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Analysis of Romanian National Publication Output in Orthopedics

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Abstract: (1) Aim: To analyze the publication output from Romania in the Web of Science (WoS) category of orthopedics. (2) Methods: We have used the WoS Core Collection Advanced Search between 2009 and 2018. (3) Results: Under the WoS Orthopedics category in SCI-Expanded, we found 72 articles with Romania as the country of origin, representing 0.105% of the total Romanian research output. Using journal rankings, distribution by quartile was: 1–12 (16.7%), 2–33 (45.8%), 3–9 (12.5%) and 4–18 (25%). Average citations in total and per year by category were: 1–22.6 range 1–91 (2.56), 2–8.85 range 0–30 (1.64), 3–8.44 range 1–30 (1.25), and 4–4.11 range 0–16 (0.74). Thirteen articles published from 1986 to 2008 were excluded by limiting the timespan. When searching for all document types and all WoS core collection citation indexes, we found 107 items; the total citations increased from 714 to 806. (4) Conclusions: Orthopedic publications from Romania have increased in the last decade, but are still low compared to category averages; however, the bibliometric qualitative distribution and patterns mostly resemble that of comparators.

Keywords: bibliometrics; databases; factual; evidence-based medicine/standards; Romania; journal impact factor; orthopedics; qualitative research; traumatology

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Introduction

The current medical practice relies on evidence to produce a value-based healthcare environment [1–3]. Medical research is aimed at improving clinical practice by producing more accurate diagnosis and safer and more efficient treatments. Results are published through peer-reviewed journals, which also serve to filter the most meaningful ideas and guarantee a certain level of scientific methodology. The impact a research publication has on the scientific community is a measure of success which may be quantified by the number of citations.

In addition, there is also academic pressure to publish, with many scholars being evaluated based on the number and impact of their research publications [4–6].

The Clarivate analytics Web of Science (WoS) is regarded as the best and most prestigious journal ranking system and scientific publication citation aggregator. The global publication output is growing year by year. With respect to orthopedics, the United States of America (USA) has maintained its dominance, but the percentage is decreasing. Countries such as China and South Korea are increasing production at a steady pace [7–9]. However, there is limited information regarding orthopedic publication outputs from countries in eastern Europe [7,8,10,11].

We therefore aimed to analyze the publication output from Romania under the WoS category of orthopedics.

Materials and Methods

In the WoS Core Collection Advanced Search we used field tags, Boolean operators and parentheses to create the following queries:

- (SU = Orthopedics OR WC = Orthopedics) AND CU = Romania;
- (SU = Orthopedics OR WC = Orthopedics) AND CU = USA.

These were first limited to English language, document type article, custom year range 2009–2018 and SCIE—Science Citation Index Expanded, and then with all document types and all WoS Core Collection citation indexes (including Emerging Sources Citation Index—ESCI) (where SU = Research Area, WC = Web of Science Category, CU = Country/Region).

Separate searches were also performed for: (SU = Orthopedics OR WC = Orthopedics); CU = Romania; CU = USA; limited to English language, document type—article, and SCI-Expanded index timespan 2009–2018 and all years (1975–2008).

According to WoS, research areas are a subject categorization system common to all WoS databases. In addition, journals covered by the WoS Core Collection are assigned to at least one category and each WoS category is mapped to one research area [12]. Highly Cited in Field (HCF) means that the article has received enough citations to place it in the top 1% of the academic field of Clinical Medicine, based on a highly cited threshold for the field and publication year [12].

Descriptive statistics were used to assess differences against main comparators: WoS orthopedics category output USA, WoS orthopedics category output world, and WoS Romania total research output. To determine journal impact factor (IF) quartile, we used the Journal Citation Reports for 2018 (76), although in 2009 this only contained 56 titles [13]. Ethics approval was not applicable for this type of research.

