

# **Organ Donation and Transplantation System**

A project report submitted in partial fulfillment  
of the requirements for the

**Second Year of Artificial Intelligence & Data Science**

by

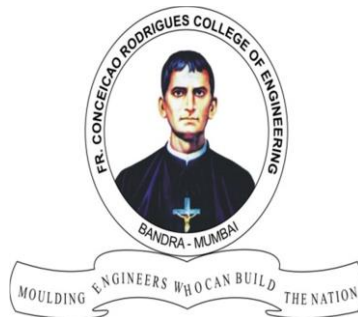
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**Mumbai 2020-21**

*This work is dedicated to my family.  
I am very thankful for their motivation and support.*

# Internal Approval Sheet

## CERTIFICATE

This is to certify that the project entitled "**Organ Donation and Transplantation System**" is a bonafide work of **OPTIMIZE PRIME - Sahil Bodkhe(9357), Shriansh Jena(9375), Abeer Kazmi (9378), Bhavika Salvi(9398)** submitted to the University of Mumbai in partial fulfillment of the requirement for term work submission of Mini Project 1- A Second year Artificial Intelligence & Data Science.

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# Approval Sheet

## Project Report Approval

This project report entitled **Organ Donation and Transplantation System** by **OPTIMIZE PRIME - Sahil Bodkhe, Shriansh Jena, Abeer Kazmi, Bhavika Salvi** is approved for the Term work submission of Mini Project –1 A, Second year Artificial Intelligence & Data Science.

Examiners 1. \_\_\_\_\_

2. \_\_\_\_\_

Date:  
18/12/20  
21

## Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Date: 18/12/2021



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# Organ Donation and Transplantation System



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## Abstract

The Online Organ Donation Management System is developed by keeping in mind that it should be more beneficial for hospitals, clinics and other health centers to govern the donor registration and user maintenance. It is an online web-based system which can only be insinuate in all over India. The people can recoup information related to organ donations with the help of this system. People who intrigued can register themselves through this system. The application will be handled by the administrator and each donor will get the feedback about their application stature. This Online Organ Donation Management System will help to improve the performance of current situation and overcome the problems that arise nowadays.

This System can help in having a centralized administration and easy to access platform which can make a successful step in rise and awareness in the organ donation in INDIA.

## 1.1 INTRODUCTION

Organ donation is yet to achieve propulsion in India. The knowledge and attitude of a society toward organ transplantation is far from satisfactory even among the educated sections of the society. The main concerns causing organ scarcity in the country are people have lack of consciousness and appropriate knowledge among them, mythological beliefs and misconception exploiting organ donation just because of some religious and devout barriers. Hence, conveying correct knowledge and awareness about the issue to the public is quite essential for the success of organ donation events in India. The health professionals, especially doctors, do have a major role in spreading correct knowledge and eradicating the barriers regarding organ donation among the public since they are the first individuals to create a relationship with a potential donor's family. However, the ground reality in India is that the identification of brain death and requesting consent from the next to the kin is often given less priority by the doctors and hospital staffs. This change in attitude is partially because of the over burden they have and more due to the improper knowledge and attitude towards this issue. Initially, it was thought that socio cultural and religious issues and lack of knowledge on the issue are the major determinants that restrict organ donation. At present, it is apparent that there are many other factors such as lack of institutional mechanisms, organizational support, and legal and ethical issues.

The medical students and doctors with correct vision and knowledge regarding the recent developments in the domain of organ donation can be the champions in this cause and can establish a powerful organ donation event in the country by hand-holding other stakeholders. Medical professionals' knowledge, attitudes, and practices are vital in promoting an atmosphere that positively impacts organ donation and procurement rate. Therefore, it is obligatory to understand and assess the perception, perspective, and execution about organ donation among the future people – the medical scholars – for the forthcoming success of the organ donation events. However, there are very rare studies conducted among medical students in India, in this regard. In most of the studies directed among medical students in India, it was found that there exist gaps in the level of knowledge and their attitude toward organ donation.

Organ donation is steadily catching up in the Indian states such as Tamil Nadu, Telangana, Andhra Pradesh, and Kerala. On the bounds of Tamil Nadu Government, Kerala also launched its corpse organ donation program, the Kerala Network for Organ Sharing – popularly called as Mritasanjeevani, a Kerala Government initiative started on 12 August, 2012, for Kerala's Reduce Donor Organ Transplantation Event. Under the program, Kerala has achieved a lot in improving its cadaveric organ donation rate through years.

## 1.2 OBJECTIVE

The aim of this study is to describe a refined process evaluation model adapted for Web-based settings and used to assess the implementation of a Web-based intervention aimed to increase organ donation among Indians.

## 1.3 OVERVIEW

The shortage of organs is virtually a universal problem but Asia lags behind much of the rest of the world. India lags far behind other countries even in Asia. It is not that there aren't enough organs to transplant. Nearly every person who dies naturally, or in an accident, is a potential donor. Even then, innumerable patients cannot find a donor.

# Literature Review

## 2.1 Indian Organ Donation and Transplant System review.

### **Situation of shortage of organs in India**

There is a wide gap between patients who need transplants and the organs that are available in India. An estimated around 1.8 lakh persons suffer from renal failure every year, however the number of renal transplants done is around 6000 only. An estimated 2 lac patients die of liver failure or liver cancer annually in India, about 10-15% of which can be saved with a timely liver transplant. Hence about 25-30 thousand liver transplants are needed annually in India but only about one thousand five hundred are being performed. Similarly about 50000 persons suffer from Heart failures annually but only about 10 to 15 heart transplants are performed every year in India. In case of Cornea, about 25000 transplants are done every year against a requirement of 1 lakh.

### **The legal Framework in India**

Transplantation of Human Organs Act (THOA) 1994 was enacted to provide a system of removal, storage and transplantation of human organs for therapeutic purposes and for the prevention of commercial dealings in human organs. THOA is now adopted by all States except Andhra and J&K, who have their own similar laws. Under THOA, source of the organ may be:

- Near Relative donor (mother, father, son, daughter, brother, sister, spouse)
- Other than near relative donor: Such a donor can donate only out of affection and attachment or for any other special reason and that too with the approval of the authorisation committee.
- Deceased donor, especially after Brain stem death e.g. a victim of road traffic accident etc. where the brain stem is dead and person cannot breathe on his own but can be maintained through ventilator, oxygen, fluids etc. to keep the heart and other organs working and functional. Other type of deceased donor could be donor after cardiac death.

Brain Stem death is recognized as a legal death in India under the Transplantation of Human Organs Act, like many other countries, which has revolutionized the concept of organ donation after death. After natural cardiac death only a few organs/tissues can be donated (like cornea, bone, skin and blood vessels) whereas after brain stem death almost 37 different organs and tissues can be donated including vital organs such as kidneys, heart, liver and lungs.

Despite a facilitatory law, organ donation from deceased persons continues to be very poor. In India there is a need to promote deceased organ donation as donation from living persons cannot take care of the organ requirement of the country. Also there is risk to the living donor and proper follow up of donor is also required. There is also an element of commercial transaction associated with living organ donation, which is violation of Law. In such a situation of organ shortage, rich can exploit the poor by indulging in organ trading.

Government of India initiated the process of amending and reforming the THOA 1994 and consequently, the **Transplantation of Human Organs (Amendment) Act 2011** was enacted. Some of the important amendments under the (Amendment) Act 2011 are as under:-

- i. Tissues have been included along with the Organs.
- ii. ‘Near relative’ definition has been expanded to include grandchildren, grandparents.
- iii. Provision of ‘Retrieval Centres’ and their registration for retrieval of organs from deceased donors. Tissue Banks shall also be registered.
- iv. Provision of Swap Donation included.
- v. There is provision of mandatory inquiry from the attendants of potential donors admitted in ICU and informing them about the option to donate – if they consent to donate, inform retrieval centre.
- vi. Provision of Mandatory ‘Transplant Coordinator’ in all hospitals registered under the Act
- vii. To protect vulnerable and poor there is provision of higher penalties has been made for trading in organs.
- viii. Constitution of Brain death certification board has been simplified- wherever Neurophysician or Neurosurgeon is not available, then an anaesthetist or intensivist can be a member of board in his place, subject to the condition that he is not a member of the transplant team.
- ix. National Human Organs and Tissues Removal and Storage Network and National Registry for Transplant are to be established.
- x. There is provision of Advisory committee to aid and advise Appropriate Authority.
- xi. Enucleation of corneas has been permitted by a trained technician.
- xii. Act has made provision of greater caution in case of minors and foreign nationals and prohibition of organ donation from mentally challenged persons

In pursuance to the amendment Act, Transplantation of Human Organs and Tissues Rules 2014 have been notified on 27-3-2014

Directorate General of Health Services, Government of India is implementing National Organ Transplant Programme for carrying out the activities as per amendment Act, training of manpower and promotion organ donation from deceased persons.

National Organ Transplant Programme with a budget of Rs. 149.5 Crore for 12th Five year Plan aims to improve access to the life transforming transplantation for needy citizens of our country by promoting deceased organ donation.

