



The Hand Surgery Subspecialty Education Program in Turkey and its Impact on Productivity in The Hand Surgery Literature

El Cerrahisi Yan-Dal Eğitim Programının Türkiye'nin El Cerrahisi Konusundaki Bilimsel Üretkenliğine Etkisi

Bilgehan ÇATAL¹, Ulaş AKGÜN²

¹İstanbul Medipol University Faculty of Medicine, Department of Orthopedics and Traumatology, İstanbul, Turkey

²Muğla Sıtkı Koçman University Faculty of Medicine, Department of Orthopedics and Traumatology, Muğla, Turkey

ABSTRACT

Objective: The aim of study of this study is to evaluate the hand surgery fellowship education program in terms of Turkey's productivity in the hand and wrist literature

Methods: Original articles published in five highly cited hand surgery journals between 2009 and 2019 were investigated. In order to examine the increase in quantity and quality of the published articles over time, the publications were divided into two groups according to two equal time periods (A=01.01.2009-30.06.2014 and B=01.07.2014-31.12.2019 period). Period A represented the period before the hand surgery subspecialty training program, and period B represented the period after it.

Results: A total of 5,179 articles on hand and wrist research from five journals were identified in the database of Web of Science from 2009 to 2019. It was found that 51.5% (n=2,665) of the studies were published in period A and 48.5% (n=2514) were published in period B. Turkey had 34 publication in period A (ranked 15th) and 55 publication in period B (ranked 11th). Contribution of Turkey to the total hand and wrist research increased by 69.2% (1.3% versus 2.2%) between the two periods, and a significant increase was observed in articles from 2009 to 2019 in Turkey (R²=0.67, p=0.003)

Conclusion: We observed a significant increase in the number of articles about hand and wrist research from Turkey after hand

ÖZ

Amaç: Bu çalışmanın amacı el cerrahisi yan dal eğitim programının Türkiye'nin el cerrahisindeki bilimsel üretkenliğine etkisini değerlendirmektir.

Yöntemler: 2009-2019 yılları arasından en yüksek etki faktörüne sahip 5 el cerrahisi dergisinde yayınlanan orijinal bilimsel çalışmalar incelenmiştir. Yayınlanan çalışmalar basıldıkları zamana göre iki ayrı gruba ayrılmış ve iki eşit zaman periyodu (periyot A= 01.01.2009-30.06.2014 ve periyot B= 01.07.2014-31.12.2019) oluşturulmuştur. Periyot A el cerrahisi yan dal eğitim programının öncesini temsil ederken, periyot B sonrasında temsil etmektedir.

Bulgular: Web of Science veri tabanı kullanılarak, 5 el cerrahisi dergisinde 2009-2019 tarihleri arasında yayınlanan, el-el bileği konusunda toplam 5.179 orijinal bilimsel makale tanımlanmıştır. Makalelerin %51,5'i (n=2.665) periyot A'da, %48,5'i de (n=2.514) Periyot B'de yayınlanmıştır. Periyot A'da Türkiye'den 34 makale yayınlanmışken (makale sayısına göre 15. sırada), periyot B'de Türkiye kökenli 55 makale (makale sayısına göre 11. sırada) basılmıştır. Türkiye'nin toplam el cerrahisi bilimsel literatürüne katkısı el cerrahisi yan dal eğitim programından sonraki dönemde %69,2 (%1,3 vs %2,2) oranında artmıştır ve bu artış istatistiksel olarak anlamlı (R²=0,67, p=0,003) bulunmuştur.

Sonuç: El cerrahisi yan dal eğitim programı sonrası Türkiye'nin bu konudaki literatüre bilimsel katkısı artmıştır. Yan dal eğitim

Address for Correspondence: Bilgehan ÇATAL, İstanbul Medipol University Faculty of Medicine, Department of Orthopedics and Traumatology, İstanbul, Turkey

E-mail: drbilgehancatal@yahoo.com **ORCID ID:** orcid.org/0000-0002-4883-4317

Cite this article as: Çatal B, Akgün U. The Hand Surgery Subspecialty Education Program in Turkey and its Impact on Productivity in The Hand Surgery Literature. Bezmialem Science 2022;10(3):325-31

Received: 05.02.2021

Accepted: 02.07.2021

surgery fellowship education program. Hand surgery fellowship training program positively affected scientific productivity of Turkey.

