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Global Research Trends in Pediatrics from 1990 to 2020: A Bibliometric Analysis

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Abstract

Background: This bibliometric analysis and visualization aimed at depicting bibliometric indicators of papers published globally in pediatrics during the recent three decades.

Methods: Using Web of Knowledge database, all papers published on pediatrics during 1990-2020 were retrieved. Bibliometric data on paper type, language, and publishing year, and publishing journal, country of origin, affiliated institutes, and subject areas were extracted. Using visualization techniques in VOSviewer software package, the collaboration / co-authorship networks, co-citation maps and keyword co-occurrence maps were depicted.

Results: Top hot papers were mainly on childhood overweight and obesity, cerebral palsy, and body-mass index. David Isaacs, Prem Puri and Anne were the top most productive authors. Seetha Shankaran from Wayne State University, USA, ranked first in citation counts. Top publishing journals were Pediatric Research, Pediatric Blood and Cancer and Pediatrics, respectively. Highly-productive countries were the USA and UK, respectively. Among research areas, neurosciences neurology, oncology and surgery were heavily considered and had top h-indices, respectively. Five subject clusters focused on diseases, metabolism, neurology, psychiatry and immunology. These clusters cover all main research areas in the field, each with its own research methodologies and highlighted keywords.

Conclusions: Global research on pediatrics found its way and ever-increasingly develops as its bibliometric indicators clearly show.

Key Words: Bibliometric analysis, Scientific visualization, Pediatrics, Most-cited publications, Hot spots, Research trend, GDP (Gross Domestic Product), VOSviewer software.

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1- INTRODUCTION

Considering an ever-increasing development in scientific publications, the scientific evaluation of research in different fields is important and quantitative analyses of scientific output, such as bibliometrics, make applicable and evaluative results (1). Bibliometrics is applied to analyzing the research trends in a certain scientific field and measures its impact on knowledge development (2). Bibliometric techniques can be used for identifying core resources, evaluating the performance of producing agents, such as authors, research institutes, countries/regions and journals, top cited and most productive agents, visualizing scientific maps and so on (3).

Bibliometric analyses, especially those related to global research trends have been applied in many scientific areas, including medical field and subfields (e.g. carbapenem resistance (4)), autism spectrum disorders (5), West Nile virus (6), health and human rights (7), aflatoxine (8), diabetic kidney disease (9), and prostate disease (10).

As a main professional field in medicine, pediatrics was introduced in the mid-19 century. The first journal in the field established in 1884 under the title of Archives in Pediatrics (11). The research output in the field has increased in recent decades and this necessitates a deep bibliometric evaluation of the field from different scientometric perspectives.

Some bibliometric analyses have been conducted in pediatrics and evaluated the field from different bibliometric aspects (e.g. (12) in citation classics, (13) on hot spots in the treatment of pediatric cerebral palsy, (14) for the top 100 most-cited papers in pediatric dentistry journals, (15) for mapping the literature of pediatric nursing, (16) for the analysis of global pediatric cancer research, (17) for bibliometric investigation of clinical and translational research in pediatric gastroenterology, (18) for highly cited publications in pediatric neurosurgery and (19) in the global research trend in child maltreatment). However, a comprehensive bibliometric analysis and visualization of global research trends in the field has not been investigated, yet. This study aimed to analyze the global research trends in Pediatrics during 1990-2020.

2- Materials and Methods

2-1. Database used

In this bibliometric analysis, Web of Science (WoS) database of Clarivate Analytics was used. As a known indexing/abstracting database of peer-reviewed publications in the World, WoS annually produced the impact factors of scientific journals as a criteria for evaluating scientific producing agents (20, 21).

2-2. Search strategy

The main subject of the study was "pediatrics medicine". As every record in WoS core collection contains the subject category of its source publications in WoS categories, pediatrics medicine has a special subject category of "pediatrics". The search query related to the extraction of data included in pediatrics in advanced search section of WoS Core Collection. The search was done on 10 May 2021. The papers published in 2021 were excluded. The search results included all papers during 1990-2020 without any language limitation. The search resulted in retrieving 602,358 related papers. The search result was as follows:

Results: 602,358 (from Web of Science Core Collection)

Searched for: WC (Web of Science Subject Category) = Pediatrics

Refined by: (excluding) PUBLICATION YEARS: (2021)

Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, ESCI.

