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Blood transfusion service in Poland in 2022

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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 2022.*

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

Results: *In 2022, there were 23 Centers and 135 local collection sites operating in Poland. Blood and blood components were also collected during 12 089 mobile collections. The overall numer of blood donors was estimated at 621 936, the majority of which were non-remunerated donors (621 715, including 31 243 responders to donation appeals) as well as 31 remunerated donors and 247 autologous donors. Most frequent were whole blood collections (1 289 164 donations), and the least frequent — granulocyte concentrate collections (111 donations) and collections by apheresis of RBC as the only component (15 donations). Whole blood was collected mostly in local collection sites (50.19%), less frequently in Centers (30.25%) and during mobile collections (19.56%). The most frequently prepared blood components were RBCs (1 266 346 units) and FFP (1 537 211 units). COVID-19 convalescent plasma was collected only sporadically (339 units altogether). In 2022, a total of 90 009 units of PCs pooled from whole blood and 52 957 units of PCs from apheresis were prepared.*

Additional processing methods (leukocyte depletion, irradiation) were more frequently applied to PCs (44.74% leukodepleted, 55.26% both leukodepleted and irradiated), than to RBCs (23.06% leukodepleted, 10.38% both leukodepleted and irradiated, 0.05% irradiated). Pathogen reaction technologies were applied to 24.73% of FFP units issued for clinical use and 12.70% of PCs.

For various reasons the following amounts of blood components were wasted in 2022: 12 935 units of whole blood, 32 803 units of RBCs, 58 122 units of FFP, 1582 units of apheresis PCs, 3658 units of pooled PCs and 1681 units of cryoprecipitate.

As compared to the years 2020–2021, the value of most indicators of the activity of the blood transfusion service in Poland has increased.

Conclusions: *The study data point to a smaller impact of the COVID-19 pandemic on blood donation in Poland in the year 2022 as compared to 2019–2021. The data may serve*

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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; COVID-19

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Introduction

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.

In this presentation of selected issues related to the annual activities of the public blood transfusion service in Poland in 2022 we take into account some conditions of the first several months of the year as caused by the COVID-19 pandemic. The following topics were discussed for 2022: 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.

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 2022. 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. One automated plasmapheresis procedure provides 3 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 ≥ 3×10^{11} platelets.

Results

Blood Transfusion Centers (Centers)

In 2022, there were 23 Centers and 135 local collection sites operating in Poland. Moreover, 12 089 mobile collections were organized which is about 8.42% more than in the previous year. In 2022 mobile collections were organized by all RCKiK and WCKiK. The largest number of mobile collections was organized by RCKiK in Łódź (1672). More than 1000 mobile collections were organized also by RCKiK in Katowice (1085) and Warsaw (1131). As compared to the previous year, the number of mobile collections increased in 19 RCKiK and decreased in 3 (Table 1).

Donors

In 2022, a total of 711 801 persons came to donate blood (in 2021 — 703 958), but only some of them (621 936) were found eligible for donation (in 2021 — 615 784).

As in the previous years, blood or blood components for clinical use were donated by 87% of the people who were willing to donate blood. The difference was mainly due to donor deferral. In 2022, a total of 9061 permanent deferrals were applied. There were also 224 128 temporary deferrals of 189 646 people, and the most common cause for deferral (74 236 cases) was low hemoglobin level (like in the previous years).

Temporary deferral was also applied to 558 people for various reasons related to the COVID-19 pandemic (disease itself, quarantine, contact with infected person/persons) and vaccinations (81). However, the number of deferrals for these reasons was significantly lower than in 2021 (3882, including 1802 vaccinations).

Donors were mostly voluntary unremunerated (621 715). In 2022, blood and blood components were also donated by 31 remunerated donors and 247 autologous donors. Amongst voluntary donors, 31 243 were responders to appeal and 67 were directed donors.

In 20 Centers blood was donated only by voluntary unremunerated donors. The highest numbers of remunerated donors were reported by RCKiK in Gdańsk (28).

Among the donors of blood and blood components there were 135 962 first-time donors (21.86%), 399 172 multiple regular donors (64.18%) and 86 802 multiple repeat donors (13.96%).

17 Centers reported an increase in the number of donors (from 0.11 to 9.67%), and 6 reported decrease (from 0.02 to 10.15%). Table 2 presents the number of donors in each Center in 2022.

As in the previous years, the most numerous group were blood donors aged 18 to 44 (a total of 509 818, including 128 481 women and 381 337 men).

Donations

In 2022, whole blood was the most frequently collected blood component (1 289 164 donations), while the least frequent were collections of: granulocyte concentrate (111 donations in 5 RCKiK) and apheresis RBCs as the only component (15 donations in 2 RCKiK). As in previous years, the largest numbers of whole blood donations were reported by RCKiK in Warsaw (112 595) and Katowice (123 610). Apheresis was mainly used for preparation of PCs (13 609 donations) and plasma (80 065 donations). The largest numbers of apheresis plasma donations were reported by RCKiK in Kalisz (15 773), and apheresis PC donations by RCKiK in Warsaw (2640).

Automated donations of a combination of blood components, mostly of PC and plasma (27 847 donations) were also collected mostly in RCKiK in Warsaw (8410), less frequently of PC and RBCs (214 donations) — almost exclusively at RCKiK in Wrocław (200 donations).

Table 3 presents the number of complete donations of blood and blood components in 2022.

Blood was collected primarily in the local collection sites (50.19% of whole blood donations), less frequently at the Center premises (30.25%), and during mobile collections (19.56%). As in previous years, the largest number of whole blood donations — 49.18% — took place during mobile collections organized by the RCKiK in Wałbrzych. Table 4 provides a list of whole blood collection sites in 2022.

