

# Organ Transplantation Evaluation by Behavioral Economics and Decision-Making

Sajjad Esmaeili Aghdam<sup>1, \*</sup>, Ramin Ghasemi Shayan<sup>2</sup>, Shila Zalnejad<sup>3</sup>

<sup>1</sup>Department of Economics, Faculty of Economics and Management, University of Tabriz, Tabriz, Iran

<sup>2</sup>Radiology Department, Paramedical Faculty, Tabriz University of Medical Sciences, Tabriz, Iran

<sup>3</sup>Accounting Department, Damegan Islamic Azad University, Damegan, Iran

## Email address:

Sac.esmaeili@gmail.com (S. E. Aghdam)

\*Corresponding author

## To cite this article:

Sajjad Esmaeili Aghdam, Ramin Ghasemi Shayan, Shila Zalnejad. Organ Transplantation Evaluation by Behavioral Economics and Decision-Making. *American Journal of Theoretical and Applied Business*. Vol. 8, No. 1, 2022, pp. 1-7. doi: 10.11648/j.ajtab.20220801.11

**Received:** November 23, 2021; **Accepted:** December 14, 2021; **Published:** March 29, 2022

---

**Abstract:** The study aimed to investigate the impact of Behavioral Economics and Decision-Making on the result of organ transplantation. We have conducted this idea that social sciences have a great reflection on the result of organ transplantation and gathered more insight over this subject by conducting the most reliable studies in the field of Behavioral Economics and the process of decision-making. Economics and psychology have an indisputable close relationship, to determine the effect of behavioral economics and decision-making on organ transplants we have declared the psychology behind this title and expanded the relative subjects. For this purpose, categorized sub-headings were included in order to bring efficient insight into this review article. Decision-making is more correspondent in pediatric organ transplantation, therefore, the main focus of the types of transplantation was pediatric organ transplantation, because pediatric transplantation has seen the most challenging decision both for the recipient's families and clinical workers. Allocation of organ transplantation and implementing an allocation system are the crucial factors having a direct impact on the result of transplanting an organ. Decision-making and the factors that have an influence on it, which originates especially from human psychology, play a key role in the result of successful organ transplantation and preventing any undesirable outcomes.

**Keywords:** Behavioral Economics, Health Economics, Decision-Making, Rational Decision

---

## 1. Introduction

Economics generally intellectualizes person behavior as the outcome of external states, such as budgets and prices (or respective beliefs), and preferences. The prosperity of economic study is typically seen in illustrating observed variation in behavior deprived of resorting to variation in preference [1]. A person's utility is modeled by preferences like time managing, risk-taking, and social preferences [2]. Old-style economic research takes up that when a person wants to make a decision it is based on maximizing utility. Preferences like these with combining future expectations, insights, opinions, planned thought, values, and limitations shape behavior. Psychology of personality, an area of psychology understanding personality and personal differences, gives information on universal traits and

personal divergences [3]. Making a decision is a process where an individual, group, or organization gets outcomes on what future steps to pursue when a set of goals and restrictions considers obtainable resources. A process like this is often challenging, involves issue framing, intelligence-gathering, coming to conclusions, and learning from experience [4]. Making a decision can be regarded as an issue-solving action yielding a solution believed to be optimum, or at least fitting. Thus progress can be rational or irrational and can be based on obvious or implicit knowledge and beliefs. Implicit knowledge is often used to fill the empty places in complex decision-making progress [5]. Transplanting organs is a medical procedure in which an organ is separated from one person and attached to the body of a receiver, to change the organ that is lost or in need of being changed. Organ donors may be alive, brain dead, or

