

International contribution of Turkey in pediatric ultrasonography research: A bibliometric analysis in SCI-E

Pediyatrik ultrasonografi araştırmalarına Türkiye'nin uluslararası katkısı: SCI-E'de bibliometrik bir analiz

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Abstract

Aim: A bibliometric study is performed to evaluate Turkey's international contribution in terms of number of publications in English, included in Science Citation Index Expanded TM (SCI-E) regarding pediatric ultrasound imaging.

Materials and Methods: ISI Web of Knowledge®-Science® was used for the analysis. All scientific papers published included in SCI-E in English from 1975 to 2015 were analyzed. A retrospective search was performed using the terms "pediatric ultrasonography", "pediatric ultrasound", "children ultrasonography", "children ultrasound", "neonatal ultrasonography", "neonatal ultrasound", "neonate ultrasonography", "neonate ultrasound", "newborn ultrasonography", "newborn ultrasound", "infant ultrasonography", "infant ultrasound", "adolescent ultrasonography", and "adolescent ultrasound". The results were further analyzed in terms of number of papers for each country, types of documentation, number of publications and citations per year, journal names, and institutions. Collected data from the comparison periods was statistically analyzed using the chi-square test.

Results: 26.755 papers related to pediatric ultrasonography were published included in SCI-E in English between 1975 and 2015. Overall 1102 of those papers were from Turkey (4.2%). The rank of Turkey among other countries according to the number of published papers was 23rd between 1985 and 1994 and of 9th between 1995 and 2004 and of 4th between 2005 and 2015, finally.

Conclusion: Turkey showed a significant positive trend in publishing papers in the scientific field of pediatric ultrasonography in the last thirty years and the rank of Turkey among other countries improved in recent decades. This can be considered as an indicator for progression of Turkey in the field of pediatric ultrasound.

Keywords: Bibliometric analysis, research activities, children, Turkey, ultrasound imaging.

Öz

Amaç: Türkiye'nin pediyatrik ultrasonografi araştırmalarına ilişkin uluslararası İngilizce literatüre katkılarının Science Citation Index Expanded (SCI-E)'de bibliometrik analiz ile değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntem: Analiz için ISI Web of Knowledge®-Science® kullanılmıştır. 1975-2015 yılları arasında SCI-E'de kapsanan tüm İngilizce yayınlar "pediatric ultrasonography", "pediatric ultrasound", "children ultrasonography", "children ultrasound", "neonatal ultrasonography", "neonatal ultrasound", "neonate ultrasonography", "neonate ultrasound", "newborn ultrasonography", "newborn ultrasound", "infant ultrasonography", "infant ultrasound", "adolescent ultrasonography", ve "adolescent ultrasound" terimleri kullanılarak retrospektif olarak tarandı. Sonuçlar daha sonra ülke başına yayın sayıları, döküman çeşitleri, sene başına yayın ve sitasyon sayıları, dergi adları ve gönderen kurumlar açısından da tarandı. Verilerin karşılaştırılmasının istatistiksel değerlendirilmesi ki-kare analizi ile yapıldı.

Bulgular: 1975-2015 yılları arasında, SCI-E'de pediyatrik ultrasonografiye dair, İngilizce, 26.755 yayın bulundu. Bu yayınların 1102 tanesi Türkiye'ye aitti (%4.2). Yayın sayıları baz alındığında Türkiye'nin diğer ülkeler arasındaki sıralaması 1985-1994 arasında 23., 1995-2004 arasında 9. ve 2005-2015 arasında 4. idi.

Sonuç: Son 30 yılda Türkiye'nin pediyatrik ultrasonografi alanındaki yayınlarında belirgin bir artış mevcuttur. Türkiye'nin diğer ülkeler arasındaki sıralaması da belirgin gelişme göstermiştir. Bu bulgular Türkiye'nin pediyatrik ultrasonografi alanındaki ilerlemesini gösteren belirteçler olarak kabul edilebilir.

Anahtar Sözcükler: Bibliometrik analiz, araştırma çalışmaları, çocuk, Türkiye, ultrasonografik görüntüleme.