Blood components

Red blood cells

Donated blood was processed into blood components, mostly RBC (a total of 1 266 346 units), which was a slight country-wide increase as compared to the previous year (1 231 538 units). As in previous years, the largest amount of RBCs was obtained in RCKiK in Katowice and Warsaw (122 796 and 112 300 units, respectively) (Table 5). Most Centers (19) reported an increase in the number of RBC units.

Table 1. Mobile collections organized in Polish Blood Transfusion Centers in 2021 and 2022

Center	Mobile collections		
	2021	2022	Tendency (increase/decrease compared to 2021)
Białystok	581	636	↑
Bydgoszcz	770	782	↑
Gdańsk	201	205	↑
Kalisz	413	428	↑
Katowice	1273	1085	↓
Kielce	206	331	↑
Kraków	712	834	↑
Lublin	403	439	↑
Łódź	1267	1672	↑
Olsztyn	511	530	↑
Opole	154	176	↑
Poznań	717	849	↑
Racibórz	113	131	↑
Radom	399	431	↑
Rzeszów	304	217	↓
Słupsk	131	206	↑
Szczecin	359	383	↑
Wałbrzych	965	832	↓
Warszawa	1048	1131	↑
Wrocław	227	236	↑
Zielona Góra	201	205	↑
WCKiK	195	350	↑
CKiK MSWiA	0	0	bz
Total	**11 150**	**12 089**	↑

WCKiK — Military Blood Transfusion Center; CKiK MSWiA — Blood Transfusion Center of Internal Affairs and Administration; ↓ — decrease as compared to 2021; ↑ — increase as compared to 2021; bz — no change since 2021

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

In 2022, a total of 292 065 units of leukodepleted RBCs were obtained (23.06% of all RBC units) and 131 387 units of leukodepleted irradiated RBCs (10.38%). RBC irradiation only was used sporadically, yielding 619 units of irradiated RBCs — 0.05% of all RBC units.

Country-wide, 33.44% of all RBCs were leukodepleted and 10.42% of RBCs were irradiated. Table 6 presents the number of leukodepleted and irradiated units of RBC prepared in individual Centers in 2022.

Platelet concentrate

Platelet concentrate was the second most frequently prepared cellular blood component, just like in the years before. 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 leuko-reduced and require no additional elimination of leukocytes.

In 2022, a total of 90 009 units of pooled PC were prepared (in 2021 — 85 677), including 52 110 units obtained from buffy coat with manual method and 37 899 with automated methods.

Table 2. Blood donors in Polish Blood Transfusion Centers in 2022

Center	Donors				Tendency (increase/decrease compared to 2021)
	First time	Multiple--regular	Multiple repeat	Total	
Białystok	4255	20 954	4225	29 434	↑
Bydgoszcz	6746	24 098	5292	36 136	↑
Gdańsk	5822	19 472	4 003	29 297	↑
Kalisz	3955	15 867	2883	22 705	↑
Katowice	9575	36 254	6841	52 670	↓
Kielce	3974	10 419	3006	17 399	↑
Kraków	11 260	32 545	7314	51 119	↑
Lublin	6425	19 264	4414	30 103	↑
Łódź	9327	22 283	6815	38 425	↑
Olsztyn	5999	12 430	992	19 421	↑
Opole	2573	10 108	1812	14 493	↑
Poznań	14 166	28 489	4296	46 951	↑
Racibórz	1943	9268	1994	13 205	↑
Radom	2473	7557	1803	11 833	↓
Rzeszów	5397	21 778	3956	31 131	↑
Słupsk	2392	5926	1531	9849	↑
Szczecin	5389	14 969	3499	23 857	↑
Wałbrzych	2605	8383	1437	12 425	↓
Warszawa	12 351	36 853	9222	58 426	↓
Wrocław	7849	23 758	5317	36 924	↓
Zielona Góra	3147	7612	3774	14 533	↓
WCKiK	6750	8487	2348	17 585	↑
CKiK MSWiA	1589	2398	28	4015	↑
Total	**135 962**	**399 172**	**86 802**	**621 936**	↑

WCKiK — Military Blood Transfusion Center; CKiK MSWiA — Blood Transfusion Center of Internal Affairs and Administration; ↓ — decrease as compared to 2021; ↑ — increase as compared to 2021

In 2022, a total of 52 957 units of PCs were obtained by apheresis (37.04% of all units issued for clinical use; in 2021 — 37.93%).

The highest number of PCs units from whole blood was obtained in Katowice (10 726 therapeutic units) and Poznań (10 360 PC units), while from apheresis — in Warsaw (11 125).

The percentage of apheresis PCs differed significantly between Centers — from 1.80% in Zielona Góra to 71.47% in Warsaw and 84.36% in Białystok (Table 7).

Since the beginning of 2021, only leukodepleted PCs are issued for clinical use in Poland; some part of PC units are also irradiated. In 2022, a total of 63 958 therapeutic doses of leukodepleted PCs were obtained which accounted for 44.74% of all obtained PCs, as well as 79 008 therapeutic doses of irradiated leukodepleted PCs (55.26%).

Table 8 presents the numbers of leukodepleted and irradiated PCs obtained in Polish Centers in 2022.

In 2022, a total of 138 594 therapeutic doses of PCs were issued for clinical use (in 2015 — 114 163, in 2016 — 118 391, in 2017 — 123 668, in 2018 — 127 049, in 2019 — 129,652, in 2020 — 120 858 and in 2021 — 130 865). So, after a decrease reported in 2020, a marked increase was recorded.

Some part of the prepared PCs were stored frozen (frozen platelet concentrate).

In 2022, subjected to freezing was 3.71% of all PCs (including 1.94% of pooled PCs and 6.78% of apheresis PCs).

