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# An investigation of the early and late period effects of the COVID-19 pandemic on blood use and destruction rates: An example of a tertiary hospital, Antalya, Türkiye

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**ABSTRACT**

**Introduction and Objective:** The Coronavirus 2019 (COVID-19) pandemic has affected many healthcare services as well as transfusion medicine practices. In this study, it is aimed to examine the early and late effects of the pandemic on the use and destruction rates of blood and blood components.

**Material and method:** This retrospective study was conducted at a tertiary hospital transfusion center. Unit numbers of blood and blood components used and destroyed in 2018-2021 were grouped according to the pre-pandemic period (27 months), early pandemic period (6 months), and late pandemic period (15 months). Monthly use and disposals in the early and late pandemic periods were compared with the pre-pandemic period.

**Results:** A total of 144114 units of blood and blood components were used. The most used components were erythrocyte concentrate (EC), fresh frozen plasma (FFP) and thrombocyte concentrate (TC), respectively. Their monthly usages in the pre-pandemic period, the early pandemic period and the late pandemic period were 2067.1±147.2, 840±161.3 and 285.4±77.4; 1564.5±287.5, 576.7±146.2 and 261.5±52.6; 1803.5±122.1, 718.6±118.8 and 325.7±52.1; respectively. EC and FFP were used significantly less in the early and late pandemic periods than in the pre-pandemic period ($p<0.001$, $p=0.001$ and $p<0.001$, $p<0.042$, respectively). The TC use did not differ significantly. EC, FFP and TC destructions in the pre-pandemic period, the early pandemic period and the late pandemic period were 4 (1-10), 3.5 (0-17) and 3 (0-9); 3.5(0-8), 2.5(1-7) and 3(2-5); 1(0-7), 2(0-10) and 3(1-7); respectively. A significant decrease in EC destructions was observed during the late pandemic period ($p=0.001$).

**Conclusion:** Less blood was used both in the early and late periods of the COVID -19 pandemic. Blood dispositions decreased during the late pandemic period.

**Key Words:** Blood components, blood destruction, blood usage, COVID-19 pandemic,

## INTRODUCTION

The novel coronavirus infection 2019 (COVID-19), caused by severe acute respiratory failure syndrome-coronavirus 2 (SARS-CoV-2), has deeply affected business, education, health and community relations with the declaration of a pandemic (1). Along with many healthcare services, blood banking and transfusion medicine have also been significantly affected (2). Blood supplies have significantly reduced in many parts of the world (3). It has been reported that blood donations have decreased not only in underdeveloped countries but also in developed countries due to social isolation and quarantine measures (3-5). The effectiveness of immune plasma obtained from individuals who have had the disease in the treatment has been discussed (6). In this period, the main purpose of blood centers was to meet the needs of critical emergencies such as major trauma (7). After the acute period the pandemic has completed two years. In recent days, pandemic restrictions have been flexed and their complete removal is being discussed. The determination of blood demands and the use of blood, which is one

of the main activities that guide good transfusion practices, need to be reviewed in terms of the effects of the pandemic (8-10). In our study, it was aimed to examine the early and late effects of the COVID-19 pandemic on the use and destruction of blood and blood components in Antalya Training and Research Hospital, a tertiary hospital in Türkiye. With the study, it is hoped that lessons will be taken for good transfusion practices in the ongoing pandemic process and in similar situations that may occur in the future.

## 2. MATERIAL AND METHOD

This retrospective study was carried out in the Transfusion Center of Antalya Training and Research Hospital with a bed capacity of 1270, which provides tertiary healthcare services to Antalya and surrounding provinces. According to the national organization, Transfusion Centers are units that provide blood and its components that are not authorized to take blood from a blood donor, except in emergencies, from the Regional Blood Center to which they are affiliated and prepare them for use in patients by cross-comparison for transfusion and other necessary tests (11).

