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Epidemiological Profile of Blood Donors in the Macroregion of Belo Horizonte Between the years 2019 and 2022

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HIGHLIGHTS

What is already known?

- Low youth participation and seasonal decline, especially during holidays.
- Regular donor shortage and high demand in large hospitals.
- Myths, fears, and misinformation impact blood donation both regionally and nationally.

What has been shown?

- Blood donors in Belo Horizonte represent only 1.15% of the population, below the WHO target.
- 91.33% of donors were motivated by blood replacement donations.
- 62.17% of donations came from first-time donors.

How can the study contribute to the literature?

- Enhances understanding of the donor profile in the Belo Horizonte region.
- Assists in the development of public policies for donor recruitment.
- Provides data to improve awareness campaigns on blood donation.

ABSTRACT

Introduction: Blood donation in Brazil is voluntary and spontaneous. Therefore, donor recruitment strategies must be precise for blood centers to meet the population's needs. Understanding the epidemiological profile of donors can contribute to implementing effective interventions aimed at improving volunteer recruitment. **Objective:** To outline the epidemiological profile of blood donors in the macroregion of Belo Horizonte between 2019 and 2022, considering predictive factors related to individual variables.

Method: This is a cross-sectional descriptive study based on data analysis from a blood collection center located in Belo Horizonte, Minas Gerais. Data from donors between 2019 and 2022 were compiled, and the epidemiological profile of blood donors in the macroregion of Belo Horizonte was analyzed, considering key variables.

Results: A total of 106,929 cases were analyzed, of which 91.33% of donors were motivated by replacement donation. Additionally, 62.17% of donations were from first-time donors. The predominant age group was 18-29 years, and most donors were male. A total of 18.88% were deemed ineligible, with the leading causes of ineligibility during screening being the risk of sexually transmitted infections, systemic arterial hypertension, and medication use.

Conclusion: The results revealed a change in the blood donor profile over four years, highlighting the need to adapt blood donation policies and campaigns. Furthermore, they emphasize the importance of raising awareness and engaging the population to ensure the sustainability of the healthcare system regarding blood donation.

Keywords: Blood donors; Blood donation; Hemotherapy service; Epidemiological profile; Epidemiology; Prevalence.

Abbreviations:

WHO - World Health Organization

STIs - Sexually Transmitted Infections

SAH - Systemic Arterial Hypertension

ANVISA - Brazilian Health Regulatory Agency

VDRL - Venereal Disease Research Laboratory

HTLV - Human T-Lymphotropic Virus

INTRODUCTION

Over the past four years, according to reports from the World Health Organization (WHO), the number of blood donors has followed a global increasing trend in nearly all analyzed continents.¹ However, this progress remains relatively modest, particularly in developing countries such as Brazil. Additionally, advancements in the complexity of surgical procedures, along with increased life expectancy and the consequent rise in chronic diseases among the population, have led to a growing demand for blood transfusions, causing the need for blood to continuously exceed its supply.² International studies indicate that the blood supply in underdeveloped and developing countries is often insufficient, with significant disparities when compared to developed nations.³

In Brazil, it is estimated that only about 1.4% of the population donates blood, while in Minas Gerais, this estimate is around 1.3% of the state's population. However, national studies on this topic are scarce, and data on blood donation and usage, compiled by ANVISA at the federal level, are often incomplete and outdated.⁴ The lack of donors results in bloodstock shortages in hemotherapy services, leading to negative consequences for both individuals and public health. Thus, encouraging more people to donate blood is one of the primary objectives of blood banks today.⁵

This challenge is compounded by the limited knowledge about blood donor behavior and their socio-demographic variables. Some studies attempt to establish parallels regarding these relationships, but most are based on active blood donations, restricting information to only one type of donation. These data are also fundamental for developing more effective blood donation campaigns.^{6,7} Strong evidence suggests that blood donation is a multifactorial phenomenon involving different individual and collective variables that influence a person's decision to donate. The way individuals integrate into social organizations and interact within the community is highly relevant and serves as a motivator in the decision to donate blood.⁸

Com isto, entendendo os padrões associados a doação de sangue, pode-se facilitar o recrutamento e retenção de doadores, seja através da fidelização dos doadores ou da mobilização contínua da população. Uma vez que se pode atribuir os baixos índices à falta de informação, motivação, campanhas e publicidade adequadas, bem como ao medo, insegurança e preconceito.⁹ Understanding blood donation patterns can facilitate the recruitment and retention of donors, whether through donor loyalty programs or continuous public engagement. Low blood donation rates can be attributed to a lack of information, motivation, appropriate campaigns and advertising, as well as fear, insecurity, and prejudice.¹⁰

