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The legal and ethical issues in organ donation and transplantation – a bibliometric analysis

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Abstract: The individualistic challenges in the successful development of organ donation and transplantation systems worldwide include legal and regulatory policies, insufficient infrastructure, and lack of coordination and management among government authorities and medico-legal firms. To impartially reveal the research scenario of legal and ethical issues in organ donation, a quantitative assessment of research papers belonging to this field for the period 2011–2022 is done. The top five nations considering research volume are the USA, UK, Canada, Italy, and Australia, but a lack of collaborative work amongst these countries is seen. The leading five nations are China, the USA, the UK, Germany, and Australia. Finally, the paper provides future research directions on legal and ethical issues in organ donation, such as prioritising organ waiting lists, planning and managing for enhancing organ conservation facilities, raising public awareness about the value of organ donation, and conducting more studies on the topic.

Keywords: organ donation; transplantation; bibliometric analysis; legal and ethical issues.

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1 Introduction

World Health Organisation (WHO) estimates that about 70,000 people are on the waiting list for a kidney transplant each year (Ambagtsheer, 2021), whereas only about 20,000 kidneys from live donors are transplanted. It is well-established that kidneys obtained from living donors are superior to those obtained from deceased donors in terms of health and longevity (15–20 years) (10–15 years).

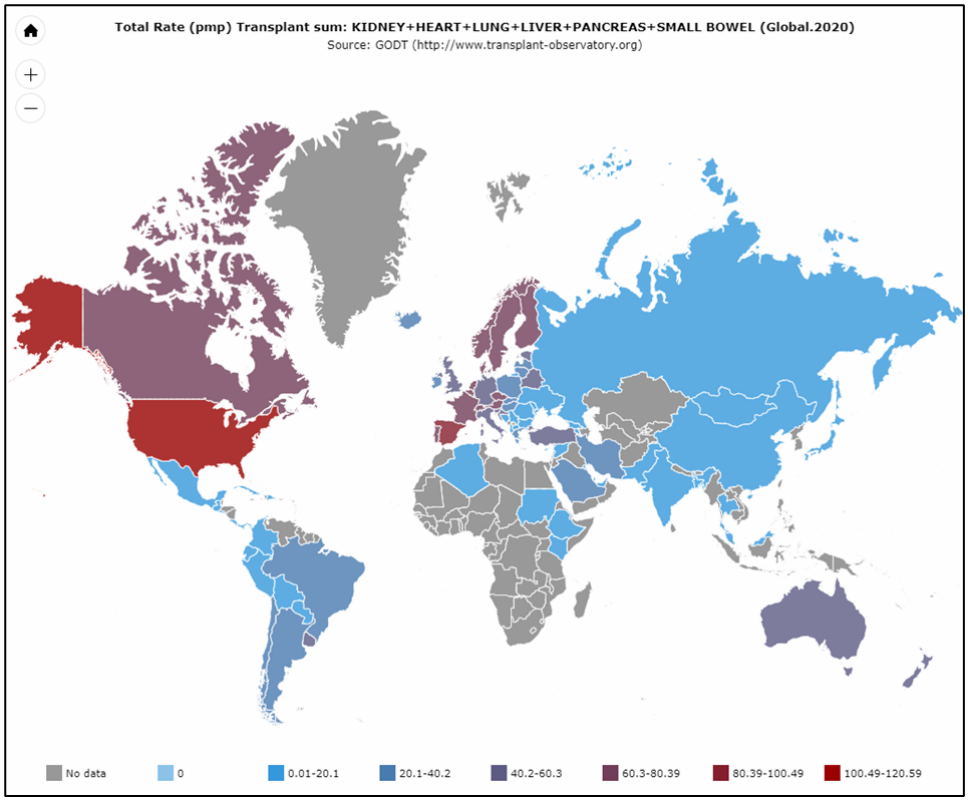
The National Transplant Organisation of the Spanish Government established the Global Observatory Committee on Donations and Transplants (GOCDT), which collaborates with the WHO (Cappadona et al., 2020). All documentation pertaining to organ distribution and transplantation programs in countries that report their data to the GOCDT is maintained and analysed by the GOCDT to improve access to organ transplantation programs worldwide. Figure 1 shows the general statistics of organ donation and transplantation globally.

Moreover, more organs are available from young, healthy people who died in accidents or other tragic circumstances than from older, sicker donors.

The paucity of available donors dampens the spirits of patients, who may then turn to questionable means to get an organ for transplantation, so supporting the illegal trafficking industry. Since the black market is usually operated by unknown people in secret, it is difficult to keep tabs on it (Mashadi, 2020).

Only a handful of countries have attempted to regulate the black market by outright prohibiting it or legalising its trading. As in 1988, Iran now allows the sale and purchase of organs despite a dearth of educated medical personnel and organ availability, although this has the excellent effect of highlighting Iran as one of the few countries with adequate organ supplies.

Figure 1 Global organ transplantation rate (see online version for colours)



Source: http://www.transplant-observatory.org/

In the world as a whole, just 10% of the organ demand is met by legal donors, and most patients die due to the shortage (Haddiya et al., 2020).

Transplantation of vital human organs has emerged as a crucial technique for saving lives, made possible by rapidly developing medical technologies. These days, a healthy donor organ can be found for almost any patient who needs one (recipient). Even though the success rate of organ transplants is rising every day, it is still a major surgical procedure. The lack of implementation of appropriate organ transplantation guidelines is concerning, given the prevalence of unethical, ineffective, and corrupt practices in organ transplantation (This Is How Much Your Body Is Worth, 2015).

Organ donation and transplantation has long been the subject of bioethics. Ethical considerations of deontological or teleological origin are common. To be called 'ethical', a medical practice must adhere to these four principles: autonomy, justice, benefit to the patient, and non-harm.

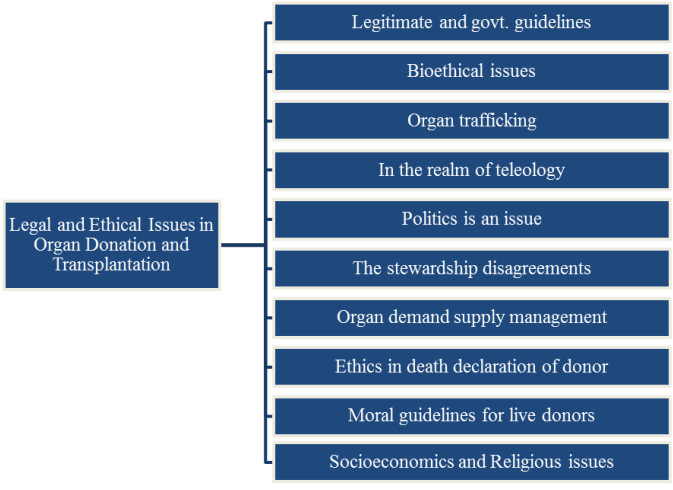
A majority of bioethicists today feel that donating an organ is morally acceptable. Involuntary organ donation is nearly tricky because of patient sovereignty, living desires, and guardianship issues. In public health matters, a substantial state interest may override a patient's right to self-determination.

