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Review

Analysis of Global Search and Research Interests on Dentists Using Infoveillance and Bibliometric Approaches

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Abstract: About half of the world's population requires the services of a dentist. However, the in-depth understanding of the concerns and priorities of the global public and scientific communities concerning dentists is essential for the planning and development of sustainable strategies, interventions, and policies that will cater for the current global oral health needs. Therefore, this study investigated the global search and research interests on dentists using a hybrid research design—a combination of infoveillance and bibliometric research designs. The data analysed in this study were obtained from Google Trends and SCOPUS. The findings show that, over the years, there has been a significant growth in the volume of information search and research outputs on dentists with huge inequalities existing between the Global South and North. It is also notable that the COVID-19 pandemic played a significantly influential role in the global information search and dissemination trends on dentists. The knowledge and funding for dentist-related research flow significantly from the countries of the Global North. The review of the network visualisation of keyword co-occurrence revealed a misplaced priority in the global research interest areas on dentists and oral health. The obtained findings could help to shape the future of dental healthcare and policy.

Keywords: dentist; dental surgeon; policy; global health; bibliometric analysis; infoveillance study

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1. Introduction

A dentist is a healthcare professional who evaluates, diagnoses, prevents and treats disorders, diseases or conditions affecting the mouth, maxillofacial area and its related and adjacent structures [1,2]. The scope of dental practice goes beyond clinical intervention alone; it also includes public health intervention, policy making, and research [3–5]. About half of the world's population requires the services of a dentist—about 2.3 billion, 796 million, and 267 million people have untreated dental caries of succedaneous teeth, severe periodontal disease, and tooth loss, respectively [1]. This shows that the global burdens of oral conditions and oral health needs are enormous.

Unfortunately, there is a short supply of dentists globally. According to the World Health Organization data, about 1.6 million dentists currently serve the world population [6,7]. It is also worrisome that inequalities exist in the regional distribution of the dentistry workforce [6]. By estimation, more than two-thirds of the dentists in the world are in Europe (27.9%) and the Americas (41.5%), while only one percent of them are in Africa [6]. The Americas have the narrowest population-to-dentist ratio (one dentist to 1400 people), while Africa has the widest ratio (one dentist to 40,000 people) [6]. This

shortage of dentists perpetuates the global inequality in accessibility to dentists and the utilisation of dental care services.

The current inequalities in the global distribution of dentists is worrisome. Pertinently, it would be more worrisome if a similar situation exists in the global trends and patterns of information search and research interests on dentists, as such information gives a reflection of the inequalities concerning oral health literacy, priorities, and uptake across the globe [8–12]; however, empirical evidence of this is currently lacking. Therefore, the provision of evidence for this area is crucial as it enhances the in-depth understanding of the trends and patterns of global awareness, knowledge, utilisation, priorities, and interests concerning dentists and oral health services.

The internet is a significant medium used for searching out or disseminating information [11,12]; it is also a commonly used data source for analysing search and research interests concerning a phenomenon of interest. Global search interests on dentists can be evaluated through an infoveillance study while a bibliometric study can evaluate the global research interest [13–24]. An infoveillance study uses internet search data to monitor search interests on a topic [13,14]. Google, Twitter, TikTok, or Instagram search data are the most utilised data for infoveillance studies [13–17]. On the other hand, a bibliometric study seeks to quantify the research interests on a topic by evaluating the metrics (obtained from electronic databases) of the researchers, institutions, and countries sourcing or funding the research outputs on such a topic [18–24]. Furthermore, bibliometric analysis helps to illustrate the trend of research outputs, identify hotspots, and summarise the volume and influence of literature published on a topic of interest [18].

This study aims to quantify and qualify the volume and patterns of global public search and research on dentists through the application of infoveillance and bibliometric research approaches. This study is of huge public health significance, as the findings obtained will provide the crucial information needed for the deeper understanding of public and researchers' interests and priority areas on dentists, particularly in the areas of online information dissemination and consumption practices in dentistry. Furthermore, this study's findings will pave the way for future research and policies relevant to the scope and practice of dentistry.

2. Methods

This study adopted a two-part research design: infoveillance and bibliometric study designs. This hybrid research design has been used in a previous study; hence, it was adopted for this present study [25].

2.1. Infoveillance Study

The infoveillance study part was based on the Google Trends data. Google Trends is the most widely utilised data source in infoveillance studies because it is the most comprehensive and most used source for data on internet-based searches globally [25–29]. On 17 June 2022, an online search of Google Trends (https://trends.google.com/trends/?geo=GB, accessed on 17 June 2022) using the search term "dentist" was carried out. The geographical coverage, time range, categorisation, and search type were set to "worldwide", "2004 (the oldest year on Google Trends) to present", "all categories", and "web search", respectively. The search yielded infodemiological data (search volume indexes (SVIs), country names, top topics, rising topics, top queries, rising queries, and time (in months and years)), which were exported from Google Trends in a .csv (comma-separated value) format. Of particular interest is the interpretation of these data. Google Trends uses an SVI to illustrate the comparison between a search term/topic/query and a geographical location or a period [25]. The value of an SVI ranges from 0 to 100 [25]. A term/topic/query with an SVI value of 100 for a particular geographical location or period means that the term/topic/query has the greatest popularity as a proportion of total searches in that geographical location or period; an SVI value of 50 means it is half as popular, while an SVI value of 0 means a lack of enough data on the term/topic/query for a particular

geographical location or period [25,27–29]. A term is a word used to conduct a search on Google Trends, which in this study was "dentist". A topic is a group of terms that share the same contextual meaning in any language [25]. A query is a word that is similar to a search term [25]. Top related topics/queries are the most popular topics/queries related to a search term. Rising related topics/queries are the related topics/queries with the most significant search frequency within a particular time range of interest.

The exported data were analysed using the Microsoft Excel 2021 software, and the analysis outcomes are presented using tables, a line graph, and a geographical map.

2.2. Bibliometric Analysis

The bibliometric analysis was conducted based on methodological guidelines proposed by Donthu and colleagues [30]. The SCOPUS database was the electronic database used for this analysis, because SCOPUS is the oldest, most comprehensive, and most widely used database for bibliometric analysis [18,31]. The justification for using only SCOPUS was because the use of multiple databases often reduces the opportunity to conduct robust bibliometric analysis due to the difficulty in synchronizing bibliometric data obtained from two or more databases [18,30–32]. Additionally, the use of one database is a common and acceptable practice in bibliometric analysis [18,30–32].

On 23 June 2022, a basic search of SCOPUS was carried out using a combination of the search terms: "dentist" or "dental surgeon". The search was used to scoop out literature published from 2004 (corresponding to the oldest date used in the Google Trends search) to 23 June 2022 and in which the word "dentist" or "dental surgeon" was mentioned in their titles, abstracts, or keywords. To make the search specific to peer-reviewed journal publications, non-journal publications such as books, book chapters, etc., were excluded using filters (Figure 1 and Box 1). Thereafter, the bibliometric data of the residual publications were exported in a .csv format for analysis.

Box 1. Search string used to retrieve articles from SCOPUS.

