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Blood transfusion service in Poland in 2020

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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 (hereinafter referred to as Centers) in 2020, taking into account the conditions related to the ongoing COVID-19 pandemic.*

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

Results: *In 2020, 23 Centers and 136 local collection sites operated in Poland. Blood and blood components were also collected during 10,432 mobile collections. The overall number of blood donors was estimated at 569,914, the majority of which were non-remunerated donors (569,566, including 50,012 responders to donation appeals) as well as 25 remunerated donors and 323 autologous donors. Most frequent were whole blood collections (1,105,434) and the least frequent — granulocyte concentrate collections (82) and RBC collections by apheresis (16). Whole blood was collected mostly in local collection sites (46.84%), less frequently in Centers (30.62%) and mobile collection sites (22.54%). The most frequently prepared blood components were RBCs (1,089,978 units) and FFP (1,264,654 units). COVID-19 convalescent plasma was also collected (57 708 units).*

In 2020, a total of 77,485 units of PCs pooled from whole blood and 52,030 units of PCs from apheresis were prepared.

Additional processing methods (leukocyte depletion, irradiation) were more frequently applied to PCs (55.47% leukodepleted, 44.53% both leuko-depleted and irradiated), than to RBC (21.03% leukodepleted, 9.85% both leukodepleted and irradiated, 0.06% irradiated). Pathogen inactivation technologies were applied to 14.21% of FFP units issued for clinical use and 11.01% of PCs.

For various reasons the following amounts of blood components were wasted in 2020: 11,430 units of whole blood, 29,530 units of RBCs, 53,946 units of FFP, 1,691 units of apheresis PCs, 5,455 units of pooled PCs and 1,381 units of cryoprecipitate.

As compared to the previous years, in 2020 almost all the indicators of the activity of the blood transfusion service in Poland have markedly decreased.

Conclusions: *The data presented in this study point to the significant impact that the COVID-19 pandemic had on blood donation in Poland in 2020. The data may serve as a starting point for the analysis of issues related to the activity of organizational units of the Polish blood transfusion service and contribute to practical benchmarking. This in turn may prove beneficial to the transfusion community as a whole.*

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 (RCKiK), 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.

This is our thirteenth presentation of selected issues related to the annual activities of the public blood transfusion service in Poland in the past year which takes into account the specific conditions caused by the COVID-19 pandemic. The following topics were discussed: the number of donors, the number of donations, the collection sites for whole blood and blood components, including red blood cell concentrate (RBC), fresh frozen plasma (FFP), platelet concentrate (PC) and granulocyte concentrate (GC) in 2020. 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.

Materials 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 2020. To the aim of standardization of the forwarded data, IHTM together with the National Blood Center (NCK) created a template of definitions.

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 $\geq 3 \times 10^{11}$ platelets.

Results

Blood Transfusion Centers (Centers)

In 2020, there were 23 Centers and 136 local collection sites operating in Poland. Moreover, 10,432 mobile collections were performed which is over 20% less than in the previous year. In 2020 mobile collections were organized by all RCKiK and WCKiK. As in the previous year, the largest number of mobile collections was organized by RCKiK in Katowice (1366). Over 1000 mobile collections were organized by RCKiK in Wałbrzych (1100) and Warsaw (1010). As compared to the previous year, the number of mobile collections decreased in 20 RCKiK and WCKiK, and increased only in RCKiK in Białystok (Table 1).

Donors

In 2020, a total of 653,467 persons came to donate blood (in 2019 — 719,627), but only some of them (569,914) were qualified for donation (in 2019 — 614,579).

As in the previous years, blood or blood components for clinical use were donated by approximately 87% of the people who were willing to donate blood. The difference was mainly due to

Table 1. Mobile collections organized in Polish Blood Transfusion Centers in 2019 and 2020

Center	Mobile collections		
	2019	2020	Tendency (increase/decrease compared to 2019)
Białystok	728	760	↑
Bydgoszcz	872	718	↓
Gdańsk	362	201	↓
Kalisz	425	349	↓
Katowice	1875	1366	↓
Kielce	283	162	↓
Kraków	793	508	↓
Lublin	404	399	↓
Łódź	1031	851	↓
Olsztyn	494	421	↓
Opole	229	131	↓
Poznań	877	636	↓
Racibórz	326	126	↓
Radom	393	377	↓
Rzeszów	229	229	bz
Słupsk	159	108	↓
Szczecin	422	342	↓
Wałbrzych	1269	1100	↓
Warszawa	1238	1010	↓
Wrocław	371	237	↓
Zielona Góra	268	186	↓
CKiK WCKiK	463	215	↓
MSWiA	0	0	bz
Total	**13 511**	**10 432**	↓

WCKiK — Military Blood Transfusion Center; CKiK MSWiA — Blood Transfusion Center of Internal Affairs and Administration ↓ — decrease as compared to 2019; ↑ — increase as compared to 2019; bz — no change since 2019

donor deferral. In 2020, a total of 9537 permanent deferrals were applied. There were also 214,049 temporary deferrals of 176,854 people, and the most common cause (65,892 cases) was low hemoglobin level (like in the previous years). Temporary deferral was applied to 2,303 people for various reasons related to the ongoing COVID-19 pandemic (including disease, vaccinations, isolation).

Donors were mostly voluntary unremunerated (569,566). In 2020, blood and blood components were also donated by 25 remunerated donors and 323 autologous donors. In the number of voluntary donors, 50,012 were responders to appeal and 111 were directed donors.

In 17 Centers blood was donated only by voluntary unremunerated donors. The highest numbers of remunerated donors were reported by RCKiK in Gdańsk and Katowice (9 for each Center).

Among donors of blood and blood components there were 118,208 first-time donors (20.74%), 367,459 multiple regular donors (64.48%) and 84,247 multiple repeat donors (14.78%).

22 Centers reported decrease in the number of donors, only in 1 (Lublin) — a slight increase was observed (by 0.19%). Table 2 presents the number of donors in each Center in 2020.

As in the previous years, the most numerous group of blood donors were people aged 18 to 44 (a total of 479,636 including 138,576 women and 341,060 men).

Donations

In 2020, whole blood was collected most frequently (1,105,434 donations), while the least frequent were collections of: granulocyte concentrate (82 donations in 6 RCKiK) and aphe-

Table 2. Blood donors in Polish Blood Transfusion Centers in 2020

Center	Donors				Increase/decrease as compared to 2019
	First-time	Multiple-regular	Multiple repeat	Total	
Białystok	4301	20 328	4234	28 863	↓
Bydgoszcz	6404	22 060	4602	33 066	↓
Gdańsk	5251	17 565	3905	26 721	↓
Kalisz	3809	13 607	2885	20 301	↓
Katowice	8250	32 047	5716	46 013	↓
Kielce	3667	9345	2419	15 431	↓
Kraków	9194	26 990	6367	42 551	↓
Lublin	6784	17 243	4309	28 336	↑
Łódź	8682	17 786	6981	33 449	↓
Olsztyn	3546	12 345	2562	18 453	↓
Opole	2068	8665	1276	12 009	↓
Poznań	7003	32 630	6468	46 101	↓
Racibórz	2333	9104	1986	13 423	↓
Radom	2815	7310	1822	11 947	↓
Rzeszów	4885	19 956	3294	28 135	↓
Słupsk	1727	5930	1038	8695	↓
Szczecin	4760	14 115	3022	21 897	↓
Wałbrzych	2312	7502	1241	11 055	↓
Warszawa	14 241	33 959	9294	57 494	↓
Wrocław	6917	22 127	5178	34 222	↓
Zielona Góra	2798	7364	3567	13 729	↓
WCKiK	5488	7777	1977	15 242	↓
CKiK MSWiA	973	1704	104	2781	↓
Total	**118 208**	**367 459**	**84 247**	**569 914**	↓

WCKiK — Military Blood Transfusion Center; CKiK MSWiA — Blood Transfusion Center of Internal Affairs and Administration
↓ — decrease as compared to 2019; ↑ — increase as compared to 2019

resis RBC as the only component (16 donations in 3 RCKiK). As in previous years, the largest number of whole blood donations was reported by RCKiK in Warsaw (102,724) and Katowice (96,486). Apheresis was mainly used for preparation of PCs (12,997 donations) and plasma (55,421 donations). The largest numbers of apheresis plasma donations were reported by RCKiK in Kalisz (9,496), and apheresis PC donations by RCKiK in Warsaw (2,043).

