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Impact of COVID-19 on the efficacy of meeting the transfusion demand by a Brazilian blood banks network

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ABSTRACT

One of the effects of the pandemic in the hemotherapy services was the reduction in the attendance of blood donors and production of blood components. It is relevant to investigate how the capacity to meet the demand for blood components was affected, especially in blood centers located in the regions most affected by the pandemic, such as Brazil. This study aimed to describe the impact of the pandemic on the capacity to meet the demand for different types of blood components by a Brazilian blood center in 2020, compared to the historical series of 2016–2019 and to discuss the measures adopted to mitigate the effects of the pandemic. Retrospective cross-sectional study was carried out with comparative analysis of the blood components requested and attended in the period from 2016 to 2020. Data analysis was performed by Graphpad Prism 5. The spread of COVID-19 cases since March 2020 had impact on the blood components production and transfusions. The reduction in the production of blood components was observed prior to the restriction measures, in March 2020. In comparison to 2016–2019, there was a reduction in the number of transfusions performed in all months of 2020. The results suggest that the measures adopted in a Brazilian blood center to face the COVID-19 pandemic resulted in reasonable regularity in the supply of blood components. The sharing of experiences between blood banks in different regions, social and epidemiological contexts can contribute to the improvement of strategies to reduce the impact of COVID-19 in transfusion medicine.

1. Introduction

Since the beginning of the Severe Acute Respiratory Syndrome pandemic, caused by the new coronavirus (SARS-Cov-2), in March 2020, about 219 million people were infected in the world, from which almost 20.8 million were in Brazil and approximately two million in Minas Gerais [1–3].

One of the effects of the pandemic in the hemotherapy services was the reduction of blood donors and production of blood components [4–7]. A reduction in the use of blood products was also reported in several countries during this period [8,9], as the postponement of elective procedures was recommended to avoid nosocomial collapse and depletion of blood components [10].

Fundação Hemominas (FH), a public blood center located in the state

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of Minas Gerais, Brazil, is part of a network formed by a Central Administration and 22 decentralized centers that perform blood collection, in addition to the External Advanced Collection Posts (PACE). Blood collections are carried out at fixed hemocenters, outposts distributed regionally across the state and through pre-scheduled external collections organized by the FH donor recruitment team. This network allows a hemotherapeutic coverage greater than 95% across the state. Minas Gerais is a state located in the southeast of Brazil, it has approximately 21 million habitants distributed in 853 counties and 588.384 km². FH values safe blood components, seeking exemplary care with infallibility to the entire hospital network linked to the state of Minas Gerais, which determines the efficacy and effectiveness of national reference in Brazil.

In 2019, 348,158 blood donor candidates were received and produced approximately 825,000 blood components. Due to the COVID-19 pandemic, a reduction in the attendance of blood donors was observed at the FH in 2020. This resulted in a decrease in the production of blood components, according to data previously published [7]. The pandemic determined a significant reduction in external collections at first and highlighted the need for planning to optimize blood donations, given the social distance imposed by the new global context, a phenomenon observed throughout the world. A decrease in the request for blood components was observed in the same period. Thus, in addition to describing the impact of the COVID-19 pandemic on blood donations, it is relevant to investigate how the capability to meet the demand for blood components was affected, especially in blood centers located in regions most affected by the pandemic, such as Brazil [4–7].

This study aimed to describe the impact of the pandemic on the capacity to meet the demand for different types of blood components by Hemominas in 2020, compared to the historical series of 2016–2019. Additionally, an analysis of the production of blood components and transfusions carried out throughout 2020 at Hemominas is presented. Finally, we present a discussion on the measures adopted to mitigate the effects of the pandemic on the continued supply of blood components in Minas Gerais.

2. Material and methods

A retrospective cross-sectional study was carried out with the comparative analysis of the blood components requested and attended in the period from 2016 to 2020. The global data from Hemominas were collected monthly in this period. The following variables were included for analysis: blood component's production, transfusions performed, blood component's request, response to requests for blood components, and effectiveness of the response to requests for blood components. Averages and standard deviations of the monthly data for the period of 2016–2019 were calculated for comparison with the 2020 data. The comparison with the mean of the four previous years was performed to avoid the influence of both seasonal variation and annual fluctuation.