deceased by cardiovascular expiry [6]. Tissue may be changed from donors which die of cardiovascular death [7], just like brain death – until 24 hours past the ending of a heartbeat. Tissues, unlike organs, except for corneas might be conserved and kept for up to half a decade, meaning they can be "saved". Transplantation brings a number of bioethical problems, accordingly the meaning of death, when and how agreement must be given for an organ to be relocated, and expense for organs for transplantation [8, 9]. Behavioral Economics is a comparatively new ground in economics that combines visions from psychology that can be attached to improve economic decision making with the possibility to improve decent health and well-being of people and societies, United Nations one-third of Sustainable Development Goals [10]. Behavioral economics offers an empirically knowledgeable viewpoint on how persons create decisions, containing the significant understanding that even subtle sorts of the environment can have eloquent influences on behavior. This explanation provides instances from the nonfiction and new government enterprises that incorporate ideas from behavioral economics to advance health, decision making, and government effectiveness [11]. Numerous factors underwrite to the differences in pediatric donor heart procedure, counting supervisory misunderstanding, the nonappearance of rules on pediatric donor heart approval, and dissimilarity among transplant series. Though, a likely extra funder to this problem is the behavioral factors prompting transplant team decisions in donor offer scenarios, a subject that has not however been studied in aspects [12]. A considerable disagreement can be made that behavioral economics lays itself well to the economics of health care, an area where customers often lack or have trouble understanding info in the face of countless dangerous selections, where an incorrect decision can have huge negative costs [13].

## 2. Organ Transplantation

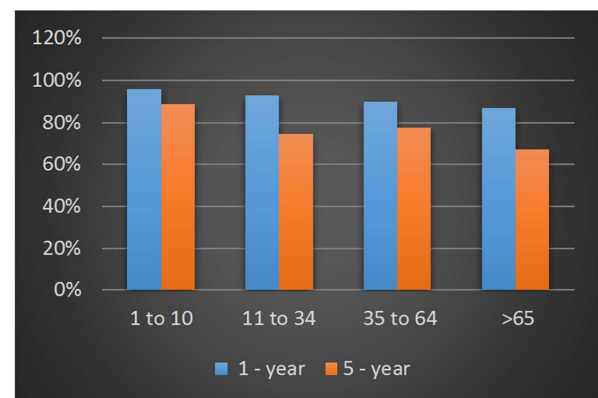
### 2.1. Pediatric Organs Transplantation

Although multiple efforts and transplant reports, the primary efficacious transplant did not occur until 1954, when a kidney from an unidentified twin was transplanted to her sibling. Stable bond endurance was a challenge due to the lack of immune suppression. As immunosuppression improved, organ transplantation with the heart, kidneys, lungs, pancreas, and small intestine boosted patient survival and transplantation with the introduction of cyclosporine (1983) [14]. Creating a registry of pediatric transplant patients is important for observational studies that may provide data for designing future RCTs and new perspectives to improve survival and long-term forecasters of reaction [15].

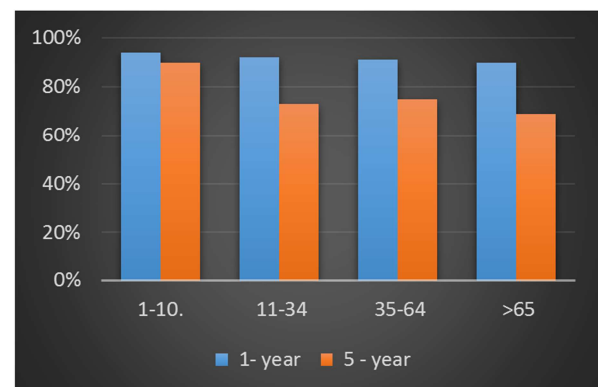
### 2.2. Challenges for Pediatric Transplant Patients and Relevant Psychological Intercessions

The importance of psychological evaluation of candidates for transplantation is widely recognized. Full screening of

potential transplant recipients is best done within a multidisciplinary team approach to ensure that patients and their families have a full understanding of transplantation and understanding. They do, it's done. To provide continuity of care [16]. The purpose of pre-transplant psychological assessment is to recognize possible risk aspects that may increase the risk of non-compliance and postoperative complications and provide information to inform treatment planning for individuals identified as high-risk [17].



**Figure 1.** The vertical axis refers to the percentage of graft survival and the horizontal axis to the recipient age. At one and five-year stages, transplant survival of all deceased donors is based on the age of the receiver. Source: OPTN / SRTR yearly Report 2004.