In 2022, there was another slight increase in the percentage of frozen blood components (by 0.93%) although a decrease in the number of frozen PCs had been recorded for several last years. An

Table 3. Whole blood and apheresis donations in 2022*

Center	Whole blood	Apheresis						Total
		Plasma	RBC	PC	GC	PC + plasma	PC + RBC	
Białystok	59 945	12 551	0	100	1	2094	0	74 691
Bydgoszcz	73 144	9784	1	883	15	0	0	83 827
Gdańsk	65 024	1582	0	357	0	109	0	67 072
Kalisz	44 376	15 773	0	0	0	427	0	60 576
Katowice	123 610	191	0	734	0	5230	0	129 765
Kielce	33 936	1367	0	785	0	0	0	36 088
Kraków	110 462	1309	0	1820	63	0	0	113 654
Lublin	61 253	6061	0	0	0	1943	0	69 257
Łódź	76 865	1179	0	1480	18	0	0	79 542
Olsztyn	40 746	1856	0	351	0	108	0	43 061
Opole	31 983	1163	0	723	0	165	0	34 034
Poznań	100 829	6543	0	0	0	1566	0	108 938
Racibórz	26 294	5242	0	0	0	397	0	31 933
Radom	23 278	2628	0	16	0	880	0	26 802
Rzeszów	67 860	4506	0	1887	0	91	0	74 344
Słupsk	19 784	1005	14	29	0	227	14	21 073
Szczecin	50 153	1061	0	5	0	940	0	52 159
Wałbrzych	27 604	274	0	26	0	196	0	28 100
Warszawa	112 595	1141	0	2640	14	8410	0	124 800
Wrocław	69 909	4641	0	1669	0	5003	200	81 422
Zielona Góra	31 867	206	0	0	0	61	0	32 134
WCKiK	30 390	1	0	54	0	0	0	30 445
CKiK MSWiA	7257	1	0	50	0	0	0	7308
Total	**1 289 164**	**80 065**	**15**	**13 609**	**111**	**27 847**	**214**	**1 411 025**

WCKiK — Military Blood Transfusion Center; CKiK MSWiA — Blood Transfusion Center of Internal Affairs and Administration;*Complete donations only

increase was noted in the percentage of frozen apheresis PCs (by 2.1%) as well as of pooled PCs (by 0.12%). In most centers the percentage of frozen PCs did not change much in the consecutive years. In 2022, there are however significant differences in this respect between individual Centers, ranging from 0% in Kalisz, Poznań and WCKiK to 11.60% in Słupsk (decrease by 0.51% as compared to 2021), 17.26% in Wałbrzych (increase by 3.42%), 35.88% in Opole (increase by 12.59%), 43.26% in Radom (increase by 24.46%) and 56.18% in Racibórz (increase by 5.28%). Unlike in the previous years, Centers in Opole, Radom and Wałbrzych reported increase in the percentage of frozen PCs. As in the previous years, Racibórz reported the highest percentage of frozen pooled PCs (57.89%, decrease by 11.49%). In Wałbrzych, Radom, Racibórz, Słupsk, Zielona Góra, CKiK MSWiA reported

Table 4. Sites of whole blood collection in 2022

Centers	Whole blood collected (units)*						
	Center site		Local collection site		Mobile collection site		Total
	U	%	U	%	U	%	U
Białystok	27 081	44.91	19 351	32.09	13 871	23.00	60 303
Bydgoszcz	18 851	25.61	30 578	41.54	24 178	32.85	73 607
Gdańsk	21 940	33.51	38 407	58.66	5125	7.83	65 472
Kalisz	9872	22.12	20 239	45.35	14 513	32.52	44 624
Katowice	23 475	18.65	80 497	63.96	21 892	17.39	125 864
Kielce	14 531	42.54	10 563	30.93	9062	26.53	34 156
Kraków	25 560	22.98	63 874	57.43	21 789	19.59	111 223
Lublin	15 575	25.15	35 545	57.40	10 807	17.45	61 927
Łódź	29 992	38.58	32 782	42.17	14 959	19.24	77 733
Olsztyn	13 179	32.03	17 569	42.69	10 404	25.28	41 152
Opole	7168	22.36	21 766	67.90	3123	9.74	32 057
Poznań	27 898	27.15	56 746	55.23	18 103	17.62	102 747
Racibórz	3937	14.82	19 552	73.62	3069	11.56	26 558
Radom	13 489	57.66	1975	8.44	7932	33.90	23 396
Rzeszów	16 362	23.92	47 068	68.81	4973	7.27	68 403
Słupsk	11 294	55.86	5454	26.98	3469	17.16	20 217
Szczecin	21 758	43.15	19 637	38.95	9027	17.90	50 422
Wałbrzych	14 246	50.82	0	0.00	13 785	49.18	28 031
Warszawa	25 457	22.35	62 494	54.86	25 964	22.79	113 915
Wrocław	33 130	46.89	30 428	43.06	7104	10.05	70 662
Ziel. Góra	10 405	32.40	17 503	54.50	4209	13.11	32 117
WCKiK	1632	5.29	21 793	70.63	7432	24.09	30 857
CKiK MSWiA	7300	100.00	0	0.00	0	0.00	7 300
Total	**394 132**	**30.25**	**653 821**	**50.19**	**254 790**	**19.56**	**1 302 743**

WCKiK — Military Blood Transfusion Center; CKiK MSWiA — Blood Transfusion Center of Internal Affairs and Administration; *incomplete donations included

the highest percentage of frozen apheresis PCs (72.98%; 70.65%, 54.19%, 53.09%, 46.67% and 28.00% respectively). At the same time, it should be noted that in Zielona Góra only 60 apheresis PCs were collected, 28 of which were frozen, while CKiK MSWiA collected 50 PCs and subjected 7 to freezing, hence such a high percentage of frozen PCs from apheresis.

