

## Global Scientific Research Progress in Thyroid Cancer: A Bibliometric Analysis

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### ABSTRACT

The incidence of thyroid cancer (TC) has rapidly increased in the world. The study aims to provide a detailed evaluation of thyroid cancer research output. Data were retrieved from the Web of Science (WOS) Core Collection and Scopus databases for bibliometric analysis. A total of 10689 and 9063 documents of TC were retrieved from Scopus and WOS, respectively. Dramatic growth in the global TC research was observed from 1991-2020. USA, China, Italy, Korea, Japan and Germany were the leading countries; the Memorial Sloan Kettering Cancer Center and the University of Pisa were the leading institutes in thyroid cancer research at the global level. A scientist from the division of medicine, biochemistry, genetics and molecular biology were contributed more than 85% of the publications. USA agencies

supported 25.68% of TC research. Journal of thyroid and journal of clinical endocrinology and metabolism are the most productive journals. Wang Y and Tuttle RM were the top productive, authors. Revised American thyroid association management guidelines for patients with thyroid nodules and differentiated thyroid cancer authored by Cooper DS et al., published in 2009, was the most cited article. The most retrieved keywords were thyroid cancer, papillary thyroid cancer, and differentiated thyroid cancer. The study concludes that USA institutes and funding agencies contribute to thyroid cancer research at a global level. Papillary thyroid cancer is a hot topic for research.

**Key words:** Thyroid cancer; Bibliometrics; Scopus; Web of Science

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### INTRODUCTION

The thyroid is important endocrine gland composed histologically two main parenchymal cell types. Follicular cells, concentrate iodine, and produce thyroid hormones. These cells rise to well-differentiated cancers (i.e., papillary and follicular) and anaplastic thyroid cancer. The para-follicular cell, produces the hormone calcitonin and is the cell for medullary thyroid carcinoma<sup>[1-5]</sup>. The incidence of thyroid cancer has increased greatly worldwide in the past few decades, about two-fold accounting for 2% of all cancers<sup>[6-10]</sup>. In the United States, thyroid cancer incidence rates have increased by 211% between 1975 and 2013<sup>[11]</sup>. This increase was attributed mainly to papillary thyroid cancer, the most common histologic subtype of thyroid cancer, accounts for 88% of all thyroid malignancies<sup>[10,12]</sup>. While the increase for follicular or medullary subtypes were to a much lesser extent<sup>[13]</sup>.

Several environmental and genetic factors are contributed in the incidence of thyroid cancer such as radiation, iodine intake, age, female sex, and family history<sup>[9,14,15]</sup>. Conventional therapeutics for thyroid cancer include surgery, chemo-therapy, radioactive iodine treatment, and external beam radiotherapy<sup>[16,17]</sup>, systemic therapy may also be offered<sup>[18]</sup>.

Bibliometrics is a useful method to evaluate the trends of research activity over time and to inform future policy<sup>[19]</sup>. The role of research in addressing the burden of disease, improved health and healthcare delivery and develop evidence-based policy<sup>[20,21]</sup>. Only one study was conducted on thyroid research and practice, but not on thyroid cancer<sup>[22]</sup>. Therefore, the aim of this study is to examine the research activity related to thyroid cancer in the world through the quantification of the published articles. Further to gives better understand of research progress and development trends over the time and provide information for funding agencies to establish related guidelines on thyroid cancer research.

## MATERIALS AND METHODS

### Data source

The data was collected from both Web of Science (WOS) Core Collection database maintained by Clarivate Analytics, including Science Citation Index Expanded (SCI-EXPANDED) and Social Sciences Citation Index (SSCI), and the Scopus databases Access date: 15 June 2020), the extracted data were analyzed using bibliometric methods.

### The literature search

The literature review was conducted using the keyword “Thyroid cancer” OR “Papillary thyroid cancer” OR “Follicular thyroid cancer” OR “Medullary thyroid cancer” OR “Anaplastic thyroid cancer” in the “Research Area” category using the advanced search option available in WOS and Scopus data bases. The search was refined by: Searched document types “ARTICLE OR REVIEW” were included in the Indexes=SCI-EXPANDED, SSCI for WOS database. Timespan starts from 1991-2020, Language=English for overall selected databases. Final cross-examination of the selected database was performed independently by (THM and HHM) in one a single day on June 15, 2020 to avoid the update of the citations. Ethical approval for the study was not necessary since we were downloaded the data of thyroid cancer from the public databases (WOS and Scopus) and did not involve any interactions with human or animal subjects.

