Research productivity in the genetics of papillary thyroid carcinoma (1991-2020): a bibliometric analysis

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Abstract. Background and aim: Papillary thyroid carcinoma accounts for 85% of thyroid follicular epithelial-derived cancers. The identification of pathogenetic mechanisms improved the understating of papillary thyroid carcinoma pathogenesis. The current study aims to examine the research productivity and trends in the genetics of papillary thyroid carcinoma from 1991 to 2020. Methods: The Web of Science Core Collection database was searched to retrieve the relevant literature. A search string was applied and 1,741 relevant records were selected for the analysis. Bibliometric techniques were used in the statistical analysis with the help of Biblioshiny (RStudio). Results: The growth in the number of publications was observed to be over a hundred publications per year since 2015. ‘Thyroid’ published the highest number of publications, followed by ‘Journal of Clinical Endocrinology & Metabolism’. ‘Nikiforov YE’ was identified as the most productive researcher with a total of 49 publications. Out of the top 20 most contributing researchers, seven belonged to Italy, and four were from the USA. ‘University of Pittsburgh’ contributed the highest number of publications. The top contributing countries in this field were the USA, China, and Italy. BRAF and RAS were among the frequently used keywords. Conclusions: This bibliometric review demonstrates that investigating the genetics underlying papillary thyroid carcinoma is a rapidly growing area of research. During the last two decades, China has been a significant contributor to the field. Besides, institutions in the USA and Italy have significantly contributed to research in the genetics of papillary thyroid carcinoma. (www.actabiomedica.it)

Key words: papillary thyroid carcinoma, genetics, oncology; bibliometrics, scientometrics

Introduction

Papillary thyroid carcinoma is a differentiated thyroid cancer, which accounts for 85% of thyroid follicular epithelial-derived cancers. According to the Surveillance, Epidemiology, and End Results (SEER) database (1975 to 2012), the incidence of papillary thyroid carcinoma had tripled from 4.8 to 14.9 per 100,000. Based on 2014-2018 data, the incidence of thyroid cancer was 15.5 per 100,000 persons (1). Although the 5-year relative survival reaches up to 98.3% (1), distant metastases, and gross invasion of surrounding neck structures are possible consequences, which may occur in about 5% of patients (2). Critical
pathogenetic mechanisms in the development and progression of differentiated thyroid cancer are the mutations in the genes encoding for the proteins involved in the mitogen-activated protein kinase (MAPK) pathway (3, 4). The understanding of pathogenetic mechanisms underlying the initiation of thyroid cancers, including papillary carcinoma, could be utilized to invent ancillary therapeutic targets.

Evaluation of thyroid cancer scientific productivity, collaboration, and trends could delineate the current state and serve as guidance for future directions. In recent bibliometric analysis, the global progress from 1991-2020 in the field of thyroid cancer was evaluated. The study demonstrated that the research productivity about thyroid cancers is steadily expanding, with the majority of research dedicated to papillary thyroid carcinoma (5). Furthermore, the trends of papillary thyroid carcinoma research were evaluated by Huang et al., where it has been demonstrated that productivity is rapidly growing with biological mechanisms being an area of great interest (6). Bibliometric analysis regarding the genetics of papillary thyroid carcinoma has, to the best of our knowledge, not been conducted. Therefore, the current study aims to examine the productivity and trends of the genetics of papillary thyroid carcinoma research from 1991 to 2020.

Objectives

The primary objective was to examine the following components related to evaluating the research productivity and citation trends in the genetics of papillary thyroid carcinoma from 1991 to 2020:

1. Annual scientific research output in the genetics of papillary thyroid carcinoma
2. Most influential sources, organizations, and countries in the genetics of papillary thyroid carcinoma research
3. Most prominent authors in the field of the genetics of papillary thyroid carcinoma research
4. Researchers’ authorship and collaboration trends in the field of the genetics of papillary thyroid carcinoma
5. Most used keywords in the genetics of papillary thyroid carcinoma research

