

Effectiveness in the Performance of Organ Transplants in the State of Paraná, Brazil

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Abstract

Objective: To analyze the effectiveness of organ transplants in the state of Paraná, Brazil.

Methods: A cross-sectional quantitative study was conducted with data from 2,036 solid organ transplants performed in the state between 2011 and 2015. Three indicators were calculated, per capita transplants, meeting the demands of the population and the demand for transplants, which demonstrated the effectiveness and the disparities in the process. The association between the variables was verified by Pearson's Chi-Square test and Fisher's exact test.

Results: Most transplants were performed in philanthropic hospitals, male, funded by public funding, and there was an annual increase in the number of transplants per capita and in the productivity of kidney, liver and heart transplantation teams. Although renal transplantation is the most performed in absolute numbers, it served a maximum of 2.2% of its demand.

Conclusion: It is necessary to devise strategies to meet the demand for organ transplants, above all, to consolidate the process of donating organs in the state under study.

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Introduction

Brazil is a country that is in evidence because it occupies the second place in absolute numbers in the accomplishment of transplants, mainly of kidneys and liver, behind only the United States of America. In relation to transplantation rates per million population (pmp), the country performs 26.9 pmp transplants, and Paraná is the Brazilian state that in the year of 2016 occupied the first position by performing 48.6 transplants of solid pmp organs [1].

The National Transplant System (NTS) manages organ transplants throughout Brazil. This system is consolidated and renowned as one of the largest public organ transplantation programs in the world, since approximately 95% of the procedures performed are financed with resources from the Unified Health System (UHS) [2].

Although the NTS presents itself as a well-structured and regulated program, it has 25 Centers for Notification, Recruitment and Donation of organs (CNRDO) in the states of the federation and 548 authorized establishments, involving 1,265 medical transplant teams [2], in an audit conducted by the Court of Union accounts it has been found that the program proposes only a few performance indicators and that not all the necessary information related to the effectiveness of the activities is raised. In this way, the program does not have adapted tools that evaluate the quality and effectiveness of this service [3].

The quality of a service can be understood as a goal, defined by the continuous search for improvement, aiming at effectively meeting customer needs [4]. On the other hand, effectiveness is understood as the achievement of results, the fulfillment of objectives and goals pursued after the implementation of a given health intervention, in which it brings benefits to individuals of a defined population [5].

As in other countries, a systematized evaluation is not yet in place in Brazil to compare effectiveness indicators in different places in the country. On the

other hand, Spain and the US stand out in the evaluation of quality, identifying the factors that impact this process, as well as its accompaniment through indicators [6, 7].

In view of the importance and lack of evaluations of the effectiveness of the solid organ transplantation program, in order to identify the managerial weaknesses of the process and the number of people waiting for heart, liver, pancreas and kidney in the country, in this study the objective was to analyze the effectiveness of organ transplants in the state of Paraná, Brazil.

Methods

A cross-sectional quantitative study carried out in the State of Paraná, which presents 10,279,545 citizens distributed in 399 municipalities. It is administratively organized in four macro-regions of health: north with population of 1,819,461 people; northwest with 1,661,013; east with 5,194,333; and west with 1,604,738 [8].

The data were provided by the State System of Transplants, referring to the 2,036 transplants carried out by 16 transplantation centers between 2011 to 2015. All the transplant notifications of this period were included.

The variables analyzed were the sex of the recipient, the year of the transplant, the donor source of the transplant, the organ transplant and macro-regional health in which the transplant was performed.

In order to verify the effectiveness of organ transplants, three indicators were proposed by Marinho; Cardoso; Almeida [9], formulated to demonstrate effectiveness and disparities in the process, the first expressed per transplants per capita, indicates the effectiveness of meeting the needs of the population (number of transplants divided by the population of the state and multiplied by 1,000,000); the number of transplants multiplied by the number of transplantation teams per capita, and the result

multiplied by 1,000,000); and the third, the demand for transplants shows the percentage of transplant needs met (number of transplants performed divided by the number of people on active waiting list, and multiplied by 100).

The indicators were calculated in the Microsoft Excel® program (version 2013 for Windows) and the other data were analyzed in the Statistical Package for Social Science (SPSS) (version 20,0 for Windows), by absolute and relative frequencies. The association between the variables related to transplantation was verified by Pearson's Chi-Square test and Fischer's exact test, considering as statistically significant $p < 0.05$.

This study followed the ethical precepts of research with human beings and was approved by the Research Ethics Committee of the State University of Londrina, Opinion no 1,395,408.

Results

The 2,036 transplants were performed in 16 hospitals accredited as solid organ transplantation centers, of which 11 (68.75%) were philanthropic institutions, 2 (12.5%) public and 3 (18.75%) were private.

