Blood Donor Screening: Study on Transfusion Safety at the Hemocenter of Sergipe

Débora Regina Passos Bispo [a], Sergio Silva Oliveira [b]

[a] Biomedicine course, Tiradentes University, Aracaju, Brazil, debora.rpb06@gmail.com

[b] Pathology analyst in the donor immunohematology department, Parreiras Horta Health Foundation, Aracaju, Brazil, sergiosoliveira11@gmail.com.

Abstract. This study aims to evaluate the effectiveness of the clinical and serological screening process of blood donors at the Hemocenter of Sergipe, Brazil, highlighting the limitations and challenges faced throughout this crucial process. Using a quantitative and qualitative approach, 35,110 donation candidates were meticulously analysed, of which 7,820 failed to meet the criteria. Among those who failed, 1,097 candidates presented serological unsuitability, which represents 3.9% of the total of 28,387 tests performed. The application of pie charts was considered effective for visualizing simple proportions, such as the overall approval rate and the distribution of unsuitability, although it revealed limitations in the more detailed comparison of the data, suggesting the need for complementary visualization methods in future studies. In addition, the analysis of the costs of the tests was represented graphically, highlighting the importance of an efficient screening process for both transfusion safety and financial resource management. Overall, it was found that the blood bags collected by the Hemocenter of Sergipe have a safety rate of over 70%, an index considered excellent for quality control and transfusion safety. These significant findings reinforce the importance of continually improving screening procedures to ensure public health and optimize the use of available resources effectively.

Keywords. Serological Screening, Clinical Screening, Blood Donors, Transfusion Safety, Pie Charts, Data Analysis.

1. Introduction

All blood donations in Brazil have been voluntary since the 1950s, in accordance with Law No. 1,075. There has been significant growth in transfusion safety and security, which became a priority with the emergence of the AIDS epidemic in the 1980s. At the same time, factors such as the aging of the population, the increase in violence and accidents, and technical and scientific advances in the medical field have resulted in a growing demand for transfusions.

In this situation, it was necessary to adopt policies with greater rigor in the donor selection process. These factors led to the creation of the Collegiate Board Resolution (RDC) 34/2014, which establishes good practices in the blood cycle. Due to the problem of high percentages of clinical and serological unsuitability among individuals who are willing to donate blood.

In this scenario, the procedures adopted are regulated by RDC 34/2014 (Good Practices in the Blood Cycle). One of the important points that should be highlighted is screening. According to the RDC "the candidate must be assessed regarding their background and current health status, through an individual interview, carried out by a duly trained higher education health professional, under medical supervision, in a room that guarantees the privacy and confidentiality of information, to determine whether the collection can be carried out without causing harm to the candidate and so that the transfusion of blood components obtained from this donation does not cause problems to the recipients."

Screening is, therefore, essential, as it allows the exclusion of candidates with a risk situation during the immunological window, which are not always detectable through serological tests. Thus, rigorous screening is crucial to maintain the safety standard required by law.

In this context, data visualization is an essential tool in the analysis and communication of results in several areas, including public health and clinical

research. Among the most common forms of visualization is the pie chart, widely used to demonstrate proportions of a whole. However, despite its popularity, the use of pie charts is often criticized due to its limitations in accurately representing data, especially when the number of categories is large or the variations between them are small .

This study analyzes the distribution of approved and failed candidates in clinical and serological screening of blood donors using pie charts to present the results, following the recommendations and criticisms found in the literature. In addition, the cost involved in the tests was considered for a better understanding of the screening.

2. Objective

The objective of this study is to analyze the effectiveness of the clinical and serological screening process of blood donors at the Hemocenter of Sergipe, highlighting the importance of transfusion safety. It also aims to demonstrate how data visualization, specifically with the use of pie charts, can be used to present the distribution of candidates approved and rejected in clinical and serological screening. In addition, the study seeks to discuss the economic impact associated with screening exams and their importance in maintaining the safety standards required by legislation, evaluating the effectiveness of this visualization in data communication.

3. Methodology

The research is characterized by being qualitative-quantitative exploratory, the study was operationalized through the descriptive quantitative analysis method. The instrument used was a retrospective bibliometric research through the data made available on the HEMOVIDA portal, analyzing the objectives proposed by the study, the blood center researched was the Hemotherapy Center of Sergipe in the year 2023. The study was carried out based on data obtained from 35,110 blood donation candidates, of which 7,820 disapproved and 28,387 were approved. Among those who failed, 1,097 were serologically ineligible. The average cost of each test performed was R$ 404.90.

Data analysis was performed in three main steps:

1. Data collection and categorization: Candidate data was separated into two groups, approved and disapproved, with an additional focus on candidates who failed due to serological ineligibility.

2. Cost calculation: The total cost of the tests was calculated based on the number of candidates and the average cost of the test, distributed between approved and disapproved candidates.