Bibliometric data on paper type, language, and publishing year, and publishing journal, country of origin, affiliated institute, and subject areas were extracted from WoS. For visualizing and depicting co-authorship, co-citation and co-occurrence networks, the papers were arranged based on Times Cited option in WoS. The bibliographic information of top 10,000 cited papers was retrieved. Each WoS-downloaded record was in data block beginning with a series of tags, including information on the block (such as AU=authors, TI=title, PY=publication year).

2-3. Bibliometric indicators and visualization techniques

The bibliometric indicators such as h-indices, highly-cited papers (HCPs), hot papers (HPs), top 20 cited papers, top 20 highly productive authors, institutes and countries as well as research areas were determined. Highly-cited papers are top 1% papers receiving citations in their field in the past year (22). Hot papers are top 0.1% ones that received more citations in their field during the past two months (23).

For qualitative evaluation of bibliometric items, we used h-indices, mean citation counts, citations per paper (CPP), citation per year (CPY) and journal impact factors. Journal impact factor reflects the yearly average number of citations received by papers published in the last two years in a given journal (24) and is retrieved from the last revision of the Journal Citation Report (JCR), dedicated to Thompson Reuters (25).

Using visualization techniques, the collaboration/co-authorship networks of institutes and countries, co-citation maps of journals, countries and institutes, and word co-occurrence maps of keywords and terms mostly used in highly most-cited papers were depicted. The co-authorship or collaboration analysis focuses on social structures and collaboration between authors, institutes and countries (26). The citation analysis emphasizes the relative influence or importance of a paper, a country, an author and institute by measuring their received citations (27). Highlighting the important keywords and terms used in papers, the co-occurrence analysis represents and depicts the conceptual structure of a certain scientific field (28).

The study results were standardized with GDP (Gross Domestic Product) and population size. Our Capita GDP for each country and its population size were extracted from the World Population Review (29).

2-4. Statistical analysis

VOSviewer software package was used for data visualization and depicting scientific maps. The software is used for depicting citation networks (authors, papers, research institutes, countries/regions and journals), co-authorship maps (authors, institutes and countries/regions), co-citation maps (papers, authors and journals), word co-occurrence maps, bibliographic couplings and subject clustering (30-32).

3- RESULTS

3-1. General findings

602,358 papers on pediatrics were indexed in WoS during 1990-2020. The mean h-index of the papers amounted to 420. The received citations amounted to minimum 0 and maximum 6124. There were 575 highly-cited papers and 16 hot papers, too.

3-2. Paper types and languages

The majority of papers were original research articles (338439; 56.19%), followed by meeting abstract (106502; 17.68%), editorials (48977; 8.13%), letters to editor (38930; 6.46%), reviews (32246;

5.35%), proceeding papers (19129; 3.18%), notes (5845; 0.97%) and corrections (3809; 0.63%), respectively. Other papers (including book reviews, early accesses, biographical items, news items, items about an individual, book chapter, correction addition, reprint, retraction, retracted publication, bibliography, software review, film review, theater review and art exhibit) amounted to 5425; 0.9%.

The majority of papers were in English (571803; 94.93%), followed by French (11139; 1.85%), German (10643; 1.77%), Spanish (5624; 0.93%), Italian (1494; 0.25%), respectively. 1655 (0.27%) papers were in 16 other languages.

3-3. Annual growth of publications

Fig. 1 represents the annual growth trend of publications on pediatrics during 1990-2020. The trend was increasing as the trend line (line of best fit) on the scatter diagram clearly shows (R^2= .89).

