

## ORIGINAL ARTICLE

# Top 50 medical journals from Balkan countries: A bibliometric analysis, 2000–2020

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## Abstract

**Background:** Science Citation Index Expanded (SCIE) is one of the most important indexes that medical journals aspire to be covered by. Currently, SCIE indexes 14,840 peer-reviewed journals across 178 disciplines. Among these journals are 3445 medical journals, divided into more than 40 subject categories.

**Objectives:** To reveal the impact and contribution of medical journals from Balkan countries through the Journal Impact Factor of those journals, the number of articles published by them, and the number of times those articles have been cited.

**Methods:** Balkan countries are countries that fall or fully or partly within the Balkan peninsula. All medical journals from those countries listed in the SCIE were ranked based on cumulative citations between 2000 and 2020. Among them, the top 50 journals in terms of cumulative citations were chosen for the study, which analysed the data on 129,259 research articles and reviews that covered 27 different subject categories within the broad field of medicine. The countries were Bosnia & Herzegovina, Croatia, Greece, North Macedonia, Romania, Serbia, Slovenia, and Turkey

**Results:** The top 50 journals included those published from eight Balkan countries. Turkey had the most journals (21) in the Web of Science (WoS) and Greece had 13 but, when ranked in terms of the number of journals in WoS per million people, Croatia topped the list, with 1.22 journals per million of its population, followed by Greece (1.21 journals). The top-cited journals were *Anticancer Research* (206,226 citations), *International Journal of Oncology* (171,654), *Oncology Reports* (157,467), *Molecular Medicine Reports* (82,009), and *Oncology Letters* (69,161). Oncology was the most cited subject category and Croatia, the country with maximum interaction with other Balkan countries, that is, papers in Croatian journals cited journals published from the maximum number of Balkan counties.

**Conclusion:** The study provides insights into the last two decades of progress in academic publishing and in the performances of medical journals published from Balkan countries.

**Keywords:** Balkan countries, bibliometric analysis, Journal Impact Factor, medical journals, Science Citation Index Expanded

## Introduction

Web of Science (WoS), by Clarivate Analytics, is one of the renowned worldwide citation databases. Its core collection comprises the following indexes: Science Citation Index Expanded (SCIE), Social Sciences Citation Index (SSCI), Arts & Humanities Citation Index (AHCI), Emerging Sources Citation Index (ESCI), Conference Proceedings Citation Index (CPCI), Book Citation Index (BKCI), Current Chemical Reactions, and Index Chemicus. In addition to books and conference proceedings, the core collection contains over 21,100 peer-reviewed journals covering more than 250 disciplines.<sup>1</sup> Of the eight indexes mentioned above, the one that most medical journal aspire to be covered by is SCIE. Of the 14,840 peer-reviewed journals representing 178 disciplines covered by the SCIE are 3445 medical journals representing more than 40 disciplines.

The importance of WoS rests mainly on its citation analysis, which is captured in the *Journal Citation Reports (JCR)*.<sup>2</sup> Based on the citation analysis that JCR provides, each journal indexed in SCIE and SSCI is given a rating, namely the Journal Impact Factor (JIF), which shows how each of those journals has fared in a given year in terms of the number of times it has been cited in the preceding two years.<sup>3</sup> Among the several metrics of the performance of journals, such as the number of articles published, the number of citations earned by those articles, journal impact factor quartile, immediacy index, and eigenfactor score, the JIF is considered one of the most selective indicators of presumed quality.<sup>4,5</sup>

Given the spectrum of its content and citation analysis, WoS is one of the most preferred platforms for bibliometric analyses. Some of these analyses focus on research areas,<sup>6-8</sup> some investigate the impact of country-based articles,<sup>9</sup> and yet others review the impact of a country or a region.<sup>10-13</sup> However, given the lack of studies focusing on the scientific contribution of Balkan countries, we wanted to examine the impact and contribution of medical journals from those countries.

More specifically, the study sought (1) to identify the top 50 medical journals from Balkan countries based on the data from WoS and (2) to investigate the contributions of those journals to medical literature and to analyse their citation performance and interactions with other Balkan countries.

