Received: 7 March 2022 | Revised: 6 December 2022 | Accepted: 16 December 2022

DOI: 10.1111/ctr.14889

Clinical TRANSPLANTATION
The Journal of Clinical and Translational Research
WILEY

ORIGINAL ARTICLE

Trends in organ donation and transplantation over the past eighteen years in Iran

Mahdi Shadnoush[1] | Marzieh Latifi[2] | Habib Rahban[3,4] | Elahe Pourhosein[5] | Alireza Shadnoush[6] | Arefeh Jafarian[7] | Sanaz Dehghani[8,9]

[1]Faculty of Nutrition & Food Technology, Shahid Beheshti University of Medical Sciences, Tehran, Iran

[2]Organ Procurement Unit, Sina Hospital, Tehran University of Medical Sciences, Tehran, Iran (Email: marziye_latifi@yahoo.com)

[3]Cardiovascular Research Foundation of Southern California, Beverly Hills, California, USA

[4]Southern California Medical Education Consortium, Temecula Valley Hospital, Universal Health System, Temecula, California, USA

[5]Organ Procurement Unit, Sina Hospital, Tehran University of Medical Sciences, Tehran, Iran
(Email: elahepoorhosein1990@gmail.com)

[6]University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

[7]Iranian Tissue Bank & Research Center, Tehran University of Medical Sciences, Tehran, Iran

[8]Organ Procurement Unit, Sina Hospital, Tehran University of Medical Sciences, Tehran, Iran

[9]Iranian Tissue Bank & Research Center, Tehran University of Medical Sciences, Tehran, Iran

Correspondence
Sanaz Dehghani, Organ Procurement Unit, Sina Hospital, Tehran University of Medical Sciences, Tehran, Iran. Sina university Hospital, Hassan-abad Sq.Emam Khomeini St. Tehran, Iran.
Email: sanaz_dehghani2002@yahoo.com

Abstract

Background: This article will review the trends in organ donation over the past 18 years in Iran.

Material and methods: All donation and transplantation statistics were extracted by reviewing the Organ Procurement and Transplantation database of the Ministry of Health of Iran from 2002 to 2019.

Results: Iran's national deceased donation rate from 2002 to 2019 increased 19.06-fold from .75 to 14.3 per million population (PMP). After the beginning of the COVID-19 pandemic, the rate of organ donation in Iran decreased significantly. Although 1 year after the onset of the pandemic, due to the widespread adoption of COVID19 vaccination, the rate of organ donation began to increase again, this system is still under performing. During the years under examination, the rate of deceased kidney donation increased significantly compared to living kidney donation and reached up to 2001 kidney transplantations in 2021. From 2002 to 2019, the rate of liver transplants increased to 12.8. Likewise, the rate of heart transplants increased 8.4-fold, from 15 to 126 cases during the same time.

Conclusion: Although a personal choice, the process of organ donation involves medical, legal, ethical, organizational, and social aspects. The trend in increasing donation rates over the past years can be attributed to multiple influences, which include rigorous team efforts in the organ donation and transplantation systems, in addition to creating a donation culture and promoting donation through media platforms. Moreover, we can say that the rising rates of deceased donor transplantation also can drive down rates of commercial living donor transplantation.

KEYWORDS
deceased donation, living donation, organ donation, organ transplantation, PMP

1 | INTRODUCTION

Iran is a Middle Eastern country with a population of over 82 million, mainly comprised of a young population. With 31 provinces, contemporary Iran has an area of 636,372 square miles.[1]

Though the Iranian population consists of different religious beliefs and cultures, a report by the statistical center of Iran found that most Iranians are Muslims (96.6%). Approximately 90%–95% belong to the Shi'a branch of Islam, the official religion of Iran, and nearly 5%–10% belong to the Sunni branch of Islam. The remaining 2% are non-Muslim religious minorities, including Zoroastrians, Jews, Christians, and others.[2]

Car accidents in Iran are the highest among the Eastern Mediterranean area and are responsible for 14.5% of total deaths from all causes in this region.[3] The yearly death volume due to car accidents in Iran is 16000.[4,5] Thus, it has been reported as the second leading cause of death after cardiovascular causes.[6] Statistics from the Ministry of Health's organ procurement and transplantation database confirms that one of the largest groups of brain death victims in Iran are young men who have sustained a head trauma in a motor vehicle accident.[7]

