VIA MEDICA

ORIGINAL ARTICLE

Journal of Transfusion Medicine
2022, vol. 15, no. 3, 225–242
DOI: 10.5603/JTM.2022.0016

ISSN 1689-6017
e-ISSN 2080-1505

Retrospective analysis of selected aspects of public blood transfusion service activities as a starting point for assessment of the status of transfusion medicine in Poland. Part 3: Donations of blood and blood components in the period 1997–2017

Agata Mikołowska, Jolanta Antoniewicz-Papis

Institute of Hematology and Transfusion Medicine, Warsaw, Poland

Summary

Background: *Blood donation is primarily an activity of collecting blood from healthy people for the benefit of those who require transfusion (e.g. surgery, oncology and hematology patients or those who suffer massive blood loss) or for the purpose of manufacturing blood products. The overall availability of blood in a country is reflected by the whole blood donation rate (WB) per 1000 inhabitants. It is accepted that the minimum of 30 WB donations/1000 inhabitants provides sufficient protection for the healthcare system, whereas blood supply is considered insufficient when the number of donors drops below 10/1000 inhabitants. A European country is at the basic level of self-sufficiency in terms of blood supply if approximately 2.5% of its population donates blood regularly. Poland has been self-sufficient for many years now, but there is growing awareness that the self-sufficiency may be disturbed mainly because of ongoing demographic changes. One such change is the growing number of elderly people which means an increase in the overall percentage of the sick. In the recent years, Poland has reached a certain level of blood donations (about 1.2 mil per year) and it may be difficult to improve the result without altering the approach to donor recruitment.*

Material and methods: *Material for analyses were the available annual reports from 21 Polish Regional Blood Transfusion Centers (RBTCs) forwarded to the Institute of Hematology and Blood Transfusion (IHTM). The following tools were used for statistical analysis of the available data: Microsoft Office: Access and Excel, Microsoft Power Business Intelligence (Power BI) software and STATISTICA version 13.3 software (TIBCO Software Inc.).*

Results: *In the years 1997–2017, a total of over 20.5 mil WB units were collected (mainly from voluntary non-remunerated donors > 99.7%). The largest number of voluntary non-remunerated donations was collected in RBTC in Warsaw and RBTC in Katowice (2.05 and 2.02 mil respectively), while the lowest number in RBTC in Słupsk and RBTC in Radom (0.43 and 0.39 mil respectively).*

Correspondence address: dr n. med. Agata Mikołowska, Instytut Hematologii i Transfuzjologii, ul. I. Gandhi 14, 02–776 Warszawa, phone: (22) 349 63 91, e-mail: amikolowska@ihit.waw.pl

Translation: mgr Krystyna Dudziak

Blood components were also obtained from apheresis: platelet cell concentrate (Aph. PC) — a total of 522.4 thous donations, plasma from automated plasmapheresis — a total of > 1.9 mil donations, plasma from manual plasmapheresis — a total of > 55.4 thous donations, granulocyte concentrate — 1.5 thous donations and red blood cells from apheresis (Aph RBCs) > 2.2 thous donations (in 2005–2017).

Throughout the analyzed period, the indicator of the number of donations per one donor was within the 1.69–2.08 range, while in the last 6 years — at the level of approximately 2. In individual RBTCs the total indicator for the period 1997–2017 was calculated at the level of 1.74–2.16.

Conclusion: *The study analysis of the number of donations collected throughout the 1997–2017 period, indicates that whole blood was the most often collected component in all RBTCs, while the least frequent one were RBCs from apheresis and granulocyte concentrate (GC).*

The number of WB donations in RBTCs varied — most donations were collected in RBTC in Warsaw and Katowice, while the least in Słupsk and Radom, which is most certainly related to the number of inhabitants/potential donors in the area of activity of these RBTCs.

Key words: blood donors, donations, blood transfusion service, Regional Blood Transfusion Centers

J. Transf. Med. 2022; 15: 225–242

Introduction

Blood donation is primarily an activity aimed at collecting blood from healthy people for the benefit of those who require transfusion (e.g. surgery, oncology and hematology patients as well as those who suffer sudden blood loss, etc.) or for the purpose of manufacturing blood products. Contrary to the popular opinion that blood is primarily used in emergency medicine, many areas of modern medicine would not be able to function without voluntary blood donation [1]. Blood donation can also be considered in social and economic terms. In the social dimension, blood donation comes straight from the heart and is motivated by the will to save the health and life of an anonymous patient. It consists in giving another human being a priceless and unique remedy [2]. In economic terms, blood is a product collected and managed by specialized staff whose main task is to ensure a balance between blood supply and demand.

Regardless of the perspective from which blood donation is perceived, blood itself is invaluable and its resources are not inexhaustible. Blood collection, preparation, storage and use require the cooperation of many people with appropriate knowledge and experience, and in every dimension, inappropriate use of blood is considered a waste.

According to the World Health Organization (WHO) data of 2019, about 12.7 thous blood establishments operate worldwide in 170 countries and they annually collect about 117.4 mil units of blood. 42% of all donations are collected in high income countries inhabited by 16% of the world's population. The average annual amount of blood donated per one blood establishment/donation center depends, among others, on the country's wealth. In high income countries, the median of donations per blood establishment per year is 23 thous WB units. In middle income countries — 8.5 thous units, and in low-income countries the number does not exceed 4.1 thous units per year [3].

In Poland blood is collected in 21 Regional Blood Transfusion Centers (RBTCs) financed by the Minister of Health, in the Military Blood Transfusion Center (MBTC) supervised by the Minister of National Defense (MON) with headquarters in Warsaw and 7 local stations, as well as in the Blood Transfusion Center of the Ministry of Internal Affairs and Administration, supervised by the Minister of the Internal Affairs and Administration. Pursuant to the Polish Act on the Public Blood Transfusion Service, these are the only establishments in Poland authorized to collect and prepare blood and responsible for supplying blood and blood components to medical entities. Blood and blood components are collected either at the

premises of RBTCs, at the local collection sites (LCS) or during mobile collections (MC).

The WB donation rate per 1000 inhabitants is the indicator of the general availability of blood in the country. The median for high income countries is 32.6 while for medium and low income countries it is 15.1 and 4.4 respectively [4].

National self-sufficiency means that all the patients' needs for safe blood are met in a timely manner and they all have fair and equal access to blood and blood components. The idea of self-sufficiency also assumes that the country's blood donation system is 100% based on voluntary non-remunerated donation (VNRD). Voluntary blood donation is believed to be safer than remunerated donation, because voluntary, non-remunerated donors show greater awareness and responsibility, and also provide more reliable information about their state of health. They do not seek to donate blood at all costs [5, 6].

Access to an adequate supply of safe blood prepared within the framework of the national blood transfusion service is crucial for the health of the population as a whole. The WHO points out that the government of the country is responsible for the effective management of the national blood donation system which is fully integrated into the health care system. WHO also indicates that blood and blood components are a valuable resource, which may be limited in the near future. All governments therefore should be prepared to develop and implement long-term strategies to ensure access of all inhabitants to an adequate amount of safe blood [6].

A European country is considered to reach the basic level of self-sufficiency in terms of blood supply if approximately 2.5% of the population regularly donate blood [5]. It is accepted that the minimum of 30 WB donations/1000 inhabitants provides sufficient protection for healthcare units. The number of donors below 10/1000 inhabitants means that blood supply for the country is insufficient.

In terms of blood and blood components Poland has been a self-sufficient country for many years now, but there are speculations that the self-sufficiency might be disturbed mainly due to progressive demographic changes, including an increase in the percentage of elderly people in the population, which also means an increase in the overall percentage of the sick [7].

Aim

The study aim was to present the characteristics of donations that were collected in the period 1997–2017.

Materials and methods

The study made use of the data obtained from 21 RBTCs. The raw material for statistical analysis were reports on the activities of RBTCs annually forwarded to the Institute of Hematology and Transfusion Medicine (IHTM).

The following tools were used for data preparation and analyzes: Microsoft Access and Microsoft Excel and Microsoft Power Business Intelligence (Power BI). A detailed description of the statistical material and the methods used were presented in the first part of the publications referring to the retrospective analysis of the selected aspects of the status of transfusion medicine in Poland [8].

Results

One study aim was to present the characteristics of the structure of donations collected in the period 1997–2017. The first step was to analyze the percentage share of WB donations collected in the RBTCs, at local collection sites and during mobile collection. The data presented in Figures 1 and 2 demonstrate the changes that occurred over the analyzed period. Every year, the largest amount of blood was collected at local collection sites (53% of all WB units), despite the fact that the percentage of blood collections in the period 1997–2017 decreased by 31%. The percentage of mobile collections (MC) increased (from 6% in 1997 to 27% in 2017) — during which period 21% of all donations were collected. A comparable percentage of platelet concentrate (PC) was collected at the premises of RBTCs — 26% of all donations (Figs. 1 and 2)

We also analyzed the data referring to PC donations collected in blood collection buses (data available since 2011). Figure 3 shows the total number of PC donations collected during mobile collections (a) the percentage of PC units collected in blood collection buses and b) during the so-called fixed-mobile collections. The data demonstrates that blood collection buses had no significant impact on the total number of mobile collections. The percentage of units collected in blood collection

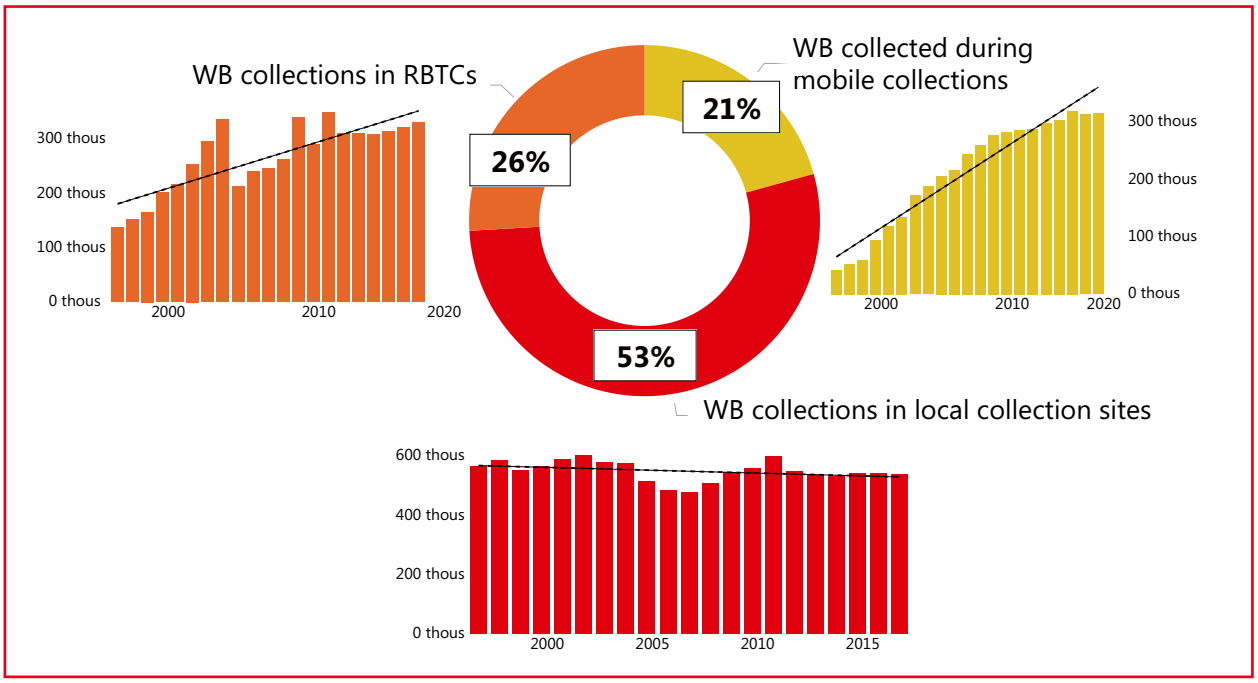

Figure 1. WB collections (1997–2017)

