

# Profile of potential organ donors and factors related to donation and non-donation of organs in an Organ Procurement Service.

## *Perfil dos potenciais doadores de órgãos e fatores relacionados à doação e a não doação de órgãos de uma Organização de Procura de Órgãos.*

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### ABSTRACT

**Objective:** to characterize the profile of potential and effective organ donors, and to identify the factors related to non-donation. **Methods:** the data was collected from the Organization of Organ Donation forms during the period of January 2013 to April 2018. The statistical analysis was done by the Biostatistic Service of the School of Medical Sciences of UNICAMP. **Results:** the study analyzed 1,772 potential donors; the male gender was predominant (57.39%). Vascular injuries (n=996) were the main cause of brain death. The family refusal (42.8%) was the leading cause of non-donation of organs. There was statistical difference between donors and non-donors in regard to the mean age and mean systolic blood pressure. There was also a relationship between the donation of organs and the absence of diabetes and smoking. **Conclusion:** the majority of effective organ donors were young males. The main causes of brain death (BD) and family refusal of organ donation were cerebrovascular disorder and no desire to donate organs after death, respectively. Alcoholics and males were more frequently found in traumatic causes of BD. Therefore, initiatives for population awareness and discussion among the families regarding organ donation can lead to increase the number of effective organ donors.

**Keywords:** Brain Death. Transplantation. Tissue Donors.

### INTRODUCTION

The rate of organ donors in Brazil has been growing in recent decades. In the beginning of the 21<sup>st</sup> century, the total number of donors did not exceed 700<sup>1</sup>. In 2017, there were almost 11,000 potential donors<sup>2</sup>, a total of 3,415 effective donors<sup>2</sup>, and approximately 7,500 organ transplantations<sup>1</sup>. However, despite the increasing number of donations in Brazil, in the first half of 2018, there were more than 24,000 needed organs, according to the waiting list (except ocular tissue)<sup>3,4</sup>. This shows that there is still a great disproportion between donors and recipients, one of the reasons being the lower expected growth of effective donors.

In order to reduce waiting time and improve implant results, attention must be paid to three pillars: donation, transplantation, and waiting list<sup>5</sup>.

It is evident that there are many factors that influence the effectiveness of the donation process, from the beginning with the correct identification of possible donors to the proper management with the family and with the viability of the organs. Thus, it becomes important to know better the profile of potential and effective donors through the causes of brain death and the factors related to donation or non-donation, and, with the results found, to establish routines and protocols that potentiate the success of the process.

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## METHODS

Retrospective study with data collection from the registration forms of the Organ and Tissue Procurement Service of *Hospital de Clínicas - Unicamp*, comprising the period from January 2013 to April 2018. These forms are called "Information about the multi-organ donor". The causes of brain death (BD) were divided into the following groups: traumatic (traumatic brain injury due to blunt or penetrating mechanism), cerebral vascular (hemorrhagic or ischemic stroke, subarachnoid hemorrhage, ruptured aneurysm, intracranial hemorrhage, intraparenchymal hemorrhage, venous thrombosis, cerebral ischemia after aneurysm clipping, and anoxic encephalopathy), infectious (bacterial meningitis, meningoencephalitis, and brain abscess), and neoplastic (tumor or hemorrhage within central nervous system tumor, intracranial granuloma), the latter three being also considered non-traumatic causes.

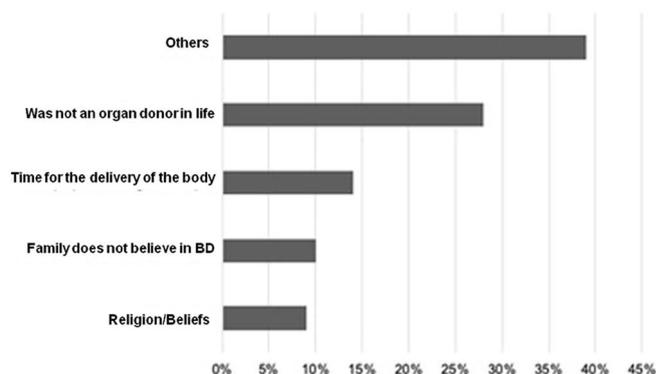
In order to describe the sample profile according to the variables under study, frequency tables of the categorical variables with absolute frequency value (n) and percentage frequency value (%) were made, as well as descriptive statistics of the numerical variables, with mean, standard deviation, minimum, maximum, and median values. Chi-square test and, when necessary, Fisher's exact test were used to compare and evaluate the relationship between the categorical variables, Mann-Whitney test was used to compare numerical variables. The significance level adopted for the study was 5%. For statistical analysis, the following software was used: SAS System for Windows (Statistical Analysis System), version 9.4 (SAS Institute Inc., 2002-2012, Cary, NC, USA)<sup>6,7</sup>. Statistical analysis was performed by the Biostatistics Service of Unicamp's Faculty of Medical Sciences.