Almost all major world religions endorse organ donation and transplantation as a fundamental tenet. The decision to donate an organ is left up to the individual or the

individual's family. Many medical experts believe that if the deceased individual or their family gives their consent before or after death, transplanting an organ from someone who has died is acceptable.

Transplantation of vital organs has been a lifesaver for many people who otherwise might not have made it. Even though the Transplantation of Human Organs Act of 1994 is the only law of its kind, several legal and ethical concerns described in Figure 2 have arisen because of a lack of action on the part of policymakers and the government (Lederer, 2020).

Figure 2 Legal and ethical issues in organ donation and transplantation (see online version for colours)



The rest of the paper is organised as Section 2 describes the need for bibliometric analysis. The methodology used in the paper is discussed in Section 3. Section 4 describes the publication trends. The document type analysis and the bibliometric analysis are discussed in Section 5 onwards.

2 Need for bibliometric analysis

Bibliometric analyses provide a broad overview of the targeted topic of study within a specific time frame. Initially proposed by Alan Pritchard in the year 1969, this phrase is now widely used in research aiming to quantify the process of written communication. We, therefore, hypothesise that such quantitative analysis will serve as an entry point for new researchers into the subject, illuminating the crucial context of the topic, the scope of previous work in the field, and the potential for new avenues of investigation. The authors of El Ayoubi et al. (2021) have published a bibliometric work on the contribution of the Arab world to organ transplantation. An extensive effort was made to give a comprehensive review of the studies conducted up to 2019. The authors of Gonzalez et al. (2020) provide a rigorous literature evaluation and bibliometric study of organ trafficking and migrations. The study was conducted on the WoS database from 1990 to 2019. We found that few surveys provide bibliometric information on additional relevant

factors, such as leading countries, subjects, publishing kinds, affiliation information, or prominent authors.

3 Methodology

Scientific fields can be evaluated, monitored, and visualised using bibliometrics (Koskinen et al., 2008; Donthu et al., 2021; Ellegaard and Wallin, 2015). Information about publications is described, and the success of researchers and organisations like universities is evaluated in terms of their impact on society. Bibliometrics is one of the oldest studies approaches in library and information science (Leydesdorff and Bornmann, 2016).

This paper used this study as an example of bibliometrics (Olczyk, 2016). The researcher explained how bibliometric tools could be used to assess the quality of scientific literature. General instructions and publication analysis are two separate sections of bibliometric methodology. As a general guide, researchers are briefed on how to conduct a search for articles using a search engine. An impact factor is a metric that measures how well a paper has been received by other scientists.

In this article, various methods were utilised to locate publications, and the primary keyword is the one listed below. We used both a computerised and a human-assisted search strategy to find the articles.

The following is the search query: TITLE-ABS-KEY (‘organ donation’ AND (‘legal issue’ OR ‘ethical issue’)) AND (LIMIT-TO (LANGUAGE, ‘English’)).

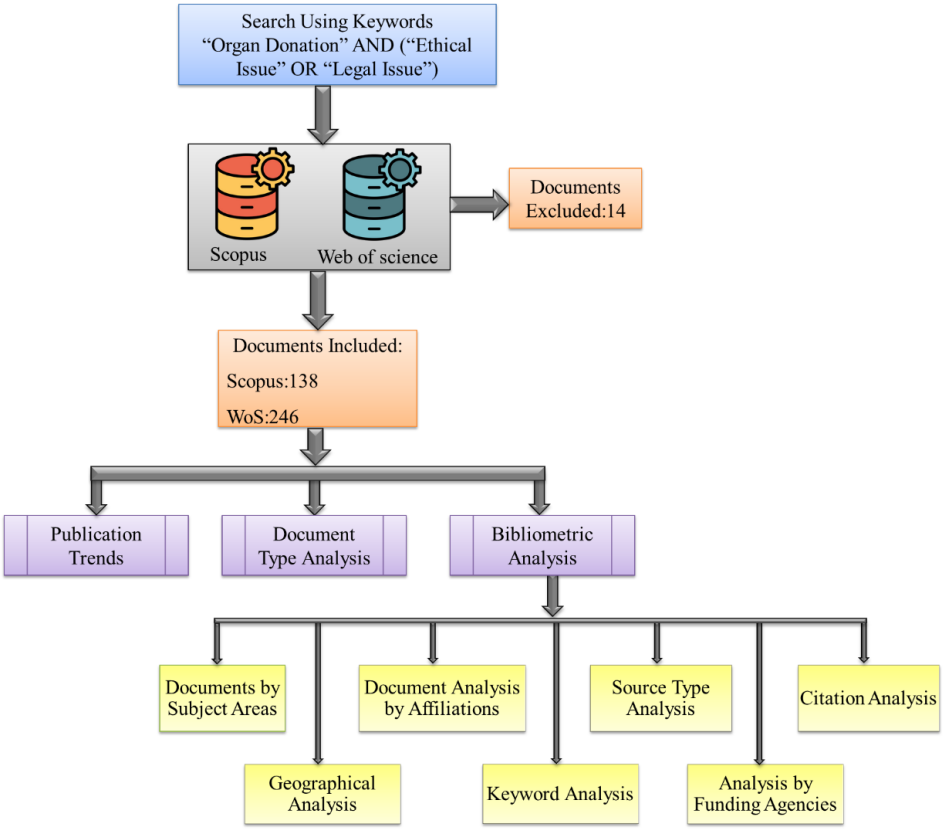
The data-collecting process flow diagram is shown in Figure 3. As described above, a search for similar papers in the Scopus and Web of Science data set is used to narrow the scope of the study between 2011 and 2021 by employing the query described above (Chadegani et al., 2013). A total of 152 publications were found in Scopus, and 246 publications were found in the Web of Science database of various journals and volumes, as well as patterns and subsections within those books (Moher et al., 2009).

The databases like the *KCI-Korean Journal*, patterns, and non-English publications are excluded from focusing on related publications only; because of this omission, we are able to keep 2,158 articles for further examination.

Impact journals, highly cited publications, research topics, and productivity were all taken into consideration in the study. Keyword frequency was also taken into consideration, as well as institutions and authors. Our final choice for a visualisation tool was the free VOSviewer (Van Eck and Waltman, 2010) application and Biblioshiney (Aria and Cuccurullo, 2017), which have various capabilities that allow us to analyse the data.

The significant findings of this paper on the topic that is related to organ donation legal and ethical issues are discussed in detail in further sections. These findings are divided into sub-topics such as publication trends/distribution of annual documents, document type analysis, productivity, research domains, institutes, authors, impact journals, most-cited articles, and keyword occurrence. The importance of these results stems from the fact that they provide bibliometric evidence of the publication rates. As an added benefit, it can also uncover high-quality research that contributes to the development of novel understanding and the assurance of more extensive investigation into the topic of organ donation.

Figure 3 The data-collecting process flow diagram is (see online version for colours)



4 Publication trends/distribution of annual documents

The overall situation and research trends are reflected in the document number distribution each year. The articles with keywords organ donation and legal or ethical issues have been searched from the year 2011. From 2011 to 2021, although there were some ups and downs in the total number of scholarly articles published, the overall trend was upward. It shows that this keyword is very influential in academic studies. Figures 4 and 5 are supplied to show the sum of publications in 2011–2021 in all three datasets of Scopus and Wos, respectively. The various studies' published results are related to ethical and legal issues of organ donation (El Ayoubi et al., 2021; Gonzalez et al., 2020; Ferhatoglu and Yapici, 2020).