Introduction

Ultrasonography (US) is the most safe and easily available imaging tool among all radiological procedures (1) and US must be considered in the first line for pediatric patients whom are very susceptible to X-rays (2). While the world is adopting the motto as-low-as-reasonably-achievable (ALARA), an approach to radiation exposure in children (3), little is known about where Turkey stands in this global trends therewithal the contribution of Turkish medical researchers to the scientific field of pediatric ultrasonography.

The number of scientific papers can be considered as an important indicator of scientific activity for countries and bibliometric studies may be used to determine the scientific productivity of a country (4). Science Citation Index® was introduced in 1961 as a tool for bibliographical retrieval and provides a large database for the analysis of journals and publications (5). Web of Science® (WoS) is a software that can be used for the analysis of scientific papers indexed in the Science Citation Index Expanded™ (SCI-E) according to various parameters (4). The aim of the current study is to analyze the scientific papers in the field of pediatric ultrasonography included in SCI-E, in English, published by Turkish authors for evaluating their contribution among other countries to the literature in the last years. According to the literature search, this is the first bibliometric study in the scientific field of pediatric ultrasonography for Turkey.

Materials and Methods

This research was conducted on March 2016 using the WoS software to analyze the pediatric ultrasonography papers included in SCI-E. ISI Web of Knowledge®-Science® was used for the analysis. We retrospectively searched all papers published in the field of pediatric ultrasonography between 1975 and 2015 by using the terms "pediatric ultrasonography", "pediatric ultrasound", "children ultrasonography", "children ultrasound", "neonatal ultrasonography", "neonatal ultrasound", "neonate ultrasonography", "neonate ultrasound", "newborn ultrasonography", "newborn ultrasound", "infant ultrasonography", "infant ultrasound", "adolescent ultrasonography", and "adolescent ultrasound" in topic search section, then refined the search to include all results in English. By using the 'analyze' function of the software, we analyzed the number of papers for each country, institution and journals published as well as publications per year and type of documentation. Number of citations to published papers was calculated by using the citation function of the same software. We also separately analyzed the contribution and the rank of Turkey among other countries in the last four decades between 1975 and 1984, 1985 and 1994, 1995 and 2004, and 2005 and 2015. Collected data from the comparison periods was statistically analyzed using the chi-square test.

Results

Overall, 26.755 papers were published in the field of pediatric ultrasonography included in SCI-E, in English between 1975 and 2015. In this time period, the biggest contribution was from The United States of America (U.S.A.) with 28.9%, followed by England (8.8%), Italy (6.8%), and Germany (5.3%). Other countries' percentage contributions were under 5% for each. Of those, 1102 papers published from Turkey in English amounted to 4.2%, ranking 8th among other countries in this time period (Table-1). The first article included in SCI-E published from Turkey was in 1992 (6). The number of publications from Turkish authors increased dramatically in later years. (Figure-1). Only 16 papers were published between 1985 and 1994, rising to 259 between 1995 and 2004, and rising to 826 between 2005 and 2015.

Table-1. Distribution of Top 10 Countries by the Papers Published Included in Science Citation Index Expanded, in English Between 1975 and 2015 in the Field of Pediatric Ultrasonography.

Rank	Country	Number	Percentage (%)
1	U.S.A.	7751	28.9
2	England	2341	8.6
3	Italy	1825	6.8
4	Germany	1424	5.3
5	Canada	1283	4.8
6	Japan	1225	4.6
7	Netherlands	1146	4.3
8	Turkey	1102	4.2
9	France	1066	3.9
10	Australia	903	3.4
11	Peoples R China	846	3.2
12	Israel	642	2.4
13	India	519	1.9
14	Spain	516	1.9
15	Sweden	487	1.8