### **Issues and Challenges**

- v. High Burden (Demand Versus Supply gap)
- v. Poor Infrastructure especially in Govt. sector hospitals
- v. Lack of Awareness of concept of Brain Stem Death among stakeholders
- v. Poor rate of Brain Stem Death Certification by Hospitals
- vi. Poor Awareness and attitude towards organ donation--- Poor Deceased Organ donation rate

- v. Lack of Organized systems for organ procurement from deceased donor
- v. Maintenance of Standards in Transplantation, Retrieval and Tissue Banking
- v. Prevention and Control of Organ trading
- v. High Cost (especially for uninsured and poor patients)
- v. Regulation of Non- Govt. Sector

### **Objectives of National Organ Transplant Programme:**

- To organize a system of organ and Tissue procurement & distribution for transplantation.
- To promote deceased organ and Tissue donation.
- To train required manpower.
- To protect vulnerable poor from organ trafficking.
- To monitor organ and tissue transplant services and bring about policy and programme corrections/ changes whenever needed.

### **NOTTO: National Organ and Tissue Transplant Organization**

National Network division of NOTTO would function as apex centre for all India activities of coordination and networking for procurement and distribution of organs and tissues and registry of Organs and Tissues Donation and Transplantation in country. The following activities would be undertaken to facilitate Organ Transplantation in safest way in shortest possible time and to collect data and develop and publish National registry.

#### **At National Level:**

1. Lay down policy guidelines and protocols for various functions.
2. Network with similar regional and state level organizations.
3. All registry data from States and regions would be compiled and published.
4. Creating awareness, promotion of deceased organ donation and transplantation activities.
5. Co-ordination from procurement of organs and tissues to transplantation when organ is allocated outside region.
6. Dissemination of information to all concerned organizations, hospitals and individuals.
7. Monitoring of transplantation activities in the regions and States and maintaining data- bank in this regard.
8. To assist the states in data management, organ transplant surveillance & Organ transplant and Organ Donor registry.
9. Consultancy support on the legal and non-legal aspects of donation and transplantation
10. Coordinate and Organize trainings for various cadre of workers

#### **For Delhi and NCR**

1. Maintaining the waiting list of terminally ill patients requiring transplants
2. Networking with transplant centres, retrieval centres and tissue Banks



3. Co-ordination for all activities required for procurement of organs and tissues including medico legal aspects.
4. NOTTO will assign the Retrieval Team for Organ retrieval and make Transport Arrangement for transporting the organs to the allocated locations.
5. NOTTO will maintain the waitlist of patients. needing transplantation in terms of the following:-
  - Hospital wise
  - Organ wise
  - Blood group wise
  - Age of the patient
  - Urgency ( on ventilator, can wait etc.)
  - Seniority in the waitlist (First in First Out)
6. Matching of recipients with donors.
7. Allocation, transportation, storage and Distribution of organs and tissues within Delhi and National Capital Territory region.
8. Post-transplant patients & living donor follow-up for assessment of graft rejection, survival rates etc.
9. Awareness, Advocacy and training workshops and other activities for promotion of organ donation

#### 1. ROTTO: Regional Organ and Tissue Transplant Organization

Name of ROTTO	States covered
Seth GS medical college and KEM Hospital, Mumbai (Maharashtra)	Maharashtra, Gujarat, Goa, UTs of DNH, Daman, Diu, M.P., Chhattisgarh
Govt. Multispecialty Hospital, Omnadurar, Chennai (Tamil Nadu)	TN, Kerala, Telangana, Seem Andhra, Karnataka, Pondicherry, A & N Islands, Lakshadweep
Institute of PG Medical Education and Research, Kolkata (West Bengal)	West Bengal, Jharkhand, Sikkim, Bihar and Orissa
PGIMER Chandigarh(UT of Chandigarh)	Punjab, Haryana, HP, J & K , Chandigarh , Rajasthan, Uttar Pradesh and Uttarakhand

Guwahati Medical College (Assam)	Assam, Meghalaya, Arunachal Pradesh, Manipur, Nagaland, Mizoram, Tripura.
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## 2. SOTTO: State Organ and Tissue Transplant Organization

It is envisaged to make 5 SOTTOs in new AIIMS like institutions.

## 3. Govt. supported Online system of Networking

A *website* by the name [www.notto.nic.in](http://www.notto.nic.in) has been hosted where information with regards to the organ transplantation can be obtained. An online system through website is being developed for establishing network for Removal and Storage of Organs and Tissues from deceased donors and their allocation and distribution in a transparent manner. A computerized system of State/Regional and National Registry of donors and recipients is also going to be put in place.

## 4. Training

There is provision of training of various cadres related to Transplant including Transplant Coordinators. *Post-Doctoral Certificate in Dialysis Medicine* course has been launched since 2012 academic session in collaboration with IGNOU, New Delhi to augment the availability of trained manpower for undertaking dialysis in the country.

## 5. Financial Support for immune- suppressants, maintenance of deceased donor:

There is provision for financial assistance to 100 needy and poor, BPL transplant recipients every year to provide financial support at the rate of Rs.6000/- per month for immunosuppressant therapy. The programme provides financial support for maintenance of deceased donor at the rate of Rs. 50000/ per donor when maintenance is done in a private hospital and organ is allocated to a Govt. Institution.

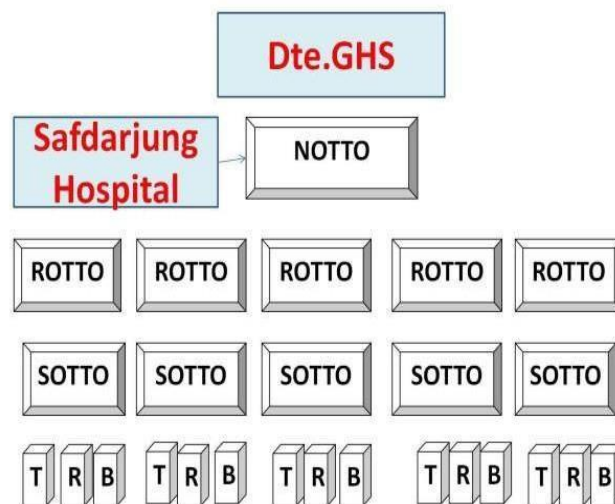
## 6. Coordination with Govt. Medical Colleges, Good Performing Private institutions and trauma Centers.

There is provision of providing transplant coordinators at identified Government Medical Colleges, Trauma Centers and good performing private Institutions.

## 7. Information, Education and Communication (IEC) activities :

The programme has main component of Information, Education and Communication (IEC) activities to promote organ donation from deceased donors.

# 1. National Human Organs and Tissues Removal and Storage Network



NOTTO: National Organ and Tissue Transplant Organization  
 ROTTO: Regional Organ and Tissue Transplant Organization  
 SOTTO: State Organ and Tissue Transplant Organization  
 T: Transplant Centre  
 R: Retrieval Centre  
 B: Biomaterial Centre (Tissue Bank)

Fig 2.1

## **2.2 ALLOCATION CRITERIA FOR HEART, LUNG & HEART-LUNG**

### **CONTENTS**

In India, the incidence and prevalence of end-stage heart failure and respiratory failure requiring transplant surgery is high. Heart transplant is possible from brain dead donors only. There is great paucity of donor organs. Presently there are only a few centres having capability and license to perform these transplant surgeries. Currently the scenario is changing with increased diagnosis, gradually increasing donor organ availability and increasing use of LVADs in maintenance of patients with chronic heart failure. An appropriate policy for equitable and judicious allocation of any available donated organ (heart and lungs) is mandatory. In order to promote the heart transplant programme it is advisable to have a dedicated heart failure clinic.

The present draft discusses the allocation policy of donated heart and lungs under the following heads -

- A. Registration of potential recipients
- B. Criteria for suitable donors for Heart and Lung
- C. Criteria for allocation of Heart, Lung and Heart-Lung
- D. Details to be recorded on the web site
- E. Post-operative update.
- F. Donor harvesting charges and charges to recipients
- G. Recognition of hospitals for organ transplantation

These are guidelines for the present. As the transplant programme picks up further modifications will be done as per the need by the sub-committee.

## **A. REGISTRATION OF POTENTIAL RECIPIENTS FOR HEART, LUNG AND HEART-LUNG TRANSPLANTATION:**

1. All hospitals should do all necessary investigations needed for their potential patients waiting for heart, lung and heart-lung transplantations and then register them with NOTTO portal. Patient is to be registered by the concerned hospital through online registration form on website [www.notto.gov.in](http://www.notto.gov.in)
2. Only those patients for whom all the necessary data is provided and registration charges are paid will be considered in the active waiting list.
3. Theregistrations for transplantation will have tobeupdated andre-registered everymonth. Status of patient must be updated regularly bythe hospital to one of the following status:
  - Active
  - Unfit
  - Recipient frequently refused
  - Lost to follow-up
  - Transplant done
  - Death
4. At any time one patient can register only with one transplantation center. In case he/she wants to shift to some other center, they need to deregister with first center and then only register with second center. There should be at least 72 hours of gap before the next deceased donor's organ retrieval.
5. Registration of Heart and Heart-Lung recipients: 3 categories are proposed:
  - Priority 1 (emergency):** These are patients on ventricular assist devices, but still critical, Intra aortic balloon pump (IABP) waiting for heart/heart lung transplantation. These recipients will get priority based on blood group and size matching. Their status need to be confirmed on weekly basis.
  - Priority 2 (semi emergency):** These are patients in intensive care unit depending on ionotropic supports for at least a week and not maintaining hemodynamics if inotropes are being weaned off. Their category needs to be updated every 48 hours. Based on their progress they may stay in priority 2 or change to other priorities. If a deceased donor organ is available, their status need to be confirmed by 3 members of the heart subcommittee as appointed by the chairman of the subcommittee.
  - Priority 3 (elective):** These are patients electively waiting for transplantation. Their status need to be confirmed or changed as per their progress on monthly basis.

