Transplant waiting list: Technology transforming lives

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ABSTRACT

Although Brazil is a world reference in organ transplants, having the largest public transplant system in the world, the shortage of organs is still a worrying scenario in the country, since the number of effective donors does not meet the demand for transplants (Brasil, 2024). Thus, the work aims to investigate and understand the waiting list model in the organ transplant process, in such a way that it is possible to mitigate this scenario through the development of an app that uses technology and artificial intelligence, to assist patients throughout their transplant process and encourage new people to become donors. The methodology involves bibliographic research, interviews with health professionals and possible users, in addition to the development of a functional prototype.

Keywords: Organ transplantation; waiting lists; artificial intelligence.

1 INTRODUCTION

The first organ transplant in Brazil happen in 1964, through a kidney transplant performed at Santa Casa da Misericórdia, in São Paulo, marking the beginning of the transplant era in the country. This advancement represented a milestone in Brazilian medicine, paving the way for other transplants to be performed. Since then, these procedures have evolved significantly in the country, with major improvements in organ donation and distribution, surgical techniques and access to post-surgery treatment. Thus, the research is focused on understanding what organ transplants are, the waiting lists for one and how technology can influence them (Ministério da Saúde, 2023).

It is important to understand what an organ transplant is and how those procedures happen, what the waiting list is, and how technology affects this issue. A transplant is a surgical procedure that consists of replacing an organ or tissue from a receiver with another organ or tissue from a donor, whether living or dead (Brasil, 2023d). Transplants are organized based on waiting lists, with all patients distributed according to the organ needed, and within these lists, priorities are based on technical criteria, so there are several lists, each for a different type of organ. In this sense, technology, combined with artificial intelligence, are integrated and contribute to the organization of this system (Brasil, 2023b).

Therefore, the study of organ transplants can play a fundamental role in society. With the help of artificial intelligence, it is possible to facilitate the dissemination of ideas about the relevance of donation and the obstacles faced by patients waiting in line, using the technology available today to ensure that information reaches a greater number of people. However, many are unaware of the long time and difficulties involved in the process, which makes awareness a crucial point in encouraging more people to donate (Brasil, 2023a).

Furthermore, understanding the mechanisms of transplants enables the development of more effective public policies, since a simpler and more efficient process reduces hospital costs and improves patients' quality of life. Therefore, the aim is to analyze data on organ transplant waiting lists from the last 10 years, that is, from 2015 to 2025, emphasizing data from Brazil, more specifically, focusing on the city of São Paulo - SP. Ultimately, a study in this area not only improves patients' lives, but also promotes significant social and public progress.

Given the problem of long waiting lists for organs and the discussion about the use of technology and its benefits in this process, the following question arises: How can technology transform waiting lists and save the lives of patients awaiting transplants? With artificial intelligence and its contribution, the problems of misinformation and donor shortages should be mitigated. As a result, the waiting lists for receiving organs will be reduced, enabling faster and more efficient access to transplants. Furthermore, the use of intelligent algorithms is expected to optimize the logistics of organ distribution, prioritizing patients with the greatest need and compatibility. In this way, it is expected not only to improve waiting times, but

also the success rate of transplants. Therefore, technology is capable of transforming waiting lists, saving the lives of patients awaiting transplants.

The main objective of the study is to investigate and understand the waiting list model in the organ transplant process and the specific objectives are (a) investigating the reasons that cause delays in receiving an organ, (b) identifying alternatives that generate transparency in the process, reducing the waiting time and raising awareness among potential donors, (c) proposing alternatives to improve the quality of treatment for patients before, during and after transplantation (d) developing an App using Artificial Intelligence.

The increasing demand for organ transplants in Brazil has posed significant challenges, such as long waiting lists. This issue is directly linked to patients' quality of life, hindering treatments and, in many cases, worsening their medical conditions at Institute of Applied Economic Research (IPEA, 2023). From this perspective, the use of technology may offer a solution to optimize the management of waiting lists, reduce waiting times, and consequently improve patients' quality of life through faster and more effective treatments (Romero, 2006).

The social relevance of this research lies in the significant contribution that technology can make in addressing a problem with major societal impact. By analyzing how artificial intelligence and mobile apps can help accelerate transplant waiting lists, it becomes clear that it is possible not only to increase the efficiency of public and private healthcare services, but also to broaden equity in access to transplants (Romero, 2006).

