



Analysis of Scientific Publications from Turkey in Dermatology: Social Network Analysis, Text Mining, and Clustering

Türkiye Kaynaklı Bilimsel Dermatoloji Yayınlarının Analizi: Sosyal Ağ Analizi, Metin Madenciliği ve Kümeleme

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ABSTRACT

Objective: To perform network analysis of publications from Turkey under the Dermatology category of the Web of Science (WoS) between 1998 and 2017.

Material and Methods: We selected all SCI-E journals listed in the WoS under the “Dermatology” category. For descriptive analyses, Clarivate Analytics of WoS was used. VOSviewer was used for text mining, co-word clustering, and visualizing the obtained results.

Results: A total of 3319 articles from Turkey were published over the span of 20 years. There is an increasing trend of publications under the “Dermatology” category until 2006, after which point the number seems to stabilize. Between 2002 and 2017, the average percentage of articles from Turkey is around 3.5% in the Dermatology category of WoS. Five large medical institutions such as Istanbul University, Gülhane Military Medical Academy, Hacettepe University, Ankara University, and Ankara Numune Hospital produced 30% of the dermatology articles from Turkey. The average number of citations per article is 9.5. The number of citations shows an increasing trend, reaching almost 3,500 in 2017. We obtained five clusters by co-authorship analysis. Generally, we have seen that geographic distance is an important factor for collaboration of institutions. Via text mining, 43,030 terms were obtained. After processing, the most important 64 terms were collected under five clusters.

Conclusion: The dermatology research output of Turkey is increasing, although it has slowed in the last decade. An important fraction of these publications originate from older institutions in Istanbul and Ankara. The publications from Turkey are both qualitatively and quantitatively concentrated on psoriasis and Behçet’s disease.

Key Words: Dermatology, Turkey, Bibliometrics, Text Mining, Cluster Analysis, Behcet Syndrome

ÖZ

Amaç: 1998-2017 yılları arasında Türkiye’den, Web of Science (WoS) dermatoloji kategorisinde yayımlanan makaleleri ağ analizi yöntemi ile incelemek.

Gereç ve Yöntemler: “Dermatoloji” kategorisinde yayımlanan tüm SCI-E dergileri seçilerek tanımlayıcı analizler WoS ClarivateAnalytics ile yapılmıştır. Metin madenciliği, ortak sözcüklerin kümelenmesi ve sonuçların görselleştirilmesi için VOSviewer kullanılmıştır.

Bulgular: Türkiye’den 20 yılda toplam 3319 makale yayımlanmıştır. Dermatoloji kategorisindeki makale sayısında 2006 yılına kadar yükselen bir eğilim olmakla birlikte, bu tarihten sonra makale sayısının stabilize olduğu görülmüştür. 2002-2017 yılları arasında, Dermatoloji kategorisindeki Türkiye kaynaklı makalelerin %3,5 civarında olduğu görüldü. İstanbul Üniversitesi, Gülhane Askeri Tıp Akademisi, Hacettepe Üniversitesi, Ankara Üniversitesi, Ankara Numune Hastanesi gibi beş büyük tıbbi kurum Türkiye kaynaklı dermatoloji makalelerinin %30’unu üretmektedir. Makale başına ortalama 9,5 atf yapılmaktadır. Atf sayısı artış eğilimi göstermiş ve 2017 yılında 3.500’e yaklaşmıştır. Ortak yazarlık analizinde beş küme saptanmıştır. Kurumların işbirliğinde, coğrafi uzaklığın önemli bir faktör olduğu görülmüştür. Metin madenciliği ile 43.030 terim saptanmış, bunlar işlendikten sonra, en önemli 64 terim beş küme altında toplanmıştır.

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Sonuç: Türkiye'nin dermatoloji araştırma çıktısı, son on yılda durgunlaşmakla birlikte artmaktadır. Bu yayınların önemli bir bölümü İstanbul ve Ankara'daki köklü kurumlar tarafından yapılmaktadır. Türkiye'den yapılan yayınlar hem niteliksel, hem de niceliksel olarak psoriasis ve Behçet hastalığı üzerine yoğunlaşmıştır.