Theconcerned hospital needs tobe given ausername and password to enable them toregister the recipients and enter data. They can see only *their* waiting patients. The subcommittee

members to be given a separate username and password and they should be able to see the waiting list members for heart, lung and heart lung transplantation and their details.

## **B.C CRITERIA FOR SUITABLE DONORS FOR HEART AND LUNGS:**

Apart from the general criteria for donors, the following criteria are needed:

### **1. Heart:**

- a) Age less than 60 years. If donor is more than 40 years, coronary angiogram is desirable to exclude asymptomatic coronary artery disease.
- b) No history of heart disease and echo-cardiogram showing good cardiac function and no anatomical abnormalities.
- c) Maintaining good haemodynamics and not on high doses of inotropes (dopamine less than 10 micrograms/kg/min; epinephrine, nor epinephrine less than 0.1 micrograms/kg/min, dobutamine less than 10 micrograms/kg/min)
- d) Cardiac arrest — Donors revived after a brief cardiac arrest must be assessed extra carefully; but can be considered if the cardiac function is absolutely normal.

### **2. Lung:**

- a) Age less than 55 years
- b) No active sepsis / malignancy in the lungs and outside
- c) No history of significant chronic obstructive pulmonary disease
- d) Chest X-ray shows clear lung fields without any evidence of trauma to lungs
- e) Arterial Blood gases: On 100% oxygen and PEEP of 5 mm of Hg. after 5 mn, PaO<sub>2</sub> should be more than 300 mm of HG
- f) If smoker, a smoking history of  $\leq$ 20 pack-years

## **C. CRITERIA FOR ALLOCATION OF HEART,**

### **LUNG AND HEART-LUNG:**

Matching of heart and Lungs are done based on

Blood group matching and  
Size matching Geographical  
distance

**Blood Group Matching-** O group donor organ is matched with O first. If no O group recipient is available, then it can be given to other group recipients as per the following criteria. Once a deceased donor heart and lungs are available, the hospital/s with first two recipients in the order of allocation will be informed. If the first recipient is not confirmed in 2 hours after that, the organ will go to the next recipient in the list and so on.

**Size and weight mismatch -** There should not be more than 20 percent size mismatch between the donor and the recipient heart / lung. Larger hearts can go to smaller patients and more mismatch is acceptable but problems can occur with small hearts in large recipients. In children more mismatch is acceptable.

**Distance** — The donated heart should be allocated to a hospital which is well within the geographical limit of cold-ischemia time for heart / lung

For a heart / lung donated at a government hospital, the first priority for allocation should be for a recipient registered with a government hospital.

If any controversies arise in allocation, the decision of the Advisory sub-committee is final.

**1. Heart and Heart-Lung:**

1. If deceased donor organs are harvested in an Organ Transplantation center, heart will go to that center. One lung will go to that centre (both lungs may be used in one patient at the discretion of Transplant team) and the other lung will go to the general pool. If the hospital does not have recipients, then the heart and both lungs will go to the general pool.
2. If deceased donor organs are harvested in a center recognized only for organ harvesting, heart and both lungs will go to the general pool.

General pool organs will be distributed first to patients in the priority 1, then to priority 2 and then to priority 3. If multiple patients are there in each category, then heart will be distributed in the chronological order of patient's registration with NOTTO portal. If donor is CMV positive, and there is a recipient who is CMV positive, they will be matched provided there is no waiting patient in priority 1 and 2.

**2. Lung:**

1. If deceased donor organs are harvested in an Organ Transplantation center, one lung will go to that center (both lungs may be used in one patient at the discretion of Transplant team) and the other lung will go to the general pool. If the hospital does not have recipients, then the heart and both lungs will go to the general pool.
2. If deceased donor organs are harvested in a center recognized only for organ harvesting, both lungs will go to the general pool.

**D. DETAILS TO BE RECORDED ON THE WEB SITE:**

The Following details should be available on the web site regarding the patients waiting for heart, lung and heart-lung transplantation:

First name:

Age:

Weight:

Hospital where  
registered:

Diabetic: Y/N

Blood Group:

CMV IgG:

Sex:

Diagnosis:

Last name:

Height:

Date

registered:

Rh typing:

positive/negative  
PRAI:percentage Positive/negativePRA  
II: percentage positive/negativeHbsAg:  
positive/negative HIV: Hep C: positive/negative Transpulmonary  
positive/negative For  
heart recipients: PVR:  
gradient:

For Lung recipients:

Room air ABG report  
6 min walk test results:



PLAN: Heart/single lung/bilateral lung/heart-lung transplantation. Priority: 1/2/3

#### **E. POST-OPERATIVE UPDATE:**

It is the responsibility of the hospital to update about the recipient condition on a monthly basis in the first 6 months, then once in 2 months for the next 2 months and then every 6 months and whenever patient is readmitted.

#### **I. RECOGNITION OF HOSPITALS FOR ORGAN TRANSPLANTATION:**

It is noted that some hospitals have applied for transplantation permission at multiple branches. It is recommended that only those hospitals/branches which have in-house full time transplantation team are to be permitted to enable round the clock care.

Appropriate recognition of a centre should be in-place as either a –harvest centre or as a–harvest plus transplant centre.

##### **List of Government hospitals in Delhi-NCR recognized for retrieval and transplant**

1. AIIMS, Ansari Nagar, New Delhi-110029(Lung & Heart Lung)

##### **List of Private sector hospitals in Delhi-NCR recognized for retrieval and transplant**

1. Fortis Escort Heart Institute & Research Centre, Okhla Road, New Delhi-110025
2. Fortis Memorial Research Institute, Sector - 44, Opposite HUDA City Centre, Gurgaon, Haryana 122002
3. Max Devis Devi Heart & Vascular Institute, 2 Press Enclave Road, Saket, New Delhi-110017
4. Medanta-The Med City, Sector — 38, Gurgaon, Haryana 122 001, India
5. Sir Ganga Ram Hospital, Sir Ganga Ram Hospital Marg, Old Rajinder Nagar, New Delhi-110060

2.3 Characterizing Organ Donation Awareness from Social Media

Q = { Context: transplant, transplantation, donor, donation, donate } x { Subject: heart, kidney, liver, lung, pancreas, intestine }

Fig. 1. The set of keywords used to collect tweets related to organ donation awareness is the Cartesian product of Context and Subject words.

TABLE I. STATISTICS OF THE DATASET USED IN THIS PAPER. THE DATASET CONTAINS COLLECTED TWEETS FROM USERS REGARDING ORGAN DONATION.

Statistic	Value
Start Data Collection	Apr 22 <sup>th</sup> 2015
Finish Data Collection	May 11 <sup>th</sup> 2016
Number of Days	385
Tweets collected	134,986
Number of Users	71,947
Avg. Tweets / Day	350
Avg. Tweets / User	1.88
Organs mentioned / Tweet	1.03
Organs mentioned / User	1.13

\*134,986 out of 975,021 tweets could be identified as from USA users.

Fig2.3.1

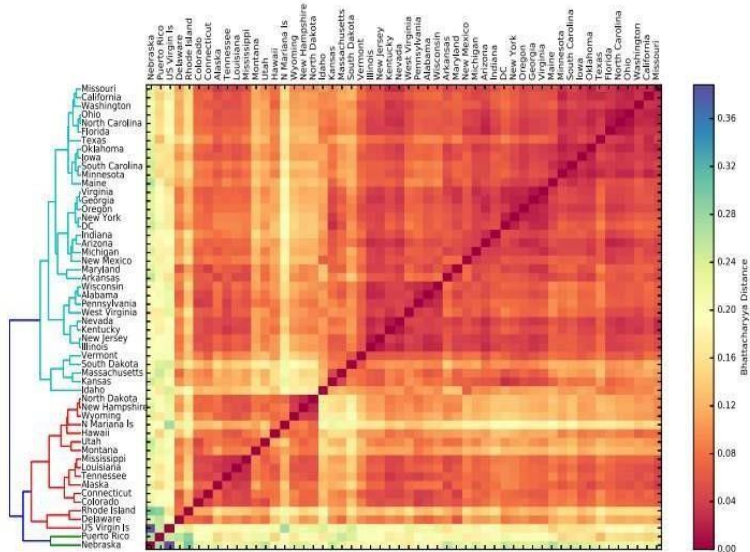


Fig. 6. Hierarchical clustering of states based on their similarity with regards to the extent of incidence of specific organ-related conversations. States are outlining zones of organ-related conversation. For instance, the states belonging to the cluster depicted in red are mostly associated with liver conversations.

