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ORIGINAL PAPER

Analysis of Notifications Received by Central de Transplantes in the State of Roraima from 2017 to 2021

Lidiane Cristina Santiago de Oliveira[1], Larissa Lima Araújo Mendes[1], Matheus Dantas Brum[1], Mykaelle Soares Lima[2], Ana Carolina Ferrer Lobo[3], Jéssica Anne Pereira Corrêa França[1], Carlos Henrique dos Santos Junior[1], Lueli Evelin Leite Mota[3], Geraldo Pereira Maia Neto[4], José Egberg Santos de Araújo[5], Matilde Nascimento Rabelo[6], Thaís Lorena Pereira da Paz[7], Victor Hugo Souza Lustosa[7], Bárbara Carvalho dos Santos[6,*], Marcelo Moura Linhares[6]

1. Exército Brasileiro – Boa Vista (RR) – Brazil.

2. Universidade Federal do Piauí – Teresina (PI) – Brazil.

3. Universidade Estadual do Piauí – Teresina (PI) – Brazil.

4. Universidade Estadual de Roraima – Boa Vista (RR) – Brazil.

5. Hospital Regional da Unimed Fortaleza – Fortaleza (CE) – Brazil.

6. Universidade Federal de São Paulo – São Paulo (SP) – Brazil.

7. Faculdade Santa Terezinha – São Luís (MA) – Brazil.

*Corresponding author: fisioterapeutabarbaracarvalho@gmail.com

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ABSTRACT

Objectives: To analyze brain death (BD) notifications received by Central de Transplantes (CET) in the state of Roraima (RR) from 2017 to 2021. **Methods:** This is a cross-sectional, quantitative, and observational study, where all notifications received by CET from 2017 to 2021 were analyzed, resulting in 120 patients from health the following centers: Hospital Geral de Roraima (HGR), Hospital Confederação Nacional das Cooperativas Médicas (UNIMED), Hospital da Criança Santo Antônio (HCSA), Hospital das Clínicas (HC), and Hospital Lotty Íris (HLI). The data were collected from the center's data management system and passed on to the collection form developed by the researcher. **Results:** This study analyzed 119 notifications after excluding one due to conflicting data. There was a predominance of males (58%), with traumatic brain injury being the most frequent cause of BD. Six organ harvestings were carried out, all at the HGR. This study found no significant associations between organ procurement and sex, age, place of hospitalization, and year. **Conclusion:** There are considerable challenges concerning organ donation in RR, with a low uptake rate over five years. Only the HGR successfully carried out organ harvesting, while other reporting hospitals were unsuccessful. Improvements are needed, highlighting the importance of more studies for a more in-depth data analysis.

Descriptors: Organ Transplantation; Organ Donation; Brain Death; Patient Care.

Análise das Notificações Recebidas pela Central de Transplantes do Estado de Roraima de 2017 a 2021

RESUMO

Objetivos: Analisar as notificações de morte encefálica (ME) recebidas pela Central de Transplantes (CET) do estado de Roraima (RR) de 2017 a 2021. **Métodos:** Trata-se de estudo transversal, quantitativo e observacional no qual foram analisadas todas as notificações recebidas pela CET no período de 2017 a 2021, resultando em 120 pacientes, dos seguintes centros de saúde: Hospital Geral de Roraima (HGR), Hospital Confederação Nacional das Cooperativas Médicas (UNIMED), Hospital da Criança Santo Antônio (HCSA), Hospital das Clínicas (HC) e Hospital Lotty Íris (HLI). Os dados foram coletados do sistema de gerenciamento de dados da central e repassados para a ficha de coleta desenvolvida pela pesquisadora. **Resultados:** Este estudo analisou 119 notificações após a exclusão de uma devido a dados conflitantes. Houve predominância do sexo masculino (58%), com trauma cranioencefálico sendo a causa mais frequente de ME. Ao todo, foram realizadas seis captações de órgãos, todas no HGR. Este

estudo não encontrou associações significativas entre a captação de órgãos e sexo, idade, local de internação e ano. **Conclusão:** Há grandes desafios em relação à doação de órgãos em RR, com uma taxa de captação baixa ao longo de 5 anos. Apenas o HGR obteve sucesso em realizar captações de órgãos, diferentemente de outros hospitais notificadores. São necessárias melhorias, destacando a importância de se realizarem mais estudos para uma análise mais aprofundada dos dados.