Keywords: Education program, hand surgery, scientific productivity, sub-specialty

programı Türkiye'nin el cerrahisindeki bilimsel üretkenliğini pozitif olarak etkilemiştir.

Anahtar Sözcükler: Eğitim programı, el cerrahisi, bilimsel üretkenlik, yan-dal

Introduction

The total number of scientific publications in a country is an important indicator of the scientific research volume and productivity of that country (1). There are many factors that affect the quantity and quality of scientific publications, and many bibliometric studies have been conducted investigating these issues. Bibliometric studies on many medical sciences such as rheumatology, oncology, neurosurgery, general surgery orthopedics and its subspecialties have been published before (2-9). It has been shown that the most important factors that increase the quality and quantity of a country's scientific publications are the country's per capita gross domestic product, the amount of funds allocated to scientific research, and national English proficiency (10).

Developments in the diagnosis and treatment of surgical diseases have made subgroup branching a necessity, especially in surgical fields. While all surgical procedures were performed by general surgeons at the beginning of the 20th century, today even the main surgical branches were divided into many sub-disciplines. USA is also a pioneer in this regard. According to a study, 91% of doctors who receive basic orthopedic training receive training in subspecialties (11). It has been reported that the main reason why doctors want to receive minor education is the opportunity to work more in the field of interest and the desire to obtain better financial conditions (12-14). Another effect of minor education programs is their positive contribution to scientific productivity (15).

Hand surgery fellowship training program has started in Turkey since 2014. Fellowship assistants determined by the Medical Minor Specialization Education Entrance Examination have been accepted to more than one training center. The aim of this study is to investigate the effect of hand surgery fellowship training program on Turkey's scientific productivity in this subject.

Method

Web of Science (WoS) database was used for literature review. WoS is one of the world's leading databases for academic impact information and has been used in many studies on scientific productivity (5-8). According to the 2018 Journal Citation Reports (2018 Journal Citation Reports, Thomson Reuters, New York, USA) the top 5 hand surgery journals with the highest impact factor in the "Orthopedics" category, Journal of Hand Surgery-European Volume, Journal of Hand Surgery-American Volume, Journal of Hand Therapy, Hand Surgery & Rehabilitation, and Hand Clinics, were the subjects of this study

(16). All publications published in these journals between 2009 and 2019 were examined. Only original scientific articles were included in the study. Reviews, letters to the editor, bibliographic articles, corrections and editorial articles were excluded from the study. The flowchart of the study is given in Figure 1. If the authors of the study were from more than one country, that study was registered in the name of the corresponding author's country. Literature review and information gathering were carried out by two independent authors, and any disagreements about publication selection were resolved through discussion.

The total number of scientific publications was used for the quantitative evaluation of the amount of scientific research. In addition, the number of publications per million population [publication per million population (PmP)], which was the regulation of the number of scientific publications according to the population, was also used. For the preparation of the PmP coefficient, the population data of the countries from the United Nations records were used (17). Apart from these, the total number of citations, the average number of citations per article, the H-index, the normalized citation impact (NCI) and the citation impact relative to the world (CIRW) were used for qualitative evaluation. The H-index is the number of articles from a country that attracts at least n citations (n). It quantifies the scientific productivity and scientific impact of the country (2). The amount of citations increases with time. For this reason, NCI and CIRW coefficients were used in the qualitative analysis of scientific publications in two time periods, one of which was older. These data and coefficients were calculated automatically by the software of the WoS database.

The scientific publications that were the subject of the study were divided into two groups according to the time of publication. The median was 2014, the year the hand surgery fellowship training program started in Turkey, and the years 2009 and 2019 were divided into two equal time intervals. Period A represented the pre-fellowship education program (01/01/2009-06/30/2014), while Period B represented the post-fellowship education program (07/01/2014-12/31/2019).

Descriptive statistics were used primarily. The chi-square test was used to compare Turkey's contribution rate to the total publications between the two time periods and the change in the total number of publications in Turkey and around the world. Regression analysis was used to determine the significant changes in the number of publications during the examined period. A p value of 0.05 or less was considered statistically significant for all analyses.