In Iran, every 10 min, one patient is added to the waiting list for organ transplantation, and, every 3 h, one person on the waiting lists dies due to organ shortage for transplantation.[8]

Between 2500 and 4000 brain deaths occur annually in Iran.[9] In 2019, Iran reached a high of 14.3 donors per million population (PMP); despite this, 7–10 patients on the waiting list die every day.[7]

During the COVID-19 pandemic in Iran, similar to other countries, deceased donation and transplantation programs dramatically decreased, and in some cases halted, all types of transplantations.[10] Nearly 1 year from the onset of the COVID-19 pandemic, as vaccination rates spread and began to affect the mortality rates, organ donation in Iran began to increase again, with 925 cases being donated. The PMP was calculated as 11.04 in 2021.[10]

Of note, Iran is one of the 29 member countries of the Middle East Society for Organ Transplantation (MESOT), which has a collective population of more than 600 million.[11] Even though Iran has the most successful rate of organ donation and transplantation in this region, the rate of PMP in Iran is lower than that of other countries such as Spain (49 PMP), USA (36.38 PMP), and Croatia (34.63 PMP).[11]

This article will review the trends in organ donation in Iran over the past 18 years by analyzing the Organ Procurement and Transplantation Database of the Ministry of Health. It also will discuss the reasons to improve the country's activities in organ donation and transplantation.

The Organ Procurement Units (OPUs) and Recognition Centers (RC) responsible for organ donation and transplantation in Iran are entities designated by the Transplantation Office of the Ministry of Health to provide donor services within defined geographical areas.

2 | METHODS

In Iran, organ and tissue procurement and transplantation is done under direct supervision of the Ministry of Health and OPUs are responsible for (a) detection of brain deaths for which there are three methods including Inspector Project (using trained nurses for visiting the ICUs every day), Telephone Donor Detection Program (using expert medical staffs for primary evaluation of possible donors and following GCS 5 and 4 and GCS3 non-brain dead cases by phone), and Hospital Reporting (reporting the possible donors to the OPUs by hospitals[12,13]), (b) facilitating donor assessments, (c) donor management, and (f) consultations and procurement.

Due to Iran's geographical vastness, RCs have been defined. These centers are a subset of OPUs that are responsible for brain death detection, donor assessment, donor management, and consultations with the deceased's families. After consent has been obtained, RCs transfer the case to OPUs for donation.

In total, there are 114 national organ donation and transplantation units defined in Iran. These are comprised of 24 Organ Procurement Units (OPU) and 31 Recognition Centers (RC) and 59 transplantation unit.

Data pertaining to the country's growth in transplant centers, the rate of deceased and living organ donations, OPUs' activities, and PMP rates were collected over 19 years from 55 OPU and RC centers in collaboration with Iran's Ministry of Health's Organ Donation and Transplantation Office.

It is worth mentioning that all processes for deceased organ donation are free for graft recipients in Iran.

3 | HISTORY OF ORGAN DONATION AND TRANSPLANTATION IN IRAN

The modern era of organ transplantation in Iran began in 1935, when the first cornea graft was performed in Tehran.[14] The first kidney transplantation from a living related donor (LRD) took place in 1967 in Shiraz.[15] Bone marrow transplantation began in 1990,[16] liver and heart transplantation in 1993,[16] lung transplantation in 2001,[16] heart and lung transplantation in 2002,[16] and pancreas transplantation in 2006.[17]

In 1988 Controlled Living Unrelated Renal Transplant Program (CLURTP) was funded by the government. Soon it was accepted by the Council of Guardians due to many dialysis patients having no LRD, or their potential LRD was reluctant.[18,19]

If a patient prefers or has to rely on living unrelated renal transplant (LURD), they will be referred to the Iranian Patients' Kidney Foundation. All 18–35-year-old people who wish to donate a kidney are referred to the foundation for registration. It worth to mention that, process of finding a LURD or to refer the kidney patient and donor to a transplant team is free of charge for both donors and recipients. After renal transplantation, the LURD received financial incentive from the recipient.[20] The other advantage of CLURTP is having no role for a middleman or agency. The university hospitals manage all transplant teams. The Iranian Society of Organ Transplantation closely observes this program for ethical issues. Per current guidelines, foreigners are not a candidate for renal transplantation from Iranian living-unrelated kidney donors.[21]

