









# Blood transfusion service in Poland in 2023

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## Summary

**Background:** *The aim of this study was to present the basic aspects of the activity of Polish blood transfusion service in 2023.*

**Material and methods:** *Analysis of data forwarded to the Institute of Hematology and Transfusion Medicine by the Polish Blood Transfusion Centers (Centers).*

**Results:** *In 2023, there were 23 Centers and 135 local collection sites operating in Poland. Blood and blood components were also collected during 12 443 mobile collections. The overall number of blood donors was estimated at 639 972, the majority of which were non-remunerated donors (639 697, including 23 331 responders to donation appeals) as well as 5 remunerated donors and 273 autologous donors. Most frequent were whole blood collections (1 343 779 donations), and the least frequent — granulocyte concentrate collections (134 donations) and collections by apheresis of RBC as the only component (34 donations). Whole blood was collected mostly in local collection sites (50.56%), less frequently in Centers (29.28%) and during mobile collections (20.15%). The most frequently prepared blood components were RBCs (1 327 472 units) and FFP (1 649 586 units). In 2023, a total of 99 347 units of PCs pooled from whole blood and 54 601 units of PCs from apheresis were prepared. However, plasma was no longer collected from COVID-19 convalescents.*

*Additional processing methods (leukocyte depletion, irradiation) were more frequently applied to PCs (100% leukodepleted, including 52.10% both leukodepleted and irradiated), than to RBCs (25.35% leukodepleted, 10.71% both leukodepleted and irradiated, 0.04% irradiated).*

*Pathogen reduction technologies were applied to 23.97% of FFP units issued for clinical use and 10.16% of PCs.*

*For various reasons the following amounts of blood components were wasted in 2023: 10 314 units of whole blood, 33 767 units of RBCs, 54 569 units of FFP, 2194 units of apheresis PCs, 4 205 units of pooled PCs and 1381 units of cryoprecipitate giving a total of 106 430 units of blood.*

*As compared to the years 2020–2022, the value of most indicators of the activity of the blood transfusion service in Poland has increased.*

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**Conclusions:** *The data presented in this report may serve as a starting point for the analysis of issues related to the activity of organizational units of the Polish blood transfusion service. The outcome may contribute to practical benchmarking, comparing experiences and seeking new solutions.*

**Key words:** blood donors; blood donation; blood components

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## Introduction

In this presentation of selected issues related to the annual activities of the public blood transfusion service in Poland in 2023 we take into account selected issues, focusing especially on data concerning: the number of donors, the number of donations, the collection sites for whole blood and blood components, including red blood cells (RBC), fresh frozen plasma (FFP), platelet concentrate (PC) and granulocyte concentrate (GC). We also discuss issues related to the use of some additional preparation methods as well as the inactivation of biological pathogens in labile blood components. The most common causes of the waste of blood components were explored as well as the degree of wastage.

The activity of Polish blood transfusion service (BTS) is regulated by the Public Blood Transfusion Service Act of August 22, 1997 [1]. Pursuant to this Act, the following units of the public blood transfusion service are entitled to collect blood and prepare blood components: 21 Regional Blood Transfusion Centers, Military Blood Transfusion Center (WCKiK, supervised by the Ministry of Defense) and the Blood Transfusion Center of the Ministry of Internal Affairs and Administration (CKiK MSWiA), supervised by the Ministry of Internal Affairs and Administration. The Institute of Hematology and Transfusion Medicine (IHTM) has substantive supervision over the activity of all the above-mentioned entities of the public blood transfusion service.

## Material and methods

This work relies on the data provided by: 21 Regional Blood Transfusion Centers (RCKiK), WCKiK, CKiK MSWiA, in the form of annual activity reports for 2023. Together with the National Blood Center (NCK), IHTM created a template of definitions for the purpose of standardization of the forwarded data.

**First-time donor** — donates blood during the reporting period but has never before donated blood for medical purposes.

**Multiple (regular) donor** — systematically donates blood (at least twice during the last 24 months).

**Multiple repeat donor** — donates blood again more than 2 years after the last donation.

**Non remunerated donor** — receives no financial compensation for donated blood/blood component at least once during the reporting period.

**Remunerated donor** — receives financial compensation for every donation during the reporting period.

**Responder to donation appeal** — donates blood /blood component following emergency appeal for donation at least once during the reporting period (the term also applies to former „family donors”).

**Directed donor** — donates blood for a specific patient at least once during the reporting period.

**Autologous donor** — donates blood/blood component for himself at least once during the reporting period.

**Donation** — whole blood or blood component collected by apheresis, including blood for clinical and scientific purposes collected from immunized and family donors etc.

**Unit (u.)** — volume of anticoagulated whole blood obtained from 450 ml of blood collected from the donor or volume of blood component obtained from one unit of anticoagulated whole blood.

**Unit of plasma** — volume of plasma obtained from whole blood or by automated plasmapheresis.

Single automated plasmapheresis procedure typically provides three units of plasma (600 mL).

**Unit of PC from apheresis** — platelets obtained from a single donor with cell separator (1 donation regardless of platelet count).

**Therapeutic dose of PC** — PCs (either pooled or from apheresis) dedicated for an adult; according to current guidelines it contains  $\geq 3 \times 10^{11}$  platelets.

**Table 1.** Mobile collections organized in Polish Blood Transfusion Centers in 2022 and 2023

Center	Mobile collections		Tendency (increase/decrease compared to 2022)
	2022	2023	
Białystok	636	619	↓
Bydgoszcz	782	789	↑
Gdańsk	205	336	↑
Kalisz	428	445	↑
Katowice	1085	1070	↓
Kielce	331	258	↓
Kraków	834	838	↑
Lublin	439	562	↑
Łódź	1672	1540	↓
Olsztyn	530	545	↑
Opole	176	165	↓
Poznań	849	859	↑
Racibórz	131	300	↑
Radom	431	362	↓
Rzeszów	217	363	↑
Słupsk	206	257	↑
Szczecin	383	375	↓
Wałbrzych	832	917	↑
Warszawa	1131	1112	↓
Wrocław	236	262	↑
Zielona Góra	205	210	↑
WCKiK	350	259	↓
CKiK MSWiA	0	0	bz
<b>Total</b>	<b>12 089</b>	<b>12 443</b>	<b>↑</b>

↓ — Decrease as compared to 2022; ↑ — Increase as compared to 2022; bz — no change since 2022

## Results

### Blood Transfusion Centers (Centers)

In 2023, there were 23 Centers and 135 local collection sites operating in Poland. Moreover, 12 443 mobile collections were organized which is about 2.93% more than in the previous year. In 2023 mobile collections were organized by all RCKiK and WCKiK. The largest number of mobile collections was organized by RCKiK in Łódź (1540). More than 1000 mobile collections were organized also by RCKiK in Katowice (1070) and Warsaw (1112). As compared to the previous year, the number of mobile collections increased in 13 RCKiK and decreased in 9 CKiK (Table 1).