Methodology

For this study, a total number of bibliographic records, 2,338, were extracted from the Web of Science Core Collection (WOSCC) database, with the date range from January 1st, 1991, to December 31st, 2020. Data were downloaded on April 6th, 2021. Researchers checked 2,338 records one by one and excluded 597 irrelevant records. Finally, 1,741 relevant records were selected for the analysis. Bibliometric techniques were used in the statistical analysis with the help of Biblioshiny (RStudio) open-source software as well as MS Excel, MS Access, and VOS Viewer. The study investigated the annual scientific research output, most influential countries and organizations, most prominent authors and their contributions, most relevant sources, and commonly used papillary thyroid cancer genetics research keywords.

Web of Science (WOS) is one of the most reliable and consistent indexing and abstracting databases utilized by researchers around the globe, with wall-to-wall coverage; with a slogan, “The Discovery Starts Here” (7-9).

Boolean operators OR and AND were used to combine keywords to obtain the most relevant and maximum results. Furthermore, data were collected by searching through a list of keywords - “TS=((papillary carcinoma") OR (“papillary thyroid carcinoma") OR (“papillary thyroid cancer” )) AND TS=( molecular OR genetics OR epigenetics OR miRNA OR “genetic alteration*” OR “molecular biomarkers” OR “genetic signature*” OR “genetic marker*” OR “genetic diagnostics” OR “gene therapy*” ); refined by: [excluding] PUBLICATION YEARS: (2021) AND [excluding] DOCUMENT TYPES: (EARLY ACCESS OR CORRECTION OR BOOK CHAPTER OR MEETING ABSTRACTS OR NOTE ). The research keywords were designed to cover a wide range of publications on the genetics of papillary carcinoma OR papillary thyroid carcinoma OR papillary thyroid cancer.
Results

4.1 Yearly growth and citations in the genetics of papillary thyroid cancer research

The yearly growth and citations-wise distribution of the genetics of papillary thyroid cancer research is shown in Figure 1. The data depicts that the topic did not get the attention of the researchers at the beginning, with only single-digit publications from 1991 to 1995 with a gap of publication in the year 1993. From 1996 to 2014, the growth in publications remained in a two-digit number. The growth in the number of publications was observed to be approximately over hundred publications from 2015 to 2020. The year 2020 contributed the highest number of publications. The citation-wise analysis ranked the year 2006 as the top year with the highest number of citations followed by 2014, 2005, and 2010.

4.2 Most preferred document types

The most preferred document types by the researchers on the topic are shown in Table 1. The analysis disclosed the document type 'Article' as the most preferred type chosen by the researchers for publishing their research, followed by document types 'Review' and 'Article; Proceedings Paper'. Likewise, the citation-wise analysis also presented the same trend. The document type 'Article' secured the highest number of citations distantly followed by 'Review' and 'Article; Proceedings Paper'. Although the least number of researchers preferred the document type 'Letter', it obtained more citations than 'Proceedings Papers'.

| Document type         | Number of publications | Percent | Citations |
|-----------------------|------------------------|---------|-----------|
| Article               | 1,454                  | 83.51   | 46,371    |
| Article; Proceedings Paper | 46              | 2.64   | 1,998     |
| Editorial Material   | 15                     | 0.86    | 234       |
| Letter                | 3                      | 0.17    | 17        |
| Proceedings Paper    | 12                     | 0.69    | 7         |
| Review                | 211                    | 12.12   | 8,851     |
| Total                 | 1,741                  | 100.00  | 57,478    |

Figure 1: Yearly growth and citations of the genetics of papillary thyroid cancer research
4.3 Authorship pattern in the genetics of papillary thyroid cancer research

The data in Figure 2 presents the authorship pattern of the researchers on the topic, and it ranges from single author to two hundred forty-three author patterns. The seven-author pattern emerged as the most favorite pattern in the collaborative research on the topic with 205 publications, followed by six and five author patterns with 200 and 192 publications, respectively. Further analysis revealed that eight to ten authored patterns each contributed over a hundred publications. Interestingly, one publication was collaborative research of two hundred forty-three authors.