In our study, blood and blood components that were discharged from the Transfusion Center between 01.01.2018 and 31.12.2021 were grouped as pre-pandemic period, early pandemic period and late pandemic period, based on March 2020, when the pandemic was declared. The pre-pandemic period; The 27-month period from January 1, 2018, to March 31, 2020. Early pandemic period; The 6-month period between April 1 and September 30, 2020. The late pandemic period; is the 15-month period from October 1, 2020, to December 31, 2021. The blood and blood components used and destroyed in the early and late periods of the pandemic were compared with the pre-pandemic period. Whole blood (WB), erythrocyte concentrate (EC), thrombocyte concentrate (TC) (apheresis and those obtained from whole blood), fresh frozen plasma (FFP), cryoprecipitate (Cryo) and immune plasma (IP) used during these periods were included in the study.

The data were obtained from the hospital's data processing system (SARUS-LISS), Transfusion Center records and quality documents. Disposal rates were determined by calculating that "destroyed blood and blood components/number of of blood or blood components entering the stock of the institution X 100" in the relevant period according to the Quality in Health Guide (12).

Also the number of using blood and blood components according to clinics and destruction rates by their causes in 2018-2021 were analysed in the scope of the study and the results are presented in the supplements 1-6.

### 2.1 Statistical analysis

Statistical analyses of collected data were conducted using STATA v16.0 (StataCorp. LLC. TX. USA). Determination of the normally distributed data was conducted using the Kolmogorov-Smirnov test. Numerical variables were expressed as the mean ± standard deviation or median (min-max). ANOVA test (post hoc: Bonferroni test) or Kruskall Wallis test (post hoc: Dunn's test) was used to compare the pre-pandemic and post-pandemic periods. Changes in blood use and blood destruction products according to periods and years were evaluated with mixed model analysis in repetitive samples. $P<0.05$ was taken as statistical significance.

## 4. RESULTS AND DISCUSSION

Between 01.01.2018 and 31.12.2021, a total of 144114 units of blood and blood components, including EC, FFP, TC, WB, Cryo and IP, were used in our hospital (Table 1).

The monthly mean blood use in the early and late pandemic periods was compared with the pre-pandemic period. In the early and late pandemic period; EC, FFP and WB were used significantly less according to the component type, while there was no significant difference in the use of TC (Table 2).

**Table 1:** The number of units of blood and blood components used in 2018-2021

| | **2018 n (%)** | **2019 n (%)** | **2020 n (%)** | **2021 n (%)** |
|---|---|---|---|---|
| **EC** | 23806 (63.97) | 25713 (65.42) | 21124 (62.98) | 21607 (63.27) |
| **FFP** | 10330 (27.76) | 9766 (24.85) | 8085 (24.10) | 8739 (25.59) |
| **TC** | 2931 ( 7.88) | 3708 (9.43) | 3793 (11.33) | 3728 (10.92) |
| **WB** | 120 (0.32) | 112 (0.28) | 43 (0.13) | 35 (0.10) |
| **Cryo** | 26 (0.07) | 6 (0.02) | 43 (0.13) | 42 (0.12) |
| **IP** | - | - | 453 (1.35) | 0 |
| **Total** | 37213 | 39305 | 33541 | 34151 |

EC: erythrocyte concentrate, FFP: fresh frozen plasma, TC: thrombocyte concentrate, Cryo: cryoprecipitate, IP: immune plasma. WB: whole blood, n: number of units in which the blood component is used, -: no component use.

**Table 2:** Monthly use of blood and blood components per pandemic period.

| | **The pre-pandemic period (27 months)** | **The early pandemic period (6 months)** | ***p*** | **The late pandemic period (15 months)** | ***p*** |
|---|---|---|---|---|---|
| **EC** | 2067.1±147.2 | 1564.5±287.5 | <0.001** | 1803.5±122.1 | <0.001** |
| **FFP** | 840±161.3 | 576.7±146.2 | 0.001** | 718.6±118.8 | 0.042* |
| **TC** | 285.4±77.4 | 261.5±52.6 | 0.999 | 325.7±52.1 | 0.215 |
| **WB** | 9 (2-21) | 1.5 (0-6) | <0.001** | 3 (0-9) | <0.001** |
| **CRY** | 0 (0-13) | 0 | 0.995 | 0(0-24) | 0.990 |
| **IP** | - | 4 (0-163) | - | 0 (0-158) | - |
| **Total** | 3203.3±271.6 | 2441.5±492.3 | <0.001** | 2871.4±175.5 | 0.002* |

EC: erythrocyte concentrate, FFP: fresh frozen plasma, TC: thrombocyte concentrate, Cryo: cryoprecipitate, IP: immune plasma, WB: whole blood, -: no component use. The number of units in which the blood component was used was shown as mean±standard deviation or median (min-max). *: p<0.05, **: p<0.001

The monthly destruction numbers of blood and blood components determined according to pandemic periods are given in Table 3. A significant decrease was found in the monthly destruction numbers of all blood products and EC in the late pandemic period compared to the pre-pandemic period (p=0.001, p<0.001, respectively).