Fig2.3.2

From this conversations we can find the keywords we mentioned in the dataset and can find the level of awareness in the various regions based on this .In this we can find the regionwise organ awareness with graphical representation like

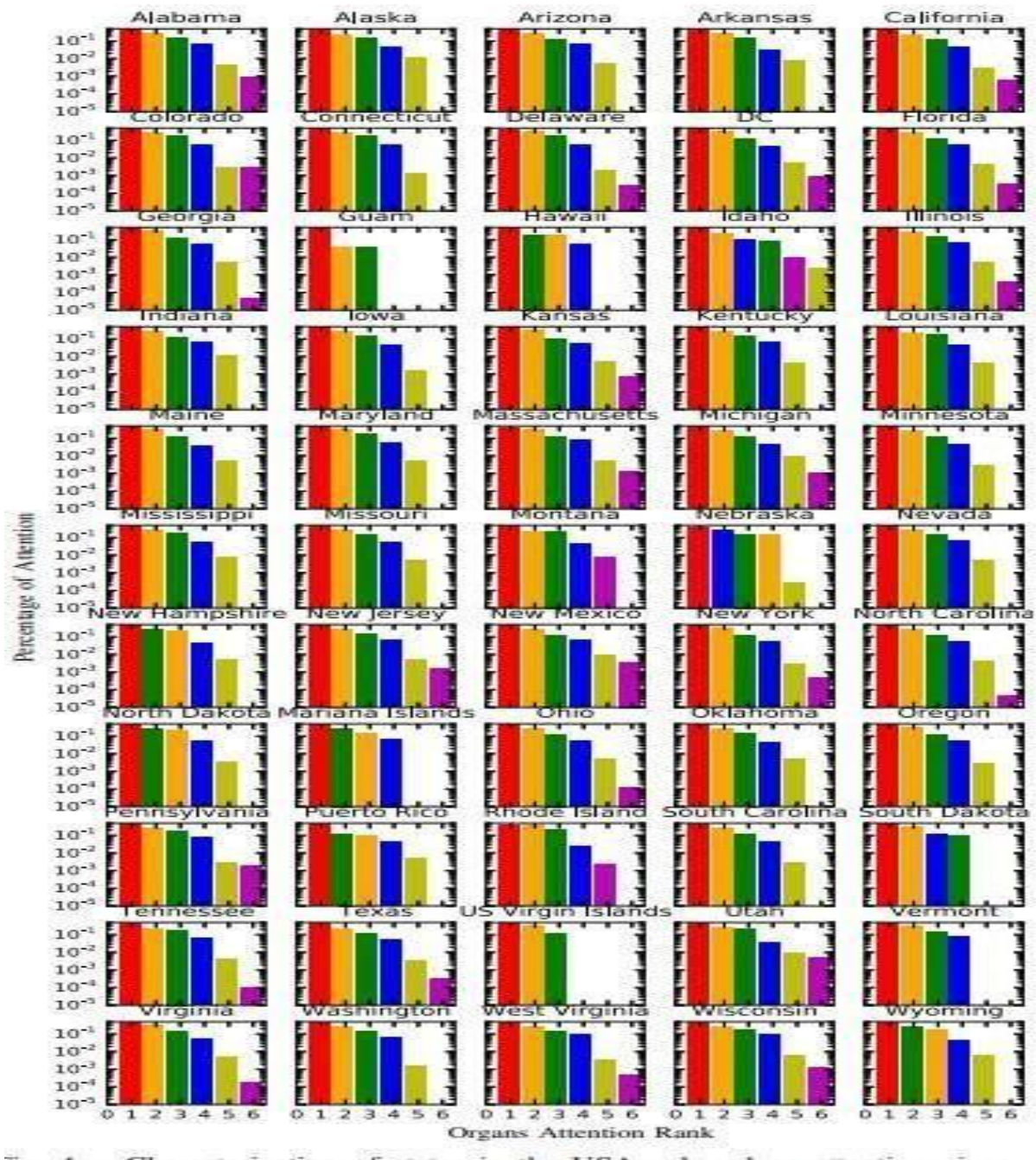


Fig 2.3.3

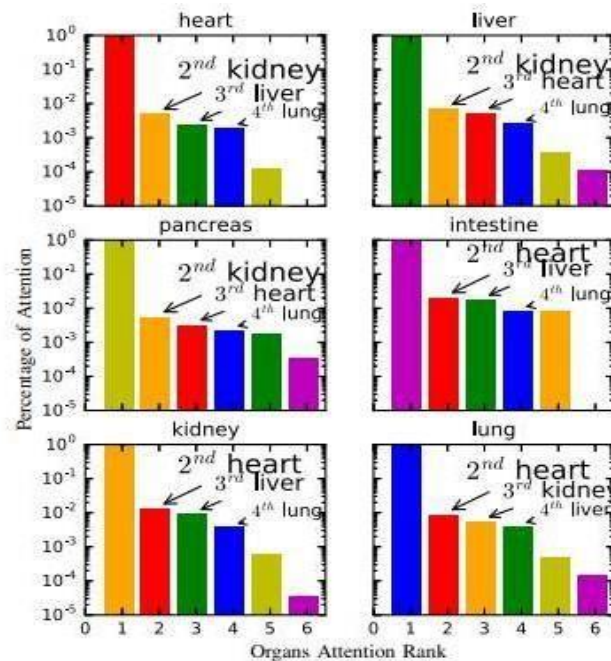


Fig 2.3.4

From this it becomes to circulate the data the awareness campaign effectively in various regions .

Identification of areas with less knowledge are identified ,proper education aided models can be given to the institutions of the regions so that they can effectively help the youth.

Extracting the data of the need of organ supply and demands in the region .

In this work, we characterized social media users and states in the USA based on their attention to different solid organs; we use markers (i.e. indicators) of awareness, norms, and behaviors towards organ donation. This characterization might lead to a better understanding of these users and their geographic variations. For instance, the geographic characterization of organ-related conversation at the state level can help us identify patterns of awareness from the angle the states in the USA. Similarly, our characterization might be used to differentiate classes of users such as health care practitioners, donors, waiting-list candidates, organ donation advocacy agencies, or simply demonstrate that different users have different behaviors towards organ donation. The potential impact of this characterization is that it can improve the assessment of organ donation awareness approaches in the United States but also derive social intervention approaches that better fit the cultural, religious, and educational differences between states. Ultimately, this characterization can inform models of social influence to be employed in the context of organ donation aiming at designing interventions that effectively target specific groups of users.

Possible limitations of our work

regards to bias in the collected data. The population of the United States is underrepresented by Twitter users since they are a highly nonuniform sample of the USA population especially with regards to geography, gender and race/ethnicity . Twitter users are biased towards highly populated counties and male users. Also, depending on the region, different race/ethnicity (i.e Caucasian, African-American, Asia and Hispanic) can be over-sampled or under-sampled. For instance, the Midwestern population of United States is underrepresented among Twitter users.



## 2.4 Exploring advantages in the waiting list for organ donations.

The waiting list for organ transplants is a complex system that affects the lives of thousands of Americans. The current policies in the United States allow patients to register at multiple Donor Service Areas (DSAs) provided they have physician approval and can cover the costs of any additional testing through insurance or personal means. This practice gives rise to ethical concerns, especially among those who believe it allows the wealthy to take unfair advantage of the system. We develop an agent-based, discrete event model that simulates the practice of multiple listings in transplant waiting list queues to explore the effects on the overall transplant system. Our analysis shows that although there are no major impacts at the national or global level, there are potential consequences at the local DSA level depending on the heterogeneity of the DSAs involved.

Patients eligible for a transplant must wait until an appropriate match is found. Many factors are considered in the matching process including blood type, height, weight, the number of HLA antigens in common between the donor and the recipient based on tissue typing, the size of the organ, and geographic location. When an organ becomes available, priority is given to patients based on the quality of the match, the health of the potential recipient, and the amount of time a patient has been waiting. Once the medical attributes are considered the system generally functions as a first-in-first-out queue of matched patients. In most cases—outside of the most severe circumstances—organs are allocated first within the DSA, then throughout the region, and finally across the rest of the country (Friedewald et al. 2013). The waiting list process is shown in Figure

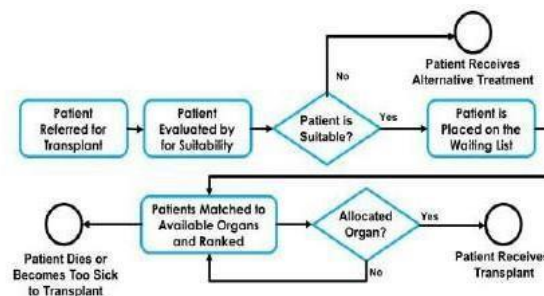


Figure 1: Organ transplant process from the initial referral to receipt of transplant or alternative treatment.

Fig 2.4.1

The agents in our model are patients who have been deemed eligible for a kidney transplant. Each patient is therefore in one of four conditions; either Waiting, Selected, Transplanted, or Deceased. Waiting patients are on at least one of the regional transplant waiting lists and have not yet been chosen for a transplant. Selected patients were at the front of at least one of the regional waiting lists in the last time step and have just been chosen for a transplant.