Thus, establishing interactions with the public through educational campaigns is essential to attracting new donors, promoting the importance of this act, clarifying doubts, and dispelling misconceptions related to blood donation. Although altruism is the primary reason for individual blood donation in Brazil, the social context can contribute significantly to this process. Therefore, this study aims to better understand blood donation behavior and donor profiles in Belo Horizonte, using a sample from a regional blood collection center. The focus is on the sociodemographic variables of donors, comparing these patterns over time, identifying

the main motivational factors, and examining their relationships to facilitate the recruitment and retention of blood donors.

METHODS

Study design

This study is a cross-sectional, population-based descriptive analysis conducted through data compilation from a blood donor database at a blood collection center in Belo Horizonte, Minas Gerais. The study examined key individual variables and blood donation-related variables between 2019 and 2022. Data were retrieved from the institution's computerized system, following the General Data Protection Law (LGPD) guidelines.

Sample:

The institution's computerized system contains the records of registered blood donors, considered a representative sample of the population under analysis. Given the study's objective, the total number of donors and their classifications according to selected variables were evaluated. The selected variables include: donation type, donor type, age group, gender, eligibility status, and causes of ineligibility.

Ethical Considerations and Procedures:

This epidemiological cross-sectional study was conducted through the analysis of registered donor data at a blood collection center in Belo Horizonte, Minas Gerais. All donors provided consent and signed an authorization form for donation and a Consent Form for Processing Personal and Sensitive Data. The study involves data collection only, with no interventions on donors or identifiable donor information.

The study aims to enhance the understanding of the epidemiological profile of this population, ultimately informing strategies to approach blood donors in the region. The final manuscript will provide scientific data to support tailored engagement strategies for this demographic.

Statistical Analysis:

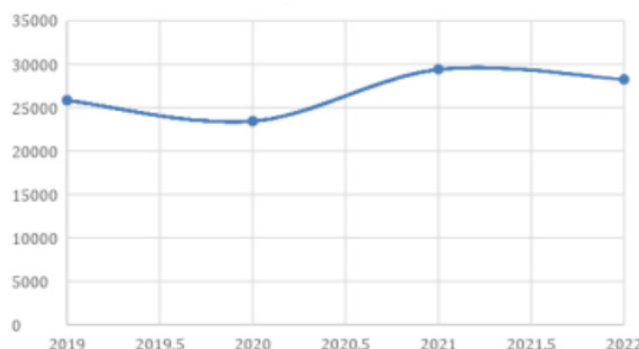
The total number of blood donors at the analyzed institution was quantified according to donation type, donor type, age group, gender, eligibility status, and causes of ineligibility from 2019 to 2022. Data were then tabulated with respective percentages to assess longitudinal trends over the study period.

RESULTS

The total of donations during the period analysed is 106.929. In 2019 there were a total of 25.850 donors; in 2020 a total of 23.428 donors; in 2021 were 29.404 donors; in 2022 were 28.247 donors. The year of 2022 had the greatest number of donors between the years analysed, while 2020 presented the lowest number of donors, as shown in the graphic (Illustration 1.) presenting a difference of 5976 donors between them.

Between 2019 and 2020, there was a decrease of 2.422 in the total of donations, equal to a 9,37% decrease. Between 2020 and 2021, there was a significant increase of 5.976 in the total number of donations. In 2020, there was an increase of 25,51%. From 2021 to 2022, there was a decrease of 1.157 in the total number of donations. In 2021 there was an increase of nearly 3,94%, as shown in the graphic (Illustration 1.).

Illustration 1. Graphic of the number of donations between 2019 and 2022



Caption: Data in absolute number of donors in each year studied.

Type of donation:

Regarding the type of donation, replacement donation was the most prevalent throughout the analyzed period, representing 91.33% of all donations (a total of 97,656 collections). Next, spontaneous donation accounted for 8.65% of the total (9,254 donations), while autologous donations represented only 0.02%, totaling 19 donations (Table 1.).