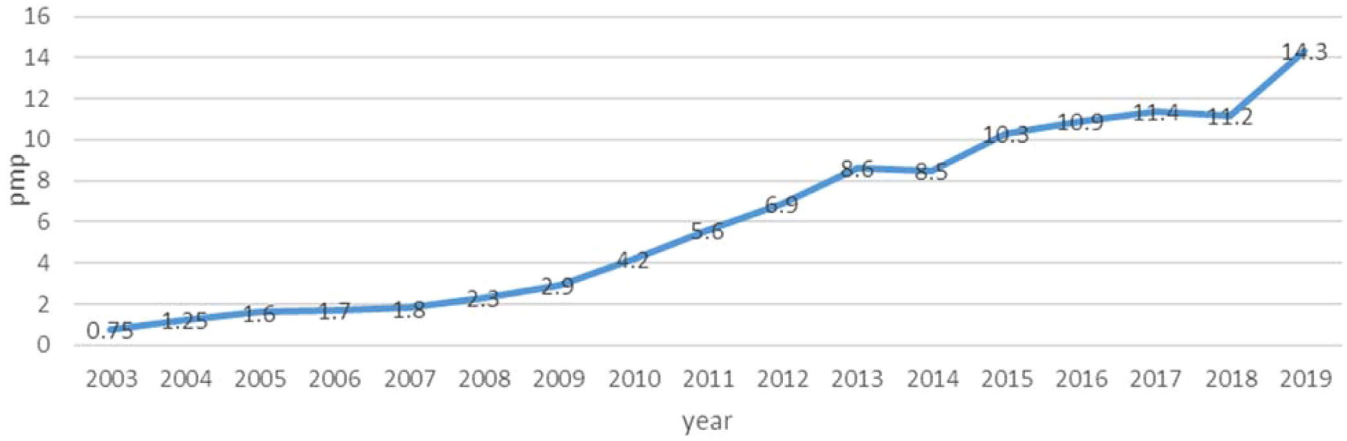


FIGURE 1 Growth of deceased donors in Iran during 2003–2019 by PMP

Since 1989, there have been multiple approvals obtained from religious figures in Iran allowing deceased organ donation.[22] Both tissue and organ transplantation legislations were officially approved in the year 2000 by the parliament. Due to both cultural and religious beliefs and lack of public awareness of the concept of brain death, deceased organ transplantation had not been successful in Iran with only a total of 84 deceased kidney transplants having been performed by the end of the year 2000.[2]

4 | CONSENT LEGISLATION IN IRAN

In some countries, including Germany and Australia and Iran, deceased organ procurement is conducted under the informed consent (Opt-In or explicit consent) principle.[23] Under an Opt in consent legislation, deems someone's organs can be used only if they announced their consent in an obvious way such as applying for a donor card. In addition to declaring the consent, the family must allow donation at the time of brain death, and having a donor card is not a legal permission for donation.[24]

5 | SUMMARIZED STATISTICS ON ORGAN TRANSPLANTATION IN IRAN

5.1 | Results

Although Iran's national deceased donation rate has increased by 19.06-fold between 2003 and 2019, the system is still underperforming. The growth rate of kidney transplantations from deceased donors in Iran is summarized in Figure 1.

The national deceased donation rate is still below the proposed ideal target of 45 PMP and well below those of countries leading in organ donation. Organ donation is unevenly distributed in Iran ranging from 0 to 42 donations PMPs in different provinces (e.g., Sistan & Baluchistan: .74 PMP; Goulestan 3.09 PMP; Kordestan: 3.55; Illam: 1.67 PMP).

Although the total rate of organ donation in Iran is lower than the rate of brain death cases, there has been an increasing growth in the donation rate from 2002 to 2019. Moving forward from 2019, there was a decrease in 2020 but the rate increased again in 2021.