The study was approved by the Research Ethics Committee (CAAE: 68134417.1.0000.5404, Opinion: 2.084.156).

## RESULTS

From 2013 to 2018, 1,772 potential donors were evaluated in the Organ and Tissue Procurement Service of *Hospital de Clínicas - Unicamp*. The male gender prevailed (57.39%); mean age was 42.55 years ( $\pm 18.19$ ); mean BMI was 26.09 ( $\pm 4.58$ ). The main causes of BD were: vascular injury in 996 cases (56.21%), followed by traumatic in 501 cases (28.27%), neoplastic (central nervous system neoplasms) in 61 (3.44%), infectious in 26 (1.47%), and others in 188 (10.61%). Out of the total number of potential donors, 681 (38.43%) were accepted for donation, of which 293 (43.02%) were female and 388 (56.98%) were male.

Family refusal (42.8%) was the main cause for non-organ donation, followed by medical contraindication (25.75%), cardiorespiratory arrest (21.63%), positive serology (4.21%), and non-completion of BD protocol ( $<0.1\%$ ). Sixty cases (5.49%) did not report the reason for non-donation. The reasons for family refusal are described in figure 1.



**Figure 1.** Reasons of family refusal for organ donation. "Others" refers to the family's option of not reporting the reason for non-donation.

Table 1 shows the frequency found in relation to personal history (diabetes mellitus [DM] and hypertension), life habits (smoking, alcoholism, and use of drugs), besides interurrences during hospitalization (infection, use of vasoactive drug, cardiorespiratory arrest, and use of hemoderivatives), for potential donors.

The number of donated organs and the possibility of disposal were evaluated. Kidneys, liver, heart, lung, pancreas, and cornea had a donation rate greater than 90%. However, these same organs had discard rates of 16%, 26%, 80%, 93%, 95%, and 28%, respectively.

Statistical analysis showed no difference between donors and non-donors regarding gender ( $p=0.778$ ). However, there was statistically significant difference regarding the presence of diabetes, smoking, cardiorespiratory arrest, use of vasoactive drugs, presence of infection, cause of BD and use of drugs. There was also a relationship between organ donation and absence of diabetes and smoking. Among the traumatic

causes of BD, there was a higher proportion of donors compared to non-donors (Table 2).

We found statistically significant difference between donation and non-donation regarding age and systolic blood pressure (SBP). The mean age was higher in non-donors ( $p=0.002$ ) and the mean SBP was higher in donors ( $p<0.001$ ). We also evaluated the relationship between causes of BD - traumatic or non-traumatic - and gender, chronic diseases, and life habits (Table 3).

The relationship between the cause of BD (traumatic or non-traumatic) was also evaluated between donors and non-donors, stratified by age group (Table 4).

It was verified a possible relationship between laboratory tests (urea, creatinine, glucose, amylase, and bilirubin) and discard or non-discard of organs. Urea values were not related to kidney discard, as well as glucose or amylase values were not related to pancreatic discard. However, mean creatinine was higher among discarded kidneys, as well as mean bilirubin was higher among discarded livers (Table 5).

**Table 1.** Personal history, life habits, and interurrences among potential donors.

Personal history	n (%)	Intercurrences during hospitalization	n (%)
DM*		Infection	
Yes	140 (7.9)	Yes	429 (24.2)
No	1,632 (92.1)	No	1,343 (75.8)
Arterial hypertension		Use of vasoactive drug	
Yes	561 (31.7)	Yes	617 (34.8)
No	1,211 (68.3)	No	1,155 (65.2)
Smoking		Cardiorespiratory arrest	
Yes	345 (19.5)	Yes	326 (18.4)
No	1,427 (80.5)	No	1,446 (81.6)
Alcoholism		Hemoderivatives	
Yes	282 (15.9)	Yes	165 (9.3)
No	1,490 (84.1)	No	1,607 (90.7)
Use of drugs			
Yes	124 (7)		
No	1,648 (93)		

\*DM: diabetes mellitus.

**Table 2.** Relationship between organ donation and diabetes mellitus (DM), smoking, cardiorespiratory arrest (CA), use of vasoactive drugs (VAD), infection, and traumatic cause of brain death (BD).