Descritores: Transplante de Órgãos; Doação de Órgãos; Morte Encefálica; Assistência ao Paciente.

INTRODUCTION

Brazil has the most extensive public organ, tissue, and cell transplant program globally, with guaranteed access to the entire population via the Unified Health System (*Sistema Único de Saúde-SUS*). Thus, the country is one of the world's largest transplanters, occupying second place in the world ranking, behind only the United States of America. In 2022, 13,349 potential donors (PD) were notified in Brazil, of which 3,522 became effective donors. In the first half of 2023, 206 heart transplants were performed in the country, representing an increase of 16% compared to the previous year[1].

Despite the high number of transplants carried out, the total number of effective donations is still below what is desired, with around 42,041 Brazilians waiting for an organ for transplant in 2024. This situation is equally critical in needier regions of the country, such as the North Region[2].

In 2020, the North Region presented, among Brazilian regions, the lowest numbers of PD notifications per year [17.4 per million population (pmp)/year] and donations made (2.1 pmp/year). That year, in the comparison between the states of the Northern Region, Roraima (RR) was one of the states with the lowest number of notifications and donations made, ahead only of the state of Amapá[3,4].

The primary candidates for PD are generally hospitalized patients with neurological problems, and the donation and transplant process involves a multidisciplinary team, requiring several actions with the aim of transforming the PD into an effective donor performing the transplant[4].

Transplants are not performed in RR, and only organ and tissue harvesting occurs. The State Transplant Center *(Central Estadual de Transplantes-CET*) coordinates intra-hospital committees for organ and tissue donations *(Comissões Intra-Hospitalares para Doações de Órgãos e tecidos-CIHDOTTs)* at the Roraima General Hospital (*Hospital Geral de Roraima-HGR*) and the Santo Antônio Children's Hospital (*Hospital da Criança Santo Antônio-HCSA*), notifying and harvesting locations[5].

Considering these aspects, the premise of this study was to evaluate the reality of RR in terms of notification of BD, organ donation, and organ harvesting surgery.

OBJECTIVE

Analyze the BD notifications received by the RR CET from 2017 to 2021, checking the donor data, notifying the hospital, and determining the outcomes of such notifications. Identify the captures carried out and the reasons that led to non-reception. Identify the average times between opening, notification, and completion of the organ procurement process.

METHODS

This study is cross-sectional, retrospective, quantitative, and observational, carried out in *Central de Transplantes* (CET) of RR, with data collection from 120 patients admitted to HGR health centers, National Confederation of Medical Cooperatives (*Hospital Hospital Confederação Nacional das Cooperativas Médicas-UNIMED*), HCSA, Hospital das Clínicas (HC) and Hospital Lotty Íris (HLI), in the period from 2017 to 2021, referring to all notifications received by CET in the period.

For data collection, the author used a form developed by herself, which asks questions about the reason for brain death (BD) of effective donors, the number of notifications in the period, the number of completed processes, the number of collections carried out, the reasons for not capturing or non-completing the process, the patient's place of hospitalization, age, sex, the outcome of the process completion and other data that may be relevant to the research.

The opening concerns the beginning of the process in the hospital where the possible BD was identified. Next, notification of the opening of the process to the CET is carried out; the finalization, which provides for the conclusion of the processes; the capture, which occurs when the organ is captured and sent for donation; and the non-effectiveness, which occurs when there is no effective capture. The study was approved by the Research Ethics Committee (REC) of the State University of Roraima (Universidade Estadual de Roraima-UERR), with CAAE number 66910323.0.0000.5621.