**Figure 2.** The vertical axis refers to the percentage of graft survival and the horizontal axis to the recipient age. At one and five-year stage, survival of living donor kidney transplant based on receivers age. Source: OPTN / SRTR yearly Report 2004.

### 2.3. Overall Models of Transplant Procedures

#### 2.3.1. Kidney and Kidney–Pancreas Transplant

About 5 to 10 children per million per year develop end-stage renal illness (ESRD). Hemodialysis or peritoneal dialysis is the only way to survive for children with ESRD. Unluckily, ESRD and dialysis can have many adverse effects, counting negative effects on the cardiovascular structure, development, nourishment, bone digestion, school presence, and child and family mental well-being. The risk of mortality in pediatric dialysis patients has been reported to increase 30-fold compared to the general population [18]. But the improvement in long-term transplant survival has been significant for young pediatric recipients of living or deceased donor transplants and

allografts (Figure 1). Two decades ago, it was believed that children had the worst transplant survival rates. But a recent analysis of OPTN / SRTR data has shown that young children have the best long-term transplant survival in any age group (Figure 2) [19, 20]. The first successful whole pancreas transplant with a kidney transplant was performed in 1966 (Table 2) by Lilly and Kelly at the University of Minnesota. The endurance rate of the transplanted pancreas is very different, partly due to disagreement over the definition of allograft failure (Table 2) [21].

### 2.3.2. Heart and Lung Transplant

The first prosperous long-term pediatric heart transplant was achieved in 1984 by Dr. Eric Rose (Table 2). Pediatric

heart transplantation and the administration of children with heart failure have come a long way from then, but donor availability, like all transplants, remains a limiting factor. Heart allocation based on the recipient's health status means that the "sickest" child should have the main priority according to the UNOS Children's Heart Allocation Plan [22]. Lung transplantation developed to be a viable clinical fact in 1983 with the introduction of the cyclosporine (Table 2). Priority among candidates depends mostly on the age group they are in (Table 1); Pediatric lung transplantation has generally developed, but after a highest in 2013, the rate of pediatric lung transplants has been comparatively little over the past few years [23].

**Table 1.** Summary of pediatric urgency in making a decision toward lung allocation [24].

Factor	Priority
Advantages of transplant, MUS	Adolescent volunteers are selected on a first-come, first-served basis
	After measuring the link profit and waiting list
	Urgency: Young people (age 11-0) are candidates for children Prioritize based on time on the waiting list
Allocation of the pediatric organ (lung)	Children volunteers have more priority than adults
	Nominations in the allocation of all child donors
	lungs

### 2.3.3. Bone Marrow and Stem Cell Transplant

Stem cells are non-specialized cells of the human body. They can differentiate into any cell of the creature and have the capability to regenerate themselves. Stem cells are existing in both embryos and mature cells. There are several stages of specialization [25]. Stem cell replacement is a general term that covers quite a few different methods. For allogeneic transplants, hematopoietic stem cells are taken from the bone marrow, peripheral blood, or umbilical cord blood of a healthy HLA-type donor (Table 2), who may be a domestic member or a distinct volunteer. For autologous transplantation, stem cells are taken from the patient's particular bone marrow or blood [26].

### 2.3.4. Liver Transplant

Doctor Tom Starzl implemented the initial prosperous pediatric liver transplant in 1968 [22, 27]. Back in the early years, children were transplanted only with whole organs [22]. Over the past 40 years, liver transplantation has evolved from a high-risk procedure to one that offers a high success rate for reversing liver dysfunction and excellent patient and transplant survival [28]. The liver is an immune organ compared to other transplant organs such as the heart, kidneys, or pancreas [29]. The liver, as the body's main digestive organ, has two groups of blood, the gateway vein, and the hepatic route. It is continually unprotected from blood-derived blood pathogens, which gives the liver an exclusive immune ranking [30].

**Table 2.** Type of organ transplantation procedures have been included (when first successfully implied), these procedures (Pancreas, Heart, Kidney, Lung, Bone marrow and stem cell, and Liver transplant) were included. Risks of the procedures (in every step of the procedure), and donor requirements, such as age, blood type, and any other aspects of the requirements are mentioned.