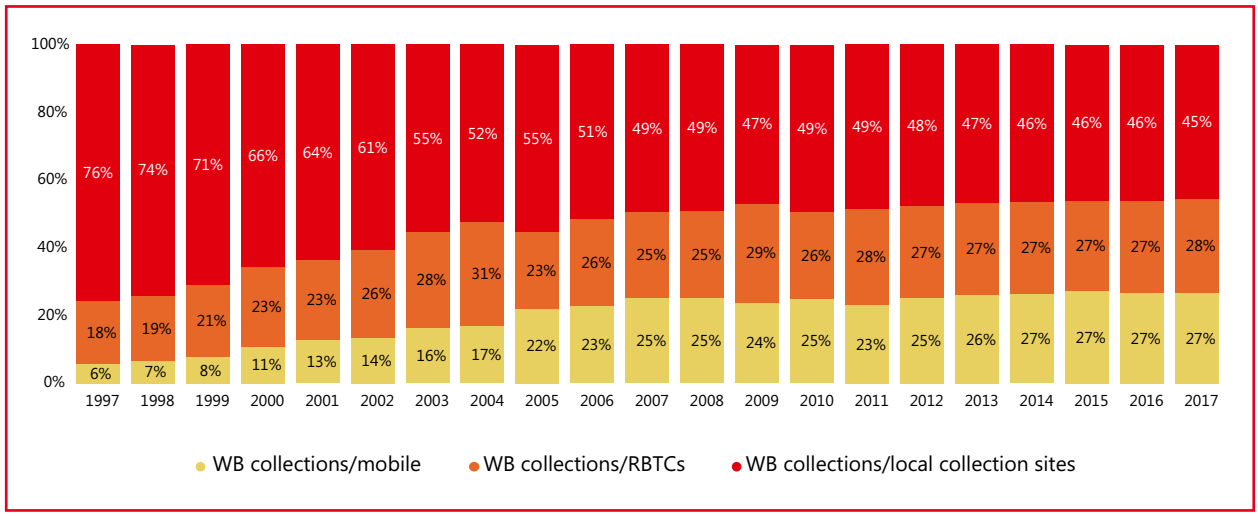

Figure 2. Percentage share of WB collected at RBTCs, local collection sites and during mobile collections in the total numer of PC donations (1997–2017)

buses ranged from about 40% in the first 3 years to over 50% in the years that followed (Fig. 3).

Donations of blood components

For the purpose of the study analysis the donations were divided into WB donations and donations of blood components collected by automated methods. Throughout the period under analysis, in all RBTCs the WB collections were most frequent while the least frequently collected components were red blood cells from apheresis (Aph.-RBC) and granulocytic concentrate (GC). Details referring to collection of PCs and other blood components are presented below.

Whole blood donations

Data regarding WB donations have been available since 1997. Throughout the analyzed period, WB was collected mainly from voluntary non-remunerated donors (> 99.7%). Remunerated donors accounted for less than 0.3% (Fig. 4).

Altogether, RBTCs collected approx. 20.5 mil units of blood from voluntary non-remunerated donors and approx. 56,0 thous units from remunerated donors. Figure 5 shows that the highest

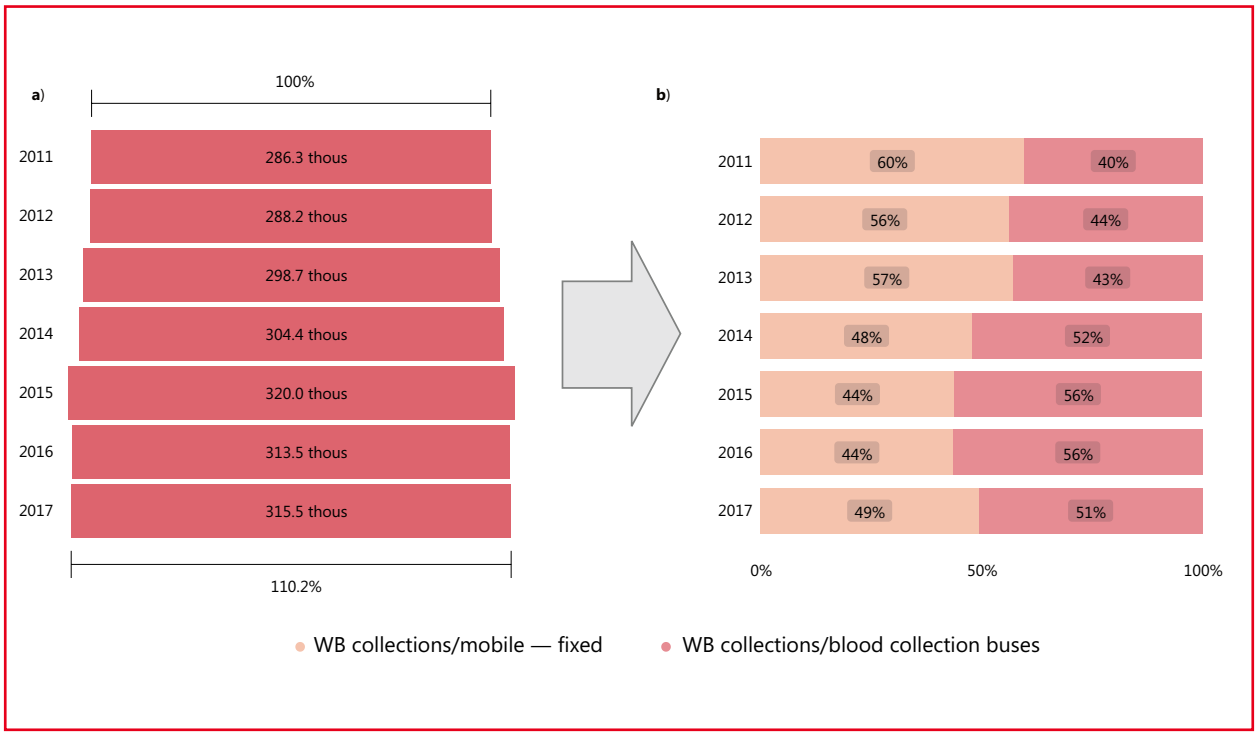

Figure 3. Share of blood collection buses (b) in the overall number of WB units collected during mobile collections (a) (2011–2017)

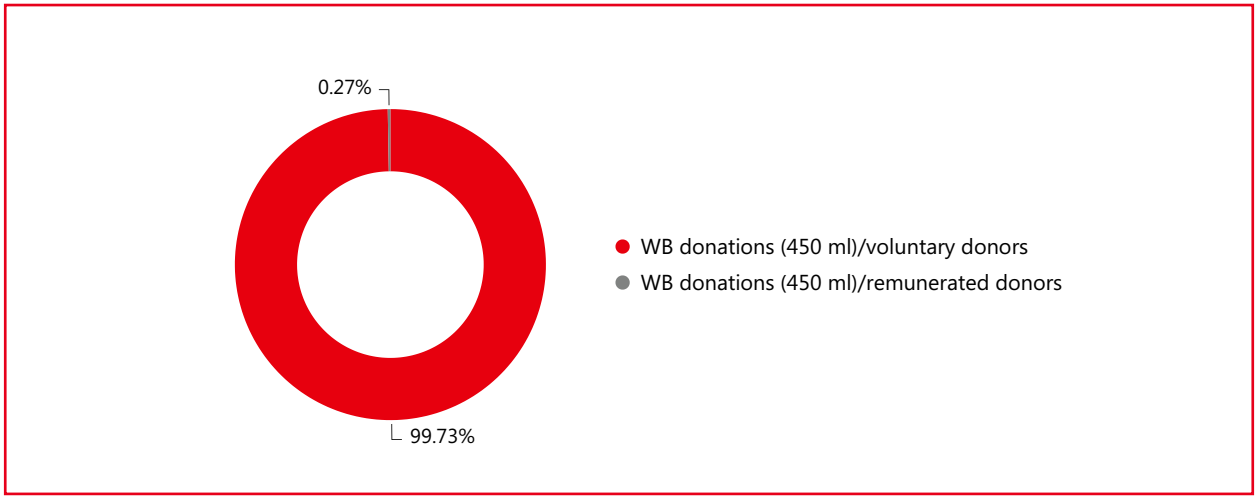

Figure 4. Percentage of WB units collected from non-remunerated and remunerated donors; cumulative data (1997–2017)

numbers of remunerated donors were registered in 1997 (approx. 15 thous) and 1998 (approx. 12 thous). In 1999, the number was much lower – approx. 5,000 and it has been decreasing by year. For many years now, the number of remunerated WB donors was < 500 per year, while the number of voluntary non-remunerated donors — > 1.1 million. The highest numbers of voluntary non-remunerated WB donations were recorded in 2012 and 2013 (black frame in Fig. 5).

The numbers of WB donations collected in each RBTC from voluntary non-remunerated and remunerated donors are presented in Figures 6 and 7. The highest number of voluntary non-remunerated donations was collected at RBTCs in Warsaw and Katowice — over 2 million, which significantly exceeded the average (0.96 million). The average values were also exceeded in RBTC in Kraków, Poznań, Bydgoszcz, Łódź, Wrocław, Gdańsk and Szczecin.

Figure 7 presents the number of WB donations collected from remunerated donors. The figure includes only the RBTCs where the total number of remunerated donors for the entire analyzed period exceeded 10.

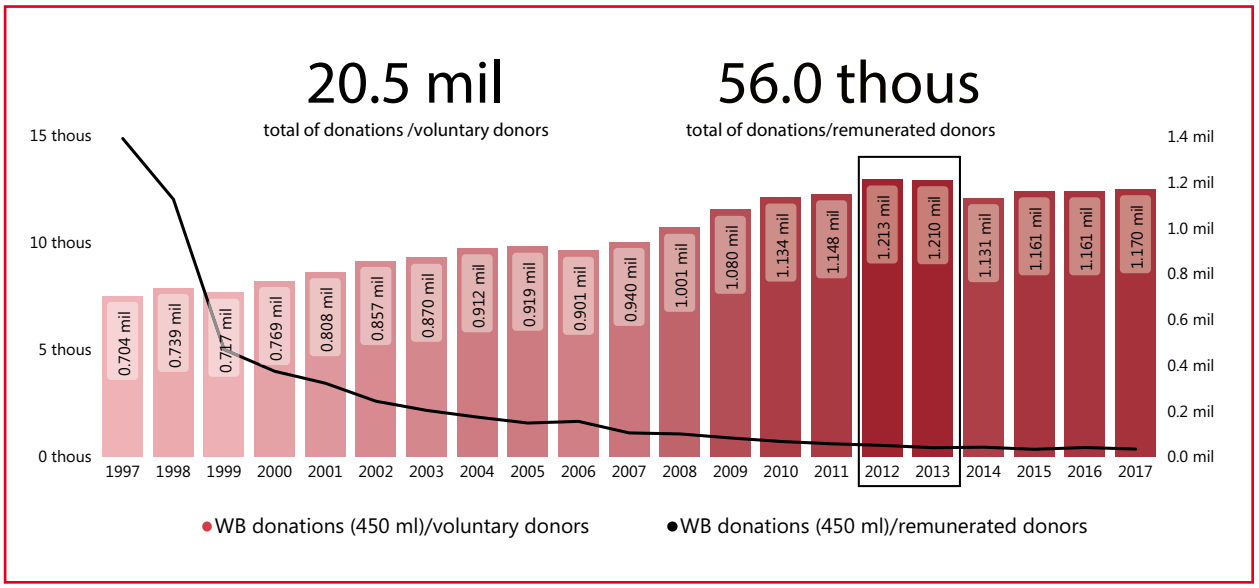

Figure 5. Number of WB donations collected from non-remunerated and remunerated donors (1997–2017)