The medical clinic that used the most blood was internal medicine in 2018-2021. While hematology, oncology and nephrology clinics used the most blood in 2018 and 2019, respectively; in 2020 and 2021, hematology, oncology and gastroenterology were the clinics that used the most blood. Among the surgical clinics, the first three surgical clinics that used the most blood were orthopedics, cardiovascular surgery and general surgery in 2018 and 2019; respectively, and in 2020 and 2021, orthopedics, general surgery, and cardiovascular surgery clinics were the surgical clinics that used the most blood. In the pandemic services, 554 units of blood were used at a rate of 1.65% in 2020 and a rate of 1.93% with 658 in 2021. In 2020, in the intensive care units and pandemic

**Table 3:** Monthly destruction rates of blood and blood components according to pandemic periods.

| | The pre-pandemic period 27 months | The early pandemic period 6 months | *p* | The late pandemic period 15 months | *p* |
|---|---|---|---|---|---|
| **EC** | 4 (1-10) | 3.5 (0-8) | 0.710 | 1 (0-7) | <0.001* |
| **FFP** | 3.5 (0-17) | 2.5 (1-7) | 0.978 | 2 (0-10) | 0.957 |
| **TC** | 3 (0-9) | 3 (2-5) | 0.984 | 3 (1-7) | 0.995 |
| **WB** | 0 (0-3) | 0 (0-3) | 0.754 | 0 | 0.066 |
| **Cryo** | 0 | 0 | 0.999 | 0 | 0.999 |
| **IP** | 0 | 0 (0-1) | 0.111 | 0 | 0.999 |
| **Total** | 12 (4-25) | 11.5 (7-15) | 0.696 | 5 (2-15) | 0.001* |

EC: erythrocyte concentrate, FFP: fresh frozen plasma, TC: thrombocyte concentrate, Cryo: cryoprecipitate, IP: immune plasma, WB: whole blood, -: no component use.
Numerical variables were expressed as median (min-max). *p<0.05 indicates statistical significance.

**Figure 1:** Use of EC, FFP and TC over three-month periods 1st period: January, February, March. 2nd period: April, May, June. 3rd period: July, August, September. 4th period: September, October, November.

