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ORIGINAL ARTICLE

The impact of COVID-19 on blood donations and blood components usage in Ceará, Brazil

Deymisson D. M. Feitosa[1], Felipe P.Mesquita[2], Fraklin J. C Santos[3], Luciana M. Carlos[3], Vânia B. A F. Gomes[3], Jannison K. C Ribeiro[4] and Pedro Everson[2]

[1]Department of Biological Sciences, Laboratory of Morphophysiopharmacology, Federal University of the Semi-Arid Region,, Mossoró, Brazil
[2]hematology and hemotherapy center, Faculty of Medicine of the Federal University of Ceará, Brazil
[3]Ceará hematology and hemotherapy center, Brazil
[4]Pro Hemo Saude Institute, Brazil

ABSTRACT

With increase cases of Coronavirus disease in Brazil and the virus propagation around the world, several health sectors were negatively affected, including hemotherapy services and generating a decrease in blood donation. In this study, we gathered information about total blood donations and usage during COVID-19 pandemic in the state of Ceará, located in the northeast side of Brazil. More specifically data from donations between April 2020 and September 2021 and compared with data gathered from donations of pre-pandemic period. During the period, the state of Ceará received 181.362 candidates for blood donation. Of these, 80.16% were eligible for donation and 19.84% unfit. The number of candidates decreased by 16.72% in 2020 and 5.10% in 2021 in comparison to the same periods in 2018. The main causes of inability for candidates during the pandemic period were low hematocrit/hemoglobin, occasional sexual intercourse in the last 12 months and suspicion or confirmation of COVID in the last 10 days. However, the increasing number of critically ill hospitalized COVID patients increased the blood supply, as transfusions increased by 1.03% in 2020 and 7.96% in 2021, showing a higher demand in RBC, platelets, FFP and CRYO. The pandemic had a significant impact on national blood stocks, causing a change in donation behavior and causing a concern to maintain an adequate blood supply during this crisis. Despite the situation, the stock of blood components in HEMOCE met the Ceará blood demand in the hospitals.

Keywords Blood Banks, Blood Donors, Hemotherapy Service, COVID-19

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INTRODUCTION

The COVID-19 pandemic represented ununprecedented challenges to governments, charities, companies, and individuals. In March 2020, crisis management in Brazil included

measures for the entire population to reduce infections through social distancing, contact restrictions, and hygiene concepts. These measures were reinforced at the beginning of July, imposing the use of face masks in everyday life[1].

With the rising of the pandemic and the imposing of lockdown in Brazil, several health-care services were negatively affected, one of them being the voluntary blood donation and blood centers. Due to security restrictions, most of the country's blood centers adopted measures to maintain a high number of incoming blood donors, such as the scheduling of donations and a reinforcement in the hygiene of blood collection sites.

It is estimated that 1.6% of Brazilian population is a blood donor, which is slightly above the 1% recommended total donors estimated by the World Health Organization (WHO). Although, those numbers are not enough to maintain a safe stock in emergencies, since some Brazilian states reported critical levels in their blood supply during the pandemic[2,3].

A decrease in voluntary blood donations was observed during the pandemic period at the national level, as stated by local news centers. The imposed security measures, constant feeling of panic, and lifestyle changes were the main causes for the decrease in the of blood components availability and donations [4]. This scenario puts many lives at risk, especially those of people in need of receiving blood transfusions while undergoing treatments, surgeries and complex medical procedures, or people who deal with the effects of chronic anemia [5], cancer [6,7] or complications of dengue and yellow fever, common tropical diseases in Brazil[8,9].

In the context of a pandemic, blood centers and hospitals may experience the impact of donations decrease, affecting the blood and blood components availability. In this scenario, we investigated the effects of the COVID-19 pandemic on the number of blood donations and how it affected the blood components usage by quantifying the number of possible blood donors and the usage of blood components in the State of Ceará during the pandemic, while also comparing to the pre-pandemic data.