In 2022, thawed frozen PCs accounted for 2.76% of all PC therapeutic doses issued for clinical use, i.e. 0.08% less than in 2021. The largest number of thawed PC units was reported by Racibórz (45.27% of all PC units issued for clinical use), Opole (24.91%), Radom (23.20%), Wałbrzych (15.45%) as well as Słupsk (10.02%). Only the Centers in Kalisz, and Poznań reported no thawed PCs issued for clinical use.

Fresh frozen plasma

In 2022, a total of 1 537 211 FFP units were prepared (in 2019 — 1 373 514 units, in 2020 — 1 264 654 units and in 2021 — 1 425 640 units). As

Table 5. Units of RBCs prepared in Polish Blood Transfusion Centers in 2022

Center	RBCs	Increase/decrease compared to 2021
Białystok	59 923	↑
Bydgoszcz	73 103	↑
Gdańsk	64 822	↑
Kalisz	41 069	↑
Katowice	122 796	↑
Kielce	33 881	↑
Kraków	110 330	↑
Lublin	61 115	↑
Łódź	76 471	↑
Olsztyn	40 687	↑
Opole	31 922	↑
Poznań	93 163	↑
Racibórz	26 234	↓
Radom	22 883	↓
Rzeszów	66 345	↑
Słupsk	19 784	↑
Szczecin	50 126	↑
Wałbrzych	27 604	↑
Warszawa	112 300	↓
Wrocław	62 082	↑
Zielona Góra	31 819	↑
WCKiK	30 642	↓
CKiK MSWiA	7245	↑
Total	**1 266 346**	↑

WCKiK — Military Blood Transfusion Center; CKiK MSWiA — Blood Transfusion Center of Internal Affairs and Administration; ↓ — decrease as compared to 2021; ↑ — increase as compared to 2021

in the previous years, FFP was mainly obtained by manual method, i.e. plasma obtained from anticoagulated whole blood. With this method, 1 247 356 FFP units were obtained in 2022. On the other hand, with the less frequent method of apheresis 289 855 units were obtained, i.e. 18.86% of the total (in 2021 — 232 001 units, i.e. 16.27% of the total). This is the continuation of the upward trend observed for the last several years.

The percentage of FFP obtained by apheresis differed between Centers (the highest was reported by RCKiK in Kalisz — 54.16% and Białystok — 46.82%).

Table 9 presents the number of FFP units obtained by the manual method and by apheresis in individual Centers in 2022.

A total of 252 332 FFP units were issued for clinical use which is more than in 2021 (246 013 FFP units) though still less than in 2019 — 273 519). As compared to the previous year, the number of FFP units issued for clinical use increased in most (17) Centers (Table 10).

COVID-19 convalescent plasma

In 2022, convalescent plasma was collected less frequently than in the previous years. A total of 339 units were collected for clinical purposes (in 2020 and 2021 — 87 071 and 57 708 respectively). Convalescent plasma was collected by 6 Centers; the highest volumes (173 units) were reported by the Center in Warsaw. 590 units of convalescent plasma were issued for clinical use (in 2021 — 58 670; in 2020 — 25 868). Table 11 presents the numbers of units obtained from COVD-19 convalescents and issued for clinical purposes by individual Centers in 2022.

Granulocyte concentrate

As in previous years, in 2022 granulocyte concentrate (GC) was only sporadically obtained (111 donations in 5 Centers), although more frequently than in 2021 (104 donations) and in 2020 (82 donations). Most GC donations took place in Kraków (63) and Łódź (18).

Quarantine and inactivation of biological pathogens in labile blood components

In Poland only quarantine[1] 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

[1] 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 6. Leukodepleted and irradiated RBCs prepared in Polish Blood Transfusion Centers in 2022

Center	Units of leukodepleted RBCs	Units of lirradiated RBCs	Units of both leukodepleted and irradiated RBCs
Białystok	1780	0	7164
Bydgoszcz	3371	0	12 325
Gdańsk	1953	3	19 533
Kalisz	38 402	0	759
Katowice	41 455	3	7248
Kielce	6240	0	3903
Kraków	9254	289	7527
Lublin	8813	7	10 532
Łódź	9100	26	14 017
Olsztyn	4458	0	4874
Opole	4204	0	606
Poznań	38 586	4	8106
Racibórz	2654	0	43
Radom	1944	0	82
Rzeszów	323	56	7851
Słupsk	1398	0	1791
Szczecin	1344	218	2531
Wałbrzych	2670	0	0
Warszawa	96 638	0	9124
Wrocław	3993	13	10 747
Zielona Góra	3453	0	2563
WCKiK	3073	0	61
CKiK MSWiA	6960	0	0
Total	**292 065**	**619**	**131 387**

WCKiK — Military Blood Transfusion Center; CKiK MSWiA — Blood Transfusion Center of Internal Affairs and Administration

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 2022 pathogen inactivation technology (PRT) was implemented in 23 Centers which used:

— Mirasol — 18 Centers (in 16 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 0.11% in Szczecin to 17.51% in Poznań. In 3 Centers, the volume of inactivated plasma exceeded 10% (Poznań — 17.51%, Warsaw — 16.9% and CKiK MSWiA — 13.20%). respectively). In another 3. Centers the percentage ranged from 3.18 to 7.57%.

