# Transplant Wait Time Prediction

Project proposal from Group F for BYOP (IPBA), IIM-I

## PROPOSED PROJECT

Title: Transplant Wait Time Prediction

Subtitle: Predictive Analytics of waiting time of potential RTRs (Renal Transplant Recipients) for cadaveric grafts using MLMs.

## PURPOSE

The proposed project aims to develop a better predictor model to estimate time on a kidney transplant waiting list using an ensemble of various ML models. It can help patients and clinicians to discuss management, thus contributing to a more efficient use of resources and making the process more equitable.

## KEYWORDS

Biostatistics, Biomedicine, Kidney Transplant, Predictive Analytics, Clinical Research, Healthcare Analytics, Generalized Linear Models, Machine Learning, Statistical Analysis, Prediction, Decision Trees, Random Forests, Support Vector Machine, Feature Engineering.

## INSPIRATION

When it comes to kidney transplants worldwide, the supply of organs does not meet demand. Statistical Science is replete with data confirming that. Also, the gap between them is growing.

Because of this demand-supply gap, recurrent tests become necessary every 2–3 years to maintain prospective RTRs on the active transplant list. This poses a significant economic burden on the healthcare system.

So predicting a patient's waiting time becomes necessary. It can help to plan for pre-transplant evaluation. And benefits in three major ways:

- **Promote a more efficient use of resources:** If we are able to predict the wait-time of a potential recipient with a fair amount of accuracy, we would carry full pretransplant evaluation only in candidates with a high chance of being transplanted. Those less likely would undergo only the most

necessary tests at registration level and have their complete evaluation done only 6–8 hours before surgery.

- **Promote Equity**: Estimating waiting time on the transplant list can help identify the underprivileged, and thus impact *allocation score*, bringing more equity to transplantation programs.
- **Mental health of patients:** The waiting time imposes significant emotional burden on the patients on dialysis. It also affects the performance of other organs like heart which is affected mostly because of dialysis. Kidney patients are anyway prone to depression. Knowing how long they have to wait will help them come to terms with reality, and rather than waiting in depression for a kidney, they will spend their energy on constructive enjoyment of their lives.

Thus, the proposed project has three angles: economic, psychological, and sociological.

## METHODOLOGY

Andrade & Team did a similar study[1] in 2021 using hazard ratio which focused on Cox regression and Kaplan-Meier models. The study is open access under creative commons license and permits unrestricted use, distribution, and reproduction in any medium, provided we credit the authors.

One can find it here:
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0252069[2]

We will make it our base and try to improve it with an infusion of TDCR (Time dependent Cox regression), random forest, pooled logistic regression (PLR) and other improved versions of survival analysis techniques.

We will also try conventional statistical analysis methods, linear regression, and non-linear models, such as decision trees, random forests, nearest neighbors, and support vector machine, which can capture non-linear relationships.

[1] Sapiertein Silva JF, Ferreira GF, Perosa M, Nga HS, de Andrade LGM (2021) A machine learning prediction model for waiting time to kidney transplant. PLoS ONE 16(5): e0252069. https://doi.org/10.1371/journal.pone.0252069
[2] Accessed and downloaded 13th March, 2022

## DATA AVAILABILITY

We will use the same dataset as used in our 'base-study' done by Andrade and Team. It is in a public repository:
https://www.kaggle.com/gustavomodelli/waitlist-kidney-brazil

## PEOPLE INVOLVED

Amruth B R, Aravind K S, Ashwin Maiya, Krishna Priyadarshini, Nittile Gupta, Rahul S & Sushree Sangita Patra.

ADVISOR: Dr.... (senior nephrologist)

MENTOR: to be allotted by IPBA committee.