Transplanted patients have successfully completed the organ transplant process. Deceased patients were in the Waiting state longer than their lifespan and thus died before being Selected and Transplanted. Upon instantiation, each patient is assigned a primary region and they are added to that region's waiting list. Each patient is also randomly designated as either -Advantaged or not according to the user-specified distribution of advantaged patients. Patients that are Advantaged are then added to additional waiting lists beyond their primary region. The number of additional waiting lists is selected from a  $U(1, N_{\text{region}} - 2)$  distribution, where  $N_{\text{region}}$  is the number of DSAs in the model not including the patient's primary region. The uniform distribution is a simplified approach to a complex problem where data on the exact number and frequency of multiple registrations on two or more lists is not known. The upper limit of half the regions as a selection criteria was implemented to show some realistic time constraints on the agents as it is time consuming to travel and apply for multiple waiting lists, although not impossible. Finally, each patient is assigned a lifespan parameter  $T_{\text{lfe}}$  at instantiation. The  $T_{\text{lfe}}$  parameter represents the maximum amount of time the patient can be in the Waiting state before moving to the Deceased state. That is, if  $T_{\text{wait}} > T_{\text{lfe}}$  the patient exits the Waiting state and enters the Deceased state. For our base case run of the model,  $T_{\text{lfe}}$  of each patient is selected from a  $\text{Normal}(98, 5)$  distribution, which corresponds to an average lifespan of 98 months. Figure 2 illustrates how this process is implemented in the model.

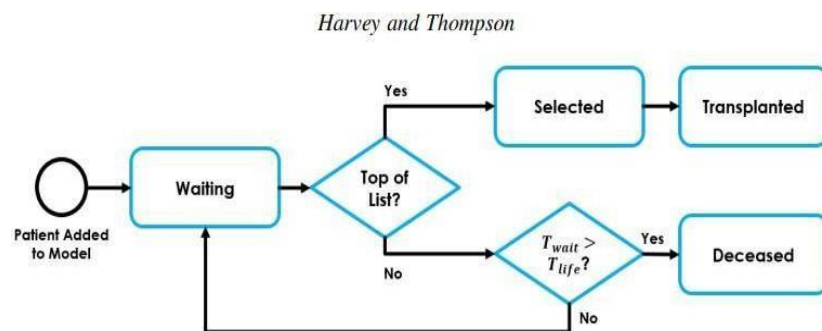


Figure 2: Overview of the states of a patient in the model.

Fig2. 4.2

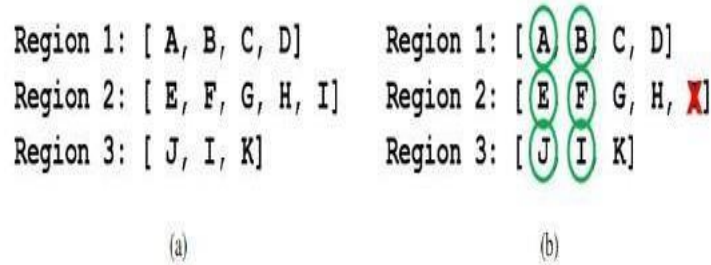


Fig2. 4.3

Through this way there is a disadvantage with K if he is just a single area recipient and the advantaged recipients are always getting a higher priority due to financial advantage .

Figure 3: (a) The status of three regional queues at time  $t = 1$  with Patient I listed on both queues.

(b) The status of the same queues at time  $t = 2$  when the first two patients in each queue have been selected for transplant. are Advantaged, they are subsequently removed from whatever position they held in the other waiting lists before the organs for that waiting list are allocated. Once the queues are updated, the patients are updated to reflect the advancement of time. Each of the patients that were not selected increment their waiting time  $T_{wait}$  by 1. If the patient is in the Selected stage, the patient transitions to the Transplanted stage. If a patient is still in the

Waiting stage and they have been waiting for longer than their predetermined lifespan, the patient will move to the Deceased stage. Finally, new patients are added to the model according to an independent Poisson process calibrated to each region. A portion of these patients will be Advantaged and therefore listed in multiple regions. The model terminates when there are no longer any patients in the Waiting state or if the number of time steps has exceeded 120.

Python's Mesa module provides the DataCollector to track patient states in the model over time (Project Mesa Team 2015). Tracking these statistics allows for simple and quick visualizations of the process and model statistics. The user can specify which statistics are managed by the

DataCollector at the start of each model run. The model also tracks the number of patients meeting the following criteria: • Patients transplanted that were a primary listing in the queue • Patients transplanted that were an alternate listing in the queue • Patients with a primary listing in the queue that received a transplant elsewhere • Patients with a primary listing that died before receiving a transplant • Patients with a primary listing • Patients listed as alternate



Table 1: Initial input parameters in the model.		
Parameter	Value	Description and Motivation
regions	4	The number of separate DSAs
initial_patients	16,000	The initial number of patients waiting at time $t = 0$
additional_patients	Poisson(230)	Average monthly arrivals of new patients needing transplant
queue_probabilities	[0.50, 0.20, 0.10, 0.20]	The portion of new patients allocated to each primary DSA, where each element represents a different region
transplant_rates	Poisson([50, 31, 16, 21])	Average monthly transplants $N_i$ in each DSA where $i$ represents the DSA
advantage_prob	$\in [0, 1]$	Advantaged portion of the population
output	True	Write output statistics to a file or not
average_lifespan	Normal(98, 5 <sup>2</sup> )	Corresponds to an average lifespan of just over 8 years
smart_listing	True	Determines whether the patient will intelligently determine where to make their alternate listings

Table 2. 4.1

Table 2: Annual Donor Service Areas transplant data from the UNOS database 2014.

Region	1	2	3	4
Deceased donor transplant	610	370	188	230
New patient arrivals	2,164	1,354	568	1,057
Transplant-eligible arrivals	1,396	568	273	567
Total patients	7,420	4,427	1,255	2,726
Transplants per patient	0.082	0.084	0.150	0.084

Table 2.4.2

Table 3: Number of patients currently on the waiting list by time spent waiting for a transplant.

Months	[0,1)	[1,3)	[3,6)	[6,12)	[12,24)	[24, 36)	[36, 60)	[60, Inf)
Candidates	3,912	7,815	9,897	17,037	27,153	20,471	23,217	18,405
% Candidates	3.1%	6.1%	7.7%	13.3%	21.2%	16.0%	18.2%	14.4%

Table2. 4.3

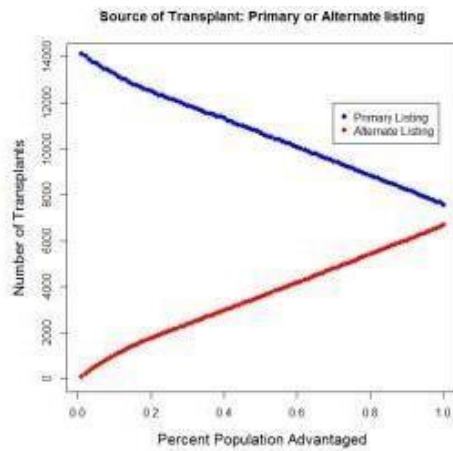


Figure 4: Number of transplants performed at either the primary or alternate listing.

2012

Fig2. 4.4

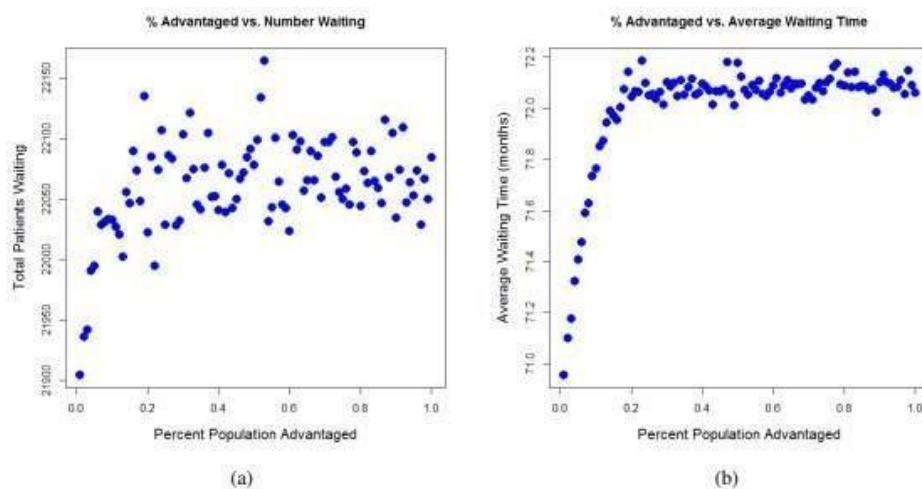


Figure 5: (a) Total number of patients in the waiting state as the Advantaged percentage increases. (b) The average wait time as the Advantaged percentage increases.

Fig 2.4.5

20% or more of the population is Advantaged there is a diminishing impact and the queue length and wait times tend to level off.