Table 7. PCs from whole blood and apheresis (2022)

Center	PC (therapeutic doses)			
	Pooled (from whole blood)	Aheresis	Total	% of apheresis PCs
Białystok	1215	6554	7769	84.36
Bydgoszcz	8423	1060	9483	11.18
Gdańsk	5771	964	6735	14.31
Kalisz	1767	745	2512	29.66
Katowice	10 726	7310	18 036	40.53
Kielce	3140	927	4067	22.79
Kraków	8688	2456	11 144	22.04
Lublin	4763	2059	6822	30.18
Łódź	4650	1494	6144	24.32
Olsztyn	3750	562	4312	13.03
Opole	486	888	1374	64.63
Poznań	10 360	2774	13 134	21.12
Racibórz	596	513	1109	46.26
Radom	578	913	1491	61.23
Rzeszów	6632	2026	8658	23.40
Słupsk	1202	307	1509	20.34
Szczecin	3705	1251	4956	25.24
Wałbrzych	1797	248	2045	12.13
Warszawa	4442	11 125	15 567	71.47
Wrocław	3738	8617	12 355	69.75
Zielona Góra	3273	60	3273	1.80
WCKiK	154	54	208	25.96
CKiK MSWiA	153	50	203	24.63
Total	**90 009**	**52 957**	**142 966**	**37.04**

WCKiK — Military Blood Transfusion Center; CKiK MSWiA — Blood Transfusion Center of Internal Affairs and Administration

Countrywide, 4.69% of all plasma was subjected to inactivation. COVID-19 convalescent plasma was also subjected to inactivation and the values ranged from 58.96% in Warsaw to 100% in WCKiK, CKiK MSWiA as well as Kraków and Radom. Countrywide, 43.07% of COVID-19 convalescent plasma was pathogen inactivated. It is worth noting that the volume of collected COVID-19 convalescent plasma markedly decreased during the last two years.

In 2022, 75.25% of quarantine FFP and 92.15% of quarantine cryoprecipitate were issued for clinical use. 24.73% units of FFP and 9.48% units of cryoprecipitate subjected to pathogen inactivation were issued to hospitals (cryoprecipitate — only in Poznań and Bydgoszcz).

Inactivation of pooled PCs was performed in 8 Centers (7 with Mirasol system, 1 with Intercept). The percentage of pooled PCs subjected to

Table 8. Leukodepleted and irradiated PCs prepared in Polish Blood Transfusion Centers (2022)

Center	PC therapeutic doses	Leukodepleted PCs	Irradiated leukodepleted PCs
Białystok	7769	0	7769
Bydgoszcz	9483	605	8878
Gdańsk	6735	384	6351
Kalisz	2512	2330	182
Katowice	18 036	11 193	6843
Kielce	4067	2282	1785
Kraków	11 144	5537	5607
Lublin	6822	838	5984
Łódź	6144	570	5574
Olsztyn	4312	510	3802
Opole	1374	1256	118
Poznań	13 134	5064	8070
Racibórz	1109	1101	8
Radom	1491	1481	10
Rzeszów	8658	4649	4009
Słupsk	1509	627	882
Szczecin	4956	1731	3225
Wałbrzych	2045	2045	0
Warszawa	15 567	15 567	0
Wrocław	12 355	3721	8634
Zielona Góra	3333	2056	1277
WCKiK	208	208	0
CKiK MSWiA	203	203	0
Total	**142 966**	**63 958**	**79 008**

WCKiK — Military Blood Transfusion Center; CKiK MSWiA — Blood Transfusion Center of Internal Affairs and Administration

inactivation ranged from 0.31% (Center in Lublin) to 99.59% (Center in Warsaw). Countrywide, this accounted for 5.38% of all pooled PC units.

9 Centers inactivated apheresis PCs (7 used Mirasol, 1 used Intercept and 1 Center — in Radom — used both systems). The percentage of inactivated apheresis PCs ranged from 0.68% (in Katowice) to 96.40% (in Warsaw). Countrywide, this accounted for 24.34% of all apheresis PC units. In 2022, 12.70% of all pathogen inactivated PC therapeutical units were issued for clinical use.

Table 12 presents the percentage of FFP, pooled PCs and PC units from apheresis subjected to pathogen inactivation in Centers (2022).

Table 13 presents the percentage of COVID-19 convalescent plasma subjected to pathogen inactivation in 2022.

Table 9. FFP (from whole blood and apheresis) prepared in Polish Blood Transfusion Centers in 2022 (number of units)

Center	Whole blood (manual method)	Apheresis	Total	% apheresis FFP
Białystok	59 928	52 759	112 687	46.82
Bydgoszcz	72 550	29 397	101 947	28.84
Gdańsk	64 803	4875	69 678	7.00
Kalisz	40 912	48 340	89 252	54.16
Katowice	122 796	5810	128 606	4.52
Kielce	33 824	4124	37 948	10.87
Kraków	110 322	3888	114 210	3.40
Lublin	59 050	20 355	79 405	25.63
Łódź	76 470	3407	79 877	4.27
Olsztyn	39 978	5748	45 726	12.57
Opole	31 922	3210	35 132	9.14
Poznań	92 990	24 180	117 170	20.64
Racibórz	26 234	16 351	42 585	38.40
Radom	22 846	8103	30 949	26.18
Rzeszów	66 332	13 526	79 858	16.94
Słupsk	19 813	3516	23 329	15.07
Szczecin	50 127	4700	54 827	8.57
Wałbrzych	26 933	1 176	28 109	4.18
Warszawa	112 227	11 718	123 945	9.45
Wrocław	61 874	24 054	85 928	27.99
Zielona Góra	31 819	618	32 437	1.91
WCKiK	16 614	0	16 614	0.00
CKiK MSWiA	6992	0	6992	0.00
Total	**1 247 356**	**289 855**	**1 537 211**	**18.86**

WCKiK — Military Blood Transfusion Center; CKiK MSWiA — Blood Transfusion Center of Internal Affairs and Administration

Table 14 presents the percentage of FFP, cryopercipitate and PC therapeutic units issued for clinical use following pathogen inactivation (2022).