Types of Procedure	First Procedure	Risks	Donor requirements	References
Kidney Transplant	In 1953	Transplant rejection-Infections-Skin tumors -Proteinuria-Hypertension- allograft failure	Be over age 18-Be in good health and psychological condition-Have a compatible blood type.	[31]
Pancreas Transplant	in 1966	Infection - Excess blood sugar (hyperglycemia) or other metabolic problems - Urinary complications	Less than 45 years - with a body mass index (BMI) of less than 30	[32]
Heart Transplant	In 1984	Contagion - Hemorrhage while or after surgery - Body fluid masses that can reason heart failure.	It should be in a normal, disease-free condition that matches your blood type and/or tissue as much as possible	[14]
Lung Transplant	In 1983	Bleeding - Infection - Blockage of blood vessels to new lung (s) - Airway obstruction - Blood clots.	Age younger than 65 years- Absence of severe chest trauma or infection- Minimal pulmonary secretions	[33, 34]
Bone marrow and stem cell Transplant	In 1956	life-threatening problems- serious infections and graft-versus-host disease	aged between 17 and 30- blood test for tissue typing	[22]
Liver Transplant	In 1963	Graft rejection – Biliary complications – Vascular complications- life-threatening problems	Being in good health-Having a blood type-Being between 20 and 60 years old	[22, 35]

### 3. Behavioral Economics

#### 3.1. Psychology and Economics

The subject of the relationship between economics and psychology has a long and relatively complex history. Psychology is probably the closest neighbor to economics (Table 3). Psychological ideas, even before the classical school of economics, have always played a role in shaping economic thought [36]. The main theory used in economics is based on a simple but powerful model of behavior. Using the available information (Table 3) and the proper processing of this information, individuals choose to maximize a useful function. [37].

#### 3.2. Implementation of the Allocation System

Organ transplantation is lifesaving or life-saving treatment for those with end-stage organ failure. However, there are more people who need a transplant than there are members available for transplantation, therefore, implementation of an allocation system can certainly ameliorate such conditions. The first cardiac allocation system implemented in France was almost exclusively geographically based on the successive sharing of local, regional, and national members, and considered only ABO donor and recipient blood groups. The system was not fair due to logistics and inequality in waiting list areas, as well as differences in candidate profiles from one center to another [38].

#### 3.3. Rational Behavior

Rational choice theory refers to a number of strategies that

help to understand economic and societal behavior [39]. This theory takes up that a person performs a cost-benefit investigation to determine if a choice is proper for them [40]. Meanwhile, it shows that a person's self-centered sensible actions help improve the inclusive economy (Table 3). The elementary evidence of rational choice theory is that decisions made by single actors cooperatively create societal behavior. The theory of rational choice deals with three perceptions: rational performers, self-centeredness, and the invisible hand [41]. Rationality can be used as a premise for the behavior of people in a wide range of non-economic settings.

#### 3.4. Economic Matters

The transplant practice is very expensive (\$ 100,000 to \$ 300,000), and most people cannot afford it without insurance or assistance. Patients, when they are candidates for longer stages (i.e., 30 to 350 days) Paying bills, is considered more stressful than emergency patients because they have more time to collect (and care about) higher medical expenses (16). Based on the data provided to the Committee by the GAO as well as the literature published, the Committee has found that total costs associated with organ procurement and transplantation are likely to increase as a result of wider sharing [42]. The great fee of treatments and the need for long-term postoperative care make transplantation a long-term economic necessity for most families, particularly in times patient is the key source of income.

**Table 3.** 4 main aspects of any assessing social sciences (Main type of theory, main method, evaluation of theory, and main type of data) are inserted. To evaluate the effect of psychology we have divided it into two groups of Economic Psychology and Economics.