Figure 4 Publication trends over the years 2011 to 2021 (WoS accessed on 07-02-2022) (see online version for colours)

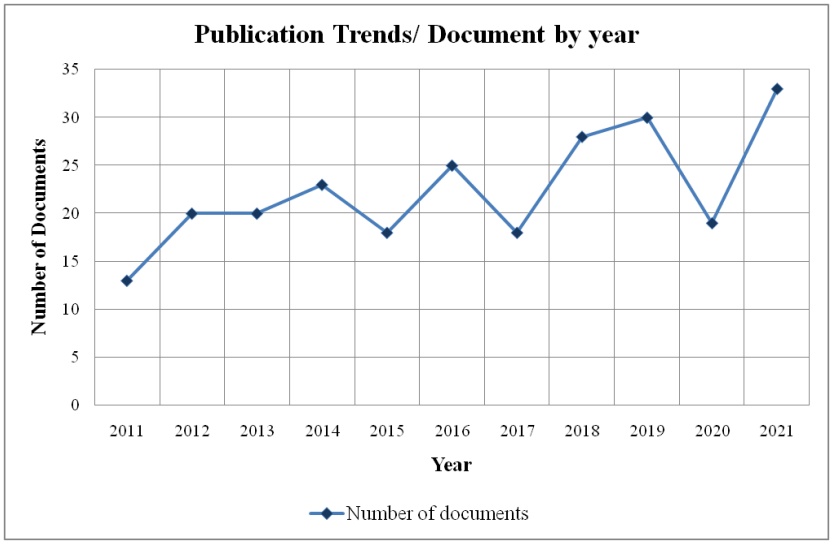
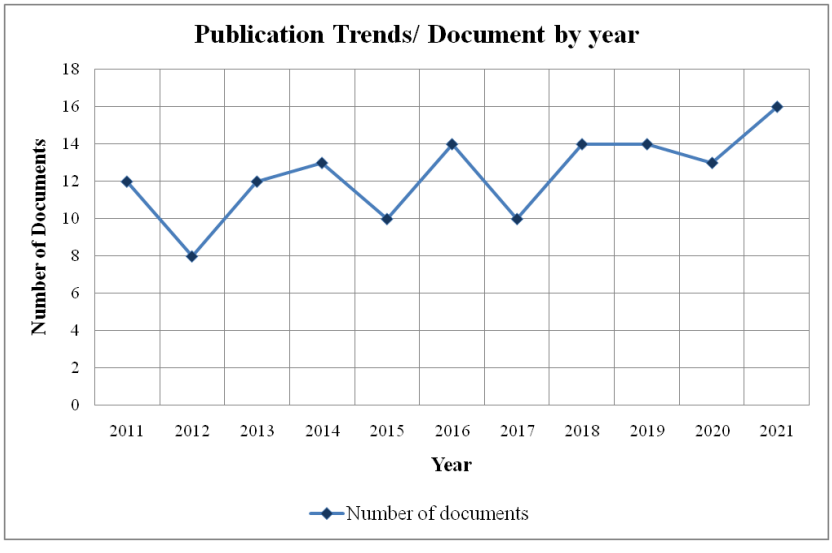


Figure 5 Publication trends over the years 2011 to 2021 (Scopus accessed on 07-02-2022) (see online version for colours)



5 Analysis of document types

The year 2021 sees a peak in the total number of publications in the area of legal and ethical issues in organ donation. Articles account for the vast majority (87%) of all documents in the web science database (accessed on 07-02-2022) that have been made public. In the pie charts presented in Figures 6 and 7, we can see how the various types of

papers appear on the Scopus and WoS dataset, respectively. However, in the Scopus dataset, the article type of documents contributed 58%, followed by review articles 25%, book chapters 10%, where books and conference papers contributed 2% each. In Figure 4, we can see a visual representation of this data in the form of a pie chart.

Figure 6 Documents type analysis (WoS accessed on 07-02-2022) (see online version for colours)

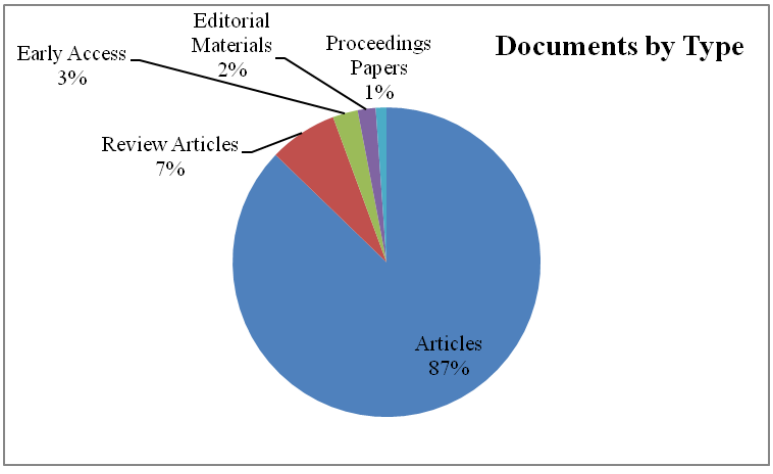
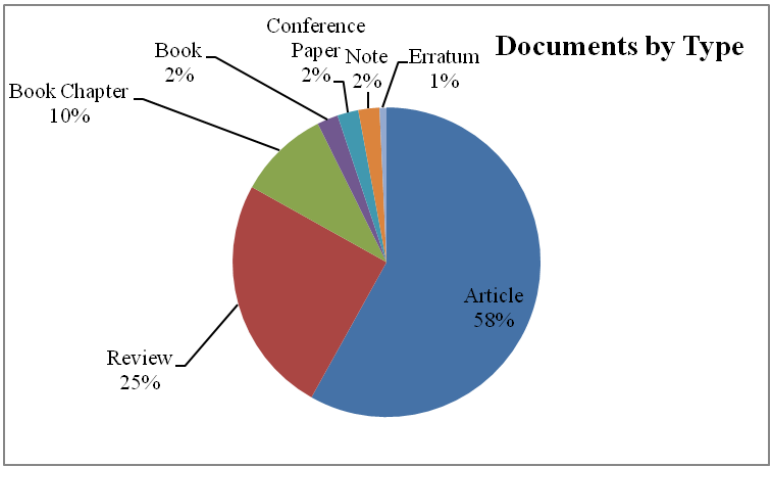


Figure 7 Documents type analysis (Scopus accessed on 07-02-2022) (see online version for colours)



6 Scientific analysis of articles by subject areas

The scientific articles are analysed based on the subject areas of publication. Table 1 represents the top ten subject areas according to both the Web of Science and Scopus

databases, respectively. Most of the articles are from transplantation (71) and medicine (113), while medicine general internal (11) and health professions (1) contribute the least.