## Materials and methods

### Journals

We used descriptive bibliometric analysis for identifying the most impactful journals, countries, and research areas in Balkan region and defined as Balkan countries the following 12 countries that fall fully or partly in the Balkan peninsula: Albania, Bosnia & Herzegovina, Bulgaria, Croatia, Greece, Kosovo, Montenegro, North Macedonia, Romania, Serbia, Slovenia, and Turkey.<sup>14</sup>

All medical journals from Balkan countries covered by the SCIE were ranked based on cumulative citations during 2000–2020 (Supplementary Table 1). First, the 12 countries were filtered from the ‘Publication sources’ section of the WoS – Incites platform. Next, the research areas, or categories (as assigned by WoS, within the broad field of medicine), were limited to 27, and the journals indexed in ESCI were excluded. This process left us with 77 journals. After excluding journals that had ceased publication or had no JIF (because they had changed their title), we were left with 55 journals, which were then ranked by their cumulative citations and the top 50 among those were taken for further study and form the core of the present study. The five journals that were left out comprised four from Turkey and one from Bulgaria. Because the top 50 had no representation from Albania, Bulgaria, Kosovo, and Montenegro, these four countries were excluded from the study. All the bilingual journals from this list of 50 core journals are referred to by their English title.

### Data collection and analysis

The following data were collected for each journal on 11 November 2020: country of publication, number of documents in the WoS database, number of citations, JIF, quartile, JIF without self-citations, and category. We analysed data from 129,259 research articles and reviews that included 27 different WoS categories.

We then analysed the impact of Balkan countries and their interactions. The number of citations earned by the articles published in those 50 journals and sorted by the country of publication of the citing journal served as the proxy for the journals’ impact, and we collected these data through the WoS – Incites platform. We searched for each of the 50 journals in the Incites platform and for countries that had published at least three articles in any of those journals. To compare the impact of a country, we used the citation impact data that Incites provides. Citation impact shows the average number of times a given article was cited during a specified period. Because our search was filtered by the country, the citation impact showed the average number of citations received by articles published in journals from a given country between 2000 and 2020.

### Statistical analysis

The results were reported as totals and as percentages. The Pearson correlation coefficient ( $r$ ) was calculated to determine whether the number of publications was correlated to the total number of citations. This relationship was examined to see whether the large numbers of citations obtained by these top-cited journals were a function of their age rather than of the quality and intrinsic value of their content. Statistical analysis was conducted using IBM SPSS Statistics ver. 22.0 for Microsoft Windows (IBM Corp., Armonk, New York).

### Ethics

As this analysis will draw on publicly available data and does not directly involve human participants, no ethical review was required for this study.

## Results

Among the top 50 journals, eight were published from Balkan countries and were listed in the WoS database. Turkey, with 21 journals, topped the list, followed, in that order by Greece (13 journals), Romania (6), Croatia (5), Serbia (2), and Bosnia & Herzegovina, North Macedonia, and Slovenia (1 each) (Table 1). However, when the population of the country was also taken into account, Croatia was ranked first (1.22 journals for every million people), closely followed by Greece (1.21).

The distribution of published articles by subject category is shown in Figure 1.

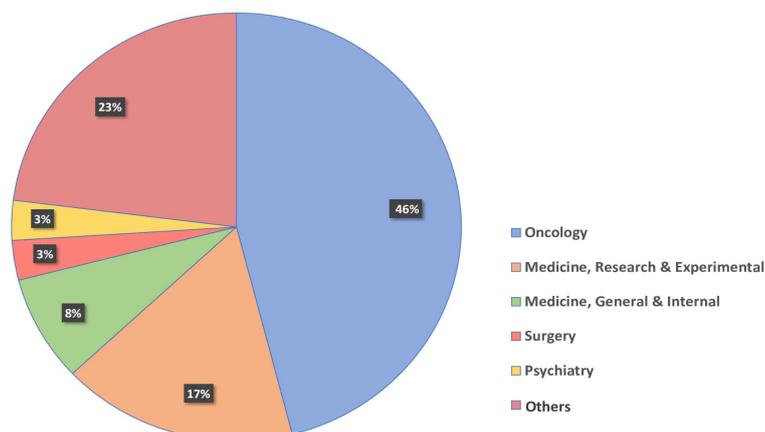


Figure 1. Distribution of 129,259 published articles, by subject category (as assigned by the Web of Science).