Living non-related donation (LNRD) of kidneys was legalized in 1988, and an associated transplantation system was established.[25] As a result, the number of transplant teams increased from 2 to 30. The number of kidney transplantations that were performed increased rapidly.[18]

Four years later, the first organ donation from a brain-dead donor was performed. By the end of 2005, more than 78% of all kidney transplantations had been from LNRD.[18] Following the criticisms of the past decade, the performance of deceased donation in Iran has considerably improved.

Due to legislative efforts, improved public awareness, and addressing various cultural hesitancies, kidney transplants from deceased donors have significantly increased between 2014 and 2019.

The number of transplants from living donors has decreased in the recent years compared to transplants from brain-death donors, which sounds to be because of increasing in the pool of brain-dead donors. survival rates of kidney recipients from brain-dead cases are same as recipients from related living donors.

In 2019, kidney transplants were carried out in 32 transplant centers in Iran; 1354 from deceased donors and 747 from living donors.

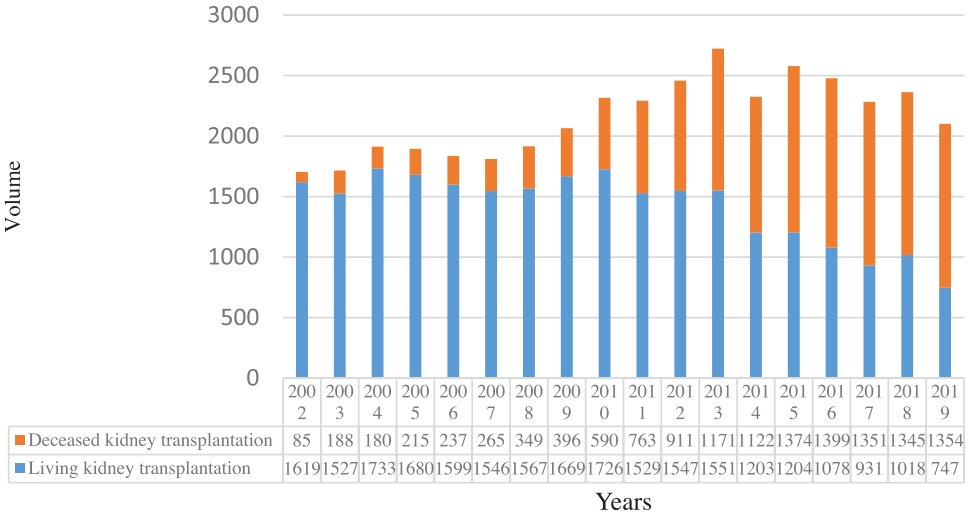
Compared to the living kidney donations, donation of deceased kidney has increased during these years. Hence, the activities of kidney transplants within the country reached up to 2001 transplants in 2019. The number of kidneys transplanted per donor (living and deceased donations) in Iran are summarized in Figure 2.

From 2002 to 2019, a total of 7928 livers were procured from deceased donors. The liver transplanted per donor has increased to 12.8 in 2019.

The rate of heart transplantation had an 8.4-fold increase from 15 cases in 2002 to 126 cases in 2019.

Up until 2019, 343 pancreas transplantations were performed in Iran. The pancreas transplanted per donor in 2019 has been reported to be approximately .38.

The first lung transplant was performed in 2001, and to date 170 lung transplantations have been conducted.



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Deceased kidney transplantation	85	188	180	215	237	265	349	396	590	763	911	1171	1122	1374	1399	1351	1345	1354
Living kidney transplantation	1619	1527	1733	1680	1599	1546	1567	1669	1726	1529	1547	1551	1203	1204	1078	931	1018	747

FIGURE 2 The kidney transplant volume (living and deceased donation) in Iran (2002–2019)