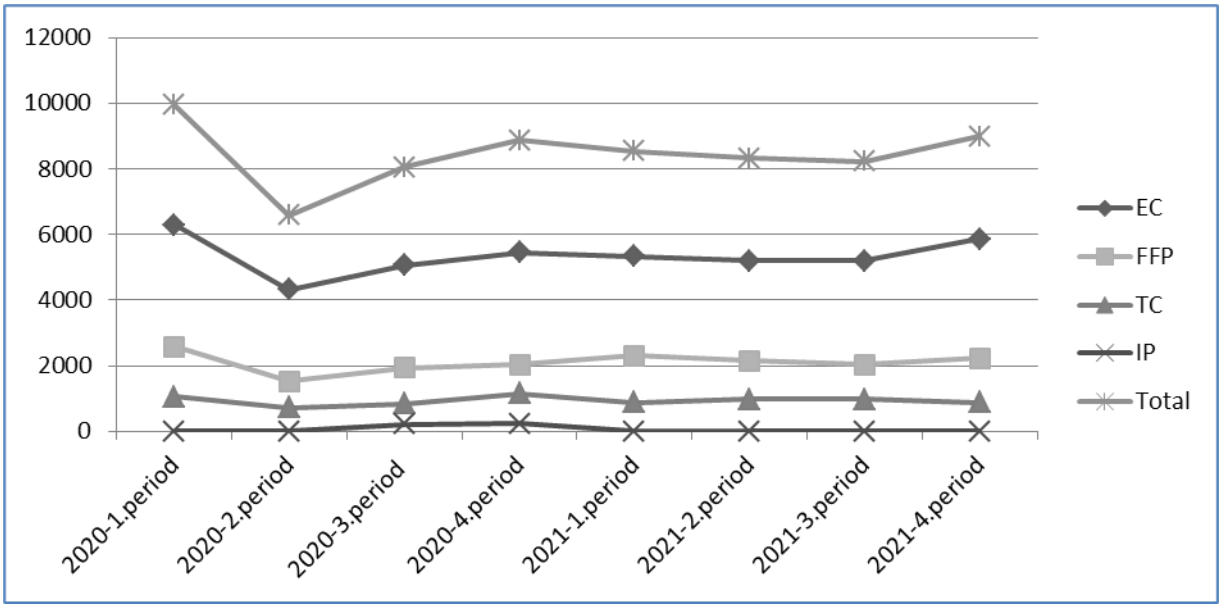
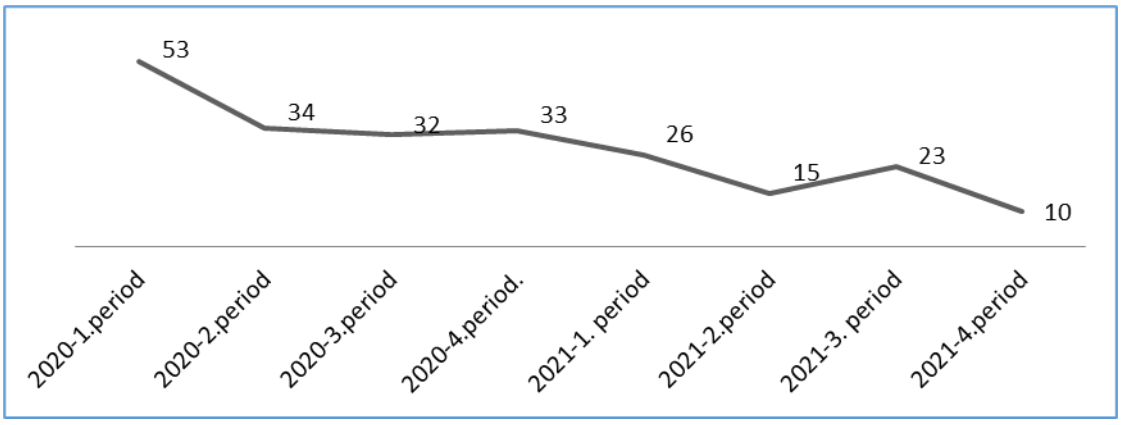



**Figure 2:** Quantitative monitoring of total blood and blood component destructions during the pandemic period.
The periods show 3-month periods of a year. 1st period: January, February, March. 2nd period: April, May, June. 3rd period: July, August, September. 4th period: September, October, November.



services, 289 and 164 units of IP; a total of 453 units of IP were used, respectively (Suplements 1-4). In our hospital destruction rates were < % 1 in 2018-2021 (Suplement 5). The most common causes of destruction were the expiration of blood components, returns from services, and bag explosions in 2018-2021 (Suplement 6).

While determining the use of blood is the main transfusion activities, it has become an even more important issue for taking precautions during the pandemic period and learning lessons for the future. In this study, to examine the early and late effects of the COVID-19 pandemic on blood use and disposal, the data for the years 2018-2021 were grouped and compared according to the pre-pandemic, early pandemic and late pandemic periods. It was determined that the use of EC, FFP and whole blood decreased significantly both in the early and late periods of the pandemic, and the use of TC did not change. It was determined that the destructions decreased in the late period. The destruction of EC decreased significantly.