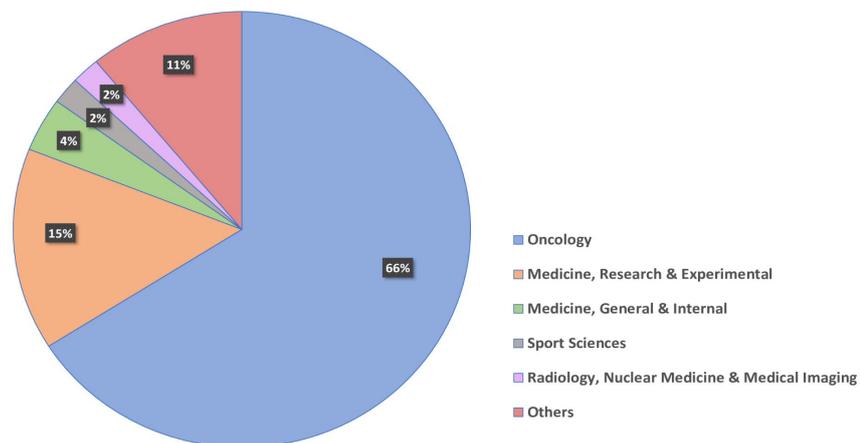
**Table 1. Number of journals from Balkan countries (total and per million population) among the 50 most-cited medical journals based on data from the World of Science database**

Country	Number of journals among the top 50	Q1/Q2*	Population (millions)	Number of journals per million people
Bosnia& Herzegovina	1	0	3.30	0.30
Croatia	5	0	4.08	1.22
Greece	13	4	10.72	1.21
North Macedonia	1	0	2.08	0.48
Romania	6	0	19.41	0.30
Serbia	2	0	6.94	0.28
Slovenia	1	0	2.08	0.48
Turkey	21	1	82.00	0.25

\*Number of journals that fall under Q1 or Q2 by the Journal Impact Factor Quartile

### Citation analysis

The top-cited category (WoS category) was Oncology, followed by Medicine, Research & Experimental, and Medicine, General & Internal (Figure 2).



**Figure 2. Distribution of total citations (961,644), by subject category (in Web of Science)**

The five top-cited journals, all from Greece, were *Anticancer Research* (206,226 citations), *International Journal of Oncology* (171,654), *Oncology Reports* (157,467), *Molecular Medicine Reports* (82,009), and *Oncology Letters* (69,161) (Table 2).

The top 5 journals, according to cumulative citation performances, were all from Greece, (Supplement 2, Table 1). Four of those five journals were on oncology; however, among the 50 journals, the journal with the highest JIF was the *Hellenic Journal of Cardiology*, with a JIF of 4.047.

### Origin of articles and integration with other Balkan countries

All details of the study group are shown in Supplementary Table 1. Of the top-50 journals, 16 had published at least three articles from at least six different Balkan countries as ascertained from the affiliations of the authors. These journals were defined as the most Balkan-interactive journals and were dominated by Greece (five journals) and Croatia (four journals). In the 20 years, *Croatian Medical Journal* published articles from ten different Balkan countries; *Psychiatria Danubina*, from nine; and *Acta Clinica Croatica* and *Acta Dermatovenerologica Croatica*, eight each. Overall, journals from Croatia showed the highest diversity in terms of the number of countries from the Balkan region; therefore, Croatia was the country with the highest interaction with other Balkan countries.

A total of 26 journals published more than 50% of the articles originating from the same country as that from which they were published, with Turkey occupying the top position in that list: of the total number of articles published in *Mikrobiyoloji Bulteni*, 97.6% were from Turkey, the corresponding figures for other journals from Turkey being 96% for *Anatolian Journal of Psychiatry*, 95.3% for *Archives of Neuropsychiatry*, 94% for *Turkish Journal of Thoracic and Cardiovascular Surgery*, and 90.0 for *Joint Diseases and Related Surgery* (Table 3). These journals have never published more than two articles from other Balkan countries in the last 20 years; however, 16 journals out of the top 50 have done so, from at least six Balkan Countries (Table 3), with *Croatian Medical Journal* and *Journal of BUON* leading the diversity, with authors from ten of the twelve Balkan countries to their credit.

The total number of citations was correlated to the number of publications ( $r = 0.985$ ;  $p < 0.001$ ).

Turkey was next to Greece in being the most prolific Balkan country in terms of both citations and the number of published articles (Supplement 2, Table 2); however, when scaled to the country's population, it ranked the lowest (0.25 journals per million people) (Table 1). Of the 21 journals based in Turkey, only one journal was in the second quartile (Q2), four were in Q3, and 16 in Q4. *Diagnostic and Interventional Radiology* had the highest JIF (1.871) among all the Turkish journals, and the *Journal of Sports Science and Medicine* was the top-cited journal with 19,434 citations in the last 20 years.