Automated donations of a combination of blood components, mostly PC and plasma (27,040 donations — the majority in RCKiK) were also performed in Warsaw (8,602 donations), less frequently of PC and RBCs (282 donations) — almost exclusively at RCKiK in Wrocław (279 donations).

Table 3 presents the number of complete donations of blood and blood components in 2020.

Blood was collected primarily in the local collection sites (46.84% of whole blood donations), less frequently at the Center premises (30.62%), and during mobile collections (22.54%). As in previous years, the largest number of whole blood donations — 54.84% — took place during mobile collections organized by the RCKiK in Wałbrzych. Table 4 provides a list of whole blood collection sites in 2020.

Blood components

Red blood cell concentrate

Donated blood was processed into blood components, mostly RBC (a total of 1,089,978 units), which was a significant country-wide decrease as compared to the previous year (1,220,178 units). As in previous years, the largest amount of RBC

Table 3. Whole blood and apheresis donations in 2020*

Center	Whole blood	Apheresis						Total
		Plasma	RBC	PC	GC	PC+ plasma	PC+ RBC	
Białystok	58 964	7262	0	159	1	1964	0	68 350
Bydgoszcz	65 015	6012	8	1091	11	56	0	72 193
Gdańsk	57 156	2020	0	527	0	0	0	59 703
Kalisz	38 900	9496	0	2	0	425	0	48 823
Katowice	96 486	846	0	688	0	4345	0	102 365
Kielce	28 010	1059	0	834	0	0	0	29 903
Kraków	86 120	359	0	1903	48	0	0	88 430
Lublin	53 464	5566	0	0	0	1760	0	60 790
Łódź	58 907	961	0	1409	0	0	0	61 277
Olsztyn	36 957	1686	0	211	0	476	0	39 330
Opole	26 218	180	0	665	0	0	0	27 063
Poznań	83 948	3620	0	234	0	1536	0	89 338
Racibórz	27 415	2709	0	0	0	438	0	30 562
Radom	22 108	2037	0	36	0	780	0	24 961
Rzeszów	59 771	2829	0	1354	0	0	0	63 954
Słupsk	17 722	987	3	19	0	220	3	18 954
Szczecin	42 351	1515	0	55	4	1835	0	45 760
Wałbrzych	23 082	336	0	74	0	38	0	23 530
Warszawa	102 724	1518	0	2043	14	8602	0	114 901
Wrocław	61 004	3985	5	1665	4	4546	279	71 488
Zielona Góra	29 121	282	0	0	0	19	0	29 422
WCKiK	25 649	17	0	16	0	0	0	25 682
MSWiA	4342	139	0	12	0	0	0	4493
Total	**1 105 434**	**55 421**	**16**	**12 997**	**82**	**27 040**	**282**	**1 201 272**

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

was obtained in RCKiK in Katowice and Warsaw (95,939 units and 102,509 units, respectively) (Table 5). A decrease in the number of RBC units was reported by all Centers.

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

In 2020, a total of 229,197 units of leucocyte--depleted RBCs were obtained (21.03% of all RBC units) and 107,377 units of leucocyte-depleted irradiated RBC (9.85%). RBC irradiation alone was used sporadically, yielding 616 units of irradiated RBCs — 0.06% of all RBC units.

Country-wide, 30.88% of all RBCs were leukocyte-depleted and 9.91% of RBCs were irradiated. Table 6 presents the number of leukocyte-depleted and irradiated units of RBC prepared in Centers in 2020.

Platelet concentrate

Platelet concentrate was the second most frequently prepared 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 leucocyte-depleted and require no additional elimination of leukocytes.

In 2020, a total of 77,485 pooled PC units were prepared (in 2019 — 82,283), including 55,828 from buffy coat with manual method and 21,603 with automated methods. In the Center in Katowice,

Table 4. Sites of whole blood collection in 2020

Center	Whole blood collected (units)*						
	Center site		Local collection site		Mobile collection site		Total
	J.	%	J.	%	J.	%	J.
Białystok	13 543	22.84	28 698	48.39	17 066	28.78	59 307
Bydgoszcz	16 914	25.89	25 611	39.20	22 809	34.91	65 334
Gdańsk	19 680	34.23	32 664	56.82	5146	8.95	57 490
Kalisz	8482	21.80	14 450	37.15	15 969	41.05	38 901
Katowice	14 741	15.02	57 260	58.33	26 169	26.66	98 170
Kielce	13 961	49.60	8239	29.27	5945	21.12	28 145
Kraków	25 190	29.00	47 909	55.16	13 753	15.83	86 852
Lublin	15 048	27.83	28 335	52.40	10 692	19.77	54 075
Łódź	20 904	34.96	21 651	36.20	17 247	28.84	59 802
Olsztyn	11 429	30.59	16 438	44.00	9492	25.41	37 359
Opole	6985	26.59	16 088	61.23	3201	12.18	26 274
Poznań	28 073	33.00	40 348	47.43	16 648	19.57	85 069
Racibórz	4395	15.92	19 815	71.75	3405	12.33	27 615
Radom	11 728	52.81	1557	7.01	8924	40.18	22 209
Rzeszów	15 911	26.44	38 335	63.71	5927	9.85	60 173
Słupsk	9901	55.20	5499	30.66	2538	14.15	17 938
Szczecin	18 438	43.29	14 931	35.06	9223	21.65	42 592
Wałbrzych	10 528	45.16	0	0	12 784	54.84	23 312
Warszawa	29 833	28.70	46 997	45.21	27 122	26.09	103 952
Wrocław	30 858	50.03	23 649	38.34	7176	11.63	61 683
Zielona Góra	8554	29.04	15 816	53.69	5090	17.28	29 460
WCKiK	2180	8.43	18 452	71	5219	20.19	25 851
MSWiA	4381	100	0	0	0	0	4381
Total	**341 657**	**30.62**	**522 742**	**46.84**	**251 545**	**22.54**	**1 115 944**

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

54 units of PC from platelet-rich plasma were prepared.

In 2020, a total of 52,030 PCs were obtained by apheresis (40.17% of all units issued for clinical use (in 2019 — 53,503, i.e. 39.4%).

The highest number of PCs from whole blood was obtained in Katowice (10,054 pooled PC units) and Poznań (9,563 pooled PC units), while from apheresis — in Warsaw (12,592).

The percentage of apheresis PCs differed significantly in Centers — from 0.67% in Zielona Góra to 80.41% in Warsaw and 88.41% in Białystok (Table 7).