Aspect	Economic Psychology	Economics	Reference
The key category of theory	Real or positive (trying to explain real behavior)	Opposing to reality or norm (demanding to describe faultlessly rational behavior)	[43, 44]
Key method	Development of range-specific theory in the light of experimental findings	Obviously general modeling of very complex situations (economy, market, households, etc.)	
Assessment of theory	Numerical approaches used in explicit hypotheses	Morals of calculated finesse, straightforwardness, and quality suitability	
The key type of data	Questionnaire and experimental data- using the information available	Official statistics If information is used, several tests of choice to test hypotheses	

### 4. Decision Making

#### 4.1. Organ Transplantation Decision Making: Processes and Problems

Any type of organ transplant contains different processes and problems throughout the whole action. The lack of available organs poses challenges for SDM in transplantation. Institutional and multidisciplinary committees determine whether transplant patients are eligible, need additional testing, or be removed from the waiting list. Decisions made by the Selection Committee on the shortage of members take into account conscious ethical policies designed to modify historical methods of patient

selection based on perceived social value [45, 46].

#### 4.2. Utility in Organ Transplantation Decision Making

As charted in the UNOS White Paper on Multi-Organ Transplant Morals, the principle of utility indicates if the system "get the most out of the profit realized by the potential recipient population of these organs." [47]. The three utility dimensions presented by the UNOS Ethics Committee for Multi-Organ Transplant Analysis are post-transplant results, advantages, and dodging of uselessness. Results can be understood in terms of the difference between those who did and did not obtain the transplant. Therefore, this criterion includes waiting list survival and post-transplant survival [48, 49].

### **4.3. Emotion in Medical Decision Making**

Although medicine today is necessarily technology-related, it is still a service that involves human intersection, often requiring the help of management tools. In fact, medicinal counseling can be a very difficult example of human intersection [50]. When a child's information is cited on the online national waiting list to have an organ, parents might feel like their family has stirred from one period of hesitation to another. On one hand, the child has been diagnosed, and parents now know that he or she needs a transplant to stay healthy. On the other hand, there are numerous other individuals on the list, therefore, it may take months or even years to get a transplant, this will add up to the means of poor rational choices which in most cases comes from emotional decision making.

### **4.4. Rational Decision Making and Psychological Intercessions**

Rational decision-making is based on traditional consumer economic theory, in which individuals are assumed to make decisions - based on their indigenous preferences and largely unchangeable, using all available information - that maximizes their desirability [13]. It gets hard to illustrate the usage of crucial organs with patients, mostly due to the shortage of data on how patients see this subject [51].

## **5. Discussion**

### **5.1. Effect of Parent's Rational Decision Making on the Result of Transplantation**

The basis of the problem arising from the decision making when it's rational by the parents, before then during the process of pediatric decision making can be found in the roots of psychology, where behavioral economics lays in as well. Nonetheless, behavioral economics would be considered a part of psychology. Further evaluating this concern, we have explored human psychology where the key to understanding this issue must be. When taking care of something for a long period of time, it brings some psychological interventions with it as well, for instance, the sense of motherhood while taking care of a child (The word mothering signifies a universal connection toward the child instead of definite behavior of a sole individual). Discussing such a crucial decision led to understanding how deciding in pediatric transplantation differs from the regular type of transplantation. Moving on a decision on a regular type of transplantation in most cases depends on the donor's decision and transplant surgeons, meanwhile, in pediatric transplant cases, decision making takes a broader society to get to a conclusion. Behavioral economics in such cases kicks in and with the assistance of it as in the (table 2) explained, society of health care system can understand the trend of decision making and get to the optimal utility point; Maximizing the utility is a process that persons and

administrations pursue to reach the peak level of gratification from their economic decisions. The utility role processes the passion to which an individual's fulfillment is met. Finding the optimal point would be necessary for every organization to make the poor rational choices meet their lowest possible amount, it even could improve actions done by an individual or a whole organization. Defining psychology in economics has led us to broaden our vision to not only rely on statistical information but to have room for unexpected from humans' choice in such crucial moments in their lives to make the choice made, the best possible.