Wastage of blood and blood components

In 2022, a total of 110 782 units of blood and most common blood components were wasted, including 12 935 units of anticoagulated whole blood, 32 803 units of RBCs, 58 122 units of FFP, 1582 therapeutic units of apheresis PCs, 3658 units of pooled PCs as well as 1681 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:

Table 10. FFP issued for clinical use in Polish Blood Transfusion Centers in 2022 (convalescent plasma not included)

Center	FFP issued for clinical use (units)	Tendency (increase/decrease compared to 2021)
Białystok	11 657	↑
Bydgoszcz	14 154	↑
Gdańsk	8792	↑
Kalisz	3353	↑
Katowice	23 395	↑
Kielce	5709	↓
Kraków	22 065	↑
Lublin	14 569	↓
Łódź	14 198	↓
Olsztyn	7291	↑
Opole	4937	↓
Poznań	18 451	↑
Racibórz	2314	↑
Radom	2267	↑
Rzeszów	11 809	↑
Słupsk	2371	↑
Szczecin	12 515	↓
Wałbrzych	6142	↓
Warszawa	35 924	↓
Wrocław	10 766	↑
Zielona Góra	6323	↑
WCKiK	9964	↓
CKiK MSWiA	3368	↑
Total	**252 332**	↑

WCKiK — Military Blood Transfusion Center; CKiK MSWiA — Blood Transfusion Center of Internal Affairs and Administration; ↓ — decrease as compared to 2021; ↑— increase as compared to 2021

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

Components from autologous donations that were not put to clinical use were also subjected to wastage (33 units of RBCs and 101 units of FFP).

Table 15 presents the number of blood components wasted in individual Centers in 2022; causes of waste are presented in Table 16.

Discussion

The year 2022 was still the year of COVID-19 pandemic but as of May 16th 2022 the state of pandemic has been replaced by the state of epidemic emergency. Regardless of the context however, the basic factor that determines the availability of blood supply is still the good will of a sufficient number of volunteer, non-remunerated blood donors [5–9].

In line with the observations presented above, in 2022 the number of donors in the Centers in Poland (621 936) was the highest in several last years (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 [10–12].

So, during the 2011–2022 period, the 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.

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 [13]. In Poland, in 2022 the average number of blood donors per 1000 inhabitants was estimated at 16.47 (in 2021 — 16.14, in 2020 — 14.42, in 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 group i.e. a group of potential future donors of blood and blood components [14].

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

Table 11. Convalescent plasma collected and issued for clinical use by Polish Blood Transfusion Centers in 2022

Center	Convalescent plasma collected (units)	Issued for clinical use (units)
Białystok	0	7
Bydgoszcz	0	0
Gdańsk	0	24
Kalisz	0	0
Katowice	0	29
Kielce	12	30
Kraków	8	12
Lublin	0	35
Łódź	64	9
Olsztyn	0	0
Opole	0	28
Poznań	0	8
Racibórz	0	0
Radom	24	17
Rzeszów	28	0
Słupsk	0	0
Szczecin	21	12
Wałbrzych	3	0
Warszawa	173	0
Wrocław	0	25
Zielona Góra	0	351
WCKiK	3	0
CKiK MSWiA	3	3
Total	**339**	**590**

WCKiK — Military Blood Transfusion Center; CKiK MSWiA — Blood Transfusion Center of Internal Affairs and Administration

— periodic disease outbreaks — eg. COVID-19 pandemic;
— travel-associated risk of infection e.g. malaria or West Nile virus [15–17];
— emerging infectious diseases (other than COVID-19) e.g. the epidemic of Zika virus infections [18–19];
— health condition of the population, including reduced hemoglobin levels (the most common cause of deferrals in the last years) [20–22];
— no opportunity to donate blood or economic reasons.

The number of autologous donors has been low in the recent years. In 2022, it was estimated at 247, i.e. the lowest number in the last several years (in 2021 — 313, in 2020 — 323, in 2019 — 630, in 2018 — 598, in 2017 — 692). The smaller number of preoperative autologous donations is a phenomenon observed in many countries [23].

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, eg. when the patient has antibodies against antigens with high prevalence in the population [24].

In 2022, the total number of blood and blood component donations amounted to 1 411 025 including 1 289 164 whole blood donations which is an increase as compared to the previous year (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 2022, the number of apheresis PCs and plasma donations combined increased as compared to 2021 (from 26 518 to 27 847) while the number of only PC donations decreased (from 14 411 to 13 609). There was a reported decrease in the number of only plasma donations (from 84 818 to 80 065). Collection by apheresis of other blood components, ie 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 2022 — only 8.64% of all donations were collected by apheresis which is less than in 2021 (9.16%).

