

NOAM

Network for Organ
Automated Matching

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A Simplified Modeling of NOAM Potential

Objective

The goal of kidney paired exchange programs is to provide incompatible (donor, recipient) pairs with a way to overcome incompatibility. These programs however suffer from an inherent defect.

By definition, compatible pairs see very little advantage in participating in such programs. Yet the probability of finding a match in an exchange program obviously increases with the number of participants. Hence non participation by compatible pairs undercuts the expected benefits of these programs, both directly by withdrawing a major fraction of the potential participants, and indirectly by pushing potential recipients to search for a compatible donor even though they might have readily paired with an incompatible donor.

A model has been constructed to quantify this issue. It is understood that any lesson learnt from this exercise must take a careful account of donation ethics.

Simplification

In this exploratory model, a major simplification has been introduced.

Despite the most recent advances in immunosuppression, blood type incompatibility and acquired sensibilization to foreign HLA represents important obstacles. We only account here for blood type incompatibility, which happens to be both fundamental and simple to model.

We believe the qualitative findings will carry even after the quantitative results are revised in a more complete modeling.

Facts and Findings

- 1 - the donor population is heavily biased toward compatibility in two ways
 - a - the percentage of O donors is much higher than in the general population
 - b - the pairing of recipients and donors shows a positive correlation between blood types
- 2 - a likely explanation for the bias is that existing exchange programs discourage participation and so recipients try hard to pair with compatible donors
- 3 - without this bias, the donor population could be increased by 36%
- 4 - without participation from compatible pairs, current exchange programs are limited to crossing (A,B) and (B,A) pairs
- 5 - a 5% participation rate from compatible pairs would boost cross exchanges by 70% and the total number of living transplants by 2% for an annual saving of \$7M
- 6 - existing exchange programs should encourage the participation by compatible pairs by increasing the transparency of their operations

Fact Derivation (see companion spreadsheet)

Fact 1: compare the blood type distribution in the general US population and in US living donations, especially living donors

Finding 3: fix the number of living O donors and compute the total number of donors who would match that number while being consistent with the general population

note: it is assumed that one's prior willingness to donate a kidney is not correlated with one's blood type

Fact 4: all other participating incompatible pairs cannot find a match by construction

note: the number of altruistic compatible pairs who enter into exchange programs today is assumed to be negligible

Finding 5: assuming blood type distribution in line with current living donations, this is derived in the spreadsheet

Finding 6: this is the logical conclusion of the preceding findings

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Next Steps

NOAM proposes to compare the outcome of kidney transplants from originally compatible pairs and from pairs whose compatibility resulted from a paired exchange.

The hypothesis to be tested is whether the outcome is statistically identical once the effect of all other relevant factors have been eliminated.

Assuming the above hypothesis is verified, it is the goal of NOAM to deploy an innovative kidney exchange program to encourage participation by compatible pairs.

Its unique characteristics, i.e. flexibility, transparency, control and geographic coverage, will enable physicians to propose such participation in a way which will be both completely ethical and convincing.

The objective is to increase the number of transplants from living donations by at least 2% after 12 months.