4.4 Most productive sources for the genetics of papillary thyroid cancer research

Table 2 ranks the most favorite sources (journals) preferred by the researchers on the topic for publishing their research. The journal ‘Thyroid’ ranked at the top of the list by publishing the highest number of documents, followed by ‘Journal of Clinical Endocrinology & Metabolism’ and ‘Endocrine Pathology’. The analysis ranked simultaneously three sources at the eighth, two sources at the ninth, three sources at the eleventh, and two sources at the thirteenth positions, due to an equal number of publications. The data also highlighted publication sources that did not receive any citation. In this regard, ‘Cancer Cytopathology’ and ‘Surgery’ had one publication each without any citation. The citation-wise analysis also ranked the source ‘Journal of Clinical Endocrinology & Metabolism’ at the top position, followed by ‘Thyroid’ and ‘Endocrine Pathology’.

4.5 Most prolific authors and their impact

The most prolific researchers on the topic are listed in Table 3. It is evident from the data that out of the top 20 most contributing researchers, seven belonged to Italy, and four were from the USA. Researcher ‘Nikiforov YE’ from the University of Pittsburgh, Pennsylvania, USA, secured the top position with 49 publications, followed by three Italian researchers, ‘Santoro M’ and ‘Fusco A’ from the University of Naples Federico II, and ‘Basolo F’ from the University of Pisa. Researchers ‘Asa SL’, ‘Zhang L’, and ‘Carty SE’
Table 2. Top 20 sources of publication for the genetics of papillary thyroid cancer research

| Rank | Source (N=452)                        | TP  | TCP  | TC   | TC/TP    | TC/TCP   | PY start |
|------|--------------------------------------|-----|------|------|----------|----------|----------|
| 1    | Thyroid                              | 81  | 81   | 2,961| 36.56    | 36.56    | 1997     |
| 2    | Journal of Clinical Endocrinology & Metabolism | 74  | 74   | 5,923| 80.04    | 80.04    | 1996     |
| 3    | Endocrine Pathology                  | 47  | 47   | 1,348| 28.68    | 28.68    | 1997     |
| 4    | Endocrine-Related Cancer             | 32  | 32   | 1,542| 48.19    | 48.19    | 2005     |
| 5    | Oncotarget                           | 26  | 26   | 626  | 24.08    | 24.08    | 2010     |
| 6    | Cancer Cytopathology                 | 24  | 23   | 654  | 27.25    | 28.43    | 1999     |
| 7    | PLoS One                             | 20  | 20   | 541  | 27.05    | 27.05    | 2009     |
| 8    | Oncogene                             | 19  | 19   | 1,981| 104.26   | 104.26   | 1991     |
| 8    | Modern Pathology                     | 19  | 19   | 1,154| 79.68    | 79.68    | 1991     |
| 8    | Surgery                              | 19  | 18   | 437  | 23.00    | 24.28    | 1995     |
| 9    | European Journal of Endocrinology    | 18  | 18   | 689  | 38.28    | 38.28    | 1996     |
| 9    | International Journal of Oncology    | 18  | 18   | 290  | 16.11    | 16.11    | 1994     |
| 10   | American Journal of Surgical Pathology | 17  | 17   | 954  | 56.12    | 56.12    | 1996     |
| 11   | Cancer Research                      | 16  | 16   | 2,273| 142.06   | 142.06   | 1995     |
| 11   | Clinical Cancer Research             | 16  | 16   | 1,457| 91.06    | 91.06    | 1998     |
| 11   | Human Pathology                      | 16  | 16   | 397  | 24.81    | 24.81    | 2000     |
| 12   | Histopathology                       | 14  | 14   | 414  | 29.57    | 29.57    | 1997     |
| 13   | Journal of Pathology                 | 13  | 13   | 906  | 69.69    | 69.69    | 1996     |
| 13   | Molecular and Cellular Endocrinology | 13  | 13   | 629  | 48.38    | 48.38    | 2010     |
| 14   | Cancer                               | 11  | 11   | 853  | 77.55    | 77.55    | 1999     |

