Kidney organ transplantation is a lifesaving treatment for those people diagnosed with kidney disease. Kidney organ transplantation is desired over renal dialysis due to the prospect of a better a quality of life, with fewer health problems, reduced restrictions on diet and working lifestyle.

However, kidney organ allocation has also posed itself as a major resource allocation problem. In short, there are a limited number of donor kidney organs which need to be matched effectively and accurately to the patient.

We aim to improve effective and accurate allocation decision-making for practitioners, as well as provide advice to potential transplant patients based on the combined interpretation of three components via a risk calculator: the genetic profile of the patient and the probability of acute rejection, eplet mismatches with donor kidneys, and the need for immunosuppression.

Through this risk calculator, we hope that practitioners will be able to confidently assess the success of a kidney transplant for patients and make decisions in regards to donor allocation. We also hope to concurrently educate patients about the factors affecting transplant success and also see their predicted outcomes when compared to the general population.

**Eplets- Donor Mismatches** 200

Eplets are small arrangements of amino acid residues that are polymorphic - that is they occur in several forms on Human Leukocyte antigens (HLA) molecules. They are essential components of HLA epitopes that are recognized by the antibodies. HLA molecules are responsible for regulating human immune systems and therefore play an important part in graft rejection. Any cell that displays a foreign HLA type is seen as an antigen and triggers an immune response in the body which then leads to the production of antibodies, resulting in the rejecting of the tissue that bears those cells.

Therefore, epitope-HLA matching is important as it determines how well the match is between the donor organ and recipient patient. In essence, the greater the mismatches between the donor and the recipient patient the lower the probability of survival is. By extension, the number of mismatches will better inform the practitioner the dose of immunosuppression medication needed for the patient.

While we aim to present a general view of the epitope mismatching by stratifying the population by the characteristics of age and sex, the study of epitope compatibility is still in its infant stages and greater research needs to take place in order to drive scientific advancement (Tambur, 2018). There is a general consensus that other variables like BMI and race are important in epitope mismatching but, we have chosen to exclude these from our application. BMI has shown no significant correlation between graft survival (Papalia et.al, 2010) but, rather associated with several other socio-economic and demographic factors such as race.

We also note that not all eplets will lead to the same type of immune response (Dorr et al., 2018; Tambur, 2018). For example, two recipient-donor combinations may have identical eplet mismatches but can exhibit different immunogenicity schemes.

Tambur 2018

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6128220/>

**Graft Failure, Acute Rejection**

This section looks at the top 70 differentially expressed genes used to determine whether the patient/ recipient is at risk of experiencing acute rejection. This result will be part of the discussion between patient and practitioner in their shared decision making, in addition to the other outcomes of this application.

Graft rejection is defined as the event that the recipient’s body destroying the transplanted tissue or organ. Acute rejection is viewed as the development of antibodies that then lead to graft rejection.

Acute rejection of a transplanted organ occurs days, weeks or even months after the transplantation, where immune system of a person detects the foreign organ and seeks to attack it. Within our context, acute rejection is defined at 3 months. However, it should be noted that acute rejection is classified as the graft failing at any given time before or at three months post transplantation. It could be possible that the graft did or did not fail shortly after.

**Immunosuppression -**

This section of the application serves to inform the practitioner and the patient, in their shared decision making, the genetic markers that indicate whether the patient will benefit from the minimizing or withdrawing from the immunosuppression medication. This will be taken into consideration along with the epitope mismatches and the genetic profile concerning acute rejection.

Immunosuppressants are drugs that lowers the body’s immune response in order to aid the survival of the transplanted organ. Maintenance drugs like Tacrolimus and Mycophenolate Mofetil to name a couple, are medications used for the long term, ensuring prolonged graft survival. Tacrolimus in particular has been said to demonstrate better renal function (Morales et.al 2006).

While consuming immunosuppressant drugs are meant to aid the survival of the transplanted kidney organ, one of the major drawbacks is the increased chance of infections especially following the surgery due to high dosages. Infection can further lead to rejection of the kidney and the failure of the graft. Therefore, the decision making that takes place prior to the organ transplantation is an important point of discussion between the practitioner and the patient when concerning the dosage of immunosuppressant medication as well as the duration.

<https://www.sciencedirect.com/topics/immunology-and-microbiology/immunosuppression>

<https://www.kidney.org/atoz/content/immuno>

Morales 2006:

<https://jasn.asnjournals.org/content/17/12_suppl_3/S296?fbclid=IwAR1WCh5u-EvP4qM85aTKW3o1wPZGa6dvt_ed6Mpwr_ANMehfZk-YY09fdf0>