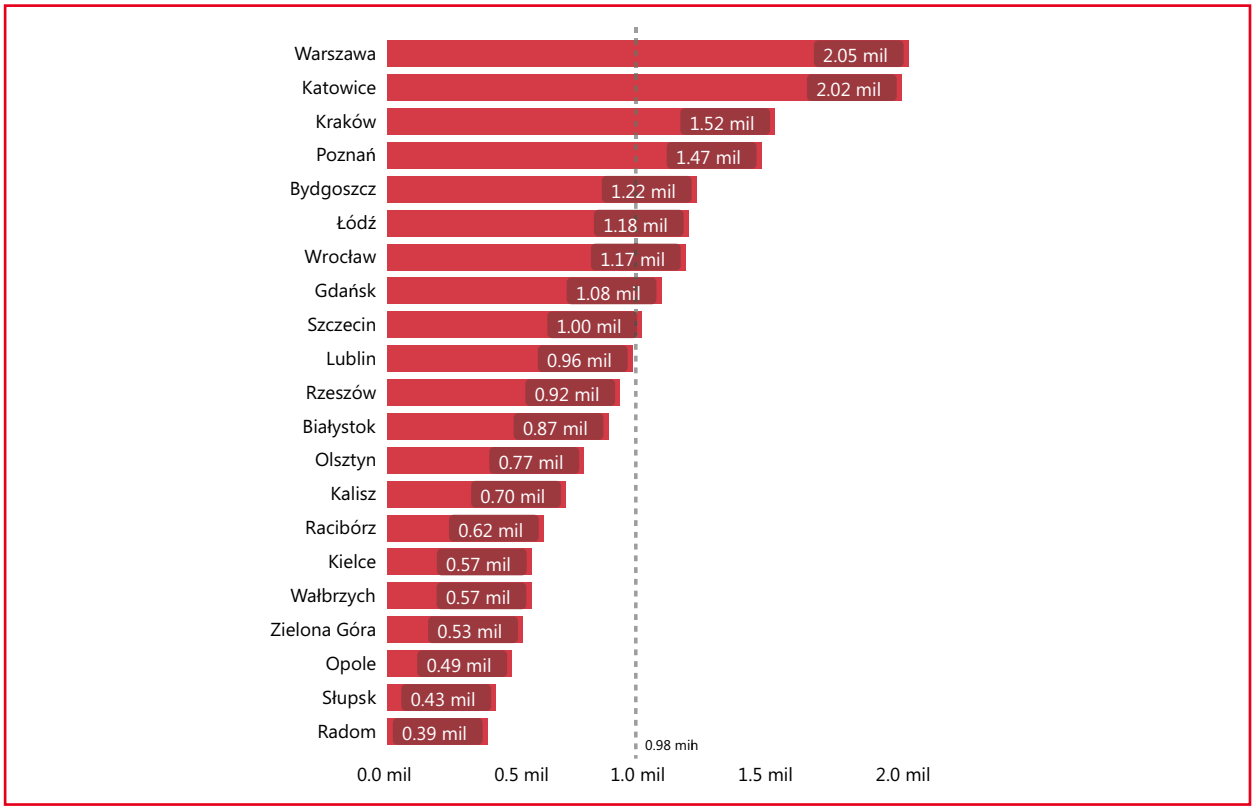

Figure 6. Number of WB donations collected in each RBTC from voluntary non-remunerated donors; cumulative data (1997–2017)

On Figure 8 we present the donation rate per donor per every year of the study period. The highest value was recorded in 2002 (2.08 donations per donor); the lowest — in 2007 (1.69 donations per donor).

The analysis of this indicator for individual RBTCs demonstrates that the highest number of donations per donor (the total for the period 1997–2017) was recorded in RBTC in Katowice (2.16), while the lowest — in Poznań (1.73) (Fig. 9).

Blood components from apheresis

Red blood cells from apheresis

Red blood cells from apheresis (Aph. RBCs) are one of the least frequently collected blood

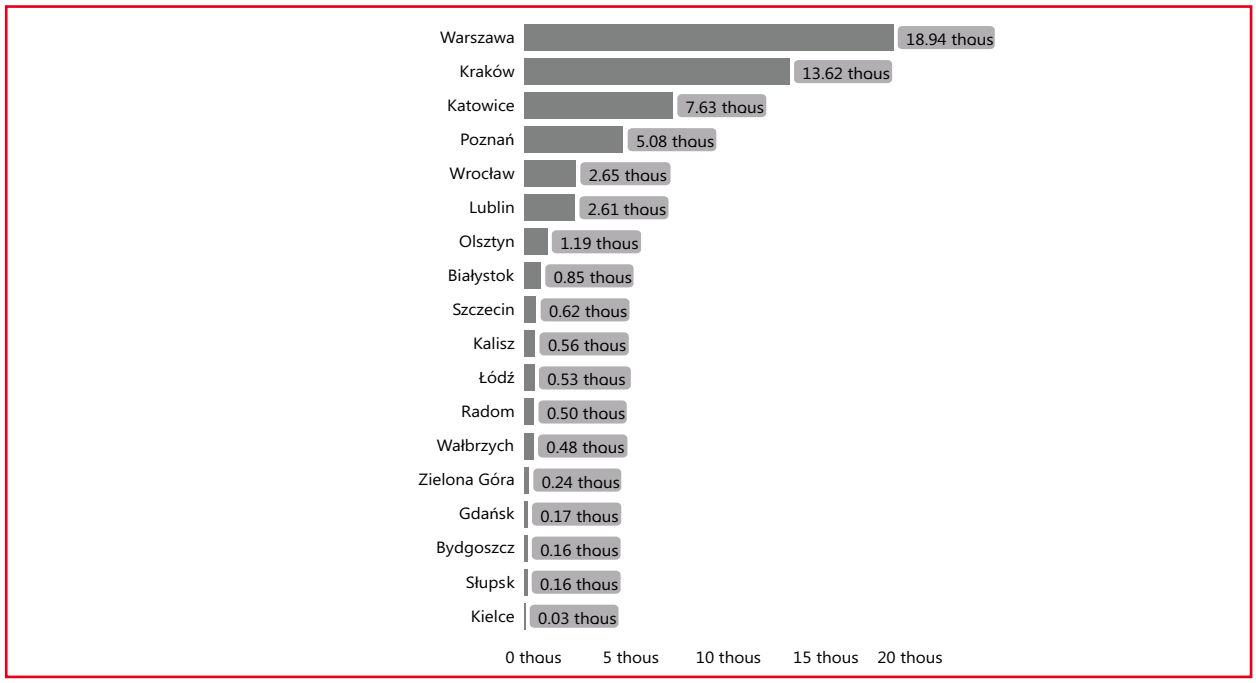

Figure 7. Number of WB donations collected in each RBTC from remunerated donors; cumulative data (1997–2017)

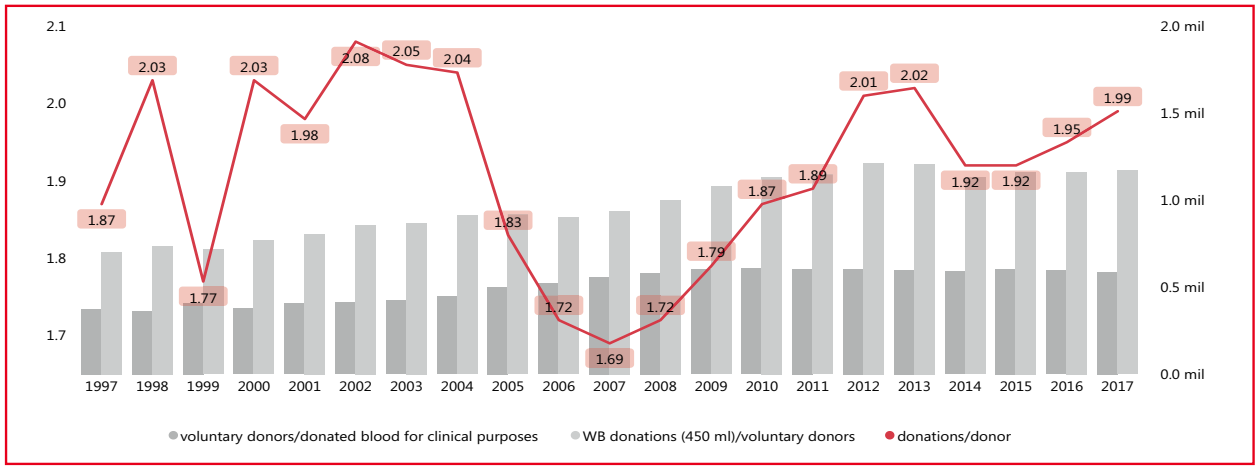

Figure 8. The number of WB donations per voluntary non-remunerated donor by years (1997–2017)

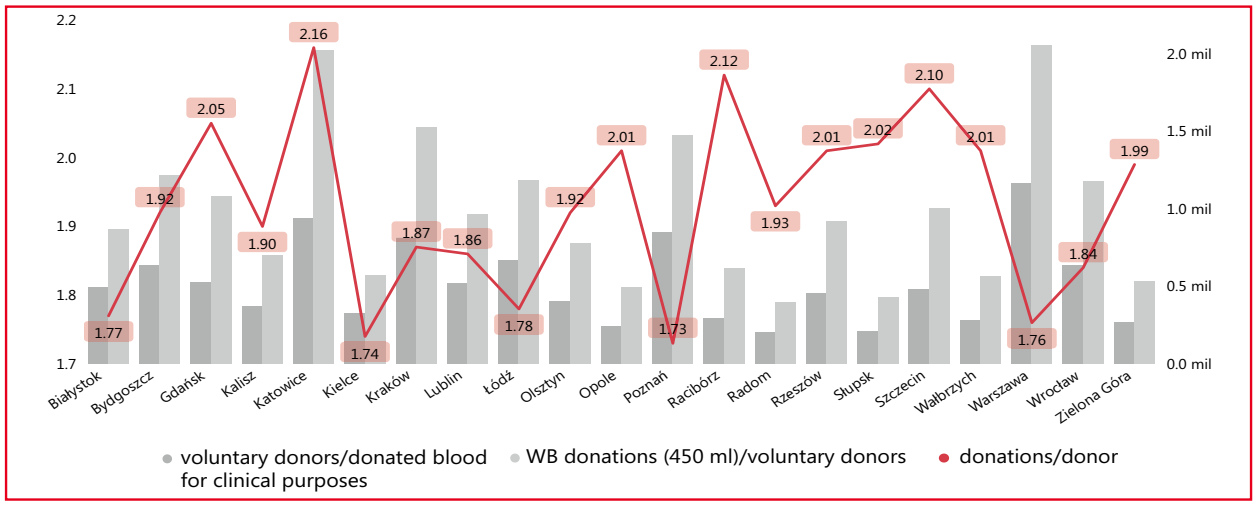

Figure 9. Number of WB donations per voluntary donor by RBTCs (1997–2017)

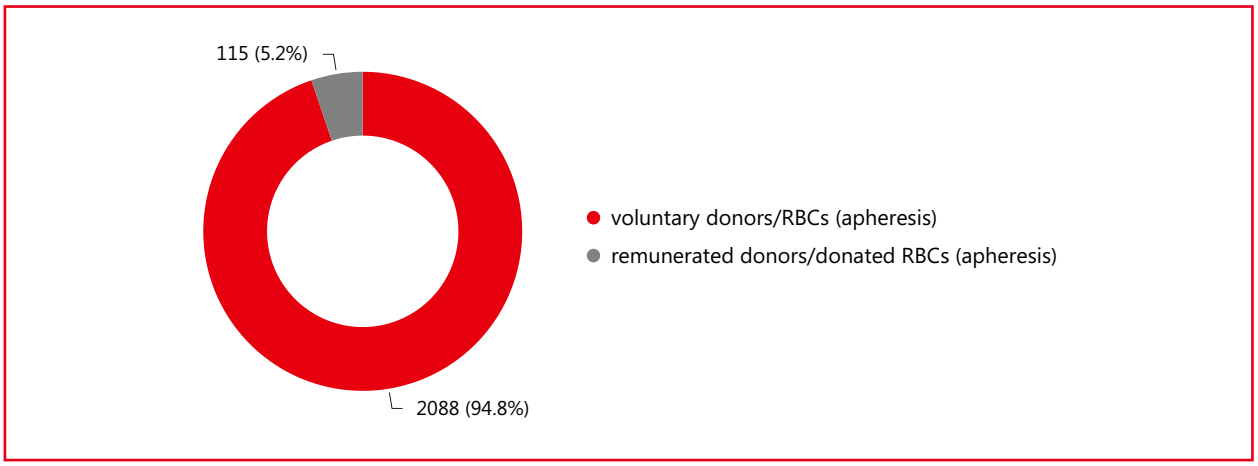

Figure 10. Percentage of Aph-RBCs collected from voluntary non-remunerated and remunerated donors, cumulative data (2005–2017)