Since 2020, only leukocyte-depleted PCs are issued for clinical use in Poland; some part of PC units are also irradiated. In 2020, a total of 71,845 therapeutic doses of leukocyte-depleted PCs were obtained which accounted for 55.47% of all obtained PCs, as well as 57,671 therapeutic doses of irradiated leukocyte-depleted PCs (44.53%).

Table 8 presents the numbers of leukocyte-depleted and irradiated PCs obtained in Polish Centers in 2020.

In 2020, a total of 120,858 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, and in 2019 — 129,652). After the upward trend observed for the several last years, a significant decline was recorded.

Some part of the obtained PCs were stored frozen.

In 2020, 3.27% of all PCs were subjected to freezing (including 2.24% of pooled PCs, 5.18% of

Table 5. Units of RBCs prepared in Polish Blood Transfusion Centers in 2020

Center	RBCs	Increase/decrease compared to 2019
Białystok	57 969	↓
Bydgoszcz	64 994	↓
Gdańsk	56 966	↓
Kalisz	37 063	↓
Katowice	95 939	↓
Kielce	27 956	↓
Kraków	86 014	↓
Lublin	53 390	↓
Łódź	58 396	↓
Olsztyn	36 870	↓
Opole	26 177	↓
Poznań	81 317	↓
Racibórz	27 195	↓
Radom	21 698	↓
Rzeszów	57 098	↓
Słupsk	17 726	↓
Szczecin	42 337	↓
Wałbrzych	22 952	↓
Warszawa	102 509	↓
Wrocław	56 684	↓
Zielona Góra	28 815	↓
WCKiK	25 573	↓
MSWiA	4340	↓
Total	**1 089 978**	↓

WCKiK — Military Blood Transfusion Center; MSWiA — Blood Transfusion Center of Internal Affairs and Administration
↓ — decrease as compared to 2019; ↑ — increase as compared to 2019

Table 6. Leukocyte-depleted and irradiated RBCs prepared in Polish Centers in 2020

Center	Units of leuko--depleted RBCs	Units of itrradiated RBCs	Units of both leuko-depleted and irradiated RBCs
Białystok	2141	0	6417
Bydgoszcz	3086	0	10 440
Gdańsk	1073	5	15 314
Kalisz	29 114	0	94
Katowice	32 529	0	5190
Kielce	5463	0	3330
Kraków	7093	407	6665
Lublin	1044	0	9236
Łódź	12 731	28	11 607
Olsztyn	4065	3	4386
Opole	4234	0	592
Poznań	17 659	9	7385
Racibórz	2789	0	35
Radom	1704	0	56
Rzeszów	328	69	6473
Słupsk	1328	0	1490
Szczecin	655	90	1906
Wałbrzych	122	0	0
Warszawa	85 098	0	6356
Wrocław	5167	5	8244
Zielona Góra	5982	0	2160
WCKiK	2722	0	0
MSWiA	3071	0	0
Total	**229 197**	**616**	**107 377**

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

apheresis PCs). The summary also includes data from WCKiK and CKiK MSWIA, although in those Centers freezing of PCs is scarcely performed — in 2020 only 1 apheresis PC unit was frozen at the latter Center.

For the last several years, the percentage of frozen PCs has been observed to decrease; however, as compared to 2019, a slight increase (by 0.04%) has been recorded. There was a decrease in the percentage of frozen apheresis PCs (by 0.08%) with a simultaneous increase in the percentage of pooled PCs (by 0.07%). In consecutive years, the percentage of frozen PCs in individual Centers is on the same level. In 2020 however, there is a significant difference between individual Centers ranging from 0% in Białystok (no PC freezing), Kalisz and Poznań, to 14.8% in Słupsk (a decrease by 2.4% as compared to 2019), 18.8% in Wałbrzych (decrease by 0.6%), 30.2% in Opole (increase by 5.5%), 29.3% in Radom (decrease by 5.7%) and 37.1% in Racibórz (increase by 2.9%). In the Centers of Radom, Słupsk and Wałbrzych, the percentage of frozen PCs systematically decreases. As in the previous years, Racibórz reported the highest percentage of frozen pooled PCs (50.7%, an increase by 7.7%). On the other hand, Zielona Góra, Słupsk and Radom reported the highest percentage of frozen apheresis PCs (56, 3%; 51.7% and 34.4% respectively). At the same time, it should be noted that in Zielona Góra only 16 apheresis PCs were collected, 9 of which were frozen, hence such a high percentage of frozen PCs.

Table 7. PCs from whole blood and apheresis (2020)

Center	PC (therapeutic doses)			
	Pooled from whole blood	Apheresis	Total	% of apheresis PCs
Białystok	555	4234	4789	88.41
Bydgoszcz	7716	1467	9183	15.98
Gdańsk	5654	745	6399	11.64
Kalisz	1835	686	2521	27.21
Katowice	10 054	6584	16 638	39.57
Kielce	2919	932	3851	24.20
Kraków	6868	2596	9464	27.43
Lublin	4408	2132	6540	32.60
Łódź	4139	1633	5772	28.29
Olsztyn	3351	882	4233	20.84
Opole	686	668	1354	49.34
Poznań	9563	3451	13 014	26.52
Racibórz	479	529	1008	52.48
Radom	380	849	1229	69.08
Rzeszów	5266	1438	6704	21.45
Słupsk	1434	259	1693	15.30
Szczecin	2776	2053	4829	42.51
Wałbrzych	1232	130	1362	9.54
Warszawa	3067	12 592	15 659	80.41
Wrocław	2599	8125	10 724	75.76
Zielona Góra	2356	16	2372	0.67
WCKiK	69	16	85	18.82
MSWiA	79	13	92	14.13
Total	**77 485**	**52 030**	**129 515**	**40.17**

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

In 2020, thawed PCs accounted for 3.13% of all PC therapeutic doses issued for clinical use, i.e. 0.18% more than in 2019. The largest number of thawed PC units was reported by Racibórz (39.7% of all PC units issued for clinical use), Radom (34, 3%), Opole (26.4%), Wałbrzych (18.1%) and Słupsk (17.2%). Centers in Kalisz, Poznań, CKiK MSWiA and WCKiK reported no issue of thawed PCs for clinical use.

Fresh frozen plasma

In 2020, a total of 1,264,654 FFP units were prepared (in 2019 — 1,373,514 units). As in the previous years, FFP was mainly obtained by manual method, i.e. plasma obtained from anticoagulated whole blood. With this method, 1,075,762 FFP units were obtained in 2020. On the other hand, with the less frequent method of apheresis 188,892 units were obtained, i.e. 14.94% of the total (in 2019 — 170,520 units, i.e. 12.41% of the total). This is one of the very few examples of an upward trend observed in 2020.

The percentage of FFP obtained by apheresis differed between Centers (the highest was reported by Kalisz — 44.01%).

Table 9 presents the number of FFP units obtained by the manual method and by apheresis in individual Centers in 2020.

A total of 229,059 FFP units were issued for clinical use which is less than in 2019 (273,519 FFP units). As compared to the previous year, the number of FFP units issued for clinical use was lower in all Centers (Table 10).