Currently, there are various studies on the application of technologies to improve healthcare processes (Brandão et al., 2025; Ahmed et al., 2023). However, there are still challenges regarding the effective implementation of such technologies, especially in efforts to reduce waiting times. Thus, changes to the current models of care may contribute to the development of public policies that encourage innovation in the healthcare sector. In this context, digital transformation plays a key role in creating a more patient-centered healthcare system (Santos Silva, 2021). Therefore, this research aims to propose recommendations to improve the quality of patient care by optimizing time and resource use.

2 THEORETICAL REVIEWS

The area of organ transplants is one of the most developed in current medicine, its evolution provides a fundamental solution for patients who need to replace their weakened organs with new ones. Progress in this area has been marked by progress in immunology, surgical techniques, and the development of immunosuppressive drugs, which have enabled an increase in the success rates of this type of procedure (Silva, 2020).

2.1 History of Transplants

Since ancient times, there have been records of transplant attempts, however the first successful procedures occurred only during the twentieth century, highlighting the kidney transplant performed by Joseph Murray in 1954 (Murray, 1991). In Brazil, the first organ transplant was performed in 1964, at the Santa Casa de Misericórdia de São Paulo, starting to perform this type of procedure in the country (Brasil, 2023c).

2.2 Waiting Lists and the Organization of Transplants

The distribution of organs is regulated by technical, clinical and ethical criteria, established by national allocation systems, such as the National Transplant System (SNT) in Brazil. The waiting time for an organ can vary significantly depending on the compatibility and availability of donors (Souza & Almeida, 2019). According to data from the Ministério da Saúde (2023), thousands of patients are waiting for a transplant, making it essential to raise awareness about organ donation.

2.3 The Role of Technology in Transplant Optimization

Currently, and especially in medicine, the use of artificial intelligence (AI) has been expanding, becoming increasingly present. It contributes to the analysis of compatibility between donors and receivers, to the prediction of organ rejection and to the management of transplant logistics (Ferreira & Costa, 2021). The latest studies indicate that some machines, through algorithms, can improve the selection of receivers, reducing waiting times and increasing transplant success rates (Guijo-Rubio et al., 2022).

2.4 Challenges and Prospects

Even with the advances, the world of organ transplants is still full of challenges, such as the small number of donors, ethical issues, and inequalities in access to procedures. According to a study by Oliveira and Martins (2020), awareness campaigns and public policies are indispensable factors when it comes to increasing donation rates and improving the functioning, logistics, and quality of the Brazilian transplant system. Thus, the construction and implementation of educational projects aimed at raising awareness about organ donation can contribute significantly to reducing these challenges, increasing donation rates and improving the efficiency of the transplant system in Brazil.

3 METHODOLOGICAL PROCEDURES

First, the study has a qualitative, descriptive and exploratory approach. Thus, the research is not only based on describing pre-established knowledge with theoretical review and comparing data, but also research in which the researchers are responsible for the analysis of new information and data collection, in which they collect and interpret subjective responses from texts or interviewees, thus prioritizing quality over quantity (Creswell & Creswell, 2021).

In this sense, the unit of analysis of the study covers the problem of delays in organ transplant waiting lists in Brazil. Initially, two articles were identified in the Web of Science database, with a search carried out in February 2025. These articles provided insights for the beginning of the study's development.

Data collection was carried out based on interviews involving a patient, a specialist physician and a professional in the area. The defined collection instrument was a semi structured questionnaire, which made the interviews more flexible, with only the questions authorized by the ethics committee and with the signed free and informed consent form (ICF) document, according to Appendix A, which guaranteed the legitimacy of the data obtained. In addition, data were collected from scientific journals, newspapers and works related to the theme found in the chosen research databases (Google Schoolar and Web of Science).

In this way, an App prototype was developed with MIT App Inventor that seeks to demonstrate the possibilities of using Artificial Intelligence for the good of society, reducing the waiting time of patients who need transplantation, in an ethical way, with support technology to accelerate the search for alternatives to the problem presented.

3.1 Results

The interviews have already been conducted, raising fundamental ideas in relation to the research theme. The data collected provided a clearer understanding of the participants' opinions and experiences on the agenda. In addition, the questions raised during the interviews allowed for a more in-depth analysis of the practices and challenges faced throughout the organ transplantation process. This information was essential for the improvement and better development of the prototype.