TP = Total publications; TCP = Total cited publications; TC = Total citations; PY = Publication year

4.6 Top highly-cited documents in the genetics of papillary thyroid cancer research

Table 4 presents the highly-cited documents on the topic. The data reported only one document with over 1000 citations. The analysis ranked ‘Agrawal N, 2014, Cell’ at the top position securing the highest total citations (1336) followed by ‘Cibas ES, 2009, Am J Clin Pathol’ and ‘He HL, 2005 Natl Acad Sci USA’. The data equally ranked ‘Xia T, 2014, Sci Rep-UK’ and ‘Takahashi M, 2001, Cytokine Growth F R’ in the fifteenth position due to the same number of citations secured. Similarly, documents ‘Zhu ZW, 2003, Am J Clin Pathol’ and ‘Nikiforov YE, 2002, Endocr Pathol’ were ranked in the sixteenth position due to the same number of citations.

4.7 Top contributing countries

Table 5 shows the top countries contributing research on the topic. The analysis reported Europe and Asia as the most contributing continents. The
country-wise analysis reported USA as the top contributing country with 432 publications, closely followed by China with 404 publications, and distantly by Italy with 256 publications in the third position. India, Israel, and Russia ranked at the bottom of the list with 24, 23, and 20 publications, respectively. USA outclassed all countries in securing citations and maintained the top position in terms of citations. Italy secured the second position with 11,273 citations, followed by China with 6,225 citations. Iran held the last position with only 277 citations.

### 4.8 Most productive organizations

The most productive organizations are presented in Table 6. The data revealed an outstanding contribution by organizations from USA as eight organizations were from USA, whereas three organizations were from China, two from Italy and South Korea each. The data ranked ‘University of Pittsburgh’ from USA at the top position in producing the highest number of publications, followed by ‘University of Pisa’ and ‘University of Naples Federico II’, both from Italy. ‘Catholic

| Author (n=7,874) | Affiliation | Country | TP | TCP | TC | Citation impact (TC/TP) | h index | PY Start |
|------------------|-------------|---------|----|-----|----|------------------------|---------|----------|
| Nikiforov YE     | University of Pittsburgh, Pennsylvania | USA     | 49 | 49  | 5,809 | 118.55 | 32 | 1998     |
| Santoro M        | University of Naples Federico II | Italy     | 32 | 32  | 3,109 | 97.16 | 25 | 1992     |
| Fusco A          | University of Naples Federico II | Italy     | 30 | 30  | 3,336 | 111.20 | 26 | 1992     |
| Basolo F         | University of Pisa | Italy     | 25 | 25  | 1,503 | 60.12 | 16 | 2000     |
| Sobrinho-Simoes M | University of Porto | Portugal | 25 | 25  | 1,188 | 47.52 | 18 | 2000     |
| Miccoli P        | University of Pisa | Italy     | 23 | 23  | 1,284 | 55.83 | 15 | 1999     |
| Nikiforova MN    | University of Pittsburgh, Pennsylvania | USA     | 22 | 22  | 1,791 | 81.41 | 16 | 2001     |
| Soares P         | Universidade do Porto | Portugal | 22 | 22  | 1,077 | 48.95 | 16 | 2002     |
| Yamashita S      | Nagasaki University | Japan | 20 | 20  | 476  | 23.80 | 13 | 1994     |
| Tallini G        | University of Bologna | Italy | 18 | 18  | 2,201 | 122.28 | 15 | 1998     |
| Asa SL           | University Health Network | Canada | 17 | 16  | 2,804 | 164.94 | 13 | 2000     |
| Fugazzola L      | Università degli Studi di Milano | Italy | 17 | 17  | 1,019 | 59.94 | 12 | 1995     |
| Jung CK          | The Catholic University of Korea | South Korea | 17 | 17  | 634  | 37.29 | 12 | 2012     |
| Elisei R         | University Hospital of Pisa | Italy | 16 | 16  | 1,212 | 75.75 | 12 | 1997     |
| Jarzab B         | Maria Skłodowska-Curie Institute–Oncology Centre | Poland | 16 | 16  | 669  | 41.81 | 13 | 2001     |
| Xing MZ          | Johns Hopkins University | USA | 16 | 16  | 3,086 | 192.88 | 16 | 2003     |
| Yip L            | University of Pittsburgh, Pennsylvania | USA | 16 | 16  | 1,112 | 69.50  | 13 | 2009     |
| Zhang L          | Huazhong University of Science and Technology Wuhan | China | 16 | 15  | 251  | 15.69  | 10 | 2008     |
| Bae JS           | The Catholic University of Korea | Korea | 15 | 14  | 2,353 | 156.87 | 13 | 2009     |
| Carty SE         | Concordia University | Canada | 15 | 14  | 2,353 | 156.87 | 13 | 2009     |