The statistical analysis used Pearson's chi-square or Fisher's exact test in quantitative variables when the expected frequencies were less than 5. For quantitative variables, the Student's t-test was used in cases where the distribution approached a normal

distribution. Otherwise, the non-parametric Mann-Whitney U test was applied. In all comparisons, the usual significance level of 0.05 was adopted. The statistical programs used were SPSS, version 21, and JAMOVI, version 2.2.5.

Qualitative variables were summarized using absolute and relative frequencies. Numerical variables were expressed using measures of central tendency, such as means, and measures of dispersion, such as standard deviations (SD), interquartile ranges, and minimum and maximum values.

RESULTS

120 notifications were analyzed; however, one notification was excluded from the search due to conflicting data. Therefore, 119 notifications were included in the study. The data was categorized and arranged in this section.

Table 1 presents the characterization of patients concerning age and gender. The mean age of the patients was 36.9 ± 19.8 years, ranging from 1 to 83 years. Regarding gender, men were predominant (58%).

Table 1. Characterization of patients concerning demographic data (n = 119).

Characteristics	
Gender	n (%)
Female	50 (42,10)
Male	69 (57,90)
Age (years)	
Mean (SD)	36,9 (19,80)
Median (percentis 25-75)	39 (22-52)
Minimum Maximum	1-83
Place of hospitalization	n (%)
HCSA	15 (12,60)
HGR	100 (84,03)
HLI	1 (0,84)
HC	1 (0,84)
UNIMED	1 (0,84)
No information	1 (0,84)
Year of notification	n (%)
2017	15 (12,60)
2018	31 (26,10)
2019	24 (20,20)
2020	20 (16,80)
2021	29 (24,40)

Source: Central de Transplantes de Roraima Management System (2017-2021).

Table 2 describes the reasons for BD, with traumatic brain injury (TBI) being the most common cause, followed by subarachnoid hemorrhage (SAH) and hemorrhagic stroke (CVA).

Table 2. Reasons for BD.

Etiology of BD	n (%)
TBI/severe TBI/diffuse TBI	33 (27,73)
SAH/traumatic SAH	18 (15,12)
AVEH/AVCH	18 (15,12)
IS/IVA	12 (10,08)
HIE	3 (2,52)
FAF in the head	3 (2,52)
Diffuse cerebral edema	3 (2,52)
TBI by FAF	2 (1,68)
hypoxia after CRA	2 (1,68)
COVID	2 (1,68)
SEPSIS	2 (1,68)
Intracranial hypertension	2 (1,68)
Others	20 (16,80)

Source: Central de Transplantes de Roraima Management System (2017-2021). IVA = ischemic cerebrovascular accident; IS = ischemic stroke; COVID = coronavirus disease; HIE = hypoxic-ischemic encephalopathy; FAF = firearm injury; SEPSIS = septic shock.

Table 3 compares patients who had or did not have organ harvesting in terms of gender, age, place of hospitalization, and year of operation. All captures were made at HGR in 2018, 2019, and 2020. From a statistical point of view, no significant associations were found.

Table 3. Comparisons between groups that performed organ harvesting.

	Total (n = 119)	Was harvesting carried out?		Valor de p
		Yes (n = 6)	No (n = 113)	
Gender		n (%)		
Female	50 (42,01)	4 (66,66)	46 (40,70)	0,209
Male	69 (57,98)	2 (33,34)	67 (59,29)	
Age		years		
Mean (SD)	36,92 (19,82)	28,33 (18,03)	37,38 (19,88)	0,278
Median (percentis 25-75)	39,00 (22,00-52,00)	21,50 (18,00-40,00)	39,00 (24,00-52,00)	
Minimum Maximum	1,00-83,00	10,00-59,00	1,00-83,00	
Place of hospitalization		n (%)		
HCSA	15 (12,60)	-	15 (13,27)	
HGR	100 (84,03)	6 (100,00)	94 (83,18)	0,945
HLI	1 (0,84)	-	1 (0,88)	
HC	1 (0,84)	-	1 (0,88)	
UNIMED	1 (0,84)	-	1 (0,88)	
No information	1 (0,84)	-	1 (0,88)	
Year of completion		n (%)		
2017	15 (12,60)	-	15 (13,27)	
2018	31 (26,05)	3 (50,00)	28 (24,78)	
2019	24 (20,17)	2 (33,33)	22 (19,47)	0,371
2020	20 (16,81)	1 (16,67)	19 (16,81)	
2021	29 (24,37)	-	29 (25,66)	