### **5.2. Processes and Problems of Making a Decision over Allocating Organs in Pediatric Transplantations**

Allocation of transplantation system has been a huge problem for decades ago. The allocation of rare donor organs is a vital topic of discussion amongst ethical, medical, and legal experts, the general public, and politicians. Making decisions on who receives the organ has been and still is a challenging decision to be made. During the last decades there has been an extreme number of enhancements over the procedure of the transplantation, decision making, and allocating organs through the community of receivers has not seen a significant chapter of itself. The process should be revised as the community that decides over the scarcity of organs and who should receive the organ, must be managed by the perfectly updated society of scientists. Dealing with such an issue requires a combination of fields of study including psychology and behavioral economics which has been the central core of this article, to obtain the optimal utility point which in the end will result in the least errors. Discussing the allocation of organs in pediatric surgeries intends even more attention, in such cases, a broader community is involved (Parents are the most effective crucial challenge). Parents will be at the center of this challenge because the decision that has been made "doesn't matter if their child will receive the organ or not" if the answer to the allocation is aligned with their desire, they will have to be open to upcoming challenges as well (if the surgery will be successful or not, and etc.), if the answer is against their desire they will be stuck in the same position to look and hope for the new organ to be received; therefore, parents must be advised through the process of decision making. Further on, the global organizations that are involved in the process of decision-making have a huge burden of responsibility for the fact that they must minimize the errors during this process.

### **5.3. Pediatric Procedure and Effect of Financial Issues on the Result of Transplantation**

Organ transplantation is an expensive technology that aids a relatively small number of people; therefore, it has been a challenging debate between organizations like insurances which eventually will decide on whether to cover the costs or not. Families who are facing such problem is in great peril

sometimes. As of 2020, the normal fee for a kidney transplant was around 442,500 U.S. dollars and the average cost for a Liver transplant was around 878,400 U.S. dollars in the USA [52], which is a huge amount of money for most families living in the U.S. Parents who have no insurances for such cases will suffer a long term situation as well, which might result in late decisions and putting their children is high risks as well as low probability of post-surgery survival. In the most practical way, this makes sense. More than 114,000 people in the United States are waiting for membership, and less than 35,000 joined last year, according to the United Nations Membership Network, or UNOS. "If you get a lifeguard, you have to be able to pay for it," says Kelly Green, executive director of HelpHopeLive, a Pennsylvania-based organization that has helped Manion. Allowing financial agents to determine who is on the waiting list seems unfair to many. UNOS data show that about half of all patients waiting for an organ in the United States have private health insurance.

## 6. Conclusion

Reviewing and researching Behavioral Economics and the Decision-Making process can give us essential information on how should we evaluate the result of Organ Transplantation based on the diverse psychological intervention of human beings. As a result, we have mentioned a few of the critical circumstances facing the procedures of transplanting especially in pediatric organ transplantation and other Economical factors which is the main concern of this study, thus, it is widely recommended for clinical workers and other organizations to put more effort on such crucial and key factors to have more desirable outputs.

## Conflict of Interest

All the authors do not have any possible conflicts of interest.

## Author Contribution

Mr. Sajjad Esmaeili Aghdam suggested the topic and wrote the article and research it, and all authors drafted and revised the article.