### Donors

In 2023, a total of 729 008 persons came to donate blood (in 2022 — 711 801), but only some

of them (639 972) were found eligible for donation (in 2022 — 621 936). As in the previous years, blood or blood components for clinical use were donated by 88% of the people who were willing to donate blood. The difference was mainly due to donor deferral. In 2023, a total of 7928 permanent deferrals were applied. There were also 231 772 temporary deferrals of 193 737 people, and the most common cause for deferral (76 954 cases) was low hemoglobin level (like in the previous years). Donor disqualification due to COVID-19 infection was applied only sporadically, with 22 cases reported.

Donors were mostly voluntary unremunerated (639 697). In 2023, blood and blood components were also donated by 5 remunerated donors and 273 autologous donors. Amongst voluntary donors, 23 331 were responders to appeal and 153 were directed donors.

**Table 2.** Blood donors in Polish Blood Transfusion Centers in 2023

Center	Donors			Total	Tendency (increase/decrease compared to 2022)
	First time	Multiple-regular	Multiple-repeat		
Białystok	4112	21 705	4366	30 183	↑
Bydgoszcz	7437	25 416	5737	38 590	↑
Gdańsk	5831	20 414	4025	30 270	↑
Kalisz	3698	16 169	2764	22 631	↓
Katowice	9709	38 709	6690	55 108	↑
Kielce	4375	11 232	3042	18 649	↑
Kraków	10 423	34 671	6606	51 700	↑
Lublin	6356	20 625	4457	31 438	↑
Łódź	8699	24 724	6373	39 796	↑
Olsztyn	4205	14 565	2968	21 738	↑
Opole	2566	10 276	1650	14 492	↓
Poznań	7423	33 816	6464	47 703	↑
Racibórz	2354	9147	1973	13 474	↑
Radom	2395	7423	1731	11 549	↓
Rzeszów	5350	22 742	3770	31 862	↑
Słupsk	2379	6361	1409	10 149	↑
Szczecin	5011	15 519	3301	23 831	↓
Wałbrzych	2559	8818	1424	12 801	↑
Warszawa	12 983	38 280	9209	60 472	↑
Wrocław	6928	23 918	5363	36 209	↓
Zielona Góra	2893	8068	3645	14 606	↑
WCKiK	7451	8904	2288	18 643	↑
CKiK MSWiA	1458	2164	456	4078	↑
<b>Total</b>	<b>126 595</b>	<b>423 666</b>	<b>89 711</b>	<b>639 972</b>	<b>↑</b>

↓ — Decrease as compared to 2022; ↑ — Increase as compared to 2022

In 21 Centers blood was donated only by voluntary unremunerated donors. Remunerated donors were recorded only in Kalisz (3 individuals) and Poznań (2 individuals).

Among the donors of blood and blood components there were 126 595 first-time donors (19.78%), 423 666 multiple regular donors (66.20%) and 89 711 multiple repeat donors (14.02%). In 2022, among the donors, there were 135 962 (21.86%) first-time donors, 399 172 (64.18%) regular repeat donors, and 86 802 (13.96%) multiple repeat donors.

18 Centers reported an increase in the number of donors (from 0.5 to 11.93%), and 5 reported decrease (from 0.01 to 1.94%).

Table 2 presents the number of donors in each Center in 2023. As in the previous years, the most numerous group were blood donors aged 18 to 44

(a total of 517 361, including 128 266 women and 389 095 men).

### Donations

In 2023, whole blood was the most frequently collected blood component (1 343 779 donations), while the least frequent were collections of: granulocyte concentrate (134 donations in 7 RCKiK) and apheresis RBCs as the only component (34 donations in 2 RCKiK). As in previous years, the largest numbers of whole blood donations were reported by RCKiK in Warsaw (122 575) and Katowice (132 921). Apheresis was mainly used for preparation of PCs (14 160 donations) and plasma (96 379 donations). The largest numbers of apheresis plasma donations were reported by RCKiK in Kalisz (19 080), and apheresis PC donations by RCKiK in Kraków (2452).

**Table 3.** Whole blood and apheresis donations in 2023\*

Center	Whole blood	Apheresis						Total
		Plasma	RBC	PC	GC	PC + plasma	PC + RBC	
Białystok	62 649	14 686	1	4	7	2146	0	79 493
Bydgoszcz	79 637	11 118	33	1194	51	0	0	92 033
Gdańsk	67 308	2118	0	122	0	478	0	70 026
Kalisz	42 822	19 080	0	0	0	403	0	62 305
Katowice	132 921	129	0	827	0	5662	0	139 539
Kielce	35 452	1920	0	970	0	0	0	38 342
Kraków	111 901	2736	0	2452	33	0	0	117 122
Lublin	64 210	7792	0	8	0	2169	0	74 179
Łódź	81 664	2001	0	1496	0	0	0	85 161
Olsztyn	43 083	2031	0	455	0	16	0	45 585
Opole	32 871	1706	0	111	0	700	0	35 388
Poznań	105 133	8870	0	0	0	1625	0	115 628
Racibórz	25 674	5819	0	0	0	455	0	31 948
Radom	22 994	2817	0	5	0	972	0	26 788
Rzeszów	71 516	4437	0	1978	17	160	0	78 108
Słupsk	20 612	1016	0	135	0	627	10	22 400
Szczecin	50 906	1286	0	7	2	1065	0	53 266
Wałbrzych	29 145	161	0	51	0	248	0	29 605
Warszawa	122 575	1448	0	2421	22	8891	0	135 357
Wrocław	69 139	4541	0	1727	2	5227	260	80 896
Zielona Góra	32 491	470	0	0	0	230	0	33 191
WCKiK	31 463	197	0	154	0	0	0	31 814
CKiK MSWiA	7613	0	0	43	0	0	0	7656
<b>Total</b>	<b>1 343 779</b>	<b>96 379</b>	<b>34</b>	<b>14 160</b>	<b>134</b>	<b>31 074</b>	<b>270</b>	<b>1 485 830</b>

\*Complete donations only

Automated donations of a combination of PC and plasma simultaneously (31 074 donations) were also collected mostly in RCKiK in Warsaw (8891 donations), less frequently of PC and RBCs (270 donations) — almost exclusively at RCKiK in Wrocław (260 donations) and only 10 in RCKiK in Słupsk.

Table 3 presents the number of complete donations of blood and blood components in 2023.

Blood was collected primarily in the local collection sites (50.56% of whole blood donations), less frequently at the Center premises (29.28%), and during mobile collections (20.15%). As in previous years, the largest number of whole blood donations — 49.52% — took place during mobile collections organized by the RCKiK in Wałbrzych. Table 4 provides a list of whole blood collection sites in 2023.