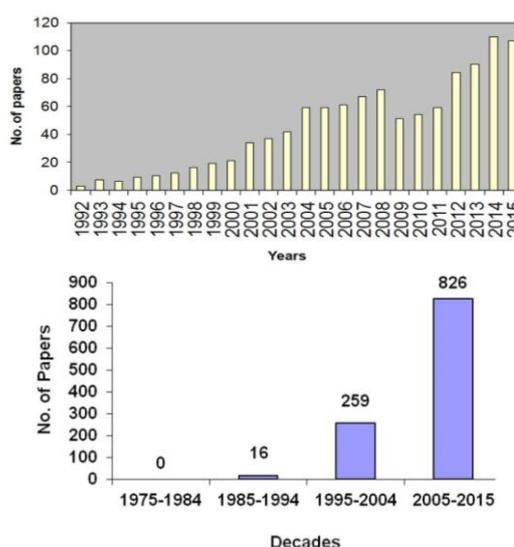


Figure-1. (A) Number of papers published in journals included in Science Citation Index Expanded from Turkey, in English between 1975 and 2015 in the field of pediatric ultrasonography. (B) Distribution by last four decades of papers published included in Science Citation Index Expanded, from Turkey in the field of pediatric ultrasonography.

For 1102 papers from Turkey, the total citations during this time period until 2015 was 6849 (6497 excluding self citations) and the citation to paper ratio was 6.22 with *h*-index of 30. The first citation was in 1993 and the number of citations increased consistently year by year (Figure-2), average citations per year being 285.4. Turkey's *h*-index was 9 between 1985 and 1994 was 26 between 1995 and 2004 and was 22 between 2005 and 2015. Turkey's average citations per year have inclined from 8.4 to 139.6 and to 298.2 for the same time intervals respectively.

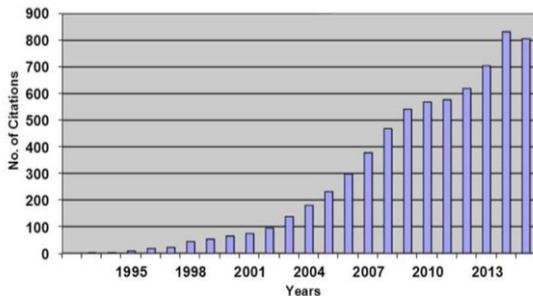


Figure-2. The chart of the number of cited papers published included in Science Citation Index Expanded of Turkish authors.

The rank of Turkey among other countries according to the number of published papers was 23rd between 1985 and 1994 and improved to the rank of 9th between 1995 and 2005 and to the rank of 4th between 2005 and 2015, finally. The contribution percentages increased from 0 to

0.63%, and to 3.2% and to 5.2% ($p < 0.05$), for the matching time intervals (Figure-3).

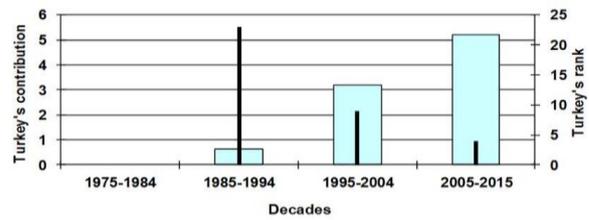


Figure-3. Increasing contribution of Turkey to the literature (bars) and the rank of Turkey among other countries (lines) by publications included in the Science Citation Index Expanded, from Turkey, in English, between 1975 and 2015, in the field of pediatric ultrasonography.

The top 8 journals published over twenty publications from Turkish authors were *Turkish Journal of Pediatrics* (n=58), *Journal of Clinical Ultrasound* (n=44), *Journal of Pediatric Surgery* (n=39), *Journal of Pediatric Endocrinology Metabolism* (n=35), *Pediatric Surgery International* (n=27), *Pediatric Radiology* (n=23), *European Journal of Radiology* (n=22), *Pediatric Nephrology* (n=22), *European Journal of Pediatric Surgery* (n=21), and *Urology* (n=21). *Pediatric Radiology* was the most frequently publishing journal in this time period with a rate of 3.1% of all publications in the pediatric ultrasonography field all around the world (Table-2).

Table-2. Distribution of Publications Between 1975 and 2015, in the Field of Pediatric Ultrasound with 5 Years Impact Factors (IF) due to Journal Citation Reports®, ISI Web of Knowledge® and SCImago Journal & Country Rank.