The average number of replacement donations over the years was 24,414, representing 91.30% of the total average across donation types. The year 2021 had the highest percentage of replacement donors, as well as the highest absolute number of this donor type. The variation in the representation of replacement donors between the year with the highest percentage (2021) and the year with the lowest representation (2022) was 2.40%.

Although 2022 had the lowest representation of replacement donors, the year with the lowest absolute number of donations was 2020, with 5,896 fewer donations than 2021, the year with the highest absolute value.

Regarding spontaneous donations, the average absolute number of donors over the years was 2,313.5, while the average percentage representation was 8.68%. 2022 had the highest percentage representation among the types of donors, as well as the highest absolute number. The variation in representation between the year with the highest percentage

(2022) and the year with the lowest percentage for this donor type (2021) was 1.82%. Although 2022 also had the highest absolute value, the year with the lowest absolute number was 2020, with 671 fewer donors than in 2022.

Among autologous donors, 2021 had the highest percentage and absolute number of this type of donor, while 2019 had the lowest absolute number, although its percentage was similar to that of 2021.

Donor Condition:

Regarding donor condition, including both eligible and ineligible donors, first-time donors were the most prevalent throughout the analyzed period, accounting for 66,483 donations (62.17%), as shown in Table 1. Repeat donors represented only 16,997 individuals (15.90%), while sporadic donors accounted for 21.93% of the total, totaling 23,449 individuals.

Although 2021 had the highest absolute number of first-time donors and 2020 had the lowest, there was a decrease in the representation of this donor category over the years. In 2019, first-time donors accounted for 64.79% of donations, whereas by 2022, this figure had dropped to 57.71%. Between 2020 and 2021, there was a small variation of 0.03% in representativeness.

Conversely, the proportion of repeat and sporadic donors increased over the years. Between 2019 and 2022, the representation of repeat donors rose by 4.26%, with a slight variation of 0.23% between 2020 and 2021. Similarly, sporadic donors increased by 3.07% between 2019 and 2022, with a minor variation of 0.20% between 2020 and 2021.

Table 1. Distribution of donation type and donor condition across the analyzed years.

Year	2019-2022	2019	2020	2021	2022
Total of donors	106.929	25.850	23.428	29.404	28.247
Type of donor					
Replacement	97.656 (91,33%)	23.545 (91,08%)	21.356 (91,16%)	27.253 (92,68%)	25.502 (90,28%)
Spontaneous	9.254 (8,65%)	2.303 (8,91%)	2.069 (8,83%)	2.142 (7,28%)	2.740 (9,70%)
Autologous	19 (0,03%)	2 (0,01%)	3 (0,01%)	9 (0,03%)	5 (0,02%)
Condition of donor					
First time	66.483 (62,17%)	16.747 (64,79%)	14.822 (63,27%)	18.613 (63,30%)	16.301 (57,71%)
Repeat	16.997 (15,90%)	3.707 (14,34%)	3.625 (15,47)	4.480 (15,24%)	5.185 (18,60%)
Sporadic	23.449 (21,93%)	5.396 (20,87%)	4.981 (21,26%)	6311 (21,46%)	6.761 (23,94%)

Caption: Data in absolute values and percentages of types of donors and donor conditions in the period studied and broken down by each year.

Donor Gender:

Regarding gender, male donors were more prevalent throughout the analyzed period, representing 53.11% of all donors (a total of 56,795 donors). Female donors, in turn, accounted for 46.89% of the total (50,134 donors), as shown in Table 2.

Over the years, there was a slight decrease of 0.43% in the percentage of male donors between 2019 and 2022. Consequently, the percentage of female donors increased by the same proportion.

Donor Age:

Regarding age group, donors aged 18 to 29 years were the most prevalent throughout the analyzed period, accounting for 30.85% of all donors (a total of 32,985 donors). Following closely, donors aged 30 to 39 years represented 30.53% of the total (32,646 donors), as shown in Table 2.

A slight increase of 0.28% was observed among donors under 18 years old, corresponding to an absolute increase of 98 donors over the four years. In contrast, the percentage of donors aged 18 to 29 years decreased by 2.05% between 2019 and 2022, with an increase in 2020 followed by a decline in 2021, showing no consistent downward trend.

Donors aged 30 to 39 years exhibited minimal variation across the years, with the largest fluctuation being 0.67% between 2020 and 2021. The most significant percentage increase was seen in donors aged 40 to 49 years, who experienced a progressive rise over the years, from 21.88% in 2019 to 24.10% in 2022 (a 2.42% increase).