	Donors n (%)	Non-donors n (%)	p-value
DM			0.0125
Yes	40 (5.87)	100 (9.17)	
No	641 (94.13)	991 (90.83)	
Smoking			0.0005
Yes	161 (23.64)	184 (16.87)	
No	520 (76.36)	907 (83.13)	
CA			0.0294
Yes	108 (15.86)	218 (19.98)	
No	573 (84.14)	873 (80.02)	
VAD			<0.0001
Yes	336 (49.34)	281 (25.76)	
No	345 (50.66)	810 (74.24)	
Infection			<0.0001
Yes	218 (32.01)	211 (19.34)	
No	463 (67.99)	880 (80.66)	
Cause of BD			<0.0001
Traumatic	241 (35.39)	260 (23.83)	
Non-traumatic	440 (64.61)	831 (76.17)	

**Table 3.** Relationship between causes of BD and gender, chronic diseases, and life habits.

	Causes of BD		p-value
	Traumatic n (%)	Non-traumatic n (%)	
DM*			<0.0001
Yes	14 (2.79)	126 (9.91)	
No	487 (97.21)	1,145 (90.09)	
Arterial hypertension			<0.0001
Yes	41 (8.18)	520 (40.91)	
No	460 (91.82)	751 (59.09)	
Alcoholism			0.0008
Yes	103 (20.56)	179 (14.08)	
No	398 (79.44)	1,092 (85.92)	
Smoking			0.0004
Yes	71 (14.17)	274 (21.56)	
No	430 (85.83)	997 (78.44)	
Gender			<0.0001
Male	415 (83)	598 (47.27)	
Female	85 (17)	667 (52.73)	

\*DM: diabetes mellitus.

**Table 4.** Relationship between organ donation and causes of BD according to age group.

Causes of BD	Donors n (%)	Non-donors n (%)	p-value
Up to 10 years			0.7752
Traumatic	4 (19.05)	20 (24.39)	
Non-traumatic	17 (80.95)	62 (75.61)	
11-20 years			0.0463
Traumatic	49 (67.12)	41 (51.25)	
Non-traumatic	24 (32.88)	39 (48.75)	
21-30 years			<0.0001
Traumatic	63 (77.78)	61 (48.03)	
Non-traumatic	18 (22.22)	66 (51.97)	
31-40 years			0.2671
Traumatic	46 (36.22)	38 (29.69)	
Non-traumatic	81 (63.78)	90 (70.31)	
41-50 years			0.1854
Traumatic	42 (25.45)	41 (19.71)	
Non-traumatic	123 (74.55)	167 (80.29)	
51-60 years			0.6116
Traumatic	23 (15.75)	36 (13.90)	
Non-traumatic	123 (84.25)	223 (86.10)	
61-70 years			0.0178
Traumatic	14 (21.88)	14 (9.72)	
Non-traumatic	50 (78.13)	130 (90.28)	
>70 anos			-
Traumatic	0 (0)	9 (14.52)	
Non-traumatic	4 (100)	53 (85.48)	

**Table 5.** Relationship between laboratory tests and discard.

	n	Mean	Standard deviation	p-value
Creatinine (kidney)				
Discarded	97	1.96	1.88	<0.05
Non-discarded	552	1.54	1.42	
Total bilirubin (liver)				
Discarded	156	0.91	1.04	0.0013
Non-discarded	462	0.73	2.17	
Direct bilirubin (liver)				
Discarded	154	0.55	0.82	0.0005
Non-discarded	459	0.35	1.05	
Amylase (pancreas)				
Discarded	581	136.27	221.89	0.831
Non-discarded	26	135.42	178.25	
Glucose				
Discarded	584	189.55	94.98	0.718
Non-discarded	26	171.96	61.19	

## **DISCUSSION**

The present study corroborated data from ABTO (Brazilian Association of Organ Transplantation) regarding gender (male - 57.39%) and the most prevalent causes of BD among potential donors: vascular cause followed by traumatic cause<sup>2</sup>, as well as data from a previous study<sup>8</sup>.

After BD identification, the next step for organ donation is the eligibility of the potential donor, by family authorization and the absence of factors that prevent donation, such as medical contraindication, cardiorespiratory arrest (CA), serology, or non-completion of BD protocol. In Brazil, only after 2009 family refusal became the major reason for non-donation<sup>2,9,10</sup>, as found in the present study, where family refusal accounted for almost half of the causes for non-organ donation (45.3%). Thus, there is a real potential for raising donation rates if the family motives are understood and overcome.