3. Visualization of results: Data were represented through pie charts, highlighting the proportion of approved and disapproved candidates, the costs of the tests performed and the distribution of candidates who failed due to serological unsuitability.

4. Results

According to the data obtained by these tables, it was possible to create some graphs.

Tab. 1- Total Candidates of 2023

Type of donor	Numbers
Campaign Donor	2.727
Summoned Donor	661
Replacement Donor	17.201
Voluntary Donor	14.521
Total	35.110

[a]From HEMOVIDA.

Tab. 2- Candidates Approved in Clinical Screening during 2023

Type of donor	Numbers
Campaign Donor	2.126
Summoned Donor	613
Replacement Donor	13.831
Voluntary Donor	11.817
Total	28.387

[b]From HEMOVIDA.

Tab. 3- Candidates Disapproved in Clinical Screening during 2023

Type of donor	Numbers
Campaign Donor	601
Summoned Donor	48
Replacement Donor	3.370
Voluntary Donor	2.704
Total	6.723

[c]From HEMOVIDA.

Tab. 4-Main Reasons for Clinical Inaptibility of 2023

Reasons	Numbers
Low Hemoglobin/Hematocrit	2.243
Arterial Hypertension	574

Procedures with a needle a year ago	375
Use of Antibiotics in the last thirty days	333
Use of Medications	331
Total	3.856

[d]From HEMOVIDA.

Tab. 5- Collected Bags of Blood of 2023

Total	27.514

[e]From HEMOVIDA.

Tab. 6- Reasons for Serological Inaptibility of 2023

Reasons	Numbers
Anti-HBc	241
Anti-HTLV I/II	103
Chagas disease	31
HBsAg	51
HCV Ag/Ab	136
HIV Ag/Ab	37
NAT-HBV	9
NAT-HCV	1
NAT-HIV	11
Syphilis	477
Total	1.097

[F]From HEMOVIDA.

With this, the pie charts revealed the following important information:

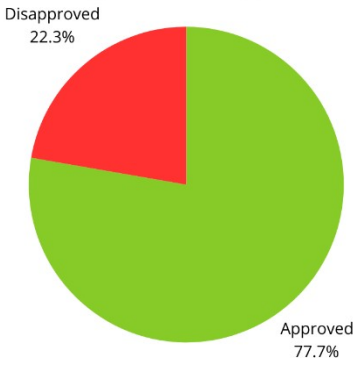

Fig. 1- Distribution of Approved and Disapproved Donors of 2023. From HEMOVIDA.

According to the tables obtained by HEMOVIDA, it was possible to verify the general distribution of donors. Of a total of 35,110 donation candidates, 7,820 were rejected. Among those rejected, 1,097 candidates presented serological unsuitability, which represents a significant portion of exclusions due to risks detected in laboratory tests. Resulting in an approval rate of 77.7%, as shown in Figure 1. This distribution reinforces the efficiency of serological screening in selecting suitable candidates.

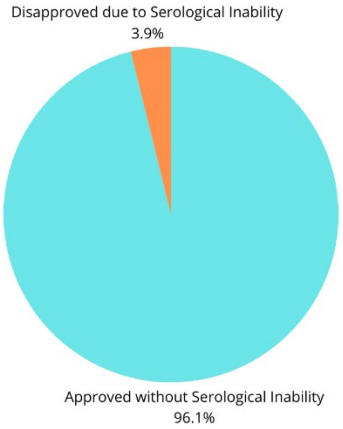

Fig. 2- Distribution of Candidates due to Serological Inability in 2023. From HEMOVIDA.

According to the tables obtained by HEMOVIDA, it was possible to verify serological unsuitability. Among the 28,387 tests performed, 1,097 candidates failed due to serological unsuitability, representing 3.9% of the total tests, as shown in Figure 2. These data provide a clear view of the prevalence of rejections due to serological issues.

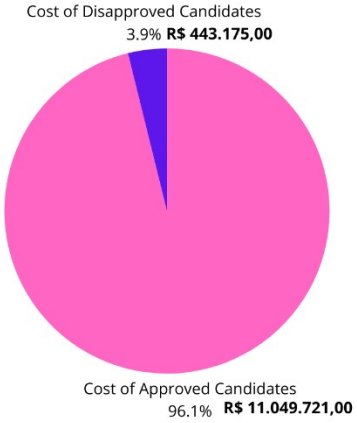

Fig. 3- Distribution of Exam Costs for Approved and Disapproved Patients. From HEMOVIDA.

