# Black Sea Journal of Health Science

# SCIENTIFIC OUTPUTS OF HYPERTENSIVE RETINOPATHY

**Ayşe Nilüfer KÖYLÜOĞLU[1], Bünyamin AYDIN[2]\***

[1]Kütahya Health Sciences University, Kütahya Evliya Celebi Training and Research Hospital, Department of Ophthalmology, 43100, Kütahya, Türkiye

[2]Kütahya Health Sciences University, Kütahya Evliya Celebi Training and Research Hospital, Department of Endocrinology and Metabolism, 43100, Kütahya, Türkiye

**Abstract:** The goal of this work was to analyze the scientific output in the field of hypertensive retinopathy and its evolution globally and by major countries or regions, with a particular focus on the leading countries and international collaborations. In this bibliometric study, the keywords related to hypertensive retinopathy ("Hypertensive" and "Retinopathy" or '' hypertensive retinopathy" or ''hypertension'' and ''eye'') were used in a search query in the Web of Science (WOS) search engine. The time span was set from 1970 to 2021. Only research articles were analyzed. Data pertaining to growth of publications, the most active countries and institutions, the most cited journals, and mapping of publications and keywords were analyzed from Web of Science Core Collection. A total of 152 articles included the study. The average number of citations of these articles was 14.69. The H-index of these articles was 22.The majority of the articles were from research areas of Ophthalmology (n=44; 28.94%), Cardiovascular System Cardiology (n=30; 19.73%) and General Internal Medicine (n=21; 13.81%). The leading countries on number of publishing articles was the Unıted States of America (USA) (n=28; 18.42%), Türkiye (n=21; 13.81%) and China (n=20; 13.15%). Akdeniz University, Türkiye (n=5, 3.289%), Capital University of Medicine and China (n=5, 3.289%) were the most productive affiliations on hypertensive retinopathy publications. The number of publications on hypertensive retinopathy have been increasing in the past two decades. The most of the publications from the USA, especially in North America countries. Citation numbers are high but international collaboration needed around the globe this growing and concerning subject.

**Keywords:** Hypertension, Eye, Hypertensive retinopathy, Publications

## 1. Introduction

Hypertension is a global public health topic that is becoming more prevalent. It is typically defined as persistent blood pressure (BP) of 140/90 mm Hg and, it is one of the leading causes of premature morbidity and mortality in the United States of America (USA) (Elliott, 2007). It is a silent killer that often goes unnoticed (Biswas et al., 2003). Hypertension is anticipated to increase in prevalence by 60% by 2025, affecting 1.56 billion people globally (Kearney et al., 2005). Furthermore, hypertension -related direct and indirect medical expenditures are expected to total $118 billion in 2015 (Heidenreich et al., 2011).

The hypertensive disease spectrum includes patients with hypertensive emergencies with markedly elevated blood pressure and associated end-organ damage (kidney, heart, eye, blood vessels, etc.) as well as asymptomatic patients with minimally elevated pressures of unknown significance (Axon et al., 2015).

Hypertension is linked to a variety of vision-threatening eye diseases, such as retinal vascular occlusion, retinal macroaneurysm, and non-arteritic anterior ischemic optic neuropathy. Furthermore, hypertension has been linked to the etiology of age-related macular degeneration and may increase the vision-threatening effects of diabetic retinopathy. Sustained hypertension manifests itself in the eye as hypertensive retinopathy and choroidopathy, indicating a systemic pathology. To ensure that hypertension patients are diagnosed and treated, close collaboration between ophthalmologists and general practitioners/physicians is required. In these patients, prompt management may lessen the risk of vision-threatening and systemic consequences (Fraser-Bell et al., 2017). In well-controlled hypertension, microvascular changes are reversible. Proper hypertension management can slow the progression of diabetic retinopathy and, as a result, visual loss caused by severe retinal diseases such as retinal vascular occlusion (artery and vein), retinal arteriolar emboli, macroaneurysm, ischemic optic neuropathy, and age-related macular degeneration (Resch et al., 2013). But hypertensive retinopathy symptoms are linked to other end-organ damage indications (such as left ventricular hypertrophy and renal impairment) and be a predictor of future clinical events like stroke, congestive heart failure, and cardiovascular mortality (Bhargava et al., 2012).