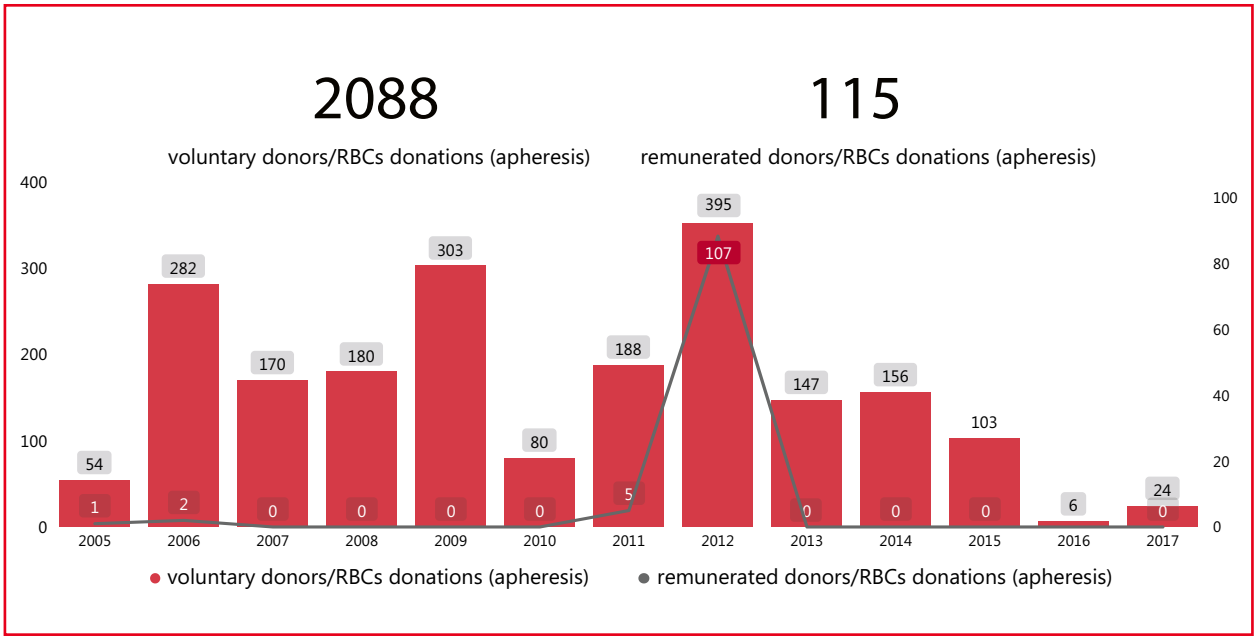

Figure 11. The number of Aph-RBCs collected from voluntary non-remunerated donors and remunerated donors (2005–2017)

components. Data referring to this component have been available since 2005. Until 2017, only slightly over 2.2 thous units were collected in all RBTCs (2.08 thous (94.8%) from voluntary non-remunerated donors, and 115 (5.2%) from remunerated donors (Fig. 10).

The highest number of donations was collected from voluntary non-remunerated donors in 2012 (395); the lowest in 2016 (6) (Fig. 11).

Data analysis demonstrates that not all RBTCs collected apheresis RBCs. Figures 12 and 13 present only those RBTCs which recorded/reported donations of this component. The highest number of apheresis RBC donations from voluntary non-remunerated donors was recorded in RBTC in Bydgoszcz — 958 (46.8% of all RBC donations). The highest number of apheresis RBC donations from remunerated donors was reported in RBTC in Katowice — 106 (92.2% of all donations).

Platelet concentrate from apheresis (Aph-PC)

Data analysis demonstrated that in the period 1997–2017 a total of 522.4 thous donations of Aph-PC were collected including 436.0 thous (83.5%) from voluntary non-remunerated donors and 86.4 thous (16.5%) from remunerated donors (Fig. 14).

The highest number of donations from voluntary non-remunerated donors was collected in 2016 (42.3 thous), the lowest in 1997 (merely 4.9 thous). In the recent years, these components

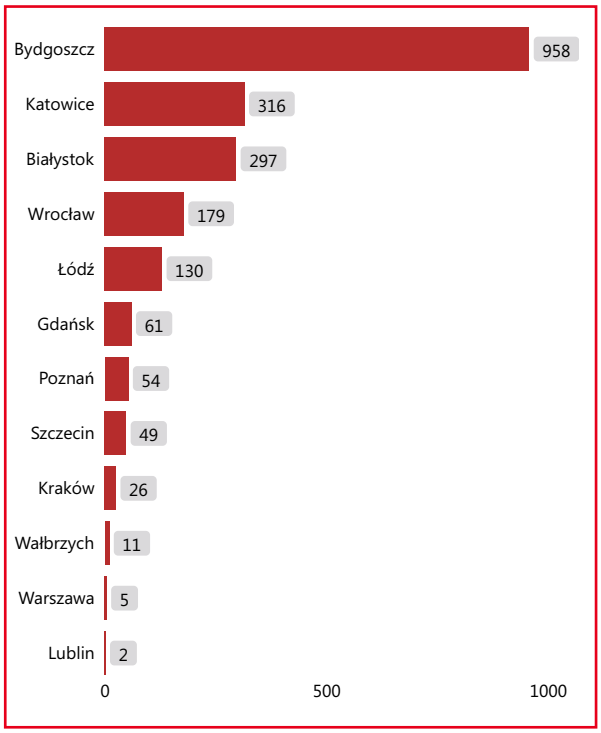

Figure 12. Number of Aph-RBC donations collected from voluntary non-remunerated donors, cumulative data (2005–2017)

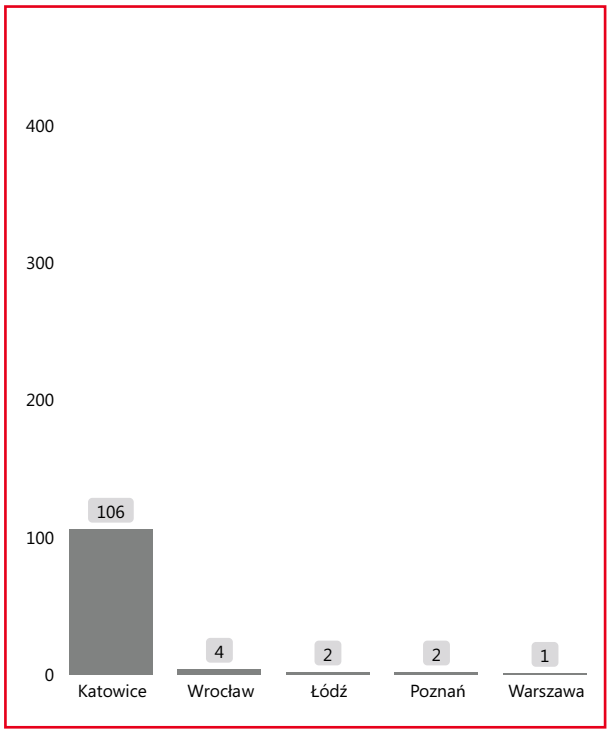

Figure 13. Number of Aph-RBC donations collected from remunerated donors, cumulative data (2005–2017)

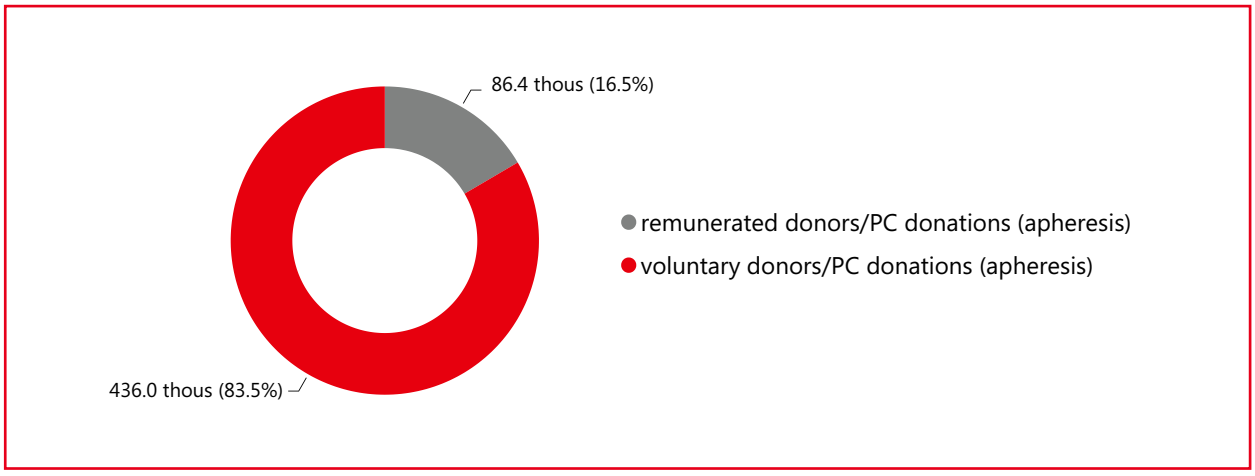

Figure 14. Percentage of Aph-PC donations collected from voluntary non-remunerated and remunerated donors, cumulative data (1997–2017)

were collected from remunerated donors only sporadically and the annual total does not exceed 60 (Fig. 15).

Definitely the largest number of donations from voluntary non-remunerated donors was collected at the RBTC in Warsaw (116.7 thous), the lowest in RBTC in Wałbrzych (0.8 thous) donations (Fig. 16).

PC units from apheresis were collected from remunerated donors only in some RBTCs (Fig. 17). The highest number of Aph-PC donations was collected at RBTCs in Katowice and Warsaw (> 33.1 and > 25 thous respectively) which accounted for 38.4% and 29.0% of all collected Aph-PC donations.

Plasma from automated plasmapheresis (AP-plasma)

In the period 1997–2017, over 1.9 mil AP-plasma donations were collected, including >1.8 mil (95.4%) from voluntary non-remunerated donors and 89.8 thous (4.6%) from remunerated donors (Fig. 18, Fig. 19).

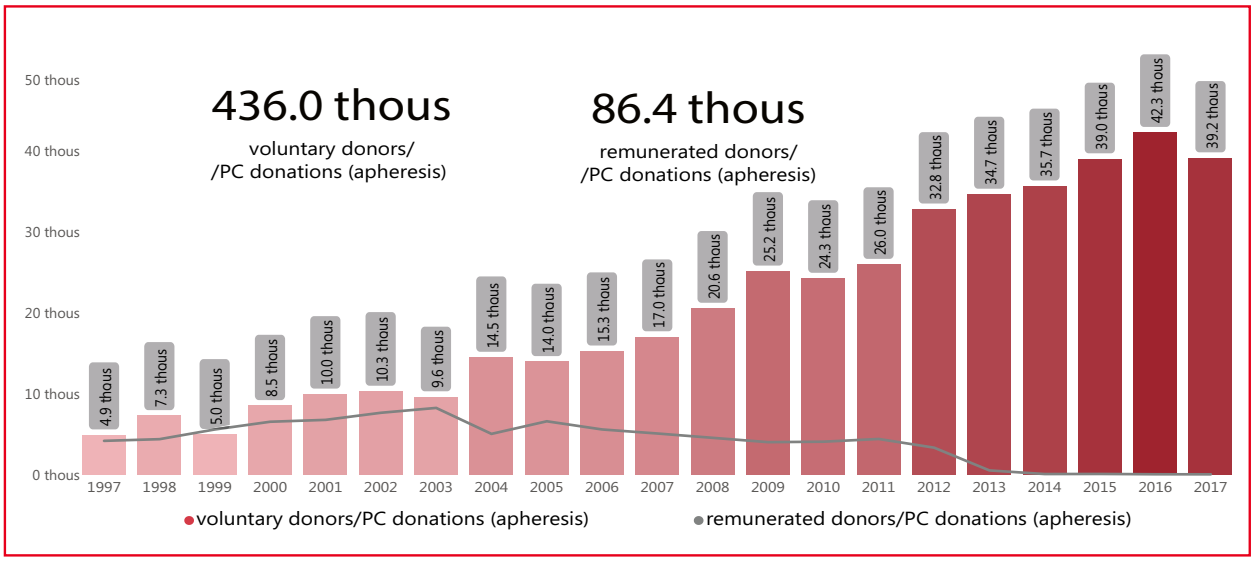

Figure 15. Number of Aph-PC donations collected from voluntary non-remunerated and remunerated donors (1997–2017)