**Table 4.** Sites of whole blood collection in 2023

Center	Whole blood collected (units)*						
	Center site		Local collection site		Mobile collection site		Total
	U.	%	U.	%	U.	%	U.
Białystok	28 406	45.02	20 665	32.75	14 025	22.23	63 096
Bydgoszcz	19 374	24.18	35 404	44.19	25 334	31.62	80 112
Gdańsk	21 702	32.02	37 761	55.71	8317	12.27	67 780
Kalisz	9142	21.23	18 337	42.58	15 586	36.19	43 065
Katowice	26 416	19.54	85 795	63.47	22 956	16.98	135 167
Kielce	14 624	41.05	12 310	34.55	8695	24.40	35 629
Kraków	24 269	21.53	67 303	59.70	21 163	18.77	112 735
Lublin	13 955	21.48	38 062	58.57	12 964	19.95	64 981
Łódź	29 831	36.12	37 351	45.23	15 399	18.65	82 581
Olsztyn	14 214	32.66	18 190	41.80	11 113	25.54	43 517
Opole	7896	23.96	22 468	68.19	2586	7.85	32 950
Poznań	26 904	25.19	60 664	56.79	19 255	18.03	106 823
Racibórz	4674	17.99	13 247	50.99	8059	31.02	25 980
Radom	13 725	59.41	2462	10.66	6916	29.94	23 103
Rzeszów	16 792	23.30	46 987	65.21	8277	11.49	72 056
Słupsk	11 112	52.98	5733	27.33	4129	19.69	20 974
Szczecin	21 804	42.54	20 816	40.61	8640	16.86	51 260
Wałbrzych	14 949	50.48	0	0.00	14 666	49.52	29 615
Warszawa	25 238	20.31	71 547	57.58	27 470	22.11	124 255
Wrocław	31 970	45.68	30 241	43.21	7781	11.12	69 992
Zielona Góra	11 056	33.74	17 842	54.45	3867	11.80	32 765
WCKiK	1964	6.16	23 447	73.57	6460	20.27	31 871
CKiK MSWiA	7645	100.00	0	0.00	0	0.00	7645
<b>Total</b>	<b>397 662</b>	<b>29.28</b>	<b>686 632</b>	<b>50.56</b>	<b>273 658</b>	<b>20.15</b>	<b>1 357 952</b>

\*Incomplete donations included

## Blood components

### Red blood cells

Donated blood was processed into blood components, mostly RBC (a total of 1 327 472 units), which was a slight country-wide increase as compared to the previous year (1 266 346 units). As in previous years, the largest amount of RBCs was obtained in RCKiK in Katowice and Warsaw

(132 000 and 122 271 units, respectively). Most Centers (19) reported an increase in the number of RBC units (Table 5).

Some part of RBC units was subjected to additional preparation the most common of which was leukocyte depletion and irradiation.

In 2023, a total of 336 535 units of leukodepleted RBCs were obtained (25.35% of all RBC units) and 142 202 units of leukodepleted irradiated

**Table 5.** Units of RBCs prepared in Polish Blood Transfusion Centers in 2023

Center	RBCs	Tendency (increase/decrease compared to 2022)
Białystok	62 653	↑
Bydgoszcz	79 681	↑
Gdańsk	67 183	↑
Kalisz	42 795	↑
Katowice	132 000	↑
Kielce	35 413	↑
Kraków	111 713	↑
Lublin	64 067	↑
Łódź	81 189	↑
Olsztyn	43 040	↑
Opole	32 805	↑
Poznań	99 050	↑
Racibórz	25 609	↓
Radom	22 743	↓
Rzeszów	70 893	↑
Słupsk	20 649	↑
Szczecin	50 885	↑
Wałbrzych	29 145	↑
Warszawa	122 271	↑
Wrocław	62 197	↑
Zielona Góra	32 447	↑
WCKiK	31 444	↑
CKiK MSWiA	7600	↑
<b>Total</b>	<b>1 327 472</b>	<b>↑</b>

↓ — Decrease as compared to 2022; ↑ — Increase as compared to 2022

RBCs (10.71%). RBC irradiation only was used sporadically, yielding 526 units of irradiated RBCs — 0.04% of all RBC units.

Country-wide, 36.06% of all RBCs were leukodepleted and 10.75% of RBCs were irradiated. Table 6 presents the number of leukodepleted

and irradiated units of RBC prepared in individual Centers in 2023.

### **Platelet concentrate**

Platelet concentrate was the second most frequently prepared cellular blood component, just like in the years before. Since the beginning of 2020, only leukodepleted PCs have been used for clinical purposes in Poland. Two basic methods were used for PC preparation:

- centrifugation of whole blood from traditional donations, and — if necessary — pooling several units of PC to obtain pooled PC. Some Centers used automated methods for obtaining PCs;
- apheresis with cell separators (some of the PCs obtained with this method were divided into smaller therapeutic doses). Apheresis PCs from modern separators are leukodepleted and require no additional elimination of leukocytes.

In 2023, a total of 99 347 units of pooled PCs were prepared (in 2021 — 85 677, in 2022 — 90 009). Of these, 68 399 units were prepared manually from leukocyte-platelet buffy coat, while 30 948 units were prepared using automated methods.

In 2023, a total of 54 601 units of PCs were obtained by apheresis (35.47% of all units issued for clinical use; in 2021 — 37.93%, in 2022 — 37.04%).

The highest number of PCs units from whole blood was obtained in Katowice (11 942 therapeutic units) and Poznań (12 654 PC units), while from apheresis — in Warsaw (11 442).

The percentage of apheresis PCs differed significantly between Centers — from 6.47% in Zielona Góra to 70.43% in Warsaw and 77.06% in Białystok (Table 7).

Some units of leukodepleted PCs were irradiated. In 2023, a total of 80 211 units of irradiated leukodepleted PCs were obtained, which accounted for 52.10%. A detailed list of irradiated leukodepleted PCs (NUKKP) obtained by individual Centers (CKiK) in 2023 is presented in Table 8. The percentage of irradiated leukodepleted PCs varied significantly across different CKiK — from 0% at the WCKiK and the CKiK MSWiA to nearly 100% in Białystok. For clinical purposes, CKiK issued a total of 150 765 units of platelet concentrates (PC) in 2023 (compared to 138 594 in 2022).

Some of the received leukodepleted PCs were then stored in a frozen state (frozen platelet concentrates — FPC).

**Table 6.** Leukodepleted and irradiated RBCs prepared in Polish Blood Transfusion Centers in 2023

Center	Units of leukodepleted RBCs	Units of irradiated RBCs	Units of both leukodepleted and irradiated RBCs
Białystok	2087	0	7740
Bydgoszcz	3571	0	13 662
Gdańsk	3067	5	20 822
Kalisz	29 067	6	1039
Katowice	52 184	9	7096
Kielce	9758	1	4159
Kraków	8017	169	7716
Lublin	13 528	1	11 384
Łódź	8054	34	15 504
Olsztyn	5177	2	5670
Opole	5321	0	437
Poznań	52 524	3	9546
Racibórz	2374	0	68
Radom	2191	0	148
Rzeszów	372	56	9526
Słupsk	967	0	2007
Szczecin	1503	234	2618
Wałbrzych	3371	6	68
Warszawa	113 099	0	9097
Wrocław	4415	0	11 141
Zielona Góra	4316	0	2754
WCKiK	3972	0	0
CKiK MSWiA	7600	0	0
<b>Total</b>	<b>336 535</b>	<b>526</b>	<b>142 202</b>

In 2023, a total of 2.58% of the collected PCs were frozen (1.62% of pooled PCs and 3.75% of apheresis PCs).