Data of confirmed COVID-19 cases were extracted from <https://github.com/wcota/covid19br>. Data analysis was performed by Graphpad Prism 5 software (San Diego, California). This study was approved by the institutional ethics committee (CAAE: 31087720.2.0000.5118).

3. Results

The average number of collections carried out in the period of the historical series (2016–2019) was 289,452 donors with an average number of apheresis of 3124 per year. The analysis of the year 2020 revealed a total number of collections of 251,170 with 4128 collections by apheresis, an increase of 32% in relation to the historical series. Regarding the age group of blood donors, there was no significant difference in the historical series and 2020, with a donation age range between 20 and 29 years. As for gender, 63.4% of the number of donors were male in 2020, in the historical series this number was 57%. Blood collection by apheresis was stimulated during the pandemic to provide

care to the hospital network and collection of fresh frozen plasma, an off-label therapy used in patients with severe COVID-19, according to the research protocol approved by the ethics committee.

The historical series refers to the monthly request for red blood cell (RBC), platelet (PLT), FFP, and cryoprecipitate (Cryo) during the period from 2016 to 2019, and was compared to the data of 2020 (Fig. 1).

In March 2020, when the community transmission of SARS-CoV-2 was detected in the state of Minas Gerais, a reduction of 19.05% was observed in the request of RBC when compared to the mean of the years of 2016–2019 for the same month (Fig. 1A). This reduction reached its maximum in April/2020 (31%), when lockdown was stricter, due to COVID-19 restricting elective surgeries [11]. In subsequent months, the difference to 2016–2019 was smaller, but a drop in RBC requests was still registered in all months of 2020. Despite the lower RBC requests in 2020, the capability to meet this demand was lower than in the previous period. However, the efficacy of the fulfillment of RBC requests throughout 2020 was not significantly affected in the first semester, except April, when there was a sharp drop in requests, resulting in greater efficiency. In this period, the variation of efficacy observed in 2020 occurred within the standard deviations observed for the 2016–2019 historical series. However, from September onwards, a downward trend in efficacy was observed (Fig. 1A).

The PLT requests, as well as the fulfillment for this blood component, were lower throughout 2020 when compared to the mean of 2016–2019 (Fig. 1B). As a result of the greater magnitude of the drop-in requests for PLT, greater efficacy was observed in meeting requests for this blood component throughout 2020 (Fig. 1B). The same pattern was observed when analyzing the efficacy of the fulfillment of FFP requests (Fig. 1C).

The request for Cryoprecipitate's (Cryo) was lower in all of 2020's months when compared to the mean of previous years', the exceptions were January and September (Fig. 1D). All variations observed in the ability to fulfill Cryo requests throughout 2020, in comparison to the mean of 2016–2019, occurred within the standard deviation calculated for the previous years (Fig. 1D).

The spread of COVID-19 cases in Minas Gerais since March 2020 impacted the blood components production and transfusions (Fig. 2). Although the number of COVID-19 confirmed cases started to rise rapidly in May, measures to reduce the risk of transmission of the virus began to be adopted in the state in April. It is interesting to note that the reduction in the production of blood components was observed prior to the restriction measures, in March (Fig. 2C). Signs of recovery were seen in September. From then onwards, the production of blood components varied within the standard deviation of the historical average (2016–2019), having slightly exceeded this average in November. In comparison to 2016–2019, there was a reduction in the number of transfusions performed in all months of 2020 (Fig. 2B).

4. Discussion

In early 2020, Brazil became the second country in the world with the most reported cases of COVID-19. In Minas Gerais, the number of confirmed cases rose dramatically, especially from June onwards, maintaining a moving average of greater than 2000 new cases per day for most of the second half of the year (Fig. 2A). Considering the underreporting of cases already described in Brazil, an even greater number of COVID-19 cases in the period is likely.