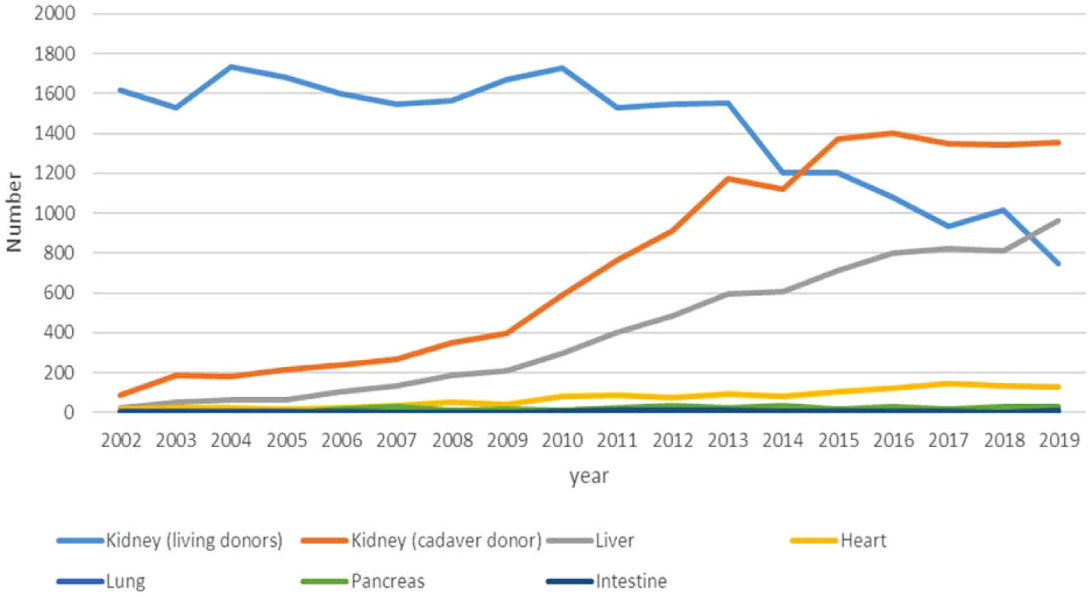


FIGURE 3 The profile of the Iranian transplant system during 2002–2019

In total, from the beginning of transplantations in Iran, 62295 transplants have been performed, of which there were 52383 kidneys, 7960 livers, 1370 hearts, 170 lungs, 343 pancreases, and 69 small intestine transplantations.

The profile of the Iranian transplantation system is summarized in Figure 3.

6 | STATISTICS ON ACTUAL DECEASED ORGAN DONATION IN IRAN

According to the Transplantation Office of the Ministry of Health, the mean age of the deceased organ donors in Iran has increased from 30 ± 14.1 in 2003-2018 to 39.3 ± 18.1 (Range:73, median 40) in 2019.

In 2021, among the organ donations in Iran, the most prevalent cause of brain death was due to cerebrovascular accidents (CVA) followed by head trauma, toxicity, hypoxia, and brain tumors. Henceforth, it is worth noting that the most prevalent cause of brain death before 2019 had been head trauma.

7 | VOLUME OF END-STAGE ORGAN FAILURE IN IRAN

By the end of 2019, 6240 patients were on the waiting list for a kidney, 814 for a liver, and 768 for a heart transplant. Organ availability for patients on the waiting list are insufficient to match the increasing demands.

8 | DISCUSSION

This article addresses the trends, practices, and characteristics of organ transplantations through analyses conducted by the Transplantation Office of the Ministry of Health in Iran.

In spite of the modest increases in the numbers of organ donations and transplants in Iran, there still is a dire shortage of organs.[26] Several factors can have positive or negative impacts on organ donation in Iran:

- -Families' perspectives and understanding, and personal experiences towards organ donation.[27,28]
- -Use of mass media platforms, such as TV.[29,30] Media has had a significant and prompt effect over the past several years.[31]
- -Establish OPUs and RCs in all universities, as well as to keep previous OPUs upgraded and organize donor detection systems.
- -Training the coordinators in all provinces has been another key factor in promoting the organ donation rates.[32]
- -In provinces with less-than-average rates of organ donation, an experienced coordinator has been considered as a support coordinator to supervise the whole donation process.
- -New strategies have been applied to expand the donor pool, one of which has been to use marginal donors for donation.
- -The presence of specialized personnel trained in the donor detection process and in how to approach the deceased's family members and explicate organ transplantation has always been considered important in the success of transplantation programs.
- -Close collaboration with the DTI Foundation, in addition to several TPM training courses that have been held for the medical staff in Iran. Physicians in charge of the brain-dead cases, through efficient training and courses, are appropriately informed about the modified indications for donation.
- -Establishing an efficient computer system for organ allocation that allocates organs based on medical urgency with the patients on the waiting lists,[33] access to transplants has improved for highly crucial patients and increased the effectiveness of the national organ-sharing programs for these patients.