MATERIALS AND METHODS

This is a descriptive study, with spatial and temporal analysis and a quantitative approach, of a descriptive and exploratory nature using data on about candidates for blood donation and blood components usage in hemotherapy services in the state of Ceará, Brazil, during the COVID-19 pandemic, from April 2020 to September 2021. Data referring to the year 2018 were also collected, used as a comparison.

Data were collected at the Ceará Hematology and Hemotherapy Center - HEMOCE, located in Fortaleza, obtained from database systems used by HEMOCE, which includes the SBS-WEB and DATASUS platforms. In addition to any other documents related to eligible and unsuitable donors found on the research site.

For the present research, a temporal analysis was considered from April 2020, the month in which a large spread of the disease was observed in Brazil. Data regarding the incidence of COVID in the country were obtained from the Health Departments of the Federative Units, data processed by Álvaro Justen and a team of volunteers from the Brasil.IO website.

The data were separated into monthly periods, where the number of candidates for donation in blood collection agencies and how the blood components were used during the determined periods were analyzed and compared. Data analysis was performed using descriptive statistics, with the elaboration of frequency tables and contingency tables for qualitative variables, categorized and transcribed in an electronic spreadsheet.

The study was carried out in accordance with Brazilian Ethical Resolutions, in particular Resolution CNS 466/2012, its Supplements and the General Law for the Protection of Personal Data (LGPD) No. 13.709/2018. It was approved by the Ethics and Research Committee of the State University of Ceará (5.457.061).

RESULTS

In 2018, the pre-pandemic year used for comparison, a total of 135,675 potential donors arrived at HEMOCE blood collection agencies looking for donation, of which 103,270 (76.12%) were eligible and 32,405 (23.88%) were unfit (Figure 1). During the analyzed pandemic period, from April 2020 to September 2021, a total of 181,362 candidates arrived at blood collection agencies for donation in Ceará, where 145,381 were eligible (80.16%) and 35,981 (19.84%) unfit.

Between April and December 2020, HEMOCE received 85,122 potential donors, of which 68,505 (80.48%) were eligible and 16,617 (19.52%) unfit. Comparing to the same period in 2018, 102,210 potential donors arrived, this number decreased by 16.72% in 2020. Of these 2018 candidates, 77,983 (76.30%) were eligible and 24,227 (23.70%) were found unfit for blood donation.

Between January and September 2021, HEMOCE received 96,240 potential donors, of which 76,876 (79.88%) were eligible for donation and 19,364 (20.12%) unfit. During the same period in 2018, the number of potential donors was 5.10% higher, with 101,412 candidates, of which 76,823 (75.75%) were eligible and 24,589 (24.25%) were unfit (Figure 4).

Ceará, over the 18 months of the study, presented 940,062 new cases of COVID (Figure 2), as stated by the weekly bulletins released by the Ceará Health Department. The total candidates number maintained stable while new confirmed COVID-19 numbers were rising.

Among the inaptitude for blood donation during the period were of multiple variations, Hematocrit or Hemoglobin below acceptable levels, occasional sexual intercourse in the last 12 months and suspected/confirmed COVID in the last 10 days were the most common causes of ineligibility during the pandemic years (Table 1). The cause of unfitness for 3.763

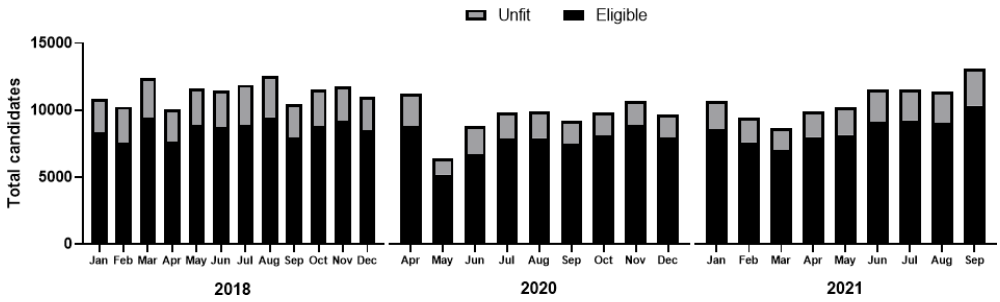

Figure 1 Eligible and unfit candidates for blood donation during the analyzed period.