Source: Central de Transplantes de Roraima Management System(2017-2021).

Table 4 presents the average time between the opening of the EM protocol and the communication/notification to the CET (TAPN) and the average time the organ procurement process opened and completed (TAFP). These times were calculated based on data on the date the process was opened at the notifying hospital, the notification of the CET, and completion.

Table 4. Comparison between opening and notification times and opening and ending times of the capture process divided for the place of hospitalization.

	Hospital					
	HCSA	HGR	HLI	HC	UNIMED	Geral
TAPN (days)	(n = 14)	(n = 96)	(n = 1)	(n = 1)	(n = 1)	(n = 113)
Mean (SD)	2,71 (2,49)	1,75 (3,63)	2,00 (-)	2,00 (-)	2,00 (-)	1,88 (3,47)
Median (percentis 25-75)	2,00 (1,00-3,75)	1,00 (0,00-2,00)	2,00 (2,00-2,00)	(2,00-2,00)	(2,00-2,00)	1,00 (0,00-2,00)
Minimum Maximum	0,00-8,00	0,00-30,00	2,00-2	2,00-2,00	2,00-2,00	0,00-30,00
TAFP (days)	(n = 12)	(n = 61)		(n = 0)	(n = 0)	(n = 73)
Mean (SD)	2,17 (2,17)	1,75 (2,07)	3,00 (-)	-	-	1,84 (2,07)
Median (percentis 25-75)	1,00 (1,00-2,25)	1,00 (0,00-2,00)	3,00 (3,00-3,00)	-	-	1,00 (1,00-2,00)
Minimum Maximum	0,00-7,00	0,00-9,00	3,00-3,00	-	-	0,00-9,00

Source: Central de Transplantes de Roraima Management System (2017-2021).

Table 5 presents the characteristics of the patients whose organs were harvested. All captures occurred at HGR, and all processes were completed with organs offered to the National Transplant Center (Central Nacional de Transplantes-CNT).

Table 5. List of donors who underwent organ removal surgery.

Year	Age	Gender	Reason for BD	TAPN	TAFP	Harvested organ
2018	24	F	Exogenous intoxication + anoxic brain injury	Same day	Same day	Liver, heart valves, corneas and kidneys
2018	10	M	Sangramento parenquimatoso + periventricular hipertensão intracraniana	Same day	Same day	Kidneys and liver
2018	59	M	Severe TBI	1	1	Kidneys
2019	18	M	TBI due to occipitofrontal transfixing FAF	Same day	1	Liver, pancreas and kidneys
2019	40	F	IS	2	2	Liver
2020	19	F	TBI	4	4	Kidneys and liver

Source: Central de Transplantes de Roraima Management System (2017-2021). F = female; M = male.

Table 6 compares hospitals regarding the reasons that led to organs not being harvested.

Table 6. Comparisons between hospitals regarding the reason for non-capture.