### Data analysis and visualization

Bibliometric analyses were performed using Bibliometrix an R Package to assess the growth trend, countries, initiations, authorship, journal, high cited articles, funding agency and research categories. VOSviewer 1.6.10 program produced by (Leiden University, Leiden, The Netherlands)<sup>[23]</sup> was used for constructing and visualizing bibliometric networks for countries/territories collaborations, insinuate collaborations, citations and co-occurrence keywords. Further Statistical analysis was conducted using SPSS (Version 22.0, SPSS Inc., Chicago, IL, USA, License). The relation between the number of publications of the countries and the Gross Domestic Product (GDP), was analyzed using the Spearman’s correlation coefficient. A correlation coefficient of 0.90 to1.00 was considered very high, 0.70 to 0.89 was considered high, 0.50 to 0.69 was considerate moderate, and 0.26 to 0.49 was low.

## RESULTS

### Global trend in thyroid cancer research

The characteristics of thyroid cancer extracted data were studied for both WOS and Scopus metadata. In Scopus, the 10689 documents received 8.49 average years from publication, 25.96 average citations per documents, and 2.629 scores of average citations per year per documents. Whereas, in WOS the 9063 documents received average

years from publication 8.19 score, average citations per documents 26.19 score, and average citations per year per documents 2.78 scores (Table 1). The global trend of publications on thyroid cancer research was annually increased; the number of publication indexed in Scopus database was higher compared with WOS (Figure 1).

### Annual citations of thyroid cancer

The citation rate of the thyroid cancer research during the study period per total cited article and total cited documents per years for WOS, and Scopus metadata are demonstrated in Figure 2. The mean total cited article was sharply decreased after 2010. While the total cited documents per year was annually increasing.

### Top productive countries in thyroid cancer research

A 58.89% of the total publications of TC were published in Scopus databases, and 78.92 % were published in WOS database. The most top 7 countries are presented with the same ranking in two databases. The USA was the highest production, followed by China, Italy, Korea, Japan and Germany, as shown in WOS databases and Scopus databases (Table 2). A correlation coefficient between the reported variables was 0.843 which shows a very high association between the thyroid cancer research in the top 10 produced countries and Gross Domestic Product (GDP) for the year 2019 (Figure 3).

### Top 10 cited articles in thyroid cancer

The results of the top 10 listed documents in thyroid cancer indexed in WOS and Scopus metadata with total citation score are shown in Table 3. The results showed that the average total citations score among the top 10 Scopus documents was 2507.60±129.64, range 4718 to 1013, compared with the average of total citation score indexed in WOS 1663.90 ± 810.51 and range 4,331 to 894. There is no significant difference between the total citations sore in Scopus and WOS among the top 10 productive documents ( $p = 0.097$ ).

**Table 1** Thyroid cancer information indexed in WOS and Scopus database (1991- 2020).

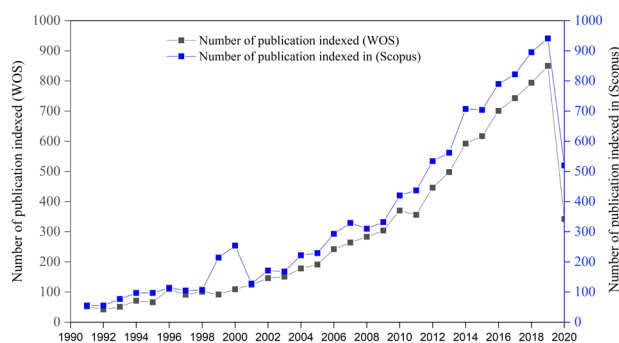
Description	WOS meta data	Scopus meta data
Timespan	1991:2020	1991:2020
Documents	9063	10689
Average years from publication	8.19	8.49
Average citations per documents	26.49	25.96
Average citations per year per doc	2.783	2.629
References	126188	270411
<b>Document types</b>		
Article	8025	9095
Review	1038	1594
<b>Document contents</b>		
Keywords Plus	9850	21832
Author's Keywords	9540	10128
Authors	28117	31128
Author appearances	57985	69797
Authors of single-authored documents	206	358
Authors of multi-authored documents	27911	30770
Authors	28117	31128
<b>Authors collaboration</b>		
Single-authored documents	275	538
Documents per Author	0.322	0.343
Authors per Document	3.1	2.91
Co-Authors per Documents	6.4	6.53
Collaboration Index	3.18	3.03