Among donors aged 50 to 59 years, a slight increase of 0.34% was observed during the analyzed period, with minor variations across the years. Similarly, donors aged 60 years and older experienced a 0.52% increase between 2019 and 2022, though with small fluctuations each year.

Table 2. Distribution of donor characteristics over the analyzed years.

Year	2019-2022	2019	2020	2021	2022
Total	106.929	25.545	23.428	29.404	28.247
Gender					
Male	70.790 (58,81%)	13.757 (53,22%)	12.565 (53,36%)	15.560 (52,92%)	14.913 (52,79%)
Female	63.147 (47,13%)	12.093 (46,78%)	10.863 (46,37%)	13.844 (47,08%)	13.334 (47,21%)
Age					
< 18 years	1.378 (1,03%)	202 (0,78%)	293 (1,25%)	337 (1,15%)	300 (1,06%)
18 - 29 years	40.592 (30,30%)	8.177 (31,63%)	7.524 (32,12%)	9.208 (31,32%)	8.076 (28,59%)
30 - 39 years	40.426 (30,17%)	7.952 (30,76%)	7.071 (30,18%)	9.070 (30,85%)	8.553 (30,28%)
40 - 49 years	30.601 (22,84%)	5.604 (21,68%)	4.962 (21,18%)	6.528 (22,20%)	6.807 (24,10%)
50 - 59 years	16.956 (12,66%)	3.195 (12,36%)	2.955 (12,61%)	3.528 (12,00%)	3.587 (12,70%)
> 60 years	4.025 (3,00%)	720 (2,79%)	623 (2,66%)	733 (2,49%)	924 (3,27%)

Caption: Data in absolute values and percentages of donor gender and age group in the period studied and broken down by each year.

Eligible, Ineligible Donors, and Causes of Ineligibility:

Among the 106,929 donors who attended the blood collection center between 2019 and 2022, only 86,744 (81.12%) were deemed eligible, while 20,185 (18.88%) were considered ineligible.

The leading causes of ineligibility during the screening process over these four years were: Risky behavior for sexually transmitted infections (STIs) – 2,572 individuals; Systemic arterial hypertension (SAH) – 165 individuals; Medication use – 150 individuals; Anemia – 141 individuals; Chagas disease – 61 individuals.

Regarding ineligibility causes, no consistent increasing or decreasing trend was observed over the studied period, as there was significant variability between years for each reason, as seen in Table 3. Anemia showed considerable variability, being cited by 123 donors in 2021, yet not reported at all in 2019 and 2022, with a percentage fluctuation between 0.00% and 2.48%. STI risk exhibited the largest percentage variation, increasing from 0.35% in 2019 to 20.67% in 2022 (a total increase of 20.32%). However, despite this high variation, a progressive yearly increase was noted: 12.33% between 2019 and 2020; 7.24% between 2020 and 2021; 0.65% between 2021 and 2022. SAH, Chagas disease, and medication use fluctuated by 0.27%, 0.24%, and 0.56%, respectively.

Among the ineligibility causes related to serology, percentage variations were also observed yearly, yet no consistent upward or downward trend was identified. Despite these variations: Positive Anti-HBc serology was the most frequent cause of ineligibility across all years, followed by VDRL. Chagas disease was the least frequent serological cause compared to others.

Table 3. Distribution of ineligibility causes over the analyzed years.

Year	2019-2022	2019	2020	2021	2022
Total	23.260	5.730	4.984	4.961	4.510
Screening					
SAH ¹	165 (0,82%)	44 (0,77%)	52 (1,04%)	50 (1,01%)	19 (0,42%)
Anemia	141 (0,70%)	0 (0,00%)	18 (0,36%)	123 (2,48%)	0 (0,00%)
Chagas	61 (0,30%)	24 (0,42%)	17 (0,34%)	12 (0,24%)	8 (0,18%)
Risk of STI ²	2.572 (12,74%)	20 (0,35%)	632 (12,68%)	988 (19,92%)	932 (20,67%)
Use of medication	150 (0,74%)	53 (0,92%)	46 (0,92%)	18 (0,36%)	33 (0,73%)
Total screening	18.891 (93,59%)	5124 (89,52%)	4808 (96,47%)	4690 (94,54%)	4269 (94,66%)
Serology:					
Anti-HBC	707 (3,50%)	326 (5,69%)	100 (2,01%)	154 (3,10%)	127 (2,82%)
Chagas	29 (0,14%)	14 (0,24%)	1 (0,02%)	5 (0,10%)	9 (0,20%)
VDRL	507 (2,51%)	243 (4,24%)	65 (1,30%)	107 (2,16%)	92 (2,0%)
HTLV	51 (0,25%)	23 (0,40%)	10 (0,20%)	5 (0,10%)	13 (0,29%)

Caption: Data in absolute values and percentages of the causes of disability in the period studied and broken down for each year.