According to Erden and Bicakci (2012) the severity and duration of hypertension are connected to the increase in the incidence of hypertensive retinopathy. Other factors, in addition to essential and secondary hypertension, have a role in the development of hypertensive retinopathy. Hypertensive retinopathy is more common among Afro-Caribbeans than in Europeans, and it is more common in women than in men. Certain genotypes are linked to an increased incidence of hypertensive retinopathy, therefore genetic factors can play a role (Chatterjee et al., 2002). In Erden and Bicakci (2012) study, 66.3 % of the patiens had hypertensive retinopathy. In another study, Kabedi et al. (2014) reported that hypertensive retinopathy affects 83.6 % of all hypertension patients, with chronic renal illness being the most important predictor of severe hypertensive retinopathy.

The goal of this work was to analyze the scientific output in the field of hypertensive retinopathy and its evolution globally and by major countries or regions, with a particular focus on the leading countries and international collaborations, using Web of Science (WOS) database.

## 2. Material and Methods

In this bibliometric study, to identify the most commonly used MeSH terms (keywords), preliminary individual studies were performed on several important hypertensive retinopathy researchers.

The keywords related to hypertensive retinopathy ("Hypertensive" and "Retinopathy" or '' hypertensive retinopathy'' or ''hypertension'' and ''eye'') were used in a search query in the WOS search engine. The time span was set from 1970 to 2021. Data pertaining to growth of publications, the most active countries and institutions, the most cited journals, and mapping of publications and keywords were analyzed from Web of Science Core Collection [Social Sciences Citation Index (SSCI), Science Citation Index Expanded (SCIE), Emerging Sources Citation Index (ESCI), Arts & Humanities Citation Index (A&HCI or AHCI), Book Citation Index (BCI) and Conference Proceedings Citation Index (CPCI)] were searched in the current study.

Only materials designated as 'journal article' in the Wos database were included in the analysis; reviews, letters, and editorials were excluded. All guidelines were also excluded.

We used the search query and deducted from 277 different type of results to only the journal articles. The VOSviewer software was used to show the maps, which were evaluated to present several bibliometric indications.

As indications of publication impact, the Hirsch (H) index of the publishing journal was utilized.

Mapping: To visualize collaborations and keywords, the VOSviewer 1.6.18 for Microsoft Windows systems program was used. From the bibliographic metadata of the articles we collected, we developed co-occurrence networks (e.g., nations, citations and keywords).

## 3. Results

### 3.1. Publications

There were a total of 277 journal articles retrieved, with an average of 10.67 citations per article. The mean H index was of the articles were found to be 25. Even if study search the publications in the period between 1970 and 2021, the first article was published in the year 1973. Distribution of publications according to the years showed in Figure 1.

Annual growth publications showed an increasing pattern during the study period. Retrieved publications were written in 6 different languages, mainly English (n=264; 94.24%) followed by French (n=6; 2.16%), German (n=5; 1.80%). The rest of them were published in Portuguese, Polish and Spanish languages.
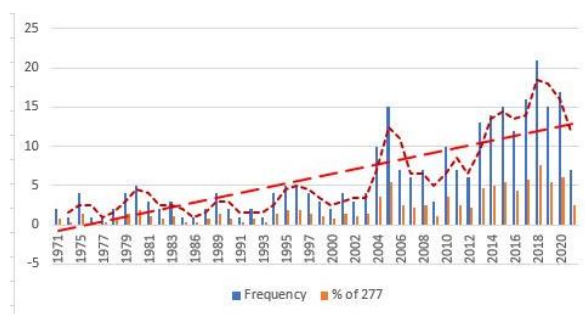


**Figure 1.** Graphics of total publication by years between 1987 and 2021 (Dark red dashed line express the moving median, red line express the trend line).