Results

Orthopedics in Romania

Under the WoS orthopedics category in SCI-Expanded, there were 72 articles which reported Romania as the country of origin, representing 0.105% of the total Romanian research output. At the national level, this was, as expected, more than the connected musculoskeletal categories of rheumatology, rehabilitation and sports medicine, and less that high-impact categories such as surgery (1.1%) and oncology (0.93%). By the 2018 journal ranking, distribution by quartile was: 1–12 (16.7%), 2–33 (45.8%), 3–9 (12.5%) and 4–18 (25%). Average

citations in total and per year by category were: 1–22.6 range 1–91 (2.56), 2–8.85 range 0–30 (1.64), 3–8.44 range 1–30 (1.25), and 4–4.11 range 0–16 (0.74). Thirteen previous articles published from 1986 to 2008 were excluded by limiting to the last 10 years. A side-by-side comparison with the sub-search with all document types and all WoS core collection citation indexes is detailed in Table 1. For reference, a summary of research output from Romania is available in Table 2.

Table 1. WoS orthopedics category from Romania.

	Orthopedics Ro (*n* = 72)	**Orthopedics Ro All (*n* = 107)**
Publication years	2018 (14)	2018 (20)
Top 5 (n)	2017 (11)	2017 (16)
	2016 (7)	2016 (12)
	2015 (10)	2015 (14)
	2014 (7)	2014 (14)
Document Types	Article/SCIE	Article (79)
		Editorial material (6)
		Letter (6)
		Review (6)
		Meeting abstract (5)
Web of Science Categories	Orthopedics (72)	Orthopedics (107)
Top 5 (n)	Surgery (18)	Surgery (28)
	Clinical neurology (6)	Rheumatology (11)
	Endocrinology metabolism (5)	Clinical neurology (10)
	Rheumatology (5)	Sport sciences (8)
Research Areas	Orthopedics (72)	Orthopedics (107)
Top 5 (n)	Surgery (18)	Surgery (28)
	Neuroscience neurology (7)	Neuroscience neurology (11)
	Endocrinology metabolism (5)	Rheumatology (11)
	Rheumatology (5)	Sport sciences (8)
Organizations-Enhanced	Victor Babes UMP (16)	Carol Davila UMP (21)
Top 5 (n)	Carol Davila UMP (15)	Victor Babes UMP (20)
	Grigore T Popa UMP (10)	Iuliu Hartiganu UMP (18)
	George E Palade UMPST (9)	Grigore T Popa UMP (14)
	Iuliu Hartiganu UMP (8)	George E Palade UMPST (11)
Source Titles	Int Orthop (22)	Int Orthop (28)
Top 5 (n)	Archives of Osteoporosis (5)	Spine J (7)
	EJOST (5)	Archives of Osteoporosis (6)
	AOTT (4)	EJOST (6)
	BMC Musculoskeletal Disorders (4)	Osteoarthritis Cartilage (6)
Open Access	All Open Access (15)	All Open Access (34)
Top 4 (n)	DOAJ Gold (11)	DOAJ Gold (13)
	Bronze (3)	Bronze (12)
	Green Published (8)	Green Published (18)
Total citations	713	806
Top 5 (n)	91	91
	54	54
	51	51
	31	31
	30	30
Highly Cited in Field	0	0
Countries/Regions	Romania (72)	Romania (107)
Top 5 (n)	France (6)	France (12)
	USA (5)	Austria (6)
	Austria (4)	USA (6)
	England (4)	England (5)

The WoS (Clarivate analytics Web of Science) orthopedics category in core collection citation indexes which recorded Romania as country of origin. Organization abbreviation: UMP—University of Medicine and Pharmacy. Journal abbreviations: Int Orthop—International Orthopedics; EJOST—European Journal of Orthopaedic Surgery and Traumatology; AOTT—Acta Orthopaedica et Traumatologica Turcica.

Table 2. Research output from Romania.