(TITLE-ABS-KEY dentist) OR TITLE-ABS-KEY (dental AND surgeon)) AND (LIMIT-TO (PUBYEAR, 2022) OR LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2016) OR LIMIT-TO (PUBYEAR, 2015) OR LIMIT-TO (PUBYEAR, 2014) OR LIMIT-TO (PUBYEAR, 2013) OR LIMIT-TO (PUBYEAR, 2012) OR LIMIT-TO (PUBYEAR, 2011) OR LIMIT-TO (PUBYEAR, 2010) OR LIMIT-TO (PUBYEAR, 2009) OR LIMIT-TO (PUBYEAR, 2008) OR LIMIT-TO (PUBYEAR, 2007) OR LIMIT-TO (PUBYEAR, 2006) OR LIMIT-TO (PUBYEAR, 2005) OR LIMIT-TO (PUBYEAR, 2004)) AND (LIMIT-TO (SRCTYPE, "j")) AND (LIMIT-TO (DOCTYPE, "ar"))

The exported bibliometric data included:

- Citation data: names/titles/volumes of authors, journals, and journal papers; journal paper type; and volume, year, issue and page numbers, citation counts of the journal publication;
- Bibliographical data: subject area, country and institutional affiliations, and language of the journal publications;
- Details of funding sponsor;
- Author keywords;
- Journal CiteScore 2021. CiteScore is a SCOPUS tool used to rank a journal's impact. The formula for calculating CiteSce 2021 is:

$$\text{CiteScore 2021} = \frac{\text{Number of citations received in 2018} - \text{2021 to 5 published document types(articles, etc.) by a journal in the same 4 years}}{\text{Total number of documents indexed in SCOPUS and published in 2018} - \text{2021}}$$

- h-Index of the authors, journal publications, journals, institutions, and countries. This index measures the level of influence and refers to the total number of h papers cited at least h times [30]. The h-index was calculated based on the relevant papers included in this study.

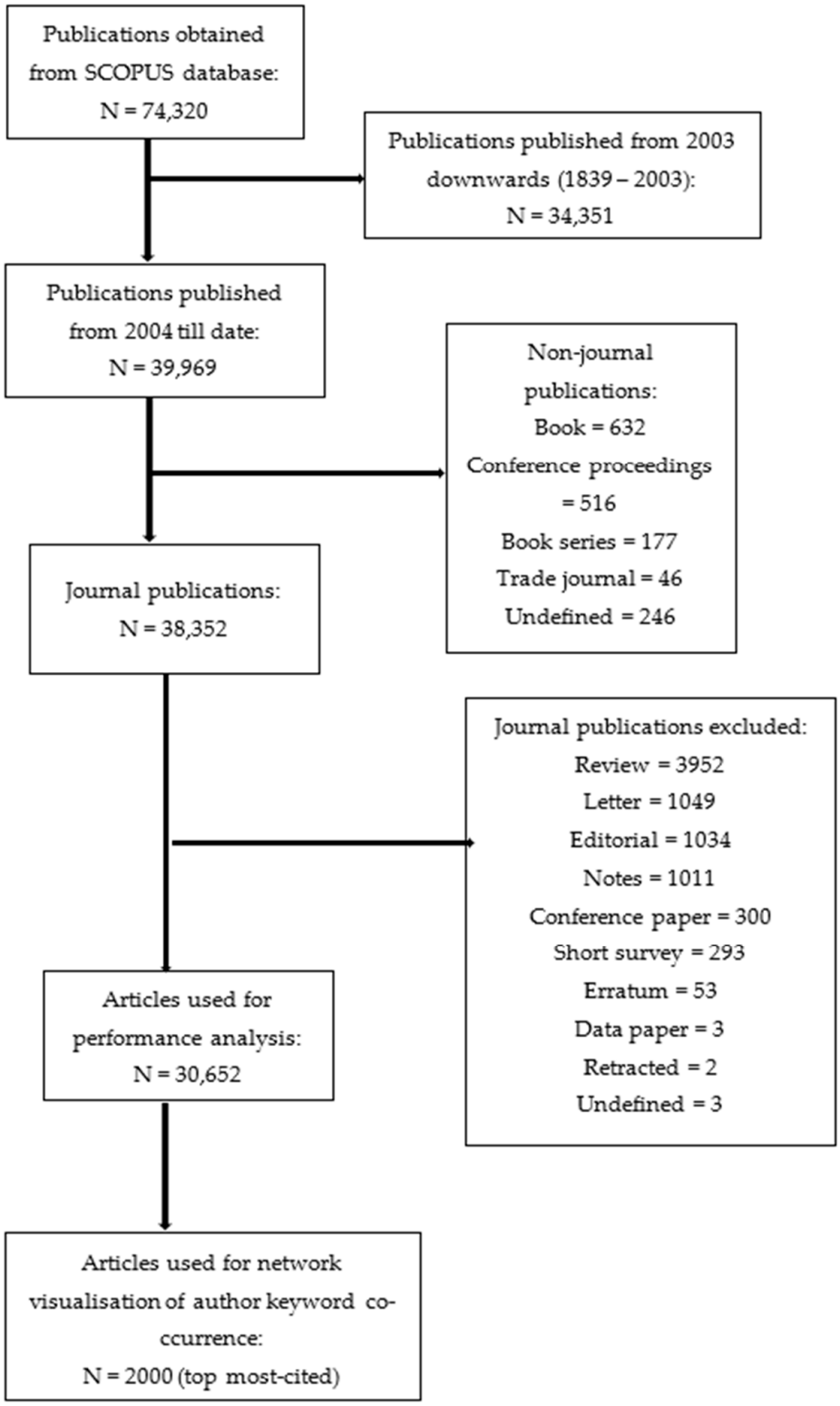

Figure 1. Flow chart for collecting articles for data analysis.

The collected bibliometric data was analysed using two software: Microsoft Excel 2021 and VOSviewer version 1.6.18 software. Microsoft Excel was used to conduct the performance analysis of the obtained articles [30]. The performance analysis involved the evaluation of the bibliometric parameters (ranking, subject areas, total citations [TC], total articles [TA], h-index, and/or CiteScore 2021) at the publication level, author level, institutional level, and country level, with the top ten authors, journals, institutions, and countries identified [18].

VOSviewer was used to generate the network visualisation (map) of the co-occurrence of the author keywords of the top 2000 most-cited journal articles on dentists [32]. In the creation of the visualisation, only those author keywords that occurred in at least five of these articles were included. The visualisation is composed of nodes, clusters, and links [18]. A node is an author keyword appearing in the visualisation; and the bolder a node in the visualisation, the higher its frequency of occurrence among the analysed journal articles. A cluster refers to a group of closely associated nodes; each cluster in a visualisation is depicted with its own colour [18]. A link is a line connecting two or more nodes; the strength of the link(s) associated with a node is regarded as its total link strength (TLS), and it exists as a positive numerical value [18]. For example, a node with a TLS of 5 is interpreted as a node connected to 5 other nodes [18].

The analysis outcomes are presented in texts, bar charts, visualisation, and tables.

3. Results

3.1. Search Interests

Figure 2 shows the global trend of the SVIs on the term "dentist" from 2004 to May 2022. As depicted by the trend line (the broken line), there has been a progressive increase in the global searches for dentists, from 2004 to 2022. January 2020 was the month with the peak SVI (n = 100), while March 2004 was the month with the lowest SVI. The month with the greatest magnitude of sudden SVI decline was April 2020 (SVI = 58).

Figure 3 shows the geographical mapping of the countries with SVIs greater than or equal to 1. Out of the 195 countries in the world, only 30 had an SVI greater than or equal to 1, most of which were countries in the Global North. For example, Egypt (SVI = 7) and South Africa (SVI = 64) are the only African countries represented on the map because they had an SVI greater than or equal to 1; the remaining 52 African countries are not represented because they had an SVI less than 1. Similarly, in South America, only Brazil (SVI = 1) is represented.