According to the estimated cost of the exams, it was possible to create a graph that illustrated the total costs of the exams. It was noted that most of the costs, approximately 96.1%, were dedicated to the tests of approved candidates, while 3.9% were spent on tests of failed candidates. This result highlights the economic efficiency of the screening. However, taking into consideration the number of candidates who failed

due to serological ineligibility and the average cost of R$404.90 per test, the total cost of failed candidates of R$443,175.00 represents a significant economic burden for the blood center, emphasizing the importance of rigorous screening to avoid unnecessary expenses with tests on candidates who could be excluded in the clinical screening stage.

5. Discussion

The results of this study provide a clear picture of the effectiveness of the clinical and serological screening process for blood donors at the Sergipe Blood Center. The 77.7% approval rate indicates that clinical and serological screening is mostly effective in identifying suitable donors. However, the clinical and serological unsuitability, which resulted in 7,820 rejections, highlights the need to improve clinical screening, for example through rapid testing for blood-borne infectious diseases or by integrating screening with electronic medical history systems that could allow health professionals to verify medical information and identify potential reasons for temporary and permanent unsuitability. In this context, it is interesting to note that 96.1% of the costs were attributed to the testing of approved candidates, while only 3.9% were spent on rejected candidates. Although this percentage is low, the amount still represents a substantial financial impact for the blood center. Therefore, it is crucial that the screening method is improved to minimize the costs of testing patients who could have been eliminated in the initial screening.

In this study, pie charts were used to represent clinical and serological screening data, raising questions about the effectiveness of this tool in visually communicating information. Although pie charts are widely used for their simplicity, they have limitations when it comes to more detailed comparisons or when the proportions are very small. In the case of this study, the representation of the proportions between approved and rejected candidates, as well as the related costs, was facilitated by the use of pie charts, but to illustrate the reasons for serological and clinical unsuitability, it was not possible to use this same resource. Bar charts may be more appropriate when greater detail or more complex comparisons are desired, as discussed by Nathan and Lang.

Furthermore, Tufte emphasizes that visual clarity is essential in the presentation of quantitative data, especially in public health contexts, where decision-making must be based on information that is easy to interpret. Even though pie charts were effective in representing the general proportions of this study, the importance of selecting the graphic tool that is most appropriate to the context and target audience is reinforced, to ensure the best understanding of the data and support decision-making based on clear and detailed information.

Transfusion safety remains one of the most important pillars of blood donation, and rigorous screening is essential to avoid risks to public health. This study highlights how improving the initial stages of screening can optimize the process, both in terms of safety and resource savings.

In summary, this study highlights the effectiveness of serological screening at the Hemocenter of Sergipe, while identifying areas where clinical screening can be improved. The financial burden of laboratory testing for candidates rejected due to serological unsuitability highlights the importance of investing in a more rigorous clinical screening process. Adjustments to the screening process can not only improve safety, but also optimize the use of available financial resources.

6. Conclusion

Voluntary blood donation is essential to maintain population health and save lives, but rigorous screening processes and unsuitability criteria ensure that transfusion safety is maintained. With public awareness and effective policies, blood banks can continue to offer a high-quality service, meeting the growing demand for blood and contributing to improving public health in Brazil.

This study highlights the excellent efficacy of clinical and serological screening at the Hemocenter of Sergipe, while also identifying areas where clinical screening can be improved. The financial cost of laboratory testing for candidates rejected due to serological unsuitability highlights the importance of investing in a more rigorous clinical screening process. Transfusion safety is a priority, and the results reinforce the continued need for rigorous and efficient screening, both in terms of candidate approval and cost management. Therefore, adjustments to the screening process can not only improve safety but also optimize the use of available financial resources.

In addition, this study also presents an analysis of the distribution of approved and rejected candidates in clinical and serological screening process for blood donors, using pie charts to represent the proportions of different groups. The use of pie charts is widely debated in the literature, especially regarding their effectiveness in presenting data. A total of 35,110 donation candidates were recruited, of which 7,820 were rejected. In addition, 1,097 candidates were rejected due to serological unsuitability, representing 3.9% of the total of 28,387 tests performed. The analysis of the costs of the tests was also represented graphically. The application of pie charts proved

to be effective for visualizing simple proportions, but some limitations were identified in the detailed comparison of data.

The use of pie charts in this study was appropriate to represent simple proportions, such as the blood donor approval rate and the distribution of test costs. Although this type of chart is useful for quickly visualizing data, caution is required in its application, especially when the data involve many categories or small details. According to recommendations in the literature, pie charts should not be used in isolation, but as complements, being a limiting factor, to other forms of visualization, such as bar charts, to offer a more complete view

The gender parameter was not used due to a trend observed in recent studies at the blood center, where there was a predominance of male candidates, with 58.8% of donors, but also with a significant increase in female donors, increasing from 39% in 2018 to 43.2% in 2022.

This study highlights the need for future research to focus on evaluating the implementation of self-exclusion in blood centers, as well as its practical and economic implications, in order to optimize the screening process and ensure the safety of blood donors and recipients.

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