### 3.2. Articles

We found a total of 152 articles after filtering the publications as articles. The average number of citations identified in these 152 articles was 14.69. These articles had an H-index of 22 and were referenced 2233 times in total.

The majority of the articles retrieved were from the fields of Ophthalmology (n=44; 28.94%), Cardiovascular System Cardiology (n=30; 19.73%), General Internal Medicine (n=21; 13.81%), Research Experimental Medicine (n=12; 7.89%), Pharmacology Pharmacy (n=10; 6.57%), and the rest were from other fields.

### 3.3. The Most Active Countries/Nations, Institutions, and Journals

The leading country on number of publishing articles was the USA with (n=28; 18.42%), followed by Türkiye (n=21; 13.81%), China (n=20; 13.15%), Germany (n=10; 6.57%), England (n=9; 5.92%), South Korea (n=7; 4.60%) (Table 1). The active countries/regions represented all of the world regions: mainly Northern and Southern America, Asia and Europe. Other 42 countries which around the globe were (n=42; 35.52%). Akdeniz University, Türkiye (n=5, 3.289%), Capital University of Medicine, China (n=5, 3.289%) and National University of Singapore (n=5, 3.289%), the University of Melbourne, Australia (n=4, 3.289%) and the University of North Carolina (n=4, 3.289%) were the most productive affiliations on hypertensive retinopathy publications.

**Table1.** The list of the top five most active countries/regions in terms of the number of hypertensive retinopathy publications (n=152)

| Ranking | Countries/Regions | n | % |
|---------|-------------------|-----|--------|
| 1 | The USA | 28 | 18.421 |
| 2 | Türkiye | 21 | 13.816 |
| 3 | Peoples Republic of China | 20 | 13.158 |
| 4 | Germany | 10 | 6.579 |
| 5 | England | 9 | 5.921 |

### 3.4. International Collaboration Analysis

Papers co-authored by authors from many countries were designated as "international collaborations." Figure 2 depicts a network map of international collaboration. Using the VOSviewer approach, an examination of international cooperation for active nations with at least one document revealed that there were clusters of international collaboration (Figure 2).
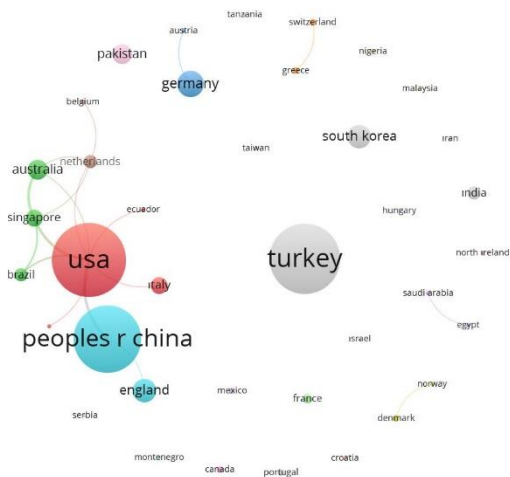