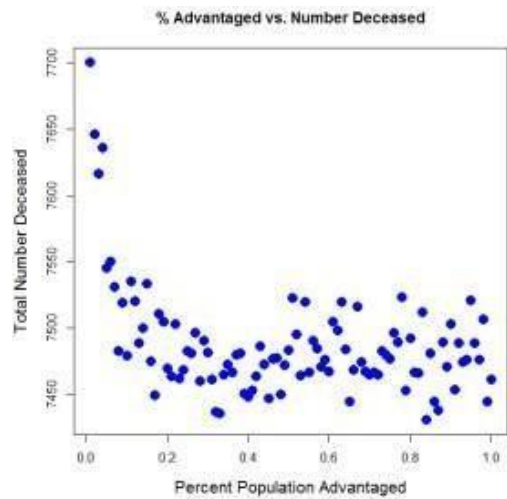


Fig2. 4.6

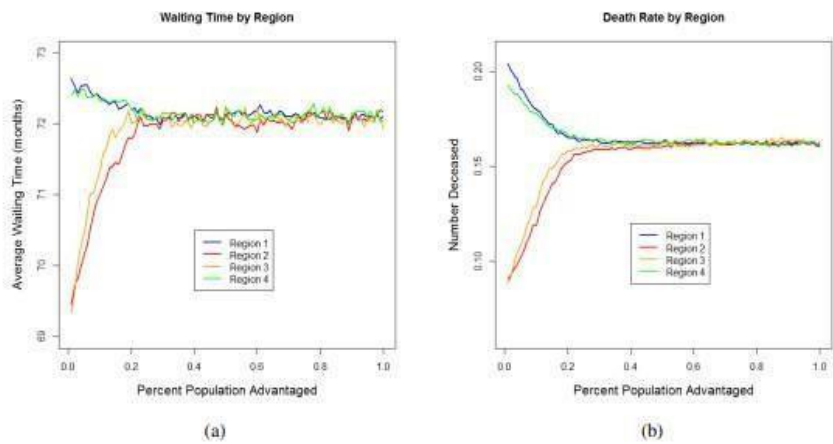


Figure 7: (a) Wait time by region as Advantage population increases. (b) Death rate by region as Advantage population increases.

Fig 2.4.7

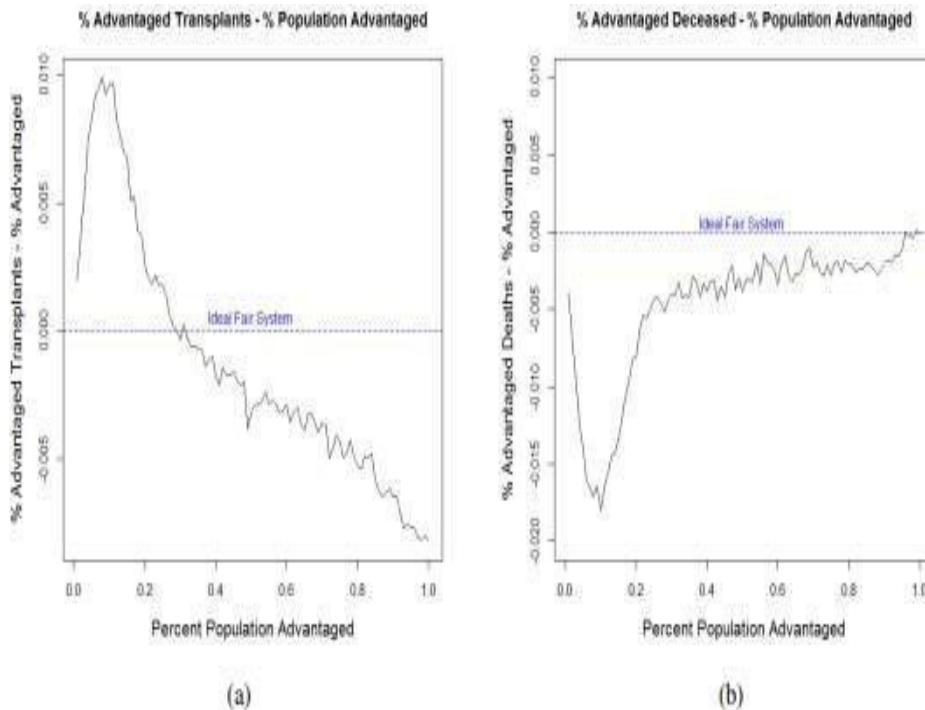


Figure 8: (a) The relative fairness in receipt of transplants. (b) The relative fairness in death rates.

Fig2. 4.8

So we studied as the % advantaged rises initially it is advantaged and as it crosses 30% mark the advantaged transplants stop and as % advantaged population increases we can see dip initially but after that we see a constant rise in deaths and after having a huge amount of % advantaged population again we arrive to a fair system .

Although this approach of U.S.A allows to hold constant rates at national level but it is having regional injustice with less advantaged people by unethical methods been applied at regional level.

So referring this we can't accept this U.S based model in India as we have seen the enrollment causing a disparity between rich and poor and the graph in India for this model will be worst as seeing India as developing country.

# PROPOSED SYSTEM

In the proposed system, to overcome the issue of wasting the organs the donor's identification will be taken in a multi variant approach. Donor's portrait of the image and a distinctive identification number is unique way of recognition. Once the person is met with an accident or stuck in any tragedy, the donor's face will be identified by the neighboring hospitals and the information about the user will be fetched easily. The retrieved information will be matched to identify whether the person is a donor or not.

A donor card would be provided during registration of the user.

## 3.1 Inferences:

- i. Easy to access platform.
- ii. AWARENESS.
- iii. Centralized agency .
- iv. Increasing the cadaveric transplants .
- v. V. Funds.
- vi. vi. proper directory for info by authority .
- vii. vii. Need of Co-operation between NGO ,Foundations,Trust,non transplant hospitals.
- viii. Viii .Less availability of co-ordinators per hospital.
- ix. ix. Lack of organ donation training in medical community comparatively
- x. x. Rapid Action Failure due to lack of planning and experience.
- xi. xi. No clear education on Brain death .
- xii. xii. Lack of Youth involvement which is the greatest factor.

Proposed initiatives which can play vital role.

- Web influence increasing day by day with INDIA having the cheapest rate + no device requirements and web being immortal it can be a good option.
- NGOs should be provided with platforms and should be welcomed to educate and have training workshops so that medical fraternity , Youth, Co-ordinators ,social workers and hence we could get a exponential rise in transplants.
- Provide the public with organ donor intent forms and brochures while issuing driving licenses, Aadhar cards and college ID cards, so they can choose to express their intent on the cards.
  - Non-transplant hospitals need to be involved in organ retrieval
  - Sensitizing police personnel and forensic experts.

- States such as Tamil Nadu for instance have recorded an 80% conversion rate 40 when it comes to donating the organs of one kin. Through a motivated network of doctors who declare brain death, personnel who maintain the deceased on life support, and transplant coordinators who convince the near relatives of the patient, the state has a record organ donation which is 15 times the national average. An important step in this direction was the creation of a network of hospitals for sharing organs
- The Maharashtra government made it compulsory for all non-transplant hospitals equipped with an ICU and operation theatre to retrieve organs for harvesting and made it mandatory for them to officially identify brain dead patients. This was a crucial point highlighted in the primary research as well and hence, needs to be implemented in the other region.

•Make Brain Death declaration mandatory.

•Recognizing the pivotal role of the Transplant Coordinator in the Organ Donation/Transplant Process.

•Improve Infrastructure within public hospitals for transplantation.

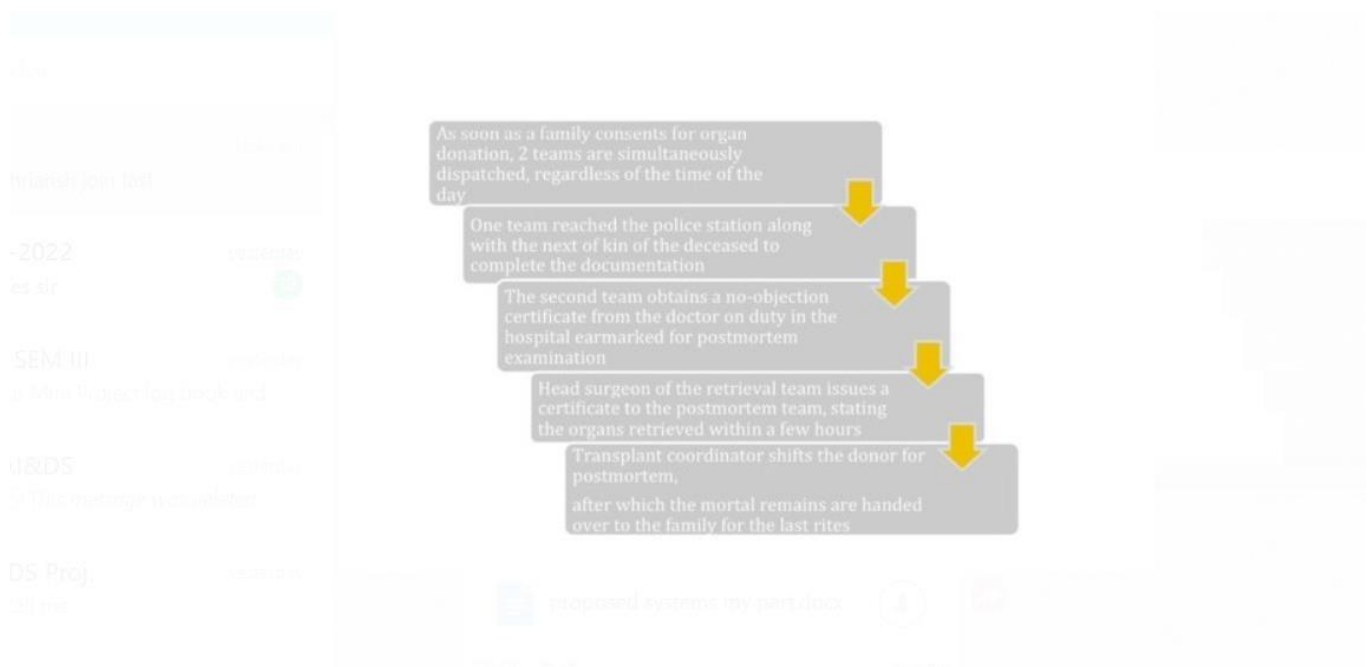
•Large-scale awareness building(Media networking for Organ donation)

•Conducting Post-Mortem Examination during the same time as Organ Retrieval Surgery to avoid unnecessary delays

•Family of organ to be honoured.