Journals publishing over 20 publications by authors from Turkey			
Journal	Number	%	IF
1. Turkish Journal of Pediatrics	58	5.3	0.498
2. Journal of Clinical Ultrasound	44	3.9	0.796
3. Journal of Pediatric Surgery	39	3.5	1.539
4. Journal of Pediatric Endocrinology Metabolism	35	3.2	0.917
5. Pediatric Surgery International	27	2.5	1.112
6. Pediatric Radiology	23	2.1	1.591
7. European Journal of Radiology	22	1.9	2.411
8. Pediatric Nephrology	22	1.9	2.75
9. European Journal of Pediatric Surgery	21	1.9	0.83
10. Urology	21	1.9	2.207
Top ten journals ranked by the number of publications by all authors around the world			
1. Pediatric Radiology	827	3.1	1.591
2. Ultrasound in Obstetrics and Gynecology	723	2.7	3.584
3. Journal of Pediatric Surgery	683	2.6	1.539
4. Journal of Urology	585	2.2	4.064
5. Prenatal Diagnosis	472	1.8	2.689
6. Journal of Ultrasound in Medicine	374	1.4	1.547
7. Pediatric Surgery International	364	1.4	1.112
8. Pediatric Nephrology	355	1.3	2.75
9. Pediatrics	345	1.3	6.169
10. Journal of Clinical Ultrasound	331	1.2	0.796

The most common type of publications from Turkey and all around the world were articles with 93.4% and 85.1% respectively (Table-3).

Table-3. Distribution of the Types of Papers Published Included in Science Citation Index Expanded in English Between 1975 and 2015 in the Field of Pediatric Ultrasonography.

Document type	Number	Percentage (%)
Publications from Turkey		
Article	1020	92.6
Proceeding paper	24	2.2
Review	20	1.8
Letter	18	1.6
Editorial material	11	0.9
Meeting abstract	9	0.8
Publications from all around the world		
Article	22.755	85.1
Proceeding paper	1231	4.6
Review	1042	3.9
Meeting abstract	828	3.1
Editorial material	293	1.1
Letter	268	1.0
Note	258	0.9
Other	80	0.3

Institutions which made up the highest percentages of all publications from Turkey were from the biggest Turkish cities such as Ankara, Istanbul and Izmir (not in the ranking order) (Table-4).

Table-4. Distribution of Top 10 Institutions Ranked by the Number of Papers Published Included in Science Citation Index Expanded, from Turkey, in English Between 1975 and 2015 in the Field of Pediatric Ultrasonography.

Institutions	Number
1. Hacettepe University, Ankara	114
2. İstanbul University, İstanbul	75
3. Ankara University, Ankara	57
4. Dokuz Eylül University, İzmir	42
5. Erciyes University, Kayseri	42
6. Gazi University, Ankara	40
7. Baskent University, Ankara	39
8. Ege University, İzmir	37
9. Marmara University, İstanbul	31
10. Selçuk University, Konya	29

Discussion

Radiation exposure is a concern in both adults and children. However children are considerably more sensitive to radiation than adults, as demonstrated in epidemiologic studies of exposed populations and children have a longer life expectancy than adults, resulting in a larger window of opportunity for expressing radiation damage (2). Therefore it's crucial to prefer an

imaging technique without X-rays in the first place in pediatric patients. Magnetic Resonance Imaging (MRI) is a technique which does not include radiation however long examination durations and the need of sedation and gadolinium based contrast agents are the risks that cannot be ignored (7), especially when working with children. Consequently, US emerges as the most safe and easily available imaging tool among all radiological procedures (3). The worlds' growing approach to radiation exposure especially in the pediatric population is based on the ALARA principle (3), however not much is known about the contribution of Turkish medical researchers to the scientific field of pediatric ultrasound.

Evaluations of scientific studies of a country could show that country's development and performance in their health system. The number of published papers can be considered as reflecting the prevalence of usage of a specific method or a modality, such as the utility of ultrasound in the pediatric population. To our knowledge, this is the first study that evaluated Turkey's research productivity in this field.