**Top 10 Institutes focusing on thyroid cancer research**

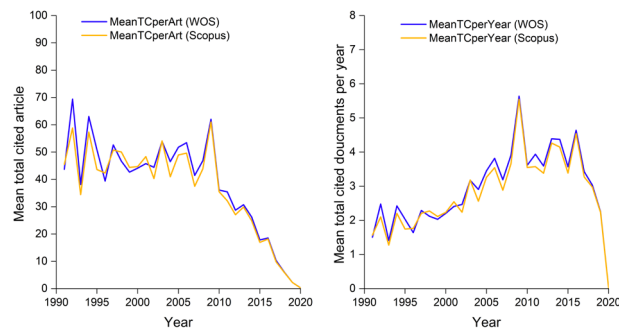
Memorial Sloan Kettering Cancer Center, New York, United States, had the greatest number of publications on thyroid cancer 716 papers, accounting for 7.90% of the total published literature in WOS, followed by the University of Pisa, Italy 582 publications, accounting for 6.42 published documents, and the University of Texas MD Anderson Cancer Center, Texas, United States of America 419 publications, accounting for 4.62% of total published literature in WOS compared with Scopus databases as shown in Table 4. Among the top 10 productive institutions in thyroid cancer, only one Chinese institute and two Korean Institute were included in Asia.

**Top 10 research categories**

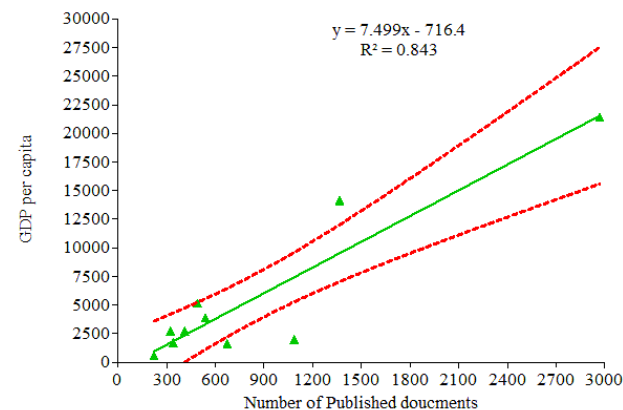
The top 10 research field categories on thyroid cancer, noted that in Scopus 9016 documents were published in medicine, accounting 55.90%, followed by 5270 documents published in biochemistry,



**Figure 1** The number of annual publications on TC research indexed in WOS and Scopus databases (1991-2020).



**Figure 2** The number of the annual trend of average cited documents per article and years in TC research indexed in WOS and Scopus databases (1991-2020).



**Figure 3** Association between the numbers of publication in top 10 countries produced article in thyroid cancer and Gross Domestic Product (GDP) for the year 2019.

genetics and molecular biology, accounting 32.68%. Whereas, in WOS 2692 documents were published in oncology accounting 29.69%, followed by 2604 documents published in endocrinology and metabolism accounting 28.72% (Table 5).

**Top 10 funding agencies**

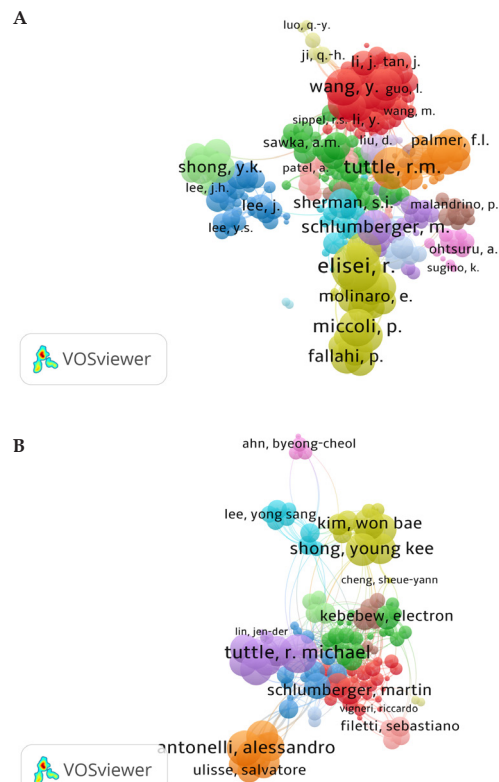
The top 10 funding agencies in WOS and Scopus Metadata are shown in Table 6. A total of 912 studies accounting 10.06% were supported by the United States Department of Health Human Services, followed by National Institutes of Health NIH, USA 904 documents accounting 9.97%, and NIH National Cancer Institute NCI 512 documents accounting 5.65% of overall articles indexed in WOS.