¹STI - Sexually Transmitted Infections

²SAH - Systemic Arterial Hypertension

DISCUSSION

Considering the number of inhabitants in the macroregion of Belo Horizonte, the average total number of donors at the blood collection center during the study period represents 1.15% of the population. This percentage is lower than the national blood donation rate of 1.4% and the 1.3% rate observed in the state of Minas Gerais. Furthermore, the number of donors does not meet the 3% target set by the World Health Organization (WHO). Thus, population availability and donor retention remain a major challenge for institutions responsible for managing blood components in the country. The study also reinforces the insufficiency of blood supply to sustain the healthcare system, which increasingly demands blood components due to the sociodemographic and epidemiological context of Brazil.

A general decrease of 9.37% in donors from 2019 to 2020 was observed, which can be linked to the initial impact of the COVID-19 pandemic.^{12,13} The pandemic caused instability in the global healthcare system, including blood donation processes.¹⁴ This situation raised concerns among donors and created physical barriers to donation due to social isolation guidelines at the time. However, few studies have investigated the motivation behind blood donations during adverse periods such as the pandemic, particularly in the Brazilian context.

In contrast, from 2020 to 2021, there was a significant increase of 25.51% in total donations. Studies indicate that, despite their negative impact, crises also foster a sense of community solidarity, encouraging individuals to contribute to the greater social good.¹⁵ This increase in donors may be attributed to stronger blood donation campaigns, adjustments in collection strategies in response to the pandemic, and greater social awareness promoted through these efforts. In this context, the internet and social media played a crucial role in disseminating public awareness cam-

paigns, stimulating discussions about blood donation, and increasing donor motivation.¹⁶ These platforms proved to be indispensable tools for donor engagement and retention. Such evidence demonstrates that virtual outreach should extend beyond pandemic-related efforts, given its greater reach compared to traditional media and campaign strategies. Starting in 2021, a 4.40% decrease in donations was observed, suggesting that donation numbers were returning to pre-pandemic levels. This trend highlights the importance of public policies and media campaigns in times of humanitarian crises, which can effectively boost public motivation for blood donation.^{13,16}

Replacement donations accounted for 91.33% of all donations at the institution, a much higher proportion than the national data reported by ANVISA, which indicates that only 41.23% of donors give blood for this reason.

Replacement donation refers to individuals donating blood to replenish used blood stocks, with or without a direct link to a specific patient. Recent studies suggest that replacement donation is associated with a lower deferral rate than other donation motivations—a pattern also observed in this study's sample.^{17,18} On the other hand, the low representation of spontaneous donors may indicate weaknesses in blood donation campaigns. This underscores the need to increase awareness, encourage continued donations, and promote altruism, even when the act of generosity is not directly tied to someone in the donor's social circle.¹⁹ It is also important to consider regional cultural factors. In southern Brazil, voluntary blood donation rates are significantly higher than those of replacement donors. In some communities, blood donation is already deeply ingrained as a social practice. An example is Santa Catarina, where 9.56 donors per 1,000 inhabitants contribute, a percentage higher than the national average.²⁰

In the study population, first-time donors were the largest donor group, accounting for 62.17% of total donations. This differs from national trends, where repeat donors represent the majority.²¹ Establishing blood donation as a habitual behavior is a primary goal of donation incentive programs. Therefore, in the context analyzed in this study, retaining first-time donors is a key objective.^{19,22} To achieve this, raising awareness about blood donation, fostering altruism, and ensuring a positive donation experience at blood centers have been associated with higher donor return rates.²³ Once again, the importance of social media and online interventions is highlighted as essential tools for engagement, with the potential to increase donor retention rates significantly.²²

