

Thesis Project Portfolio

**DESIGNING A DASHBOARD TO STREAMLINE PEDIATRIC HEART TRANSPLANT
DECISION MAKING**

(Technical Report)

**THE USE AND IMPACT OF RISK INDICES IN PEDIATRIC HEART TRANSPLANT
DECISION MAKING**

(STS Research Paper)

An Undergraduate Thesis

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Bachelor of Science, School of Engineering

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SOCIOTECHNICAL SYNTHESIS

Robust decision making practices are crucial in the medical field to ensure successful outcomes. Emerging technologies assist physicians in making better decisions for their patients. The thesis specifically investigates technologies designed to help organ transplant practitioners evaluate donated organs to determine if and how they should be utilized. When a donated organ becomes available, practitioners have limited time to assess large amounts of data and decide if and how they want to utilize the organ. The technical project aims to enhance the current interface practitioners use to evaluate donated organs by making the design more user-centered. The accompanying Science, Technology, and Society (STS) research considers the use of risk indices in organ transplant decision making. It explores the use of already established risk indices in other types of organ transplants to determine if one would be suitable in the pediatric heart transplant field. The overall goal is to positively impact the organ transplant field by improving decision making practices through the use of technology.

The technical project presents a dashboard design which will effectively support cardiologists in evaluating donor offers for pediatric heart transplants. The team began the design process by defining the problem space and working to understand and empathize with the users (physicians) who would benefit. Following a literature review of 15 research articles which provided insight into the current donor evaluation practices from a systems perspective, the team then interviewed eight different pediatric cardiologists from various transplant programs. These interviews helped identify key needs and tendencies of the users as well as shortcomings of current systems. The interview findings drove the establishment of functional requirements for an interface design. Following the ideation phase, prototyping began. Wireframes of an interface were sketched to help visualize user flows and general content placement. The wireframes were

next converted into high fidelity prototypes with mock data to make the implementations look as realistic as possible. The design process was iterative, incorporating feedback from cardiologists who reviewed the ongoing designs. Once the iterative process was completed, a final prototype was presented to the United Network of Organ Sharing (UNOS), which administers the only Organ Procurement and Transplantation Network in the United States.

The associated STS research analyzes the use and impact of risk indices in organ transplants - looking to determine if one could be beneficial and suitable in the pediatric heart transplant field. The analysis begins with a background on organ transplants as well as common perceptions of risk. Differing perspectives of risk are contrasted to assess which is most appropriate in the context of decision making in a health care setting. The research then presents some deficiencies of current pediatric heart donor evaluation practices, including a lack of standardization and quantitative analysis. It also details several risk indices that have been produced in other organ transplant fields to combat these shortcomings - such as the Kidney Donor Risk Index (KDRI), the Liver Donor Risk Index (LDRI), and the Pancreas Donor Risk Index (PDRI). The current use of these risk indices is used to predict how an index might impact pediatric heart transplant decision making. Finally, Callon, Akrich, and Latour's Actor Network Theory adds insight into the perception of risk indices by different actor groups to determine the likelihood of technology adoption.

The research suggests that if a risk index were to be introduced in the pediatric heart transplant field today, it would likely not be utilized. While risk indices could facilitate the standardization and acceleration of the donor evaluation process, due to the high variability in decision making practices, it will be difficult to create an index that a majority of cardiologists accept. The LDRI, which has been established for many years, is perceived as misleading and

inferior to the practitioners' own assessments, and therefore has had low utilization. It follows that a risk index in pediatric heart transplants is unlikely to be embraced until greater consensus is reached on what variables are significant and until the predictive power of the indices strengthen. Furthermore, if a risk index is ever to be introduced under the aforementioned circumstances, it should be used as a tool, not as the sole means of evaluation, as advised by sociocultural perspective of risk assessment. In the meantime, it is recommended that the most effective path forward is to improve the channels and means for practitioners to communicate, discuss, and share opinions so as to decrease variability in donor evaluation practices, increase the number of successful transplants, and reduce overall program mortality.

Both the technical project and the STS analysis focus on decision making in organ transplants – specifically pediatric heart transplants. The project aims to improve the current interface pediatric cardiologists use to evaluate donor hearts with emphasis on user-centered design. The analysis examines the use and impact of risk indices in organ transplants to determine suitability in the pediatric heart transplant field.

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