Results

A total of 5,179 articles on hand surgery research from 5 journals were identified in the WoS database between 01/01/2009-31/12/2019 (Table 1). A total of 60 countries contributed to the hand surgery literature during the time period studied. The USA (n=2,414, 46.7%) had the most articles, followed by France (n=347, 6.7%) and the United Kingdom (n=290, 5.6%).

According to the PmP coefficient, Switzerland (10.48) was the first, followed by Singapore (9.41) and Sweden (9.08).

In terms of the total number of citations, the USA (25,484) was in the first place, followed by the United Kingdom (2,875) and Japan (2,250). The first three countries were also the same in the H-index ranking of the countries that were directly related to the total amount of citations and the number of publications.

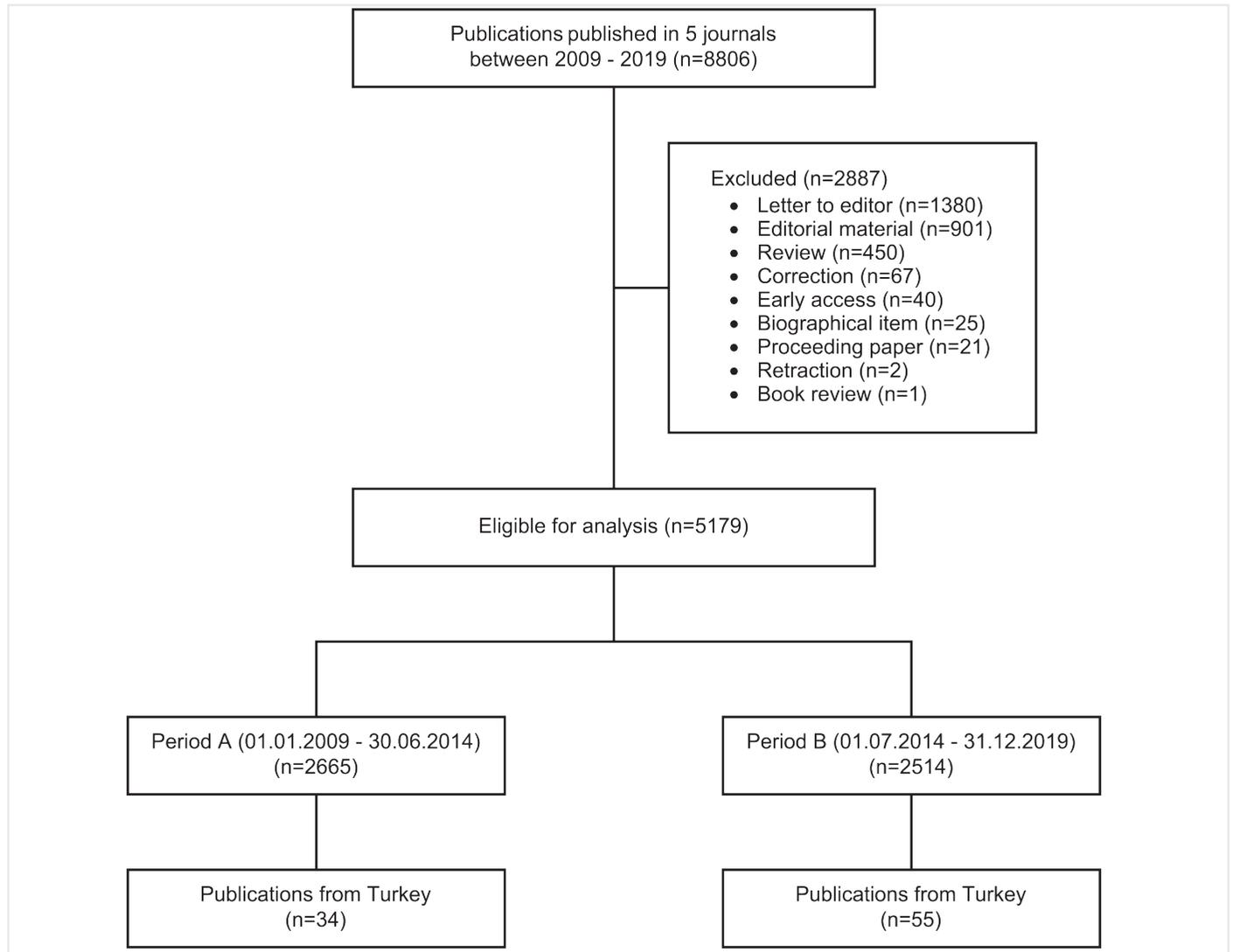


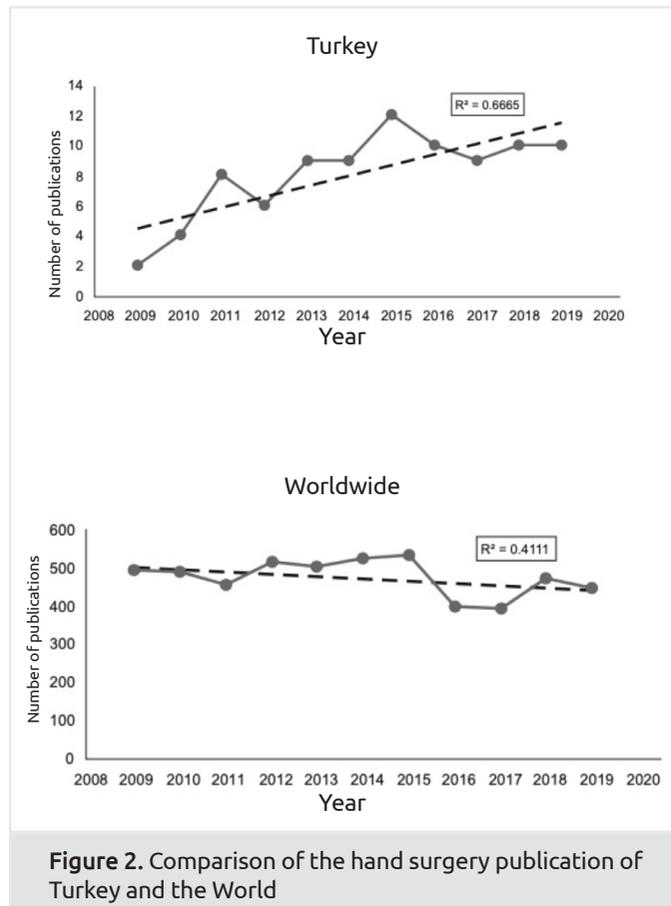
Figure 1. Flowchart of the study

Table 1. The most cited journals on hand surgery indexed in the Science Citation Index Expanded and their impact measurements

	2018 impact factor	5-year impact factor	Number of publications between 2009-2019
Journal of Hand Surgery, American Volume	2.090	2.114	2.663
Journal of Hand Surgery, European Volume	2.225	1.922	1.079
Hand Clinics	1.236	1.477	589
Journal of Hand Therapy	1.532	1.983	433
Hand Surgery & Rehabilitation	0.571	0.571	415

According to the average number of citations per article, Sweden (15.85) came first, followed by Norway (15.27) and Brazil (12.77) (Table 2).