**Top 10 productive authors**

Wang Y and Tuttle RM were the top productive authors published articles of thyroid cancer research in both WOS and Scopus databases. Pacini F has published 71 documents with high total citation reached to 13565 and h-index 35 scores in WOS. In addition, Pacini F was also published 86 documents with total citations 15902 scores, and h-index 39 scores in the Scopus database (Table 7).

**Top 10 productive journals and their impact factor**

The top productive journal published thyroid cancer articles include 1,114 journals in WOS databases and 1,653 journals in Scopus databases. Among WOS databases, only 2175 documents have been reported published in top 10 journal compare with 2157 documents published in Scopus databases. Both the top productive journal indexed in WOS, and Scopus databases were published more than 100 papers. The greatest number of thyroid cancer documents



**Figure 4** A: Scopus metadata. Co-authorship networks among authors by applying a threshold of 20. Of the 30363 authors, 283 authors meet the thresholds; B: Web of Science metadata. Co-authorship networks among authors by applying a threshold of 20. Of the 34677 authors, 130 authors meet the thresholds.

**Table 2** Top 10 most corresponding authros countries with more publications on thyroid cancer.

Country	Articles	% of article	No. of articles per million	SCP	MCP	MCP_Ratio
Scopus data base						
USA	2297	21.49	6.94	1904	393	0.17
China	896	8.382	6.22	849	47	0.05
Italy	773	7.232	1.28	634	139	0.18
Korea	700	6.549	2.71	647	53	0.07
Japan	437	4.088	3.45	394	43	0.09
Germany	373	3.49	4.48	254	119	0.32
France	240	2.245	3.68	183	57	0.24
United kingdom	222	2.077	3.27	178	44	0.19
Canada	215	2.011	5.69	172	43	0.2
Poland	142	1.328	3.7	128	14	0.09
<b>Total</b>	<b>6295</b>	<b>58.89</b>	<b>41.42</b>	<b>5343</b>	<b>952</b>	<b>1.6</b>
Web of Sciences (WOS)						
USA	2430	26.812	7.34	1973	457	0.18
China	1458	16.087	1.01	1345	113	0.07
Italy	880	9.71	1.46	706	174	0.19
Korea	637	7.029	2.47	589	48	0.07
Japan	423	4.667	3.34	372	51	0.12
Germany	401	4.425	4.82	282	119	0.29
France	275	3.034	4.21	196	79	0.29
Canada	240	2.648	6.35	187	53	0.22
United kingdom	218	2.405	3.21	172	46	0.21
Turkey	191	2.107	2.26	181	10	0.05
<b>Total</b>	<b>7153</b>	<b>78.92</b>	<b>2.26</b>	<b>181</b>	<b>10</b>	<b>0.05</b>