Participant A contributed to a more humanized view of the patients, in such a way that the main impediments to the progress of the queues were understood, as well as the lack of information of the patients throughout the process, before, during and after transplantation.

On the other hand, participant B was essential for obtaining scientific and technical data, collaborating with new research sources, such as the Brazilian Association of Organ Transplantation (ABTO).

3.2 Prototype

The prototype was developed and perfected as advances in the literature discoveries occurred and interviews were conducted. The MIT App Inventor Platform, Life4All, developed by the authors, was used, as shown in Figure 1. The central idea was to present transparency to the user, while ensuring ethics and data protection, in this way, only the part of access to personal data needs a username and password, as it is confidential. The use of artificial intelligence serves as support, and the final decision will always be made by a person prepared for their activity.

The main screen allows access to a chat to clarify doubts, and the user must confirm their understandings with a doctor who accompanies their treatment. In addition, he can access the waiting list,

how to make donations, news related to the topic of transplants, objectives and information about the institution. The MIT App Inventor exceeded expectations, according to participants in the interviews conducted so far.

Figure 1: MIT App Inventor – Life4All

Source: Authors (2025).

4. FINAL CONSIDERATIONS

Although Brazil is a world reference in organ transplants, having the largest public transplant system in the world, investigating and understanding the waiting list model in the organ transplant process is essential to mitigate this scenario. The development of an artifact developed using the MIT App Inventor with the support of technology and artificial intelligence, has been proven to assist patients throughout their transplant process and encourage new people to become donors.

The methodology used was fundamental to unite Theory with practice, allowing users to experiment with the prototype, with suggestions for improvement, with results that really make a difference for society, for patients, doctors and partners involved. It is hoped that with this study, scholars, researchers and interested professionals will build transparent processes that bring useful information to all those involved in the process.

Technology can transform lives, but for this we recommend future studies that deepen the relationship between the various factors presented during the study, such as transparency, the use of compatible organs between donors and recipients, and that medicine evolves increasingly supported by ethical technologies and impact on society.

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APPENDIX A

Table 1: Questionnaire applied to the participants

Questions	**Participant A**	**Participant B**	**Participant C**
What were your feelings at the time you were waiting to have your transplant?	X		
Did you have information about your place in the waiting line? What did they share with you on this subject?	X		
Is there any way for you to know about your exact place in the queue?	X		
Did you receive any kind of emotional support during the process?	X		
How did you feel when you received the news that an organ was available?	X		
What advice would you give to a patient who is waiting for a transplant?	X		
Have you used any technological resources (such as apps, websites, or online platforms) to track your position on the waiting list or to obtain information about the transplant? If so, how was your experience with these tools?	X		
How is the process of including a patient on the waiting list for organ transplantation? What are the main medical criteria used to determine priority in the transplant queue?		X	
What are the biggest challenges faced by doctors when dealing with patients on the waiting list?		X	
Do you believe that artificial intelligence can optimize the process of organ compatibility and distribution?		X	
How is the compatibility assessment between donor and recipient done?		X	
On average, what is the level of knowledge of patients and family members about the transplant process when they enter the queue?		X	
How does bias and misinformation affect the acceptance of organ donation?		X	
In your opinion, how does the lack of information impact organ donation rates?	X	X	X
Do you think that a subject like organ transplantation should be taught or at least mentioned during school? If so, what is the relevance of the agenda?			X
In your opinion, what is missing in Brazilian education to improve the understanding of organ donation?			X
How to demystify prejudices and myths about organ donation through education?			X
How can digital technologies (such as apps or online platforms) be used in organ transplant education?			X
What do you suggest for the topic to be addressed more comprehensively in basic and high school education?			X
What is the ideal age or grade level to start addressing this topic with students?			X

Questions	**Participant A**	**Participant B**	**Participant C**
Do you believe that the lack of knowledge contributes to the low rate of organ donation in the country?	x	x	X
Do you think that with the technological mechanisms we have today, it is possible to speed up the organ transplant queues?	X	X	X
What do you think could be done to improve the donation and transplant system?	X	X	X
Do you think an app could speed up the queues and inform people about what an organ transplant is and how to donate?	X	X	X

Participant A = Patient

Participant B = Renowned physician in the field

Participant C = Educator and specialist in the subject in education

Source: Authors (2025).