Romania, with six journals, ranked third in its share of the top 50 journals. The *Journal of Gastrointestinal and Liver Diseases* was the most cited journal from Romania with 10,340 citations and a JIF of 2.351. Romania's six journals represented seven categories: Gastroenterology & Hepatology; Developmental Biology; Acoustics; Radiology; Nuclear Medicine and Medical Imaging; Endocrinology & Metabolism; Medicine, legal; and Medicine, research, and experimental. All the Romanian journals are shown in Supplement 2, Table 3.

*Croatian Medical Journal* was the top-ranked journal in Croatia and ranked ninth among the top 50, with 18,694 citations (Supplement 2, Table 4). According to the journals' impact in the general medicine research area, the journal ranks second, next to *Balkan Medical Journal*, with a JIF of 1.247. However, *Croatian Medical Journal* was the most cited in the general-medicine category over the 20-year period.

Two journals from Serbia (Supplement 2, Table 5) are indexed in the same category, namely Medicine, General & Internal. *Vojnosanitetski Pregled* was ranked 31st, with 3437 citations, whereas *Srpski Arhiv Za Celokupno Lekarstvo* was ranked 36th, with 2186 citations. However, in terms of the JIF, these two journals are at the bottom of the list, with JIFs of 0.152 and 0.142, respectively.

*Radiology and Oncology* is the only journal from Slovenia (Supplement 2, Table 5) and covers the same area as the one that was the most frequently covered by the top 50 journals, namely Radiology, Nuclear Medicine & Medical Imaging and Oncology. The Journal Impact Factor of *Radiology and Oncology* was 1.746 (4843 citations) and the journal was placed in Q3 in Radiology, Nuclear Medicine & Medical Imaging and in Q4 in Oncology.

Of the Slovenian, Bosnian, and North Macedonian journals (listed in Supplement 2; Table 5), *Bosnian Journal of Basic Medical Sciences* was the only journal from Bosnia & Herzegovina in the study. The journal is indexed under Medicine, Research & Experimental and was placed in Q3 within that category. The journal was cited 3509 times and ranked 30th in the top 50. *Bosnian Journal of Basic Medical Sciences* is the second journal in the category, after *Molecular Medicine Reports*, with a JIF of 2.050. *Balkan Journal of Medical Genetics* is the only journal in our study that was unique in two ways, in its category, namely Genetics & Heredity, and in its country of origin, namely North Macedonia. With only 656 citations in 20 years, it was at the bottom of the list, and its JIF, 0.400, earned it a place in Q4 within the category Genetics & Heredity.

## Discussion

Of the 27 subject categories covered by the top 50 journals, Oncology was at the top, with eight journals; however, most of them fell either in Q3 or in Q4 within the category, and none was placed in Q1. *International Journal of Oncology* and *Oncology Reports*, both from Greece, appear to be the most impactful oncology journals in that category and were placed in Q2. According to the study by Taş,<sup>15</sup> the most-cited oncology articles have been published mainly in *New England Journal of Medicine*, *The Lancet*, *Nature Reviews*, and *Cancer*. These data show that high-quality research with high citation potential is more likely to be published in world-renowned journals than to the regional ones.

Rosenkrantz and Ayoola<sup>16</sup> found that journals focusing on such subspecialties of radiology as cardiac imaging and molecular imaging have the highest JIF. However, of the four radiology journals in the present study, the only general radiology journal from Turkey, *Diagnostic and Interventional Radiology*, had the highest JIF of all (Table 2).

Medicine, General & Internal, was the second leading category, with seven journals, followed by Medicine, Research & Experimental, with five journals. Although the number of journals was very close to that for oncology, general medicine accounted for only 8% of the total articles and only 4% of the total citations, and journals in that category were placed in Q3 and Q4. *Croatian Medical Journal* was the most cited general medicine journal, with 18,694 citations, followed by *Turkish Journal of Medical Sciences*, with 6208 citations. However, *Croatian Medical Journal* earned the highest number of citations among the general medicine journals, and *Balkan Medical Journal* was the most impactful journal in the category with a JIF of 1.553. Among the 27 subject categories, Medicine, General & Internal was a significant one; because journals in that category publish articles from all fields of medicine, those journals represent a broad spectrum of subject categories. General medicine journals should be a rallying point for the local and international exchange of ideas, and it will be a pity if, in the 21st century, general medicine journals are successful only locally. Therefore, regional journals should strive harder to be more prominent internationally.<sup>17</sup>

Journals from Turkey showed the widest distribution in that they represented 20 research categories, followed by Greece (8 categories) and Romania (7 categories). Turkey had two paediatrics journals in the top 50 and is the only Balkan country to publish journals on paediatrics. Despite its low JIF (0.349), *Turkish Journal of Pediatrics* ranked 13th among the top 50 journals, with 8886 citations.