In Iran, organ transplantation has been accepted in accordance with its specific values and cultures. According to studies, the religious, social, and cultural beliefs of the family can play a major role on their consent for donation.[34–40] According to Mojtabaei et al.,[41] religious and cultural reasons are listed as the leading cause of organ donation proposal rejection, with the greater proportion of religious refusals (66.6%) coming from the Sunni population.

Reports have shown lower organ donation rates in provinces with a majority Sunni population. As the most important factor, awareness of religious leaders' order, known as Fatwa, significantly guides people's inclination toward organ donation. Most religious leaders do agree with organ donation from brain dead cases. However, public awareness seems insufficient at this point and needs further attention.[42]

Moreover, to increase the rate of organ donation, the following items are considered as ongoing programs in Iran:

- -Attempting to increase the pool of donors by making donations after circulatory death (DCD).
- -Use of marginal donors due to the increasing age of donors in Iran.
- -Reactivating pancreas transplant centers and increasing the number of kidney-pancreas and liver-pancreas transplants, due to the prevalence of diabetes in Iran.
- -Designing a heart and liver registry system to estimate the number of patients in need of heart and liver transplants.
- -Establishing an integrated national registry system for all steps, from donation to organ transplantation and waiting lists, as well as post-transplant patient follow up.

9 | CONCLUSION

This paper provides a comprehensive review of Iran's national data on organ donation and transplantation. Increasing donation rates have been a multifactorial trend, including team efforts in Iran's organ donation and transplantation systems, increasing cultural awareness of transplantation, and promotion through the media.

Although a personal choice, the process of organ donation involves medical, legal, ethical, organizational, and social aspects.[27] Further expertise of the ICU team and continuous collaboration with mass media outlets, especially TV, would potentially result in higher rates of organ donation. Although there are many elements fundamental to improving the organ donation system, the factors providing the highest impact are hiring trained dedicated personnel (OPUs directors and in-hospital donation specialist teams) and tackling cultural and religious issues. For quality purposes and more satisfaction for the families, all coordinators should participate in seasonal classes on methods for obtaining consent under the transplant division of the health ministry.

The use of organs from expanded and nonstandard risk donors and the initiating of the donation system after cardiac death, along with raising public awareness about the concept of brain death, in addition to collaboration with mass media platforms to promote organ donation could potentially have a positive effect.

ACKNOWLEDGMENT

The authors wish to acknowledge all the OPU and RC personnel, as well as all the transplant centers. A special thanks to the Ministry of Health's Organ Transplant and Donation Office for providing the data.

CONFLICTS OF INTEREST

There are no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author.

ORCID

Mahdi Shadnoush https://orcid.org/0000-0002-3716-0994
Marzieh Latifi https://orcid.org/0000-0003-3178-5405
Habib Rahban https://orcid.org/0000-0002-7679-1457
Elahe Pourhosein https://orcid.org/0000-0001-6678-6569
Alireza Shadnoush https://orcid.org/0000-0002-7849-6734
Arefeh Jafarian https://orcid.org/0000-0003-0576-087X
Sanaz Dehghani https://orcid.org/0000-0001-5946-2611