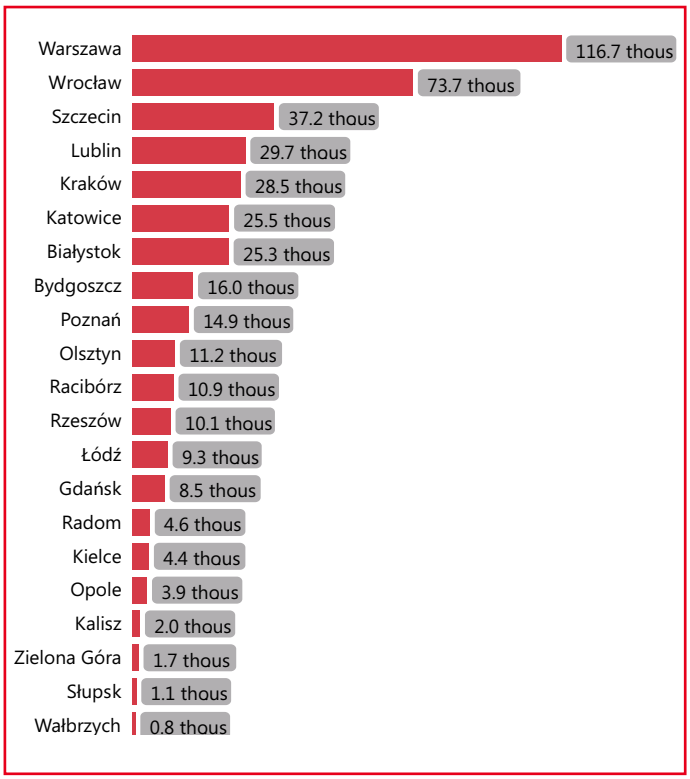

Figure 16. Number of Aph-PC donations collected in RBTCs from voluntary non-remunerated donors, cumulative data (1997–2017)

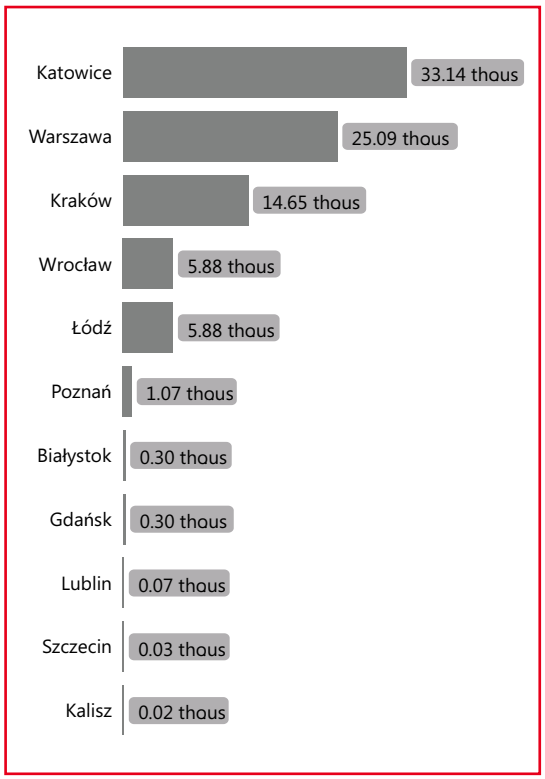

Figure 17. Number of Aph-PC donations collected from remunerated donors, cumulative data (1997–2017)

The highest number of donations from voluntary non-remunerated donors was collected in 1999 (> 284 thous), the lowest in 2006 (11.7 thous) (Fig. 19).

The highest number of donations from voluntary non-remunerated donors was collected in RBTC in Bydgoszcz (288.6 thous) which was about 15.2% of the total number of donations, while the lowest number was collected in RBTC in Warsaw — 8.4 thousand (0.44%) (Fig. 20).

AP-plasma was collected from remunerated donors only in some RBTCs. The highest number was collected at RBTCs in Katowice and Warsaw — almost 24.4 thous and over 12.2 thous respectively which accounted for 27.1% and 13.6% of all donations (Fig. 21).

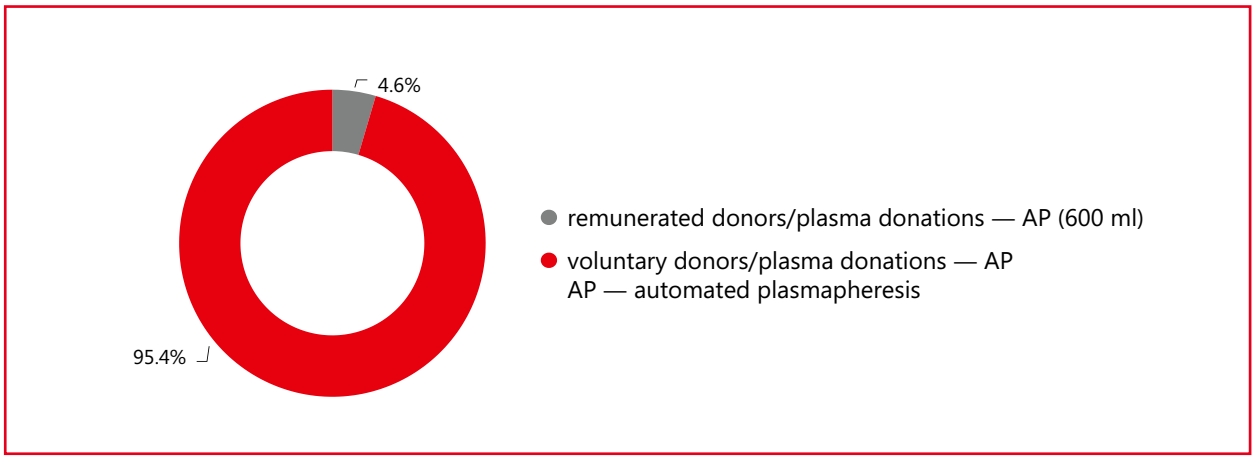

Figure 18. Percentage of AP-plasma donations collected from voluntary non-remunerated and remunerated donors, cumulative data (1997–2017)

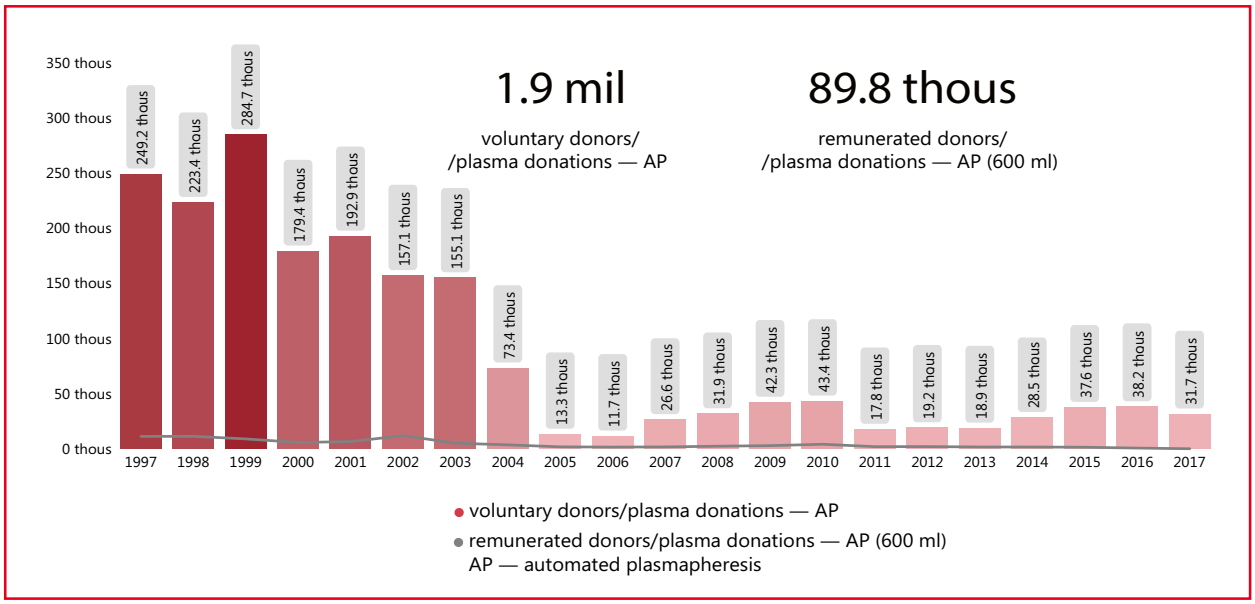

Figure 19. Number of AP-plasma donations collected from voluntary non-remunerated and prenumeratę donors (1997–2017)

Plasma from manual plasmapheresis (MP-plasma)

Plasma from manual plasmapheresis is more often collected from remunerated donors (61.3%) than from voluntary, non-remunerated donors (38.7%) (Fig. 22).

Below we present the numbers of MP-plasma donations collected by years. The data show that the component was collected in RBTCs until 2004. In that period, a total of 55.4 thous donations were collected, including 21.4 thous donations from voluntary non-remunerated donors and 34.0 thous from remunerated donors (Fig. 23).

The component was collected only in some RBTCs. The highest number of donations from voluntary non-remunerated donors was collected at RBTC in Rzeszów (> 5.3 thous; 24.9%); from remunerated donors in RBTC in Poznań (> 22.2 thous; 65.3%) (Figs. 24 and 25).

Granulocyte concentrate (GC)

Data referring to GC has been available since 2005; GC is the least frequently collected component and only in some RBTCs. Until 2017, a total of no more than 1.5 thous donations was collected, including > 1.3 thous (88.2%) from voluntary non-remunerated donors and only 182 donations (11.8%) from remunerated donors. The highest number of donations was collected in 2009 (253), while the lowest in 2016 (48) (Figs. 26, and 27).

The highest number of GC donations from voluntary non-remunerated donors was collected at RBTC in Bydgoszcz (373; 27.4%), and from

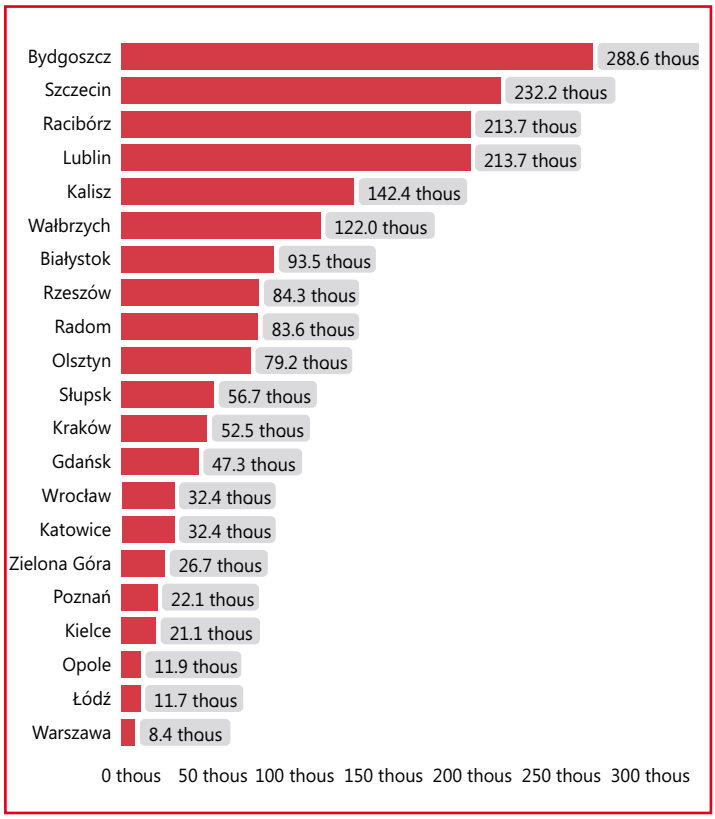

Figure 20. Number of AP-plasma donations collected from voluntary non-remunerated donors, cumulative data (1997–2017)