*Turkish Neurosurgery* and *Archives of Neuropsychiatry* were the only clinical neurology journals in the top 50. Sarica *et al*<sup>18</sup> showed that Turkey contributed 2.5% to neurosurgical journals and ranked 10th globally. Our study showed that Turkish neurosurgical journals ranked first in the Balkan region, with the majority of authors being Turkish (60% in *Turkish Neurosurgery* and 96% in *Archives of Neuropsychiatry*).

*Acta Orthopaedica et Traumatologica Turcica* is one of the only two orthopaedics journals in the top 50. Another orthopaedics journal is *Joint Diseases and Related Surgery*. In the study by Gürbüz et al.<sup>9</sup>, Turkey ranked 14th among 122 countries in terms of the number of articles published on orthopaedics, and Turkey's contribution to this field continues to increase. Those two journals were the only ones from the Balkan region to contribute to the literature on orthopaedics in SCIE.

Among the top 50 journals, only one represented microbiology. Apart from *Mikrobiyoloji Bulteni*, no other journal from the Balkan countries is indexed in SCIE, which makes the journal particularly important to the Balkan region. Macias et al.<sup>19</sup> showed that continued existence of many so-called classic journals devoted to microbiology is threatened because new microbiology journals are more popular. Although the only microbiology journal in the Balkan region, the journal is published only in Turkish, which may explain why the JIF of *Mikrobiyoloji Bulteni* keeps fluctuating over the years despite it being the sole representative of microbiology.

Among the top 50 journals, only two dealt with Gastroenterology & Hepatology, namely the *Journal of Gastrointestinal and Liver Diseases*, from Romania, and *Turkish Journal of Gastroenterology*: the former was ranked first among the journals from Romania (10th among the top 50). These two journals are sole representatives of the Balkan countries in SCIE in the Gastroenterology & Hepatology category. Azer and Azer<sup>20</sup> found that the mean number of citations to papers published before 2000 was lower than that for papers published after 2000. However, the mean number of citations to articles published after 2000 tended to be higher, possibly indicating the significance of scientific content and the tendency of researchers to cite more recent work. The fact that these two journals indexed in SCIE are in the top-50 may be due to the increasing popularity of, and therefore more citations to, this research area. Similarly, citations of both these show that their JIFs have been increasing.

Four journals – all from Greece – published more than 10,000 articles each between 2000 and 2020 (Table 2). On the other hand, *Balkan Journal of Medical Genetics* from North Macedonia published only 329 articles in 20 years, making it the journal with the fewest publications. Although there are many journals devoted to medical genetics, only a few are from regions outside Western Europe and North America.<sup>10,21</sup>

Among the journals from Balkan countries, only two in the category Cardiac & Cardiovascular Systems are indexed in SCIE, namely the *Hellenic Journal of Cardiology*, from Greece, which had the highest JIF (4.047) among the top 50, the other being the *Anatolian Journal of Cardiology*, from Turkey (JIF 1.223).

When we analysed the listed journals taking into account self-citations, two showed a significant difference between their JIF with and without self-citations: *Joint Diseases and Related Surgery* had the highest self-citation rate of 78%, followed by *Hellenic Journal of Cardiology*, of 48%. Although *Hellenic Journal of Cardiology* had the highest JIF in the top 50, when the list is sorted by the JIF without self-citations, the journal falls to the 6th place and *Joint Diseases and Related Surgery* falls to the 43th place from the 23rd. A high self-citation rate does not always imply manipulation. When journals get on in the years, their archives expand and their visibility increases; these factors can increase a journal's self-citation rate organically. However, the impact factor without self-citation is an important parameter to see the changes in the journal's rank in a given category.

We acknowledge that the present study has several limitations, one of them being that it was based on data only from the WoS: for better insights into the impact of medical journals from Balkan countries, data from other indices such as Scopus should also be considered (the coverage of which is broader than that of WoS).<sup>22</sup> Another limitation was that we capped the list at 50 whereas to investigate Balkan countries' contribution to the literature, all journals from the region should be investigated irrespective of the number of citations.