The COVID-19 pandemic was declared by WHO on March 2020, with mandatory closures imposed due to the prevalence and highly contagious nature of the infection. In many countries, including the USA, along with the underdeveloped countries, blood donations have decreased and a blood shortage has emerged. In some countries, it has been suggested to stop elective surgeries at the national level. Hospitals in North America have changed their operations considerably to prepare for the expected COVID-19 patient population. While these changes vary from hospital to hospital, they include cancelling elective surgeries and procedures, suspending live solid organ transplants and autologous stem cell transplants, reducing the blood used by sickle cell anemia exchange programs, and raising awareness of the risk of blood shortages. Thus, the decrease in blood supply was partially offset by the decrease in demand (13). After the declaration of the pandemic, there was no warning to restrict blood use at the national level in our country. However blood donation calls were made and hospitals took their transfusion measures. In our hospital. the hospital management and all clinics were informed about blood stocks by the transfusion center, and it was recommended to consider limited blood stocks during surgical planning and transfusion decisions. According to the study, a significant decrease was found in the use of EC, FFP, whole blood in the first 6-month pandemic period after the declaration of a pandemic in our hospital compared to the pre-pandemic period. When we analysed the blood usage by dividing the years 2020 and 2021 into 3-month periods, it was found that this decrease was the highest in the first 3-month period after the declaration of the pandemic. Figure 1 shows the temporal course of blood used in the pandemic. These results are consistent with a study conducted in the USA. In that study, it was reported that blood use decreased in the initial period of the pandemic, and it was associated with the call for the postponement of elective surgeries at the national level (14). Similarly, our results seem to be related to the reduction of blood donations and the planning of treatment and/or elective surgeries in the first period.

As time progressed in the pandemic, long lockdown periods were followed by opening-closure periods and while calling for blood donations, a call to action was issued encouraging all stakeholders and providers to implement patient blood management principles, professionalism and versatility approaches. The ABC of patient blood management is explained with the call to action (15). While the difficulties in voluntary blood donations continued in our region, the relatives of the patients supported the process of providing blood adaptively. These supports have reached more than their patients. On the other hand, to manage the decreasing blood stock, good transfusion practices have come to the fore in line with the principles of patient blood management. Blood outputs from the transfusion center at one time were reduced

from 2 units to 1 unit. It was requested that the transfusion thresholds be lowered and the decision for the 2nd unit blood request should be made by evaluating the patient after the 1st unit blood transfusion. In order to reduce destructions other than inevitable destructions, the blood in stock and reserved blood was strictly monitored. The information that critical stock levels have decreased has been announced to all clinics in difficult times. Although blood use increased in the late pandemic period compared to the early period, it continued to be less than blood use in the pre-pandemic period. Indeed, when elective surgical procedures are resumed, it has been predicted that there will be long-term blood supply shortages after the peak of the pandemic (2,13). We think that this problem is balanced with the support of patient relatives which are not normally needed in our region.

According to the results of our study, while there was no significant change in monthly destruction numbers in the early pandemic period, a significant decrease was observed in EC and total blood destruction in the late pandemic period. These results seem to be related to good transfusion practices as a result of decreased blood use and increased awareness of maintaining blood stocks. In a challenging period such as the pandemic all over the world, patient blood management principles have gained vital importance as approaches that ensure the effective use of limited resources (16).

One of the most important principles of modern transfusion medicine is to give the necessary blood components to the patient instead of whole blood. In the last 4 years, the ratio of whole blood to total blood usage in our hospital was 0.32, 0.28, 0.13, and 0.10, respectively. It was mostly used in cardiovascular surgery and intensive care units. It was not used in COVID-19 services. It was used significantly less in the early and late pandemic periods than in the pre-pandemic period. The transfusion rate of whole blood in a country is an important health indicator and this rate is quite low in developed countries. With the right indication, this rate should be 3-5% at most. The use of whole blood in our country differs from region to region (17).

The COVID-19 pandemic did not affect the frequency of use of blood components (EC, FFP and TC, respectively) and the order of causes of destruction (respectively, expiration of the blood component, returns from services and bag explosion) in our hospital.

The ratio of the blood used in the pandemic services to the total blood and blood components used in the hospital was 1.65% in 2020 and 1.93% in 2021. It was less than in other clinics. The results is compatible with studies that reported hospitalized COVID-19 patients had low blood usage (18,19).

IP was used in the pandemic services in the period between May-December 2020, and it was never used in 2021. Although IP was initially used as a treatment option but it is abandoned due to transfusion-related circulatory overload and antibody-mediated exacerbation effects. Indeed, IP was initially used as a treatment option (20).

**4. CONCLUSION**

To our knowledge, this study is the first to investigate the effects of the both early and late period of the COVID-19 pandemic on blood use and destruction rates. In extraordinary situations, difficulties are encountered in meeting the need for blood. According to the results of our study, the COVID-19 pandemic caused a decrease in blood use. Its effect was greatest in the first 3 months, and the effects continued in the late period. Ensuring the balance between supply and demand has been the main idea in the pandemic. This balance requires the supply of sufficient blood and the effective use of the supplied blood. Quickly applicable transfusion action plans should be ready with financial and human resources for the similar prosess in future.