Anahtar Sözcükler: Dermatoloji, Türkiye, Bibliyometri, Metin madenciliği, Küme Analizi, Behçet Hastalığı

INTRODUCTION

The main component of scientific growth is through scientific articles. Scientific knowledge is built on the foundation of accumulated information supplied by individual articles. Since the early 20th century, several authors have devised methods to document the number and topics of scientific articles (1). They developed some "bibliometric" or "scientometric" methods to examine time-dependent change in number, content, and impact of articles (2).

Research indicators are used for many different purposes, ranging from high-level nationwide policies, to micro-considerations regarding the choice of a publication outlet. In a classification, the five main types of use have been identified as general science policy, funding allocation, organization and management, content management and decisions, and consumer information (3).

Scientific publications in an area can be examined by classical descriptive techniques. However, with the development of computer methods, techniques such as text mining (4), social networks (5) or clustering (6) were introduced to bibliometric studies in recent years. These new methods help to examine the data from different points of view, and to present it by sophisticated visual designs. The new methods permit the examination of interrelations between thousands of articles with the help of powerful modern computers.

In Turkey, the first modern medical school was established in 1827 without a Dermatology Department. Modern dermatology in Turkey began with Ernest von Düring and his colleague, Huseyin Hulki in 1889. Following Dr. Düring's return to Germany in 1902, Dr. Celal Muhtar was appointed as the Chair of the Department of Skin Diseases and Syphilis in the Civilian and Military Medical School (7-9).

Dr. Hulusi Behçet graduated from Gülhane Military Medical School in 1910, after which he specialized in Dermatology and Venereal Diseases. Three patients with whom he had consulted for years, and who shared similar symptoms, made him suspect a new disease and viral etiology may play a role in the appearance of what would be known as Behçet's disease. After several discussions and publications, the medical literature had accepted Behçet's disease as a special entity. Dr. Behçet published a total

of 196 articles, 53 of which were published in prestigious international journals (10).

There are several periodicals that have been published in Turkey about dermatology. The Turkish Journal of Dermatology is the official journal of the Turkish Society of Dermatology; TURKDERM-Archives of the Turkish Dermatology and Venerology is the official journal of the Turkish Society of Dermatology and Venerology. Other journals in Turkey are the Journal of the Turkish Academy of Dermatology, and *Türkiye Klinikleri Journal of Dermatology* (7). Only TURKDERM was indexed by Science Citation Index Expanded (SCI-E) from 2008 to 2014.

Studies to describe dermatology publications have been published previously, of which some were related to specific subsets of dermatology such as teledermatology (11, 12), contact dermatitis (13), Behçet's disease (14, 15), psoriasis (16), pemphigus (17), dermoscopy (18), and leishmaniasis (19). Some of them were general (20, 21), and some of them attempted to describe the scientific output of countries including Spain (22), UK (23), Iran (24), and Brasilia (25). There is no study describing the scientific dermatology output of Turkey.

The objective of this study is to analyze the publications under the Dermatology category of WoS between 1998 and 2017 from Turkey.

METHODS

Data

For the years from 1998 to 2017 (20 years in total), we selected all SCI-E journals listed in the Web of Science (WoS) under the "Dermatology" category. The data was downloaded on December 28th, 2018. Publication type was restricted to article and address was restricted to Turkey.

Descriptive Analysis

For descriptive analyses, Clarivate Analytics of WoS was used. In the top 10 cited articles list, the 9th article was excluded because it was related to myofascial pain.

Social Networking and Clustering of Organizations According to Co-Authorship

VOSviewer (version 1.6.8) (26) was used for networking, clustering, and also for visualizing the obtained results. For co-authorship, we selected the organizations with at least

50 co-authored articles. For this visualization, association strength was used as the normalization method and the default resolution value (1.00) was used.