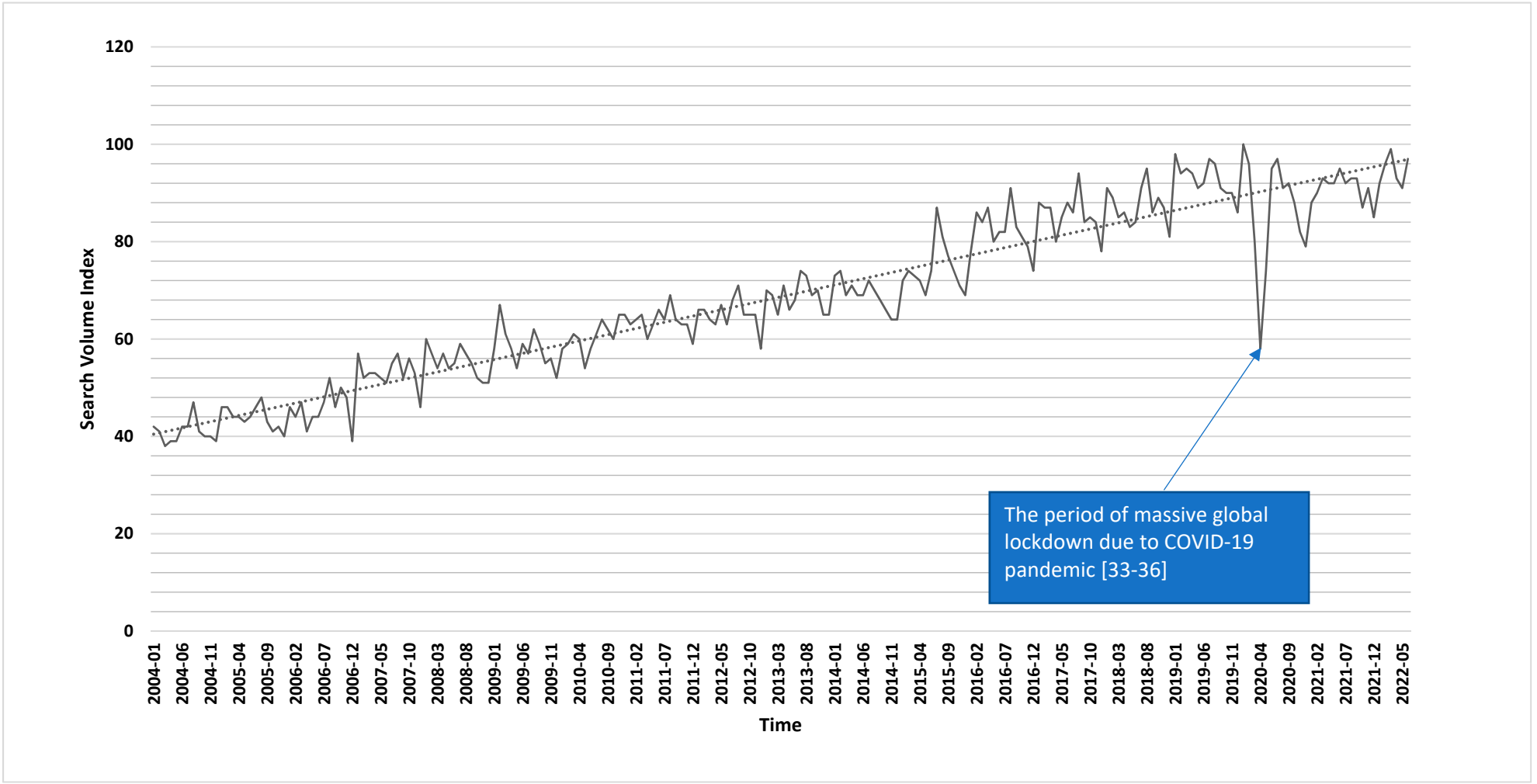

Figure 2. Trend of SVI of the search term "dentist" from 2004 to May 2022 [33–36].

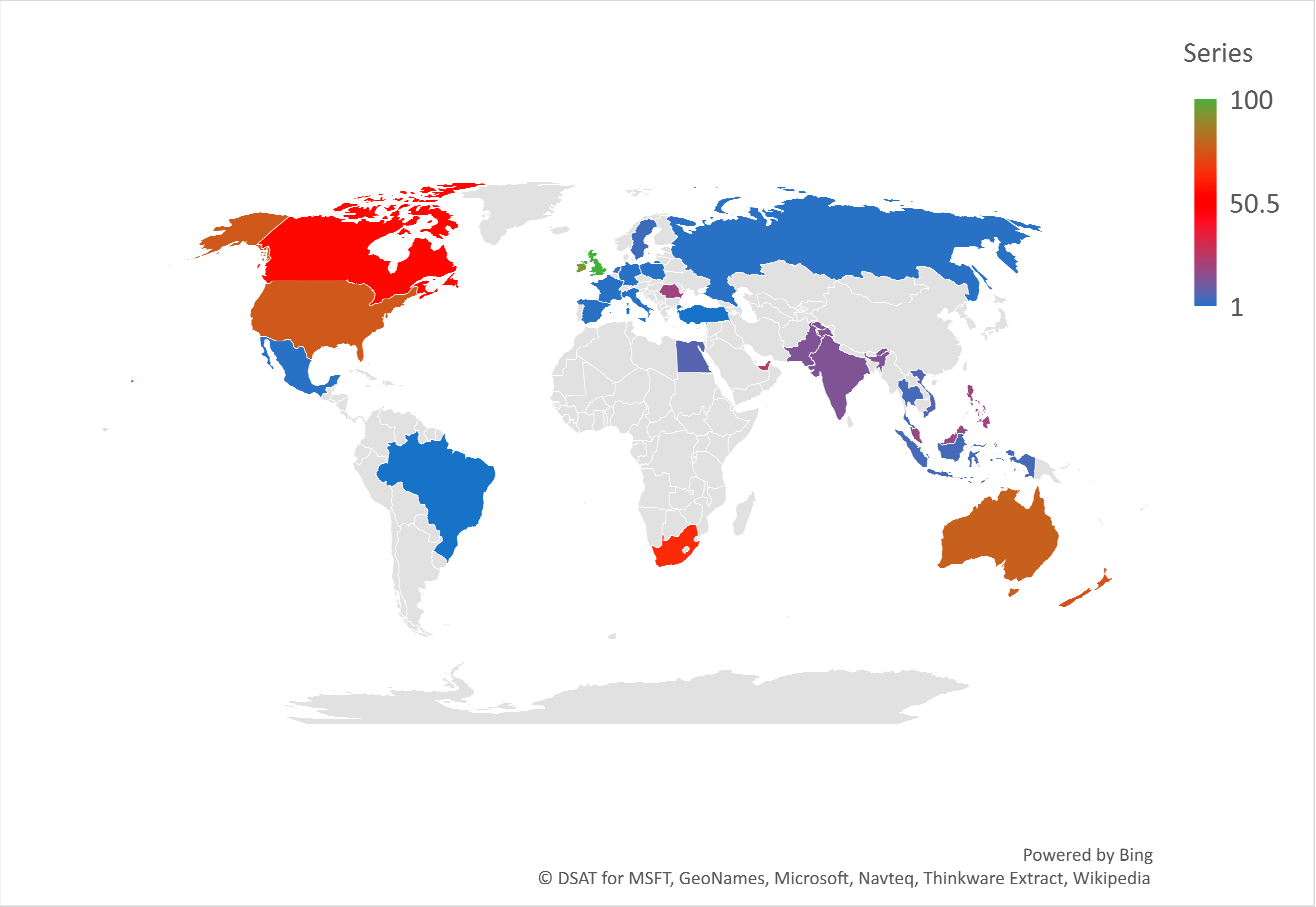

Figure 3. The geographical mapping of the countries with SVIs greater than or equal to 1.