**Figure 2.** Network visualization map of co-authorship among nations with at least one hypertensive retinopathy article. Collaboration was seen with lines linking nations. Stronger cooperation were indicated by thicker lines. Countries with higher circle sizes or font sizes had more articles per capita.
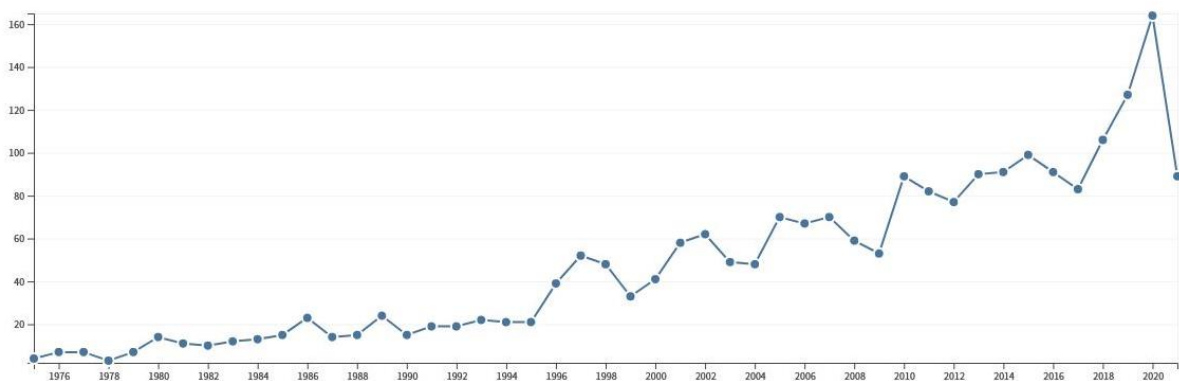
### 3.5. Citing Analysis

The retrieved articles received a total number of citations of 2233, an average of 14.69 citations per article. The mean of H index of the retrieved articles on hypertensive retinopathy was 22. A total of 126 articles (82.89%) were mentioned at least once, while the remaining 26 articles (18.11%) were not cited at all. Annual citation growth on hypertensive retinopathy showed slow growth until 1996s followed by a dramatic increase in last decade. Figure 3 shows the annual growth of the citation on hypertensive retinopathy. The highest number of citations was seen in 2019 (total of 235 citation) (Table 2).

The lines that connect the countries show that they are working together. Stronger cooperation were indicated by thicker lines. Countries with a larger circle or text size had a higher level of international collaboration (Figure 4).

Citation was shown by the lines connecting the authors. Authors with a greater circle size or font size had a higher number of citations (Figure 5).

### 3.6. Publishing Journals

The top three cited articles on hypertensive retinopathy were published in Ophthalmology (245), New England Journal of Medicine (198 citations), British Journal of Ophthalmology (122 citations) journals.
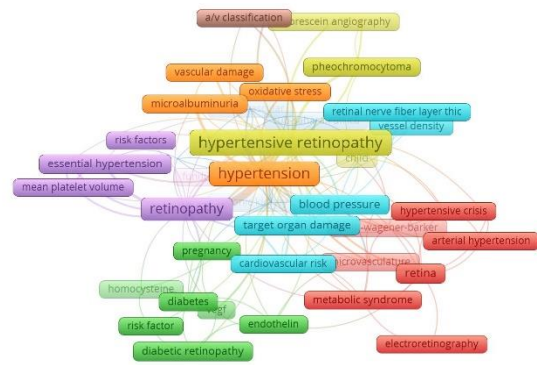
### 3.7. Keyword Analysis

In articles, linked lines indicate occurrence relationships. Keywords denoted by a higher circle size or text size appeared in the articles more frequently (Figure 6) (Table 3).

## 4. Discussion

Uncontrolled hypertension has an impact on multiple systems, including the cardiovascular, renal, cerebrovascular, and retina. Target-organ damage is the term for the harm to these systems (Kabedi et al., 2014). Hypertension causes a cascade of pathophysiological changes that have a major impact on the retinal, choroidal, and optic nerve circulations.