Table 1 Scientific analysis of articles by subject areas

WoS			*Scopus*		
Sr. no.	*Subject area*	*Documents*	*Sr. no.*	*Subject area*	*Documents*
1	Transplantation	71	1	Medicine	113
2	Surgery	63	2	Social Sciences	30
3	Ethics	58	3	Nursing	21
4	Medical Ethics	47	4	Arts and Humanities	12
5	Social Sciences Biomedical	46	5	Psychology	6
6	Immunology	28	6	Neuroscience	5
7	Social Issues	27	7	Immunology and Microbiology	3
8	Critical Care Medicine	20	8	Biochemistry, Genetics and Molecular Biology	1
9	Anesthesiology	12	9	Business, Management and Accounting	1
10	Medicine General Internal	11	10	Health Professions	1

7 Leading academic journals and conferences

Over the period from 2011 to 2021 total of 249 papers are published in 128 journals. The journals shown in Figure 8 are those that have contributed at least five relevant articles. *Journal of Medical Ethics*, *American Journal of Transplantation*, and *BMC Medical Ethics Journals* have contributed 15, 11, and 7 articles, respectively.

Figure 8 Leading academic journals sources (WoS dataset) (see online version for colours)

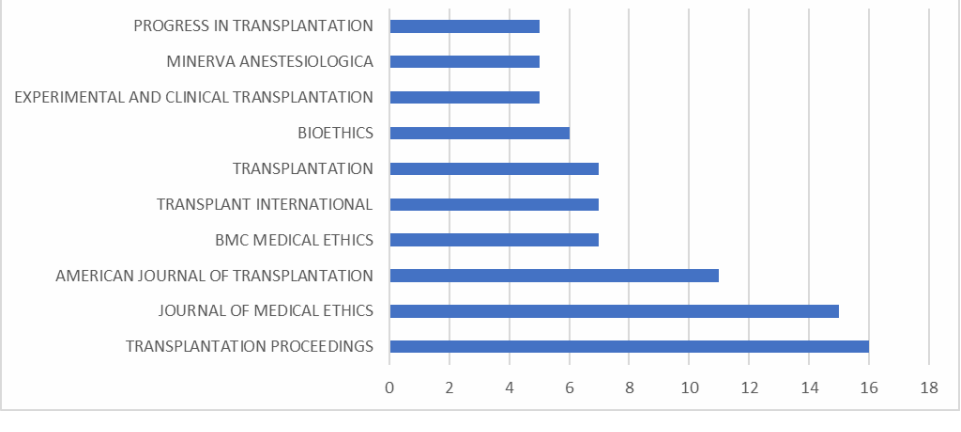
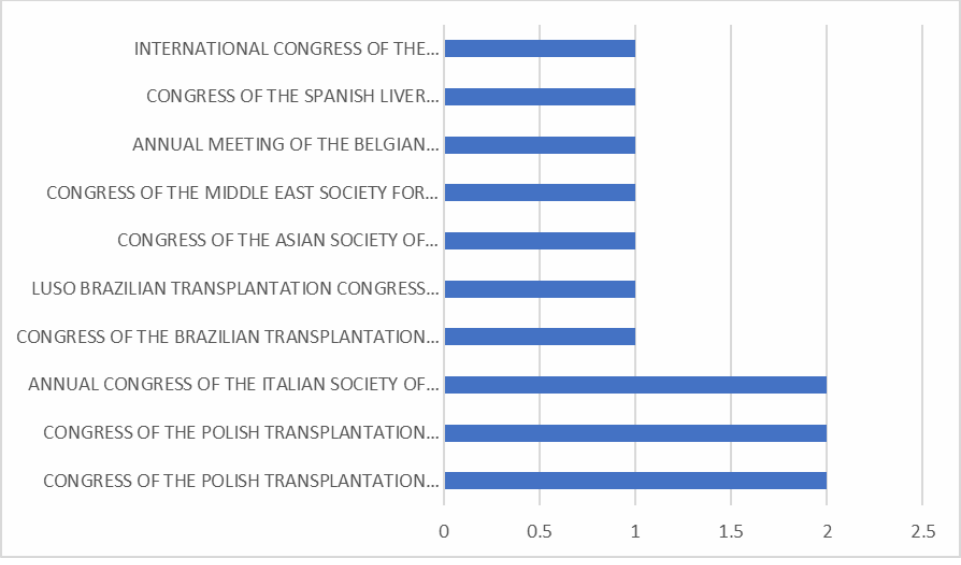


Figure 9 Leading academic conference sources (WoS dataset) (see online version for colours)



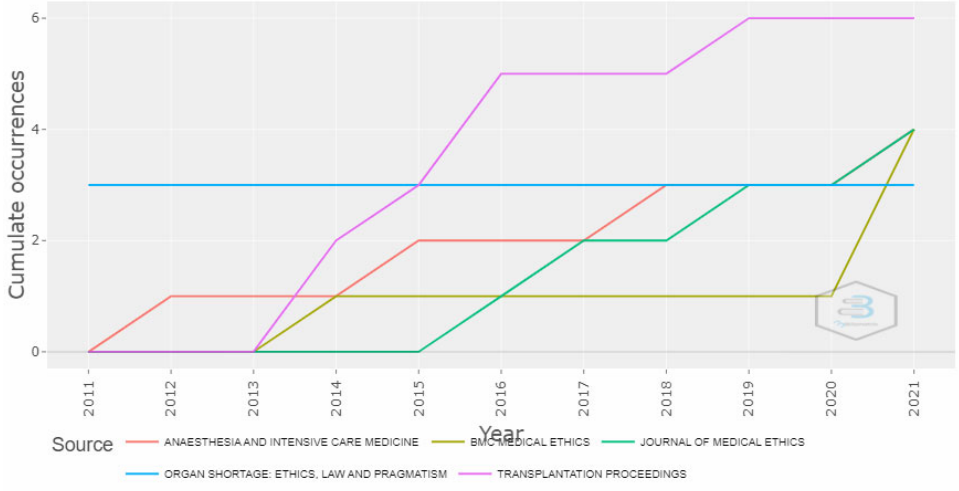
In the analysis of conferences, we have considered 13 conferences, from which 16 articles have been contributed. All conferences with at least one accepted article have been included. The ten most relevant conferences are shown in Figure 9. 'Congress of the Polish Transplantation Society' and Annual Congress of The Italian Society of Organ Transplantation SITO have contributed two articles each.

8 Source growth analysis

The growth of the top five sources of WoS and Scopus datasets over time from 2011 to 2021 is shown in Figures 10 and 11. The cumulate occurrences of the top five sources show that *Anesthesia and Intensive Care Medicine*, *BMC Medical Ethics*, *Journal of Medical Ethics*, Organ Shortage: Ethics Law and Pragmatism and Transplantation Proceedings were consistent up to the year 2013. Between 2013 to 2021, significant growth in the number of articles published by Transplantation Proceedings can be observed. In any case, the graph displays the outcome of the Loess regression. Quantity and date of publication of the journal are included as independent variables. In other words, if the data is very close to zero, the function can assume values below zero because of this method. As a result, it helps the overall visual effect and draws attention to the gap between the publication times.