Table 8. Leukocyte-depleted and irradiated PCs prepared in Polish Centers in 2020

Center	PC therapeutic doses	Leukocyte-depleted PCs	Irradiated Leukocyte-depleted PCs
Białystok	4789	557	4232
Bydgoszcz	9183	7805	1378
Gdańsk	6399	453	5946
Kalisz	2521	2519	2
Katowice	16 638	11 105	5533
Kielce	3851	1861	1990
Kraków	9464	4427	5037
Lublin	6540	423	6117
Łódź	5772	4677	1095
Olsztyn	4233	484.2	3749
Opole	1354	1211	143
Poznań	13 014	4364	8650
Racibórz	1008	993	15
Radom	1229	1224	5
Rzeszów	6704	5674	1030
Słupsk	1693	677	1016
Szczecin	4829	2355	2474
Wałbrzych	1362	1362	0
Warszawa	15 659	15 633	26
Wrocław	10 724	2225	8499
Zielona Góra	2372	1638	734
WCKiK	85	85	0
MSWiA	92	92	0
Total	**129 514**	**71 845**	**57 671**

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

COVID-19 convalescent plasma

The outbreak of COVID-19 pandemic announced by WHO in March 2020, has burdened the Polish blood transfusion service with the additional task of collecting convalescent plasma. In 2020, a total of 57 708 units of convalescent plasma were collected, 25,868 units of which (44.83%) were issued for clinical purposes.

Convalescent plasma was collected by all Centers; the highest volumes were reported by the Centers in Warsaw and Bydgoszcz (5094 and 5644, respectively). Table 11 presents the numbers of convalescent plasma units obtained from COVD-19 convalescents and issued for clinical purposes by individual Centers in 2020.

Granulocyte concentrate

As in previous years, in 2020, granulocyte concentrate (GC) was only sporadically obtained (82 donations in 6 Centers), i.e. less frequently than in 2019 (94 donations) and 2018 (116 donations). Most GC donations took place in Kraków (48) and Warsaw (14).

Quarantine and inactivation of biological pathogens in labile blood components

In Poland we rely solely on quarantine[1] or pathogen inactivated FFP and cryoprecipitate with the aim of ensuring the safety of transfused blood components. Currently there are three (3) 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 plasma and PC. Some methods of inactivation (Mirasol PRT and Intercept) do not only minimize the risk of pathogen transmission but may also serve as alternative to irradiation of cellular blood components used for prevention of transfusion-associated Graft Versus Host Disease (TA-GvHD). PCs already subjected to pathogen inactivation with one of these PRT systems do not need to be subjected to irradiation [2–4].

In 2020, pathogen inactivation technology (PRT) was used by 23 Centers. The following systems were used:

— Mirasol in 16 Centers (in 14 regional Centers, WCKiK and CKiK MSWiA);
— Theraflex MB Plasma (in 10 regional Centers);
— Intercept (in 4 regional Centers; Białystok applied inactivation solely for validation purposes — 25 units of apheresis plasma were subjected to inactivation).

The percentage of plasma subjected to inactivation ranged from 0.02% (Center in Szczecin) to 12.50% (Center in Poznań). Countrywide, a total of 3.01% of all plasma was subjected to inactivation. COVID-19 convalescent plasma was also subjected to inactivation and the values ranged from 27.93% in Lublin to 100% in Poznań, WCKiK and CKiK MSWiA (63.36% countrywide).

A total of 85.92% of quarantine FFP and 93.11% of quarantine cryoprecipitate were issued for clinical use as well as 14.21% of pathogen inactivated FFP units and 6.89% of pathogen inactivated cryoprecipitate (cryoprecipitate in Poznań only).

Inactivation of pooled PCs was implemented in 7 Centers, (6 used the Mirasol system, 1 used

[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 9. FFP (from whole blood and apheresis) prepared in Polish Blood Transfusion Centers in 2020

Center	Whole blood (manual method)	Apheresis	Total	% apheresis FFP
Białystok	57 943	29 749	87 692	33.92
Bydgoszcz	64 551	17 805	82 356	21.62
Gdańsk	56 506	4160	60 666	6.86
Kalisz	37 064	29 138	66 202	44.01
Katowice	95 939	6821	102 760	6.64
Kielce	27 662	1960	29 622	6.62
Kraków	86 035	1094	87 129	1.26
Lublin	51 350	15 079	66 429	22.70
Łódź	58 396	3182	61 578	5.17
Olsztyn	35 064	3891	38 955	9.99
Opole	26 075	49	26 124	0.19
Poznań	80 985	10 823	91 808	11.79
Racibórz	27 193	5029	32 222	15.61
Radom	21 557	5611	27 168	20.65
Rzeszów	57 098	8464	65 562	12.91
Słupsk	17 723	2422	20 145	12.02
Szczecin	42 337	7240	49 577	14.60
Wałbrzych	22 132	941	23 073	4.08
Warszawa	102 509	13 079	115 588	11.32
Wrocław	56 317	21 174	77 491	27.32
Zielona Góra	29 064	777	29 841	2.60
WCKiK	18 029	51	18 080	0.28
MSWiA	4 233	355	4588	7.74
Total	**1 075 762**	**188 892**	**1 264 654**	**14.94**

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

Intercept). The percentage of pooled PCs subjected to inactivation ranged from 0.04% (Center in Rzeszów) to 100.00% (Center in Warsaw). Countrywide, this accounted for 5.18% of all pooled PC units.

11 Centers inactivated apheresis PCs (10 used Mirasol, 1 used Intercept). The percentage of inactivated apheresis PCs ranged from 0.05% (in Białystok) to 98.13% (in Warsaw). Countrywide, this accounted for 26.19% of all apheresis PC units. In 2020, a total of 11.01% of inactivated PC therapeutic units were issued for clinical use.

Table 12 presents the 2020-percentage of pathogen inactivated FFP units, pooled PCs and apheresis PCs issued for clinical use.

The percentage of convalescent plasma subjected to pathogen inactivation in 2020 is presented in Tabele 13.

The percentage of FFP, cryoprecipitate and PC therapeutic units issued for clinical use following pathogen inactivation in 2020 is presented in Tabele 14.

Wastage of blood and blood components

In 2020, a total of 103,433 units of blood and most common blood components were wasted, including 11,430 units of anticoagulated whole blood, 29,530 units of RBCs, 53,946 units of FFP, 1,691 therapeutic units of apheresis PCs, 5,455 units of pooled PCs from whole blood, as well as 1,381 units of cryoprecipitate.

As in the previous years, the most common reasons for wastage of blood components were:

1. Expiry date;
2. Seropositivity for transfusion transmitted diseases, syphilis tests, implementation of look-back procedure;
3. Other causes, including:

— inadequate visual control;

Table 10. FFP issued for clinical use in Polish Blood Transfusion Centers in 2020 (convalescent plasma not included)

Center	FFP issued for clinical use (units)	Tendency (increase/ /decrease compared to 2019)
Białystok	11 042	↓
Bydgoszcz	14 888	↓
Gdańsk	8182	↓
Kalisz	3500	↓
Katowice	21 222	↓
Kielce	5447	↓
Kraków	19 236	↓
Lublin	13 319	↓
Łódź	14 072	↓
Olsztyn	6561	↓
Opole	4007	↓
Poznań	15 195	↓
Racibórz	2305	↓
Radom	2065	↓
Rzeszów	10 011	↓
Słupsk	2425	↓
Szczecin	12 850	↓
Wałbrzych	4878	↓
Warszawa	35 607	↓
Wrocław	7056	↓
Zielona Góra	5405	↓
WCKiK	7568	↓
MSWiA	2217	↓
Total	**229 059**	↓

WCKiK — Military Blood Transfusion Center; MSWiA — Blood Transfusion Center of Internal Affairs and Administration
↓ — decrease as compared to 2019; ↑ — increase as compared to 2019