Sum of Times Cited per Year



**Figure 3.** Growth of number of citations over the years (Line express the citing number).

**Table 2.** The top 15 cited articles and publishing journals on hypertensive retinopathy

| Journal | Times Cited | Number of Articles |
| --- | --- | --- |
| Ophthalmology | 338 | 2 |
| British J Ophthalmology | 226 | 4 |
| New England J Medicine | 201 | 1 |
| Diabetologia | 171 | 2 |
| Clinical And Experimental Hypertension | 117 | 7 |
| Hypertension | 114 | 3 |
| British Medical Bulletin | 113 | 1 |
| J American Animal Hospital Association | 86 | 3 |
| Graefes Archive for Clinical and Exp Ophthalmology | 76 | 2 |
| J Human Hypertension | 74 | 3 |
| Retina-The J Retinal and Vitreous Diseases | 59 | |
| American J Veterinary Res | 49 | 1 |
| Clinical Nephrology | 47 | 1 |
| Journal of Hypertension | 36 | 3 |
| Blood Pressure | 34 | 1 |



**Figure 4.** Countries having at least one publication on hypertensive retinopathy were showed in a network visualization map of citations.



**Figure 5.** Citation visualization map among authors with a minimum of one publication on hypertensive retinopathy.
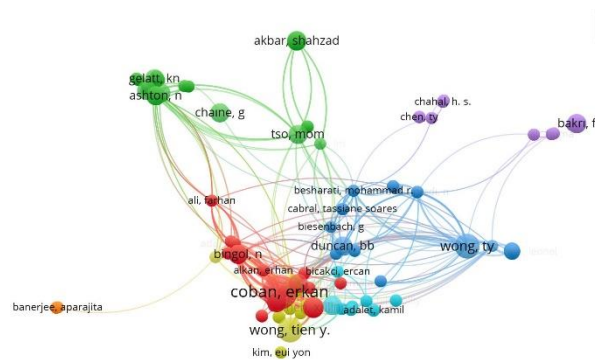


**Figure 6.** Keyword visualization map of articles with a minimum of one occurence on hypertensive retinopathy.

**Table 3.** The list of commonly used keywords on hypertensive retinopathy

| Keyword | Occurrences |
| --- | --- |
| hypertensive retinopathy | 49 |
| hypertension | 33 |
| retinopathy | 18 |
| blood pressure | 5 |
| retina | 5 |

The most prevalent symptom is hypertensive retinopathy, which is linked to stroke, congestive heart failure, and cardiovascular death (Konstantinidis and Guex-Crosier, 2016). Hypertension affects an estimated 1.28 billion persons aged 30 to 79 worldwide, with the majority (two-thirds) residing in low- and middle-income countries, according to the World Health Organization (WHO) data. An estimated 46% of people with hypertension are entirely unaware of their illness. Hypertension is identified and treated in less than half of individuals (42%). Approximately one-fifth of persons with hypertension (21%) have it under control. Between 2010 and 2030, one of the worldwide non-communicable disease objectives is to lower the prevalence of hypertension by 33% (WHO, 2022). As long as the hypertension is controlled, hypertensive retinopathy does not cause visual loss in the majority of patients. However, if blood pressure is not controlled, visual loss can occur in a short period of time. Vision loss can be caused by retinal pigmentary changes or secondary to optic atrophy, both of which are irreversible (Do et al., 2015). There are some bibliometric analysis studies published on hypertension. However, the current study is the first bibliometric study on hypertensive retinopathy from the available literature (Devos and Menard, 2019; Park et al., 2019; Devos and Ménard, 2020).

The goal of this study is to create a systematic and complete overview of hypertensive retinopathy articles. In this study for review of literature, the articles on hypertensive retinopathy in English language were acquired from the WoS database between 1970 and 2021. Effective organizations, authors, and nations on the issue of hypertensive retinopathy were presented using

maps after text mining operations. The distribution of publication numbers by authors and the change in publication numbers over time from 1970 to 2021 were also depicted using graphics. At the completion of the data analysis, the top referred articles in this field were displayed in Table 2.