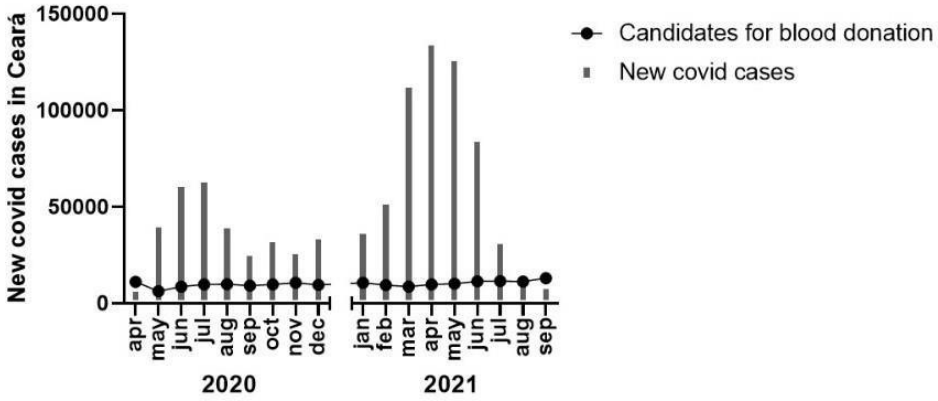

Figure 2 Monthly confirmed cases of COVID obtained from the weekly bulletins released by the Health Department of Ceará and number of donations during the same period.

candidates were related to COVID, as showed in Figure 3.

In relation to blood components usage during the pandemic years, 89,945 transfusions were registered in Ceará between April and December 2020, and 96,935 during January and September 2021; an increase in 1.03% and 7.96% when compared to the same periods in 2018, respectively. When analyzing each type of transfused blood component individually and comparing it with the same period in 2018, an increase in Fresh Frozen Plasma (FFP) (15.36%), Platelets (12.30%) and CRYO (28.98%) transfusions were observed in 2020, while the demand for Packed Red Blood Cell (RBC) decreased by 5.03%. During January and September 2021, an increase in the demand for all blood components was observed, represented by a rise in RBC (4.83%,) FFP (7.45%), Platelets (24.5%) and CRIO (24.41%) transfusions. Figure 4 show the distribution of transfused blood components during the studied periods in comparison with the number of eligible candidates.

Table 1. – Main causes of rejection for blood donation during the studied period

2018	**Female**	**Male**	**Total**
HT/HB below acceptable levels	4541	334	4875
Occasional sexual intercourse in the last 12 months	1633	3045	4678
Medication use	1147	1047	2194
Home/work contact with suspected/confirmed COVID	-	-	-
Suspeita/confirmação de COVID nos últimos 10 dias	-	-	-
Others	10207	10815	21022
2020	**Female**	**Male**	**Total**
HT/HB below acceptable levels	2450	144	2594
Occasional sexual intercourse in the last 12 months	851	1398	2249
Medication use	523	452	975
Home/work contact with suspected/confirmed COVID	111	120	231
Suspeita/confirmação de COVID nos últimos 10 dias	322	406	728
Others	5052	4788	9840
2021	**Female**	**Male**	**Total**
HT/HB below acceptable levels	2838	195	3033
Occasional sexual intercourse in the last 12 months	940	1780	2720
Medication use	522	457	979
Home/work contact with suspected/confirmed COVID	260	211	471
Suspeita/confirmação de COVID nos últimos 10 dias	980	1353	2333
Others	5073	4755	9828

