usually registered. For the residence, in most cases the postal code will be sufficient.
- iii) Participants of the blood donor survey should be asked whether they have also participated in the population representative survey.

In most cases, age and residence will be distributed very differently in both data sets, merely because of differences in the recruitment procedures. Therefore, these differences should be controlled for by appropriate statistical tests. For this purpose, the comparisons between the population of blood donors and the population of those not donating blood should be performed using hypothesis-driven multivariate regression analyses with donation as the dependent, the characteristic in question as the independent and gender, age and residence as control variables.

Recently the Bavarian Red Cross Blood Donation Service obtained sociodemographic data and information on selected health characteristics and co-morbidities from 6,016 blood donors [18]. They found more men than women being blood donors but otherwise the donor population age distribution reflected the age structure of the general Bavarian population. However, blood donors more often lived in communities with <20,000 inhabitants (OR 4.73; 95% CI 3.69–6.13) and were more often born in Germany (OR 2.71, 95% CI 2.12–3.50), and seem to have a lower level of education compared to non-blood donors. Comparing these findings with the ones of the Canadian [17] and the Dutch study [16] shows interesting differences and indicates that blood donor characteristics likely differ considerably between countries. Hence regional aspects are likely of major importance.

A subset of 1,187 of these blood donors living in more rural areas was then further analyzed, and the data were compared with the data of the KORA study. The KORA study is a long-term cross-sectional population health study including the population of the city of Augsburg and two adjacent counties. Regular blood donors were generally more healthy than the general population. Especially the incidence of myocardial infarction was highly significantly reduced in blood donors compared to non-blood donors (OR 0.17; 95% CI 0.08–0.34). Whether this reduced rate of myocardial infarction is a direct effect of blood donation or whether it is an indirect effect of a general better health and/or more healthy lifestyle in people who donate blood is still unresolved.

This approach shows the potentially far reaching consequences of blood donor research. A reduction in the risk for myocardial infarction by more than 80% in blood donors is remarkable. If this reduction could be causally linked to blood donation, a positive impact on the donor's own health could become a major incentive to motivate people of older age groups to donate blood.

Conclusion

Analysis of demographic data indicates an increased future demand for blood and blood products that coincides with reduction in blood donations. This will inevitably cause shortfalls in blood supply if the transfusion medicine community will not be able to increase the percentage of blood donors in

Fig. 3. **a** Age and sex distribution in the population of the 10 eastern European (new) member states of the EU 2004 and estimation for 2025. **b** Age and sex distribution in the population of the 15 western European (old) member states of the EU 2004 and estimation for 2025 [21].

all age groups. Compensating these shortages by importing blood from other regions will become increasingly difficult as comparable demographic changes will occur in most other European regions with a time delay of roughly 10 years [19, 20]. This is particularly pronounced in the new member states of the EU (fig. 3). Only France, the Scandinavian countries and the UK face a somewhat less pronounced decline in the younger age groups [21]. Nevertheless, even in the latter countries, the absolute number of the elderly will increase in the future, leading to an increase in blood demand.

It will be increasingly important to motivate people of all ages to donate blood and to increase the proportion of younger people to become permanent donors. This needs systematic donor research and targeted, evidence-based intervention. We propose that this is an ideal area for a joint approach of experts in epidemiology, social sciences and transfusion medicine. The second major approach to counteract shortfalls in blood supply which has not been addressed in this review is to optimize medical practice to decrease unnecessary blood transfusion whenever possible.

Disclosure

The authors declared no conflict of interest.

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