There are many bibliometric analysis studies published in the field of medicine. In some of these studies, Scopus, Pubmed, and WOS datasets were the databases used in these studies. These databases allow bibliometric analysis and mapping or further visualization methods with different programs (Dindar et al., 2021; Köylüoğlu et al., 2021; Malakoutikhah et al., 2021; Özlü, 2022). The following are some of the reasons that WOS was chosen as a search reference: WOS is older than Scopus, which began in 2004, and studies on WOS can be found dating back to the 1970s. Older items can also be accessible, according to several research. The three WOS journal citation indexes, SCI-EXPANDED, SSCI, and Arts and Humanities Citation Index (A&HCI), are well-known and often utilized in research (Akyüz et al., 2022). There are two search methods in this WOS database: a basic search and an advanced search, which allows to craft complex and broad search queries to reach your aim with high validity. This database allows users to search for keywords in titles, abstracts, journal/author names, and affiliations (Web of Science, 2021). In this study, we sought to give a bibliometric overview of literature on hypertensive retinopathy. To accomplish this, we used the well-known WOS database, which has been used in previously published bibliometric studies (Gürler et al., 2021; Şahin et al., 2022).

The collaborations between countries were shown using the VosViewer program developed by the Centre for Science and Technology Studies (bibliometric department of Leiden University, Leiden, Netherlands) (VOSviewer, 2021). Vosviewer identifies each of the clusters in the literature network by selecting sample phrases from the cited literature. By analyzing the citation network and keywords in the time dimension to discover the development, flourishing, and collapse of certain research clusters, we may detect the research hotspots and trends of a given era (Gao et al., 2021).

According to our findings, the difference between co-authorship and citation figures showed that this subject is a global concern and needs to much more international collaboration studies (co-authorship).

Our study showed that publications on hypertensive retinopathy have been increasing and growing rapidly in the past decade. The high H-index number even with low number of publications is a strong indication of the importance of this subject to variety of clinicians and researchers. Top countries were USA and Türkiye. Growing numbers of the study on hypertensive retinopathy in these countries highly eye-catching and needs to be investigating.

## 5. Conclusion

Publications on hypertensive retinopathy have been increasing in the past two decades. The study showed that most of the publications on contributed by USA which has a growing number of publications especially in North America countries. The rest of the world contributed considerable share. This bibliometric analysis showed the growing numbers in the globe. Citation numbers are high but international collaboration needed around the globe this growing and concerning subject.

### Author Contributions

Concept: A.N.K. (50%) and B.A. (50%), Design: A.N.K. (50%) and B.A. (50%), Supervision: B.A. (100%), Data collection and/or processing: A.N.K. (50%) and B.A. (50%), Data analysis and/or interpretation: A.N.K. (50%) and B.A. (50%), Literature search: A.N.K. (50%) and B.A. (50%), Writing: A.N.K. (100%), Critical review: A.N.K. (50%) and B.A. (50%), Submission and revision A.N.K. (50%) and B.A. (50%). All authors reviewed and approved final version of the manuscript.

### Conflict of Interest

The authors declared that there is no conflict of interest.

### Ethical Approval/Informed Consent

As the study is not an animal or human study, ethical approval was not required.

## References

Akyüz HÖ, Alkan S, Gökçe ON. 2022. Overview on pressure ulcers studies based on bibliometric methods. Iberoam J Med, 4(1): 18-23.

Axon RN, Turner M, Buckley R. 2015. An update on inpatient hypertension management. Curr Cardiol Rep, 17(11): 94.

Bhargava M, Ikram MK, Wong TY. 2012. How does hypertension affect your eyes? J Hum Hypertens, 26(2): 71-83.

Biswas S, Dastidar DG, Roy KS, Pal SK, Biswas TK, Ganguly SB. 2003. Complications of hypertension as encountered by primary care physician. J Indian Med Assoc, 101(4): 257-259.

Chatterjee S, Chattopadhyay S, Hope-Ross M, Lip PL, Chattopadhya S. 2002. Hypertension and the eye: changing perspectives. J Hum Hypertens, 16(10): 667-675.

