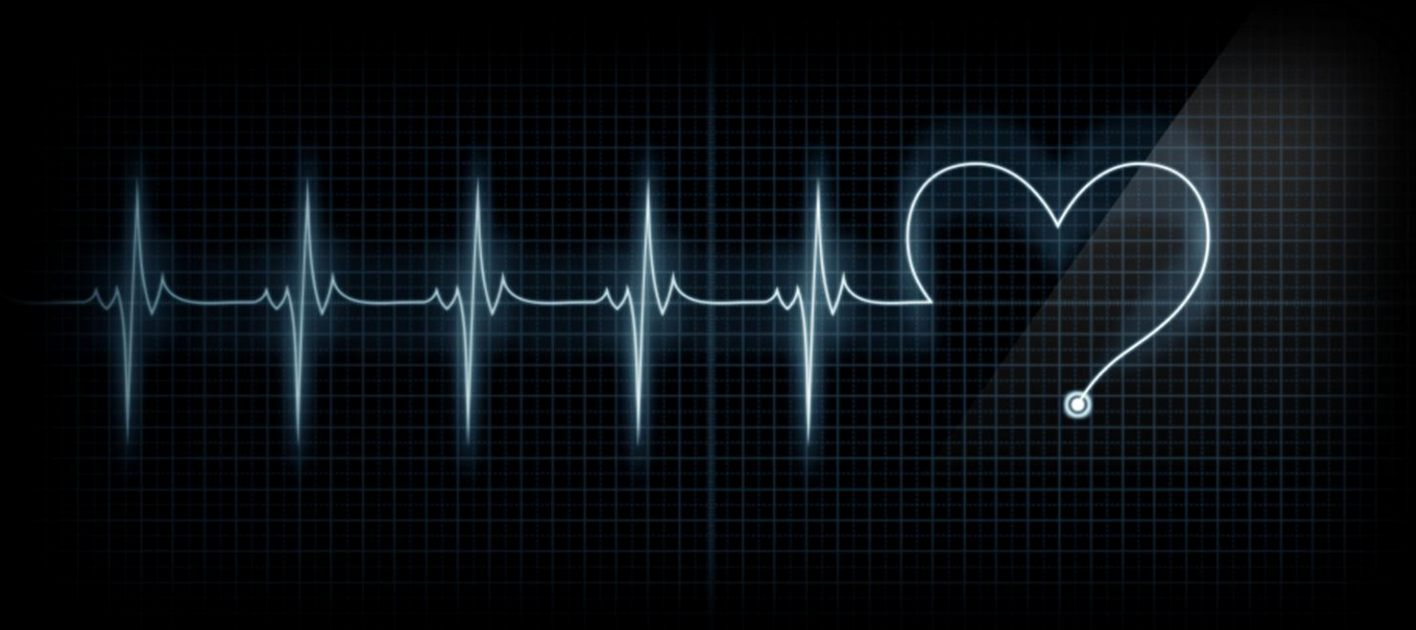
An Organ donation system beyond pair-wise matching



What is Organ donation?

Organ donation is the process of removing an organ from a live, or recently dead, person to be used in another.

The former is the donor and the latter is the recipient.

People of all ages can become donors.

Types of donors

Some organs can be donated by a living person

Almost all organs can be donated by someone dead but this has to reach the recipient within a few hours after the donor's death.

In case of live donation the donor should give his consent .

In case of cadaver donation, relatives need to provide consent.

Voluntary Donation

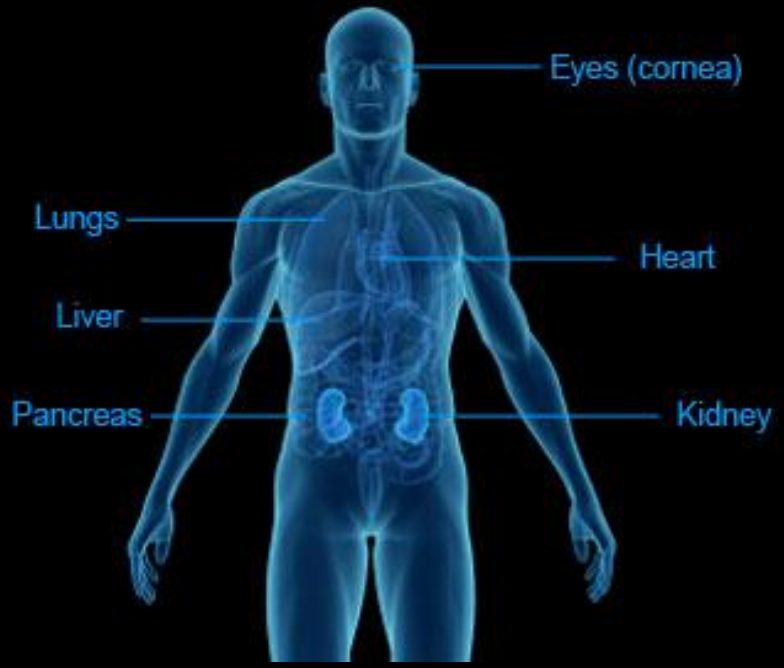
AImost everywhere organ donation is voluntary