## References

- [1] Hoff K, Stiglitz JE. Striving for balance in economics: Towards a theory of the social determination of behavior. *Journal of Economic Behavior & Organization*. 2016; 126: 25-57.
- [2] Allport GW, & Odbert, H. S. Trait-names: A psycho-lexical study. *Psychological Monographs*, 47 (1), i-171. 1936.
- [3] Kosse AB-TD-TD-AF-F. The Relationship Between Economic Preferences and Psychological Personality Measures. 2012.
- [4] Russo J. decision-making. 2014.
- [5] Brockmann EN, Anthony WP. Tacit Knowledge and Strategic Decision Making. *Group & Organization Management*. 2002; 27 (4): 436-55.
- [6] Manara ARM, P. G.; O'Callaghan, G. "Donation after circulatory death" *British Journal of Anaesthesia* 108: i108-21. 2011.
- [7] Bernat JL, Capron AM, Bleck TP, Blosser S, Bratton SL, Childress JF, et al. The circulatory-respiratory determination of death in organ donation\*. *Critical Care Medicine*. 2010; 38 (3).
- [8] WHO Guiding Principles on human cell taot, Annexed to World Health Organization. 2008.
- [9] WHO FsitBoEot. 2016.
- [10] Siegel R, Gordon K, Dynan L. Behavioral Economics: A Primer and Applications to the UN Sustainable Development Goal of Good Health and Well-Being. *Reports*. 2021; 4 (2).
- [11] Matjasko JL, Cawley JH, Baker-Goering MM, Yokum DV. Applying Behavioral Economics to Public Health Policy: Illustrative Examples and Promising Directions. *Am J Prev Med*. 2016; 50 (5 Suppl 1): S13-S9.
- [12] Butler A, Chapman G, Johnson J, Amodeo A, Böhmer J, Camino M, et al. Part VII: Behavioral economics—A framework for donor organ decision-making in pediatric heart transplantation. *Pediatric Transplantation*. 2020; 24.
- [13] Rice T. The Behavioral Economics of Health and Health Care. *Annual Review of Public Health*. 2013; 34 (1): 431-47.
- [14] Walter S. Andrews BJK, Richard J. Hendrickson. Organ allocation and utilization in pediatric transplantation. 2017.
- [15] Malik S, Kassai B, Cochat P. Overview of pediatric organ transplantation: current opinion and future perspectives on immunosuppression. *Current Opinion in Organ Transplantation*. 2015; 20 (5).
- [16] Olbrisch M, Benedict S, Ashe K, Levenson J. Psychological assessment and care of organ transplant patients. *Journal of consulting and clinical psychology*. 2002; 70: 771-83.
- [17] Craven J, Rodin G. Psychiatric aspects of organ transplantation. *Jama-journal of The American Medical Association - JAMA-J AM MED ASSN*. 2021; 260.
- [18] Shroff R, Ledermann S. Long-term outcome of chronic dialysis in children. *Pediatr Nephrol*. 2009; 24 (3): 463-74.
- [19] Harmon WE H-ST, Magee JC et al.. Improvements in outcomes in pediatric renal transplantation: children less than 10 years of age now have best graft survival of all recipients. *Am J Transplant* 2003; 3 (Suppl. 5): 285.
- [20] Sarwal MM CJ, Millan MT, Salvatierra O Jr.. Adult-size kidneys without acute tubular necrosis provide exceedingly superior long-term graft outcomes for infants and small children: a single center and UNOS analysis. *United Network for Organ Sharing. Transplantation*. 2000.
- [21] Han DJ, Sutherland DE. Pancreas transplantation. *Gut Liver*. 2010; 4 (4): 450-65.
- [22] Andrews WS, Kane BJ, Hendrickson RJ. Organ allocation and utilization in pediatric transplantation. *Semin Pediatr Surg*. 2017; 26 (4): 186-92.

