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# Effect of the COVID-19 Pandemic on Organ Donation and Transplantation in São Paulo, Brazil

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## ABSTRACT

The COVID-19 pandemic has affected donation and transplantation activities in São Paulo, Brazil, as well as the patients receiving these organs. In this study, information from the database of the São Paulo Organ Allocation System was analyzed and compared 2 periods—before the pandemic and during the pandemic—to identify this effect. The COVID-19 pandemic interfered in the mortality rate and the time on the waiting list for heart, liver, pancreas, lung, and kidney transplants; the number of effective donors; and the use or disposal of available organs from deceased donors. It also reduced the transplant activity with living donors. Regarding the activity of eye tissue transplantation, the time on the waiting list increased and the number of transplant procedures decreased. The kidney transplant program was the most affected in our study. There was an increase in waiting time and mortality in the waiting list for this organ and also a decrease in kidney utilization rates.

**S**INCE the discovery of COVID-19 in late December 2019 in Wuhan, China, the world has watched the disease rapidly spread and become declared a pandemic by the World Health Organization [1,2]. Since then, it has had an important impact on organ donation and transplant programs around the world and in Brazil, where the donor rate declined by 13% in 2020 when compared to 2019 [3]. This reduction could have occurred because of both a decrease in notification of potential donors and an increase in the number of contraindications for transplantation. To minimize the effect of this pandemic in São Paulo, in April 2020, a reverse transcription–polymerase chain reaction test for severe acute respiratory syndrome coronavirus 2 was adopted in the screening of effective donors and protocols and flowcharts used in the clinical evaluation of potential donors were adapted. In addition, for liver and kidney transplantation with a living donor, it became the responsibility of each transplant center to perform the surgery. Regarding the activities of harvested cornea and elective corneal transplantation, they were suspended for 6 months, starting on March 23, 2020, only performing this surgery on an emergency basis and cornea harvested only from deceased donors. The aim of this study was to assess the effect of COVID-19 on donation and transplantation using information from the São Paulo Organ Allocation System database.

## METHODS

This is a cross-sectional, retrospective, and descriptive study that analyzed information from the database of the São Paulo Organ Allocation

System. The period of analysis was divided into a prepandemic period (April 1, 2019, to March 31, 2020) and the pandemic period (April 1, 2020 to March 31, 2021). The following variables were analyzed between the groups: number of effective donors; use or discard of available organs; mortality rate; and time on the list of patients waiting for heart, liver, pancreas, lung, and kidney transplants. Statistical analysis was performed with Statistical Package for the Social Sciences (SPSS Inc, Chicago, IL). The Z test was used to evaluate 2 means and the test of equality of 2 proportions to evaluate 2 variables. A two-sided *P* value of  $\leq .05$  was considered statistically significant.

## RESULTS AND DISCUSSION

**Table 1** shows the number of waiting list candidates for each type of transplant before and during the pandemic period of COVID-19 was, respectively: heart, 406 and 378; liver, 2130 and 1861; pancreas, 98 and 104; lung, 190 and 182; and kidney, 19,423 and 19,332. In both periods, the notification of potential donors and number of effective donors dropped by 1.4% (3056 and 3012) and 5.7% (1115 and 1051), respectively, although family refusal rate dropped from 36.6% to 33.4% (*P* = .052). Others have identified higher rates of mortality due to COVID-19 among deceased donor kidney transplantation waitlist [4]

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**Table 1. Donation and Transplantation in São Paulo, Brazil, Before and During the COVID-19 Pandemic**

Characteristic	COVID-19 Activity		P Value
	Before Pandemic	During Pandemic	
Donation after brain death, n			
nonorgan donor	3.056	3.012	not significant
organ donor	1.115	1.051	
Waitlisted patient	n	n	
Heart	406	378	< .001
mo*	12.3	9.5	
Liver	2.130	1.861	< .001
mo	7.1	5.3	
Pancreas	98	104	< .001
mo	7.8	4.1	
Lung	190	182	< .001
mo	20.6	17.1	
Kidney	19,423	19,332	< .001
mo	27	27.6	
Cornea	2.594	3.651	< .001
mo	4.4	6.7	
Transplantation activity, n			
Heart	discarded <sup>†</sup>	1.249	not significant
transplanted	131	130	
Liver	discarded	831	not significant
transplanted	616	587	
Pancreas	discarded	1.156	not significant
transplanted	98	113	
Lung	discarded	2.379	.003
transplanted	107	63	
Kidney	discarded	755	< .001
transplanted	1.709	1.556	
Cornea	discarded	5.910	< .001
transplanted	5.342	2.397	

\* Average time waiting for a transplant.