There was no publication included in SCI-E from Turkey between 1975 and 1984. The first article contributed by a Turkish author in the field of pediatric ultrasonography included in SCI-E, in English was published in 1992, as a musculoskeletal ultrasound study in congenital muscular dystrophy patients (6). There were 16 publications between 1985-1994 and it increased to 259 between 1995-2004 and then increased to 826 between 2005-2015, with the contribution percentages of 0%, 0.63% and 3.2% and 5.2% in these periods of time, respectively. The number of publications from Turkey in the pediatric ultrasonography field has increased significantly in the last decades. The rank of Turkey among other countries has also improved from 23rd to 9th and to 4th in the last three decades.

The quantification of scientific activity of a country could be accepted as that country's development in research status in a specific area (8). It can be determined that, the main reason for the increase in ultrasonography publications especially for the last decade is Turkey's adaptive status to the rapidly developing global technology, widespread lodgement in human resources and well educated medical researchers being trained in the area of scientific writing and contributing to publishing (9). Also government policies elaborating pediatric health and pediatric centers in Turkey has led to Turkey's inclining scientific activities in the area of pediatric ultrasonography.

Among other countries, between 1975 and 2015, the U.S.A. published the most research with percent of 28.9 followed by other developed countries such as England, Italy, Germany and Canada. This can be considered as the growing interest of publishing ultrasonography articles for pediatric populations among all around the world like in Turkey.

For the publications from Turkey, between 1975 to 2015 the citation to paper ratio was 6.22 with *h*-index of 30 and average citations per year being 285.4. *h*-index is useful because it discounts the disproportionate weight of highly cited papers or papers that have not yet been cited (10). It demonstrates that at least 30 publications from Turkey had 30 citations or more. When comparing the last two decades, the decrease in the *h*-index despite the increase in average citations per year can be attributed to the prone nature of the *h*-index to manipulations through self-citations and the necessitation of preventive measures to overcome this issue.

The impact factor (IF) of a journal is a measure reflecting the average number of citations to recent articles published in the journal. However IF only gives an idea of the scientific use of a journal and not necessarily its usefulness in clinical practice and journals are increasingly finding new ways to improve their impact factor by increasing self citation by publishing more review articles, in the absence of a good alternative, the IF will continue to be used as an indicator of a journal's performance (11). The average of impact factor of top ten journals preferred by all authors around the world was 2.584 and by authors from Turkey was 1.465. It can be concluded that papers from Turkish authors are published by journals which have impact factors more or less the same as the journals publishing other countries' authors.

For journals, *Turkish Journal of Pediatrics* was the most preferred journal by authors from Turkey, whereas *Pediatric Radiology* was the most preferred journal in the world. There are five common journals in the top ten most preferred journal list with authors from Turkey and authors from other countries. Turkish authors seem to prefer in part the same journals for publications as their colleagues from other countries.

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The majority of the publications published in SCI-E, in English from Turkey between 1975 and 2015 were articles with 92.6% for Turkey and 85.1% for all around the world. It can be inferred that Turkish authors are putting valuable effort to publishing original articles rather than other types of documents when compared to their colleagues from all around the world.

These WoS based bibliometric studies have some limitations. It is not possible to obtain articles included in SCI-E published before 1975 and as the list is updated regularly, the numerical changes in results should be taken into consideration. Another handicap is the uncertainty of addresses; some researches even from the same clinic could be noted differently, therefore, the standardization of the addresses during publication carries importance. The same problem can be encountered with authors' names. Authors should be encouraged to use the same initials for listing properly. Even an enumeration system can be created by WoS and applied to authors to overcome this problem.

Conclusion

In conclusion, bibliometric measurement of scientific research productivity is one of the most practical methods for evaluating scientific activity for countries. With this bibliometric study, it's found that there is a significant improvement of scientific activity in the pediatric ultrasonography field in Turkey among other countries in the last years, which is also concordant with increasing pediatric radiology centers both in universities and in the hospitals of ministry of health in Turkey as a part of government policy. It can be claimed that Turkey can be a model for other developing countries in the area of pediatric ultrasonography research.