Reason for not harvesting n (%)	Hospital						
	Total (n = 113)	HCSA (n = 15)	HGR (n = 95)	HLI (n = 1)	HC (n = 1)	UNIMED (n = 1)	No information (n = 1)
Medical contraindication	24 (21,23)	6 (40,00)	17 (17,89)	1 (100,00)	-	-	-
Indigenous people living in a village	2 (1,76)	1 (6,66)	1 (1,05)	-	-	-	-
Logistics	2 (1,76)	-	2 (2,10)	-	-	-	-
Family negative	19 (16,81)	3 (20,00)	15 (15,78)	-	-	-	1 (100,00)
CPA before completion	2 (1,76)	-	2 (2,10)	-	-	-	-
Death	52 (46,01)	3 (20,00)	48 (50,52)	-	1 (100,00)	-	-
Other causes	8 (6,72)	1 (6,66)	7 (7,36)	-	-	-	-
No information	4 (3,53)	1 (6,66)	3 (3,15)	-	-	-	-

Source: Central de Transplantes de Roraima Management System (2017-2021).

In Table 7, there is a comparison between hospitals regarding the reasons for not carrying out the transplant.

Table 7. Comparison between hospitals regarding the reasons for not carrying out the transplant.

Reason for not harvesting n (%)	Hospital						
	Total (n =113)	HCSA (n = 15)	HGR (n = 95)	HLI (n = 1)	HC (n = 1)	UNIMED (n = 1)	No information (n = 1)
Medical contraindication	31 (25,43)	6 (40,00)	24 (25,53)	1 (100,00)	-	-	-
Unconfirmed diagnosis	1 (0,87)	1 (6,66)	-	-	-	-	-
Logistics	5 (4,38)	-	5 (5,31)	-	-	-	-
Family negative	17 (17,54)	3 (20,00)	13 (13,82)	-	-	-	1 (100,00)
CPA before the family interview	6 (5,26)	1 (6,66)	5 (5,31)	-	-	-	-
CPA before consent completion	45 (39,47)	1 (6,66)	42 (44,68)	-	1 (100,00)	1 (100,00)	-
Other causes	4 (3,50)	2 (13,33)	2 (2,12)	-	-	-	-
No information	4 (3,50)	1 (6,66)	3 (3,19)	-	-	-	-

Source: Central de Transplantes de Roraima Management System (2017-2021).

Table 8 represents the comparison between hospitals regarding the reasons for not completing the process.

Table 8. Comparisons between hospitals regarding the reason for non-completion.

Reason for non-completion n (%)	Hospital						
	Total (n = 113)	HCSA (n = 15)	HGR (n = 95)	HLI (n = 1)	HC (n = 1)	UNIMED (n = 1)	No information (n = 1)
Medical contraindication	30 (25,21)	6 (40,00)	23 (24,46)	1 (0,80)	-	-	-
Indigenous people living in a village	2 (1,68)	1 (6,66)	1 (1,06)	-	-	-	-
Family negative	17 (14,28)	3 (20,00)	13 (13,82)	-	-	-	1 (100,00)
Other causes	1 (0,84)	-	1 (1,06)	-	-	-	-
Logistics	6 (5,04)	-	6 (6,38)				
No information	9 (7,56)	3 (20,00)	6 (6,38)	-	-	-	-
Death	48 (40,33)	2 (13,33)	44 (46,80)	-	1 (100,00)	1 (100,00)	-

Source: Central de Transplantes de Roraima Management System (2017-2021).

DISCUSSION

The analyses found in this study corroborate some findings in the literature, as discussed below. Table 1, which showed the profile of PDs, demonstrated similar results to the survey by Leblebici[6], which sought to determine the prevalence and potential correlates of family refusal to donate organs for patients declared to have BD through a retrospective analysis of 12 years of data. The average age of the patients was 36.0 years, with a prevalence of males (56.1%), similar to the data found in this research.

The most common causes found by Leblebici[6] were non-traumatic intracranial hemorrhage (58.5%), followed by traumatic intracranial hemorrhage (28%) and encephalitis (13.4%). These findings differ from those found in RR, where the main reasons for BD found were TBI, with 27.73% of cases, SAH, corresponding to 15.12% of causes, and hemorrhagic stroke (CHVA), with the same percentage of SAH (Table 2). Regarding family consent, 51.2% of family members did not consent to the donation, while 48.8% did; in this study, family refusal was the third most significant cause of non-donation (Table 6).