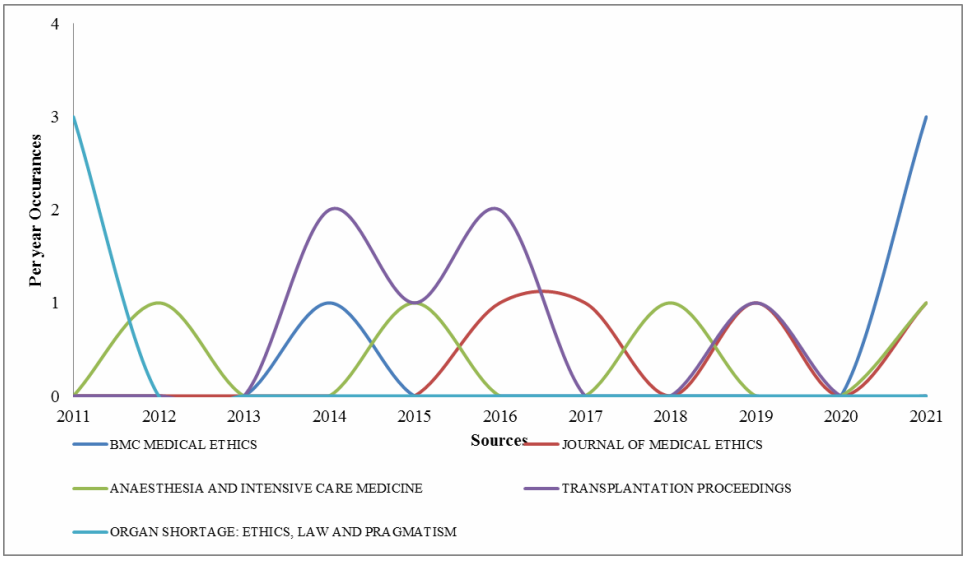
The year-wise occurrence of the top five sources from the Scopus dataset show that Organ Shortage: Ethics Law and Pragmatism had a great start in 2011 with three articles, whereas no growth was observed after that. *Anesthesia and Intensive Care Medicine* is observed to be consistent throughout the period of study.

Figure 10 Cumulate source growth analysis of top five WoS sources (see online version for colours)



Source: Biblioshiny R-package

Figure 11 Year wise source growth analysis of top five Scopus sources (see online version for colours)

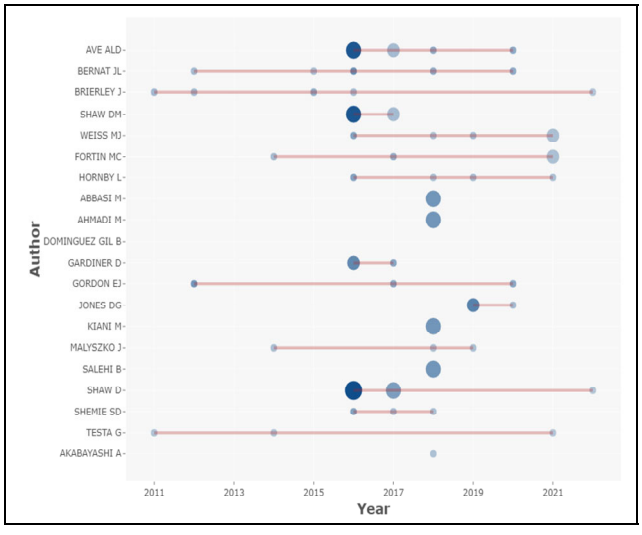


9 Substantial participating authors

Once finding the most possible sources of funding is done, then showcasing the most influential authors is next step. The visualisation of the top 20 substantial participating authors from WoS and Scopus dataset is shown in Figure 12. In WoS there are 908

authors who have contributed to scholarly articles in this field; only 43 of those articles were written by a single author. 78% of the writers have only one paper decreasing the average productivity. At least three articles by each of 30 authors have been published. Table 2 lists the most prolific authors with at least three works cited, along with their h-index, g-index, total citations (TC), number of documents published (NP), and the year their article production began (PY start). Ave. Ald. has the highest h-index and has published the most articles (7) despite having a PY start year of 2016.

Figure 12 Substantial participating authors (WoS vs. Scopus) (see online version for colours)



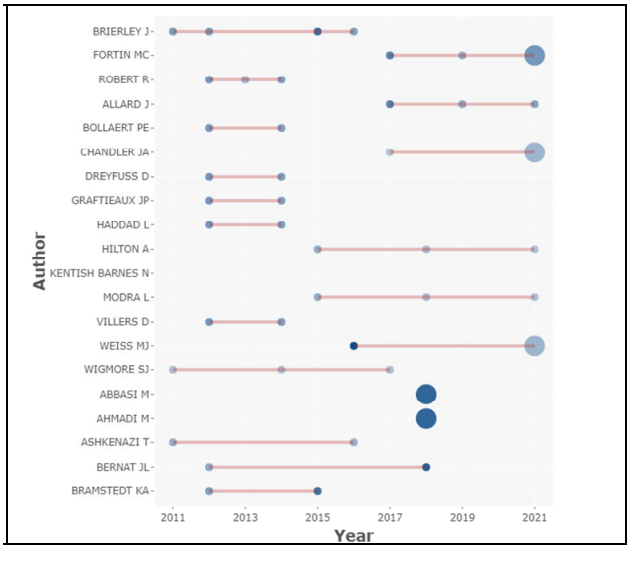


Table 2 Top 20 influential authors and impact scores (WoS dataset)

Rank	*Author*	*Articles*	*h_index*	*g_index*	*m_index*	*TC*	*NP*	*PY_start*
1	Ave, Ald.	7	6	7	0.857	109	7	2016
2	Bernat, J.	5	5	5	0.455	75	5	2012
3	Brierley, J.	5	4	5	0.333	56	5	2011
4	Shaw, D.M.	5	4	5	0.571	88	5	2016
5	Weiss, M.J.	5	3	5	0.429	33	5	2016
6	Fortin, M.C.	4	2	4	0.222	22	4	2014
7	Hornby, L.	4	3	4	0.429	33	4	2016
8	Abbasi, M.	3	3	3	0.6	25	3	2018
9	Ahmadi, M.	3	3	3	0.6	25	3	2018
10	Dominguez Gil, B.	3	0	0	0	0	0	
11	Gardiner, D.	3	3	3	0.429	63	3	2016
12	Gordon, E.J.	3	3	3	0.273	81	3	2012
13	Jones, D.G.	3	3	3	0.75	31	3	2019
14	Kiani, M.	3	3	3	0.6	25	3	2018
15	Malyszko, J.	3	2	3	0.222	9	3	2014
16	Salehi, B.	3	3	3	0.6	25	3	2018
17	Shaw, D.	3	2	3	0.286	25	3	2016
18	Shemie, S.D.	3	3	3	0.429	34	3	2016
19	Testa, G.	3	2	2	0.167	6	3	2011
20	Akabayashi, A.	3	1	1	0.2	2	1	2018

Table 3 Top 20 influential authors and impact scores (Scopus dataset)