Text Mining and Clustering of Terms

Text mining analysis of abstracts of the articles was used to obtain terms. Terms were expressions with one to four words. These terms were clustered by using the co-word method with binary counting (27). VOSviewer was used for text mining, co-word clustering, and visualizing the obtained results (26). The text mining module of VOSviewer is based on the Apache OpenNLP toolkit (28). Its text mining functionality is described in a previous article (29). Firstly, the most frequent (more than 20) terms were checked, and terms with the same or similar meanings were collected under one term. Then, terms with a frequency of more than 50 were determined and the most relevant 60% were selected. The remaining terms were checked for being informative about research content, and non-informative terms (such as skin, patient, disease, $p < 0.001$, years old, etc.) were eliminated. For visualization of the results, association strength was used as the normalization method. Resolution value was 1.30.

RESULTS

A total of 3,319 dermatology articles from Turkey were published from 1998 to 2017. During this period, 160,633 articles from Turkey were published under the life sciences category. Dermatology articles compose 2.1% of life sciences article production of Turkey. There is an increasing publication trend until 2006, and the number seems to stabilize after that point (Figure 1).

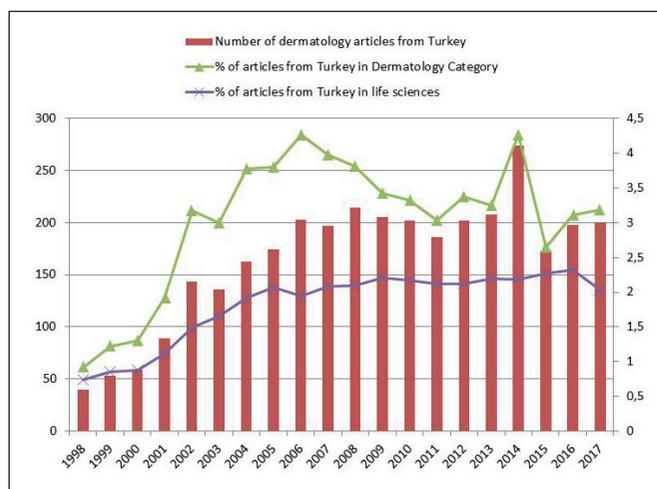


Figure 1: The number of dermatology articles from Turkey according to years. The green line shows the percent of Turkey-addressed articles for all articles under the Dermatology Category of WoS. The purple line shows the percent of articles from Turkey in all Life Sciences & Biomedicine categories of WoS.

The top five organizations in number of publications are Istanbul University (301, 9.1%), Gülhane Military Medical Academy (219, 6.6%), Hacettepe University (161, 4.9%), Ankara University (141, 4.2%), and Ankara Numune Training Research Hospital (140, 4.2%). The top five journals in number of publications are the International Journal of Dermatology (343, 10.3%), TURKDERM - Archives of the Turkish Dermatology and Venerology (332, 10.0%), Journal of the European Academy of Dermatology and Venereology (227, 6.8%), the Journal of Dermatology (196, 5.9%), and Burns (185, 5.6%). Authors from Turkey also co-authored some of the articles with foreign colleagues. The top five countries of co-authors are the United States of America (75, 2.3%), Germany (54, 1.6%), Italy (35, 1.1%), England (33, 1.1%), and Israel (31, 0.9%). The majority of the articles are in English (2,873, 86.6%), while Turkish (442, 13.3%) and German (4, 0.1%) are the other represented languages.

During this 20 year span, 3,319 articles were cited 31,633 times. Average citation per article is 9.5. The number of citations show an increasing trend, reaching almost 3,500 in 2017 (Figure 2). The articles with the highest number of citations are presented in Table I. Turkish dermatology articles were cited by 25,353 single articles. The top five categories of journals for these articles were: Dermatology (10,926, 43.1%), Surgery (2,624, 10.4%), Medicine - General Internal (1,634, 6.4%), Immunology (1,124, 4.4%), and Pharmacology Pharmacy (1,121, 4.4%). The top five countries of citing authors were from the United States of America (5,652, 22.3%), Turkey (4,120, 16.3%), Italy (1,822, 7.2%), Germany (1,728, 6.8%), and China (1,493, 5.9%).

Twenty-two organizations from Turkey have more than 50 inter institutional co-authored articles. We obtained five clusters by co-authorship analysis (Figure 3).

Cluster 1: Celal Bayar University, Dokuz Eylül University, Ege University, Gazi University, Hacettepe University, Mustafa Kemal University, Ondokuz Mayıs University.