There was a noticeable decrease in the percentage of frozen components (by 1.13%) in 2023, which aligns with the trends observed in previous years, except for 2022, when there was an unexpected increase in the percentage of frozen PCs. In 2023, there was another slight decrease in the percentage of frozen blood components from apheresis (by 3.03%) and in case of pooled PCs (by 0.32%). In most centers the percentage of frozen

PCs did not change much in the consecutive years. However, in 2023 there are significant differences in this respect between individual Centers, ranging from 0% in Kalisz, Poznań and WCKiK to 15.02% in Słupsk (increase by 3.42% as compared to 2021), 13.35% in Wałbrzych (decrease by 3.91%), 21.56% in Opole (decrease by 14.32%), 10.37% in Radom (decrease by 32.89%) and 31.09% in Racibórz (decrease by 25.09%). In the remaining Centers, the percentage of frozen PCs was below 10%. In most Centers, a decrease in the percentage of frozen PCs was observed, except in Słupsk, Gdańsk,



**Table 7.** PCs from whole blood and apheresis (2023)

Center	PC (therapeutic doses)			
	Pooled (from whole blood)	Apheresis	Total	% of apheresis PCs
Białystok	1275	4282	5557	77.06
Bydgoszcz	9084	1607	10 691	15.03
Gdańsk	6103	885	6988	12.66
Kalisz	2245	719	2964	24.26
Katowice	11 942	8046	19 988	40.25
Kielce	3227	1149	4376	26.26
Kraków	9345	3487	12 832	27.17
Lublin	4858	2270	7128	31.85
Łódź	4817	1881	6698	28.08
Olsztyn	4418	555	4973	11.16
Opole	709	817	1526	53.54
Poznań	12 654	2554	15 208	16.79
Racibórz	522	562	1084	51.85
Radom	432	986	1418	69.53
Rzeszów	6978	2204	9182	24.00
Słupsk	1685	925	2610	35.44
Szczecin	3980	1424	5404	26.35
Wałbrzych	1899	348	2247	15.49
Warszawa	4804	11 442	16 246	70.43
Wrocław	4353	8021	12 374	64.82
Zielona Góra	3399	235	3634	6.47
WCKiK	167	154	321	47.98
CKiK MSWiA	451	48	499	9.62
<b>Total</b>	<b>99 347</b>	<b>54 601</b>	<b>153 948</b>	<b>35.47</b>

Katowice, Kielce, and Zielona Góra, where a slight increase was recorded. As in the previous years, Racibórz reported the highest percentage of frozen pooled PCs. In Zielona Góra, Wałbrzych, Słupsk, Racibórz, Opole, Radom and Kielce, CKiK MSWiA reported the highest percentage of frozen apheresis PCs (33.19%, 31.32%, 30.81%, 25.44%, 15.42%, 14.60% and 11.31% respectively). In the case of

pooled PCs, the highest percentage of frozen preparations was observed in Racibórz (37.16%), Opole (28.63%), and Wałbrzych (9.11%). In the remaining Centers this percentage did not exceed 5%.

In 2023, thawed frozen PCs accounted for 2.51% of all PC therapeutic doses issued for clinical use, i.e. 0.25% less than in 2022. The largest number of thawed PC units was reported by

**Table 8.** Leukodepleted and irradiated PCs prepared in Polish Blood Transfusion Centers (2023)

Center	PC therapeutic doses	Leukodepleted PCs	Irradiated leukodepleted PCs
Białystok	5557	5465	98.34
Bydgoszcz	10 691	9693	90.67
Gdańsk	6988	6544	93.65
Kalisz	2964	555	18.72
Katowice	19 988	6257	31.30
Kielce	4376	1827	41.75
Kraków	12 832	7033	54.80
Lublin	7128	5100	71.55
Łódź	6698	5209	77.77
Olsztyn	4973	4562	91.74
Opole	1526	172	11.27
Poznań	15 208	8446	55.54
Racibórz	1084	8	0.74
Radom	1418	23	1.62
Rzeszów	9182	4542	49.47
Słupsk	2610	1662	63.68
Szczecin	5404	3442	63.69
Wałbrzych	2247	83	3.69
Warszawa	16 246	47	0.29
Wrocław	12 374	8235	66.55
Zielona Góra	3634	1307	35.97
WCKiK	321	0	0
CKiK MSWiA	499	0	0
<b>Total</b>	<b>153 948</b>	<b>80 211</b>	<b>52.10</b>

Racibórz (34.57% of all PC units issued for clinical use), Radom (22.28%), Opole (21.40%), Wałbrzych (13.97%) as well as Słupsk (10.37%). Only the Centers in Kalisz, Poznań and WCKiK reported no thawed PCs issued for clinical use.

### **Fresh frozen plasma**

In 2023, a total of 1 649 586 fresh frozen plasma units were prepared (in 2020 — 1 264 654 units, in 2021 — 1 425 640 units and in 2022 — 1 537 211 units). The primary method of obtaining FFP, as in

previous years, was the collection of plasma from whole blood. Using this method, 1 311 075 units of FFP were obtained in 2023. A less commonly used method, apheresis, was employed to collect 338 511 units, accounting for 20.52% of the total (in 2021 — 232 001 units, or 16.27%, and in 2022 — 289 855 units, or 18.86%).

This is the continuation of the upward trend observed for the last several years. The percentage of FFP obtained by apheresis differed between

**Tabela 9.** FFP (from whole blood and apheresis) prepared in Polish Blood Transfusion Centers in 2023 (number of units)

Center	Whole blood (manual method)	Apheresis	Total	% apheresis FFP
Białystok	62 654.00	60 024.00	122 678	48.93
Bydgoszcz	78 918.00	33 037.00	111 955	29.51
Gdańsk	67 133.00	6792.00	73 925	9.19
Kalisz	42 799.00	57 702.00	100 501	57.41
Katowice	132 000.00	5969.00	137 969	4.33
Kielce	35 391.00	5711.00	41 102	13.89
Kraków	111 713.00	8062.00	119 775	6.73
Lublin	62 190.00	25 097.00	87 287	28.75
Łódź	81 189.00	5826.00	87 015	6.70
Olsztyn	42 491.00	6001.00	48 492	12.38
Opole	32 806.00	3819.00	36 625	10.43
Poznań	98 974.00	31 769.50	130 744	24.30
Racibórz	25 609.00	17 689.00	43 298	40.85
Radom	22 743.00	8788.00	31 531	27.87
Rzeszów	70 893.00	13 265.00	84 158	15.76
Słupsk	20 736.00	3692.00	24 428	15.11
Szczecin	50 885.00	5536.00	56 421	9.81
Wałbrzych	28 621.00	936.00	29 557	3.17
Warszawa	122 271.00	12 986.00	135 257	9.60
Wrocław	61 934.00	23 913.00	85 847	27.86
Zielona Góra	32 447.00	1386.00	33 833	4.10
WCKiK	20 412.00	510.00	20 922	2.44
CKiK MSWiA	6266.00	0.00	6266	0.00
<b>Total</b>	<b>1 311 075</b>	<b>338 511</b>	<b>1 649 586</b>	<b>20.52</b>

Centers (the highest was reported by RCKiK in Kalisz — 57.41% and Białystok — 48.93%).

Table 9 presents the number of FFP units obtained by the manual method and by apheresis in individual Centers in 2023. A total of 247 170 units of FFP were issued for clinical purposes, which is fewer than in 2022 (252 332 units) and 2019 (273 519 units of FFP), but more than in 2020 (229 059 units) and 2021 (246 013 units). As compared to the previous year (2022), the number

of FFP units issued for clinical use decreased in most (13) Centers (Table 10).