Table 11. Convalescent plasma issued for clinical use by Polish Blood Transfusion Centers in 2020

Center	Convalescent plasma (units)	Issued for clinical use (units)	% of plasma used for clinical purposes
Białystok	2369	1779	75.10
Bydgoszcz	5644	3136	55.57
Gdańsk	2601	1333	51.25
Kalisz	1875	870	46.40
Katowice	3249	1599	49.22
Kielce	1472	743	50.48
Kraków	3184	1267	39.78
Lublin	5539	1929	34.82
Łódź	2665	1036	38.87
Olsztyn	1998	1113	55.71
Opole	632	365	57.74
Poznań	3010	1604	53.29
Racibórz	3705	1302	35.14
Radom	1938	879	45.36
Rzeszów	3060	749	24.48
Słupsk	861	234	27.18
Szczecin	2271	609	26.82
Wałbrzych	713	690	96,77
Warszawa	5094	2003	39,32
Wrocław	4573	1789	39.12
Zielona Góra	849	457	53.83
WCKiK	51	33	64.71
MSWiA	355	350	98.59
Total	**57 708**	**25 868**	**44.83**

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— low quantity/volume;
— seropositive serological results;
— other, including incorrect procedures, medical deferral, mechanical damage, donor self-deferral etc.

Subjected to wastage were also blood components from autologous donations that were not put to clinical use.

Table 15 presents the number of blood components wasted in individual Centers in 2020; causes of waste are shown in Table 16.

Discussion

In many ways, 2020 was a very special year as it was the first year of the announced COVID-19 pandemic. In the section *"Current problems of blood donation and transfusion medicine"* we present some pandemic-related circumstances and the implications they may have regarding blood donation. Regardless of the circumstances however, the basic factor that determines the availability of blood supply is still the good will, and thus — a sufficient number of volunteer, non-remunerated blood donors [5–9].

In line with the observations presented above, in 2020 the number of donors in the Centers in Poland — 569,914 — was the lowest in several last years (614,579 in 2019, 614,570 in 2018).

One factor that contributes to the decline in the number of blood donors observed in the recent years is the decrease in population in the 18–65 age

Table 12. Percentage of pathogen inactivated units of FFP, pooled PCs and apheresis PCs prepared in Centers (2020)

Center	FFP (%)	Pooled PCs (%)	Apheresis PCs (%)	Systems
Białystok	0.84	0.00	0.05	Mirasol, Theraflex
Bydgoszcz	1.82	0.00	0.00	Mirasol, Theraflex
Gdańsk	0.61	0.00	0.00	Mirasol
Kalisz	0.00	0.00	0.00	Theraflex
Katowice	1.03	1.26	1.37	**Mirasol**
Kielce	0.12	0.00	16.63	Mirasol,
Kraków	8.44	0.23	0.32	**Mirasol**
Lublin	0.73	0.00	0.00	Mirasol, Theraflex
Łódź	3.90	3.77	10.73	**Mirasol**
Olsztyn	0.00	0.00	0.00	Theraflex
Opole	0.03	0.00	0.00	Theraflex
Poznań	12.50	0.00	0.00	Theraflex
Racibórz	0.91	0.00	0.00	Theraflex
Radom	0.00	0.00	42.17	**Mirasol, Intercept**
Rzeszów	1.15	0.04	0.30	Mirasol Theraflex
Słupsk	0.00	0.00	0.00	Mirasol
Szczecin	0.02	0.00	0.00	Mirasol, Intercept
Wałbrzych	2.66	0.00	0.00	Mirasol
Warszawa	6.83	100.00	98.13	Intercept
Wrocław	2.50	0.00	0.55	**Mirasol**
Zielona Góra	0.39	0.00	0.00	Theraflex
WCKiK	3.79	42.47	25.00	**Mirasol**
MSWiA	11.90	12.66	61.54	**Mirasol**
Total	**3.01**	**5.18**	**26.19**	

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

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 — only 24,689,690 [10, 11]. During this period (2011–2020), the population in the above-mentioned age group decreased by almost two million, which may impact negatively on the number of active blood donors.

In the member states of the Council of Europe, the average number of blood donors per 1,000 inhabitants decreased in the period 2008–2011 from 29.0 to 25.0 [12]. In Poland, in 2020, the numbers per 1000 inhabitants were 14.42 (in 2019 — 15.39, 2018 — 15.37, and in 2017 — 15.30).

Moreover, 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 especially true for certain age groups. In Poland, such a tendency can be observed especially in the 18–24 age group i.e. a group of potential donors of blood and blood components in the future [13].

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

— periodic disease outbreaks — eg. COVID-19 pandemic;
— travel-associated risk of infection e.g. malaria or West Nile virus [14–16];
— emerging infectious diseases (other than COVID-19) e.g. the epidemic of Zika virus infections [17, 18];
— health condition of the population, including reduced hemoglobin levels (the most common cause of deferrals in the last years) [19–21];
— no opportunity to donate blood or economic reasons.

The number of autologous donors has been low in the recent years. In 2020, it was estimated at

Table 13. COVD-19 convalescent plasma — percentage subjected to pathogen inactivation in Centers (2020)

Center	Convalescent plasma (units)	Convalescent plasma) subjected to pathogen inactivation (units)	Percentage of plasma subjected to pathogen inactivation
Białystok	2369	2170	91.58
Bydgoszcz	5644	3790	67.15
Gdańsk	2601	1613	62.01
Kalisz	1875	1265	67.47
Katowice	3249	2671	82.21
Kielce	1472	935	63.52
Kraków	3184	2592	81.41
Lublin	5539	1547	27.93
Łódź	2665	1471	55.20
Olsztyn	1998	1808	90.49
Opole	632	561	88.71
Poznań	3010	3010	100.00
Racibórz	3705	1209	32.63
Radom	1938	875	45.15
Rzeszów	3060	1907	62.32
Słupsk	861	244	28.34
Szczecin	2271	1232	54.23
Wałbrzych	713	514	72.09
Warszawa	5094	3859	75.76
Wrocław	4573	2272	49.67
Zielona Góra	849	616	72.56
WCKiK	51.0	51	100.00
MSWiA	355.0	355	100.00
Total	**57 708**	**36 565**	**63.36**

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

Tabele 14. Percentage of pathogen inactivated FFP, cryoprecipitate and PC units issued for clinical use in 2020

Center	% FFP (units)	% Cryoprecipitate (units)	% PC (therapeutic units)
Białystok	5.35	0	0.04
Bydgoszcz	8.61	0	0.00
Gdańsk	1.91	0	0.00
Kalisz	0.06	0	0.00
Katowice	2.54	0	1.32
Kielce	0.00	0	5.47
Kraków	23.64	0	0.27
Lublin	1.85	0	0.00
Łódź	15.47	0	6.12
Olsztyn	1.68	0	0.00
Opole	0.17	0	0.00
Poznań	41.03	100	0.00
Racibórz	25.46	0	0.00
Radom	0.00	0	31.16
Rzeszów	8.91	0	0.08
Słupsk	0.00	0	0.00
Szczecin	0.00	0	0.00
Wałbrzych	0.00	0	0.00
Warszawa	33.88	0	92.78
Wrocław	18.33	0	0.36
Zielona Góra	0.00	0	0
WCKiK	0.98	0	11.76
MSWiA	12.81	0	29.58
Total	**14.21**	**6.89**	**11.01**

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

323, i.e. the lowest number in the last several years (in 2019 — 630, in 2018 — 598, in 2017 — 692). The smaller number of preoperative autologous donations is a phenomenon observed in many countries [22]. 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 population [23].