•Quick Flight allowances and efficient Green door application.

### 3.2 Action plan



### 3.3 Things to learn:

Australia and England :Organize one international test match in almost every series for various medical awareness related programs .

#### Spain

The Spanish system provides a markedly different alternative to other organ donor management systems utilized globally. It allows for more government involvement in individual healthcare, and also enables the government to easily collect data and build a donor registry. It is managed by the Organizacion Nacional De Transplantes (ONT) and utilizes the “optout” method of registration; all Spanish citizens are assumed to consent to organ donation upon death, and doctors at hospitals are able to operate under that premise unless families explicitly refuse. Spanish hospitals have specially trained staff members in charge of interacting with the families of deceased patients whose organs are suitable for donation. It is estimated that 5,500 citizens died while waiting for a donor organ in the EU (which has the highest rates of organ donation in the world) in the year 2011. Spain’s current rate of organ donation is 35.3 donations from deceased patients per Millions of population (pmp). Spain’s recent success in increasing donor rates and galvanizing national support for the organ donation movement rests on ONT’s reliance and focus on recruiting and utilizing the Spanish national media to convey their message. The ONT has a very comprehensive and well organized website, and has published best practices for the processes of organ donation in multiple languages.

- ISRAEL: Israel has implemented the “Pay It Forward” Scheme<sup>27</sup>. Under this scheme, if more than one person is on the list for obtaining a transplant, the person who had earlier agreed to donate his/her organs would be the recipient of the transplant. This makes sure that people step forward and donate so that they can benefit should there arise a need. This is an important step to encourage proactive organ donations.

# **Chapter Four: Hardware & Software Requirements**

## **and Implementation Plan**

### **4.1 Web Application Server Hardware Requirements:**

<u>Components:</u>	<u>Minimum Requirement:</u>
Processor minimum per core	64 bit, four core, 2.5 GHz
Hard disk	80 GB
RAM evaluation use,	8 GB for developer or  16 GB for production use

### **4.2 SQL Server Hardware Requirements:**

<u>Component:</u>	<u>Minimum Requirement:</u>
Processor minimum per core	64 bit, four core, 2.5 GHz
RAM	16 GB
Hard disk	80 GB

### **4.3 Software Requirements:**

- Operating system
- SQL server
- Heroku server (for deployment)



- VS code
- Hyper

#### **4.4 Front-end Technology:**

- HTML 5
- CSS 3
- Bootstrap 4
- JavaScript
- React

#### **4.5 Back-end Technology:**

- Node-js
- Express js
- Adding all the required dependencies/packages for execution of the project in the next sem.

#### **4.6 Database:**

- Postgre SQL Server
- PgAdmin

#### **4.7 Implementation Plan for Next Sem:**

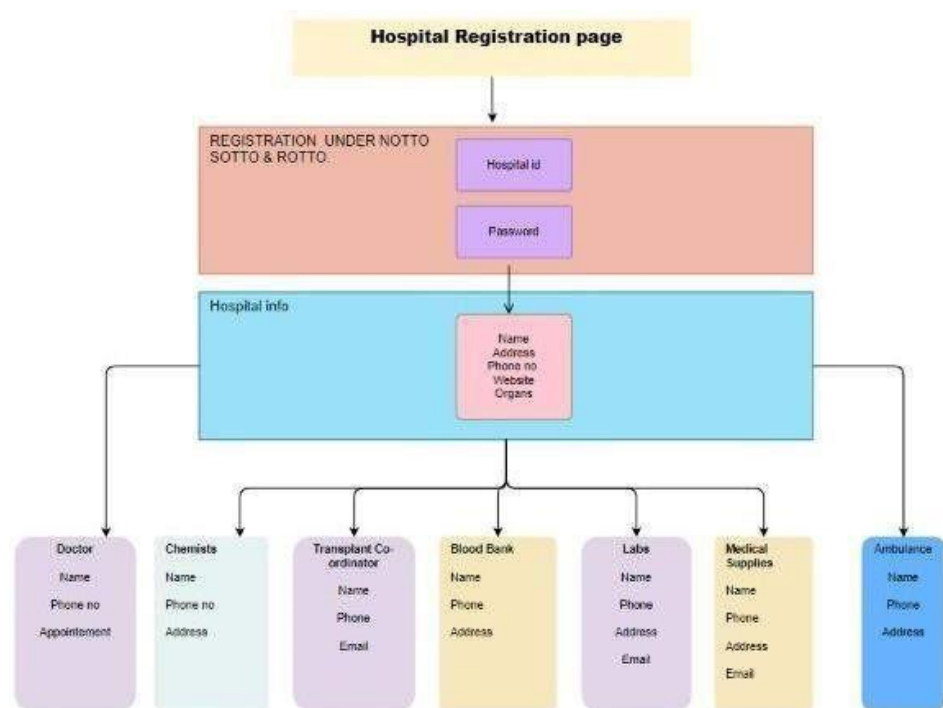
- Designing of the database
- Gathering data from various sources
- Back-end implementation such as:
  1. Server set-up
  2. Routing

3. Back-end connections with database
4. Deployment on Heroku server

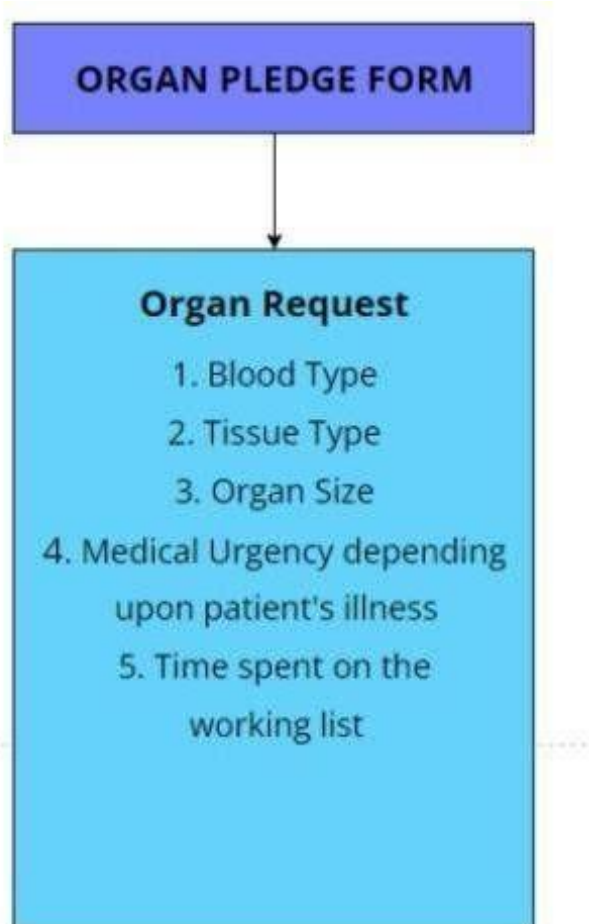
- Front-end implementation plan:

1. Using React to create interactive UIs or rendering the data changes
2. Using external plug-ins to render the webpages using React libraries