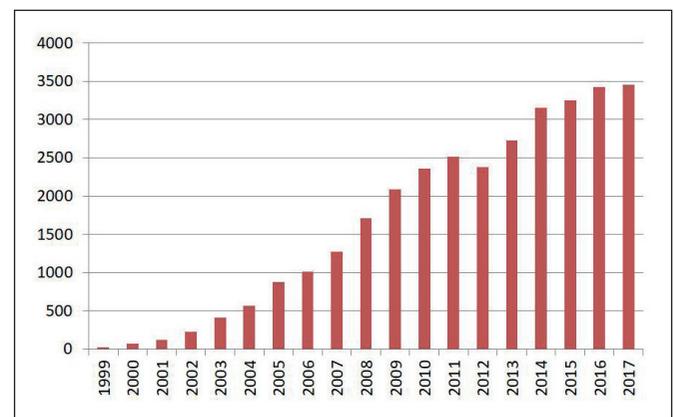
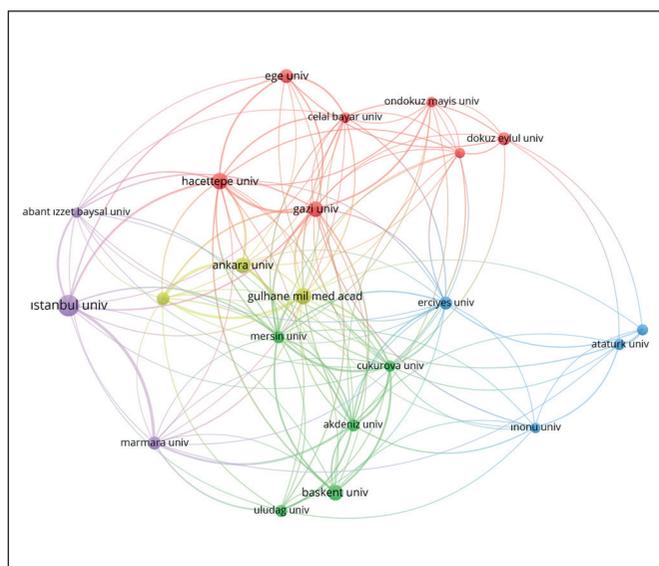
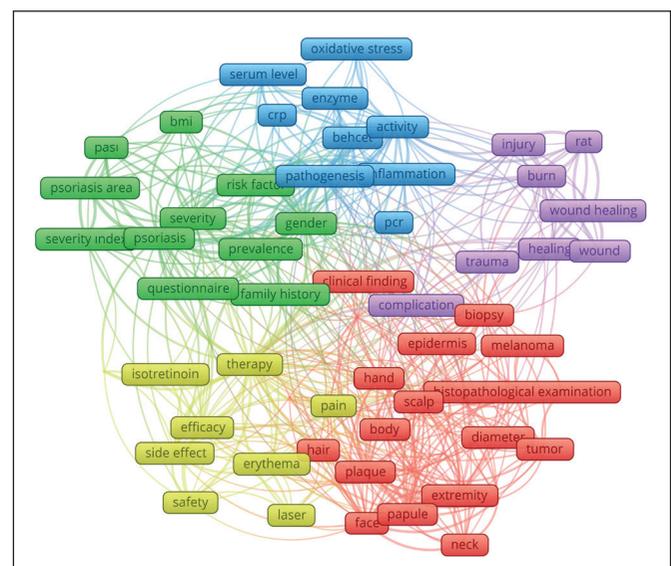


Figure 2: Number of citations to Turkish dermatology articles by year.

Table I: Top ten articles from Turkey by number of citations.