Rank	*Author*	*Articles*	*h_index*	*g_index*	*m_index*	*TC*	*NP*	*PY_start*
1	Brierley, J.	4	4	4	0.333	59	4	2011
2	Fortin, M.C.	4	2	4	0.333	19	4	2017
3	Robert, R.	4	3	3	0.273	32	3	2012
4	Allard, J.	3	2	3	0.333	18	3	2017
5	Bollaert, P.E.	3	2	2	0.182	27	2	2012
6	Chandler, J.A.	3	1	1	0.167	1	3	2017
7	Dreyfuss, D.	3	2	2	0.182	27	2	2012
8	Graftieaux, J.P.	3	2	2	0.182	27	2	2012
9	Haddad, L.	3	2	2	0.182	27	2	2012
10	Hilton, A.	3	1	2	0.125	7	3	2015
11	Kentish Barnes	3	0	0	0	0	0	
12	Modra, L.	3	1	2	0.125	7	3	2015
13	Villers, D.	3	2	2	0.182	27	2	2012
14	Weiss, M.J.	3	1	3	0.143	29	3	2016
15	Wigmore, S.J.	3	1	1	0.083	4	3	2011
16	Abbasi, M.	2	2	2	0.4	16	2	2018
17	Ahmadi, M.	2	2	2	0.4	16	2	2018
18	Ashkenazi, T.	2	2	2	0.167	12	2	2011
19	Bernat, J.l.	2	2	2	0.182	27	2	2012
20	Bramstedt, K.A.	2	2	2	0.182	35	2	2012

In the Scopus dataset, there are 446 authors who have contributed to scholarly articles in this field; only 34 of those articles were written by a single author. 63% of the writers have only one paper decreasing the average productivity. Table 3 lists the 20 most prolific authors from the Scopus dataset with at least three works cited, along with their h-index, g-index, TC, number of documents published (NP), and the year their article production began (PY start). Brierley, J. has the highest h-index and has published the most articles (4).

Table 4 Top ten most global cited document

WoS			*Scopus*		
Paper	*Total citations*	*TC per year*	*Paper*	*Total citations*	*TC per year*
Cammarota, G. (2019), *Gut*	151	37.75	Mancini, M.E. (2015), *Circulation*	107	13.375
Matesanz, R. (2011), *Transpl Int*	145	12.0833	Huang, J. (2012), *Lancet*	89	8.0909
Mancini, M.E. (2015), *Circulation*	102	12.75	Bastami, S. (2013), *Crit. Care Med*	40	4
Huang, J.F. (2012), *Lancet*	92	8.3636	Tchana-Sato, V. (2019), J. *Heart Lung Transplant*	37	9.25
Gries, C.J. (2013), *Am. J. Resp. Crit. Care*	78	7.8	Fallat, M.E. (2013), *Pediatrics*	37	3.7
Rojas-Pena, A. (2014), *Transplantation*	69	7.6667	Geraci, P.M., (2011), *Minerva Anestesiol.*	35	2.9167
Wallis, C.B. (2011), *Nephrol. Dial. Transpl.*	58	4.8333	Lauterio, A. (2015), *World J. Gastroenterol.*	34	4.25
Gordon, E.J. (2012), *Am. J. Transplant*	54	4.9091	Bollen, J. (2016), *Am. J. Transplant*	31	4.4286
Smith, M. (2019), *Intens. Care Med.*	53	13.25	Weiss, M.J., (2016), *Pediatr. Crit. Care Med.*	28	4
Mackay, D. (2016), *Am. J. Bioethics*	46	6.5714	Henderson, M.L. (2017), *Am. J. Transplant*	25	4.1667

Table 4 stands for the top ten most internationally cited articles. In WoS among the 2,954 citations, 848, i.e., (28.7%) are the citations for top ten articles and the article published in mediators of inflammation in the year 2019 authored by Cammarota, G. has the maximum international citation count of 151. In Scopus among 1,062 citations, 463, i.e., (43.49%) are the citations for top ten articles and the article published in Circulation in the year 2015 authored by Mancini, M.E. has the maximum international citation count of 107.

10 Geographical productivity analysis

Table 5 shows the list of leading nations among 42 in terms of the paper published, considering at least ten publications in WoS and five publications in Scopus. Compared to other countries, the USA, Canada and UK ranks top in the rate of publications as per

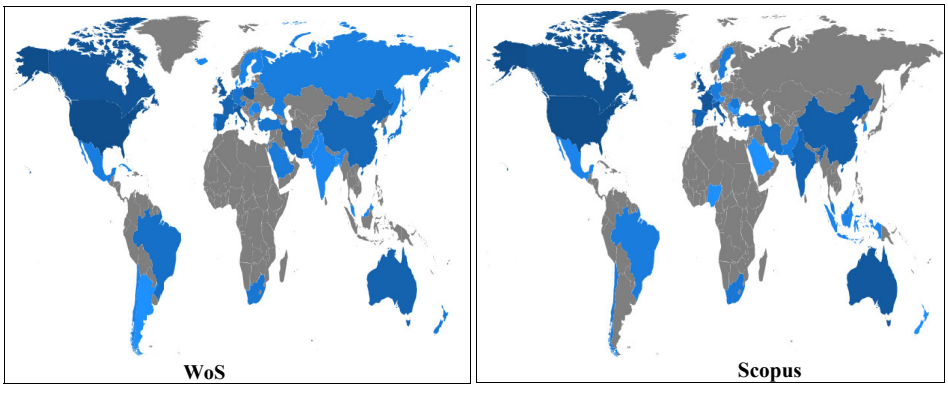
both datasets, and the reason may be due to decent funding policies. India, which is ranked 10th in Scopus dataset with 12 publications is not ranked in WoS.

Table 5 List of leading nations

WoS			*Scopus*		
Rank	*Region*	*Frequency*	*Rank*	*Region*	*Frequency*
1	USA	190	1	USA	56
2	Canada	100	2	Canada	43
3	UK	79	3	UK	39
4	Italy	55	4	France	31
5	Australia	36	5	Australia	27
6	Netherlands	36	6	Italy	23
7	Poland	33	7	China	19
8	Spain	32	8	Netherlands	14
9	Switzerland	31	9	Spain	13
10	France	28	10	India	12
11	Belgium	23	11	Belgium	9
12	China	22	12	Israel	8
13	Iran	20	13	Switzerland	8
14	Brazil	12	14	Iran	6
15	Israel	12	15	Taiwan	5

Nation-wise scientific production is highlighted in Figure 13. The dark shades and light shades indicating high and low productive regions, respectively. The USA and Canada produce the most research on the 'ethical and legal issues of organ donation', followed by Western Europe. The country Nigeria does not have contribution in WoS, whereas a small contribution from Nigeria can be seen in Scopus.