TP = Total publications; TCP = Total cited publications; TC = Total citations; PY = Publication year

Table 3. Top 20 contributing authors and their impact
Table 4. Most cited documents in the genetics of papillary thyroid cancer research

| Documents (n=1,741) | TC  | CY | TCPY |
|---------------------|-----|----|------|
| Agrawal N, 2014, Cell | 1336 | 7  | 190.86 |
| Cibas ES, 2009, Am J Clin Pathol | 968 | 12 | 80.67 |
| He HL, 2005, P Natl Acad Sci USA | 943 | 16 | 58.94 |
| Xing MZ, 2005, J Clin Endocr Metab | 678 | 16 | 42.38 |
| Xing MZ, 2007, Endocr Rev | 673 | 14 | 48.07 |
| Brzezianska E, 2006, Mutat Res-Fund Mol M | 643 | 15 | 42.87 |
| Kondo T, 2006, Nat Rev Cancer | 629 | 15 | 41.93 |
| Carломагно F, 2002, Cancer Res | 490 | 19 | 25.79 |
| Elisei R, 2008, J Clin Endocr Metab | 359 | 13 | 27.62 |
| Xu XL, 2003, Cancer Res | 355 | 18 | 19.72 |
| Adeniran AJ, 2006, Am J Surg Pathol | 351 | 15 | 23.40 |
| Capper D, 2011, Acta Neuropathol | 347 | 10 | 34.70 |
| Huang Y, 2001, P Natl Acad Sci USA | 343 | 20 | 17.15 |
| Kebebew E, 2007, Ann Surg | 317 | 14 | 22.64 |
| Xia T, 2014, Sci Rep-UK | 307 | 7  | 43.86 |
| Takahashi M, 2001, Cytokine Growth F R | 307 | 20 | 15.35 |
| Zhu ZW, 2003, Am J Clin Pathol | 304 | 18 | 16.89 |
| Nikiforov YE, 2002, Endocr Pathol | 304 | 19 | 16.00 |
| Hou P, 2007, Clin Cancer Res | 284 | 14 | 20.29 |
| Santoro M, 1994, Oncogene | 283 | 27 | 10.48 |

TC = Total citations; CY = Citation years; TCPY = Total citations per year

University of Korea, ‘Sungkyunkwan University’, and ‘University of Texas MD Anderson Cancer Center’ remained at the bottom of the list with 21 publications from each organization. The highest number of citations were received by ‘Johns Hopkins University’, followed by ‘University of Pisa’, ‘University of Pittsburgh’, and ‘University of Naples Federico II’.

4.9 Country collaboration map for the genetics in papillary thyroid cancer research

Figure 3 depicts the country collaboration map related to the genetics in papillary thyroid cancer research. USA had the maximum collaboration with other countries in publishing research on the topic. USA also maintained three top positions in collaborating with other countries among the top four positions. The research collaboration from USA and Italy ranked at the top position with a contribution of 49 publications, followed by China and USA, USA and Germany, and USA and UK.