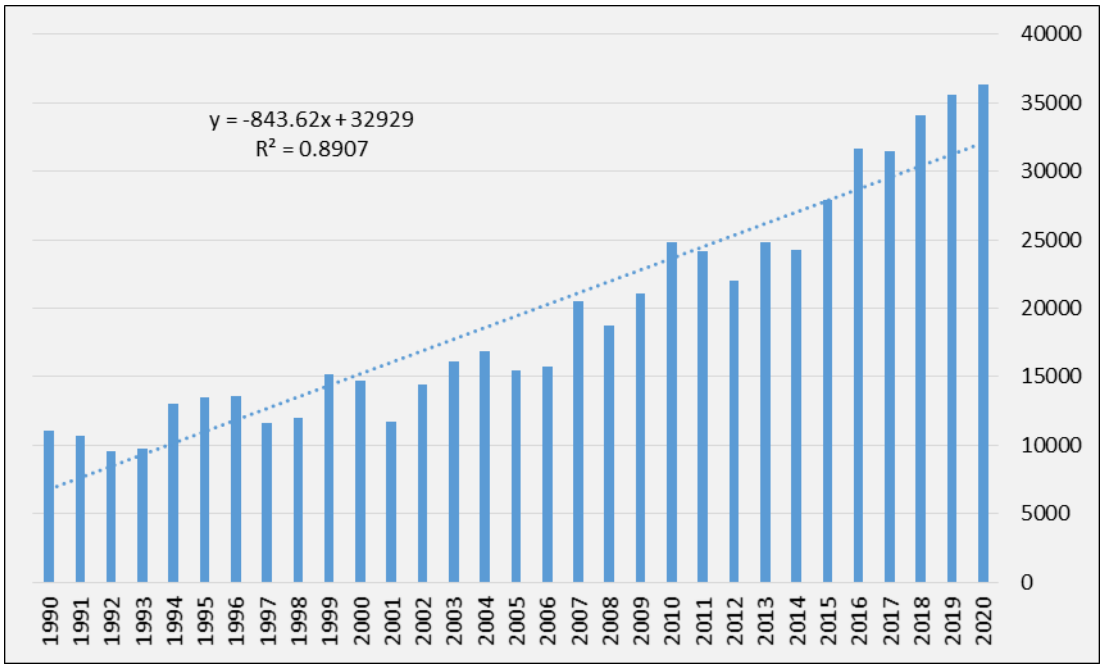

Fig. 1: Research trend in pediatrics publication (1990-2020)

3-4. Most-cited papers

Table 1 shows some bibliographic information and bibliometric indicators of the top 20 most-cited pediatrics papers. The first-ranked paper entitled "Schedule for affective disorders and schizophrenia for school-age children-present and lifetime version (K-SADS-PL): initial reliability and validity data" was cited 6124 times. A review entitled "The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents" was in the second rank with 4721 received citations and had the top CPY (277.7). The top two journals in publishing most-cited papers were Pediatrics with 6 top-cited papers and Journal of the American Academy of Child and Adolescent Psychiatry with 5 top-cited papers, respectively. Considering paper types, 15, 4 and 1 papers were original articles, reviews and proceeding papers, respectively. From subject perspective, 4, 2 and 2 papers were on childhood overweight and obesity, cerebral palsy, and body-mass index, respectively.

Table-1: Most-cited papers on pediatrics (1990–2020)

SCR*	Title	Year	Source title (IF* 2019)	NC* (CPY)*	Paper type
1	Schedule for affective disorders and schizophrenia for school-age children-present and lifetime version (K-SADS-PL): initial reliability and validity data (33)	1997	Journal of the American academy of child and adolescent psychiatry (6.936)	6124 (255.2)	Article
2	The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents (34)	2004	Pediatrics (5.359)	4721 (277.7)	Review
3	Development and reliability of a system to classify gross motor function in children with cerebral palsy (35)	1997	Developmental medicine and child neurology (4.406)	3689 (153.7)	Review
4	Breastfeeding and the use of human milk (36)	2005	Pediatrics (5.359)	3535 (220.9)	Review
5	Psychometric properties of the strengths and difficulties questionnaire (37)	2001	Journal of the American academy of child and adolescent psychiatry (6.936)	3400 (170.0)	Article
6	Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: Summary report (38)	2007	Pediatrics (5.359)	2745 (196.1)	Article
7	Lifetime prevalence of mental disorders in U.S. adolescents: results from the national comorbidity survey replication-adolescent supplement (NCS-A) (39)	2010	Journal of the American academy of child and adolescent psychiatry (6.936)	2712 (246.5)	Article
8	NIMH diagnostic interview schedule for children version IV (NIMH DISC-IV): Description, differences from previous versions, and reliability of some common diagnoses (40)	2000	Journal of the American academy of child and adolescent psychiatry (6.936)	2432 (115.8)	Article
9	Evidence based physical activity for school-age youth (41)	2005	Journal of pediatrics (3.7)	2302 (143.9)	Article
10	HLH-2004: Diagnostic and therapeutic guidelines for hemophagocytic	2007	Pediatric blood & cancer (2.355)	2295 (163.9)	Review