The top ten countries with the greatest SVIs are depicted in Table 1. These countries were all on the list of the top 50 countries with the highest gross domestic product (GDP); 80% in the Global North with 40% in Europe [37,38].

Table 1. Top Ten Countries with the greatest SVI.

Rank	Country	Continent	Location [37]	GDP Ranking (in USD) [38]	SVI
1st	UK	Europe	Global North	5th (2.76Tn)	100
2nd	Ireland	Europe	Global North	29th (425.55Bn)	93
3rd	Australia	Australia	Global North	13th (1.36Tn)	78
4th	United States	North America	Global North	1st (20.89Tn)	76
5th	New Zealand	Europe	Global North	50th (210.70Bn)	74
6th	South Africa	Africa	Global South	41st (335.34Bn)	64
7th	Canada	North America	Global North	9th (1.65Tn)	55
8th	Singapore	Asia	Global North	37th (345.29Bn)	29
9th	United Arab Emirates	Asia	Global South	35th (358.87Bn)	24
10th	Romania	Europe	Global North	47th (249.51Bn)	20

All the top related topics and queries on dentists, together with their SVI value and ranking, are listed in Table 2. There were 18 top related topics with SVI values ranging from >0 to 100. The top two related topics of search interest were about the dentists profession

("Dentistry" (SVI = 100) and "Dentist" (SVI = 100)). There were 25 top related queries with SVI values ranging from 8 to 100. The top two related queries were "dental" (SVI = 100) and "dentist near me" (SVI = 67).

Table 2. The list of top related topics and queries on dentists.

Topic			Query		
Rank	**Top Related Topic**	**SVI**	**Rank**	**Top Related Query**	**SVI**
1st	Dentistry	100	1st	dental	100
1st	Dentist	100	2nd	dentist near me	67
3rd	Tooth	6	3rd	the dentist	45
4th	Paediatrics	4	4th	paediatric dentist	28
4th	Paediatric dentistry	4	5th	dentist emergency	26
6th	National Health Service	3	5th	emergency	26
6th	Emergency	3	7th	Teeth	23
8th	Medicaid	1	8th	my dentist	22
8th	Cosmetic dentistry	1	8th	NHS dentist	22
8th	MyDentist	1	8th	NHS	22
8th	Emergency Dentist	1	11th	best dentist	21
8th	Toothache	1	11th	dentists	21
13th	Aspen Dental	<1	13th	Tooth	17
14th	Bupa	<1	14th	dentistry	16
15th	David After Dentist	<1	14th	family dentist	16
16th	Dentist games	<1	16th	dentist office	15
17th	UnitedHealth Group	<1	17th	kids dentist	12
18th	Dental abscess	<1	18th	doctor	11
			18th	DDS	11
			19th	dentist insurance	10
			19th	dentist school	10
			21st	cosmetic dentist	9
			22nd	dentist salary	8
			22nd	Medicaid	8
			22nd	Medicaid dentist	8

All the rising related topics and queries on dentists, together with their percentage increase (PI) and ranking, are listed in Table 3. There were 15 associated topics with a PI greater than or equal to 100%, with the top two being the names of two UK dental care companies: "MyDentist" (PI = +1850%); and "Aspen Dental" (PI = +1550%). All the rising related queries on dentistry were 25 and their PI were all breakout (i.e., their PI was greater than +5000%); however, the top two queries were phrases used to search for nearby dental offices: "dentist near me"; and "emergency dentist near me".

Table 3. The list of rising related topics and queries on dentists.

Rising Related Topic			Rising Related Query		
Rank	**Rising Related Topic**	**PI**	**Ranking**	**Rising Related Query**	**PI ***
1st	MyDentist	+1850%	1st	dentist near me	Breakout
2nd	Aspen Dental	+1550%	2nd	emergency dentist near me	Breakout
3rd	UnitedHealth Group	+800%	3rd	paediatric dentist near me	Breakout
4th	Dentist games	+650%	4th	best dentist near me	Breakout
4th	Emergency Dentist	+650%	5th	NHS dentist near me	Breakout
6th	David after dentist	+500%	6th	dentists near me	Breakout
7th	Emergency	+400%	7th	Kids' dentist near me	Breakout
8th	Medicaid	+350%	8th	Medicaid dentist near me	Breakout
9th	Dental abscess	+300%	9th	dentist office near me	Breakout
10th	Toothache	+250%	10th	dentist open near me	Breakout
10th	Paediatrics	+250%	11th	family dentist near me	Breakout
10th	Bupa	+250%	12th	emergency dental near me	Breakout
10th	Paediatric dentistry	+250%	13th	dental clinic near me	Breakout
14th	Tooth	+110%	14th	David after dentist	Breakout
15th	National Health Service	+100%	15th	cheap dentist near me	Breakout
			16th	my kids' dentist	Breakout
			17th	dentist meme	Breakout
			18th	dentist that accept Medicaid near me	Breakout
			19th	dentist for kids near me	Breakout
			20th	walk in dentist near me	Breakout
			21st	good dentist near me	Breakout
			22nd	Lumino dentist	Breakout
			23rd	Children's dentist near me	Breakout
			24th	24 h dentist near me	Breakout
			25th	cosmetic dentist near me	Breakout

PI—Percentage increase; * A query with the PI value of "breakout" means that such query has a PI greater than +5000% [30].

3.2. Research Interests

Of all the SCOPUS-indexed journal articles (original research articles) published between 2004 and 23 June 2022, only 30,652 articles had dentists (or dental surgeons) mentioned in their titles, abstracts and/or keywords. These articles were published in

36 different languages. However, the top ten languages of use were European, with English (rank = 1st; TA = 28,138 (91.8%)), German (rank = 2nd; TA = 424 (1.4%)), and Portuguese (rank = 3rd; TA = 396 (1.3%)) being the top three (Table 4).

Table 4. Top ten languages in which articles concerning dentists were published.

Rank *	Language (n = 30,652)	TA ** (%)	TC	h-Index
1st	English	28,138 (91.8)	TLFA	TLFA
2nd	German	424 (1.4)	1679	19
3rd	Portuguese	396 (1.3)	2514	24
4th	French	326 (1.1)	751	11
5th	Chinese	266 (0.9)	184	6
6th	Spanish	264 (0.9)	865	14
7th	Italian	234 (0.8)	429	10
8th	Dutch	196 (0.6)	171	5
9th	Polish	192 (0.6)	205	6
10th	Russian	189 (0.6)	74	4

* Ranking was based on TA; ** Some publications may be published/translated in more than one language; TA—total articles; TC—total citations; TLFA—too large for analysis (SCOPUS can only generate TC and h-index for articles less than or equal to 20,000); n—total number of journal articles.