Figure 13 Visualisation of country-wise scientific production (see online version for colours)

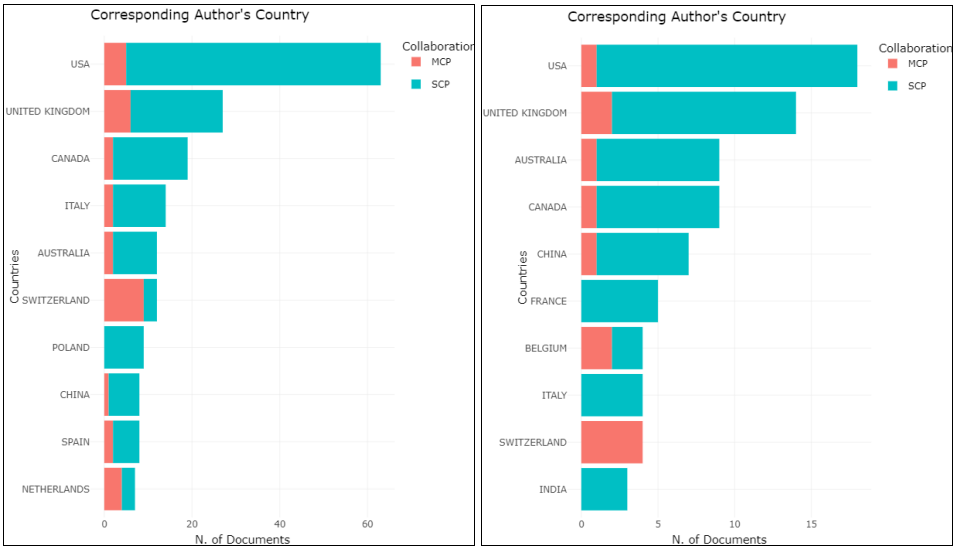


Source: Image from Biblioshiny

Table 6 Countries and their collaborative index

WoS						*Scopus*					
Country	*Articles*	*Freq*	*SCP*	*MCP*	*MCP_Ratio*	*Country*	*Articles*	*Freq*	*SCP*	*MCP*	*MCP_Ratio*
USA	63	0.2636	58	5	0.0794	USA	18	0.16514	17	1	0.0556
United Kingdom	26	0.10879	20	6	0.2308	United Kingdom	14	0.12844	12	2	0.1429
Canada	19	0.0795	17	2	0.1053	Australia	9	0.08257	8	1	0.1111
Italy	14	0.05858	12	2	0.1429	Canada	9	0.08257	8	1	0.1111
Australia	12	0.05021	10	2	0.1667	China	7	0.06422	6	1	0.1429
Switzerland	11	0.04603	3	8	0.7273	France	5	0.04587	5	0	0
China	8	0.03347	7	1	0.125	Belgium	4	0.0367	2	2	0.5
Poland	8	0.03347	8	0	0	Italy	4	0.0367	4	0	0
Spain	8	0.03347	6	2	0.25	Switzerland	4	0.0367	0	4	1
Netherlands	7	0.02929	3	4	0.5714	India	3	0.02752	3	0	0

Figure 14 Visualisation of countries and their collaborative indexes (see online version for colours)



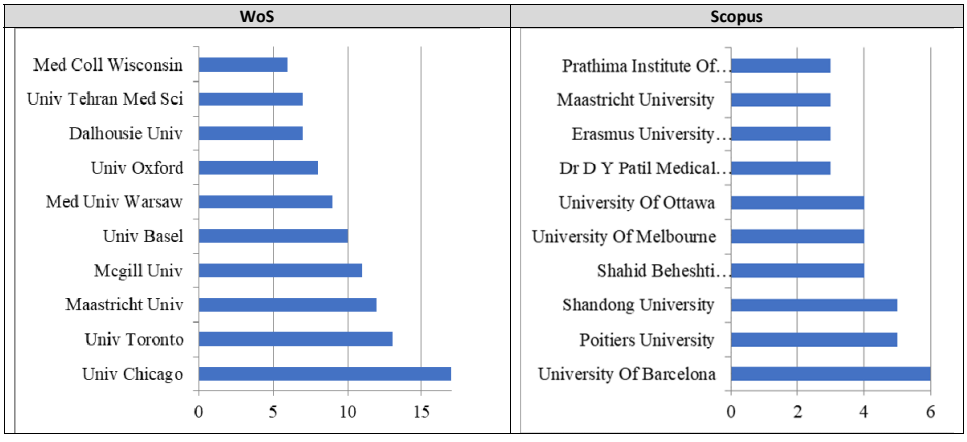
Source: Image from Biblioshiny

Considering only those countries with a minimum of seven publications in WoS and three publications in Scopus, Table 6 illustrates the countries and the collaborative work amongst them. Multiple country publications (MCP) and single country publications (SCP) detailing international and domestic cooperation are also included. Using the MCP ratio, we can see how many articles were written by authors from different countries in comparison to the total articles. Table 6 and Figure 14 show that the USA positions first in the category of total articles and has the most SCPs based on the countries of corresponding authors, while Switzerland ranks sixth as per WoS and ranked nine as per Scopus in terms of total publications but has the maximum MCP ratio of 8 and 4 respectively in WoS and Scopus as compared to other countries.

11 Document analysis by affiliations

Document analysis by affiliations indicates organisations exploring organ donation and ethical or legal issues. Figure 15 shows the document analysis by affiliations using the Web of Science dataset and Scopus. In WoS, considering top ten universities taking part in the research it is found that the University of Chicago and the University of Toronto are more active in this particular research domain. In Scopus University of Barcelona, Poitiers University, and Shandong University are more active in this particular research domain.

Figure 15 Document analysis by affiliations (see online version for colours)



12 Keyword analysis

Through the use of keyword analysis, relevant articles can be located in relevant databases. Future research directions can be gleaned from the analysis of popular search terms, keywords, and subject areas.

Table 7 Top ten keywords used by authors in last ten years (WoS)

Year	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*
Organ donation	5	9	14	16	17	20	24	29	32	37	41
Ethics	4	9	14	15	16	23	26	29	32	34	39
Organ transplantation	1	4	6	6	6	10	13	16	16	17	21
Transplantation	3	3	5	5	6	9	11	13	16	18	20
Brain death	0	2	4	4	4	6	6	11	11	12	15
Donation	2	3	3	3	3	4	4	5	7	7	10
Organ procurement	0	1	4	6	7	8	8	9	10	10	10
Informed consent	1	3	5	6	7	7	7	7	7	8	9
Kidney transplantation	2	3	3	3	3	3	4	6	7	8	9
Bioethics	1	1	3	3	4	6	6	7	7	7	7

Tables 7 and 8 highlights the top ten keywords used by authors in the last ten years, considering the top ten essential aspects such as organ donation, ethics, organ transplantation, and brain death. The density-based visualisation using VOSviewer below, Figure16 highlights the combination of keywords representing ethics, human, and organ donation.