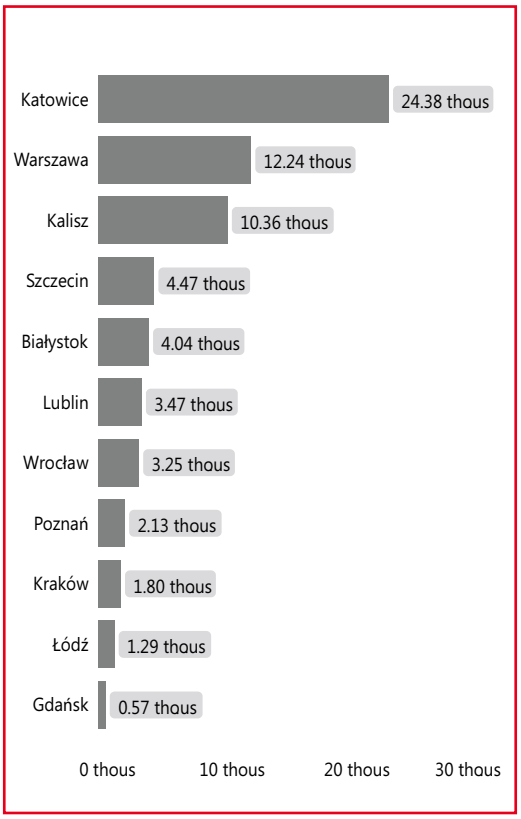

Figure 21. Number of AP-plasma donations collected from remunerated donors, cumulative data (1997–2017)

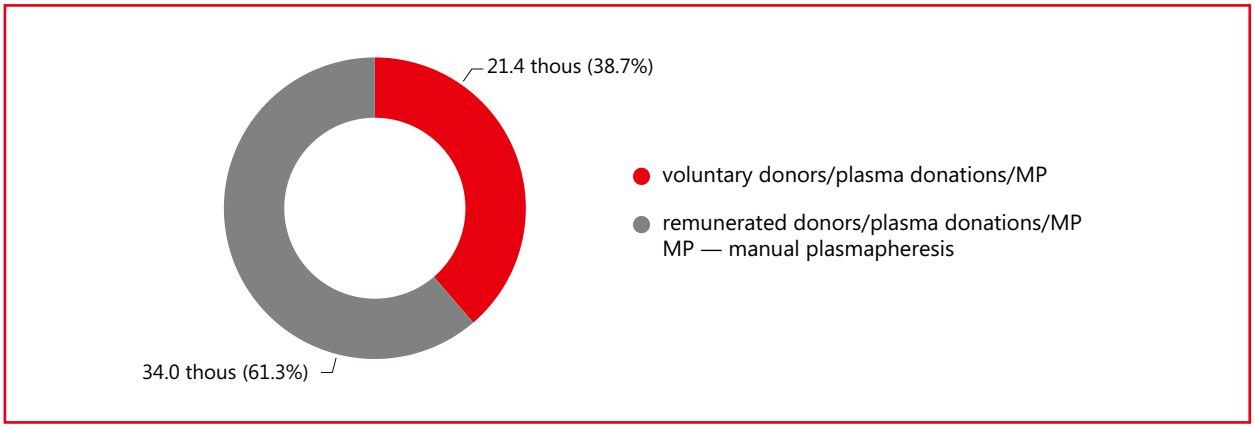

Figure 22. Percentage of MP-plasma donations collected from voluntary non-remunerated and renumerated donors, cumulative data (1997–2017)

renumerated donors in RBTC in Krakow (163; 89.6%) (Figs. 28, 29).

Self-sufficiency in blood and blood components

For the purpose of the study we introduced two concepts: a) the "national self-sufficiency index" (NSI) which defines the number of WB donations/1000 inhabitants and b) the "regional self-sufficiency index" (RSI), which determines the number of WB donations/1000 inhabitants of the region controlled by each RBTC. The two indexes reflect the security of Poland in terms of the supply of blood and blood components for clinical use. The demographic data were taken from the Central Statistical Office of Poland (GUS). The analyzed data for NSI and RSI referred to a period of 13 years, (2005 to 2017).

National self-sufficiency index (NSI)

Throughout the entire analyzed period the NSI average was estimated at 30.5 WB dona-

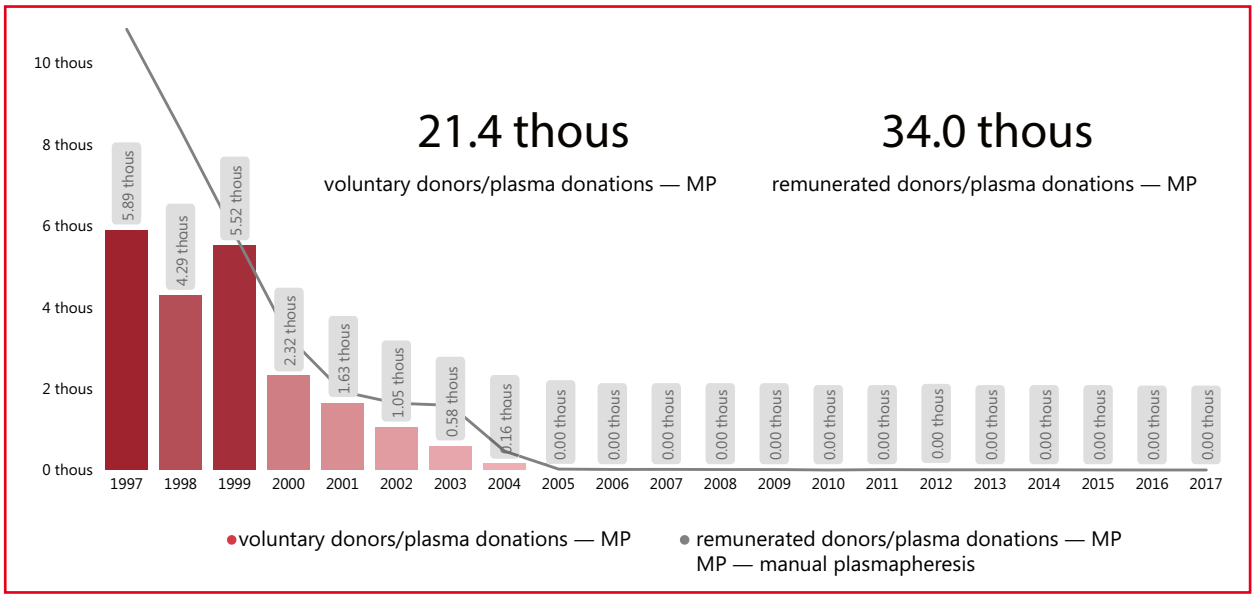

Figure 23. Number of MP-plasma donations collected from voluntary non-remunerated and remunerated donors (1997–2017)

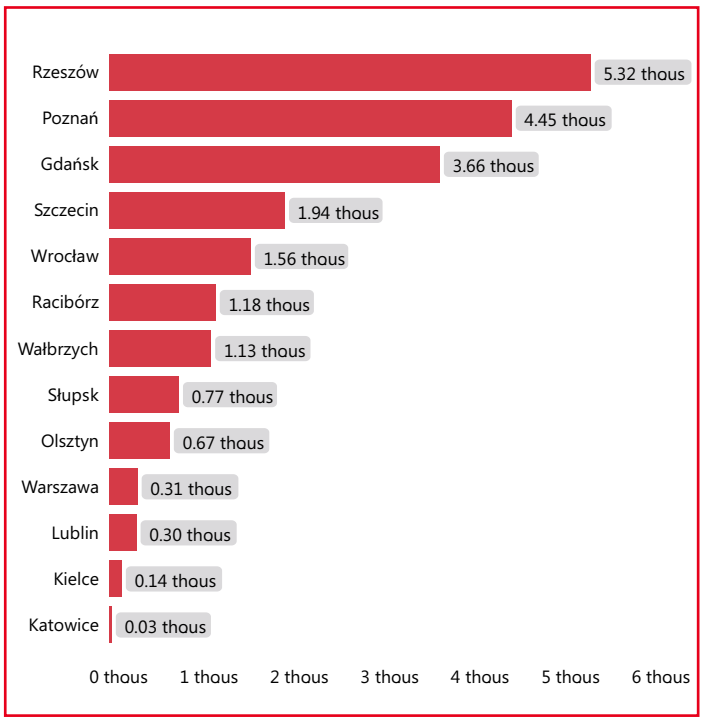

Figure 24. Number of MP-plasma donations collected from voluntary non-remunerated donors, cumulative data (1997–2017)

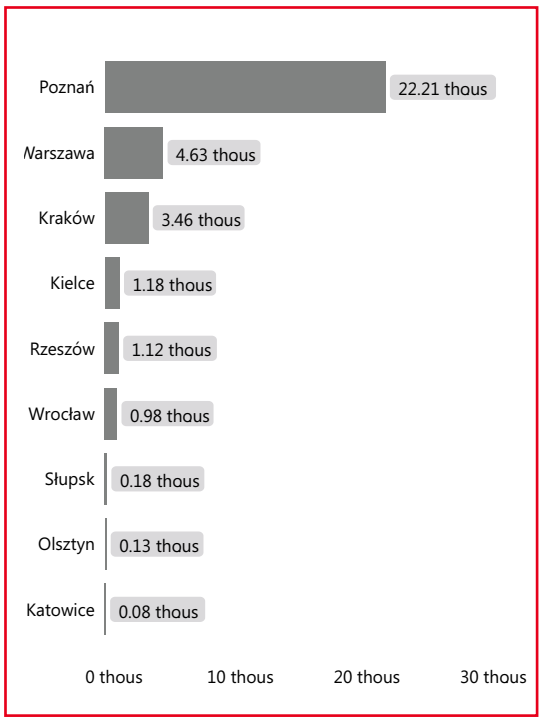

Figure 25. Number of MP-plasma donations collected from remunerated donors, cumulative data (1997–2017)

tions/1000 inhabitants. The value was exceeded in 2009 and since then the NSI maintained the level of > 30. The maximum was reached in 2013 — 33.5, while the minimum was recorded in 2006 — 25.4. This indicates a clear upward trend (Fig. 30).

Regional self-sufficiency index (RSI)

The level of blood supply was estimated by calculating RSI for each RBTC for each year of the period under analysis. We also took into account the average value for each RBTC calculated from the cumulative data for the years 2005–2017. The results are presented in Figure 31. They demonstrate marked differences between RCTCS. The highest index value was recorded in RBTC in Racibórz (an average 54.7, which was 23.4% higher than the next highest average index recorded in RBTC in Słupsk (41.9%) and 58.7% higher than the lowest

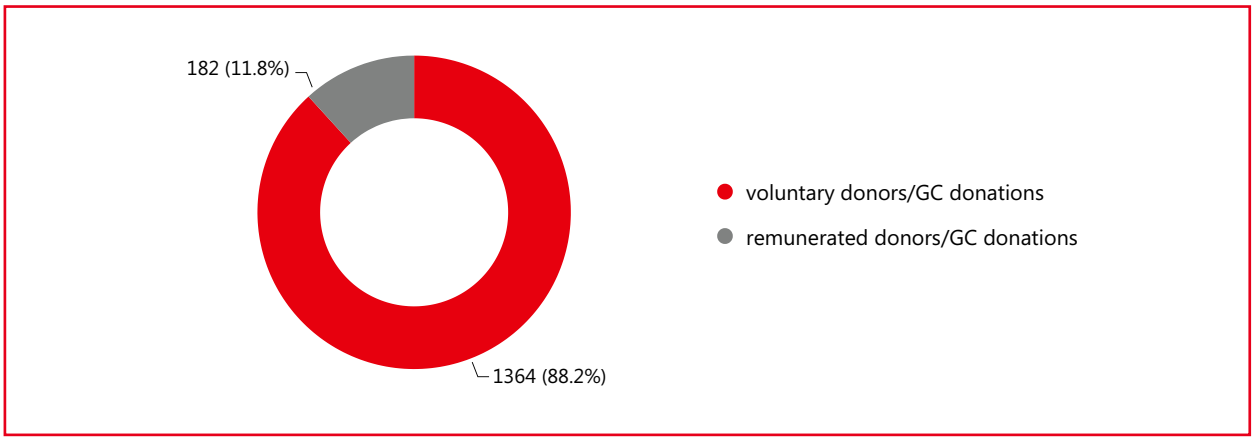

Figure 26. Percentage of GC donations collected from voluntary non-remunerated donors remunerated donors, cumulative data (2005–2017)