It was verified that the majority of the transplants were performed in the male sex ($p = 0.001$), funded by public funding ($p = 0.071$), as well as an increase in the number of transplants over the years ($p < 0.001$) in the eastern macroregion ($p < 0.001$), mainly liver and kidney, as shown in **Table 1**.

Figure 1 shows the increasing annual evolution of the per capita transplant indicator in the state for most organs. In pancreas transplants there was a decrease from 2.4 pmp in 2011 to 1.9 pmp in 2015. On the other hand, the renal increased from 18.4 pmp to 31.5 pmp in the analyzed period.

Renal and hepatic transplantation services were the most accessible to the population, both by the availability of the organ and by the number of available transplantation teams (**Figure 2**).

Table 1. Distribution of the variables related to the transplantation according to macro-regional health. Paraná, Brazil, 2011 to 2015; ($n = 2036$).

Variables	Macroregional Health								Value of p^*
	North		Northeast		East		West		
	n	%	n	%	n	%	n	%	
Sex of the receptor									
Female	35	4.7	52	7.0	563	75.7	94	12.6	0.001
Male	42	3.4	85	6.9	967	78.6	136	11.1	
Ignored	7	11.3	1	1.6	39	62.9	15	24.2	
Year									
2011	14	5.0	9	3.2	229	81.2	30	10.6	<0.001
2012	14	3.5	18	4.5	313	77.7	58	14.4	
2013	16	3.7	41	9.5	300	69.3	76	17.6	
2014	20	5.0	41	10.3	309	77.6	28	7.0	
2015	20	3.8	29	5.6	418	80.4	53	10.2	
Funding Source									
UHS	78	4.0	129	6.6	1514	77.6	231	11.8	0.071
Private	6	7.1	9	10.7	55	65.5	14	16.7	
Transplanted organ									
Heart	14	10.2	-	-	111	81.0	12	8.8	-
Liver	-	-	-	-	487	100.0	-	-	
Liver-Kidney	-	-	-	-	18	100.0	-	-	
Pancreas	-	-	-	-	17	100.0	-	-	
Kidney	70	5.4	138	10.7	845	65.7	233	18.1	
Kidney-Pancreas	-	-	-	-	91	100.0	-	-	

*: Pearson's Chi-Square and Fischer's Exact.
Source: State System of Transplants of Paraná, 2011 to 2015.

Figure 1: Annual evolution of per capita transplant indicator (pmp), Paraná, Brazil, 2011 to 2015.

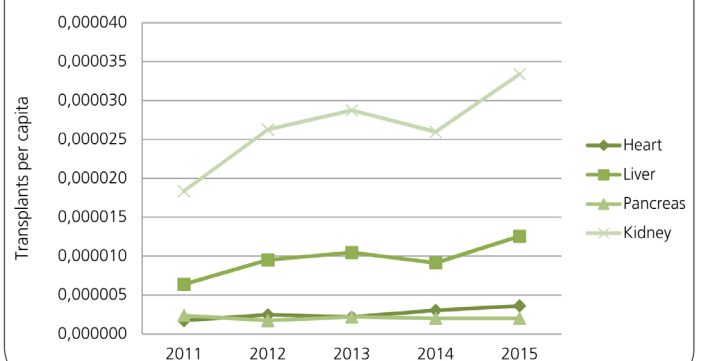


Figure 2: Annual evolution of the indicator of attendance to the demands of the population (pmp). Paraná, Brazil, 2011 to 2015.

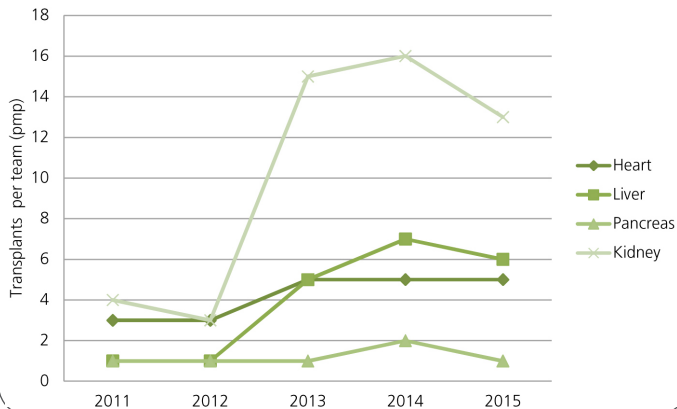
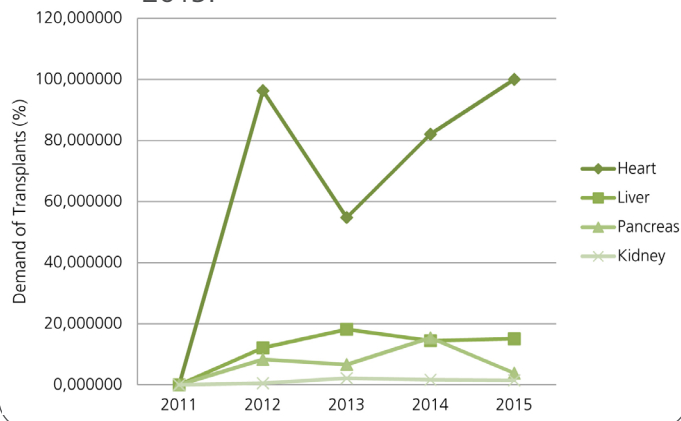