	Romania (*n* = 68,823)	**Romania HCF (*n* = 616)**
Publication years	2018 (7279)	2018 (31)
Top 5 (n)	2017 (7124)	2017 (36)
	2016 (7306)	2016 (23)
	2015 (7307)	2015 (22)
	2014 (6798)	2014 (22)
Web of Science Categories	Chem multidisciplinary (7834)	Medicine general internal (65)
Top 5 (n)	Mat sci multidisciplinary (6512)	Cardiac cardiovasc systems (29)
	Engineering chemical (5110)	Psychiatry (22)
	Mathematics (4804)	Oncology (19)
	Mathematics applied (4723)	Rad nuclear med med imag (13)
Research Areas	Chemistry (12,887)	General internal medicine (68)
Top 5 (n)	Physics (11,787)	Cardiovasc sys cardiology (29)
	Engineering (9281)	Psychiatry (22)
	Materials science (8536)	Oncology (19)
	Mathematics (7992)	Rad nuclear med med imag (13)
Organizations-Enhanced	Ro Academy of Sciences (8435)	Harvard (66)
Top 5 (n)	Polytech Univ Bucharest (7926)	University of London (65)
	University of Bucharest (7085)	Imperial College (55)
	Babes Bolyai (6914)	Karolinska institutet (51)
	7th Carol Davila UMP (4086)	Univ Cal system (50)
Source Titles	Rev Chim (3905)	The Lancet (40)
Top 5 (n)	Metalurgia International (2136)	NEJM (23)
	EEMJ (1446)	The Lancet Oncology (10)
	RJME (1383)	European Journal of Heart Failure (7)
	Mat plastice (1066)	Journal of Clinical Oncology (7)
Open Access	All Open Access (15,931)	All Open Access (142)
Top 4 (n)	DOAJ Gold (7232)	Other Gold (31)
	Bronze (4628)	Bronze (60)
	Green Published (6897)	Green Published (83)
Funding Agencies	EU (3368)	Eli Lilly (40)
Top 5 (n)	CNCSIS (2962)	US Dept of Health (35)
	ESF (2194)	US NIH (33)
	NSF (2122)	AstraZeneca (32)
	DGF (2117)	Bristol Myers Squibb (29)
Total citations	Not calculated	-
Top 5 (n)	-	2808
	-	2460
	-	2269
	-	2250
	-	2028
Countries/Regions	Romania (68,823)	Romania (183)
Top 5 (n)	France (7811)	Italy (148)
	Germany (7096)	USA (147)
	USA (6687)	Germany (135)
	Italy (6330)	France (129)

The WoS (Clarivate analytics Web of Science) core collection citation indexes which recorded Romania as country of origin. HCF—Highly Cited in Field. Journal abbreviations: *EEMJ—Environmental engineering and management journal*; *RJME—Romanian journal of morphology and embryology*; *NEJM—New England Journal Of Medicine*. Funding Agencies abbreviations: EU—European Union; CNCSIS—National University Research Council; ESF—European social fund; NSF—National science foundation; DGF—German research foundation; NIH—USA National institute of Health.

Orthopedics in the United States

Under the WoS orthopedics category in SCI-Expanded, there were 38,414 articles which recorded the United States as the country of origin, representing 1.219% of the national research output. Of these, 118 were highly cited in their field, representing 0.0025% of all U.S. HCF articles within the time frame and 0.003% of orthopedic articles. HCF articles represented 0.0146% of the entire country research output within the 2009–2018 timeframe, almost five times more that the percentage found in the field of orthopedics. A side-by-side comparison to the sub-search with all document types and all WoS core collection citation indexes is detailed in Table 3.

Table 3. WoS orthopedics category from the United States.

	Orthopedics USA (*n* = 38,414)	**Orthopedics USA All (*n* = 54,931)**
Publication years Top 5 (n)	2018 (4612) 2017 (4666) 2016 (4427) 2015 (4138) 2014 (4021)	2018 (7042) 2017 (6973) 2016 (6761) 2015 (6391) 2014 (5370)
Document Types	Article/SCIE	Article (42,276) Editorial material (4646) Review (4040) Meeting abstract (2106) Book chapter (1424)
Web of Science Categories Top 5 (n)	Orthopedics (38,414) Surgery (12,541) Sport sciences (10,128) Clinical neurology (4615) Rehabilitation (1590)	Orthopedics (54,931) Surgery (17,744) Sport sciences (11,908) Clinical neurology (6105) Rheumatology (3606)
Research Areas Top 5 (n)	Orthopedics (38,414) Surgery (12,541) Sport sciences (10,128) Neuroscience neurology (5572) Rehabilitation (1590)	Orthopedics (54,931) Surgery (17,744) Sport sciences (11,908) Neuroscience neurology (7110) Rheumatology (3606)
Organizations-Enhanced Top 5 (n)	Harvard (2751) Univ Cal system (2626) Hosp special surg (2038) Mayo (1767) PCSHE (1695)	Harvard (3738) Univ Cal system (3626) Hosp special surg (2699) PCSHE (2328) Mayo (2263)
Source Titles Top 5 (n)	Journal of Arthroplasty (2520) Spine (2430) CORR (2226) JBJS Am (2010) AJSM (1851)	CORR (3550) Osteoarthritis Cartilage (3118) Spine (2838) Journal of Arthroplasty (2761) JBJS Am (2644)
Open Access Top 4 (n)	All Open Access (10,267) DOAJ Gold (1798) Bronze (2683) Green Published (5501)	All Open Access (16,923) DOAJ Gold (2816) Bronze (6285) Green Published (9370)
Funding Agencies Top 5 (n)	U.S. Dept. of Health (4783) NIH (4635) NIAMS (1429) Arthrex (732) Smith & Nephew (725)	U.S. Dept. of Health (5348) NIH (5191) NIAMS (1661) Arthrex (1127) Smith & Nephew (1039)