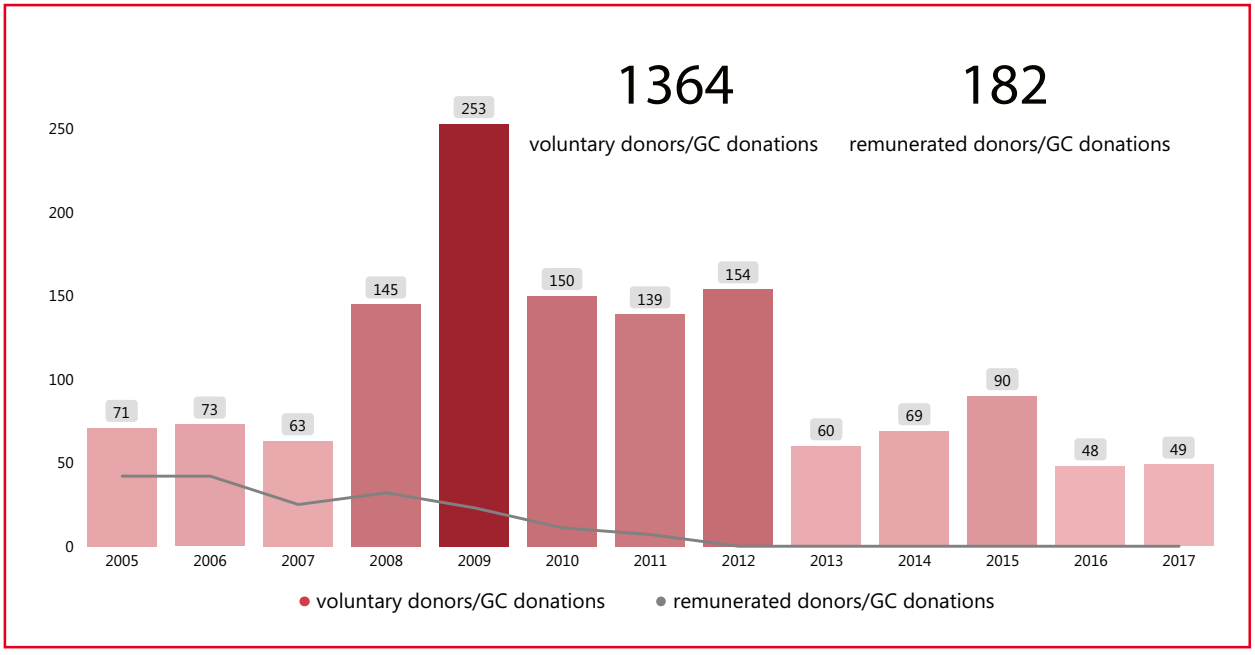

Figure 27. Number of GC donations collected from voluntary non-remunerated and remunerated donors (2005–2017)

average index for RBTC in Lublin (22.6). The data also shows that the average RSI exceeded 30.0 in 8 of 21 RBTCs and in the remaining RBTCs it was within the 22.6–28.9 range. In the subsequent years most RBTCs recorded an increase in the RSI, while other RBTCs (in Szczecin, Olsztyn, Katowice or Wałbrzych) observed an average (or close to average) RSI for each year with no significant tendency to increase (Fig. 31).

Discussion

In the recent years, the number of blood donations in Poland has reached the limit of approximately 1.2 mil per year. To exceed this limit without changing the approach to promotion of voluntary blood donation, donor recruitment and encouragement to donate will be no easy task. The number of donors/donations is closely related to the demographic condition but also to the health status of the society as a whole. The global and national epidemiological situation also has significant impact particularly in terms of occurrence of diseases that result in donor deferral [5]. This becomes particularly significant during summer months when people travel abroad and visit places with confirmed occurrence of new blood borne infectious agents [7].

Analysis of the data referring to the donations collected throughout the analyzed period indicates that WB was the most frequently collected component in all RBTCs while the least

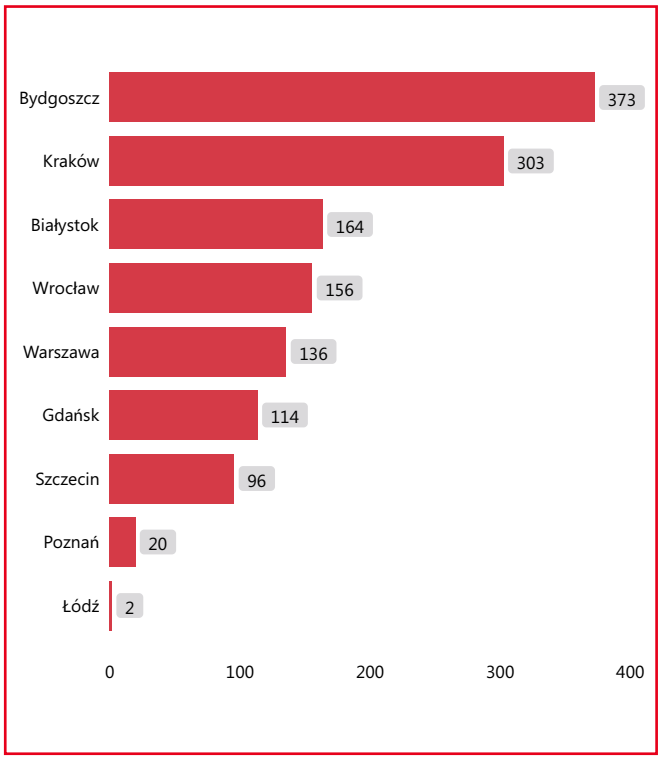

Figure 28. Number of GC donations collected from voluntary non-remunerated donors, cumulative data (2005–2017)

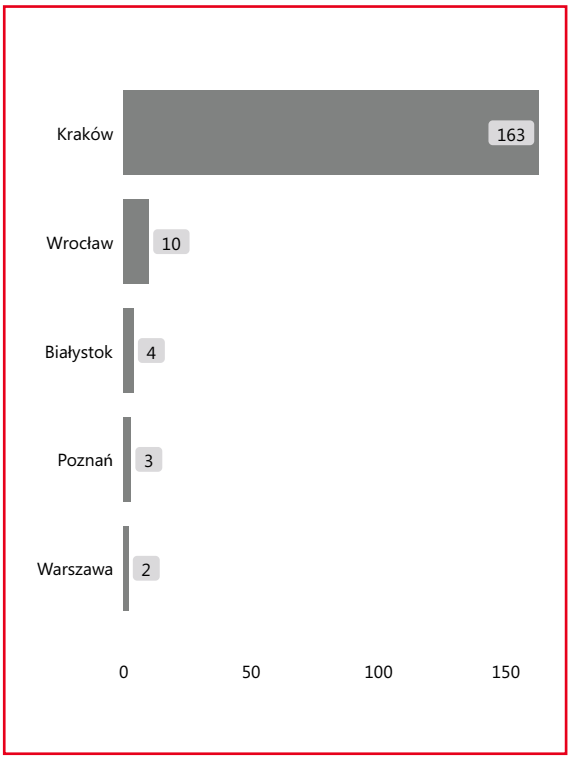

Figure 29. Number of GC donations collected from remunerated donors, cumulative data (2005–2017)

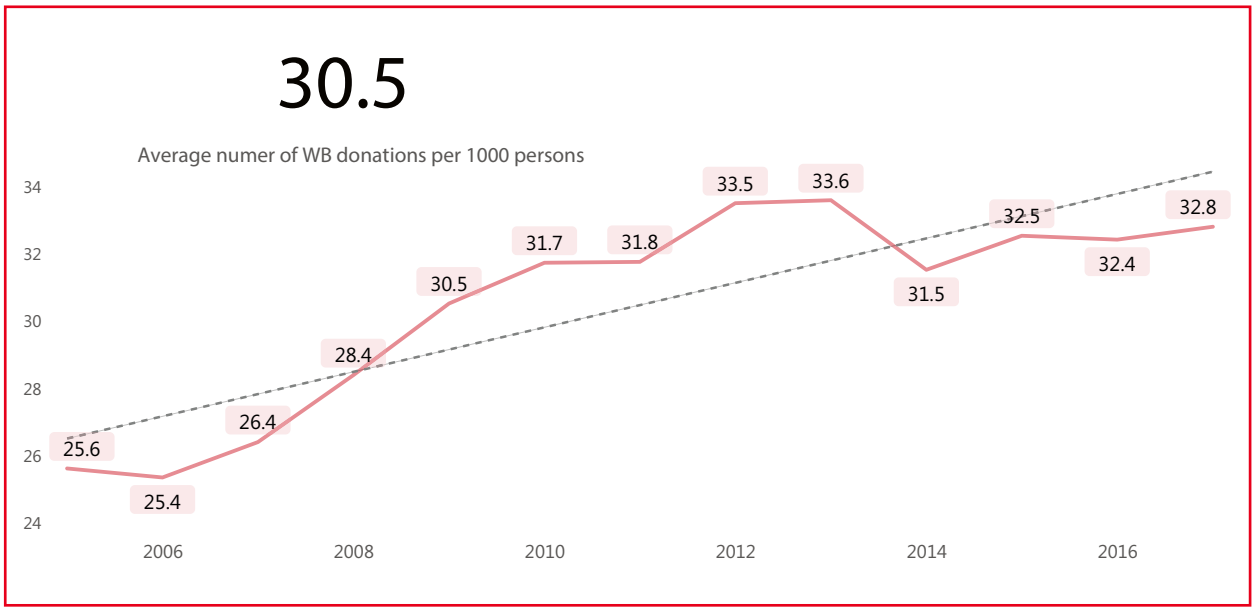

Figure 30. National self-sufficiency index (NSI), 2005–2017

often collected ones were red blood cells from apheresis and granulocyte concentrate. The number of WB donations differed among RBTCs; the highest number was collected in RBTC in Warsaw and Katowice, the lowest in RBTC in Słupsk and Radom. One of the likely reasons for the differences is the number of inhabitants in the area supervised by each RBTC which translates to the availability of potential blood donors. In our study we also present the donation rate per donor per each year of the analyzed period and for individual RBTCs. Throughout the analyzed period the rates were within the 1.69–2.08 range. During the last 6 years the value was about 2 which means that for all RBTCs, the average was 2 donation/per donor/ /per year. The value for the whole 1997–2017 peri-