The fact that the potential donor is not an organ donor in life (Figure 1) was the second main reason for family refusal (28%). Besides expressing donation intention to families, one way to overcome this obstacle would be a national register of donors, in which people, in life, expressed their wish to donate, helping families to make a favorable decision at the time of donation<sup>11</sup>. A study carried out in the Netherlands has shown that, in cases in which the potential donor had registered a statement of will, the donation rate has been approximately 94% against 23%, when the family had decided on its own, without the aid of a register to express the desire for donation<sup>12</sup>.

Despite the difficulties presented above to actually initiate the donation process, after family acceptance and absence of medical contraindications, donation rates of kidneys, liver, heart, lung, pancreas, and cornea are greater than 90%; however, they are still not sufficient to equate the waiting list<sup>3,4</sup>.

This shows how important it is to overcome the reasons for non-donation and to further minimize the rate of organ discard.

After confirming the eligibility of the potential donor, that is, after having family authorization and no clinical contraindications, there is the medical team's difficulty in controlling the homeostasis and the hemodynamic stability of the donor<sup>13</sup>, in order to maintain the viability of the organs for donation. This challenge is demonstrated by the present study, which showed that there was less use of vasoactive drugs and antibiotics in non-donors than in donors and higher mean systolic blood pressure among donors ( $p < 0.001$ ).

It was possible to find that higher mean creatinine and bilirubin are related to the discard of kidneys and liver, respectively. Thus, it is possible to perceive the difficulty in taking care of an effective donor, from the adequate management of blood pressure with the use of vasoactive drugs to the accomplishment of measures that prevent the worsening of renal or hepatic function<sup>13,14</sup>.

We analyzed the relationship between the causes of BD (traumatic and non-traumatic) and organ donation and it was verified that, among the traumatic causes, there was a greater proportion of donors than non-donors. De Oliveira et al. have suggested a possible parallel between the increase of donations in traumatic BD, possibly due to the availability increase of healthy organs<sup>15</sup>.

The prevalence of certain chronic diseases or life habits of the donor was also evaluated and we found a relationship between absence of diabetes and organ donation, corroborating literature data<sup>14</sup>. In addition, these same variables were evaluated in relation to the causes of BD. It was found that diabetes, hypertension, and smoking are more common in non-traumatic causes of BD, however, alcoholism is more common in traumatic causes.

Finally, it was verified that, among traumatic causes of BD, the male gender is the most common and, among non-traumatic ones, the female gender is the most prominent. These data corroborate the study by Ackerman *et al.*, in which the profile of more than 190,000 donors has been analyzed and a relationship between traumatic causes of BD<sup>16</sup> and diabetes, hypertension, and male gender has been found.

Our study has some limitations, mainly related to the lack of data and systematization in filling out the forms of the Organ and Tissue Procurement Service. In addition, the system does not integrate donor and recipient data,

making it unfeasible to correlate the profile of donors with the functionality and duration of grafts and the quality of life of the transplant recipients.

The present study concluded that the organ donor profile was male and young. The main causes of BD and family refusal were, respectively, vascular disorders and non-manifestation of the willingness to be a donor after death. Alcoholism and male gender were more present in traumatic causes of BD, the former being a preventable event. Therefore, initiatives for population awareness and discussion opening within families regarding organ donation contribute to increase the index of effective organ donors.

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## R E S U M O

**Objetivo:** caracterizar o perfil dos potenciais e dos efetivos doadores de órgãos, e identificar os fatores relacionados a não efetivação da doação. **Métodos:** estudo retrospectivo transversal com coleta de dados das fichas da Organização de Procura de Órgãos do Hospital das Clínicas da Unicamp, referente ao período de janeiro de 2013 a abril de 2018. **Resultados:** o estudo contou com 1.772 potenciais doadores; predominou-se o sexo masculino (57,39%) e o evento vascular (n=996) foi a principal causa de morte encefálica. A recusa familiar (42,8%) foi o motivo mais comum para não doação de órgãos. Houve diferença estatística entre doadores e não doadores quanto à média de idade e pressão arterial sistólica, assim como houve relação entre a doação de órgãos e a ausência de diabetes e tabagismo. **Conclusão:** a maioria dos doadores efetivos foi do sexo masculino e jovem. As principais causas de morte encefálica e de recusa familiar foram, respectivamente, vasculares e não manifestação da vontade de ser doador após a morte. O etilismo foi mais presente nas causas traumáticas, assim como, o sexo masculino. Assim, iniciativas de conscientização populacional e abertura de discussão dentro da família sobre o ato da doação contribuem para o aumento do índice de doadores efetivos.

**Descritores:** Morte Encefálica. Transplante. Doadores de Tecidos.

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