In 2023, plasma was not collected from COVID-19 convalescents.

### **Granulocyte concentrate**

As in previous years, in 2023 granulocyte concentrate (GC) was only sporadically obtained (134 donations in 7 Centers), although more frequently than in 2022 (111 donations) and in 2021

(104 donations). Most GC donations took place in Bydgoszcz (51) and Kraków (33).

### Quarantine and inactivation of biological pathogens in labile blood components

In Poland only quarantine\* or pathogen inactivated FFP and cryoprecipitate are issued for clinical use to ensure the safety of transfused blood components. Currently there are three pathogen inactivation systems implemented in the Polish Blood Transfusion Centers: Theraflex MB Plasma (with methylene blue) for pathogen inactivation in plasma, Mirasol PRT (with riboflavin) and Intercept (with amotosalen hydrochloride) for pathogen inactivation in FFP and PC. Inactivation methods (Mirasol PRT and Intercept) are also effective for inactivation of immunocompetent T lymphocytes and this is an alternative to irradiation of cellular blood components for prevention of transfusion-associated Graft Versus Host Disease (TA-GvHD) [2–4]. In 2023 pathogen inactivation technology (PRT) was implemented in 23 Centers which used:

- Mirasol — 16 Centers (in 14 regional Centers, WCKiK and CKiK MSWiA);
- Theraflex MB Plasma (in 12 regional Centers);
- Intercept (in 2 regional Centers).

Individual Centers subjected different amounts of plasma to inactivation, ranging from 0.07% in Szczecin and Słupsk to 19.31% in Poznań. In 3 Centers, the volume of inactivated plasma exceeded 10% (Poznań — 19.31%, Warsaw — 14.73% and CKiK MSWiA — 14.63%). In another 3 Centers (Zielona Góra, Radom, Kraków) the percentage ranged from 5.15 to 5.73%. Countrywide, 4.54% of all plasma was subjected to inactivation. In 2023, plasma was neither collected from COVID-19 convalescents nor subjected to inactivation. In 2023, 76.01% of quarantine FFP and 90.66% of quarantine cryoprecipitate were issued for clinical use. 23.97% units of FFP and 9.34% units of cryoprecipitate subjected to pathogen inactivation were issued to hospitals (cryoprecipitate exclusively by the RCKiK in Poznań, Bydgoszcz, and WCKiK).

Inactivation of pooled PCs was performed in 8 Centers (7 with Mirasol system, 1 with Intercept). The percentage of pooled PCs subjected to inactivation ranged from 0.06% (Center in Lublin) to 97.63% (Center in Warsaw). Countrywide, this accounted for 6.13% of all pooled PC units.

11 Centers inactivated apheresis PCs (9 used Mirasol, 1 used Intercept and 1 Center — in Radom — used both systems). The percentage of

**Table 10.** FFP issued for clinical use in Polish Blood Transfusion Centers in 2023

Center	FFP issued for clinical use (units)	Tendency (increase/decrease compared to 2022)
Białystok	11 214	↓
Bydgoszcz	13 788	↓
Gdańsk	8932	↑
Kalisz	2968	↓
Katowice	22 613	↓
Kielce	6063	↑
Kraków	20 706	↓
Lublin	12 797	↓
Łódź	14 701	↑
Olsztyn	7605	↑
Opole	4802	↓
Poznań	16 675	↓
Racibórz	2067	↓
Radom	2045	↓
Rzeszów	12 064	↑
Słupsk	2282	↓
Szczecin	12 555	↑
Wałbrzych	7063	↑
Warszawa	35 658	↓
Wrocław	10 783	↑
Zielona Góra	6730	↑
WCKiK	10 152	↑
CKiK MSWiA	2910	↓
<b>Total</b>	<b>247 170</b>	↓

↓ — Decrease as compared to 2022; ↑ — Increase as compared to 2022

inactivated apheresis PCs ranged from 0.58% (in Łódź) to 92.89% (in Warsaw). Countrywide, this accounted for 26.29% of all apheresis PC units. In 2023, 10.16% of all pathogen inactivated PC therapeutical units were issued for clinical use.

\* Quarantine of FFP and cryoprecipitate consists in storage for at least 16 weeks of donation date followed by testing the donor for infectious disease markers (to eliminate the diagnostic window period)

**Table 11.** Percentage of pathogen-inactivated units of FFP, pooled PCs, apheresis PCs prepared in Polish Blood Transfusion Centers in 2023

Center	FFP [%]	Pooled PCs (%)	Apheresis PCs (%)	Systems
Białystok	0.56	0.00	0.00	Theraflex, Mirasol
Bydgoszcz	2.02	0.00	0.00	Theraflex, Mirasol
Gdańsk	0.82	0.00	0.00	Theraflex, Mirasol
Kalisz	1.89	0.00	0.00	Theraflex
Katowice	2.46	0.73	0.76	Mirasol
Kielce	1.15	0.00	82.77	Mirasol
Kraków	5.73	0.43	1.20	Mirasol
Lublin	2.18	0.06	64.23	Theraflex, Mirasol
Łódź	1.52	17.77	0.58	Mirasol
Olsztyn	0.60	0.00	0.00	Theraflex
Opole	0.17	0.00	0.00	Theraflex
Poznań	19.31	0.00	0.00	Theraflex
Racibórz	0.48	0.00	0.00	Theraflex
Radom	5.27	0.00	77.38	Mirasol, Intercept
Rzeszów	2.13	0.92	7.49	Theraflex, Mirasol
Słupsk	0.07	0.00	0.00	Mirasol
Szczecin	0.07	0.00	0.00	Mirasol
Wałbrzych	1.79	0.00	0.00	Mirasol
Warszawa	14.73	97.63	92.89	Intercept
Wrocław	3.36	0.00	1.85	Theraflex, Mirasol
Zielona Góra	5.15	0.00	0.00	Theraflex
WCKiK	0.43	36.53	62.34	Mirasol
CKiK MSWiA	14.63	66.30	77.08	Mirasol
<b>Total</b>	<b>4.54</b>	<b>6.13</b>	<b>26.29</b>	

Table 11 presents the percentage of FFP, pooled PCs and PC units from apheresis subjected to pathogen inactivation in Centers (2023).

The percentage of FFP units, cryoprecipitate, and leukodepleted PCs units issued for clinical use after pathogen inactivation in 2023 is presented in Table 12.

### Wastage of blood and blood components

In 2023, a total of 106 430 units of blood and most common blood components were wasted, including 10 314 units of anticoagulated whole blood, 33 767 units of RBCs, 54 569 units of FFP, 2194 therapeutic units of apheresis PCs, 4205 units of pooled PCs as well as 1381 units of cryoprecipitate. As in the previous years, the most common reasons for wastage of blood components were:

- expiry date;
- seropositivity for transfusion transmitted viral diseases, syphilis tests, implementation of

look-back procedure (hereinafter referred to as “pathogens”);

- other causes, including:
  - inadequate visual control,
  - low quantity/volume,
  - incorrect serological results,
  - other, including incorrect procedures, medical deferral, mechanical damage, donor self-deferral.