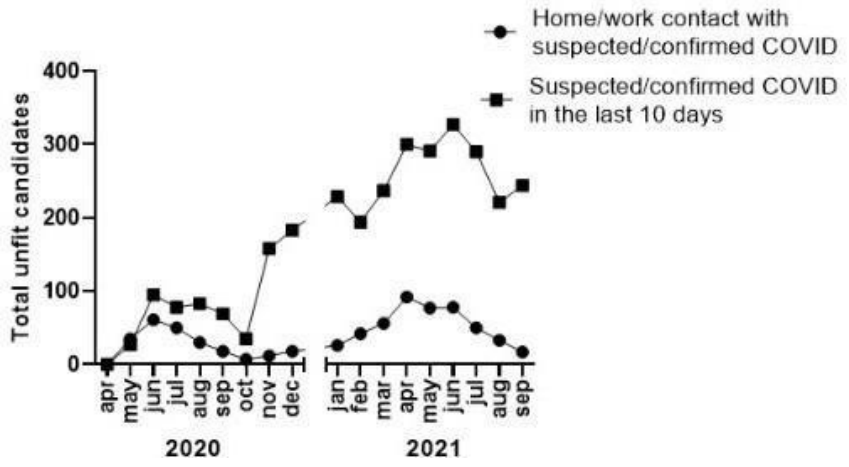

Figure 3 Cases of ineligibility related to COVID during the analyzed period.

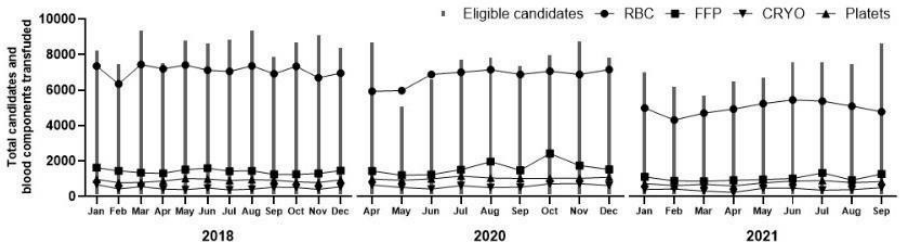

Figure 4 Distribution of transfused blood components during 2018 in comparison with the number of eligible candidates.

DISCUSSION

In this study, we analyzed the blood consumption trends and blood donations in the State of Ceará, Brazil during the COVID-19 pandemic. Blood transfusion and availability of blood components are among the many challenges that arise when facing a new infectious agent, in this case SARS-CoV-2, especially when the disease (COVID-19) evolves to the point of causing a pandemic. Transfusion of whole blood or blood components are a compulsory support for patients with hematological diseases, during surgeries with large blood loss or when the patient suffers from acute bleeding [10].

However, blood transfusions are limited by its availability, being dependent on voluntary blood donations. Social distancing and lockdown measures adopted during COVID-19 pandemic as an attempt to combat the virus spread, and the fear of contracting the virus impacted the number of regular blood donations worldwide, impacting the availability of blood components, especially when we consider that the specific demand for blood transfusions in patients affected by COVID-19 was unknown during the early stages of the pandemic [1,10–13].

We observed a decrease in the number of donors during the pandemic, when compared to the pre-pandemic period, decreasing by 16.72% between March and December 2020 and 5.10% between January and November 2021. This decrease was caused by the previously mentioned measures to avoid the virus contamination.

During the pandemic, the month of September 2021 had the highest number of candidates, representing an increase in 4.63% when comparing to August 2018, the month with the highest number of candidates in the pre-pandemic period studied. This increase can be explained due to the advancement of vaccination in the general population and a relaxation of the imposed distancing policies, where people began to feel more secure in relation to the pandemic situation[4,14]. We also noticed that this was the first time that the number of blood donation candidates surpassed the number of new COVID since March 2020.

It is also worthy to mention the month of May 2020, that had the lowest number of donation candidates, marking an increase in COVID cases in the country, where social

restriction laws started to take effect[15].

Even with a decrease in the number of donations and blood availability across the country, Ceará managed to keep its stock and number of donations above the national average, where through of the National Blood Contingency Plan, HEMOCE served as an important blood distribution center across the country [16–19].