In 2020, the total number of blood and blood component donations amounted to 1,201,272, including 1,105,434 whole blood donations; a decrease compared to the previous year (in 2019 — 1,331,447 donations and 1,242,012 whole blood donations, respectively).

One of the methods used for more effective collection of blood components is automated apheresis. In 2020, the number of apheresis PCs and plasma donations combined decreased as compared to 2019 (from 28,966 to 27,040), and so did the number of PC donations only (from 17,858 to 12,997). On the other hand, there was an increase in the number of plasma donations only (from 42,386 to 55,421). Collection by apheresis of other blood components, ie RBCs and granulocyte concentrate (GC) was sporadic.

Table 15. Wastage of blood components in Polish Blood Transfusion Centers in 2020

Center	Whole blood	RBCs	KKP (packages)		FFP	Cryoprecipitate
			Pooled (from whole blood)	Apheresis		
Białystok	171	448	1	27	828	66
Bydgoszcz	25	50	54	0	356	22
Gdańsk	223	1176	376	19	2175	107
Kalisz	144	990	195	12	1171	39
Katowice	805	2459	400	184	3161	89
Kielcach	53	815	732	51	1400	37
Kraków	744	1475	178	41	6613	80
Lublin	87	1767	171	94	2195	16
Łódź	1339	2628	255	99	3449	83
Olsztyn	87	742	194	62	806	112
Opole	72	761	24	21	929	0
Poznań	1151	3443	1029	99	2997	18
Racibórz	122	1134	45	22	542	0
Radom	507	1194	151	103	1072	89
Rzeszów	2685	1791	521	46	1621	67
Słupsk	0	245	154	16	668	2
Szczecin	161	1394	251	111	2322	37
Wałbrzych	249	555	125	11	213	0
Warszawa	1421	2366	159	540	7792	176
Wrocław	688	1645	124	120	1939	50
Zielona Góra	397	902	285	3	640	1
WCKiK	257	1434	6	10	8101	290
MSWiA	41	117	25	0	2959	0
Total	**11 430**	**29 530**	**5455**	**1691**	**53 946**	**1381**

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

Table 16. Reasons for blood component wastage in Polish Blood Transfusion Centers in 2020

Reason	Whole blood	RBCs	PC therapeutic doses pooled from whole blood	PC therapeutic doses from apheresis	FFP	Cryoprecipitate
Expiry date	0	11 586	3730	606	10 847	44
Seropositive for transfusion transmitted diseases, syphilis tests, implementation of look-back procedure	29	2110	204	48	3260	12
Other causes, including:	11 400	15 967	1521	1037	39 654	1325
inadequate visual control						
low quantity/volume						
seropositive serological results, other, including incorrect procedures, medical deferral, mechanical damage, donor self-deferral etc.						
Unused blood components from autologous donations	3	102			186	
Total	**11 432**	**29 765**	**5455**	**1691**	**53 947**	**1381**

It should be noted that automated methods (apheresis) are still used in Poland to a relatively small extent, in 2020 — only 8% of all donations.

Mobile collections are organized to make blood donation easier for donors. In 2020, the Centers organized 10,432 mobile teams which is significantly less than in the previous year (13,511). The percentage of whole blood donations collected by mobile teams was also relatively small — 22.69%. In 2020, blood was mainly collected at local collection sites — 46.84% 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 influenced 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 had strong impact on the activity of hospitals, and on the use of blood components.

In 2020, approximately 27.87 units of RBCs per 1,000 inhabitants were issued for clinical purposes (in 2019 — 30.7 units, in 2018 — 30.38 units, in 2017 — 30.22 units, 2016 — 29.99, 2015 — 29.87) [11, 24–28]. The upward trend in RBC consumption observed in the previous years has changed and the RBC consumption in 2020 decreased. The RBC consumption in Poland has for years been lower than in some other European countries — for example, in 2011 the RBC consumption in 32 member states of the Council of Europe was on average 37 units/1,000 inhabitants [12].

In 2020 the number of FFP units issued for clinical purposes amounted to 229,059 units and was lower than in the previous year (273,519 units). On the other hand, the ratio of RBC for clinical use to FFP was approximately 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 [29–33]. These observations indicate that the consumption of FFP gradually declines as compared to RBC consumption. However, the RBC/FFP ratio is still higher than in many European countries [12]. This may be explained by the lower consumption of RBC in Poland — as mentioned above, but in many cases also by the fact that FFP is used for no sufficient justification and sometimes against currently restrictive indications [34, 35].

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 [36]. In 2020 however, only 120,858 therapeutic units of PC were issued for clinical purposes, so also in this case the decline is obvious.

Additional preparation methods (leukocyte depletion, irradiation) for prevention of transfusion associated adverse reactions were applied mainly to PCs (55.47% leukocyte depleted PCs and 44.53% of irradiated leukocyte depleted PCs), less often to RBC (21.03% of leukocyte depleted RBCs, 9.85% irradiated leukocyte depleted RBC and 0.06% irradiated RBCs). As already mentioned above, since 2020, only leucocyte-depleted PCs are issued for clinical use in Poland. Moreover, leucocyte--depleted RBCs require additional preparation, while in the case of apheresis PCs leukodepletion may occur at collection.

Some automated methods of PC preparation from the buffy coat also allow for the simultaneous elimination of leukocytes, but the cost of such preparation is still relatively high as compared to manual methods. Automated methods do however guarantee higher quality parameters due to standardization.

Regular/common leuko-depletion is now implemented in many countries, although its effectiveness for prevention of transfusion related adverse reactions is sometimes questioned [37].

As in the previous years, the number of frozen PCs in some Centers is too high. As mentioned above, in 2020 no decrease in the percentage of frozen PCs was reported which may be related to the COVID 19 pandemic. The percentage reported for the country as a whole is acceptable. It must be noted however, that routine freezing of large volumes of PCs, as is the case in some Centers, is not to be accepted.

The example of the Center in Białystok is a good illustration that freezing is not to be abandoned completely. Although in 2020, the Center did not perform freezing procedures, it did issue 3.9% of thawed PCs for clinical use. Current indications for the use of thawed PCs are limited. The components should be used only in exceptional cases, mostly for patients with anti-HLA or anti-HPA antibodies. Therefore it is not recommended to freeze more than 10% of all PCs prepared. This does not refer to freezing of apheresis PCs collected from patients with anti-HLA or anti-HPA antibodies.

It should be emphasized that freezing and thawing negatively affect the quality parameters of

platelets and their therapeutic efficacy. However, in specific circumstances — as in the pandemic year 2020 — thawed PCs may prove to be the only option for patients who require frequent transfusions.

It is the Centers that are obliged to safeguard the supply of blood/blood components; however, to fulfill this task they need to cooperate with hospitals and such cooperation requires implementation of appropriate management of blood and blood components in every hospital, taking into account the individual needs of patients. The currently available data demonstrate that the ongoing cooperation between Centers and hospitals calls for significant changes which need to be preceded by extensive training activity aimed at increasing the awareness of the principles related to the above-mentioned issues. Training activity should be the responsibility of Centers on the one hand and the hospitals on the other. It is of utmost importance to establish constant cooperation between 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 [38].

The most common causes of wastage in 2020 (as in previous years) belong to the category of "other reasons", in particular:

— inadequate visual control;
— incorrect/low volume;
— seropositive test results;
— incorrect procedures, medical deferral, mechanical damage, donor self-deferral etc.