In order to make blood donation easier for donors mobile collections are organized. In 2022, the Centers organized 12 089 mobile teams which is more than in the previous years (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 — 19.56%. In 2022, blood was mostly collected at local collection sites — 50.19% 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. No doubt, the COVID-19 pandemic also had strong

Table 12. Percentage of pathogen-inactivated units of FFP, pooled PCs, apheresis PCs prepared in Polish Blood Transfusion Centers in 2022

Center	FFP (%)	Pooled PCs (%)	Apheresis PCs (%)	Systems
Białystok	1.26	0.00	0.00	Theraflex, Mirasol
Bydgoszcz	2.44	0.00	0.00	Theraflex, Mirasol
Gdańsk	1.12	0.00	0.00	Theraflex, Mirasol
Kalisz	2.07	0.00	0.00	Theraflex
Katowice	0.96	0.70	0.68	Mirasol
Kielce	0.74	0.00	66.67	Mirasol
Kraków	7.58	0.92	0.73	Mirasol
Lublin	2.43	0.31	8.35	Theraflex, Mirasol
Łódź	1.17	2.06	0.80	Mirasol, Intercept
Olsztyn	2.52	0.00	0.00	Theraflex
Opole	2.30	0.00	0.00	Theraflex
Poznań	17.51	0.00	0.00	Theraflex
Racibórz	1.13	0.00	0.00	Theraflex
Radom	2.35	0.00	56.96	Mirasol, Intercept
Rzeszów	2.76	1.43	12.29	Theraflex, Mirasol
Słupsk	0.35	0.00	0.00	Mirasol
Szczecin	0.11	0.00	0.00	Mirasol, Interscept
Wałbrzych	3.18	0.00	0.00	Mirasol
Warszawa	16.90	99.59	96.40	Mirasol, Intercept
Wrocław	3.38	0.00	0.00	Theraflex, Mirasol
Zielona Góra	2.20	0.00	0.00	Theraflex
WCKiK	0.98	33.12	44.44	Mirasol
CKiK MSWiA	13.20	1.31	54.00	Mirasol
Total	**4.69**	**5.38**	**24.34**	

WCKiK — Military Blood Transfusion Center; CKiK MSWiA — Blood Transfusion Center of Internal Affairs and Administration

impact on the activity of hospitals, and on the use of blood components.

In 2022, approximately 33 units of RBCs per 1 000 inhabitants were issued for clinical purposes (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) [11, 12, 25–28].

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 — eg. in 2011 the RBC consumption in 32 member states of the Council of Europe averaged 37 units/1000 inhabitants [13].

In 2022 the number of FFP units issued for clinical purposes amounted to 252 332 and was higher than in the previous year (246 013 units) though still lower than in 2019 (273 519 units). The ratio of RBCs issued for clinical use to FFP was approximately 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 [29–35].

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 [13]. 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 [36, 37].

What is noteworthy is the significant decrease in the number of collections and clinical use of COVID-19 convalescent plasma for SARS-CoV-2 therapy, the so-called passive immunotherapy. In the first months of the COVID-19 pandemic, there was considerable interest in this therapeutic method,

Table 13. COVD-19 convalescent plasma — percentage subjected to pathogen inactivation in Polish Blood Transfusion Centers in 2022

Centers	Convalescent plasma (units)	Convalescent plasma subjected to pathogen inactivation (units)	Percentage of convalescent plasma subjected to pathogen inactivation
Białystok	0	0	0.00
Bydgoszcz	0	0	0.00
Gdańsk	0	0	0.00
Kalisz	0	0	0.00
Katowice	0	0	0.00
Kielce	12	0	0.00
Kraków	8	8	100.00
Lublin	0	0	0.00
Łódź	64	0	0.00
Olsztyn	0	0	0.00
Opole	0	0	0.00
Poznań	0	0	0.00
Racibórz	0	0	0.00
Radom	24	24	100.00
Rzeszów	28	0	0.00
Słupsk	0	0	0.00
Szczecin	21	0	0.00
Wałbrzych	3	0	0.00
Warszawa	173	102	58.96
Wrocław	0	0	0.00
Zielona Góra	0	0	0.00
WCKiK	3	3	100.00
CKiK MSWiA	3	3	100.00
Total	**339**	**146**	**43.07**

WCKiK — Military Blood Transfusion Center; CKiK MSWiA — Blood Transfusion Center of Internal Affairs and Administration

but subsequent studies have not given reliable results to prove its efficacy. Recommendations regarding the use of COVID-19 convalescent plasma are disputable and may apply only to certain groups of patients [38]. This probably was the reason for significant decline in interest in this therapeutic method both in Poland and other countries.

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 [39].

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, so again an increase was recorded.

Additional preparation methods (leukocyte depletion, irradiation) for prevention of transfusion associated adverse reactions were applied mainly to PCs (44.74% leukodepleted PCs and 55.26% irradiated leukodepleted PCs), less often to RBCs (23.06% of leukodepleted RBCs, 10.38% irradiated leukodepleted RBCs and 0.05% irradiated RBCs).

Table 14. Percentage of pathogen-inactivated FFP, cryoprecipitate and PC units issued for clinical use in 2022

Center	% FFP (units)	% Cryoprecipitate (units)	% PCs (therapeutic doses)
Białystok	10.47	0	0.00
Bydgoszcz	8.29	15.95	0.00
Gdańsk	1.02	0	0.00
Kalisz	58.44	0	0.00
Katowice	7.34	0	0.69
Kielce	6.04	0	17.15
Kraków	39.05	0	0.87
Lublin	15.25	0	2.71
Łódź	12.63	0	1.35
Olsztyn	11.15	0	0.00
Opole	11.77	0	0.00
Poznań	96.44	100	0.00
Racibórz	28.61	0	0.00
Radom	36.79	0	38.07
Rzeszów	31.40	0	4.11
Słupsk	9.57	0	0.00
Szczecin	0.99	0	0.00
Wałbrzych	14.05	0	0.00
Warszawa	33.03	0	98.34
Wrocław	43.56	0	0.00
Zielona Góra	9.50	0	0.00
WCKiK	0.55	0.23	3.63
CKiK MSWiA	13.27	0	17.02
Total	**24.73**	**9.48**	**12.70**

WCKiK — Military Blood Transfusion Center; CKiK MSWiA — Blood Transfusion Center of Internal Affairs and Administration

As mentioned above, since 2021, 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 [40].