**Table 3** Top 10 cited papers in thyroid cancer indexed in Scopus data bases.

R	Manuscript (first author, title, journal and year) indexed in Scopus	TC
1st	Cooper, D.S., et al. Revised American thyroid association management guidelines for patients with thyroid nodules and differentiated thyroid cancer, 2009. <i>Thyroid</i> .19(11), pp. 1167-1214	4718
2nd	Haugen, B.R. et al. 2015 American Thyroid Association Management Guidelines for Adult Patients with Thyroid Nodules and Differentiated Thyroid Cancer: The American Thyroid Association Guidelines Task Force on Thyroid Nodules and Differentiated Thyroid Cancer, 2016. <i>Thyroid</i> 26(1), pp. 1-133	3793
3rd	Davies, L., Welch, H.G. Increasing incidence of thyroid cancer in the United States, 2006 1973-2002	2299
4th	Rahib, L., et al. Projecting cancer incidence and deaths to 2030: The unexpected burden of thyroid, liver, and pancreas cancers in the united states, 2014. <i>Cancer Research</i> 74(11), pp. 2913-2921	2242
5th	Mazzaferrri, E.L., Jhiang, S.M. Long-term impact of initial surgical and medical therapy on papillary and follicular thyroid cancer, 1994. <i>The American Journal of Medicine</i> 97(5), pp. 418-428	1974
	Cooper, D.S. et al. Management guidelines for patients with thyroid nodules and differentiated thyroid cancer, 2006. <i>Thyroid</i> 16(2), pp. 109-141	1602
7th	Liaw, D., et al. Germline mutations of the PTEN gene in Cowden disease, an inherited breast and thyroid cancer syndrome, 1997. <i>Nature Genetics</i> 16(1), pp. 64-67	1562
8th	Hundahl, S.A. et al. A National Cancer Data Base report on 53,856 cases of thyroid carcinoma treated in the U.S., 1985-1995, 1998. <i>Cancer</i> 83(12), pp. 2638-2648	1358
9th	Kimura, E.T., et al. High prevalence of BRAF mutations in thyroid cancer: Genetic evidence for constitutive activation of the RET/PTC-RAS-BRAF signaling pathway in papillary thyroid carcinoma, 2003. <i>Cancer Research</i> 63(7), pp. 1454-1457	1197
10th	Ron E, et al. Thyroid cancer after exposure to external radiation: A pooled analysis of seven studies, 1995. <i>RADIATION RESEARCH</i> Volume: 141 Issue: 3 Pages: 259-277 Published: MAR 1995	1013
	Manuscript (first author, title, journal and year) indexed in WOS	
1st	Cooper, D.S., et al. Revised American thyroid association management guidelines for patients with thyroid nodules and differentiated thyroid cancer, 2009. <i>Thyroid</i> .19(11), pp. 1167-1214	4331
2nd	Haugen, B.R. et al. 2015 American Thyroid Association Management Guidelines for Adult Patients with Thyroid Nodules and Differentiated Thyroid Cancer, 2016. <i>Thyroid</i> 26(1), pp. 1-133	3573
3rd	Rahib, L., et al. Projecting cancer incidence and deaths to 2030: The unexpected burden of thyroid, liver, and pancreas cancers in the united states, 2014. <i>Cancer Research</i> 74(11), pp. 2913-2921	2162
4th	Davies, L., Welch, H.G. Increasing incidence of thyroid cancer in the United States, 2006 1973-2002	2140
5th	Mazzaferrri, E.L., Jhiang, S.M. Long-term impact of initial surgical and medical therapy on papillary and follicular thyroid cancer, 1994. <i>The American Journal of Medicine</i> 97(5), pp. 418-428	1752
	Liaw, D., et al. Germline mutations of the PTEN gene in Cowden disease, an inherited breast and thyroid cancer syndrome, 1997. <i>Nature Genetics</i> 16(1), pp. 64-67	1457
7th	Cooper, D.S. et al. Management guidelines for patients with thyroid nodules and differentiated thyroid cancer, 2006. <i>Thyroid</i> 16(2), pp. 109-141	1441
8th	Hundahl, S.A. et al. A National Cancer Data Base report on 53,856 cases of thyroid carcinoma treated in the U.S., 1985-1995, 1998. <i>Cancer</i> 83(12), pp. 2638-2648	1216
9th	Kimura, E.T., et al. High prevalence of BRAF mutations in thyroid cancer: Genetic evidence for constitutive activation of the RET/PTC-RAS-BRAF signaling pathway in papillary thyroid carcinoma, 2003. <i>Cancer Research</i> 63(7), pp. 1454-1457	1110
10th	Ron E, et al. Thyroid cancer after exposure to external radiation: A pooled analysis of seven studies, 1995. <i>RADIATION RESEARCH</i> Volume: 141 Issue: 3 Pages: 259-277 Published: MAR 1995	894

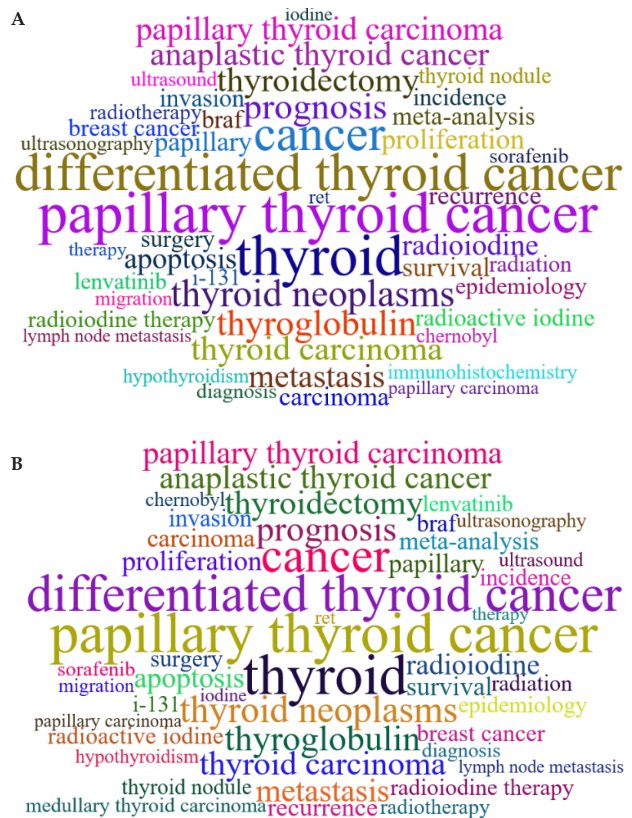
published in Thyroid Journal (Impact factors 5.309, 2019), ( $n = 661$ ) in WOS, and ( $n = 635$ ) documents in Scopus, followed closely by the Journal of Clinical Endocrinology & Metabolism (Impact factor 5.399, 2019) ( $n = 435$ ) in WOS, and ( $n = 443$ ) in Scopus database. The results show that the top 10 journals published documents in thyroid cancer research have impact factors more than 2 (Table 8).