While 51.5% (n=2.665) of the total publications between 2009-2019 were published in Period A, 48.5% (n=2.514) were published in period B. The top three countries according to the total number of publications in both time periods were the USA, France and the United Kingdom. Comparing both time periods showed a 5.7% reduction in the number of hand surgery research publications worldwide. Despite the decrease in the number of publications worldwide, hand surgery publications originating from Turkey increased by 61.8% after the hand surgery fellowship training program was initiated. The number of publications was 34 in period A and 55 in period B in Turkey. According to the total number of publications in 2009-2019, Turkey was in the 12th place (n=89). It was observed that while it was in the 15th rank in the period before the hand surgery fellowship training program (period A), it rose to the 11th rank according to the total number of publications in the period after it (period B). It was observed that Turkey's contribution to total hand surgery publications increased by 69.2% (1.3% vs. 2.2%) between the two time periods (Table 3). As seen in Figures 2a and 2b, while the number of publications in the field of hand surgery in Turkey increased statistically from 2009 to 2019 ($R^2=0.67$, $p=0.003$), there was no significant increase in the number of publications worldwide ($R^2=0.41$, $p=0.53$).



Discussion

With the present study, we aimed to reveal the quantitative and qualitative impact of the hand surgery fellowship training program on Turkey's scientific productivity in hand surgery. Our study showed that the hand surgery fellowship training program made a significant contribution to Turkey's scientific productivity in the field of hand surgery.