Components from autologous donations that were not put to clinical use were also subjected to wastage (34 units of RBCs and 111 units of FFP).

Table 13 presents the number of blood components wasted in individual Centers in 2023; causes of waste are presented in Table 14.

### Discussion

The year 2023 marked the first year following the COVID-19 pandemic period. On July 1, 2023,

**Table 12.** Percentage of pathogen-inactivated FFP, cryoprecipitate and PC units issued for clinical use in 2023

Center	% FFP (units)	% Cryoprecipitate (units)	% PCs (therapeutic doses)
Białystok	7.02	0.00	0.00
Bydgoszcz	4.79	13.88	0.00
Gdańsk	5.00	0.00	0.00
Kalisz	55.82	0.00	0.00
Katowice	13.71	0.00	0.76
Kielce	7.90	0.00	22.87
Kraków	36.99	0.00	0.60
Lublin	20.24	0.00	23.56
Łódź	8.42	0.00	11.89
Olsztyn	10.24	0.00	0.00
Opole	2.56	0.00	0.00
Poznań	97.97	100.00	0.00
Racibórz	10.06	0.00	0.00
Radom	55.10	0.00	48.69
Rzeszów	15.02	0.00	2.55
Słupsk	3.16	0.00	0.00
Szczecin	0.27	0.00	0.00
Wałbrzych	9.17	0.00	0.00
Warszawa	35.32	0.00	73.37
Wrocław	36.85	0.00	1.13
Zielona Góra	25.05	0.00	0.00
WCKiK	0.34	2.02	58.26
CKiK MSWiA	41.55	0.00	56.25
<b>Total</b>	<b>23.97</b>	<b>9.34</b>	<b>10.16</b>

the state of epidemic threat, which had been in effect in Poland since May 16, 2022, was officially lifted. This led to the elimination of several pandemic-related conditions affecting both hospital operations — and consequently the use of blood components — and the functioning of the blood service. For instance, the collection of plasma from COVID-19 convalescents, previously used as part of experimental SARS-CoV-2 treatment in the form of so-called passive immunotherapy, was completely discontinued [5].

Moreover, donor deferral due to SARS-CoV-2 infection was applied only sporadically. As in previous years, the primary factor ensuring the fulfilment of transfusion medicine needs in 2023 remained the goodwill and, consequently, a sufficient number of voluntary blood donors [6–10].

In line with the observations presented above, in 2023 the number of donors in the Centers in Poland (639 972) was the highest in several last

years (621 936 in 2022, 615 784 in 2021, 569 914 in 2020, 614 579 in 2019).

The increase in the number of blood donors was observed despite the several-year decrease in the population in the 18–65 age group — the potential “recruitment source” of blood donors. According to the data provided by the Demographic Yearbook reports (Central Statistical Office of Poland) for 31 December 2011 this number was estimated at 26 460 477, while for 31 December 2020 — 24 689 690 and for 12 December 2022 — 23 989 507, for 31 December 2023 — 23 739 037 [11–13]. Therefore during this period, the said population in the above-mentioned age group decreased by 2.5 million, which may have a negative impact on the number of active blood donors. One of the consequences may be the observed decline in the number of first-time donors in recent years — from 141 512 in 2021 to 135 962 in 2022 and 126 595 in 2023.

**Table 13.** Wastage of blood components in Polish Blood Transfusion Centers in 2023

Center	Whole blood	RBCs	PCs (therapeutic doses)		FFP	Cryoprecipitate
			Pooled (from whole blood)	Apheresis		
Białystok	196	640	31	18	1126	68
Bydgoszcz	501	621	149	0	2138	64
Gdańsk	242	1314	183	19	829	109
Kalisz	125	807	179	4	922	11
Katowice	0	3738	515	339	5425	95
Kielcach	36	883	309	30	1084	7
Kraków	885	1802	113	50	6774	112
Lublin	142	1451	103	116	58	58
Łódź	1388	3413	370	146	3789	79
Olsztyn	46	687	144	18	523	14
Opole	109	899	40	34	886	0
Poznań	1810	3785	285	52	2305	22
Racibórz	64	573	81	46	658	0
Radom	354	1444	54	65	1128	67
Rzeszów	627	2335	504	74	2325	100
Słupsk	325	784	19	14	565	0
Szczecin	237	2453	255	62	3476	118
Wałbrzych	492	1010	144	31	603	5
Warszawa	1986	2854	93	1022	9985	220
Wrocław	0	0	0	0	0	0
Zielona Góra	319	680	565	9	530	5
WCKiK	431	1595	69	45	9441	227
CKiK MSWiA	0	0	0	0	0	0
<b>Total</b>	<b>10 314</b>	<b>33 767</b>	<b>4205</b>	<b>2194</b>	<b>54 569</b>	<b>1381</b>

In the member states of the Council of Europe, the average number of blood donors per 1000 inhabitants decreased in the period 2008–2011 from 29.0 to 25.0 [14]. In Poland, in 2023 the average number of blood donors per 1000 inhabitants was estimated at 17.00 (in 2022 — 16.47, in 2021 — 16.14, in 2020 — 14.42, 2019 — 15.39, 2018 — 15.37 and in 2017 — 15.30). This was the highest value in the last several years.

Both in Poland and in other countries, there is a downward trend in the number of people declaring their willingness to donate blood; this is particularly true for certain age groups. In Poland, such a tendency can be observed mostly in the 18–24 age groups i.e. a group of potential future donors of blood and blood components [15].

Apart from the above-mentioned demographic changes, the number of blood donors is adversely affected by factors such as:

- periodic disease outbreaks — e.g. COVID-19 pandemic;
- travel-associated risk of infection e.g. malaria or West-Nile virus [16–18];
- emerging infectious diseases (other than COVID-19) e.g. epidemic of Zika virus infections [19–20];
- health conditions of the population, including reduced hemoglobin levels (the most common cause of deferrals in the last years) [21–23];
- lack of opportunity to donate blood or economic reasons.

**Table 14.** Reasons for blood component wastage in Polish Blood Transfusion Centers in 2023

Reason	Whole blood	RBCs	PC therapeutic doses pooled from whole blood	PC therapeutic doses from apheresis	FFP	Cryoprecipitate
Expiry date	2	12 567	2365	555	13 601	67
Seropositive for transfusion transmitted diseases, syphilis tests, implementation of <i>look-back</i> procedure	6.8	2492	234	108	3816	8
Other causes including: • inadequate visual control • low quantity/volume • incorrect serological results • other, including incorrect procedures, medical deferral, mechanical damage, donor self-deferral etc.	11 099	19 617	1761	1636	49 843	1405
Unused blood components from autologous donations		34			111	
<b>Total</b>	<b>11 107</b>	<b>34 710</b>	<b>4360</b>	<b>2299</b>	<b>67 371</b>	<b>1480</b>

The number of autologous donors has been low in the recent years. In 2023, the figure stood at 273 individuals, slightly higher than in 2022 (247 individuals) but lower than in previous years (313 in 2021, 323 in 2020, 630 in 2019, 598 in 2018, and 692 in 2017). The smaller number of preoperative autologous donations is a phenomenon observed in many countries [24].