The COVID-19 pandemic has affected hemotherapeutic systems in several ways. The decrease in blood donors due to circulation restrictions, fear of contracting COVID-19 in public environments, or even deferral due to flu-like symptoms or contact with someone who has COVID-19 led to a reduction in the production of blood components in several countries [4–7]. On the other hand, the demand for blood transfusions was also reduced due to both the voluntary delay or avoidance of medical care by patients [12] and the adoption of policies that postponed elective procedures by health services [10,13]. Because of this reduction in the request for blood components, the decrease in

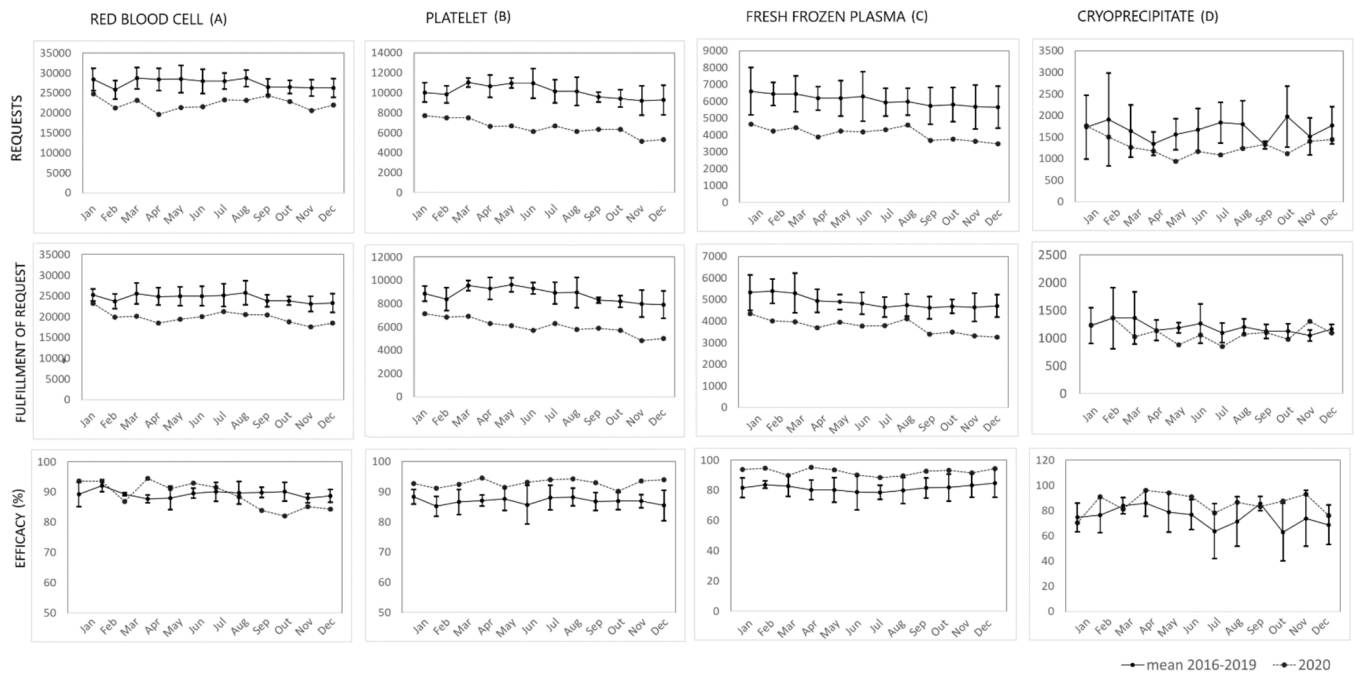


Fig. 1. Variation in request and supply of blood components by Fundação Hemominas in 2020 compared to the mean of previous years (2016–2019). The graphs show data of red blood cell, platelet, fresh frozen plasma, and cryoprecipitate requests, fulfillment of request and efficacy (%) in each month of 2020 (dashed line), and the mean of 2016–2019 years (continuous line). The bars indicate standard deviation.

their production did not necessarily impact the efficiency in meeting the transfusion demand. This was seen at Hemominas when comparing the efficacy of meeting the transfusion demand in the year 2020 to the mean of previous years (2016–2019). Except for RBC, where the efficacy was lower from September 2020, it was higher in meeting the demand for platelets, fresh frozen plasma, and cryoprecipitate compared to the previous period (Fig. 1). In 2020, there were no changes to the laws that regulate hemotherapy services in Brazil aiming to increase the number of blood donors due to the pandemic.