4.10 Most frequently used keywords in the genetics of papillary thyroid cancer research

Figure 4 presents the analysis of author-supplied keywords with a minimum number of keyword occurrences of 12. Out of 2,582 keywords, 63 met the threshold. The map divided the keywords into seven clusters. The same color of the circles describes the similarity of the topic in the keywords. Similarly, the circle size indicates the frequency of the occurrence
of the author-supplied keywords. The larger size of the circle reflects the more co-selection of the keywords by the researchers on the topic. The keyword ‘papillary thyroid carcinoma’ appeared to be the most frequently used keyword by the researchers. Other prominent keywords were BRAF, thyroid, thyroid cancer, papillary thyroid cancer, papillary carcinoma, and RAS.

Discussion

Over the past three decades, a total of 1,741 publications on the genetics of papillary thyroid carcinoma were identified. This constitutes almost one-fifth of all publications related to thyroid cancer, indicating that the genetics of papillary thyroid cancer is a hotspot of research (6). The number of publications per year did not exceed 100 publications till the year of 2015. This reflects a recent growing interest in genetics, and the great potential that genetic research holds in advancing therapeutic alternatives for papillary thyroid carcinoma. The study conducted by Agrawal et al., which was identified as the most cited article in the field, extended the set of known genetic alterations that derive papillary thyroid cancer to incorporate EIF1AX, PPM1D, and CHEK2 (10). Based on this discovery, the percentage of papillary thyroid cancer of unknown oncogenic drive was reduced from 25% to 3%; therefore, a reclassification of papillary thyroid cancer was suggested for better reflection of the underlying pathogenetic mechanisms and therapeutic strategies (10).
a total of 49 publications, whereas ‘Xing MZ’ from Johns Hopkins University secured the highest citation impact. Interestingly, in disagreement with our results, ‘Nikiforov YE’ was not identified as one of the top 5 contributing authors in thyroid cancer research and papillary thyroid cancer research (5, 6). One of Nikiforov’s papers features in the list of top 20 cited publications in the present analysis. In that paper, the rearrangement of the RET gene in papillary thyroid cancer was reviewed thoroughly (12). Different types of RET/PTC are clearly correlated with distinct morphologic variants of papillary thyroid carcinoma. RET/PTC1 is commonly associated with typical papillary microcarcinomas with the usually benign course, while RET/PTC3 is associated with a solid variant of

‘Thyroid’ published the largest number of publications (N = 81), followed by ‘Journal of Clinical Endocrinology & Metabolism’ (N = 74). Nonetheless, ‘Journal of Clinical Endocrinology & Metabolism’ received double the citations (5,923) received by ‘Thyroid’ (2,961), indicating that the impact of a source is not necessarily a function of the number of publications. These findings are in line with the previous reports (5, 6). The fourth most cited publication was published in the ‘Journal of Clinical Endocrinology & Metabolism’, where Xing et al. demonstrated that the BRAF mutation is associated with poorer prognosis and independently predicts tumor recurrence (11).

‘Nikiforov YE’ from the University of Pittsburgh was identified as the most productive researcher with

| Organizations (n=1,871) | Country          | TP  | TCP  | TC     | PY start | PY end   |
|------------------------|------------------|-----|------|--------|----------|----------|
| University of Pittsburgh | United States    | 47  | 47   | 2,858  | 2003     | 2019     |
| University of Pisa     | Italy            | 47  | 46   | 3,098  | 1995     | 2020     |
| University of Naples Federico II | Italy | 35  | 35   | 2,673  | 1998     | 2020     |
| University of Porto    | Portugal         | 34  | 33   | 1,360  | 1995     | 2020     |
| Nagasaki University    | Japan            | 32  | 29   | 785    | 1991     | 2020     |
| China Medical University | Taiwan          | 31  | 27   | 593    | 2010     | 2020     |
| Mem Sloan Kettering Cancer Center | United States | 30  | 30   | 1,282  | 1997     | 2020     |
| Shanghai Jiao Tong University | China     | 29  | 27   | 502    | 2009     | 2020     |
| Wenzhou Medical University | China          | 29  | 27   | 333    | 2015     | 2020     |
| Harvard University     | United States    | 28  | 28   | 2,394  | 2001     | 2017     |
| Fudan University       | China            | 28  | 24   | 413    | 2008     | 2020     |
| Johns Hopkins University | United States  | 27  | 23   | 3,504  | 2001     | 2017     |
| Mayo Clinic            | United States    | 27  | 20   | 1,461  | 1991     | 2020     |
| Brigham & Women’s Hospital | United States  | 26  | 11   | 2,085  | 2001     | 2020     |
| University of Toronto  | Canada           | 24  | 24   | 1,778  | 2000     | 2020     |
| University Sao Paulo  | Brazil           | 24  | 21   | 1,243  | 2002     | 2020     |
| National Cancer Institute | United States | 22  | 22   | 2,363  | 1997     | 2017     |
| Catholic University of Korea | South Korea | 21  | 21   | 776    | 2010     | 2020     |
| Sungkyunkwan University | South Korea     | 21  | 21   | 530    | 1998     | 2018     |
| University of Texas MD Anderson Cancer Center | United States | 21  | 21   | 574    | 2009     | 2020     |