REFERENCES

1. Danaei G, Farzadfar F, Kelishadi R, et al. Iran in transition. *Lancet*. 2019; 393(10184): 1984-2005.
2. Ghods A. The history of organ donation and transplantation in Iran. *Exp Clin Transplant*. 2014; 12: 38-41. Suppl.
3. Soori H, Hussain SJ, Razzak JA, Road safety in the Eastern Mediterranean Region -findings from the Global Road Safety Status Report. 2011.
4. Bakhtiyari M, Mehmandar MR, Khezeli M, Latifi A, Jouybari TA, Mansournia MA. Estimating the avoidable burden and population attributable fraction of human risk factors of road traffic injuries in Iran: application of penalization, bias reduction and sparse data analysis. *Int J Inj Contr Saf Promot*. 2019; 26(4): 405-411.
5. Pourhosein E, Bagherpour F, Latifi M, et al. The influence of socioeconomic factors on organ donation in Iran: findings from a single center study. Wiley 111 River St, Hoboken 07030-5774, NJ USA; 2021:218-218.
6. Shahbazi F, Nazari SSH, Soori H, Khodakarim S. Socioeconomic inequality in mortality from road traffic accident in Iran. *J Res Health Sci*. 2019; 19(1): e00437.
7. Organ dontion statistics. Ministry of Health Accessed 8.22, 2021. medcare.health. Accessed month: 06, 2022. gov.ir/hospman/dtsd/default.aspx
8. Pourhosein E, Bagherpour F, Latifi M, et al. The influence of socioeconomic factors on deceased organ donation in Iran. *kjt*. 2022; 36(1): 54-60. doi: 10.4285/kjt.21.0034
9. Abbasi P, Lebni JY, Nouri P, Ziapour A, Jalali A. The obstacles to organ donation following brain death in Iran: a qualitative study. *BMC Med Ethics*. 2020; 21(1): 1-9.
10. Latifi M, Bagherpour F, Jafarian A, et al. Evaluating the impact of COVID-19 pandemic on organ donation and transplantation activities in Iran. *Shiraz E Med J*. 2022; 23(1).
11. Mekkodathil A, El-Menyar A, Sathian B, Singh R, Al-Thani H. Knowledge and willingness for organ donation in the Middle Eastern region: a meta-analysis. *J Relig Health*. 2019: 1-14.
12. Najafizadeh K, Ghobadi O. Persian possible donor detection program, a way to decrease shortage of organ donors. *Transplantation*. 2017; 101. doi: 10.1097/01.tp.0000524967.10853.63
13. Etemadi A, Ghobadi O, Latifi M, et al. National implementation of Persian possible donor detection program: an 8-month efficiency evaluation. *Transplantation*. 2020; 104(S3): S233. doi: 10.1097/01.tp.0000699600.66652.74
14. Kiani M, Abbasi M, Ahmadi M, Salehi B. Organ transplantation in Iran; current state and challenges with a view on ethical consideration. *J Clin Med*. 2018; 7(3): 45.
15. Einollahi B, Nafar M, Bakhtiari S, Hajarizadeh B, Aghighi M. Epidemiology of chronic renal failure in a community based mass screening in Tehran, Iran. *Nephrol Dial Transplant*. 2003: 18.
16. Larijani B, Zahedi F, Taheri E. Ethical and legal aspects of organ transplantation in Iran. *Transplant Proc*. 2004; 36(5): 1241-1244. doi: 10.1016/j.transproceed.2004.05.065
17. Mahdavi-Mazdeh M, Rouchi AH, Rajolani H, Norouzi S, Aghighi M, Ahrabi S, Transplantation Registry in Iran. *Transplant Proc*. 2008;40(1):126-128. doi: 10.1016/j.transproceed.2007.11.010
18. Ghods AJ, Savaj S. Iranian model of paid and regulated living-unrelated kidney donation. *Clin J Am Soc Nephrol*. 2006; 1(6): 1136-1145.
19. Mahdavi-Mazdeh M. The Iranian model of living renal transplantation. *Kidney Int*. 2012; 82(6): 627-634. doi: 10.1038/ki.2012.219
20. Simforoosh N, Basiri A, Tabibi A, et al. Living unrelated versus related kidney transplantation: a 25-year experience with 3716 cases. *Urol J*. 2016; 13(1): 2546-2550.
21. Ghods AJ. Renal transplantation in Iran. *Nephrol Dial Transplant*. 2002; 17(2): 222-228. doi: 10.1093/ndt/17.2.222
22. Akrami SM, Osati Z, Zahedi F, Raza M, Brain death: recent ethical and religious considerations in Iran. *Transplant Proc*. 2004;36(10):2883-2887. doi: 10.1016/j.transproceed.2004.10.046