In the study population, there was no significant difference between male and female donors. Male donors were slightly more prevalent, with 6.22% more donations than female donors throughout the analyzed years. This finding differs from national data reported by ANVISA, which shows almost 20% more male donors in 2018.²¹ The gender gap in blood donation is even more pronounced on a global scale. In some countries, men outnumber women by approximately 30%, and 16 nations report female donors comprising less than 10% of total donors. One of the main reasons for lower female donor participation worldwide is concern about developing anemia or physical weakness. Therefore, educational strategies and improved access to healthcare services are essential to maintaining high female participation rates in Brazil. These efforts should also support first-time female donors, ensuring they feel safe and confident about becoming repeat donors.²⁴

Regarding age distribution, the study findings differ from national patterns. Donors aged 18-29 years represented 30.85% of total donations, significantly lower than the national rate of 40.55%.²¹ However, a

shift in donation patterns was observed over the study period. An increasing number of donors aged 39-40 years was noted, and by 2022, this group had surpassed younger donors. This trend aligns more closely with patterns observed in European and American countries, where younger donor participation is decreasing while adult donor participation is rising. In contrast, in Africa and less developed regions of Asia and the Middle East (e.g., Laos, Cambodia, Lebanon, and Egypt), young donors remain the majority.²⁵ Such a characteristic also suggests that regional strategies to encourage blood donation may be more effective if they resemble those adopted in European and American countries. These strategies include public education programs, partnerships with public institutions, companies, and workplaces to integrate blood donation awareness into daily life, as well as a focus on health education and awareness campaigns regarding the importance of donation. Since the age profile of the studied region is diverging from the Brazilian standard and becoming more aligned with developed nations, adopting these strategies may enhance donation rates.^{26,27}

Regarding causes of ineligibility during screening, three main factors can be identified: risky behavior for STIs, systemic arterial hypertension (SAH), and medication use. Despite variability over the studied years, when compared to national data, the studied population presented a similar percentage of ineligibility due to STI risk (12.74% and 14.05%, respectively). However, anemia is the leading cause of ineligibility at the national level, accounting for 15.03% of ineligible donors, while in the studied population, anemia represents less than 1% of ineligible causes.²¹ Anemia is a global issue, frequently ranking among the top reasons for ineligibility.²⁸ In this regard, hypertension is a significant cause of ineligibility both nationally and globally, with its increasing prevalence linked to the aging population—a trend already discussed in

the section on the rising age of donors in the studied region.²⁹ The high prevalence of systemic arterial hypertension (SAH) as a cause of ineligibility may also be associated with deficiencies in the local healthcare system in terms of screening for non-communicable chronic diseases and ensuring continuity of healthcare services. The leading serology-related cause of ineligibility is Anti-HBc positivity, representing 3.05% of total ineligible donors and 54.64% of ineligible cases due to serology, following the same pattern observed nationally and globally.²¹ The presence of Chagas disease among ineligible donors is expected, given the endemic regions near the capital of Minas Gerais. However, this also suggests a potential lack of prior diagnosis, as some donors only become aware of their positive test results after donation³⁰

Limitations

This study presents some limitations and potential biases that should be considered. First, the analysis was based on data from a single blood collection center, which may not fully reflect the diversity of donor profiles in other institutions across the macroregion of Belo Horizonte. Additionally, another important aspect is the possibility of underreporting information related to risky behaviors and health conditions, which may affect the accuracy of ineligibility data. Finally, the cross-sectional nature of the study limits its ability to establish causal relationships between the analyzed variables.

CONCLUSION

The analysis of the past four years revealed a change in the blood donor profile, with a decline in young donors and an increase in adult donors, aligning with trends observed in European and American countries. Thus, the comparison with national data highlighted significant differences, emphasizing the need to adapt blood donation policies and campaigns. The public perception of blood donation campaigns underscored

the importance of awareness regarding donation criteria, reinforcing the need for continuous and effective education.

The primary motivation for blood donation was replacement donation, and the largest donor group consisted of first-time donors. This finding highlights the importance of fostering social responsibility and raising awareness about the continuous need for blood and blood components. Therefore, retaining these first-time donors should be a primary objective. To achieve this, social media must be utilized as a key tool for public engagement, ensuring that blood donation rates are maintained and increased. In summary, the results emphasize the importance of solidarity, awareness, and public engagement in ensuring the sustainability of the healthcare system about blood donation.

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THE AUTHORS DECLARE THAT THERE IS NO
CONFLICT OF INTERESTS IN RELATION TO THIS ARTICLE.