Expiry date or positive results of viral tests were less frequently the cause of waste. Subjected to waste were also unused blood components from autologous donations.

Data related to quarantine and pathogen inactivated FFP and cryoprecipitate reveal that quarantine FFP is still most commonly used in clinical practice. Although all Centers are equiped with PRT systems (some with two different systems) most of them did not make adequate use of the illuminators installed on their premises. With the exception of several Centers (in which the percentage of pathogen inactivated blood components exceeds 10%) in most Centers only" "trace amounts" of plasma and PC are subjected to pathogen inactivation. In 2020 r. the Mirasol PRT system was implemented for plasma inactivation in the Centers in Radom, Słupsk and Wałbrzych, and they were mainly applied for inactivation of convalescent plasma (just like in all other Centers). Neither the Center in Słupsk nor in Radom applied pathogen inactivation to „conventional" FFP, while the Center in Wałbrzych subjected to pathogen inactivation only 2.66% of FFP. On the other hand, the Center in Radom subjected to pathogen inactivation more than 40% of apheresis PCs. The Center which applies pathogen inactivation on a large scale is again Warsaw (6.83% FFP, 100% pooled PCs, 98.13% apheresis PCs). In 2020, the Center in Lublin gave up applying pathogen inactivation to PCs. In 2020, the Centers in Kalisz, Olsztyn, Opole and Zielona Góra implemented the Theraflex PRT system mainly for convalescent plasma. In 2020, the Centers in Białystok, Radom and Szczecin implemented the Intercept PRT system (in Białystok — for purposes of validation).

As in the previous years, most Centers do 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. On the other hand, physicians who order components for clinical use are not always fully aware that pathogen inactivated plasma is much safer than quarantine plasma; it offers protection against the consequences of the „diagnostic window" (just like quarantine plasma) but also prevents the transmission of a wide spectrum of pathogens other than HIV, HBV, HCV and syphilis.

It is also likely that physicians do not always have sufficient knowledge and awareness regarding TA-GVHD prophylaxis which may be due to inadequate information on transfusion-related adverse reactions that appear in guidelines/regulations dedicated to some medical disciplines.

There is no justification however, for the sometimes observed procedure of physician's order for PCs subjected to pathogen inactivation(with one of the above mentioned systems) and also irradiated. Such procedure is incorrect, because the use of both gamma irradiation and inactivation may induce platelet activation which contributes to faster removal of platelets from the recipient's circulatory system [39].

Conclusions

The study is a brief presentation of selected issues related to the activities of the Polish Blood Transfusion Centers (Centers) in 2020, as well as some recently recorded trends of changes observed

over a longer period of time. As compared to the previous years, almost all 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 been observed to decrease which is most probably due to the ongoing COVID-19 pandemic.

The 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 in other countries.

Current problems of blood transfusion medicine

In 2020, blood transfusion service had to face problems that were largely related to the COVID-19 pandemic.

As result of rapid escalation of SARS-CoV-2 infections, on March 11th 2020 the World Health Organization (WHO) declared the COVID-19 pandemic. This brought about several important challenges for blood transfusion service:

— implementation of additional precautionary measures in blood collecting units;
— introduction of additional criteria for blood donor deferral;
— facing new tasks related to predicted blood component shortages, planning emergency actions and priority setting of supplies for clinical use [40].

From the point of view of blood transfusion medicine the following pandemic–related issues were most relevant:

— impact of the COVID-19 pandemic on the supply of blood components for clinical use and the need to secure adequate protection for patients in this respect;
— likely impact of COVID-19 infection on blood and the hematopoietic system which may lead to increased demand for blood components used as substitutive therapy;
— concerns about the possibility of disease transmission through transfusion of blood and components;
— tasks related to the collection and clinical use of convalescent plasma for COVID-19 patients as passive immunotherapy.

One important consequence of the ongoing COVID-19 pandemic is blood and blood component shortage observed in so many countries. The circumstances have led to the focus of attention on rational blood therapy, reduction in the number of allogenic blood transfusions as well as on the optimal use of the patient's own blood [41].

A number of international organizations, including the European Center for Disease Prevention and Control (ECDC), have emphasized the importance of implementation and applying the principles of Patient Blood Management (PBM) in this situation of crisis [42].

The consequences of the COVID-19 pandemic are serious both for the blood transfusion service and transfusion medicine. Patients should be ensured timely access to safe blood and blood components and the main task of Centers is to safeguard the health of patients in this respect.

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References

1. Ustawa z dnia 22 sierpnia 1997 r. o publicznej służbie krwi (Dz. U. Nr 106, poz. 681 z późn. zmian.).
2. Osselaer JC, Cazenave JP, Lambermont M, et al. An active haemovigilance programme characterizing the safety profile of 7437 platelet transfusions prepared with amotosalen photochemical treatment. Vox Sang. 2008; 94(4): 315–323, doi: 10.1111/j.1423-0410.2007.01035.x, indexed in Pubmed: 18248574.
3. Schlenke P. Pathogen inactivation technologies for cellular blood components: an update. Transfus Med Hemother. 2014; 41(4): 309–325, doi: 10.1159/000365646, indexed in Pubmed: 25254027.
4. Grass JA, Wafa T, Reames A, et al. Prevention of transfusion-associated graft-versus-host disease by photochemical treatment. Blood. 1999; 93(9): 3140–3147, indexed in Pubmed: 10216113.
5. Farmer S, Trentino K, Hofmann A, et al. A Programmatic Approach to Patient Blood Management – Reducing Transfusions and Improving Patient Outcomes. Open Anesthesiol J. 2015; 9(1): 6–16, doi: 10.2174/1874321801509010006.
6. van Hoeven, Koopman MMW, Koffijberg H, et al. Historical time trends in red blood cell usage in the Netherland. Intl J Clin Transf Med. 2016; 4: 67–77.
7. Ellingson KD, Sapiano MRP, Haass KA, et al. Continued decline in blood collection and transfusion in the United States-2015. Transfusion. 2017; 57 Suppl 2: 1588–1598, doi: 10.1111/trf.14165, indexed in Pubmed: 28591469.
8. WHO Expert Group. Expert Consensus Statement on achieving self-sufficiency in safe blood and blood products, based on voluntary non-remunerated blood donation (VNRBD). Vox Sang. 2012; 103(4): 337–342, doi: 10.1111/j.1423-0410.2012.01630.x, indexed in Pubmed: 22690746.
9. World Health Organization. Towards Self-Sufficiency in Safe Blood and Blood Products based on Voluntary Non-Remunerated Donation. Global Status.; 2013.