**Co-authorship networks visualization**

The visualizations of co-authorship networks for publication indexed in Scopus metadata shows 281 items which presented in 15 clusters with 2890 links, and total link strength 10404 scores. Among the presented authors are Elisei R. published 95 documents with 6636 citations score and total link strength 413, followed by Tuttle RM published 128 documents with 16136 citation score and total length strength 314 (Figure 4A). Overall author’s networks in WOS metadata were presented in 13 clusters with 548 link score and total link strength 3216 score. The high authors outcome based on the total link strength were Tuttle RM published 96 documents, with 12197 citations score, and total length strength 209, followed by Antonelli Alessandro published 52 documents, with 1146 citations score and total length strength 117 (Figure 4B).

**Top 50 authors key words on thyroid cancer**

The top 50 authors keywords on thyroid cancer were analyzed using the word cloud visualizations indexed in WOS and Scopus metadata. Among the 9582 Author’s Keywords, only the top 50 keywords indexed in WOS metadata are shown in the word cloud network. The analysis shows thyroid cancer were frequency presented more than 2221 time, followed by papillary thyroid cancer 527 time, differentiated thyroid cancer 521 times, and thyroid neoplasms



**Figure 5** A: The analysis of the top 50 authors keywords indexed in WOS, and Scopus database; B: The analysis of the top 50 authors keywords on thyroid cancer using wordcloud visualizations indexed in Scopus.

**Table 4** Ranking of institutions that published articles on the thyroid cancer research.

R	Web of Science metadata		Scopus meta database	
	Affiliations	NP (%)	Affiliations	NP (%)
1st	Memorial Sloan-Kettering Cancer Center	716 (7.90)	University of Pisa	407 (3.89)
2nd	The University of Pisa	582 (6.42)	National Cancer Institute	374 (3.58)
3rd	The University of Texas MD Anderson Cancer Center	419 (4.62)	Memorial Sloan-kettering Cancer Center	294 (2.81)
4th	Seoul National University	407 (4.49)	University of California	245 (2.34)
5th	Johns Hopkins University	380 (4.19)	Memorial Sloan Kettering Cancer Center	205 (1.96)
6th	Ohio state University	378 (4.17)	Harvard Medical School	189 (1.81)
7th	Yonsei University	357 (3.94)	University of Toronto	186 (1.78)
8th	University Calif San Francisco	328 (3.62)	Yonsei University College of Medicine	169 (1.61)
9th	University Ulsan	318 (3.51)	Mayo Clinic	168 (1.61)
10th	Fudan University	294 (3.24)	Johns Hopkins University School of Medicine	158 (1.51)

Note: R: rank, NB: Number of publications.

**Table 5** Top 10 research field categories on thyroid cancer.

R	Web of Science categories	NP (%)	Scopus categories	NP (%)
1st	Oncology	2,692 (29.69)	Medicine	9016 (55.90)
2nd	Endocrinology Metabolism	2,604 (28.72)	Biochemistry, Genetics and Molecular Biology	5270 (32.68)
3rd	Surgery	1,222 (13.48)	Pharmacology, Toxicology and Pharmaceutics	304 (1.88)
4th	Radiology Nuclear Medicine Medical Imaging	864 (9.53)	Multidisciplinary	191 (1.18)
5th	Otorhinolaryngology	433 (4.77)	Agriculture and Biological Sciences	158 (0.98)
6th	Medicine Research Experimental	430 (4.74)	Neurosciences	148 (0.92)
7th	Cell Biology	396 (4.37)	Environmental sciences	141 (0.87)
8th	Medicine General internal	358 (3.95)	Physics and Astronomy	130 (0.81)
9th	Biochemistry Molecular Biology	325 (3.58)	Immunology and Microbiology	122 (0.76)
10th	Public Environmental Occupational Health	260 (2.87)	Chemistry	120 (0.74)

Note: R: rank, NB: Number of publications.