It is interesting to note that, in Minas Gerais, the production of blood components started to decrease in March, when COVID-19 was still not a local concern. This drop may be attributed to the low attendance of eligible blood donors due to carnival parties that took place in late February 2020. This drop remained significant in the first half of 2020 when COVID-19 rapidly spread in the state and only showed recovery at the end of the year, because of the reinforcement in the efforts to recruit donors (Fig. 2B). At this point, we draw attention to the month of November, when the production of blood components exceeded the average of recent years. This can be attributed both to the reduction of the number of COVID-19 cases in Minas Gerais and to specific campaigns related to the national day of blood donation. This scenario illustrates the importance of specific actions to maintain the bloodstock in crisis situations. On the other hand, the drop in the number of transfusions was seen in all of 2020 when compared to the average of recent years, including the first three months, when COVID-19 was not a concern (Fig. 2B).

The reduction in requests for blood components to blood therapy services during the COVID-19 pandemic, concomitant with the reduction in blood donations, has been reported in different regions of the world, such as Greece, the United States, the eastern Mediterranean region, Spain, India, Africa and Colombia [14–18].

In Brazil, the suspension of elective procedures occurred in March 2020, by recommendation of the Brazilian College of Surgeons to avoid nosocomial collapse and depletion of blood supplies [19]. The number of hospitalizations for surgical procedures in the public health system in Brazil decreased by 15% in 2020 when compared to the 2016–2019 average [20]. Decrease rates were 35% for elective procedures and 1%

for urgent procedures. We believe this reduction has directly impacted the drop in the number of requests for blood components, especially RBC and PLT.

Among the blood components analyzed, the one that most calls attention is RBC due to the downward trend in the efficacy of meeting requests from September 2020 (Fig. 1A). For the other blood components (PLT, FFP, and Cryo), although an increase in efficacy in meeting demand during the pandemic was observed, there is also great concern about the risk of scarcity as elective care is normalized. Thus, it is essential for blood banks to be very attentive to variations in the supply and demand of blood components. Adequate management of stocks and efficiency management must be carried out to avoid both the lack of blood components and disposal due to drop-in demand.

Since the beginning of the pandemic, Hemominas has taken several measures to guarantee the supply of blood components. In our previous study [7], we described the measures taken to maintain blood stocks. These measures were adopted at the beginning of the pandemic and associated with rigorous stock management, dialog between Hemominas regional centers and hospitals, and measures for the recruitment of blood donors. The analysis of the second half of 2020 reveals that the measures adopted were in fact capable of ensuring that the demand for blood products was met in Minas Gerais, despite the worsening of the pandemic (Fig. 2A). In the case of Hemominas, a factor of great importance was the network activity of their centers, which enables the exchange of blood components and the adoption of integrated and coordinated measures in the public hemotherapy service in Minas Gerais. It is also important to emphasize that the measures adopted by Hemominas occurred dynamically, in order to monitor the epidemiological situation in the state throughout the critical year. An interesting consequence of the measures adopted was a reduction in the number of RBC and PLT discarded due to the expiration date throughout the entire second half of 2020 in comparison to previous years (data not shown).

In conclusion, the results suggest that the measures adopted in Brazilian blood centers to face the COVID-19 pandemic were effective and determined an efficient supply of blood components to the hospital network. Special attention should be given to monitoring the impact of resuming elective procedures on blood component requests, in order to