According to the PmP coefficient, which showed the total number of publications according to the population, the top three countries were Switzerland, Sweden and Singapore, respectively. We have seen that industrialized rich countries with low populations lead the way in the number of publications per million population. We observed that countries with similar characteristics rank first in the qualitative ranking of publications. According to the average number of citations per publication, Sweden, Norway and Brazil were in the top three places. According NCI, the first three countries were Norway, Sweden and Denmark, while the first three countries according to CIRW were Sweden, Norway and Brazil. Our study has shown that high quality publications in the field of hand surgery originate from less populated northern European countries. The fact that Northern European countries produce high quality scientific publications is a situation defined in other literature studies on general orthopedics and its subspecialties (6-9,18). Brazil is an exception here, and it's ranking high because of the few studies that have received very high citations (19-21). This situation showed that even a few high-quality scientific articles made by a few researchers can rank countries higher in scientific qualitative rankings.

The increase or decrease in scientific publications indicates the speed of progress in science and technology according to bibliometric theory (2,22). The rapid change in the number of publications marks an important turning point for scientific development (23). Our study showed that the start of the hand surgery fellowship training program was a turning point for the scientific productivity of hand surgery in Turkey. When we looked at the previous publications in the literature, it was stated that doctors who received fellowship training in many medical branches such as general surgery, ophthalmology, plastic surgery and dermatology showed much higher academic productivity (24-28). The same is true for orthopedics. In a study originating from the USA, it was shown that institutions providing arthroplasty fellowship training produced approximately 2/3 of all scientific articles published in the country on this subject (15).

The development of knowledge and techniques on surgical diseases requires surgeons to acquire new skills to provide optimal patient care. This trend has led to the division of the main specialties of surgery into subspecialties (29). Under the orthopedics main specialty, subspecialties started in the USA in the 1970s and spread to the whole world (30). Currently, 90% of the doctors who have completed the orthopedics general education program in the USA continue to subspecialty education programs (31). Perhaps, this may be one of the reasons why the USA is always in the first place in the literature on orthopedics

and its subspecialties (6-9). Hand surgery is the first subspecialty established under the orthopedics main specialty in Turkey, and training activities have started since 2014. We are of the opinion that the opening of other fellowship training programs in both orthopedics and other surgical specialties will contribute to the scientific productivity of the country.

Study Limitations

The present study had several limitations. The 5 hand surgery journals with the highest impact were included in the study. For this reason, publications on hand surgery in general orthopedic journals and basic research journals were excluded from the

Table 2. Data from the top 25 countries with the highest number of publications on hand surgery between 2009 and 2019

Rank	Country	Number of publications	Contribution to the total amount of publications (%)	Number of publications per million population	Total number of citations	Average number of citations per publication	H-index	Normalized citation impact	Citation impact relative to the world
1	USA	2419	46.7	7.59	25,484	10.53	53	0.73	1.11
2	France	347	6.7	5.41	1,804	5.20	19	0.42	0.55
3	United Kingdom	290	5.6	4.43	2,875	9.91	24	0.75	1.04
4	Japan	249	4.8	1.94	2,250	9.04	24	0.61	0.95
5	Canada	205	4.0	5.75	1,825	8.90	22	0.69	0.94
6	Chinese	162	3.1	0.12	1,450	8.95	20	0.88	0.94
7	South Korea	155	3.0	3.06	873	5.63	14	0.48	0.59
8	Holland	130	2.5	7.70	1,063	8.18	17	0.69	0.86
9	Germany	108	2.1	1.33	1,222	11.31	20	0.73	1.19
10	Spain	103	2.0	2.20	1,039	10.09	18	0.78	1.06
11	australia	100	1.9	4.24	1,135	11.35	18	0.87	1.19
12	Turkey	89	1.7	1.15	514	5.78	13	0.59	0.61
13	Sweden	88	1.7	9.08	1,395	15.85	23	1.05	1.67
14	Switzerland	86	1.7	10.48	807	9.38	15	0.85	0.99
15	Belgium	59	1.1	5.26	346	5.86	12	0.64	0.62
16	Italy	53	1.0	0.88	603	11.38	14	0.65	1.20
17	Saudi Arabia	53	1.0	1.71	392	7.40	11	0.42	0.78
18	Singapore	52	1.0	9.41	348	6.69	11	0.53	0.70
19	Brazil	43	0.8	0.21	549	12.77	13	0.72	1.34
20	India	40	0.8	0.03	239	5.98	10	0.52	0.63
21	Denmark	35	0.7	6.18	404	11.54	13	0.9	1.22
22	Finland	31	0.6	5.68	242	7.81	9	0.57	0.82
23	Taiwan	30	0.6	1.28	343	11.43	12	0.79	1.20
24	Austria	25	0.5	2.90	239	9.56	9	0.75	1.01
25	Norway	22	0.4	4.28	336	15.27	11	1.11	1.61