Figure 3: Annual evolution of the transplant demand indicator. Paraná, Brazil, 2011 to 2015.



Despite the fact that in 2013 the demand for heart transplants decreased to 54.8% in 2015, met 100.0% and zeroed the waiting list. The other bodies answered the maximum of 18.2% of their demand. Although renal transplantation is the most performed in absolute numbers, over the years it has only served 0.5 to 2.2% of its total progressive demand (**Figure 3**).

Discussion

The evaluation by means of effectiveness indicators allowed to draw a diagnosis of transplantation in

the State of Paraná, which will allow the development of management strategies aimed at improving the performance of the service provided.

Most of the transplants in Paraná were performed by philanthropic hospitals, which are important providers of services to the UHS, since they are mixed-economy, non-profit institutions and for this reason, after public hospitals are the ones of choice in the agreement with the public system [10]. In order for an institution to receive philanthropic certification in Brazil, it must provide an effective 60% or more of admissions to the public service [11].

Transplants were performed predominantly in the male sex, since it is similar to other studies performed in Brazil [12, 13]. It is noteworthy that men are the majority of patients on the waiting list [14], so it is assumed that they are more vulnerable to illness, because they seek less prevention and treatment at the onset of symptoms [13, 15]. In addition, pathologies that cause organ failure are more prevalent among them [16].

However, in the USA, the predominance shown in some studies has been the greater achievement of transplants in women, where demand is fast, and they are more likely to achieve transplantation [17, 18].

The main funding source for transplants was the UHS, which in the period from 2011 to 2013, cost approximately 2 billion reais, of which 195 million were used in Paraná [19]. Considering that transplantation is a high-cost procedure, UHS argues with these values, in order to comply with the constitutional precepts of universal access and integral health care [20]. In 2015, more than 95% of the transplants were financed with public resources [21].

It is added that all procedures related to organ donation and transplantation are funded by the Strategic Actions and Compensation Fund (SACF), whose purpose is to finance new procedures and policies considered strategic for UHS [22].

The macroregional health east of Paraná was evidenced by performing the largest number of transplants in the years studied. By 2016, 32 of the 15 solid organ transplantation teams in the state were under its management, which justifies its performance. In addition, it is the largest macro-region of Paraná, where the state capital and municipalities with the best infra-structure and available human resources are located [9].

Throughout the years, the growth in the accomplishment of transplants has crossed the reality of the state of Paraná. In Brazil, from 2011 to 2016 there was an increase in the pmp rate in the performance of transplants, this ranged from 34 pmp to 38 pmp [23]. Compared to the world rate, it was verified that the growth in transplants was more significant, since of 16% in 2011, increased by 53% in 2016 [24], strengthening the data found on the per capita transplant indicator.

The growth of kidney transplantation may be associated with the high prevalence of chronic renal failure, end-stage renal disease, and dialysis, since this procedure is considered the best therapeutic option for individuals in these clinical settings. In addition, the kidney allows the donation in the deceased donor, as well as the donation of living individuals, since this transplantation also depends on the availability and availability of the organ [25]. This type of transplant represents approximately 90% of all transplants and their costs in Brazil, demonstrating their relevance [15].

On the other hand, the data indicated a decrease in the performance of pancreas transplants, which has also been happening at the international level [26]. In Canada, the rate of pancreas transplants ranged from 3.15 pmp in 2011 to 2.12 pmp in 2015. In Croatia the rate of pancreas transplantation fell by 0.83% in the same period [24]. In Brazil, the rate ranged from 0.94 pmp in 2011 to 0.58 pmp in 2015, demonstrating that it was lower than in the state in the same period [1]. The decrease in the performance of this type

of transplantation can be understood due to the decrease in donation rates of the organ and the waiting list [26].

Despite the results obtained, the number of transplants performed in the country is still insufficient compared to the need of the population [22].