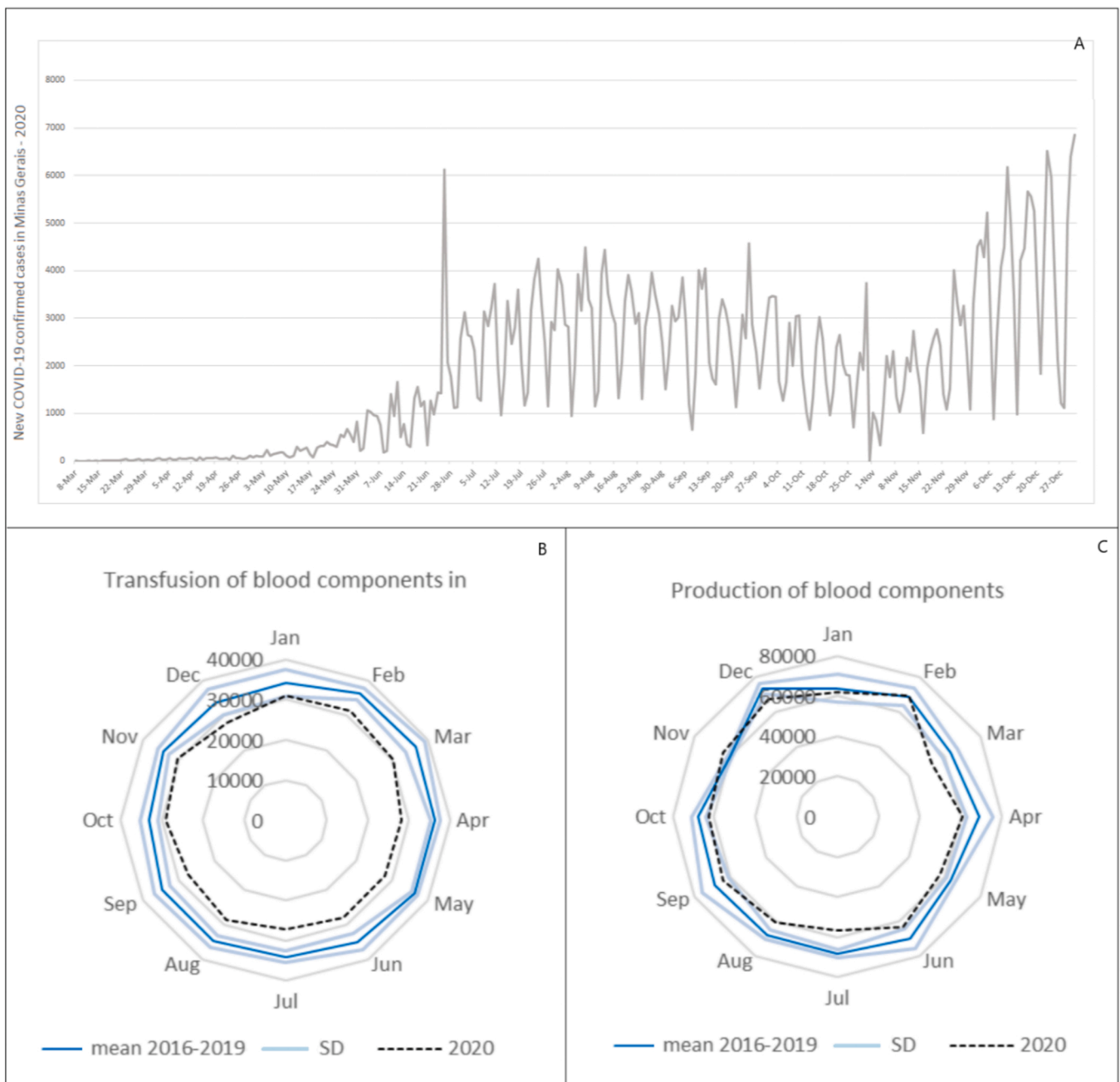


Fig. 2. Impact of COVID-19 in blood components production and transfusion. (A) COVID-19 confirmed cases at Minas Gerais in 2020 as registered by State Health Department; (B) number of transfusions performed in 2020 and 2016–2019 by hospitals served by Hemominas; (c) Number of blood components produced by Hemominas in 2020 and 2016–2019 (mean and standard deviation).

avoid shortages and problems in meeting demand, given the reduction in the number of blood donations.

The sharing of experiences between blood banks in different regions and different social and epidemiological contexts can contribute to the improvement of strategies to reduce the impact of COVID-19 in transfusion medicine.

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CRediT authorship contribution statement

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Declaration of Competing Interest

The authors have disclosed no conflicts of interest.

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