Title	Year	Citations per year	Total citations	Notes
Dermoscopy of pigmented skin lesions: Results of a consensus meeting via the Internet (30)	2003	37.4	636	International multi-centre study with participation from Ege University
The International Criteria for Behcet's Disease (ICBD): a collaborative study of 27 countries on the sensitivity and specificity of the new criteria (31)	2014	31.7	190	International multi-centre study with participation from Ankara University
Prevalence of Behcet's disease in Istanbul, Turkey (32)	2003	10.9	185	A study from Istanbul University
The Psychological Burden of Skin Diseases: A Cross-Sectional Multicenter Study among Dermatological Out-Patients in 13 European Countries (33)	2015	36.8	184	International multi-centre study with participation from Şişli Etfal Teaching and Research Hospital
Evaluation of clinical findings according to sex in 2313 Turkish patients with Behcet's disease (34)	2003	9.8	167	A study by Mersin University and Ankara University
Interferon alfa-2a in the treatment of Behcet disease - A randomized placebo-controlled and double-blind study (35)	2002	8.9	161	A study by Akdeniz University and Antalya State Hospital
An investigation on burn wound healing in rats with chitosan gel formulation containing epidermal growth factor (36)	2006	10.9	152	A study by Gazi University and Gülhane Military Medical Academy
The depression, anxiety, life satisfaction and affective expression levels in psoriasis patients (37)	2000	7.0	140	A study from Ankara University
Increased carotid artery intima-media thickness and impaired endothelial function in psoriasis (38)	2009	10.6	116	A study from Mustafa Kemal University
Efficacy and Safety of Omalizumab in Patients with Chronic Idiopathic/Spontaneous Urticaria Who Remain Symptomatic on H-1 Antihistamines: A Randomized, Placebo-Controlled Study (39)	2015	23.0	115	International multi-centre study with participation from Uludağ University

**Figure 3:** Clusters of the organizations according to co-authorship.**Figure 4:** Clusters of the terms.

Cluster 2: Akdeniz University, Başkent University, Çukurova University, Mersin University, Uludağ University.

Cluster 3: Atatürk University, Erciyes University, Yüzüncü Yıl University, İnönü University.

Cluster 4: Ankara Numune Training and Research Hospital, Ankara University, Gülhane Military Medical Academy.

Cluster 5: Abant İzzet Baysal University, Marmara University, İstanbul University.

By text mining, 43,030 terms were obtained. The terms with a frequency of more than 50 were determined and the most relevant 60% (133 terms) of them were checked for being informative or not. The remaining 64 terms were collected under five clusters (Figure 4). The terms by clusters are presented in Table II.

DISCUSSION

When we divide the 20 year period into two decades, we can see that in the first decade there is a fast increase in both the number and impact of dermatology articles from Turkey. In the second decade, the number and share of the articles from Turkey seems to level off (Figure 1); however, the impact factors of the articles continue to increase (Figure 2). The average percent of the articles from Turkey is around 3.5 in the Dermatology category of WoS. The general situation of Turkey in Life Sciences is worse compared to Dermatology in the last decade. Turkey's share is about 1.9%, roughly half of the dermatology field (Figure 1). It

seems that scientific production of dermatology in Turkey is better compared to other life sciences. However, the number of articles is not increasing over the last decade and it therefore shares the same fate with the other health disciplines. The reason for this problem is beyond the scope of this study, but it must be investigated.

Furthermore, five large medical institutions (Istanbul University, Gülhane Military Medical Academy, Hacettepe University, Ankara University, and Ankara Numune Training Research Hospital) from Istanbul and Ankara produce 30% of the dermatology articles from Turkey. The first two institutions were founded before the republic, and they have the oldest dermatology departments in Turkey. The other institutions were founded before 1960.

Four of the ten articles with the highest number of citations are international multi-centre studies. From the remaining six studies, three studies are related to Behçet's disease, two studies are about psoriasis, and one is an experimental study on wound healing (Table I). Behçet's disease was discovered by a Turkish physician, Hulusi Behçet, and its prevalence is high in Turkey (10). Traditionally, Turkish dermatology departments have expertise on Behçet's disease, and the amount scientific research on Behçet's disease is high in Turkey. Turkey is the country with the highest number of articles about Behçet's disease (26.6% of global scientific production). Istanbul University and Hacettepe University are the institutions that publish the highest number of Behçet's disease articles in the world. They produce 5.66% and 2.45% of all Behçet's articles, respectively (15).

Table II: List of the terms in each cluster. In Cluster 1, only 12 terms with the highest occurrences are shown. n: number occurrences for each term.