Table 3. *Cont.*

	Orthopedics USA (*n* = 38,414)	**Orthopedics USA All (*n* = 54,931)**
Total citations	Not calculated	Not calculated
Top 5 (n)	810	1279
	658	923
	635	836
	624	810
	595	658
Highly Cited in Field	118	139
Countries/Regions	USA (38,414)	USA (54,931)
Top 5 (n)	Canada (1295)	Canada (1875)
	Germany (918)	Germany (1352)
	Peoples Republic of China (730)	England (977)
	Japan (671)	Australia (894)

The WoS (Clarivate analytics Web of Science) orthopedics category in core collection citation indexes which recorded the United States as the country of origin. Organizations-Enhanced abbreviation: PCSHE—Pennsylvania Commonwealth System of Higher Education. Journal abbreviations: *CORR—Clinical Orthopedics and Related Research*; *JBJS Am—Journal of Bone and Joint Surgery American Volume*; *AJSM—American Journal of Sports Medicine*. Funding Agency abbreviations: NIAMS—National institute of arthritis musculoskeletal skin diseases.

Orthopedics in the World

Searching the WoS Core Collection Science Citation Index Expanded for the research area/Web of Science category 'Orthopedics', a time frame of all years, in the English language, and article document types, we found 225,323 results, indicating the total world output of articles in WoS category of orthopedics. The top 10 cited had over 2000 citations each; however, only the first two had more than 3000. Of those 10, 6 presented clinical rating systems. A total of 102,918 articles were published from 2009 to 2018. Of the top 10 cited (560–937), most (6) were epidemiology studies, and most (6) addressed the topic of joint replacement. Only 177 (0.0017%) were HCF. The world's strongest economies were also the top contributors to orthopedic research output. By far, the United States had the largest share, with 37.3%, followed by England (7%), Japan (6.8%), the Peoples Republic of China (6.7%) and Germany (63%). Orthopedic articles represented 0.967% of the national research output in England, 0.756% in Germany, 0.677% in France, 0.569% in Italy, 0.196% in Poland and 0.265% in Hungary.

Discussion

This is the first critical analysis of orthopedic publication output from Romania based on WoS category and indexation. Although the total number of articles was low compared to world category and national level, over the last five years, the number of publications per year doubled, a much greater increase than all comparators. The distribution by document types was similar, with a preponderance of original research. Compared to the United States, in the top five WoS categories/research areas, 'Sports sciences' were less represented. At the national level, Victor Babes University of Medicine and Pharmacy from Timisoara shared the top place with Carol Davila University of Medicine and Pharmacy from Bucharest, an above-average result based on national medical university rankings [12]. *International Orthopedics* was by far the leading journal for Romanian authors, publishing 30.5% of titles. Open access notably increased when all document types and all WoS core collection citation indexes were included. The top five articles by number of citations were the same in both search modes, and ranged from 30 to 91. There were no publications included in the HCF category. At the national level, all top five HCF WoS categories/research areas were from clinical medicine, even though the main outputs from Romania were from the fields of chemistry, physics, engineering and

mathematics. Both national and the top orthopedic publication collaborations were with countries from western Europe, England and the United States.