In line with current recommendations, autologous donations are mostly relied on when they have significant advantage over allogenic transfusions, and when indications for transfusion are strong. Autologous donations are useful primarily in cases when compatible allogenic blood is unavailable, e.g. when the patient has antibodies against antigens with high prevalence in the population [25].

In 2023, the total number of blood and blood component donations amounted to 1 485 830 including 1 343 779 whole blood donations which is an increase as compared to the previous year (in 2022 — 1 411 025, including 1 289 164 whole blood donations, in 2021 — 1 374 572 including 1 248 585 whole blood donations, in 2020 — 1 201 272 donations and 1 105 434 whole blood donations).

One of the methods used for more effective collection of blood components is automated apheresis. In 2023, compared to 2022, there was an increase in the number of apheresis platelet con-

centrate (PC) donations (from 13 609 to 14 160) as well as the total number of combined PC and plasma donations (from 27 847 to 31 074). There was a reported increase in the number of only plasma donations (from 80 065 to 96 379). Collection by apheresis of other blood components, i.e. RBCs and granulocyte concentrate (GC) was only sporadic.

It is worth noting that automated methods (apheresis) are still used in Poland to a relatively small extent, in 2023 — only 9.56% of all donations were collected by apheresis which is slightly more than in 2022 (8.64%) and in 2021 (9.16%).

In order to make blood donation easier for donors mobile collections are organized. In 2023, the Centers organized 12 443 mobile teams which is more than in the previous years (in 2022 — 12 089 teams, in 2021 — 11 150, in 2020 — 10 432) but still less than in the year 2019 (13 511). The percentage of whole blood donations collected by mobile teams was also relatively small — 20.15%. In 2023, blood was mostly collected at local collection sites — 50.56% of all whole blood donations. This may be explained by the fact that donors are more willing to donate in familiar places. However, the contemporary high standards for collection of blood dedicated for clinical use do not favor small collection sites; centralization of blood transfusion service is recommended.



The demand for blood components is affected by a number of factors, including current guidelines issued by scientific societies, profile of the clinical ward and recommendations of the physician.

In 2023, approximately 34.46 units of RBCs per 1 000 inhabitants were issued for clinical purposes (in 2022 — 33 units, in 2021 — 30.92 units, in 2020 — 27.87, 2019 — 30.7 units, in 2018 — 30.38 units, in 2017 — 30.22 units, 2016 — 29.99, 2015 — 29.87) [12, 13, 26–29].

Following the downward trend in RBC consumption observed in 2020, the RBC consumption in 2022 increased. However, for years now the RBC consumption in Poland has been lower than in some other European countries — e.g. in 2011 the RBC consumption in 32 member states of the Council of Europe averaged 37 units/1000 inhabitants [14].

In 2023 the number of FFP units issued for clinical purposes amounted to 247 201 and was less than in 2022 (252 332 units) and in 2019 (273 519 units), yet more than in 2021 (246 013 units). The ratio of RBCs issued for clinical use to FFP in 2023 was approximately 5.25 (in 2022 — 4.94, in 2021 — 4.81, in 2020 — 4.57, in 2019 — 4.31, in 2018 — 4.09, in 2017 — 3.77, in 2016 — 3.56, in 2015 — 3.45), so the upward trend continues [30–37].

These observations indicate that the consumption of FFP gradually declines as compared to RBC consumption. However, the RBC/FFP ratio still shows a higher consumption of FFP relative to RBCs than in many European countries [14]. This may be explained by the lower consumption of RBCs in Poland — as mentioned above, but in many cases also by the fact that FFP is used with no sufficient rationale and sometimes against currently rather restrictive indications for use [38, 39].

The last several years have witnessed the increase in the consumption of PC. In the period 2015–2019, the number of PC therapeutic units issued for clinical use increased from 114 163 to 129 652 (more than 13%). A similar phenomenon was observed in other countries [40].

In 2020 however, only 120 858 therapeutic units of PC were issued for clinical purposes, so the decline is obvious. In 2021 however, the number of PC therapeutic units issued for clinical use was 130 865, and in 2022 — 138 594 therapeutic units and a further increase was observed in 2023, with 150 765 units issued.

Additional preparation methods (leukocyte depletion, irradiation) for prevention of transfusion associated adverse reactions were applied mainly to PCs (100% leukodepleted PCs and 52.10% ir-

radiated leukodepleted PCs), less often to RBCs (25.35% of leukodepleted RBCs, 10.71% irradiated leukodepleted RBCs and 0.04% irradiated RBCs). As mentioned above, since 2020, only leukodepleted PCs are issued for clinical use in Poland. Moreover, leukodepleted RBCs require additional preparation, while in the case of apheresis PCs leukodepletion usually occurs at collection from the donor. Some automated methods of PC preparation from buffy coat also allow for the simultaneous elimination of leukocytes, but the cost of such procedure is still relatively high as compared to manual methods. Automated methods do however guarantee higher quality parameters due to standardization of preparation methods. Regular leukodepletion is now implemented in many countries; although its effectiveness for prevention of transfusion related adverse reactions is sometimes questioned [41].

As in the previous years, the number of frozen PC units is still too high in some Centers. In 2023 there was a slight decrease in the percentage of frozen PCs. The reported country-wide percentage is acceptable and in 2023 it was 2.58%. Maintaining a certain stock of frozen platelet concentrates (PC) is entirely justified, primarily to address emergency bleeding situations or to support patients with anti-HLA or anti-HPA antibodies. However, the indications for transfusing cryopreserved PC remain very limited. In some blood centers, the proportion of frozen PCs is still excessively high. Freezing more than 10% of the collected PCs is not recommended. It is worth stressing that freezing and thawing increase the cost of preparation of components for clinical use and have a negative impact on the quality parameters of platelets and therefore their therapeutic efficacy. It is encouraging to note the decrease in the percentage of FPCs in Centers where this percentage has traditionally been very high. It is to be hoped that this trend will continue in the upcoming years. However, in some Centers, the percentage still exceeds 30% for all PCs, as well as for specific groups of components — apheresis PC or pooled PC. It should however be emphasized that the overall percentage has decreased as compared to 2022, also in the case of the issued components (decrease from 2.76% to 2.51%).

The Centers are obliged to safeguard the supply of blood/blood components but to fulfil this task they need to cooperate with hospitals and such cooperation requires implementation of appropriate management procedures for blood and blood components in every hospital, taking into account the

individual needs of patients. Furthermore, it is of utmost importance to establish constant and regular cooperation between physicians responsible for blood management, hospital transfusion committees and the Centers.

Depletion of blood and blood component supplies is associated with wastage which — though sometimes inevitable — occurs for a number of reasons. In order to limit the extent of waste of blood and blood components some countries have implemented special procedures [42].

The most common causes of wastage in 2023 (just like in previous years) are included in the category of “other reasons”, in particular:

- inadequate visual control,
- incorrect/low volume,
- incorrect serological results,
- incorrect performance (procedures), medical deferral, mechanical damage, donor self-deferral, etc.

The less frequent causes of waste were expiry date or positive results of viral tests.