23. Abadie A, Gay S. The impact of presumed consent legislation on cadaveric organ donation: a cross-country study. *J Health Econ*. 2006; 25(4): 599-620. doi: 10.1016/j.jhealeco.2006.01.003
24. Saunders B. Opt-out organ donation without presumptions. *J Med Ethics*. 2012; 38(2): 69-72.
25. Major RW. Paying kidney donors: time to follow Iran? *McGill J Med*. 2008; 11(1): 67.
26. Aghayaw HR, Arjmand B, Emami-Razavi SH, et al. Organ donation workshop – a survey on nurses' knowledge and attitudes toward organ and tissue donation in Iran. *Int J Artif Organs*. 2009; 32(10): 739-744. doi: 10.1177/039139880903201005
27. Abbasi M, Kiani M, Ahmadi M, Salehi B. Knowledge and ethical issues in organ transplantation and organ donation: perspectives from Iranian health personnel. *Ann Transplant*. 2018; 23: 292.
28. Forsberg A, Lennerling A, Fridh I, Rizell M, Lovén C, Flodén A. Attitudes towards organ donor advocacy among Swedish intensive care nurses. *Nurs Crit Care*. 2015; 20(3): 126-133.
29. Latifi M, Najafizadeh K, Pourmohammadi A, et al. Effect of TV advertisement on donor card registration. *Transplantation*. 2018; 102.
30. Parsa P, Taheri M, Rezapur-Shahkolai F, Shirahmadi S. Attitudes of Iranian students about organ donation: a qualitative study. *BMC Med Ethics*. 2019; 20(1): 1-11.
31. Najafizadeh K, Ghobadi O, Shafaghi S. Media effect on organ donation: which program? *Transplantation*. 2017; 101: S55. doi: 10.1097/01.tp.0000525064.73009.3c
32. Malek-Hosseini SA, Habibzadeh F, Nikeghbalian S. Shiraz organ transplant center: the largest liver transplant center in the world. *Transplantation*. 2019; 103(8): 1523-1525. doi: 10.1097/tp.0000000000002581
33. Huang J, Wang H, Fan ST, et al. The national program for deceased organ donation in China. *Transplantation*. 2013; 96(1): 5-9. doi: 10.1097/TP.0b013e3182985491
34. Conesa C, Ríos A, Ramírez P, et al. Psychosocial profile in favor of organ donation. *Transplant Proc*. 2003;35(4):1276-1281. doi: 10.1016/S0041-1345(03)00468-8
35. Zambudio AR, Conesa C, Ramírez P, et al. What is the attitude of hospital transplant-related personnel toward donation? *J Heart Lung Transplant*. 2006; 25(8): 972-976. doi: 10.1016/j.healun.2006.04.004
36. Demırkiran O, Bozbay S, Elmaagac M, Agkoç M. *Religious and cultural aspects of organ donation in the Turkish population*. Elsevier; 2019: 2158-2162.
37. Can F, Hovardaoglu S, Organ donation: a comparison of donating and nondonating families in Turkey. *Transplant Proc*. 2017;49(9):1969-1974. doi: 10.1016/j.transproceed.2017.09.032
38. Madli F, Sondoh Jr SL, Totu A, Annuar SNS. Exploring the impact of religious belief for organ donation promotion through social media platform: a critical review. *Malays J Bus Econ*. 2019.
39. Latifi M, Pauli J, Dehghani S, Nejad MS. Application of theory of planned behavior on organ donation behavior: a systematic review. *Saudi J Kidney Dis Transpl*. 2021; 32(5): 1201.
40. Ghaffari M, Rakhshanderou S, Najafizadeh K, Ramezankhani A, Latifi M. Determinants of medical students for intention to organ donation: application of theory of planned behavior. *Saudi J Kidney Dis Transpl*. 2019; 30(6): 1375.

41. Mojtabaee M, Ghorbani F, Mohsenzadeh M, Beigee FS, Update on causes of family refusal for organ donation and the related factors: reporting the changes over 6 years. *Transplant Proc*. 2018;50(1):10-13. doi: 10.1016/j.transproceed.2017.11.021
42. Afzal Aghaee M, Dehghani M, Sadeghi M, Khaleghi E. Awareness of religious leaders' fatwa and willingness to donate organ. *Int J Organ Transplant Med*. 2015; 6(4): 158-164.

How to cite this article: Shadnoush M, Latifi M, Rahban H, et al. Trends in organ donation and transplantation over the past eighteen years in Iran. *Clin Transplant*. 2023;37:e14889. https://doi.org/10.1111/ctr.14889