Figure 16 Heat map of author keywords (see online version for colours)

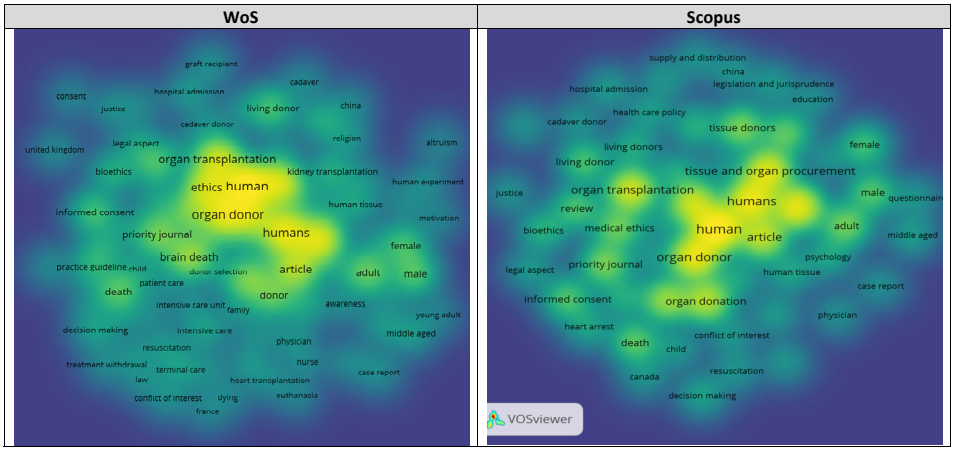


Table 8 Top ten keywords used by authors in last ten years (Scopus)

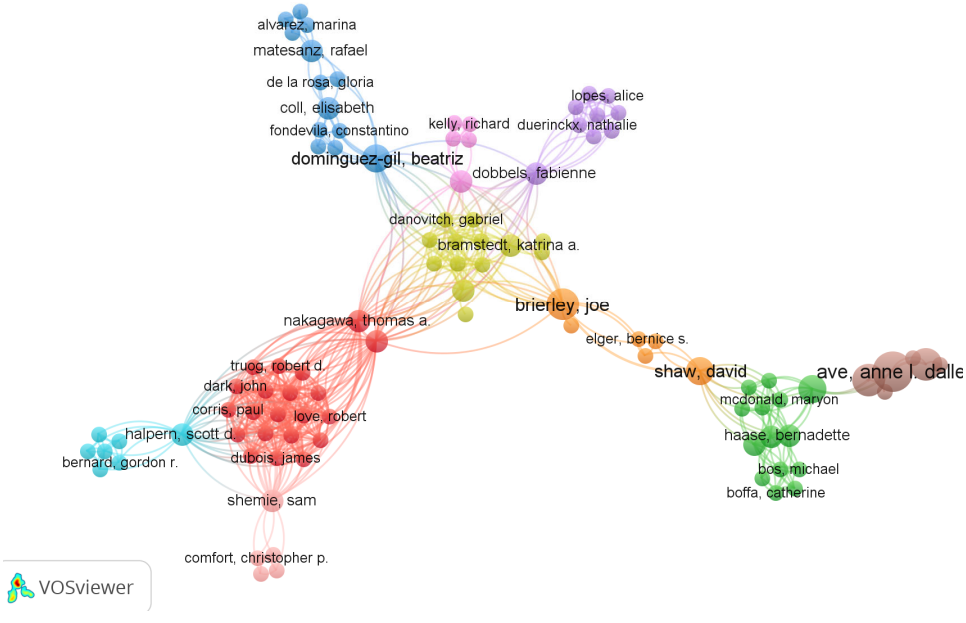
Year	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*
Human	12	7	8	10	8	12	5	12	12	7	9
Organ transplantation	9	4	3	7	5	10	5	12	11	9	10
Humans	9	3	7	11	6	9	3	8	9	6	6
Organ donor	8	5	8	5	5	8	4	12	9	5	4
Tissue and organ procurement	8	3	6	11	3	7	3	7	8	4	6
Transplantation	2	2	2	7	4	10	3	12	12	5	6
Article	5	4	6	4	6	5	2	8	9	3	1
Brain death	3	3	9	2	3	4	5	4	8	3	3
Ethics	2	4	2	6	3	8	2	10	6	3	1
Adult	4	2	2	0	6	3	1	10	10	5	1

13 Co-authorship (authors and country)

Figure 17 and 18 shows the co-authorship map of WoS authors to illustrate the scientific research collaboration among them and is generated by the VOSviewer software. According to WoS in this collaboration map, many author cooperative sub-networks are generated, with a relatively complex relationship between the sub-networks centred on Ave, Anne I. Dalle. In this paper, ten separate networks are established.

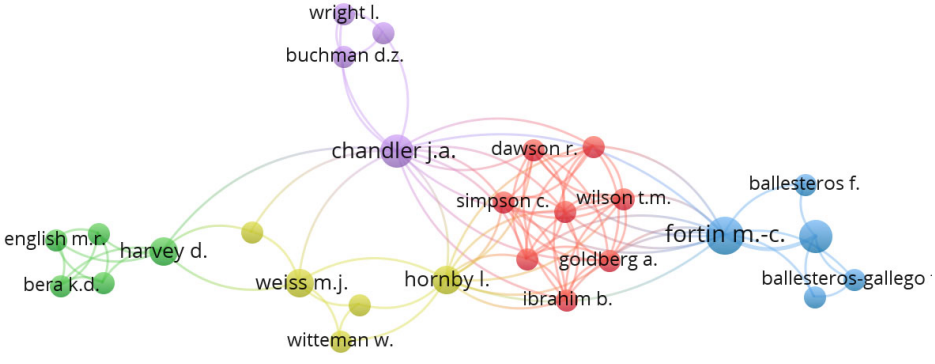
The sub-network represented by Thomas A. Nakagawa began his research in the field of organ donation in 1990, has a high clustering density and significant influence in the same field. His citation frequency, h-index, and g-index values are 1996, 21, and 27 separately. Thomas A. Nakagawa's research ideas mainly include organ donation/ transplantation and end-of-life care.

Figure 17 Co-authorship map in the field of ethical and legal issues in organ donation (WoS dataset) (see online version for colours)



Source: VOSviewer

Figure 18 Co-authorship map in the field of ethical and legal issues in organ donation (Scopus) (see online version for colours)



Source: VOSviewer

According to Scopus in this collaboration map of Figure 18, five author cooperative sub-networks are generated, with a relatively complex relationship between the sub-networks centred on Chandler, J.A.

14 Conclusions

Based on the Scopus, and WoS datasets, literature on the legal and ethical issues in organ donation from 2011–2021 were retrieved and analysed with the help of biblioshiny and VOS viewer software.

Legal and ethical issues in organ donation research continue the following attributes and subject: First, from the point of view of publication patterns, the document number in the field of legal and ethical issues in organ donation continues to grow, and the focus on organ donation research and the number of scholars taking part in the same study are rising over the time. Second, developed nations such as the USA, the UK, Canada, Italy, and Australia are more critical as research power is considered, revealing less awareness of these issues in countries of continents like Africa and Asia. The analysis of articles reveals that international collaboration is uncommon, while papers based on independent research are more common. This trend, however, is counterproductive to the ongoing globalisation of scientific study.

Third, the most often keywords used in the field of organ donation are ethics, organ transplantation, brain death, organ procurement, and bioethics. Conclusively, from the pooled analysis of most common keywords in the field of research that the need for a government-authorised organ distribution network, the solution to prevent the corrupt practice of organ donations and its trading, and improved organ conservation facilities would be significant research guidelines for upcoming research.

More international collaborations, if promoted, may result in worldwide guidelines in ethics in organ transplantation and donation-related practices and medication.

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