From 2004 to 2021, there was no steady growth in the annual publication rate of articles on dentists (Figure 4). From 2004 to 2014, there was a progressive growth in the rate; however, from 2015 to 2017, there was a steady decline in the publication rate. In 2018, there was a resurgence and a steady growth till 2021. In the half-year of 2022 alone, over 1000 articles were published—this was higher than the rate recorded in the entirety of 2004 (TA = 986), and almost on a par with that of 2005 (TA = 1053).

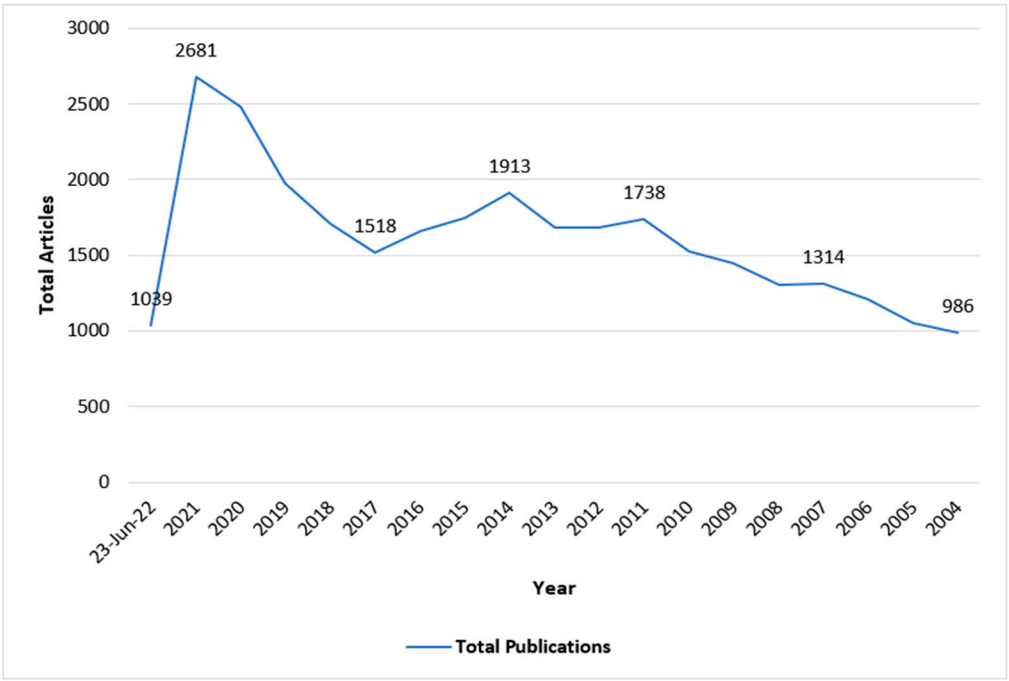

Figure 4. Trend analysis of journal articles on dentists by year.

These articles were published in diverse subject areas. Medicine (TA = 16,562), Dentistry (TA = 16,360), and Social Sciences (TA = 1785) were the three subject areas with the

highest number of articles. Decision Sciences (TA = 22), and Earth and Planetary Sciences (TA = 22) had the lowest number of articles (Figure 5).

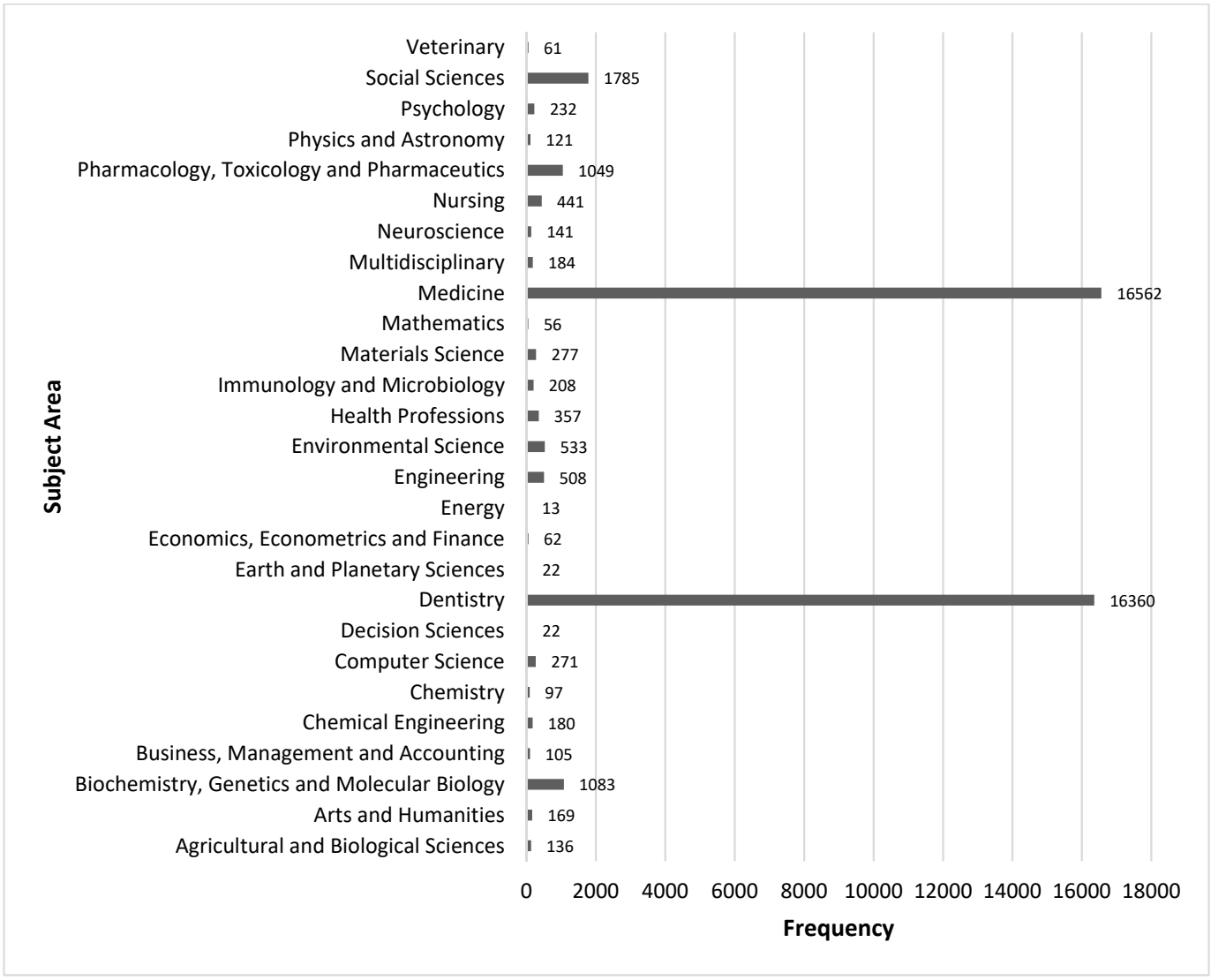

Figure 5. Distribution of articles by subject area.

A total of 159 countries/territories sourced the articles on dentists, with the top ten countries being the United States (TA = 5690), the UK (TA = 2831), India (TA = 2607), Brazil (TA = 2188), Germany (TA = 1283), Japan (TA = 1044), Italy (TA = 960), Saudi Arabia (TA = 927), Australia (TA = 925), and Turkey (TA = 773) (Figure 6).

The top ten institutions sourcing these articles are depicted in Table 5. Half of these institutions are situated in the Global South. The three most productive institutions are in the Global South: Saveetha Dental College and Hospitals (TA = 609 (2.0%); TC = 2532; h-index = 26); Saveetha Institute of Medical and Technical Sciences (TA = 525 (1.7%); TC = 1428; h-index = 17); and Universidade de Sao Paulo (TA = 453 (1.5%); TC = 5390; h-index = 35). Among the top five institutions in the Global North, three were in the USA.