<sup>†</sup> Discarded organs regardless of whether they were retrieved or not.

and a reduction of organ donation in several countries such as in Argentina, Colombia, and Poland [3,5].

The availability of organ donation from deceased donors before and during the COVID-19 pandemic periods, respectively, was as follows: heart, 1380 and 1334; liver, 1447 and 1311; pancreas, 1254 and 1202; lung, 2486 and 2320; and kidney, 2464 and 2431 (Table 1). The organ transplantation activity in these 2 periods, respectively, was as follows: heart, 131 and 130; liver, 616 and 587; pancreas, 98 and 113; lung, 107 and 63; and kidney, 1709 and 1556. Consequently, there was a reduction in transplant activity statistically significant only for lung (4.3% vs 2.7%,  $P = .003$ ) and kidney transplantation (69.4% vs 64.0%,  $P < .001$ ). Similar results were reported by Kwapisz et al [5] and in a multicenter study conducted in 22 countries [6].

Because living donor kidney and liver transplantation were under the responsibility of each transplant center in São Paulo, there were a decrease of 21.9% for liver and 61.7% for kidney transplants (128 vs 100 liver transplants and 475 vs 182 kidney transplants for prepandemic and pandemic periods, respectively). A survey [7] of 204 kidney transplant centers, with 75% of the centers responding, reported that living donor kidney transplant surgery was on hold (from 67% of North American centers to 91% of European centers).

Candidates on the corneal transplant waiting list increased during the COVID-19 pandemic period when compared to the previous period, from 2594 to 3651. At the same time, the number of surgical procedures fell by 55.1%, from 5342 to 2397 (Table 1).

Mortality of candidates on the waiting list before and during the pandemic increased for all organs (Table 1), but it was significant only for pancreas/kidney candidates, which increased from 12.5% to 18% ( $P = 0.033$ ); for lung candidates, which increased from 11.5% to 23.9% ( $P = 0.019$ ); and for kidney candidates, which increased from 4.6% to 7.4% ( $P < .001$ ). A study of the COVID-19 database of the European Renal Association also identified that the probability of death of patients waiting kidney transplantation, after 28 days of contamination by COVID-19, was of 25% [8], and a multi-step systematic search of the literature performed by Alfano et al [9] identified a mortality rate of 47%. Furthermore, in the United States, the hazard of mortality among kidney transplant candidates was 37% higher in the first 10 weeks after the beginning of the COVID-19 national emergency [10]. On the other hand, in the current study, we observed that the mean time on the waiting list decreased for each type of transplant before and during the pandemic period, as follows: for heart transplant, from 12.3 to

9.5 months; for liver transplant, from 7.1 to 5.3 months; for pancreas transplant, from 7.8 to 4.1 months; for pancreas and kidney transplant, from 50.8 to 28.5 months; and for lung transplant, from 20.6 to 17.1 months ( $P < .001$  for all organ type; Table 1). In contrast, the mean time on the waiting list for kidney transplant increased from 27 to 27.6 months ( $P < .001$ ).

## CONCLUSIONS

The COVID-19 pandemic affected the Donation and Transplant Program of the São Paulo State Transplant System. It interfered in the mortality rate and time on the waiting list for heart, liver, pancreas, lung and kidney transplants, number of effective donors, and use or disposal of available organs from deceased donors. In addition, it reduced the transplant activity with living donors. For eye tissue transplantation, the time on the waiting list increased and the number of transplant procedures decreased. The kidney transplant program was the most affected in our study. There was an increase in waiting time and mortality in the waiting list for this organ and also a decrease in kidney utilization rates. On the other hand, actions promptly adopted in São Paulo to mitigate the effects of COVID-19 altogether positively changed the course of the donation and transplant program in the State of São Paulo during the pandemic; these actions included conducting the reverse transcription–polymerase chain reaction test for the diagnosis of COVID-19 in donors and recipients, managing health care services with an area dedicated to patients positive for COVID-19, and working toward patient care and hospital safety and incentives to maintain donor viability activities.

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