As in the previous years, the number of frozen PC units is still too high in some Centers. In 2022 — there was a slight decrease in the percentage of frozen PCs. The reported country-wide percentage is acceptable but in some Centers the routine procedure of freezing large volumes of PCs is much too frequent and has to be limited. In some Centers, the number of frozen PC units has increased despite previously observed tendencies to be lower. Current indications for the clinical use of thawed PCs are quite limited. The component should be used only in exceptional cases, so it is not recommended to freeze more than 10% of all PCs prepared. This does not refer to freezing of apheresis PCs collected for patients with anti-HLA or anti-HPA antibodies. 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. A cause for anxiety are those Centers which subject to freezing more than 50% of all PC units prepared; for apheresis PCs and pooled PCs — 50% and almost 60% respectively. It should however be emphasized that the overall

Table 15. Wastage of blood components in Polish Blood Transfusion Centers in 2022

Center	Whole blood	RBCs	PCs (therapeutic doses)		FFP	Cryoprecipitate
			Pooled (from whole blood)	Apheresis		
Białystok	168	662	26	12	693	83
Bydgoszcz	490	828	0	0	2307	282
Gdańsk	307	1336	281	10	2156	145
Kalisz	152	989	0	0	1749	23
Katowice	1082	3159	524	247	4716	116
Kielcach	59	925	262	34	1103	56
Kraków	808	2668	117	40	7158	115
Lublin	133	1381	178	99	2070	18
Łódź	1259	2379	313	103	2506	0
Olsztyn	65	529	59	9	559	13
Opole	110	931	35	45	902	4
Poznań	2062	2855	310	64	2426	18
Racibórz	60	455	60	38	663	0
Radom	522	1707	0	68	1037	54
Rzeszów	1511	2054	419	52	2306	94
Słupsk	455	705	102	11	812	34
Szczecin	191	2100	225	47	2343	71
Wałbrzych	453	1295	136	8	498	5
Warszawa	1515	2277	71	568	7664	170
Wrocław	725	1213	73	105	1787	61
Zielona Góra	299	660	423	10	589	5
WCKiK	454	1652	43	13	9144	302
CKiK MSWiA	55	43	0	0	2933	12
Total	**12 935**	**32 803**	**3658**	**1582**	**58 122**	**1681**

WCKiK — Military Blood Transfusion Center; CKiK MSWiA — Blood Transfusion Center of Internal Affairs and Administration

percentage has decreased as compared to 2021, also in the case of the issued components (decrease from 2.84% to 2.76%).

The Centers are obliged to safeguard the supply of blood/blood components but to fulfill 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 [41].

The most common causes of wastage in 2022 (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 reve-

Table 16. Reasons for blood component wastage in Polish Blood Transfusion Centers in 2022

Reason	Whole blood	RBCs	PC therapeutic doses pooled from whole blood	PC therapeutic doses from apheresis	FFP	Cryoprecipitate
Expiry date	4	12 053	2094	435	12 582	109
Seropositive for transfusion transmitted diseases, syphilis tests, implementation of *look-back* procedure	28.3	2810	247	76	5076	13
Other causes including: • inadequate visual control • low quantity/volume • incorrect serological results • other, including incorrect procedures, medical deferral, mechanical damage, donor self-deferral etc.	12 965	17 907	1317	1072	40 363	1647
Unused blood components from autologous donations	0	33			101	
Total	**12 997**	**32 803**	**3658**	**1583**	**58 122**	**1769**

al that quarantine FFP is still the most commonly used component in clinical practice (75.25%). Although currently all Centers are equiped with PRT systems (some have two different systems) only 7 (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 pathogen inactivate only „trace amounts" of plasma and PCs. In 2022, all centers used pathogen inactivation systems for FFP however, in 4 Centers the percentage of inactivated FFP units decreased. For the remaining Centers the numbers of pathogen inactivated units of FFP were higher than in the previous year (eg. by 0.09 in Szczecin and 4.28% in Poznań). So far, only the Center in Warsaw had implemented pathogen inactivation of FFP on a large scale. In 2022 an increase was reported also in CKiK MSWiA (13.20%) and Poznań (17.51%. In the latter Center the percentage of FFP subjected to pathogen inactivation was the highest. In Warsaw the percentage was 16.90%). For components such as pooled PC and apheresis PC the percentage of pathogen inactivated units was in Warsaw the highest of all Centers (99.59% and 96.40% respectively). In 2021 the values were 15.91% for FFP, 99.21% for pooled PC 98.53% for apheresis PC. Although many Centers had two pathogen inactivation systems installed, the percentage of pathogen inactivated components was still low. Pathogen inactivation of pooled PCs and apheresis PCs is still performed only by several Centers (pooled PCs by 8 Centers and apheresis PCs by 9 Centers). In 2022, 3 Centers stopped performing pathogen inactivation of apheresis PCs. Among 8 Centers which performed pathogen inactivation of pooled PCs, 5 reported an increase in the number of inactivated PCs as compared to 2021. Among the 9 Centers which performed pathogen inactivation of apheresis PCs, 5 reported an increase in the number of inactivated PCs as compared to 2021.

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 2022, as well as of some recently recorded trends observed over a extended period of time. 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 which is most probably due to the weaker effect of the COVID-19 pandemic and then of the state of epidemic emergency. 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

Problems related to the declining number of donors, fewer whole blood donations as the main source of RBCs — the most common blood component — are currently a major challenge for the blood transfusion service. This was particularly noticeable during the COVID-19 pandemic. 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).

The solutions developed in the previous year 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;
— 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 [42].

There are ongoing studies to assess the effective use of the available stock of blood components and to restrict indication criteria for transfusion eg. lower hemoglobin level at which transfusion is indicated [43, 44].

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 [45].

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 specialities (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 [46–48].

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 a 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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