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**Conflict of Interest:** The authors declare that they have no competing interest.

**Ethical Statement:** Ethical approval was taken from the Clinical Research Ethics Committee of Antalya Training and Research Hospital (Date:20.01.2022, approval number: 2/9).

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## Supplementary data

**Supplement 1:** Utilization of blood components according to clinics in 2018

| | EC | FFP | TC | WB | Cryo | TOTAL |
|---|---|---|---|---|---|---|
| **EMERGENCY SERVICES** | **1779** | **173** | **152** | **0** | **0** | **2104** |
| **INTENSIVE CARE UNITS** | **5150** | **4836** | **627** | **60** | **7** | **10680** |
| **SURGICAL CLINICS** | **5761** | **2700** | **80** | **60** | **0** | **8601** |
| Cardiovascular surgery | 781 | 1219 | 6 | 59 | 0 | 2065 |
| Orthopedia | 1882 | 238 | 7 | 0 | 0 | 2127 |
| General surgery | 1341 | 529 | 26 | 0 | 0 | 1896 |
| Obstetrics&Gynecology | 948 | 455 | 21 | 1 | 0 | 1425 |
| Urology | 257 | 99 | 4 | 0 | 0 | 360 |
| Neurosurgery | 413 | 135 | 14 | 0 | 0 | 562 |
| Others * | 139 | 25 | 2 | 0 | 0 | 166 |
| **MEDICAL CLINICS** | **11116** | **2621** | **1976** | **0** | **19** | **15732** |
| Pediatrics | 165 | 140 | 15 | 0 | 0 | 320 |
| Internal Medicine | **10951** | **2481** | **2057** | **0** | **19** | **15508** |
| Hematology | 6672 | 1155 | 1515 | 0 | 0 | 9342 |
| Oncology | 1873 | 390 | 348 | 0 | 0 | 2611 |
| Nephrology | 1002 | 235 | 27 | 0 | 0 | 1264 |
| Gastroenterology | 480 | 217 | 25 | 0 | 0 | 722 |
| Other internal medicine clinics ** | 238 | 410 | 126 | 0 | 19 | 793 |
| Other medical clinics *** | 686 | 74 | 16 | 0 | 0 | 776 |
| **TOTAL** | **23806** | **10330** | **2931** | **120** | **26** | **37213** |

EC; erytrocyte concentrate. TC; trombocyte concentrate. FFP; fresh frozen plasma. Cry; cryoprecipitate. WB; whole blood

*__Others;__ plastic surgery. otolaryngology. thorasic surgery

**__Others internal medicine;__ generally internal medicine. cardiology. endocrinology. rheumatology

***__Other medical clinics;__ Infection diseases. thorasic diseases. physical rehabilitation. neurology

**Supplement 2:** Utilization of blood components according to clinics in 2019

| | EC | FFP | TC | WB | Cryo | TOTAL |
|---|---|---|---|---|---|---|
| **EMERGENCY SERVICES** | 1836 | 167 | 178 | 0 | 2 | **2183** |
| **INTENSIVE CARE UNITS** | 5179 | 5134 | 779 | 39 | 4 | **11135** |
| **SURGICAL CLINICS** | **6963** | **2992** | **121** | **73** | **0** | **10149** |
| Cardiovascular surgery | 980 | 1151 | 3 | 72 | 0 | 2206 |
| Orthopedia | 2425 | 440 | 29 | 0 | 0 | 2894 |
| General surgery | 1450 | 581 | 43 | 0 | 0 | 2074 |
| Obstetrics&Gynecology | 1125 | 481 | 27 | 1 | 0 | 1634 |
| Urology | 315 | 88 | 13 | 0 | 0 | 416 |
| Neurosurgery | 454 | 217 | 3 | 0 | 0 | 674 |
| Others * | 214 | 34 | 3 | 0 | 0 | 251 |
| **MEDICAL CLINICS** | **11735** | **1473** | **2630** | **0** | **0** | **15838** |
| Pediatrics | 305 | 95 | 13 | 0 | 0 | 413 |
| Internal Medicine | **11096** | **1363** | **2578** | **0** | **0** | **15037** |
| Hematology | 7690 | 436 | 1918 | 0 | 0 | 10044 |
| Oncology | 1243 | 309 | 371 | 0 | 0 | 1923 |
| Nephrology | 830 | 83 | 28 | 0 | 0 | 941 |
| Gastroenterology | 379 | 245 | 81 | 0 | 0 | 705 |
| Other internal medicine clinics ** | 954 | 290 | 180 | 0 | 0 | 1424 |
| Other medical clinics *** | 334 | 15 | 39 | 0 | 0 | 388 |
| **TOTAL** | **25713** | **9766** | **3708** | **112** | **6** | **39305** |