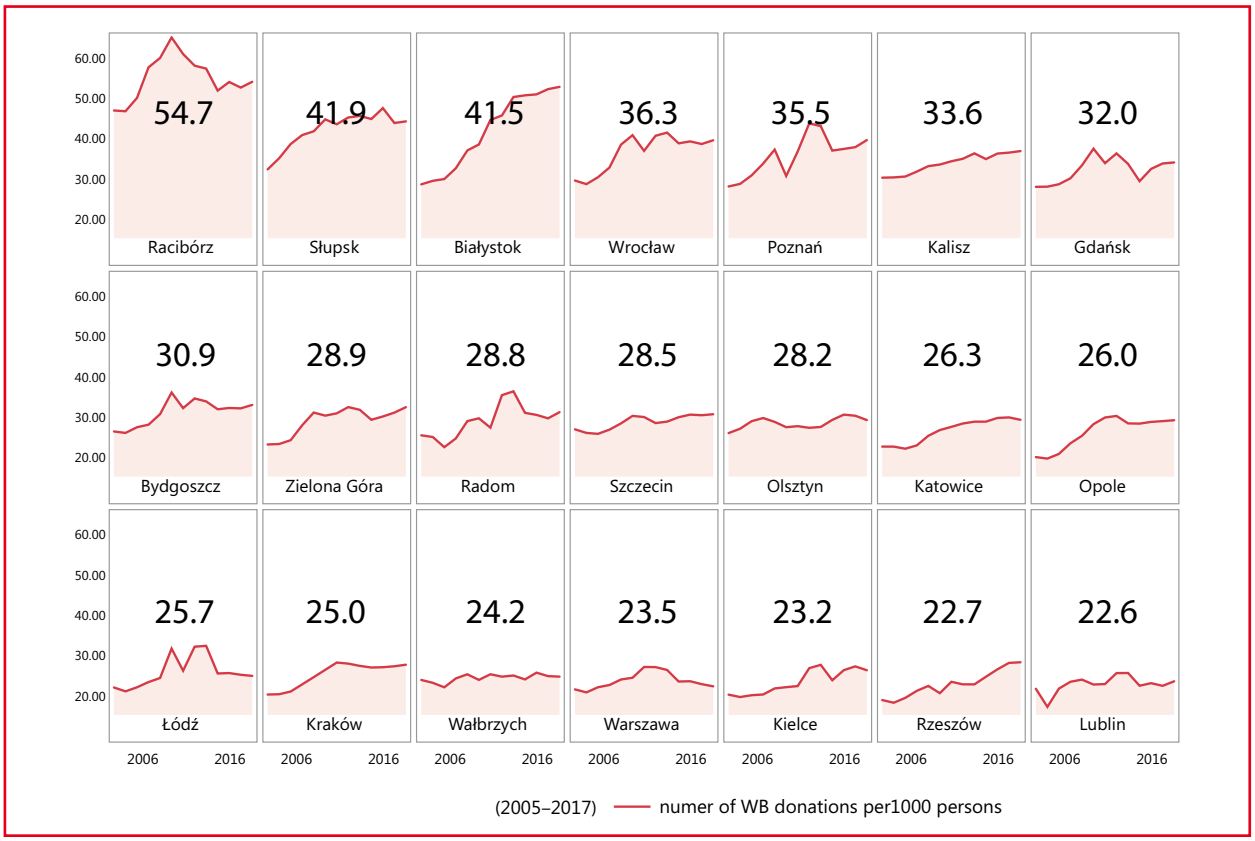

Figure 31. Regional Self-sufficiency Index (RSI), 2005–2017

od also varied in individual RBTCs from 1.74–2.16. The analysis of the values for RBTCs with the highest number of WB donations (in Katowice and Warsaw) demonstrates that for the former RBTC (Katowice) the index value was the highest (2.16) while for the latter (Warsaw) only 1.76 (one of the lowest records). The most likely explanation are different numbers of first-time donors who report just once to these RBTCs with the intention of donating blood.

Over the period of the last several last years, the Polish blood transfusion service has undertaken numerous attempts to increase the number of donors/donations. For many years now mobile collections have been organized to make blood donation easier for donors. In our study, we analyzed the data referring to mobile collections organized in the years 1997–2017 just to find that their number increased when local collection sites were closed down. In the first year of the analyzed period 1,389 mobile collections were organized, while in the final year (2017) as many as 13,189 (a 949.5% increase compared to 1997 data). We also analyzed the share (%) of RBTCs, local collection sites and mobile collection in the total number of the blood units collected. The share of mobile collections was found to have been on the increase from 6% in 1997 to 27% in 2017.

From the point of view of the medical personnel, collecting blood in fixed places is definitely easier and more convenient whereas mobile collections organized in schools, work places etc. facilitate the recruitment of potential donors who — for logistical reasons — would not have found their way to stationary local collection sites or RBTC premises. For many people mobile collections may be the first encounter with blood donation and so they are more likely to become regular donors in the future. An alternative to mobile collections at schools or work places etc. are the so called blood collection buses. This as an initiative put forward in 2011 as part of the national health policy program „Strengthening the self-sufficiency of the Republic of Poland in terms of blood, blood components and blood products" (for the years 2009–2014). Within the framework of this program, the RBTCs were assigned buses adapted for the purpose of blood collection and were able to organize mobile blood collections in locations distant from the RBTCs as well as during occasional cultural events such as festivals and concerts.

Our analyzes indicate that blood collection buses brought no significant change to the overall

number of donations collected during mobile collections; the percentage of units collected in buses ranged from about 40% in the first 3 years to over 50% in the years that followed. Data on the number of donors reporting at mobile collection (either in schools, work places or in blood collection buses were unavailable so the phenomenon could not be analyzed in terms of donor interest in mobile blood collections). No increase in the total number of donations recorded after blood collection buses were introduced may be related to a higher number of donor deferrals imposed at the stage of medical decision regarding donor eligibility. During mobile collections there are no conditions for complete blood count to be performed as hematology analyzers cannot be used in buses. The main criterion for donor eligibility for blood donation is hemoglobin concentration. If donors require a complete blood count (first-time donors as well as multiple donors who need a complete blood test once a year) such tests are performed post factum in donors' blood samples transported to the RBTC. It happens that despite normal hemoglobin concentration a donation has to be destroyed because some other test results are abnormal. Such donation cannot undergo further preparation and cannot be dedicated for clinical use. Moreover, during mobile collections the staff is often unable to make proper use of the information and communication system which would allow an immediate verification of the donor and his donation history. During mobile collections, donors may be registered, their blood collected but at the RBTC it may turn out that the system has the donor recorded as temporarily deferred. His donation therefore has to be destroyed. This shows how important it is to use the information and communication system (ICT) at every stage of the donor's visit, either in RBTC, the local collection site or during mobile collections. Equally important is the implementation of one central ICT system for all Blood Transfusion Centers (BTCs) in our country.

Adequate blood/blood component supply as well as optimal inventory management should be analyzed in relation to the conditions which the Polish blood transfusion service will have to face in a dozen or so years. Demographic changes will most likely be one of the main factors affecting increased demand for blood. According to the forecasts of the Central Statistical Office (GUS), by 2050 the working-age population of Poland (i.e. the group of potential blood donors) will have decreased by more than 5 million [9, 10]. This will probably lead to shortages of blood and blood components.

A similar tendency is observed in the USA and the member states belonging to the Council of Europe. As the American demographic forecasts indicate, the demographic boom of the 1950s will be followed by a population decline in the near future with significant impact on blood donation. By 2031, the number of senior citizens will have doubled and will account for 20% of the American population. Blood consumption in the 70–80 age group is estimated as 8 fold higher than in the 20–40 age group [11] so the prognosed demographic changes together with the present experience in blood transfusion may result in faster increase in the demand for blood components in the coming years. If the demographic parameters remain unchanged, by 2030 all European countries will be facing the same problem [12, 13].

While keeping in mind that the level of unmet needs in hemotherapy often remains unknown, Roberts et al. set out to estimate the demand for blood and blood components as well as the supply of blood in 195 countries worldwide. They found that in as many as 119 (61%) countries blood supply was not sufficient for the needs of hemotherapy. The overall blood shortage in these 119 countries amounted to > 102.3 mil units, which corresponds to 1,849 units per 100,000 inhabitants worldwide. They found that countries like central, eastern or western sub-Saharan Africa, Oceania or South Asia do not collect enough blood to meet the needs of their respective populations. The data for Poland indicate that the demand for blood is estimated at > 5,000–6,300/100,000 inhabitants while the supply at: > 6,000–10,000/100,000. The consumption rate for Poland is > 0.3–1 therefore we are a self-sufficient country (the ratio of < 1 means that blood supply is sufficient to meet the needs of hemotherapy, and that of > 1 means that the supply of blood is insufficient). One should however be cautious about this data because — as mentioned above — the real demand for blood components in Poland is not known. The results of the study indicate that many low income and middle income countries are faced with critical blood shortage, and the situation will worsen/aggravate with better access of citizens to healthcare. According to the authors, the WHO guidelines of 10–20 WB donations per 1,000 inhabitants as sufficient to meet the needs of hemotherapy are largely underestimated. Worldwide, procedures aimed at optimizing blood therapy should be continued while new strategies

are to be implemented for the purpose of improving blood supply and availability [14].

Poland is now a self-sufficient country, but also here it is of utmost importance to implement strategies for prevention of blood and blood component shortages. Such procedures include efficient management of donor resources, proper management of blood inventories as well as development and implementation of procedures for optimal blood therapy. To this aim it is absolutely essential to have access to data on the actual demand for blood components in individual regions of the country. It is also advisable to collect information on the current needs of hospitals as well as to monitor the medical activities that require higher blood consumption (e.g. elective surgery or selected transplant procedures).

The RSI values indicate that attention should also be paid to the cooperation between individual RBTCs. To this purpose it seems necessary to analyze the correlation between supply and demand in individual regions. In particular, this applies to large clinical centers such as Warsaw, Katowice, Kraków, Lublin, where the RSI value is below the national average.

Conflict of interest: none declared

References

1. Drozd W. Marketing społeczny w krwiodawstwie: jak rozmawiać z ludźmi, żeby oddawali krew. CeDeWu; 2016.
2. Ojrzyńska A, Twaróg S. Badanie autokorelacji przestrzennej krwiodawstwa w Polsce. Acta Universitatis Lodziensis Folia Oeconomica. 2011;253 Ekonometria przestrzenna i regionalne analizy ekonomiczne:129-141, doi: 11089/649.
3. World Health Organization. Global Status Report on Blood Safety and Availability, 2016; 2017. http://apps.who.int/iris/bitstream/10665/254987/1/9789241565431-eng.pdf.
4. World Health Organization. Blood safety and availability. https://www.who.int/news-room/fact-sheets/detail/blood-safety-and-availability [dostęp z dnia 11.10.2020].
5. Pogłód R, Rosiek A, Grabarczyk P, et al. Charakterystyka podstawowych wskaźników dotyczących krwiodawstwa i krwiolecznictwa w Europie — aktualne wyzwania i działania. J Transf Med. 2015; 8(2): 60–77.
6. Towards Self-Sufficiency in Safe Blood and Blood Products Based on Voluntary Non-Remunerated Donation. Global Status 2013. World Health Organisation; 2013.
7. Zapewnienie samowystarczalności RP w krew i jej składniki na lata 2015-2020 - Ministerstwo Zdrowia — Portal Gov.pl. Ministerstwo Zdrowia. https://www.gov.pl/web/zdrowie/zapewnienie-samowystarczalnosci-rp-w-krew-i-jej-skladniki [dostęp z dnia 11.10.; 2020].
8. Mikołowska A, Antoniewicz-Papis J. Retrospective analysis of selected aspects of public blood transfusion service as a starting point for assessment of the status of transfusion medicine in Poland Part 1: Demographic characteristics of the donor population reporting for blood donation. J Transfus Med. 2020; 13(1): 67–103, doi: 10.5603/jtm.2020.0002.
9. Prognoza ludności na lata 2014-2050 (opracowana 2014 r.). Główny Urząd Statystyczny; 2014. https://stat.gov.pl/obszary-tematyczne/ludnosc/prognoza-ludnosci/prognoza-ludnosci-na-lata-2014-2050-opracowana-2014-r-,1,5.html.
10. Sytuacja demograficzna Polski do 2018 roku. Tworzenie i rozpad rodzin. Główny Urząd Statystyczny; 2019. https://stat gov pl/obszary-tematyczne/ludnosc/ludnosc/sytuacja-demograficzna-polski-do-2018-roku-tworzenie-i-rozpad-rodzin,33. ; 2: html.
11. Roh J, Choi SJ, Kim S, et al. Blood Supply and Demand in Korea: What is in Store for the Future? Yonsei Med J. 2020; 61(5): 400–405, doi: 10.3349/ymj.2020.61.5.400, indexed in Pubmed: 32390363.
12. European Directorate for the Quality of Medicines & Healthcare. Guide to the Preparation, Use and Quality Assurance of Blood Components: Recommendation No. R (95) 15.; 2017.
13. Rosiek A, Tomaszewska A, Lachert E, et al. Działalność jednostek organizacyjnych służby krwi w Polsce w 2014 roku. J Transf Med. 2015; 8(4): 119–132.
14. Roberts N, James S, Delaney M, et al. The global need and availability of blood products: a modelling study. Lancet Haematol. 2019; 6(12): e606–e615, doi: 10.1016/S2352-3026(19)30200-5, indexed in Pubmed: 31631023.