TP = Total publications; TCP = Total cited publications; TC = Total citations; PY = Publication year
**Figure 3.** Top 20 country collaborations in the genetics of papillary thyroid cancer research

**Figure 4.** Most frequently used keywords in the genetics of papillary thyroid cancer research
papillary carcinoma, which manifests a more aggressive tumor behavior (13, 14). In concordance with the institutional affiliation of the top contributing authors, University of Pittsburgh, USA, was ranked the first in terms of the number of publications, while Johns Hopkins University, USA, secured the highest total citations despite being ranked much lower in terms of the number of publications. Therefore, the impact of an organization is not necessarily reflected by the number of publications.

Regarding contributing countries, about half of the publications were contributed by USA (N = 432/1,741) and China (N = 404/1,741). Interestingly, China’s publication year start was in 2001, while that for USA was ten year earlier (1991). This reflects the rapidly expanding research contribution from China in this field. In agreement with our report, Huang et al. found that China had the highest sustained research output in relation to papillary thyroid carcinoma since 2012 (6). In the near future, it is likely that China will surpass USA and be the leading country in contributing to research on the genetics of papillary thyroid cancer. The collaboration between USA and Italy was the most predominant pattern of collaboration with a total of 49 publications. Although the presence of some developing countries, including Brazil, Iran, and India, were noted in the top 20 contributing countries, the collaboration between developed and developing countries is rather scarce. Bridging the gaps between the developed and developing countries is crucial to enhance the global health.

Unsurprisingly, papillary thyroid carcinoma was the most frequently used keyword. Additionally, other frequently used keywords included BRAF and RAS, indicating the central role played by these biological mechanisms in understanding the pathogenetic mechanism of papillary thyroid carcinoma. The identification of the RET-Ras-BRAF signaling cascade improved the understating of papillary thyroid carcinoma pathogenesis (4). Furthermore, BRAF mutation has been associated with clinical progression, recurrence, and failure of treatment (15).

A number of limitations of the present analysis should be considered. First, only a single database (WOSCC) was searched, with the possibility of missing relevant data. Second, our analysis was largely based on citation metrics, which are subjected to several biases, such as citation bias and self-citation, leading to inaccurate measurement of research impact. Additionally, the true impact of a publication should not be solely evaluated by scientometric measurements; what matters is the content therein.

Conclusion

Papillary thyroid carcinoma is the most common thyroid cancer. Since 1975, the incidence of papillary thyroid carcinoma has increased three times. In the present bibliometric review, we mapped the research productivity and trends in the genetics of papillary thyroid carcinoma. The review demonstrates that studying the genetics underlying papillary thyroid carcinoma is a newly evolving and rapidly growing area of research. Additionally, almost half of the publications were contributed by USA and China. China has been a big contributor to the field during the last two decades and may become the leading contributor in this specific area in the near future. Research collaborations were mainly observed between developed countries. It is worth repeating that collaborations between developed and developing countries is rather scarce. Bridging the gaps between the developed and developing countries is crucial to enhance the global health.

Conflict of Interest: Each author declares that he/she has no commercial associations (e.g., consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

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