A bibliometric analysis of Romania's research output between 2005 and 2014 was commissioned by the Executive Unit for Financing Higher Education, Research, Development and Innovation (UEFISCDI) in partnership with Thompson Reuters [Lau]. This allowed full data access including to Thomson Reuters InCites: Essential Science Indicators field of 'Clinical medicine'. The top five categories by number of publications were Surgery, Gastroenterology & Hepatology, Medicine, Research & Experimental and Endocrinology & Metabolism; however, only Oncology ranked much higher than the world domain average in terms of citations. A UEFISCDI report chose the Czech Republic, Poland, Slovenia, Turkey and Hungary as direct comparators. On an aggregate level, Turkey published the most research papers, but Romania had the greatest increase in publication output. Citation trends were similar and mostly below the world average citation impact, and only in 2014 had Romania's normalized citation impact climbed above that threshold [10].

The IF system is a historic authority on research impact and measure of prestige in the field. Some of its criticism has been that it includes self-citations, it favors review articles, there is wide disparity among disciplines, it is not a measure of each article but a cumulative journal effort, and it makes no distinction regarding the quality of citing sources. In top-ranking journals, randomized controlled trials and metanalyses receive more citations overall and are more likely to be cited outside the field, in the general medical literature [14]. Altmetric scores had a significant positive association with the citation rates of articles in five high-impact orthopedic journals [15]. Citations in the WoS system were the most restrictive. Scopus and Google Scholar had higher citation counts than WoS, and the difference was larger between Google Scholar and WoS [16].

The IF of orthopedic journals falls well behind other specialties with broader addressability, such as internal medicine [17]. By using only the WoS category, we did not include orthopedic publications and publications authored by orthopedic surgeons in other journals [18]. This is particularly important because the pressure to publish may push academic orthopedics to look for open access, multidisciplinary mega-journals instead of the classic orthopedic titles. Additionally, the effects may be multiple: faster publication, easier acceptance, higher impact factor and even increased citations. Mavrogenis et al. explored the validity of assessing orthopedic surgeons by their number of publications. Practicing clinicians from the academic sector are often evaluated solely by their research performance. Future reforms should try to also include surgical proficiency in the ranking of orthopedists [19].

Ultimately, the goal of orthopedic research should be to increase translation into practice. To achieve this target, the orthopedic literature has to overcome several hurdles. The clinician should be able to understand the technical soundness of a paper [20]. On the other hand, researchers should avoid academic misconduct and fraud [21]. Everyone in the health care system has to limit potential conflicts of interest [22]. An analysis found that the majority of the recommended readings for residency training curricula stem from higher impact general orthopedic and major subspecialty journals, albeit with a preponderance of low level of evidence (Level IV) research [23]. Independent and peer-reviewed sources of information are preferred by surgeons when choosing between treatments and implants. However, there is also bias stemming from extrinsic factors such as investigator reputation and perceived journal quality [24].

Conclusion

Orthopedic publications from Romania have increased in the last decade, but are still low compared to category averages; however, the bibliometric qualitative distribution and patterns mostly resemble those of comparators.

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Abbreviations

WoS	Clarivate analytics Web of Science
USA	United States of America
SCIE	Science Citation Index Expanded
HCF	Highly Cited in Field
IF	Impact factor
UMP	University of Medicine and Pharmacy
EJOST	European Journal of Orthopaedic Surgery and Traumatology
AOTT	Acta Orthopaedica et Traumatologica Turcica
DOAJ	Directory of Open Access Journals
EEMJ	Environmental engineering and management journal
RJME	Romanian journal of morphology and embryology
NEJM	New England Journal Of Medicine
EU	European Union
CNCSIS	National University Research Council
ESF	European Social Fund
NSF	National Science Foundation
DGF	German Research Foundation
NIH	National Institute of Health
PCSHE	Pennsylvania Commonwealth System of Higher Education
CORR	Clinical Orthopedics and Related Research
JBJS	Journal of Bone and Joint Surgery
AJSM	American Journal of Sports Medicine
NIAMS	National Institute of Arthritis Musculoskeletal Skin Diseases

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