Table 3. Comparison of Turkish hand surgery publications between two different periods

	Period A (01.01.2009-30.06.2014)	Period B (01.07.2014-31.12.2019)
Number of publications	34	55
Rank in the world by number of publications	15	11
Contribution to total publication (%)	1.3	2.2
Total citation	327	187
Average citation per publication	9.62	3.4
H-index	10	7
Normalized citation impact	0.53	0.59
Citation impact relative to the world	0.7	0.78

study. However, we think that the journals included in the study show a general trend since they publish a large part of the total publications on hand surgery. In addition, the WoS database was used for the study; therefore, using another database might cause changes in the results. Citation analysis was used to assess the quality of articles, and the number of citations was considered a proxy measure of influence, reflecting peer recognition and quality of published research (32). However, reasons such as excessive quoting, biased citation and ignorance of the literature reduce the reliability of citation analyzes and become a general problem of literature studies (33).

Conclusion

In conclusion, after the start of the hand surgery fellowship training program, there has been a rapid increase in scientific articles on hand surgery from Turkey. The fellowship training program has positively affected Turkey's scientific productivity in the field of hand surgery.

Ethics

Ethics Committee Approval: İstanbul Medipol University Non-Invasive Clinical Research Ethics Committee (decision no: 369/date: 18/03/2021).

Peer-review: Externally peer reviewed.

Authorship Contributions

Concept: B.Ç., U.A., Design: B.Ç., U.A., Data Collection or Processing: B.Ç., U.A., Analysis or Interpretation: B.Ç., U.A., Literature Search: B.Ç., U.A., Writing: B.Ç., U.A.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