	lymphohistiocytosis (42)				
11	A report: the definition and classification of cerebral palsy - April 2006 (43)	2007	Developmental medicine and child neurology (4.406)	2124 (151.7)	Proceedings Paper
12	Worldwide trends in childhood overweight and obesity (44)	2006	International journal of pediatric obesity (3.025)	1830 (122.0)	Article
13	The lifelong effects of early childhood adversity and toxic stress (45)	2012	Pediatrics (5.359)	1824 (202.7)	Article
14	WHO child growth standards based on length/height, weight and age (46)	2006	Acta paediatrica (2.111)	1796 (119.7)	Article
15	Health consequences of obesity in youth: Childhood predictors of adult disease (47)	1998	Pediatrics (5.359)	1695 (73.7)	Article
16	Efficacy, safety and immunogenicity of heptavalent pneumococcal conjugate vaccine in children (48)	2000	Pediatric infectious disease journal (2.126)	1667 (79.4)	Article
17	Psychiatric disorders in children with autism spectrum disorders: Prevalence, comorbidity, and associated factors in a population-derived sample (49)	2008	Journal of the American academy of child and adolescent psychiatry (6.936)	1638 (126.0)	Article
18	Percentiles of body-mass index in children and adolescents evaluated from different regional German studies (50)	2001	Monatsschrift kinderheilkunde (0.252)	1514 (75.7)	Article
19	Metabolic syndrome in childhood: Association with birth weight, maternal obesity, and gestational diabetes mellitus (51)	2005	Pediatrics (5.359)	1533 (95.8)	Article
20	Body-mass index reference curves for the UK, 1990 (52)	1995	Archives of disease in childhood (3.041)	1531 (58.9)	Article

* SCR: standard competition ranking, NC: Number of citations, CPY: citations per year, IF: Impact Factor, HCP: highly-cited paper; R: rank

3-5. Most active authors

Table 2 shows some bibliometric indicators of the top 20 most productive authors in pediatrics. David Isaacs from the University of Sydney, Australia with 507 papers (CPP=6 and h-index= 27) ranked first. The second and third ranks belonged to Prem Puri from the University College Dublin, Ireland with 496 papers and Anne Greenough from King's College London, England with 488 papers. Seetha Shankaran from Wayne State University, USA ranked first in citation counts with 17653 received citations (CPP=50 and h index= 52). Out of the top 20 active authors, 5 authors were from USA; and Australia, Germany, and Japan each had 2 authors in the list.

Table-2: Top 20 authors publishing on Pediatrics (1990–2020)

SCR	Author	Papers	Citations (R)[a]	CPP* (R)[a]	h-index (R)[ab]	Affiliation
1	Isaacs, David	507	3024 (17)	6 (19)	27 (12)	University of Sydney, Australia
2	Puri, Prem	496	7427 (11)	15 (14)	39 (5)	University College Dublin, Ireland
3	Greenough, Anne	488	7515 (10)	15.4 (13)	28 (11)	King's College London, England
4	Saugstad, Ola Didrik	428	8670 (8)	20.3 (10)	37 (7)	University of Oslo, Norway
5	Stevenson, David K.	401	14827 (2)	37 (4)	39 (5)	Stanford University, USA
6	Shimizu, Toshiaki	380	3092 (16)	8.1 (16)	25 (14)	Juntendo University, Japan
7	Shulman, Stanford T.	378	9028 (6)	23.9 (7)	36 (9)	Northwestern University, USA
8	Tibboel, Dick	376	8093 (9)	21.5 (8)	25 (14)	Erasmus MC - Sophia Children's Hospital, Netherlands
9	Kumar, Rakesh	360	2657 (19)	7.4 (18)	21 (18)	All India Institute of Medical Sciences (AIIMS), India
10	Shankaran, Seetha	350	17653 (1)	50.4 (1)	52 (1)	Wayne State University, USA
11	Cohen, Robert	340	5265 (13)	15.5 (12)	35 (10)	Association clinique et thérapeutique infantile du Val-de-Marne (Activ), France
12	Schaefer, Franz	336	11115 (5)	33.1 (5)	45 (3)	Ruprecht Karls University Heidelberg, Germany
13	Tubbs, R. Shane	331	2690 (18)	8.1 (17)	12 (20)	Tulane University, USA
14	Yamataka, Atsuyuki	314	3098 (15)	9.9 (15)	22 (17)	Juntendo University, Japan
15	Sharma, Arya M.	311	13291 (4)	42.7 (3)	52 (1)	University of Alberta, Canada
16	Vandenplas, Yvan	308	6352 (12)	20.6 (9)	27 (12)	University Hospital Brussels, Belgium
17	Stein, Martin T.	306	4782 (14)	15.6 (11)	24 (16)	University of California San Diego, USA
18	Doyle, Lex W.	305	13828 (3)	45.3 (2)	43 (4)	Murdoch Children's Research Institute, Australia
19	Koletzko, Berthold	304	8783 (7)	28.8 (6)	37 (7)	University of Munich, Germany
20	Kerbl, Reinhold	300	1076 (20)	3.6 (20)	15 (19)	LKH Hochsteiermark, Austria