**Table 6** Top 10 related funding agencies contributed in published documents related to thyroid cancer.

R	Web of Science Categories	NP (%)	Scopus database	NP (%)
1st	United States Department of Health Human Services	912 (10.06)	National Institutes of Health	367 (3.51)
2nd	National Institutes of Health NIH USA	904 (9.97)	National Natural Science Foundation of China	330 (3.16)
3rd	NIH National Cancer Institute NCI	512 (5.65)	National Cancer Institute	195 (1.87)
4th	National Natural Science Foundation of China	444 (4.89)	National Research Foundation of Korea	95 (0.91)
5th	Associazione Italian Per la ricerca Sul cancro airc	156 (1.72)	Association Italian per la Ricerca sul Cancro	66 (0.63)
6th	Ministry of education universities and Research Miur	99 (1.09)	American Cancer Society	53 (0.51)
7th	American cancer society	65 (0.72)	Eisai Inc.	40 (0.38)
8th	Genzyme corporation	63 (0.69)	Ministry of Science, ICT and Future Planning	32 (0.31)
9th	Ministry of Education Culture Sports Science and Technology Japan Mext	58 (0.64)	Ministry of Science and Technology, Taiwan	28 (0.27)
10th	Eisai inc	52 (0.57)	European Commission	26 (0.25)

Note: R: rank, NP: Number of publications.

229 times, prognosis 210 times, thyroglobulin 208 times, thyroid carcinoma 183 times, papillary thyroid carcinoma 168 times, medullary thyroid cancer 161 times, and lymph node metastasis 53 times (Figure 5A). The same indexed author’s keyword was shown in Scopus word cloud visualization map (Figure 5B).

## DISCUSSION

The incidence rate of thyroid cancer has been rising rapidly worldwide in recent decades; however, its trend remains unclear<sup>[4]</sup>. Bibliometrics may quantitatively monitor research performance in science and present predictions<sup>[24]</sup>. In the present study, 10689 documents relating to TC were retrieved from Scopus, and 9063 documents from WOS, dramatic growth in the global publication number on TC research was observed from 1991-2020. This was consistent with the increase in the incidence of thyroid cancer worldwide. Environmental and lifestyle factors (e.g., radiation, iodine intake, and nitrates), and chronic lymphocytic thyroiditis were possible causes for thyroid cancer incidence<sup>[15]</sup>. The increase in the incidence may be attributable to the widespread use of imaging studies, such as ultrasounds, computed tomography, magnetic resonance imaging, and positron emission tomography scans, that incidentally detect thyroid nodules<sup>[25]</sup>.

In terms of country analysis, USA, China, Italy and South Korea were the leading countries in thyroid cancer publications in the world. It was highly associated with the Gross Domestic Product (GDP) of these countries. The previous study showed that the number of new cases of thyroid cancer and thyroid cancer-related deaths was estimated to be 62,450 and 1950 in 2015, respectively, in the USA<sup>[26]</sup>. Therefore, Memorial Sloan Kettering Cancer Center in the United States and the University of Pisa in Italy are the leading institute in TC research at the global level. Similarly, among the top funding agencies contributed in thyroid cancer research the first three rank agencies were from USA (United States Department of Health Human Services, National Institutes of Health NIH USA, and NIH national Cancer Institute NCI). Among all institute’s division of medicine, and Biochemistry, Genetics and Molecular Biology were contributed more than 85% of the publications.