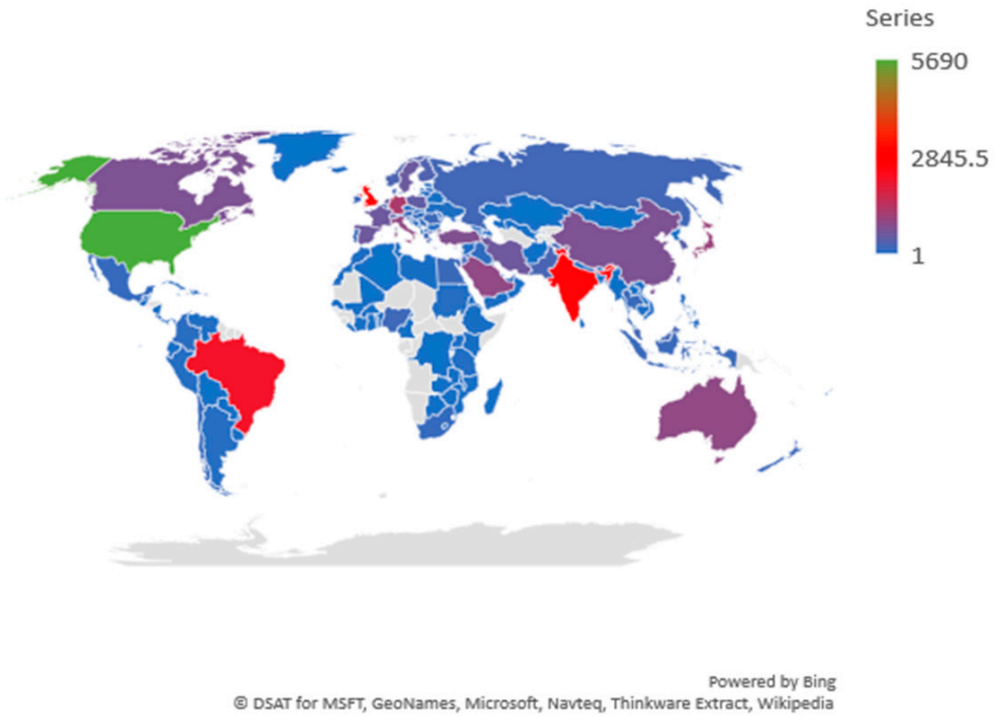

Figure 6. Countries sourcing articles concerning dentists.

Table 5. Top ten institutions sourcing journal articles on dentists.

Rank *	Institutions (n = 30,652)	Country	TA (%)	TC	h-Index
1st	Saveetha Dental College and Hospitals	India	609 (2.0)	2532	26
2nd	Saveetha Institute of Medical and Technical Sciences	India	525 (1.7)	1428	17
3rd	Universidade de Sao Paulo	Brazil	453 (1.5)	5390	35
4th	King's College London	UK	292 (1.0)	3340	31
5th	Academisch Centrum Tandheelkunde Amsterdam	Netherlands	261 (0.9)	4499	36
6th	University of Washington	USA	256 (0.8)	6019	40
7th	The University of North Carolina at Chapel Hill	USA	231 (0.8)	5071	39
8th	Universidade Estadual Paulista Julio de Mesquita Filho	Brazil	220 (0.7)	2357	24
9th	Harvard School of Dental Medicine	USA	219 (0.7)	4623	32
10th	The University of Adelaide	Australia	214 (0.7)	4094	31

* Ranking was based on TA; n—total number of journal articles; TA—total articles; TC—total citations; percentage of TA were calculated based on the proportion of "n".

The top ten funding sponsors of journal articles on dentists are depicted in Table 6. The top three most productive funding sponsors were in the Global North and were all in the USA: National Institute of Dental and Craniofacial Research (TA = 613; TC = 14,579; h-index = 58); National Institutes of Health (TA = 575; TC = 11,931; h-index = 52); and U.S. Department of Health and Human Services (TA = 356; TC = 7596; h-index = 46). None

of these funding sponsors was in Africa while the funding sponsors from South America making the list were all in Brazil.

Table 6. Top ten sponsors of research on dentists.

Rank *	Funding Sponsor (n = 30,652)	Country	TA (%)	TC	h-Index
1st	National Institute of Dental and Craniofacial Research	USA	613 (2.0)	14,579	58
2nd	National Institutes of Health	USA	575 (1.9)	11,931	52
3rd	U.S. Department of Health and Human Services	USA	356 (1.2)	7596	46
4th	Coordenação de Aperfeiçoamento de Pessoal de Nível Superior	Brazil	213 (0.7)	1373	20
5th	Japan Society for the Promotion of Science	Japan	195 (0.6)	2188	24
6th	Conselho Nacional de Desenvolvimento Científico e Tecnológico	Brazil	185 (0.6)	1568	22
7th	National Natural Science Foundation of China	China	143 (0.5)	1564	20
8th	Ministry of Education, Culture, Sports, Science and Technology	Japan	138 (0.5)	1927	24
9th	National Center for Advancing Translational Sciences	USA	89 (0.3)	1278	21
10th	Fundacao de Amparo a Pesquisa do Estado de Sao Paulo	Brazil	86 (0.3)	1141	19

* Ranking was based on TA; n—total number of journal articles; TA—total articles; TC—total citations; percentage of TA were calculated based on the proportion of "n".

The journal articles on dentists were published in several journals, with the top ten depicted in Table 7. These top ten journals are different non-specialised and specialised dental journals, and their publishers are headquartered in the Global North. Furthermore, the majority (80%; 8/10) is headquartered in a European country. Half (50%; 4/4) of those journals headquartered in Europe are published by Elsevier. Amongst the top ten, the *Journal of the American Dental Association* was the journal with the highest CiteScore 2021.

The top ten most productive authors are depicted in Table 8. The most productive researcher globally is Ganapathy, D.M. (TA = 91; TC = 75; h-index = 4)—a researcher from India (a country in the Global South). Australia, the UK, and the USA were the top three countries producing these authors. None of these authors was from an African country. Gordan, V.V. (TA = 83; TC = 1518; h-index = 22) was the author with the highest h-index among these top ten authors.

Table 7. Top ten journals publishing articles on dentists.

Rank *	Source Title (n = 30,652)	Publisher (Country HQ)	CiteScore 2021	TA (%)	TC	h-Index
1st	Journal of Oral and Maxillofacial Surgery	Elsevier (The Netherlands)	2.9	1257 (4.1)	36,397	81
2nd	British Dental Journal	Springer Nature (Germany)	2.7	987 (3.2)	9165	39
3rd	Journal of the American Dental Association	Elsevier (The Netherlands)	4.8	676 (2.2)	15,736	62
4th	Journal of Dental Education	Wiley-Blackwell (USA)	2.1	626 (2.0)	8699	38
5th	International Journal of Oral and Maxillofacial Surgery	Elsevier (The Netherlands)	4.6	504 (1.6)	14,669	62
6th	British Journal of Oral and Maxillofacial Surgery	Elsevier (The Netherlands)	2.5	396 (1.3)	7027	40
7th	BMC Oral Health	Springer Nature (Germany)	3.6	376 (1.2)	5009	30
8th	Journal of Michigan Dental Association	Michigan Dental Association (USA)	NA	349 (1.1)	57	4
9th	General Dentistry	Academy of General Dentistry (USA)	0.9	313 (1.0)	1709	18
10th	Dental Update	George Warman Publications (Pty.) Ltd. (UK)	0.5	295 (1.0)	1086	15

TA—total articles; TC—total citations; * ranking was based on TA; NA—not available; HQ—headquarters; percentage of TA were calculated based on the proportion of "n".