*) CPP: citations per paper, R: rank, SCR: standard competition ranking

a) The number of papers, citations and h-indices are in pediatrics only.

b) Equal authors have the same ranking number and then a gap is left in the ranking numbers.

3-6. Top highly-publishing journals

Table 3 shows some bibliometric indicators of the top 20 highly-publishing journals in the field. The first to third ranks belonged to the Pediatric Research with 42824 papers, Pediatric Blood and Cancer with 28298 papers and Pediatrics with 27223 papers, respectively. Journals with high impact factors were the Journal of the American Academy of Child and Adolescent Psychiatry (6.936), Pediatrics (5.359) and the Journal of Adolescent Health (3.945), respectively. Pediatrics had the highest h-index (311) and citations per paper (2.918).

Table-3: Top 20 journals publishing on Pediatrics (1990–2020)

SCR	Journal	Papers	Citations (R)[a]	CPP (R)[a]	h-index (R)[ab]	IF (2019)
1	Pediatric Research	42824	13816 (7)	0.323 (18)	137 (5)	2.747 (7)
2	Pediatric Blood & Cancer	28298	11805 (10)	0.417 (16)	93 (13)	2.355 (10)
3	Pediatrics	27223	79434 (1)	2.918 (1)	311 (1)	5.359 (2)
4	Pediatric Pulmonology	17837	6764 (15)	0.379 (17)	98 (11)	2.534 (9)
5	Journal of Pediatrics	17664	31902 (2)	1.806 (2)	202 (3)	3.700 (4)
6	Pediatric Nephrology	17166	9325 (12)	0.543 (15)	96 (12)	2.676 (8)
7	Journal of Pediatric Surgery	15269	16683 (4)	1.093 (7)	118 (9)	1.919 (16)
8	Acta Paediatrica	14818	13189 (8)	0.89 (10)	117 (10)	2.111 (15)
9	Journal of the American Academy of Child and Adolescent Psychiatry	13523	19831 (3)	1.466 (4)	240 (2)	6.936 (1)
10	Archives of Disease in Childhood	12085	16291 (5)	1.348 (5)	133 (7)	3.041 (5)
11	Pediatric Infectious Disease Journal	11079	11779 (11)	1.063 (8)	137 (5)	2.126 (13)
12	European Journal of Pediatrics	10833	7810 (14)	0.721 (13)	86 (14)	2.305 (11)
13	Journal of Pediatric Gastroenterology and Nutrition	10351	12405 (9)	1.198 (6)	121 (8)	2.937 (6)
14	Journal of Adolescent Health	10316	16287 (6)	1.579 (3)	142 (4)	3.945 (3)
15	Archives de Pediatrie	8952	1383 (20)	0.154 (20)	31 (20)	0.591 (20)
16	International Journal of Pediatric Otorhinolaryngology	8456	8247 (13)	0.975 (9)	72 (17)	1.241 (19)
17	Pediatric Radiology	7810	6323 (16)	0.81 (12)	77 (15)	2.126 (14)
18	Hormone Research in Paediatrics	7384	2146 (19)	0.291 (19)	42 (19)	2.174 (12)
19	Childs Nervous System	7245	5893 (17)	0.813 (11)	76 (16)	1.298 (18)
20	Journal of Paediatrics and Child Health	7105	4513 (18)	0.635 (14)	68 (18)	1.71 (17)

*) SCR: Standard competition ranking, IF: impact factor, R: rank, CPP: citations per paper

a) The number of papers, citations and h-indices are in pediatrics only.

b) Equal journals have the same ranking number and then a gap is left in the ranking numbers.

