

Thesis Project Portfolio

Designing a Dashboard to Streamline Pediatric heart Transplant Decision Making

(Technical Report)

Understanding the ethics behind incentive schemes that drive pediatric heart transplant programs nationwide

(STS Research Paper)

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Sociotechnical Synthesis

Roughly 40% of eligible pediatric cardiac donor hearts are being thrown away resulting in children dying on the waitlist before being offered a chance at survival. Without an acute understanding of the space, you may identify the quality of donor hearts as the main culprit, but rather it is systematic issues that are hindering the decision-making process. These issues stem from competing incentive schemes of regulated pediatric heart transplant (PHTx) programs and the healthcare industry, encouraging cardiologists to value the credibility of their career and the status of their respective programs' prestige, rather than attempting to maximize the number of lives saved. My thesis and technical project work in parallel to provide a comprehensive analysis of the PHTx processes, focusing on the technical flaws that hinder the decision-making process and the inaccuracy of efforts from governmental organizations respectively.

There exists high variability across the world in the decision making process of cardiologists who must determine the suitability of a prospective donor heart offer in a high pressure environment. DonorNet acts as the current interface that cardiologists interact with to gain an understanding of the health status of the donor heart offer and the feasibility of said donor heart being a suitable replacement for a particular candidate recipient. However, a lack of user friendly design choices has yielded suboptimal decisions and a lack of confidence in cardiologists to make the correct decision. My technical project, conducted in a team of six systems engineers under the advising of Professor Sara Riggs, aims to adopt a user-centered systems design approach to develop a new DonorNet dashboard to better support the decision making process for pediatric cardiologists. Our team underwent multiple iterative stages in order to adequately accomplish this goal. A literature review was conducted on the factors that influence practitioners in their decision making process and post hoc factors that are predictors of transplant success were identified. Interviews by the research team with eight pediatric heart

transplant practitioners, including our client Doctor McCulloch, who have DonorNet experience built an understanding of how end-users make decisions and the pain points they frequently encounter: difficulty finding relevant data and comparing timelines of different factors. Through these stages, we developed two designs, varying in fidelity, utilizing Figma, an interface design software. An initial wireframe design was developed representing the information we gained throughout our research and user interviews, which underwent thorough end-user testing, yielding our final high fidelity semi-functioning prototype.

A redesign of the DonorNet interface will yield positive results within the PHTx space; however, the outdated system is a product of the systemic issues that are crippling this industry. This paper aims to gain an understanding of the ethics behind incentive schemes that drive pediatric heart transplant programs nationwide. These issues will be addressed under the scope of the utilitarian framework to judge the merits of PHTx programs as they balance preserving program prestige and saving lives. Utilitarianism has driven the healthcare industry since its inception, aiming to maximize the benefits of all involved parties or, more explicitly, providing the best care possible for all people. This paper first addresses the history of PHTx: how processes have changed, the introduction of governmental organizations to monitor the space, and the specific adverse issues that have developed over time. These issues are not only addressed, but a discussion of conceptual and implementable solutions are presented in order to actively return the space to a utilitarian framework. In addition, these solutions look to improve underperforming metrics including, but not limited to utilization rate and waitlist mortality. The main findings of this paper target regulatory organizations, calling for change rather than auditing programs and cardiologists who are struggling in a failing system. Three areas these organizations can place their efforts include: 1) equitable distribution of information worldwide,

2) increased research efforts to improve understanding of necessary variables during the decision making process, and 3) improve program culture to better support cardiologists. Utilizing these three objectives as a guideline for future regulation and organized effort offers clear progress towards 100% utilization of donor hearts and a 100% success rate of PHTx procedures.