In conclusion, this study shows that top journals from Balkan countries are dominated by a few categories such as Oncology and General Medicine in terms of the number of articles published and the number of times they are cited. Greece and Turkey were the most prominent countries in terms of the number of journals in the top 50, cumulative citations, and the number of published articles. On the other hand, Croatia had the highest interactions with other Balkan countries in that it published papers by authors from maximum number of Balkan countries. Balkan journals thus have a broad representation in the field of medicine and a considerable impact. Lastly, more studies, and in greater details, are needed to broaden our understanding of the contribution of journals from Balkan countries.

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## Competing interests

The authors have no conflict of interest to declare.

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**Table 2. Top 50 medical journals from Balkan countries in terms of cumulative citations earned by them: 2000–2020**

Rank	Journal title	Country	Number of articles published	Number of times articles were cited	Journal Impact Factor	Quartile	Journal Impact Factor without self-citations	Subject category (in Web of Science)
1	Anticancer Research	Greece	20,769	206,226	1.994	Q4	1.824	Oncology
2	<i>International Journal of Oncology</i>	Greece	8209	171,654	3.899	Q2	3.816	Oncology
3	<i>Oncology Reports</i>	Greece	10,766	157,467	3.417	Q2	3.356	Oncology
4	<i>Molecular Medicine Reports</i>	Greece	11,388	82,009	2.100	Q3/Q4	2.027	Medicine, Research & Experimental / Oncology
5	<i>Oncology Letters</i>	Greece	11,941	69,161	2.311	Q3	2.228	Oncology
6	<i>Experimental and Therapeutic Medicine</i>	Greece	8,962	43,801	1.785	Q4	1.709	Medicine, Research & Experimental
7	<i>In Vivo</i>	Greece	3,263	27,970	1.541	Q4	1.451	Medicine, Research & Experimental
8	<i>Journal of Sports Science and Medicine</i>	Turkey	1,619	19,434	1.806	Q3	1.742	Sport Sciences
9	<i>Croatian Medical Journal</i>	Croatia	2,132	18,694	1.247	Q3	1.091	Medicine, General & Internal
10	<i>Journal of Gastrointestinal and Liver Diseases</i>	Romania	1,329	10,340	2.351	Q4	2.198	Gastroenterology & Hepatology
11	<i>Journal of Buon</i>	Greece	2,911	10,175	1.695	Q4	1.256	Oncology
12	<i>Romanian Journal of Morphology and Embryology</i>	Romania	2,107	9,843	1.411	Q4	1.229	Developmental Biology
13	<i>Turkish Journal of Pediatrics</i>	Turkey	2,350	8,866	0.349	Q4	0.328	Pediatrics
14	<i>Diagnostic and Interventional Radiology</i>	Turkey	1,037	7,756	1.871	Q3	1.814	Radiology, Nuclear Medicine & Medical Imaging
15	<i>Psychiatria Danubina</i>	Croatia	2,103	7,437	0.764	Q4	0.615	Psychiatry
16	<i>Turkish Neurosurgery</i>	Turkey	1,839	7,087	0.963	Q4/Q4	0.856	Clinical Neurology / Surgery
17	<i>Turkish Journal of Medical Science</i> 18s	Turkey	2,578	6,208	0.717	Q4	0.7	Medicine, General & Internal
18	<i>Journal of Musculoskeletal &amp; Neuronal Interactions</i>	Greece	592	5,675	1.660	Q4/Q4	1.594	Physiology / Neurosciences
19	<i>Anatolian Journal of Cardiology</i>	Turkey	2,212	5,541	1.223	Q4	1.112	Cardiac & Cardiovascular Systems
20	<i>Experimental and Clinical Transplantation</i>	Turkey	1,763	5,312	0.852	Q4	0.812	Transplantation
21	<i>Turkish Journal of Gastroenterology</i>	Turkey	1,914	5,127	1.111	Q4	1.029	Gastroenterology & Hepatology
22	<i>Hellenic Journal of Cardiology</i>	Greece	1,177	4,858	4.047	Q2	2.094	Cardiac & Cardiovascular Systems
23	<i>Radiology and Oncology</i>	Slovenia	654	4,843	1.746	Q3/Q4	1.568	Radiology, Nuclear Medicine & Medical Imaging / Oncology
24	<i>Acta Orthopaedica et Traumatologica Turcica</i>	Turkey	1,292	4,648	1.121	Q4	1.047	Orthopedics
25	<i>Hippokratia</i>	Greece	924	4,561	0.246	Q4	0.246	Medicine, General & Internal
26	<i>Medical Ultrasonography</i>	Romania	868	4,234	1.553	Q3/Q3	1.376	Acoustics / Radiology, Nuclear Medicine & Medical Imaging
27	<i>Cancer Genomics &amp; Proteomics</i>	Greece	416	4,022	3.280	Q2/Q3	3.151	Genetics & Heredity   Oncology
28	<i>Ulusal Travma Ve Acil Cerrahi Dergisi (Turkish Journal of Trauma &amp; Emergency Surgery)</i>	Turkey	1,373	3,840	0.641	Q4	0.571	Emergency Medicine
29	<i>Journal of Clinical Research in Pediatric Endocrinology</i>	Turkey	618	3,733	1.803	Q4/Q2	1.682	Endocrinology & Metabolism   Pediatrics
30	<i>Bosnian Journal of Basic Medical Sciences</i>	Bosnia & Herzegovina	783	3,509	2.050	Q3	2.01	Medicine, Research & Experimental
31	<i>Vojnosanitetski Pregled</i>	Serbia	2294	3,437	0.152	Q4	0.132	Medicine, General & Internal