In terms of journals, we observed that the Journal of Thyroid published far more TC research papers, followed by the Journal of Clinical Endocrinology and Metabolism. The thyroid is a medical journal in the field of endocrinology, covering research on thyroid cancer and all thyroid-related diseases. It is the official journal of the American Thyroid Association and published by Mary Ann Liebert,

**Table 7** Top 10 author impact in the thyroid cancer research.

R	Author	h_index	TC	NP	PY_start
Web of Sciences data					
1st	Wang Y	21	1775	114	2007
2nd	Tuttle RM	43	10979	114	1998
3rd	Zhang Y	18	1647	90	2007
4th	Schlumberger M	39	9742	87	1991
5th	Clark OH	39	3699	83	1991
6th	Elisei R	37	5901	82	1991
7th	Li X	17	839	74	2007
8th	Chen H	26	2075	75	1996
9th	Zhang L	21	1565	74	2005
10th	Pacini F	35	13565	71	1991
Scopus data bases					
1st	Tuttle RM	46	17041	133	1998
2nd	Wang Y	23	1863	120	2007
3rd	Schlumberger M	50	18791	123	1991
4th	Clark OH	46	5391	107	1991
5th	Elisei R	40	7597	101	1991
6th	Zhang Y	22	1897	94	2007
7th	Kebebew E	37	3903	88	2000
8th	Pacini F	39	15902	86	1991
9th	Chen H	29	2964	83	1996
10th	Sosa JA	28	6743	82	2006

Note: R: Rank, NP: Number of publications, TC: Total citations, PY-star: Publications year starting.

Inc., with an impact factor of 7.78. The most active authors were Wang Y and Tuttle RM, some of their highly cited research focus are on thyroid carcinoma<sup>[27]</sup>, controversial issues in thyroid cancer management<sup>[28]</sup>, and risk stratification in differentiated thyroid cancer from detection to final follow up<sup>[29]</sup>. Analysis of top ten cited articles showed that Revised American Thyroid Association Management Guidelines for Patients with Thyroid Nodules and Differentiated Thyroid Cancer authored by Cooper DS et al., published in 2009 was the most cited article, which indicated that these guidelines might be classic and fundamental for further studies and should be read by any scientist in the field of thyroid cancer.

As shown in the bibliometric mapping of keywords, the most occurrence authors keywords retrieved were thyroid cancer, papillary thyroid cancer, and differentiated thyroid cancer. Differentiated thyroid cancer, which includes papillary and follicular histologies,

**Table 8** The top 10 Journals published article related to thyroid cancer research.

R	Web of Sciences data				Scopus meta data			
	Sources of Journal, n (1114)	NP	(%)	IF (2019)	Journal, n (1653)	NP	(%)	IF (2019)
1st	Thyroid	661	7.29	5.309 (Q1)	Thyroid	635	6.15	5.309 (Q1)
2nd	Journal of Clinical Endocrinology & Metabolism	435	4.8	5.399 (Q1)	Journal of clinical endocrinology and Metabolism	443	4.29	5.399 (Q1)
3rd	Surgery	188	2.07	3.356 (Q1)	Endocrine-related Cancer	173	1.68	4.8 (Q1)
4th	Endocrine-related Cancer	175	1.93	4.8 (Q1)	Clinical Nuclear Medicine	163	1.58	6.622 (Q1)
5th	Clinical Endocrinology	134	1.48	3.38 (Q2)	Clinical Endocrinology	137	1.33	3.38 (Q2)
6th	Endocrine	126	1.39	3.235 (Q3)	Endocrine	129	1.25	3.235 (Q3)
7th	PLOS ONE	117	1.29	2.74 (Q2)	Journal of Endocrinological Investigation	126	1.22	3.397 (Q2)
8th	Journal of Endocrinological Investigation	115	1.27	3.397 (Q2)	Oncotarget	120	1.16	5.168 (Q1)
9th	World Journal of Surgery	115	1.27	2.234 (Q2)	PLOS ONE	119	1.15	2.74 (Q2)
10th								

Note: R: Rank, NP: Number of publications, IF: Impact factor, Q: Quartile range.

is a common malignancy and is increasing in incidence. Previous studies indicated that the increase in thyroid cancer was attributed mainly to papillary thyroid cancer, which accounts for 88% of all thyroid malignancies<sup>[10,12]</sup>. It was proposed that the increased incidence of papillary thyroid cancer was attributed to the enhanced diagnostic detection in recent years<sup>[30]</sup>. Therefore, the governments in the developing world should pay more attention to thyroid cancer research and provide more manpower and supported materials. This study represents a useful tool for scientists and public health policy makers in planning and organizing scientific program for the treatment of thyroid cancer.

## CONCLUSIONS

This study demonstrates that the literature on TC was continuously growing. USA and China made the largest contribution in TC research. Research direction in TC was papillary thyroid cancer and differentiated thyroid cancer. The efforts should be made by the developed countries to help developing countries with the highest prevalence of TC.

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