In view of the annual evolution of the indicator of care of the population, it is analyzed that the kidney and liver are the most accessible organs of the population, which is compatible with some studies that demonstrate that in relation to the organs captured, the kidneys predominated in its accomplishment, followed by the liver, corroborates that Paraná is the state among the five most efficient in maximizing transplants in Brazil [27].

The demand for liver donors presents with an increasing average in the last years, it is considered their availability by the procedure to be performed with living donors, nationally the waiting list mortality rate remains high [28].

However, the Brazilian Registry of Transplants [23] demonstrated that the performance of kidney transplantation in Paraná presented a rate of 15 pmp in the performance of transplants with a living donor, evidencing the relevance of the availability of this organ.

Although this type of transplantation is still the most accomplished, the demand is not fully met, since in the waiting list of Brazil there are 18,818 patients (93 pmp) and of these 1,172 were as active patients in the queue in the state of Paraná at the end 2015 [1].

In view of the number of kidney transplants performed, the results showed that Paraná served a maximum of 2.2% of its demand, a low number, than expected in the state. In Brazil, only 30% of the total number of people who are in the waiting list of this organ is attended, and this may be the only option for many patients. It is noteworthy that in all Brazilian states the queue for waiting for organs is unique and its allocation is regulated by a specific law and administered by NTS [1, 29].

The growing number of people waiting for kidney transplants is due to dialysis, which improves the quality and life expectancy of people awaiting kidney transplantation. However, lung, liver and heart transplants present smaller queues when compared to the kidney, this is due to the limitations to enter the waiting queue, because for the indication of transplantation for these organs, it happens when the life expectancy related to the organ is less than 30 months, a fact that keeps the list small when compared to the kidney, where candidates can be maintained for a long time on dialysis or hemodialysis [30].

However, the occurrence of a waiting queue for the kidney is not only a Brazilian reality, because compared to other countries such as the US, the kidney is the second largest queue in the country, with 105,359 patients waiting [31, 32].

Therefore, the effectiveness of the transplantation services demonstrates the preponderance in meeting the needs of the kidney and liver transplantation service, due to the availability of transplantation teams of these organs, ending 2015 with 13 transplantation teams for kidney and six transplants for liver in Brazil [33].

On the other hand, it was verified that the indicator of effectiveness of the service related to the demand of the heart transplant was the most attended. In Brazil, the number of heart transplants increased 14.5% in 2015, maintaining steady growth in the last four years, but is still far from the 8.0 pmp goal. The state of Paraná carried out approximately 3.4 pmp transplants, and it was found that even being an effective service in this state is still far from the stipulated national goal [1].

The greatest difficulty in achieving effective transplantation is the lack of donors to meet the demand that is in the waiting queue [34-36].

However, the predominance of the shorter waiting time in the Federation Units, in the South and Southeast regions, which concentrate most of the transplants performed and the patients in the

queues, is also evident [37]. Thus, it was shown that the state of Paraná, as well as Brazil, has been struggling to increase the number of effective donations and transplanted patients in all spheres [8, 38].

As limitations of the study, we cite the cross-sectional design and the impossibility of analyzing the effectiveness of the service in relation to the structure of hospital units, physical, material, human and organizational resources. In addition, it was not possible to verify whether the organs came from Paraná or from another state. The data refer to a Brazilian state, which prevents the generalization of its results, considering that each CNRDO has the autonomy to carry out its own policies and thus, it is suggested that further studies should be carried out regarding the effectiveness of transplants in the other countries and Brazilian states.

This study demonstrates information relevant to the planning and improvement of the management of transplantation programs, especially that the State of Paraná has progressively progressed over the years in this process and needs to draw up strategies to achieve the national transplantation goal, mainly by strengthening the process of organ donation, whose transplants do not meet the demand, such as renal, hepatic and pancreas.

In addition, it can be inferred that the culture of Brazilian society is little used to practice evaluative processes, thus, authorities and managers are not aware of the real need to determine indicators linked to the quality and effectiveness of the service performed, preventing possible failures and improvement of the process.

Conclusion

The state of Paraná is seeking actions for the effectiveness of transplants, during the years 2011 to 2015, there was an increase in the number of procedures performed per million population, even in the face of difficulties in the donation process and transplants.

UHS support for the implementation of the procedures was fundamental for the consolidation of the National Transplant System, even though the state still presents itself far from the established national goal, during the study period.

Therefore, the evaluation through effectiveness indicators allowed us to indicate opportunities for improvement, as well as the identification of some weaknesses, such as the waiting list for some organs and the attendance of 18.2% of its progressive demand, except for the heart that zeroing the waiting list in the year 2015. It is considered that the state needs to devise strategies to meet the demand for organ transplants, above all, to consolidate the donation process in the state.

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