Comparing RR data with those from Brazil, the study by Santos[7] sought to identify the temporal trend in the rates of effective organ and tissue donors and notifications and types of organs transplanted per million of the population in Brazil and detected a growing trend in PD and effective donors across the country, with an average annual increase of 2. 33 and 0.92, respectively. The region with the highest rate of PDs (83.8) and effective donors (34.1) was the South Region. The North Region had the lowest rates, with a rate of PDs of 20.2 and effective donors of 3.9, a persistent trend, as seen in the results obtained in RR. Still, in Santos' work[7], the main reason for donating was family refusal, followed by medical contraindication, differing slightly from the RR results, which presented death and medical contraindication as the most frequent causes for non-registration (Tables 6, 7, and 8).

Although the patients were primarily male, the female sex prevailed in the collections, corroborating a similar study in which it was found that, in the PD of organs and tissues in which the donation occurred, the sex most frequently was female (61 .90%)[8]. However, there were no differences in terms of uptake. In another similar study carried out in the Southern Region of Brazil, in which 102 PD records were analyzed, it was observed that 56.86% of patients were female, with a mean age of 49 years, in contrast to the results of this study. The causes of BD are similar to the RR results, in which the author found that 27.4% had SAH, 22.55% TBI, and 22.55% CHVA[8].

Still, in the previous study, 31.67% of the declared reason for not donating was, mainly, family refusal, and 35% of the reasons for not donating were death before starting or completing the BD protocol, medical contraindication, a patient living in the community therapy that required judicial authorization to be a donor and registration on a non-donor ID card[8]. These results are similar to those found in RR, including the finding in this research of indigenous people living in villages as a factor in non-donation. In this case, the indigenous people obey the norms specific to their culture and, therefore, do not accept organ donations among their own.

This study also demonstrated that 42 of the 102 patients were effective donors[8]; Of the 119 notifications analyzed, only six donations were made, a NUMBER much higher than those found in RR. All captures were carried out at HGR.

Table 4 compares the results of the analyses between TAPN and TAFP, and the average time between opening and notification was shorter in HGR compared to HCSA. This data indicates the possibility of greater agility in communication with other institutions listed in the HGR, facilitating the progress of the process. Even so, as already discussed, the number of donations made was tiny, considering the number of notifications.

Table 3 compares patients who underwent capture and did not obtain significant differences in the statistical test. There is a tendency for donors to be younger, and no donors under ten or over 60 years of age. Bertasi's study[9] presents results that confirm the tendency for the most significant number of donations to be made to young people. The author observed data from 1,772 PDs, in which, when comparing the age ranges of donors and non-donors, the most significant number of donations occurred in the range of 21 to 60 years old (519 donors in total), with a peak of donors in the range of 41-50 years old (165 donors). The number of donations reduced in the 61-70 age range, with 64 donations, and after the age of 70, only four donations were recorded. Up to 10 years of age, 21 donors were found, with the number increasing in the range of 11-20 years, in which 73 donations were made, demonstrating that the number of donors tends to be lower among those under 10 and over 60.

In Bertasi's study[9], it was also observed that the majority of PDs were male (57.39%), as well as the data found in this study, with an average age of 42.55 years, slightly higher than that found in Table 1. About the causes of BD, the main one seen in this research was vascular, with 996 cases (56.21%), followed by traumatic in 501 (28.27%), neoplastic (central nervous system neoplasms) in 61 (3.44%), infectious in 26 (1.47%) and 188 classified in the other category (10.61%).