EC; erytrocyte concentrate. TC; trombocyte concentrate. FFP; fresh frozen plasma. Cry; cryoprecipitate. WB; whole blood

***Others;** plastic surgery. otolaryngology. thorasic surgery

****Others internal medicine;** generally internal medicine. cardiology. endocrinology. rheumatology

*****Other medical clinics;** Infection diseases. thorasic diseases. physical rehabilitation. neurology

**Supplement 3:** Utilization of blood components according to clinics in 2020

| | EC | FFP | TC | WB | Cryo | IP | TOTAL |
|---|---|---|---|---|---|---|---|
| **EMERGENCY SERVICES** | **1646** | **110** | **231** | **0** | **7** | **0** | **1994** |
| **INTENSIVE CARE UNITS** | **4206** | **3835** | **856** | **24** | **28** | **289** | **9238** |
| **SURGICAL CLINICS** | **5139** | **2394** | **91** | **19** | **0** | **0** | **7643** |
| Cardiovascular surgery | 586 | 787 | 6 | 16 | 0 | 0 | 1395 |
| Orthopedia | 1725 | 410 | 13 | 0 | 0 | 0 | 2148 |
| General surgery | 1114 | 523 | 30 | 0 | 0 | 0 | 1667 |
| Obstetrics&Gynecology | 981 | 369 | 29 | 3 | 0 | 0 | 1382 |
| Urology | 344 | 175 | 0 | 0 | 0 | 0 | 519 |
| Neurosurgery | 238 | 116 | 6 | 0 | 0 | 0 | 360 |
| Others * | 151 | 14 | 7 | 0 | 0 | 0 | 172 |
| **MEDICAL CLINICS** | **10133** | **1746** | **2615** | **0** | **8** | **164** | **14666** |
| Pediatrics | 83 | 73 | 6 | 0 | 0 | 0 | 162 |
| Internal Medicine | **9534** | **1536** | **2506** | **0** | **8** | **0** | **13584** |
| Hematology | 7281 | 374 | 1933 | 0 | 0 | 0 | 9588 |
| Oncology | 614 | 214 | 343 | 0 | 0 | 0 | 1171 |
| Nephrology | 482 | 245 | 13 | 0 | 0 | 0 | 740 |
| Gastroenterology | 473 | 298 | 34 | 0 | 8 | 0 | 813 |
| Other internal medicine clinics ** | 684 | 405 | 183 | 0 | 0 | 0 | 1272 |
| Other medical clinics *** | 255 | 93 | 18 | 0 | 0 | 0 | 366 |
| **PANDEMI CLINICS** | 261 | 44 | 85 | 0 | 0 | 164 | **554** |
| **TOTAL** | **21124** | **8085** | **3793** | **43** | **43** | **453** | **33541** |

EC; erytrocyte concentrate. TC; trombocyte concentrate. FFP; fresh frozen plasma. IP; immun plasma. Cry; cryoprecipitate. WB; whole blood