Two voluntary systems :–

1.Opt In - Where the donor gives consent

2.Opt Out - Where anyone who has not refused is considered as a donor

Organs for Donation



Some of the organs that are commonly donated are :-

- **Kidneys**
- **Eyes (cornea)**
- **Heart**
- **Lungs**
- **Liver**
- **Pancreas**
- **Skin**

Organ shortage

Family consent, and negative attitude contribute towards organ shortage.

This could be due to the following reasons :-

- **Religion**
- **Fear, ignorance and misunderstanding**
- **Legal aspects**
- **Media reports on scandals involving organ rackets**

Improving Organ Donation

Currently organ donation can be termed as a "crisis with a cure." The following are some ways to improve organ donation:-

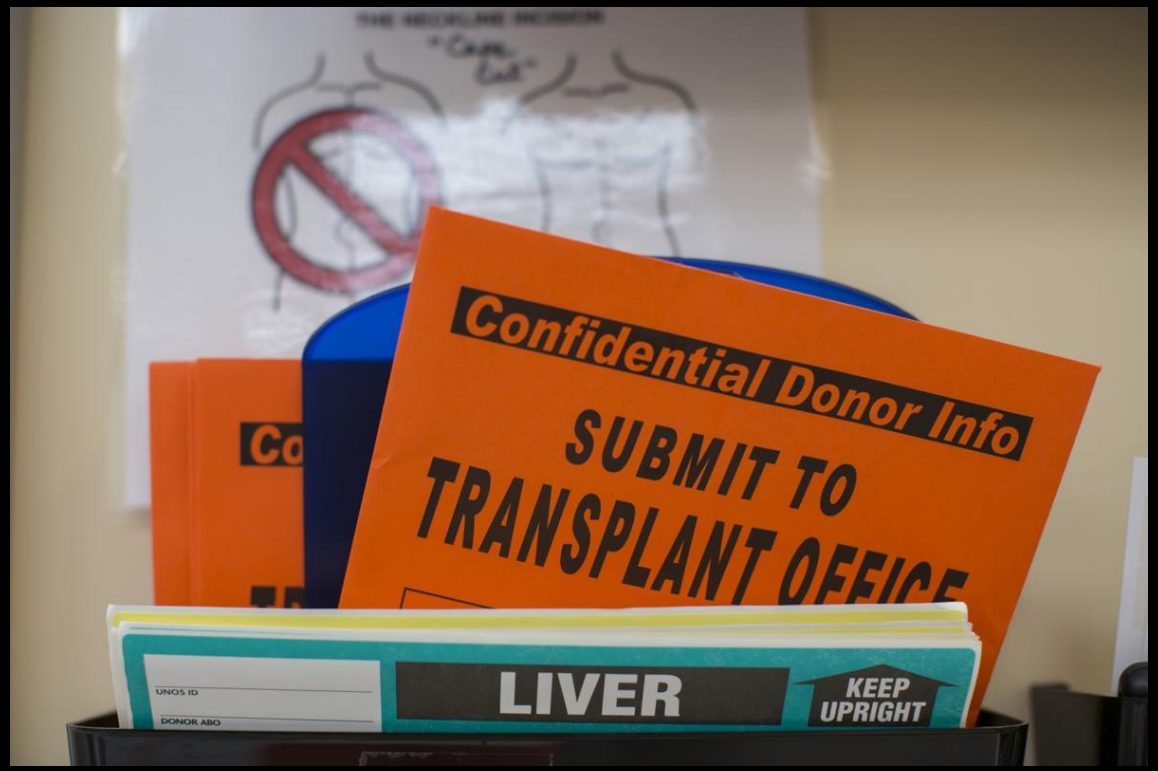
- Increased HLA typing and cross matching facilities
- Improved facilities in packing, transport and retrieval of organs
- Supporting organization for networking and registry maintenance
- Effective use of technology to facilitate organ donation

Problem statement

On average 18 people die every day while awaiting an organ transplant in the U.S., and every 10 minutes, another name is added to the list of people waiting for a donation. In spite of the advances in medicine, the number of deaths that occur due to organ failure or other complications that could be avoided by organ donation are still very high.

This is contributed in part by the fact that there is currently no way of connecting potential donors to recipients that need the organs.