During the pandemic, one of the adopted measures to reduce the blood demand in hospitals was to postpone most elective surgeries and non-urgent medical treatments. However, the increasing number of critically ill hospitalized COVID patients, many of whom develop significant cytopenia or coagulopathy required an increase in blood supply [10,20], as transfusions increase by 1.03% in 2020 period and 7.96% in 2021 when compared to the same period in 2018. This increase in blood component transfusions, in contrast to the decrease in blood component donors, can be related to the social distancing, hospital overcrowding and the increase in blood demand of patients in serious conditions in ICU beds[21].

Another study conducted with COVID patients in ICU showed that elderly patients who required transfusion, had at least two clinical risk factors for severe COVID illness, prolonging their time at the hospital. The study also stated that mortality among hospitalized patients with COVID who required transfusion was higher (45%) [22].

Chandler et al. (2021) reported that in Europe, around half of all donors that participated in their survey donated less than they normally would. However, they also identified a number of donors who donated more, being motivated by the concerned with the healthcare system overcrowding, indicating that altruistic motives played an important role in donors' decision to donate and were weighed up against potential risks [13].

Analyzing the causes of disability among candidates, low Hematocrit or Hemoglobin and occasional sexual intercourse in the last 12 months remained among the main causes during the studied period. This high frequency of disability due to Ht/Hb below acceptable levels may be associated with the occurrence of anemia in women due to the additional need for iron during reproductive life, especially in the post-menstrual period[23]. We noticed a prevalence of unfit women, due to the state of anemia diagnosed by the low hemoglobin level at the time of donation. During the pandemic years, people who had contact with suspected or confirmed COVID-19 or had suspected or confirmed illness in the last 10 days were considered unfit, causes that represented 3,763 rejections during the studied period.

Overall, our data suggests that the reduction in blood donations during the COVID-19 pandemic isn't parallel with the reduction in hospital transfusion needs. And, although we observed a decrease in the number of donations and an increase in the demand for blood components during the pandemic, HEMOCE measures to maintain a high number of donations and keep the blood stock at acceptable levels were effective in suppressing the necessary demand for blood not only in the state, but also in of some other hemotherapy services through the country during certain periods.

CONCLUSIONS

The pandemic had a significant impact on national blood stocks, causing a change in donation behavior and causing a concern to maintain an adequate blood supply during this crisis. Despite the situation, the stock of blood components in HEMOCE met the Ceará blood demand in the hospitals. However, this is a retrospective study of a single region, and this experience may be different from other hemotherapy centers with different activity and demand.

In view of the analyzed data and the expected blood shortage associated with other possible crisis scenarios, measures must be taken to alleviate the shortage of blood components. These measures should include promotion of blood donation and proper blood supply management to optimize the availability of blood components.

Abbreviations

HT: hematocrit

HB: hemoglobin.

Declarationss

Authors' contribution

Contributor Role	Degree of Contribution		
	Lead	Equal	Supporting
Conceptualization	VBAFG	JKCR	DDMF
Data curation	DDMF		
Formal analysis	DDMF		
Funding acquisition			
Investigation	DDMF		
Methodology	JKCR	VBAFG	DDMF
Project administration	JKCR	VBAFG	
Resources	JKCR	VBAFG	
Software	PEAA		
Supervision	JKCR		
Validation			
Visualization			
Writing-original draft	DDMF		
Writing-review & editing	JKCR		

Conflicts of interests

DDMF declares no conflicts of interest. The other authors are employees at HEMOCE, and are responsible, in different levels, for the blood network management of Ceará state.

Ethical approvals

The study was carried out in accordance with Brazilian Ethical Resolutions, in particular Resolution CNS 466/2012, its Supplements and the General Law for the Protection of Personal Data (LGPD) No. 13.709/2018. It was approved by the Ethics and Research Committee of the State University of Ceará, under opinion number 5.457.061 and Certificate of Ethical Presentation (CAAE): 57834222.2.0000.5534.

Data availability

The data supporting this study's findings are available on request from the corresponding author, D.D.M.F. The data are not publicly available because they contain information that could compromise the privacy of research participants.

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