3-7. Most contributing countries

Some main bibliometric indicators of the top 20 contributing countries, including those of GDP-related ratios were shown in Table 4. The first rank belonged to the USA (242195; 40.21%) having also the highest number of h-index (382), most-cited papers (347) and hot papers (8). UK (42682; 7.09%) and Canada (31130; 5.17%) ranked second and third, respectively. When the papers were standardized by population size, Sweden, Israel and Finland ranked first to third, respectively. In standardization by GPD, the first to third ranks belonged to Turkey, Israel and Finland, respectively. Considering the number of papers per GDP per capita, India, Turkey and USA ranked first to third, respectively.

Table-4: Top productive countries in pediatrics (1990–2020)

SCR*	Country	Papers (%) [a]	h-index (R*)	HCP*	HP*	Papers /1million Inhabitants (R*)	Papers / billions GDP* (R*)	Papers per GDP per capita (R*)
1	USA	242195 (40.21)	382 (1)	347	8	727.5 (8)	10.91 (13)	3.632 (2)
2	England	42682 (7.09)	230 (2)	97	4	625.8 (9)	14.57 (7)	0.995 (5)
3	Canada	31130 (5.17)	201 (3)	73	1	822.5 (6)	17.01 (5)	0.647 (9)
4	Germany	29378 (4.88)	160 (6)	39	2	350.2 (13)	7.06 (16)	0.593 (10)
5	Italy	24386 (4.05)	152 (8)	51	3	404 (11)	11.67 (10)	0.704 (8)
6	France	23717 (3.94)	152 (9)	35	0	362.5 (12)	8.24 (15)	0.54 (11)
7	Turkey	22409 (3.72)	84 (18)	9	0	263.5 (15)	27.68 (1)	2.354 (3)
8	Japan	21789 (3.62)	109 (15)	7	0	172.9 (16)	3.96 (19)	0.5 (12)
9	Australia	20685 (3.43)	168 (4)	57	3	802.1 (7)	13.98 (8)	0.36 (14)
10	India	19471 (3.23)	83 (19)	17	1	14 (19)	5.97 (17)	8.328 (1)
11	Netherlands	16036 (2.66)	168 (5)	42	0	933.8 (5)	16.79 (6)	0.288 (15)
12	Spain	12801 (2.13)	117 (12)	35	1	273.8 (14)	8.53 (14)	0.4 (13)
13	China	11901 (1.98)	96 (16)	26	4	8.2 (20)	0.77 (20)	1.111 (4)
14	Sweden	10757 (1.79)	153 (7)	28	1	1058.8 (1)	18.65 (4)	0.19 (17)
15	Brazil	9255 (1.54)	85 (17)	11	0	43.2 (18)	4.49 (18)	0.96 (6)
16	Israel	8924 (1.48)	117 (13)	17	0	1015.4 (2)	22.09 (2)	0.194 (16)
17	Switzerland	8244 (1.37)	135 (10)	28	2	946 (4)	11.13 (11)	0.097 (20)
18	Belgium	6840 (1.14)	115 (14)	26	1	588 (10)	12.35 (9)	0.144 (18)
19	Iran	5460 (0.91)	47 (20)	4	0	64.2 (17)	11.01 (12)	0.937 (7)
20	Finland	5457 (0.91)	120 (11)	17	0	983.6 (3)	19.33 (3)	0.105 (19)

*) SCR: standard competition ranking, GDP gross domestic product, R: rank, HCP: highly-cited papers, HP: hot papers

a) Because of collaboration of involved countries, the total percentage is more than 100.

3-8. Most active institutions

Table 5 shows the top 20 highly-productive research institutes in pediatrics. The top three productive institutes with higher h-indices as well as more top-cited papers were Harvard University (17915 papers), the University of California System (17718 papers) and the University of London (13013), respectively. 15 most active institutes were from the USA.

Table-5: Most active institutes publishing in Pediatrics (1990–2020)

SCR[a]	Institution	Papers	h-index (R*)[a]	HCP*	HP*	Affiliation country
1	Harvard University	17915	211 (1)	66	2	USA
2	University of California System	17718	204 (2)	73	1	USA
3	University of London	13013	175 (3)	57	2	United Kingdom
4	University of Pennsylvania	11366	156 (7)	33	1	USA
5	University of Toronto	11235	143 (11)	29	0	Canada
6	Boston children s hospital	10883	170 (4)	37	1	USA
7	Assistance Publique Hopitaux Paris APHP	9595	123 (19)	17	0	France
8	University of Texas System	9412	151 (9)	20	1	USA
9	Childrens Hospital of Philadelphia	9374	139 (15)	24	1	USA
10	University College London	9169	142 (13)	32	2	United Kingdom
11	Pennsylvania Commonwealth System of Higher Education PCSHE	9037	169 (5)	26	0	USA
12	Hospital for Sick Children SickKids	8911	129 (18)	21	0	Canada
13	Cincinnati Childrens Hospital Medical Center	8472	143 (11)	30	0	USA
14	Johns Hopkins University	8468	156 (7)	32	2	USA
15	Baylor College of Medicine	8030	133 (16)	16	1	USA
16	University of Pittsburgh	6443	158 (6)	23	0	USA
17	University of Washington Seattle	6237	149 (10)	38	1	USA
18	University of California san Francisco	6199	142 (13)	27	1	USA
19	University of Colorado System	5860	132 (17)	26	0	USA
20	Ohio State University	5858	104 (20)	14	1	USA