32	<i>Turk Psikiyatri Dergisi</i>	Turkey	658	3,377	0.473	Q4	0.432	Psychiatry
33	<i>Mikrobiyoloji Bulteni</i>	Turkey	1,004	3,243	0.541	Q4	0.482	Microbiology
34	<i>Acta Clinica Croatica</i>	Croatia	1,196	2,666	0.532	Q4	0.441	Medicine, General & Internal
35	<i>Hellenic Journal of Nuclear Medicine</i>	Greece	864	2,603	0.982	Q4	0.835	Radiology, Nuclear Medicine & Medical Imaging
36	<i>Srpski Arhiv Za Celokupno Lekarstvo</i>	Serbia	1,659	2,186	0.142	Q4	0.092	Medicine, General & Internal
37	<i>Balkan Medical Journal</i>	Turkey	987	2,170	1.533	Q3	1.444	Medicine, General & Internal
38	<i>Acta Dermatovenerologica Croatica</i>	Croatia	725	2,120	1.048	Q4	0.952	Dermatology
39	<i>Turkish Journal of Hematology</i>	Turkey	1,047	1,716	1.685	Q4	1.548	Hematology
40	<i>Kinesiology</i>	Croatia	382	1682	1.225	Q3/Q4	1.188	Rehabilitation   Sport Sciences
41	<i>Eklem Hastaliklari Ve Cerrahisi (Joint Diseases and Related Surgery)</i>	Turkey	484	1,626	1.338	Q3/Q3	0.382	Surgery / Orthopedics
42	<i>Noropsikiyatri Arsivi (Archives of Neuropsychiatry)</i>	Turkey	844	1,550	0.707	Q4	0.691	Clinical Neurology
43	<i>Acta Endocrinologica Bucharest</i>	Romania	983	1,431	0.550	Q4	0.356	Endocrinology & Metabolism
44	<i>Journal of International Advanced Otolaryngology</i>	Turkey	919	1,419	0.848	Q4	0.781	Otorhinolaryngology
45	<i>Turkish Journal of Biochemistry-Turk Biyokimya Dergisi</i>	Turkey	922	1,412	0.373	Q4	0.355	Biochemistry & Molecular Biology
46	<i>Anadolu Psikiyatri Dergisi (Anatolian Journal of Psychiatry)</i>	Turkey	1,008	1,345	0.329	Q4	0.225	Psychiatry
47	<i>Turk Gogus Kalp Damar Cerrahisi Dergisi (Turkish Journal of Thoracic And Cardiovascular Surgery)</i>	Turkey	1,727	1,145	0.190	Q4	0.095	Surgery
48	<i>Romanian Journal of Legal Medicine</i>	Romania	821	1,107	0.488	Q4	0.393	Medicine, Legal
49	<i>Revista Romana De Medicina De Laborator</i>	Romania	517	722	0.945	Q4	0.397	Medicine, Research & Experimental
50	<i>Balkan Journal of Medical Genetics</i>	Macedonia	329	656	0.400	Q4	0.4	Genetics & Heredity