Table 8. Top ten authors of articles on dentists.

Rank *	Author (n = 30,652)	Current Institutional Affiliation **	TA (%)	TC	h-Index
1st	Ganapathy, D.M.	Saveetha Dental College and Hospitals, Chennai, India	91 (0.3)	75	4
2nd	Gordan, V.V.	University of Florida, Gainesville, USA	83 (0.3)	1518	22
3rd	Gilbert, G.H.	Department of Clinical and Community Sciences, Birmingham, USA	65 (0.2)	615	15
4th	Paiva, S.M.	Universidade Federal de Minas Gerais, Belo Horizonte, Brazil	63 (0.2)	781	17
5th	Gallagher, J.E.	King's College London, London, UK	59 (0.2)	667	15
5th	Tennant, M.	The University of Western Australia, Perth, Australia	59 (0.2)	621	16
7th	Burke, F.J.T.	University of Birmingham, College of Medical and Dental Sciences, Birmingham, UK	58 (0.2)	724	16
7th	Schwendicke, F.	Charité—Universitätsmedizin Berlin, Berlin, Germany	58 (0.2)	826	15
9th	Brennan, D.S.	The University of Adelaide, Adelaide, Australia	56 (0.2)	827	16
9th	Spencer, A.J.	The University of Queensland, Brisbane, Australia	56 (0.2)	1546	20

* Ranking was based on TA; ** Affiliation used in the most recent publication, as shown on SCOPUS; TA—Total articles; TC—Total citations; Percentage of TA were calculated based on the proportion of "n".

The top 2000 most-cited journal articles on dentists had a total of 3463 author keywords, of which only those keywords (n = 166) that occurred at least five times were mapped in the network visualisation of keyword co-occurrence (Figure 7). The bolder the size of a keyword in Figure 7, the greater its frequency of co-occurrence. The top three author keywords were: oral health (frequency of occurrence (FO) = 82; total link strength (TLS) = 120); children (FO = 31; TLS = 64); and dentistry (FO = 49; TLS = 64). Figure 7 had 11 clusters. The biggest cluster is depicted in red, predominantly containing keywords relevant to prosthodontists ("CAD/CAM", "dental implant", "implants", "prosthodontists", etc.). The second biggest cluster, depicted in green, predominantly contains keywords relevant to oral and maxillofacial surgeons ("orthognathic surgery", "oral surgery", "third molar surgery", etc.). The third biggest cluster, depicted in blue, predominantly contains keywords relevant to dental education and training specialists ("curriculum", "dental education", "dental students", "rubber dam", etc.). The fourth cluster, depicted in lemon, predominantly contains keywords relevant to public health dentists ("dental health services", "primary health care", "health services accessibility", "socioeconomic factors", etc.). The fifth cluster, depicted in purple, predominantly contains keywords relevant to periodontologists ("periodontal disease", "tooth loss", "oral hygiene", etc.). The sixth cluster predominantly contains keywords relevant to sedative dentists ("dental anxiety", "dental fear", "risk assessment", etc.). The seventh cluster contains keywords relevant to oral physicians and radiologists ("bisphosphonate", "cancer", "screening", "radiographs", etc.). The eighth cluster contains keywords relevant to dental microbiologists ("COVID-19", "SARS-CoV-2", etc.) and occupational/mental health of dentists ("anxiety", "burnout", "depression", "dental practice", etc.). The ninth cluster contains keywords relevant to paediatric and/or special needs dentists ("autism", "fluoride", "pediatric dentistry", etc.). The tenth cluster contains keywords relevant to conservative dentists ("amalgam", "restoration", "resin composite", "atraumatic restorative treatment", etc.). The eleventh cluster—which is the smallest cluster—contains keywords relevant to dental traumatologists ("avulsion", "dental trauma", etc.).

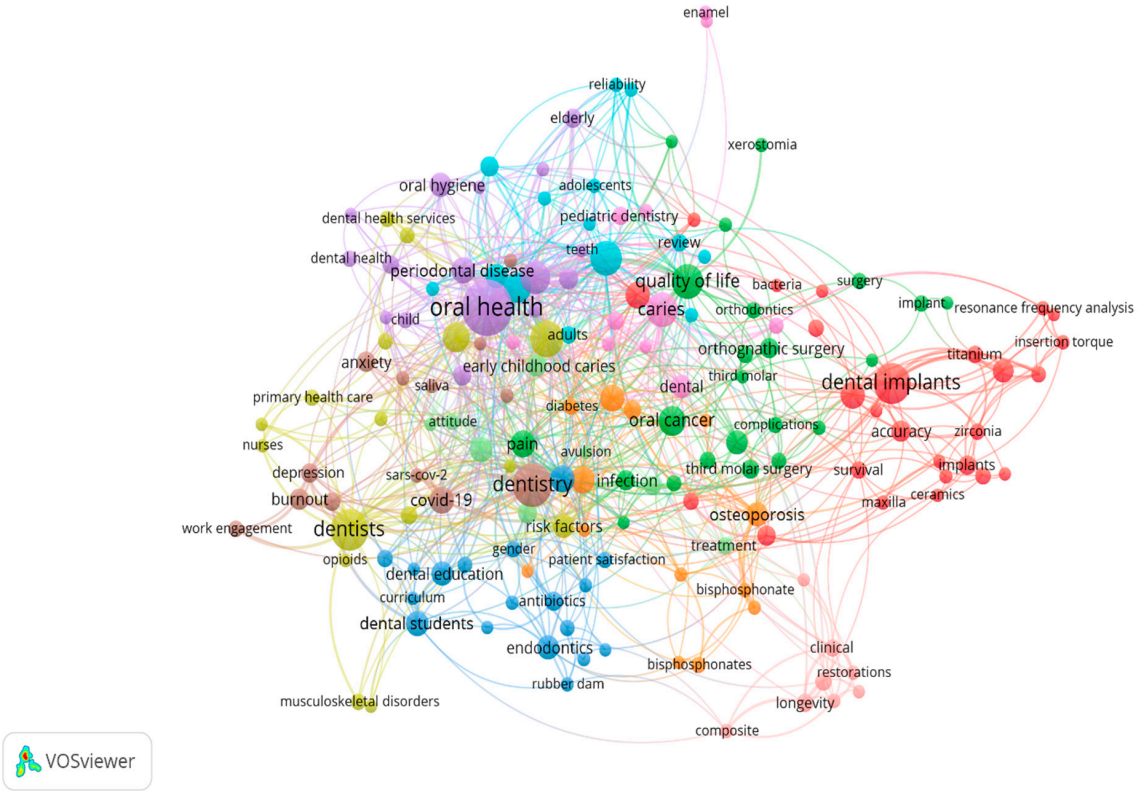

Figure 7. Network visualisation of author keywords.