Background

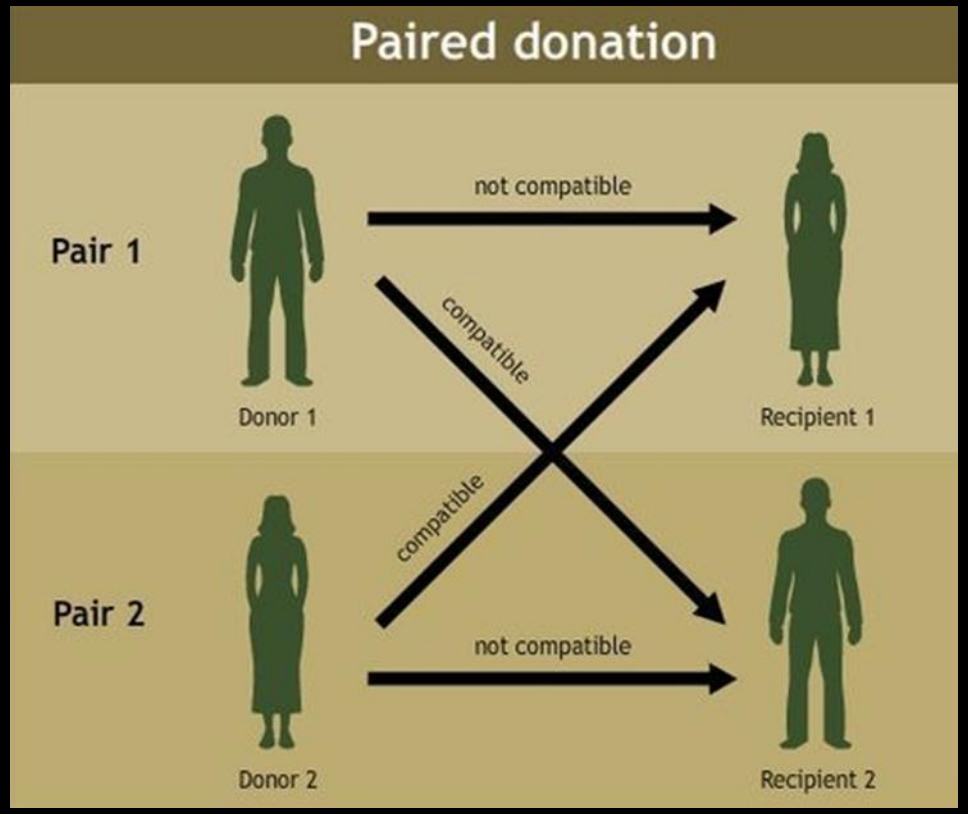


According to the United Network for Organ Sharing (UNOS), the national waiting list of patients in need of an organ had about 114,653 names as of June 2018.

Organ-specific waiting lists have grown so large that the mean waiting time for kidney now exceeds three years.

This project proposes to develop a system that will allow potential donors to interact with potential recipients and also match donors to the most suitable recipient(s).

Objectives



1. To identify the challenges that medical practitioners face when searching for compatible organ donors and recipients.
2. To review current methods used by hospitals to match organ donors and recipients.
3. To analyze matching algorithms that can be used to find a stable match between more than two patients.
4. To develop a web-based organ donation and receipt system that can simultaneously match more than two patients.
5. To test the developed system using simulated data.

Strategy

DR-locus mismatches	0 mismatches	2.0
	1 mismatch	1.0
	Any other mismatches	0.0
Zero-antigen mismatch	Yes	6.0
	No	0.0
High PRA	>=80	10.0
	>=50	6.0
	Any other PRA	0.0
Travel distance	Same centre or same city	3.0
	Any other distance	0.0
Paediatric recipient	Age <= 5	4.0
	Age <= 17	2.0
	Any other age	0.0
Recipient was once a donor	Yes	6.0
	No	0.0
Known negative cross match and PRA >= 80	Yes	6.0
	No	0.0

- To deal with the issue of difficulties in the matching of donors to the most suitable recipients, the use of a scoring rubric is proposed.
- A rubric is a scoring instrument that can be utilized for summative or developmental appraisal purposes.

Functional Requirements

- It should allow authenticated donors to access the system.
- It should allow designated donation centres to view available donors.
- It should validate that one is an eligible donor.
- It should provide correct contact information for potential donors.
- It should be able to match donors to recipients correctly.
- It should alert the donation centre when a requested organ is made available.

Non-functional Requirements

- It should be available at all times to the users.
- Should be secure such that unauthorized users are no allowed to access data in that is in the system.
- It should output an appropriate error message in the event that unexpected or wrong data is input.
- It should have a user interface that is friendly and easy to interact with to ensure that all users can interact with the system with ease.