

**DETERMINING FACTORS OF HEART QUALITY AND DONOR ACCEPTANCE IN  
PEDIATRIC HEART TRANSPLANTS**

**EFFECT OF ORGAN SHORTAGES ON PEDIATRIC ORGAN DONOR AND  
RECIPIENT SELECTION**

An Undergraduate Thesis Portfolio  
Presented to the Faculty of the  
School of Engineering and Applied Science  
In Partial Fulfillment of the Requirements for the Degree  
Bachelor of Science in Systems Engineering

By

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## **SOCIOTECHNICAL SYNTHESIS**

Pediatric heart transplantation is a very complex field due to the potential health risks and possible ethical implications associated with the selection of donors and recipients. The purpose of the technical project is to conduct research and analysis on past heart donor data with the overall goal of optimizing donor heart matches and increase recipient survival post transplantation. The science, technology, and society (STS) research paper will examine the limited supply of pediatric organs and the role that affiliated social groups and ethical considerations impact the overall pediatric donor and recipient selection process. The technical topic and the tightly coupled STS topic together address the uncertainty and ethical implications related to pediatric donors and recipients with the intent to inform future research within the field.

Despite many advancements in the heart transplantation field, the overall heart utilization rate is low. High heart rejection rates, a lack of guidelines on criterion for heart acceptance, and a shortage of available organs is resulting in high waitlist mortality rates. The technical topic analyzes pediatric donor data from the United Network for Organ Sharing (UNOS) to determine key characteristics and differences between accepted and rejected donor hearts. A longitudinal study of donor hearts from the time of brain death until heart procurement or rejection was developed to assess the effect of different measurements on heart function on an aggregate level. Logistic regression and statistical analysis were used to determine differences between accepted and rejected hearts. Visualizations were also created for physicians to analyze donor measurements on an individual level.

The aggregate level analysis successfully identified many similarities and differences among measurements between accepted and rejected donor hearts. The logistic regression

analysis determined that Age and Left Ventricular Dysfunction are highly significant when predicting donor heart acceptance. Both the aggregate and individual level analyses provide essential information to physicians about the course of donor heart function after brain death that will allow them to make informed decisions about the acceptance of hearts and optimal heart extraction times. This research will also help inform future research in optimizing donor and recipient heart matches in the transplantation field.

The STS topic examines the effect of the organ shortage on associated social groups, and explores possible ethical concerns within the pediatric donor and recipient selection process. The analysis was conducted using the Actor-Network Theory (ANT) framework developed by Latour, Callon, and Law, in which the main actors examined were the donor and recipient social groups. Both the donor and recipient social groups were also divided into three separate sub-groups to be analyzed individually: the patient, the parents or guardians, and the medical staff caring for the patient.

The donor social groups were strongly affected by the lack of available organs. The organ shortage resulted in different organ allocation and preservation methods to be implemented, which led to concerns of the patient's best interest not being taken into consideration. Likewise, the organ shortage influenced the recipient social groups, as external factors affect the recipient selection process, appeals to the public for organ transplant assistance increase, and minority groups are excluded from transplant waitlists. The unethical practices related to both the donor and recipient social groups emphasize the need for the establishment of uniform procedures to prevent factors unrelated to the patient's health from influencing the donor and recipient selection process.

The technical and STS research provide valuable information in the pediatric heart transplantation field, an area that currently lacks a substantial amount of research. This research can hopefully provide a foundation for future extensive research into this topic, and will increase knowledge and provide standardization within the pediatric transplantation field.

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Technical advisor: Michael Porter, Department of Engineering Systems and Environment

#### **EFFECT OF ORGAN SHORTAGES ON PEDIATRIC ORGAN DONOR AND RECIPIENT SELECTION**

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### **PROSPECTUS**

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