4. Discussion

The findings obtained in this study are noteworthy and of huge relevance to global public health and policy development, and with noteworthy implications to clinicians, dental researchers, and oral health communities. To start with, the overall growth trends in the volume of global search and research on dentists has increased within the past decades (Figures 2 and 4), and these trends corroborate the existing reports on the increasing rate of global awareness of dentists and oral healthcare services. Many factors might have been responsible for this growth trend; however, the most notable factor was the recent strengthening of oral health systems in many countries of the world, especially those in the Global South—a typical example was the recent establishment of dental institutions in many African and Asian countries (including Qatar, Rwanda, etc.) which have significantly improved dental research productivity, the supply and demand of dentists and dental care services, and the development of various dental public health interventions and policies in those countries [1,6,8,9]. Another important factor was the advent and global spread of the internet facility which might have encouraged information searching and dissemination practices for dentists. Overall, this finding affirms that dentists and dental researchers should consider the regular use of internet services in educating the global communities on issues pertaining to oral health, as this medium has a large and steadily growing audience.

However, a comparative review of the trends of global searches and research on dentists (Figures 2 and 4) with respect to the COVID-19 pandemic revealed that the pandemic played an influential role. A sharp decline in online searches for dentists was observed during the first episode of the COVID-19 lockdown [33–36], with an overall slight decline since the pandemic; this suggests that the public health regulations imposed during the pandemic might have reduced public interest in seeking professional dental care services, as the delivery of such services was significantly impaired during the pandemic. However, the opposite was observed for research productivity on dentists Prior to the pandemic, there was a progressive decline in the volume of journal publications on dentists; however, during the pandemic, there was a resurgence. During the early months of the pandemic, several institutions were temporarily closed due to the enforcement of public health protection regulations [33–36], and this might have given many researchers ample time to produce a huge volume of journal papers exploring dentist-related research topics. Overall, this finding shows that an infectious disease pandemic and lockdowns can have a far-reaching impact on oral health communication involving dentists, dental researchers, and the global public. Hence, this recommends the need for the development of a robust strategy addressing dental public health communications and research against future pandemics.

The volume of research productivity and online searches on dentists was very low in the Global South, compared to the Global North (Figures 3 and 6). This huge disparity may be due to the higher (digital) literacy rates, deeper internet penetrance, narrower dentist–population ratio, and greater wealth (Table 1) in the Global North countries compared to the Global South countries [6]. Furthermore, in the Global South, South America was the continent having the highest proportion of countries with an SVI lower than one while Africa was the continent having the highest proportion of countries with very little or no research productivity on dentists; this further shows that research and search interests about dentists are poorest in these parts of the Global South. It is also notable that the top ten countries, institutions, journals, and authors funding/sourcing journal articles concerning dentists were in the Global North (Tables 5–8). Obviously, this is an inequality gap which needs to be closed. To do so, it is recommended that the Global South countries should dedicate more resources to dental public health services and research. Notable examples of the resources needed to reduce this inequality include the provision of more research funding for dental research and training, the development and implementation of international policies and strategies that encourage the development of dental research and training in the Global South countries.

There are several reasons why the global public searched for dentists on the internet (Tables 2 and 3). However, the online booking of an appointment with a dentist is one of the

predominant reasons; this is based on the contextual interpretation of the commonest search terms used (e.g., "dentist near me", "dentist open near me", etc.). The other pertinent issues for which the global public searched for dentists were on dental care insurance, affordable dental care, dental emergencies, child dental care, and gaming. Based on the percentage increase in the rate of search queries and topics on these topics and queries, it can be asserted, without doubt, that there has been a huge increase in the global awareness, knowledge and utilisation rates of dentists and dental care services; by implication, this suggests that the global efforts towards improving oral healthcare have been working so far. In addition to the afore-mentioned, these findings also pinpoint the areas of concern to the global public.

It is also noteworthy that inequalities exist in the volume of research papers produced across various academic disciplines concerning dentists (Figure 5). Medicine and Dentistry were the two disciplines with the highest volume of research on dentists; however, this finding is not surprising as they are the most closely related disciplines to the dental profession. The papers produced in other disciplines were very few. Perhaps, researchers in the non-medical or non-dental disciplines might not have produced many papers on dentist-relevant issues probably because they felt it was non-relevant to their field. However, dentist-relevant research findings from these disciplines (e.g., "Decision Sciences" and "Economics, Econometrics and Finance") are crucial to the organisational and economic planning and development of dental care, practice, policy, and interventions. Therefore, there is an essential need to rejuvenate the productivity of non-dental/non-medical disciplines on research projects relevant to the dental profession. By so-doing, dentists, oral health policy makers, and other relevant stakeholders will have access to a richer body of evidence needed for decision-making processes.

The key areas of scientific interest among researchers investigating dentists were diverse cutting across several specialisations in dentistry (Figure 7). However, only very little to no interest exists for legal dentistry, as evidenced by the network visualisation of the commonly occurring keywords. Legal dentistry is a newly emerging aspect of the dental profession and only a few countries—including Australia, the UK, and the USA—are officially practising legal dentistry [39–41]. Furthermore, it was observed that prosthodontics was the most investigated dental specialisation area while conservative dentistry was the least investigated; this finding does not align with the recent statistics for the global burden of oral conditions because dental caries of the succedaneous teeth are the leading oral health condition globally and are primarily managed by general dentists and conservative dentists [1]. Prosthodontist care is primarily focused on the prosthetic replacement of missing orofacial structures including teeth [42]. However, the magnitude of the current global prevalent burden of dental caries is the greatest while the burden of tooth loss is just about one-tenth of that of the dental caries burden [1]. Overall, this suggests that a misplacement of priority exists in the research productivity in this area. Therefore, it is recommended that research productivity on conservative dentists and conservative dental care services should be given the highest priority.

However, this study has its limitations. Firstly, this study adopted the use of only one data source—Google Trends—for the infoveillance study; therefore, data from other search engines (e.g., Bing.com, etc.,) were not utilised. Google may not be the predominant search engine in all countries; for example, North Korea and China. It is possible that those countries may be underrepresented based on the study data. Secondly, this study adopted the use of only one database—SCOPUS—for the bibliometric study; therefore, data from other databases (e.g., PubMed, Embase, CINAHL, PsycINFO, etc.) were not utilised. As a result, there is a possibility that those publications not indexed in SCOPUS were by default excluded. Therefore, those authors, institutions, countries, journals, and disciplines sourcing/funding dentist-related research might have been underrepresented based on the study data.

Regardless of these limitations, this study has its strengths. First, this is the first study, to the best of the authors' knowledge, to investigate the global search and research

interests on dentists. Secondly, the two data sources used for this study were the biggest sources used for each study design; therefore, the possibility of missing information is minimal [18,25–32]. Thirdly, the findings obtained in this study have provided deep insights into the hot and cold areas of interest among the global public and the global scientific community. These insights are essential for the evidence-based planning and development of dental public health and policy strategies targeting oral health literacy and behaviours.

5. Conclusions

Dental health challenges are higher in the Global South than in the North. The internet has helped improve global public awareness of dentists over the years. Despite improved global efforts in dental services and research, public search and research inequality exists between the Global South and North. Public search and research are significantly higher in the Global North than in the South. Differential Internet penetration and digital literacy rates explain the North–South divide concerning public searches. Knowledge and funding for dental health research flow significantly from the countries of the Global North. It is, therefore, not surprising that the research on dental health is also dominated by the countries of the North. The network visualisation of keyword co-occurrence shows the scientific interest concerning dentists. This could help to shape public dental healthcare and relevant policy. While the onus to improve global dental healthcare lies on every nation, the countries of the Global South need to do more concerning dental healthcare.

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