As for the donors in this study, of the total, 681 (38.43%) were available for donation – 293 (43.02%) female and 388 (56.98%) male –this finding is consistent with the described in Table 5, in which the majority of donors were female. Other data from the author are also similar to the RR results, where the main reason for not donating organs was family refusal (42.8%) followed by medical contraindication (25.75%), cardiorespiratory arrest (CPA) (21, 63%), positive serology (4.21%) and failure to complete the BD protocol; in 60 cases (5.49%) there was no reason for non-donation[9].

In Table 4, an analysis was made between TAPN and TAFP, showing that HGR had the shortest times and was more agile in the process than other hospitals. HGR was still the main notifier and the only place among the five hospitals described in Table 4 to carry out the captures. HGR is the primary reference hospital in RR, where urgent and emergency care of medium and high complexity is provided. Located in the state capital, Boa Vista, the hospital receives patients from the capital from all municipalities in the state. Also, it serves patients from Venezuela and Guyana, countries that border RR. Due to its size and relevance, it became the hospital with the highest patient volume, notifying PD and making donations. The hospital still receives many investments in expansion and infrastructure, which can contribute to greater agility in the organ donation process[10].

Carrying out the study in RR presented some limitations, including a need for more information on some patients in the system, conflicting information from patients, and changes in some variables, such as families who gave consent to the donation but

withdrew it after a few days. It is essential to highlight that patients who suffered CPA before harvesting did not donate corneas, as the state does not yet have the necessary infrastructure for this harvesting. However, since 2023, there has been a project to build and implement the Human Ocular Tissue Bank (Banco de Tecido Ocular Humano -BTOC), which already has a location where it will be built in the city of Boa Vista, according to information provided by the nurse responsible for the RR CET. In the researched literature, only some studies were found on the topic, some of which needed to be updated and, therefore, not included in this study.

Despite the limitations and difficulties inherent in the organ donation process, in RR and all Brazilian states, the effort and organization of institutions and the professionals involved in making the donations are clear. Therefore, it is very valid that studies on this topic are developed, preferably with a deeper analysis of the cases, and other hospitals and/or professionals are also sought to understand better all the factors influencing whether to donate organs.

CONCLUSION

Carrying out this study demonstrated that RR still needs to work on organ donation, with a deficient number of harvests carried out over 5 years. Of the hospitals mentioned in the study, only HGR was successful, with no captures in the other reporting hospitals. Despite efforts, RR follows the trend of the North Region, which has the lowest organ donation rates in Brazil. However, there is an increasing agility in organ donation, from the opening to the procurement of organs/completion of the process, with the majority occurring on the same day or within 1 day.

In the acquisitions carried out, the majority occurred on the same day or within one day after the opening of the process, with the capture carried out in 2020, possibly due to the COVID-19 pandemic, the longest, with 4 days between opening and completion of the process. There was also the procurement of multiple organs and tissues from most donors, with only two donating just one organ. Although studies in the literature point to family refusal as one of the main reasons for non-harvesting of organs, in RR, death and medical contraindication were the most frequent causes, with family non-consent generally being the third most significant cause of non-harvesting.

It is concluded that several points need to be improved to modify the panorama presented in RR. More studies on the topic, with more in-depth data analysis, are vital to resolve the deficits listed here and others that may be identified and offer more support for creating new strategies to optimize the organ donation process in the state.

CONFLICT OF INTEREST

Nothing to declare.

AUTHOR'S CONTRIBUTION

Substantive scientific and intellectual contributions to the study: Rabelo MN, Oliveira LCS, Santos BC, Linhares MM; **Conception and design:** Oliveira LCS, Santos BC, França JAPC; **Data analysis and interpretation:** Santos Junior CH, Maia Neto GP, Brum MD, Rabelo MN; **Article writing:** Oliveira LCS, Santos BC, Mota LEL, Lobo ACF, Paz TLP, Lustosa VHS; **Critical revision:** Araújo JES, Lima MS, Mendes LLA, Santos BC, Linhares MM; **Final approval:** Oliveira LCS, Santos BC, Linhares MM.

DATA AVAILABILITY STATEMENT

All dataset were generated or analyzed in the current study.

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