Analysis of data related to quarantine and pathogen inactivated FFP and cryoprecipitate reveal that quarantine FFP is still the most commonly used component in clinical practice (76.01%). Although currently all Centers are equipped with PRT systems (some have two different systems) only 8 (in which the percentage of pathogen inactivated blood components exceeds 10%) make adequate use of the illuminators installed on their premises to inactivate PCs and plasma. Other Centers pathogens inactivate only „trace amounts” of plasma and PCs. In 2023, as in 2022, all Centers used pathogen inactivation systems for FFP however, in 16 Centers the percentage of inactivated FFP units decreased (in Warsaw the percentage dropped from 16.90% in 2022 to 14.73% in 2023, in Wałbrzych from 3.18% to 1.79%, in Kraków from 7.58% to 5.73%). An increase in the percentage was observed in some Centers, including the one in Radom where it rose from 2.35% in 2022 to 5.27% in 2023. The biggest percentage of pathogen inactivated units of FFP was in Poznań — 19.31%. For other components, such as pooled leukodepleted PCs and apheresis leukodepleted PCs, the percentage of pathogen inactivation performed in Warsaw was the highest among all Centers at 97.63% and 92.89%, respectively. In 2022, these values were 99.59% for leukodepleted PCs and 96.40% for apheresis leukodepleted PCs. Despite the availability of two inactivation systems, many Centers still reported low percentages of inactivated blood components. Inactivation of leukodeple-

ted PCs and apheresis leukodepleted PCs is still conducted only by a limited number of Centers (leukodepleted PCs: 8 Centers; apheresis leukodepleted PCs: 11 Centers). Among the 8 Centers performing inactivation of leukodepleted PCs, 4 recorded an increase in the percentage of inactivated leukodepleted PCs compared to 2022. Out of the 11 Centers using pathogen inactivation systems for apheresis leukodepleted PCs, 6 reported percentages of inactivated apheresis leukodepleted PCs ranging from 62.34% to 92.89%.

As in the previous years, most Centers did not make adequate use of pathogen inactivation systems implemented on their premises. The most likely reason is that physicians rarely make orders for pathogen inactivated FFP, cryoprecipitate and PCs. One reason for limited use of pathogen inactivated plasma is the easy access to quarantine FFP. Moreover, physicians who order components for clinical use are not always fully aware that pathogen inactivated plasma is much safer than quarantine plasma as it is the safeguard against a wide spectrum of pathogens other than HIV, HBV, HCV and syphilis and offers protection against the consequences of the „diagnostic window” (as is the case for quarantine plasma). It is also likely that not all physicians have adequate knowledge and awareness regarding TA-GVHD prophylaxis which may be due to insufficient information on transfusion-related adverse reactions that are found in guidelines and regulations dedicated to some medical disciplines.

## Conclusions

The study is a brief presentation of selected issues related to the activities of the Polish Blood Transfusion Centers (Centers) in 2023, as well as of some recently recorded trends observed over an extended period of time. In 2023 as compared to the previous years, some values related to the activity of the Polish blood transfusion service (including the number of donors, donations, blood components prepared and issued for clinical use) have increased, what may have an impact to the lifting of the COVID-19 pandemic status in the preceding year and the removal of the epidemic threat status in 2023. The above observations may serve as starting point for the analysis of issues related to the activities of healthcare units in the Polish blood transfusion service, for comparison of experience and development of optimal solutions for the future. Similar data reviews

related to blood and blood components are systematically performed also in other countries.

### **Current problems of blood transfusion service**

One of the most critical challenges facing not only blood services but also all organizational units involved in preparing and utilizing substances of human origin (SoHO) or, more broadly, medicinal products of human origin (MPHO), remains ensuring their safety and traceability. To develop the best solutions in this area, numerous initiatives are being undertaken by global and international organizations, such as WHO publications and conferences, and events like Forum 30 [43].

Emerging and re-emerging infectious agents are increasingly becoming a concern for blood service units and may pose significant threats in the coming years. An example of this is the West Nile Virus (WNV), which was previously endemic to specific regions but now presents a potential threat to Polish blood services. According to data published by the European Centre for Disease Prevention and Control (ECDC), Poland was considered free of native WNV infections in humans [44]. However, with the virus spreading to new areas, influenced by climate change and WNV cases detected in birds in Poland, recommendations to mitigate WNV transmission via transfusion were prepared as early as 2020 [17]. The situation is rapidly evolving, as evidenced by cases of WNV in 2024 among birds, primarily in the Mazowieckie Voivodeship, and infections in horses. This strongly suggests the potential emergence of indigenous WNV infections in humans in Poland. Given these developments, it is crucial to prepare for ensuring the safety of blood components under such circumstances. Various aspects and possible action scenarios must be considered. In particular, it is essential to explore solutions that do not necessitate halting blood collection in areas where indigenous WNV cases are detected.

Problems related to the declining number of donors, fewer whole blood donations as the main source of RBCs — the most common blood components — are currently a major challenge for the blood transfusion service. This was particularly noticeable during the COVID-19 pandemic. The COVID-19 pandemic highlighted the vulnerability of blood donation systems to such situations. Research is being conducted in many countries to study trends in blood donation, including the potential to predict the supply of blood and blood components.

Predictive models allow for the estimation of donation volumes in future years, accounting for various unforeseen circumstances. Interestingly, a similar trend to that observed in Poland is being reported elsewhere: a decline in blood donation rates among younger age groups and an increase among older ones. This suggests the need for diverse strategies and tailored approaches to encourage blood donation, depending on the age category of potential and current donors [45].

On the one hand, it is important to effectively manage donors (which is the task of blood transfusion service) as well as patients (which is the task of medical entities).

It is also important to emphasize the need to maintain exclusively voluntary, unpaid blood donation, which ensures greater safety of the collected blood and its components, thereby enhancing patient safety. Both global legal regulations and various publications highlight this aspect as a critical factor [46].

The solutions developed in the previous years are still relevant and involve the following important motions related to blood:

- implementation of additional precautions and safety measures in blood establishments;
- implementation of additional criteria for blood donor deferral associated with current epidemiological situation, and
- implementation of solutions for coping with new challenges related to predicted deficiencies in the supply of blood and blood components, emergency situations and development of principles for priority supply of blood for patients.

There are ongoing studies to assess the effective use of the available stock of blood components and to restrict indication criteria for transfusion e.g. lower hemoglobin level at which transfusion is indicated [47, 48].

It is interesting that in the United States, for example, after a several year period of decline in the number of donations (and therefore a lower number of RBC units), since 2019 a stabilization of both the amount of prepared RBCs and the number of units used for clinical purposes has been observed [49].

A limitation of the studies and study results is the inability to obtain data on the one hand from all Centers which collect blood and on the other — from medical entities that transfuse blood and blood components. One must also consider differences in the consumption of blood components

by regions as well as medical specialties (e.g., pediatric or emergency medicine departments).

Of utmost importance are: proper management of blood donors, ensuring the safety of personnel in blood transfusion establishments as well as implementation and application of Patient Blood Management (PBM) principles in situations of crisis [50–52].

In the coming years, the focus of attention shall be to seek methods and solutions to encourage voluntary blood donation in the general population and to determine the amount of blood components ordered and used in the clinical wards. The lack of a unified database for collection of reliable data is one of the main obstacles for proper assessment of both the capabilities of blood establishments as well as the needs of the medical entities. Implementation of the e-blood system which is currently developed should facilitate such assessment.

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