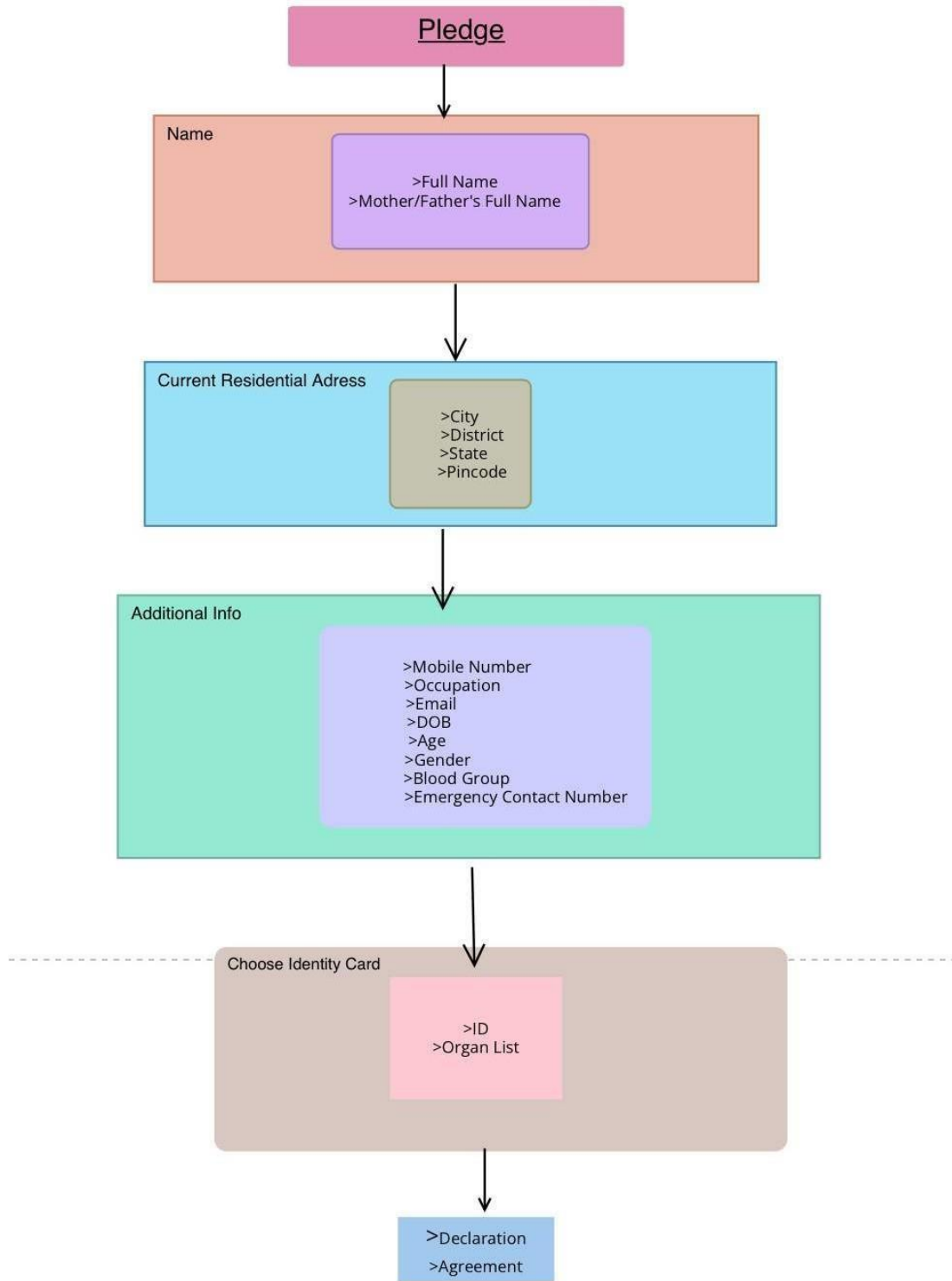
## 4.8 Diagrams for further Implementation



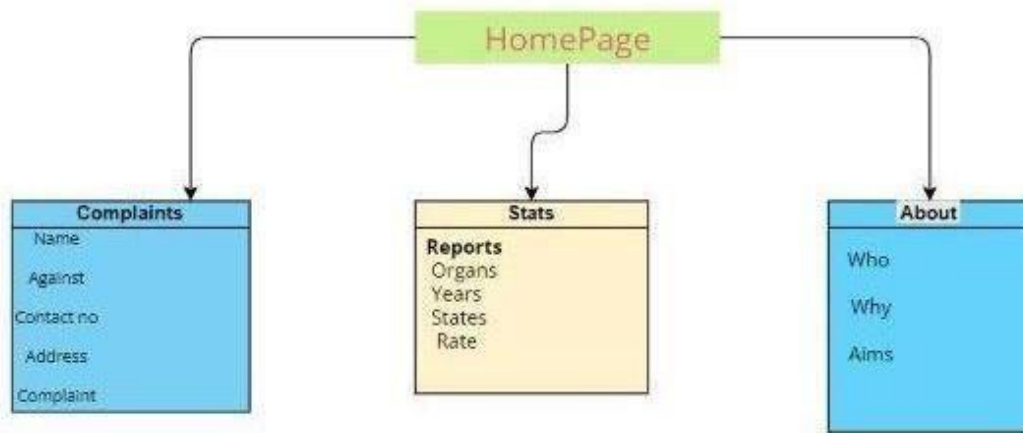
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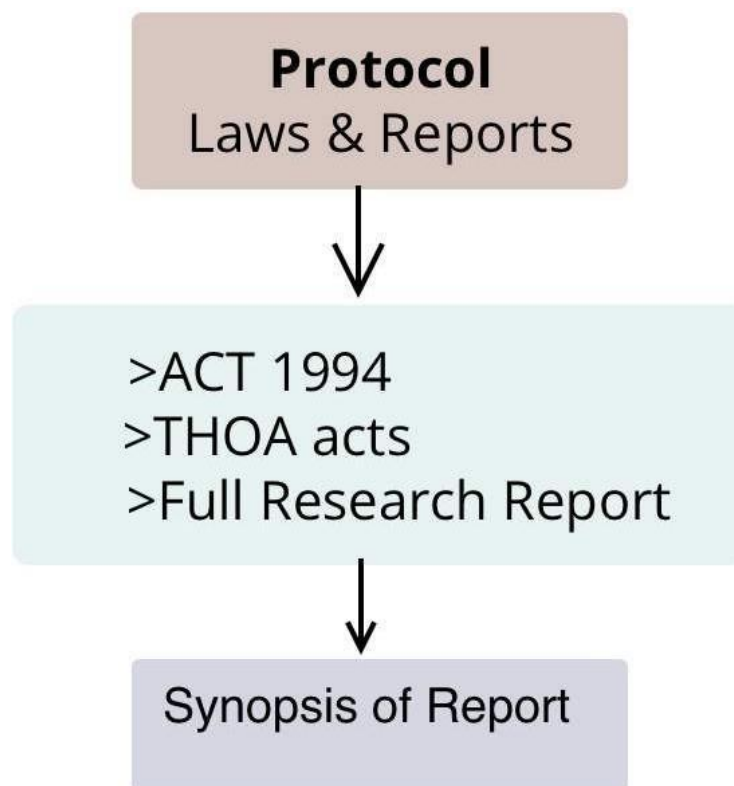
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4.3



4.4



4.5

## Awareness Pages

>Videos (famous personalities)

>NGO (videos)

>Books for Awareness

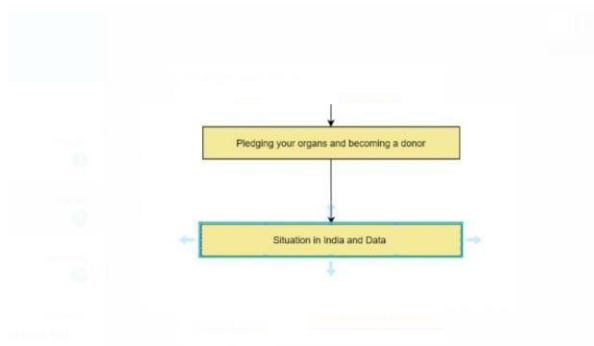
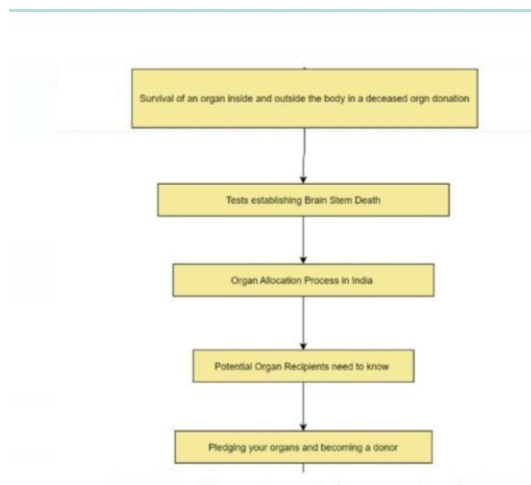
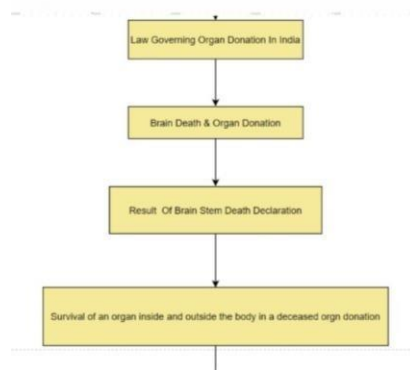
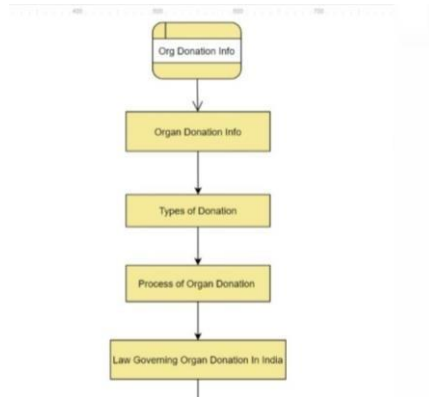
>Posters

>Articles

>Success Stories(photos and blogs)

>Myths and Facts

4.6



## **5.1 FUTURE SCOPE**

In the future, we can use the technique of artificial intelligence and machine learning for understanding the medical prescriptions and reports and carry out the major matching between donors and recipients through the application itself. It can be the most self-evolved application that can read medical reports and find matches, especially taking the time of requirement as the major consideration.

## **5.2 Conclusion**

This application will be a very user-friendly platform to enroll people in a brilliant initiative that will save countless lives of people that are dying due to the lack of organ donation. It will create a long-term lifesaving role for every citizen in our country. Our prime target is to provide organs to the seeker when they are in need and make it a lifesaving platform for those who are dying due to the lack of organs and spread the idea of saving lives through one's death.



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