**Table 3. Top 50 medical journals from Balkan countries and their interactions**

Journal title	Country of publication	Proportion (%) of author affiliations from		Number of Balkan countries represented in affiliations*	Mean citation impact of Balkan countries
Croatian Medical Journal	Croatia	Croatia	(37.2)	10	10.22
Journal of BUON	Greece	China	(25.5)	10	3.06
Psychiatria Danubina	Croatia	Croatia	(21.4)	9	7.59
Vojnosanitetski Pregled	Serbia	Serbia	(87.1)	9	1.93
Bosnian Journal of Basic Medical Sciences	Bosnia & Herzegovina	Bosnia & Herzegovina	(32.3)	8	4.12
Acta Dermatovenerologica Croatica	Croatia	Croatia	(30.5)	8	3.32
Acta Clinica Croatica	Croatia	Croatia	(71.6)	8	1.87
Srpski Arhiv Za Celokupno Lekarstvo	Serbia	Serbia	(82.3)	8	1.37
Hippokratia	Greece	Greece	62.3)	7	3.58
Balkan Journal of Medical Genetics	North Macedonia	Turkey	(23.4)	7	2.35
Anticancer Research	Greece	Japan	(18.1)	6	8.05
In Vivo	Greece	Japan	(17.6)	6	5.94
Oncology Letters	Greece	China	(65.7)	6	5.77
Radiology and Oncology	Slovenia	Slovenia	(43.7)	6	5.1

Journal of Gastrointestinal and Liver Diseases	Romania	Romania	(27.3)	6	5.08
Balkan Medical Journal	Turkey	Turkey	(77.4)	6	2.21
Oncology Reports	Greece	China	(38.8)	5	13.32
Medical Ultrasonography	Romania	Romania	(41.5)	5	5.06
Hellenic Journal of Nuclear Medicine	Greece	Greece	(25.8)	5	3.98
Turkish Journal of Pediatrics	Turkey	Turkey	(82.4)	5	2.49
Romanian Journal of Legal Medicine	Romania	Romania	(59.5)	5	1.34
International Journal of Oncology	Greece	Japan	(20.2)	4	18.42
Journal of Sport Science and Medicine	Turkey	USA	(14.8)	4	14.6
Molecular Medicine Reports	Greece	China	(77.9)	4	10.12
Experimental and Therapeutic Medicine	Greece	China	(78.9)	4	5.94
Hellenic Journal of Cardiology	Greece	Greece	(61.6)	4	4.39
Romanian Journal of Morphology and Embryology	Romania	Romania	(79.8)	4	4.09
Kinesiology	Croatia	Croatia	(13.4)	4	4.06
Turkish Neurosurgery	Turkey	Turkey	(57.8)	4	3.67
Turkish Journal of Gastroenterology	Turkey	Turkey	(67.4)	4	2.56
Anatolian Journal of Cardiology	Turkey	Turkey	(66.1)	4	2.24
Turkish Journal of Medical Sciences	Turkey	Turkey	(83)	4	1.78
Turkish Journal of Hematology	Turkey	Turkey	(65.4)	4	1.57
Acta Endocrinologica Bucharest	Romania	Romania	(48,9)	4	0,72
Journal of Musculoskeletal & Neuronal Interactions	Greece	USA	(14,9)	3	3,91
Turkish Journal of Biochemistry	Turkey	Turkey	(71,4)	3	1,56
Journal of International Advanced Otolaryngology	Turkey	Turkey	(35,1)	3	0,56
Cancer Genomics & Proteomics	Greece	USA	(21,1)	2	5,15
Acta Orthopaedica Et Traumatologica Turcica	Turkey	Turkey	(73)	2	3,92
Turkish Journal of Trauma & Emergency Surgery	Turkey	Turkey	(82,3)	2	1,89
Experimental and Clinical Transplantation	Turkey	Turkey	(20)	2	1,65
Diagnostic and Interventional Radiology	Turkey	Turkey	(43,6)	1	8,96
Journal of Clinical Research in Pediatric Endocrinology	Turkey	Turkey	(59,1)	1	2,83
Revista Romana De Medicina De Laborator	Romania	Romania	(84,4)	1	0,73
Turkish Journal of Thoracic and Cardiovascular Surgery	Turkey	Turkey	(94)	1	0,2
Mikrobiyoloji Bulteni	Turkey	Turkey	(97,6)	0	0
Anatolian Journal of Psychiatry	Turkey	Turkey	(96)	0	0
Archives of Neuropsychiatry	Turkey	Turkey	(95,3)	0	0
Joint Diseases and Related Surgery	Turkey	Turkey	(90,9)	0	0
Turk Psikiyatri Dergisi	Turkey	Turkey	(87,8)	0	0

\*Only the countries that published three and more articles between 2000 and 2020