Devos P, Menard J. 2019. Bibliometric analysis of research relating to hypertension reported over the period 1997-2016. J Hypertens, 37(11): 2116-2122.

Devos P, Ménard J. 2020. Trends in worldwide research in hypertension over the period 1999-2018: A bibliometric study. Hypertension, 76(5): 1649-1655.

Dindar Demiray EK, Oğuz Mızrakçı S, Alkan S. 2021. Analysis of publications on Acinetobacter: A Scopus database search study. J Clin Med Kaz, 18(5): 44-48.

Do DV, Wang X, Vedula SS, Marrone M, Sleilati G, Hawkins BS. 2015. Blood pressure control for diabetic retinopathy. Cochrane Database Syst Rev, 1: CD006127.

Elliott WJ. 2007. Systemic hypertension. Curr Probl Cardiol, 32(4): 201-259.

Erden S, Bicakci E. 2012. Hypertensive retinopathy: incidence, risk factors, and comorbidities. Clin Exp Hypertens, 34(6):

397-401.

Fraser-Bell S, Symes R, Vaze A. 2017. Hypertensive eye disease: a review. Clin Exp Ophthalmol, 45(1): 45-53.

Gao K, Dou Y, Lv M, Zhu Y, Hu S, Ma P. 2021. Research hotspots and trends of microRNA in periodontology and dental implantology: a bibliometric analysis. Ann Transl Med, 9(14): 1122.

Gürler M, Alkan S, Özlü C, Aydın B. 2021. Collaborative network analysis and bibliometric analysis of publications on diabetic foot infection. J Biotechinol Strat Health Res, 5(3): 194-199.

Heidenreich PA, Trogdon JG, Khavjou OA, Butler J, Dracup K, Ezekowitz MD. 2011. American heart association advocacy coordinating committee. Circulation, 123(8): 933-944.

Kabedi NN, Mwanza JC, Lepira FB, Kayembe TK, Kayembe DL. 2014. Hypertensive retinopathy and its association with cardiovascular, renal and cerebrovascular morbidity in Congolese patients. Cardiovasc J Afr, 25(5): 228-232.

Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, He J. 2005. Global burden of hypertension: analysis of worldwide data. Lancet, 365(9455): 217-223.

Konstantinidis L, Guex-Crosier Y. 2016. Hypertension and the eye. Curr Opin Ophthalmol, 27(6): 514-521.

Köylüoğlu AN, Aydın B, Özlü C. 2021. Bibliometric evaluation based on scopus database: Global analysis of publications on diabetic retinopathy and comparison with publications from Turkey. D J Med Sci, 7(3): 268-275.

Malakoutikhah M, Alimohammadlou M, Rabiei H, Faghihi SA, Kamalinia M, Jahangiri M. 2021. A scientometric study of unsafe behavior through Web of Science during 1991-2020. Int J Occup Saf Ergon, 2021: 1-13.

Özlü A. 2022. Bibliometric analysis of publications on pulmonary rehabilitation. BSJ Health Sci, 5(2): 219-225.

Park Y, Kim HW, You SC, Hripcsak G, Cho HE, Han JH. 2019. Network analysis of citation in hypertension clinical guidelines. Stud Health Technol Inform, 264: 1017-1020.

Resch M, Süveges I, Németh J. 2013. Hypertension-related eye disorders. Orv Hetil, 154(45): 1773-1780.

Şahin S. 2022. Overview on vascular surgery. BSJ Health Sci, 5(3): (in-press). DOI: 10.19127/bshealthscience.1076552.

VOSviewer 2021. Visualizing scientific landscapes. URL: http://ww@w.vosviewer.com/ (access date: May 10, 2022).

Web of Science. 2021. URL: https://mjl.clarivate.com/search-results. (access date: May 10, 2022).

WHO. 2022. Hypertension. URL: https://www.who.int/news-room/fact-sheets/detail/hypertension. (access date: May, 25, 2022).