Cluster 1 (Total 25 terms)		Cluster 2 (Total 12 terms)		Cluster 3 (Total 10 terms)		Cluster 4 (Total 9 terms)		Cluster 5 (Total 8 terms)	
Term	n	Term	n	Term	n	Term	n	Term	n
papule	172	Psoriasis	294	pathogenesis	251	therapy	501	burn	165
biopsy	170	Gender	269	activity	241	efficacy	235	complication	146
face	161	Severity	193	Behcet	160	side effect	173	injury	133
plaque	153	Prevalence	146	inflammation	122	pain	111	rat	130
hand	151	risk factor	116	enzyme	79	erythema	108	wound	126
extremity	148	Questionnaire	98	serum level	69	laser	88	healing	100
tumor	122	family history	81	etiopathogenesis	65	safety	85	trauma	81
clinical feature	119	severity index	68	PCR	64	isotretinoin	74	wound healing	73
recurrence	116	PASI	66	CRP	59	phototherapy	65		
scalp	100	psoriasis area	62	oxidative stress	56				
trunk	100	BMI	56						
differential diagnosis	94	disease severity	52						

Five clusters were obtained by co-authorship analysis (Figure 3). Cluster 1 is composed of three universities from the Aegean Region, two from Ankara, one university from Hatay (East Mediterranean Region) and one university from the Black Sea region. The geographic distribution of this group is heterogeneous. There must be institutional connections between these centers. Cluster 2 is composed of three universities in the Mediterranean Region, one university which is located in Ankara and has a branch in the Mediterranean Region, and a university from the Marmara region. Cluster 3 is composed of universities in the east part of Turkey. Cluster 4 is composed of three institutions in Ankara, and Cluster 5 is composed of two Istanbul universities and a university close to Istanbul. Generally, we have seen that geographic distance is an important factor for collaboration of institutions.

By text mining, 43,030 terms were obtained and 64 terms were selected for final clustering analysis (Figure 4, Table II). From this, five clusters were obtained. Cluster 1 is the largest, and it seems to be an umbrella-cluster containing several entities, including tumours. Cluster 2 seems to be related to psoriasis. The most frequently related terms are “gender”, “severity”, “prevalence”, and “risk factor”. Cluster 3 is related to Behçet’s disease. “Pathogenesis” and “activity” of the disease are the most popular terms. Cluster 4 is on therapy and side effects. “Laser”, “isotretinoin” and “phototherapy” terms feature prominently in this group. Cluster 5 is mainly about wound healing and burns. A fraction of the articles in this group may possibly be coming from “Burn” journal, which is in the Dermatology category of WoS; consequently, some of the results may not be directly related to the dermatology discipline. Clustering of text mining terms shows that an important part of dermatology studies from Turkey is related to psoriasis and Behçet’s disease.

The present study has several limitations, mostly due to the complex nature of the research subject.

One limitation is that the articles that were examined were limited to the Dermatology category of WoS. Therefore, the present study did not include proceedings of important meetings, or journals which are not covered by WoS. In addition, it is possible that dermatology articles are also published in a wide range of journals. However, since most high-quality dermatology research is communicated through the journals under the Dermatology category of WoS, these journals were our primary focus.

Additionally, the clustering method itself imposes a number of limitations besides the foundational one of choosing a similarity measure for the clustering. The size of the clusters can be chosen to be either smaller or larger, and to include fewer or more items. This depends on just how “loosely and generally” one wishes to define such a heterogeneous and complex field of study and application.

The text mining method still depends on important choices of parameters that are largely subjective. Despite selecting 60% of the most relevant terms, many terms which do not give clues about research subjects were observed, and they had to be manually excluded from the analysis. This term elimination process was done according to experiences and perception or opinion of the author, introducing hard-to-assess subjectivity, though it does represent state-of-the-art methods.

CONCLUSION

The dermatology research output of Turkey is increasing, although it has slowed in the last decade. Turkey produces approximately 3.5% of dermatology articles. An important fraction of these publications originate from older institutions in Istanbul and Ankara. The publications from Turkey are both qualitatively and quantitatively concentrated on psoriasis and Behçet’s disease.

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