- [23] Kirkby S, Hayes D, Jr. Pediatric lung transplantation: indications and outcomes. *J Thorac Dis.* 2014; 6 (8): 1024-31.
- [24] William E. Harmon RAM, Jorge D. Reyes, Nancy D. Bridges, Stuart C. Sweet, Cindy M. Sommers, Mary K. Guidinger. Pediatric transplantation. 1994–2003.
- [25] Zakrzewski W, Dobrzyński M, Szymonowicz M, Rybak Z. Stem cells: past, present, and future. *Stem Cell Research & Therapy.* 2019; 10 (1): 68.
- [26] Lennard AL, Jackson GH. Stem cell transplantation. *West J Med.* 2001; 175 (1): 42-6.
- [27] Starzl TE, Groth CG, Brettschneider L, Penn I, Fulginiti VA, Moon JB, et al. Orthotopic Homotransplantation of the Human Liver. *Annals of Surgery.* 1968; 168 (3): 392-415.
- [28] Thomson AW, Vionnet J, Sanchez-Fueyo A. Understanding, predicting and achieving liver transplant tolerance: from bench to bedside. *Nature Reviews Gastroenterology & Hepatology.* 2020; 17 (12): 719-39.
- [29] Calne RY. Prope tolerance—the future of organ transplantation from the laboratory to the clinic. *International Immunopharmacology.* 2005; 5 (1): 163-7.
- [30] Jenne CN, Kubes P. Immune surveillance by the liver. *Nature Immunology.* 2013; 14 (10): 996-1006.
- [31] Hatzinger M, Stastny M, Grützmacher P, Sohn M. [The history of kidney transplantation]. *Urologe A.* 2016; 55 (10): 1353-9.
- [32] Daniel Casanova obotSPTG. Pancreas transplantation: 50 years of experience. pages 254-260 (May 2017).
- [33] Venuta F, Van Raemdonck D. History of lung transplantation. *J Thorac Dis.* 2017; 9 (12): 5458-71.
- [34] Chaney J, Suzuki Y, Cantu E, 3rd, van Berkel V. Lung donor selection criteria. *J Thorac Dis.* 2014; 6 (8): 1032-8.
- [35] Meirelles Júnior RF, Salvalaggio P, Rezende MB, Evangelista AS, Guardia BD, Matielo CE, et al. Liver transplantation: history, outcomes and perspectives. *Einstein (Sao Paulo).* 2015; 13 (1): 149-52.
- [36] Stavros A. and Katselidis I. The Relationship between Psychology and Economics: Insights from the History of Economic Thought. 2017.
- [37] DellaVigna S. Psychology and Economics: Evidence from the Field. *Journal of Economic Literature.* 2009; 47 (2): 315-72.
- [38] Richard Dorent CJ, Benoît Audry, Florian Bayer, Camille Legeai, Christelle Cantrelle, Jacqueline M. Smits, Howard Eisen, Christian Jacquelinet, Pascal Leprince, Olivier Bastien., New French heart allocation system: Comparison with Eurotransplant and US allocation systems. 2020.
- [39] Easley LEBaD. "The New Palgrave Dictionary of Economics, 2nd Edition. 2008.
- [40] Gary Browning AH, Frank Webster. Understanding Contemporary Society: Theories of the Present, London: SAGE Publications. 2000.
- [41] Levin JaM, P. Introduction to choice theory. 2004.
- [42] Policy. IoMUCoOPaT. Organ Procurement and Transplantation: Assessing Current Policies and the Potential Impact of the DHHS Final Rule. Washington (DC): National Academies Press (US). 1999.
- [43] Fontana M, Ambrosino A, Gigante A. "Shifting boundaries in Economics: the Institutional Cognitive strand" 2015.
- [44] Rabin M. Psychology and Economics. *Journal of Economic Literature.* 1998; 36 (1): 11-46.
- [45] E. J. Gordon ZB, S. E. Jensen, A. Lok-Ming Lehr, J. Franklin, Y. Becker, L. Sherman, W. J. Chon, N. Beauvais, J. Hanneman, D. Penrod, M. G. Ison, M. M. Abecassis. Opportunities for Shared Decision Making in Kidney Transplantation. 2013.
- [46] Rettig RA ME. Implementing the end-stage renal disease program of Medicare. Santa Monica, CA: The RAND Corporation (R-2505-HCFA). 1980.
- [47] US OECEiomt, Department of Health and Human Services e. A detailed review from the Organ Procurement and Transplantation Network regarding all of the ethical implications of multiorgan transplantation. 2019.
- [48] Kim W, Kremers W. Benefits of "The Benefit Model" in liver transplantation. *Hepatology (Baltimore, Md).* 2008; 48: 697-8.
- [49] Cheng XS, Wall A, Teuteberg J. Ethical decision-making in simultaneous heart–liver transplantation. *Current Opinion in Organ Transplantation.* 2020; 25 (5).
- [50] Mendonça FV, Catalão-Lopes M, Marinho RT, Figueira JR. Improving medical decision-making with a management science game theory approach to liver transplantation. *Omega.* 2020; 94: 102050.
- [51] Volk ML, Tocco RS, Pelletier SJ, Zikmund-Fisher BJ, Lok AS. Patient decision making about organ quality in liver transplantation. *Liver Transpl.* 2011; 17 (12): 1387-93.
- [52] Amount charged for select organ transplants in the U.S. as of 2020 [Internet]. 2020.