10. Główny Urząd Statystyczny, Komitet Redakcyjny. Rocznik demograficzny; 2012.
11. Główny Urząd Statystyczny Rocznik Demograficzny 2021 https://stat gov pl/obszary-tematyczne/roczniki-statystyczne/roczniki-statystyczne/rocznik-demograficzny-2021,3; 15: html.
12. Pogłód R, Rosiek A, Grabarczyk P, et al. Charakterystyka podstawowych wskaźników dotyczących krwiodawstwa i krwiolecznictwa w Europie — aktualne wyzwania i działania. J Transf Med. 2015; 8(2): 60–77.
13. Mikołowska A, Antoniewicz-Papis J. Retrospektywna analiza wybranych aspektów działalności publicznej służby krwi jako punkt wyjścia do oceny stanu polskiego krwiodawstwa. Część 1: Charakterystyka struktury demograficznej zbiorowości dawców. J Transf Med. 2020; 13(1): 29–66.
14. Napp S, Petrić D, Busquets N. West Nile virus and other mosquito-borne viruses present in Eastern Europe. Pathog Glob Health. 2018; 112(5): 233–248, doi: 10.1080/20477724.2018.1483567, indexed in Pubmed: 29979950.
15. Grabarczyk P, Niczyporuk J, Czupryna P, et al. Rekomendacje dotyczące ograniczania przenoszenia wirusa Zachodniego Nilu (WNV) przez transfuzje krwi oraz jej składników na terenie Polski. J Transf Med. 2020; 13(4): 228–238.
16. Siński E. Pasożytnicze pierwotniaki krwi potencjalnym zagrożeniem bezpieczeństwa krwiodawstwa w świetle doniesień prezentowanych na konferencji „Aktualne problemy dotyczące czynników zakaźnych przenoszonych przez krew" (10 marca 2017 r., Warszawa). J Transf Med. 2017; 10(2): 67–72.
17. Stramer SL, Hollinger FB, Katz LM, et al. Emerging infectious disease agents and their potential threat to transfusion safety. Transfusion. 2009; 49 Suppl 2: 1S–29S, doi: 10.1111/j.1537-2995.2009.02279.x, indexed in Pubmed: 19686562.
18. Jimenez A, Shaz BH, Bloch EM. Zika Virus and the Blood Supply: What Do We Know? Transfus Med Rev. 2017; 31(1): 1–10, doi: 10.1016/j.tmrv.2016.08.001, indexed in Pubmed: 27569055.
19. Rosiek A, Tomaszewska A, Lachert E, et al. Obniżone stężenie hemoglobiny najczęstszą przyczyną dyskwalifikacji krwiodawców na terenie polski. Acta Haematol Polonica. 2015; 46: 24, doi: 10.1016/j.achaem.2015.07.044.
20. Goldman M, Magnussen K, Gorlin J, et al. International Forum regarding practices related to donor haemoglobin and iron. Vox Sang. 2016; 111(4): 449–455, doi: 10.1111/vox.12431, indexed in Pubmed: 27564140.
21. Vuk T, Magnussen K, De Kort W, et al. International forum: an investigation of iron status in blood donors. Blood Transfus. 2017; 15(1): 20–41, doi: 10.2450/2016.0101-16, indexed in Pubmed: 27643753.
22. Vassallo R, Goldman M, Germain M, et al. BEST Collaborative. Preoperative Autologous Blood Donation: Waning Indications in an Era of Improved Blood Safety. Transfus Med Rev. 2015; 29(4): 268–275, doi: 10.1016/j.tmrv.2015.04.001, indexed in Pubmed: 26006319.
23. European Directorate for the Quality of Medicines and HealthCare (EDQM). Guide to the preparation, use and quality assurance of blood components: recommendation No. R (95) 15, wyd.; 20: 2020.
24. Główny Urząd Statystyczny. Ludność. Stan i struktura ludności oraz ruch naturalny w przekroju terytorialnym (stan w dniu 31.12.2019). https://stat.gov.pl/obszary-tematyczne/ludnosc/ludnosc/ludnosc-stan-i-struktura-ludnosci-oraz-ruch-naturalny-w-przekroju-terytorialnym-stan-w-dniu-31-12-2019, 6, 27. html# [online].
25. Główny Urząd Statystyczny, Komitet Redakcyjny. Rocznik demograficzny; 2017.
26. Główny Urząd Statystyczny, Komitet Redakcyjny. Rocznik demograficzny; 2015.
27. Główny Urząd Statystyczny, Komitet Redakcyjny. Rocznik demograficzny; 2016.
28. Komitet Redakcyjny Głównego Urzędu Statystycznego. Rocznik demograficzny; 2019.
29. Rosiek A, Tomaszewska A, Lachert E, et al. Działalność jednostek organizacyjnych służby krwi w Polsce w 2015 roku. J Transf Med. 2016; 9(4): 1–18.
30. Rosiek A, Tomaszewska A, Lachert E, et al. Działalność jednostek organizacyjnych służby krwi w Polsce w 2016 roku. J Transf Med. 2017; 10(4): 113–129.
31. Rosiek A, Tomaszewska A, Lachert E, et al. Działalność jednostek organizacyjnych służby krwi w Polsce w 2017 roku. J Transf Med. 2018; 11(4): 113–130.
32. Rosiek A, Tomaszewska A, Lachert E, et al. Działalność jednostek organizacyjnych służby krwi w Polsce w 2018 roku. J Transf Med . 2019; 12(4): 127–143.
33. Rosiek A, Tomaszewska A, Lachert E, et al. Działalność jednostek organizacyjnych służby krwi w Polsce w 2019 roku. J Transf Med. 2020; 13(4): 195–211.
34. NICE. Blood transfusion. NICE guideline. Published: 18 November 2015. nice.org.uk/guidance/ng24 [Online]. [Online].
35. Klein AA, Arnold P, Bingham RM, et al. AAGBI guidelines: the use of blood components and their alternatives 2016. Anaesthesia. 2016; 71(7): 829–842, doi: 10.1111/anae.13489, indexed in Pubmed: 27062274.
36. Estcourt LJ. Why has demand for platelet components increased? A review. Transfus Med. 2014; 24(5): 260–268, doi: 10.1111/tme.12155, indexed in Pubmed: 25327286.
37. Simancas-Racines D, Osorio D, Martí-Carvajal AJ, et al. Leukoreduction for the prevention of adverse reactions from allogeneic blood transfusion. Cochrane Database Syst Rev. 2015(12): CD009745, doi: 10.1002/14651858.CD009745.pub2, indexed in Pubmed: 26633306.
38. Heitmiller ES, Hill RB, Marshall CE, et al. Blood wastage reduction using Lean Sigma methodology. Transfusion. 2010; 50(9): 1887–1896, doi: 10.1111/j.1537-2995.2010.02679.x, indexed in Pubmed: 20456700.
39. Apelseth TØ, Bruserud Ø, Wentzel-Larsen T, et al. In vitro evaluation of metabolic changes and residual platelet responsiveness in photochemical treated and gamma-irradiated single-donor platelet concentrates during long-term storage. Transfusion. 2007; 47(4): 653–665, doi: 10.1111/j.1537-2995.2007.01167.x, indexed in Pubmed: 17381624.
40. Stanworth SJ, New HV, Apelseth TO, et al. Effects of the COVID-19 pandemic on supply and use of blood for transfusion. Lancet Haematol. 2020; 7(10): e756–e764, doi: 10.1016/S2352-3026(20)30186-1, indexed in Pubmed: 32628911.
41. Baron DM, Franchini M, Goobie SM, et al. Patient blood management during the COVID-19 pandemic: a narrative review. Anaesthesia. 2020; 75(8): 1105–1113, doi: 10.1111/anae.15095, indexed in Pubmed: 32339260.
42. European Centre for Disease Prevention and Control. Coronavirus disease — 2019 (COVID-19) and supply of substances of human origin in EU/EEA — first update. April 2020 . https://www.ecdc.europa.eu/sites/default/files/documents/COVID%2019-supply-substances-human-origin-first-update.pdf.
43. Rabel PO, Planitzer CB, Farcet MR, et al. Increasing West Nile virus antibody titres in central European plasma donors from 2006 to 2010. Euro Surveill. 2011; 16(10), doi: 10.2807/ese.16.10.19812-en, indexed in Pubmed: 21435324.