References

- Rennie D, Yank V, Emanuel L. When authorship fails. A proposal to make contributors accountable. *JAMA* 1997;278:579-85.
- Cheng T, Zhang G. Worldwide research productivity in the field of rheumatology from 1996 to 2010: A bibliometric analysis. *Rheumatology (Oxford)* 2013;52:1630-4.
- Bakker IS, Wevers KP, Hoekstra HJ. Geographical distribution of publications in the scientific field of surgical oncology. *J Surg Oncol* 2013;108:505-7.
- Altınors N, Comert S, Sonmez E, Altinel F. Turkish contribution to journal of neurosurgery and acta neurochirurgica. *Turk Neurosurg* 2017;27:1007-15.
- Gürbüz Y, Sügün TS, Özaksar K. A bibliometric analysis of orthopedic publications originating from turkey. *Acta Orthop Traumatol Turc* 2015;49:57-66.
- Luo X, Liang Z, Gong F, Bao H, Huang L, Jia Z. Worldwide productivity in the field of foot and ankle research from 2009-2013: A bibliometric analysis of highly cited journals. *J Foot Ankle Res* 2015;8:12.
- Sun J, Ding R, Ma T, Shi X, Bao C, Guan H. Worldwide research productivity in fracture surgery: A 10-year survey of publication activity. *Exp Ther Med* 2017;14:1260-4.
- Çatal B, Akman YE, Şükür E, Azboy İ. Worldwide arthroplasty research productivity and contribution of turkey. *Acta Orthop Traumatol Turc* 2018;52:376-81.
- Ajuied A, Back D, Smith C, Davies AJ, Wong F, Earnshaw PH. Publication trends in knee surgery: A review of the last 16 years. *J Arthroplasty* 2013;28:751-8.
- Man JP, Weinkauff JG, Tsang M, Sin DD. Why do some countries publish more than others? An international comparison of research funding, english proficiency and publication output in highly ranked general medical journals. *Eur J Epidemiol* 2004;19:811-7.
- Hariri S, York SC, O'Connor MI, Parsley BS, McCarthy JC. Career plans of current orthopaedic residents with a focus on sex-based and generational differences. *J Bone Joint Surg Am* 2011;93:e16.
- Gaskill T, Cook C, Nunley J, Mather RC. The financial impact of orthopaedic fellowship training. *J Bone Joint Surg Am* 2009;91:1814-21.
- Sarmiento A. Additional thoughts on orthopedic residency and fellowships. *Orthopedics* 2010;33:712-3.
- Morrell NT, Mercer DM, Moneim MS. Trends in the orthopedic job market and the importance of fellowship subspecialty training. *Orthopedics* 2012;35:e555-60.
- Formby PM, Pavey GJ, Van Blarcum GS, Mack AW, Newman MT. An analysis of research from faculty at u.S. Adult reconstruction fellowships. *J Arthroplasty* 2015;30:2376-9.
- 2018 Journal Impact Factor, Journal Citation Reports (Clarivate Analytics, 2019).
- United Nations, Department of Economic and Social Affairs, Population Division (2019) World Population Prospects 2019, Online Edition Rev 1.
- Kennedy C, P OS, Bilal M, Walsh A. Ireland's contribution to orthopaedic literature: A bibliometric analysis. *Surgeon* 2013;11:267-71.
- Faria-Fortini I, Michaelsen SM, Cassiano JG, Teixeira-Salmela LF. Upper extremity function in stroke subjects: Relationships between the international classification of functioning, disability, and health domains. *J Hand Ther* 2011;24:257-264;quiz 265.
- Bertelli JA, Ghizoni MF. Nerve root grafting and distal nerve transfers for c5-c6 brachial plexus injuries. *J Hand Surg Am* 2010;35:769-75.
- Bertelli JA, Ghizoni MF. Reconstruction of complete palsies of the adult brachial plexus by root grafting using long grafts and nerve transfers to target nerves. *J Hand Surg Am* 2010;35:1640-6.
- Hui Z, Yi Z, Peng J. Bibliometric analysis of the orthopedic literature. *Orthopedics* 2013;36:e1225-32.
- Wei M, Wang W, Zhuang Y. Worldwide research productivity in the field of spine surgery: A 10-year bibliometric analysis. *Eur Spine J* 2016;25:976-82.
- Valsangkar NP, Liang TW, Martin PJ, Mayo JS, Rosati CM, Feliciano DV, et al. Impact of clinical fellowships on academic productivity in departments of surgery. *Surgery* 2016;160:1440-6.

25. DeLong MR, Hughes DB, Tandon VJ, Choi BD, Zenn MR. Factors influencing fellowship selection, career trajectory, and academic productivity among plastic surgeons. *Plast Reconstr Surg* 2014;133:730-6.
26. Eloy JA, Svider PF, Mauro KM, Setzen M, Baredes S. Impact of fellowship training on research productivity in academic otolaryngology. *Laryngoscope* 2012;122:2690-4.
27. Huang G, Fang CH, Lopez SA, Bhagat N, Langer PD, Eloy JA. Impact of fellowship training on research productivity in academic ophthalmology. *J Surg Educ* 2015;72:410-7.
28. Tierney EP, Hanke CW, Kimball AB. Academic productivity and affiliation of dermatologic surgeons. *Dermatol Surg* 2009;35:1886-92.
29. Daniels AH, Grabel Z, DiGiovanni CW. ACGME accreditation of orthopaedic surgery subspecialty fellowship training programs. *J Bone Joint Surg Am* 2014;96:e94.
30. Horst PK, Choo K, Bharucha N, Vail TP. Graduates of orthopaedic residency training are increasingly subspecialized: A review of the american board of orthopaedic surgery part ii database. *J Bone Joint Surg Am* 2015;97:869-75.
31. Salsberg ES, Grover A, Simon MA, Frick SL, Kuremsky MA, Goodman DC. An AOA critical issue. Future physician workforce requirements: Implications for orthopaedic surgery education. *J Bone Joint Surg Am* 2008;90:1143-59.
32. Lefaivre KA, Shadgan B, O'Brien PJ. 100 most cited articles in orthopaedic surgery. *Clin Orthop Relat Res* 2011;469:1487-97.
33. MacRoberts MH, MacRoberts BR. Problems of citation analysis. *Scientometrics* 1996;36:435-44.