*__Others;__ plastic surgery. otolaryngology. thorasic surgery

**__Others internal medicine;__ generally internal medicine. cardiology. endocrinology. rheumatology

***__Other medical clinics;__ Infection diseases. thorasic diseases. physical rehabilitation. neurology

**Supplement 4:** Utilization of blood components according to clinics in 2021

| | EC | FFP | TC | WB | Cryo | IP | TOTAL |
|---|---|---|---|---|---|---|---|
| **EMERGENCY SERVICES** | 2188 | 169 | 198 | 0 | 0 | 0 | **2555** |
| **INTENSIVE CARE UNITS** | 4477 | 4190 | 858 | 25 | 0 | 0 | **9550** |
| **SURGICAL CLINICS** | **4932** | **2352** | **160** | **10** | **0** | **0** | **7454** |
| Cardiovascular surgery | 491 | 720 | 6 | 8 | 0 | 0 | 1225 |
| Orthopedia | 1839 | 449 | 12 | 0 | 0 | 0 | 2300 |
| General surgery | 795 | 438 | 64 | 2 | 0 | 0 | 1299 |
| Obstetrics&Gynecology | 1048 | 440 | 70 | 0 | 0 | 0 | 1558 |
| Urology | 336 | 133 | 0 | 0 | 0 | 0 | 469 |
| Neurosurgery | 294 | 137 | 8 | 0 | 0 | 0 | 439 |
| Others * | 129 | 35 | 0 | 0 | 0 | 0 | 164 |
| **MEDICAL CLINICS** | **10010** | **2028** | **2512** | **0** | **42** | **0** | **14592** |
| Pediatrics | 162 | 42 | 37 | 0 | 0 | 0 | 241 |
| Internal Medicine | **9340** | **1865** | **2339** | **0** | **10** | **0** | **13554** |
| Hematology | 6854 | 559 | 1653 | 0 | 2 | 0 | 9068 |
| Oncology | 675 | 236 | 443 | 0 | 0 | 0 | 1354 |
| Nephrology | 553 | 313 | 19 | 0 | 0 | 0 | 885 |
| Gastroenterology | 609 | 425 | 65 | 0 | 8 | 0 | 1107 |
| Other internal medicine clinics ** | 649 | 332 | 159 | 0 | 0 | 0 | 1140 |
| Other medical clinics *** | 120 | 5 | 14 | 0 | 0 | 0 | 139 |
| **PANDEMI CLINICS** | 388 | 116 | 122 | 0 | 32 | 0 | **658** |
| **TOTAL** | **21607** | **8739** | **3728** | **35** | **42** | **0** | **34151** |

EC; erytrocyte concentrate. TC; trombocyte concentrate. FFP; fresh frozen plasma. IP; immun plasma. Cry; cryoprecipitate. WB; whole blood

*__Others;__ plastic surgery. otolaryngology. thorasic surgery

**__Others internal medicine;__ generally internal medicine. cardiology. endocrinology. rheumatology

***__Other medical clinics;__ Infection diseases. thorasic diseases. physical rehabilitation. neurology

**Supplement 5:** Destruction rates of blood and blood components by year.

| | EC | FFP | TC | WB | Cryo | IP | Destruction numbers | The component of blood in the stock | Destruction rates |
|---|---|---|---|---|---|---|---|---|---|
| **2018** | 55 | 49 | 24 | 3 | 0 | - | 131 | 37395 | 0.35 |
| **2019** | 65 | 46 | 42 | 12 | - | - | 165 | 39918 | 0.41 |
| **2020** | 52 | 52 | 38 | 5 | 0 | 1 | 148 | 33679 | 0.44 |
| **2021** | 16 | 24 | 34 | 0 | 0 | 0 | 74 | 34993 | 0.21 |

EC: erythrocyte concentrate. FFP: fresh frozen plasma. TC: thrombocyte concentrate.
Cryo: cryoprecipitate. IP: immune plasma. WB: whole blood. -; no component usage

**Supplement 6:** Rates of the destruction of blood and blood components by causes

| | 2018 n (%) | 2019 n (%) | 2020 n (%) | 2021 n (%) |
|---|---|---|---|---|
| **Expiration** | 50 (% 39.37) | 70 (42.42) | 66 (44.59) | 39 (52.70) |
| **Return from clinics** | 45 (% 35.43) | 60 (36.36) | 49 (33.11) | 24 (32.43) |
| **Bag explosion** | 29 (% 22.83) | 34 (20.61) | 33 (22.30) | 9 (12.16) |
| **The hemolytic component** | 1 (0.79) | 1 (% 0.61) | 0 | 0 |
| **Others** | 2 (% 1.57) | 0 | 0 | 2 |
| **Total** | 127 | 165 | 148 | 74 |