*) SCR: standard competition ranking, R: rank, HCP: highly-cited papers, HP: hot papers
a) Equal institutes have the same ranking number.

3-9. Most interested research areas

Table 6 shows the top 20 interested research areas in pediatrics. Among these areas, neurosciences neurology (considered in 41339 papers), oncology (considered in 39360 papers) and surgery (considered in 38.779 papers) were heavily considered and had top h-indices, respectively. The top areas in having highly-cited papers were surgery (with 84 papers), psychology (with 63 papers) and immunology (with 31 papers), respectively.

Table-6: Top research areas in collaboration with pediatrics (1990–2020)

SCR*	Research area	Papers	h-index (R*)[a]	HCP*	HP*
1	Neurosciences neurology	41,339	178 (1)	11	-
2	Oncology	39,630	114 (2)	5	-
3	Surgery	38,779	263 (3)	84 (1)	-
4	Psychology	37,879	248 (4)	63 (2)	3
5	Hematology	37,218	162 (5)	2	-
6	Obstetrics gynecology	31,076	150 (6)	16 (4)	-
7	Psychiatry	24,002	148 (7)	5	3
8	Urology nephrology	20,298	139 (8)	4	-
9	Respiratory system	19,553	134 (9)	-	-
10	Immunology	15,044	128 (10)	31 (3)	-
11	Endocrinology metabolism	14,905	123 (11)	16 (4)	-
12	Infectious diseases	12,586	105 (12)	5	-
13	Public environmental occupational health	12,369	104 (13)	6	1
14	Nutrition dietetics	12,143	104 (13)	7	-
15	Cardiovascular system cardiology	10,407	96 (15)	-	-
16	Gastroenterology hepatology	10,363	92 (16)	3	-
17	Nursing	8,879	83 (17)	9	-
18	Otorhinolaryngology	8,456	78 (18)	3	-
19	Orthopedics	8,397	72 (19)	2	-
20	Radiology nuclear medicine medical imaging	7,810	71 (20)	1	-

*) SCR: standard competition ranking, HCP: highly-cited papers, HP: hot papers
a) Equal areas have the same ranking number.

3-10. Country collaboration network

115 countries contributed to 10000 most-cited papers on pediatrics. Among them, 93, 66 and 45 countries published at least 2, 5 and 10 papers, respectively. Figure 2 depicts the collaboration map of countries collaborating with publishing at least 10 papers in three clusters. The numbers in parentheses show the total link strength, i.e. the importance of linked countries in making international collaboration. The first cluster (in red) included 23 countries worldwide, including Germany (1089), Italy (950), France (874), Netherlands (873), Switzerland (647), Sweden (602), Spain (588), Belgium (575), Denmark (558), Israel (391), Finland (366), Norway (310), Poland (278), Austria (239), Hungary (218), Czech Republic (185), Portugal (185), Turkey (180), Ireland (172), Croatia (163), Greece (114), Slovenia (87) and Northern Island (84). 19 countries were in the second cluster (in green), including USA (1890) as well as Canada (763), Australia (548), Japan (192), India (134), China (130), Brazil (126), New Zealand (122), Chile (117), South Africa (114), Mexico (74), Argentina (67), Singapore (63), Taiwan (49), Egypt (39), Thailand (33), Pakistan (31), Bangladesh (26) and South Korea (25). The third cluster in blue included UK (1413) collaborating with Scotland (284) and Wales (120).

From a time perspective, the most-cited papers published by five countries, including Croatia, Hungary, India, Czech Republic and China were more recent than those of other countries. Most-cited papers published by Mexico, Japan, Sweden and New Zealand were older than those of other countries during the study time span.

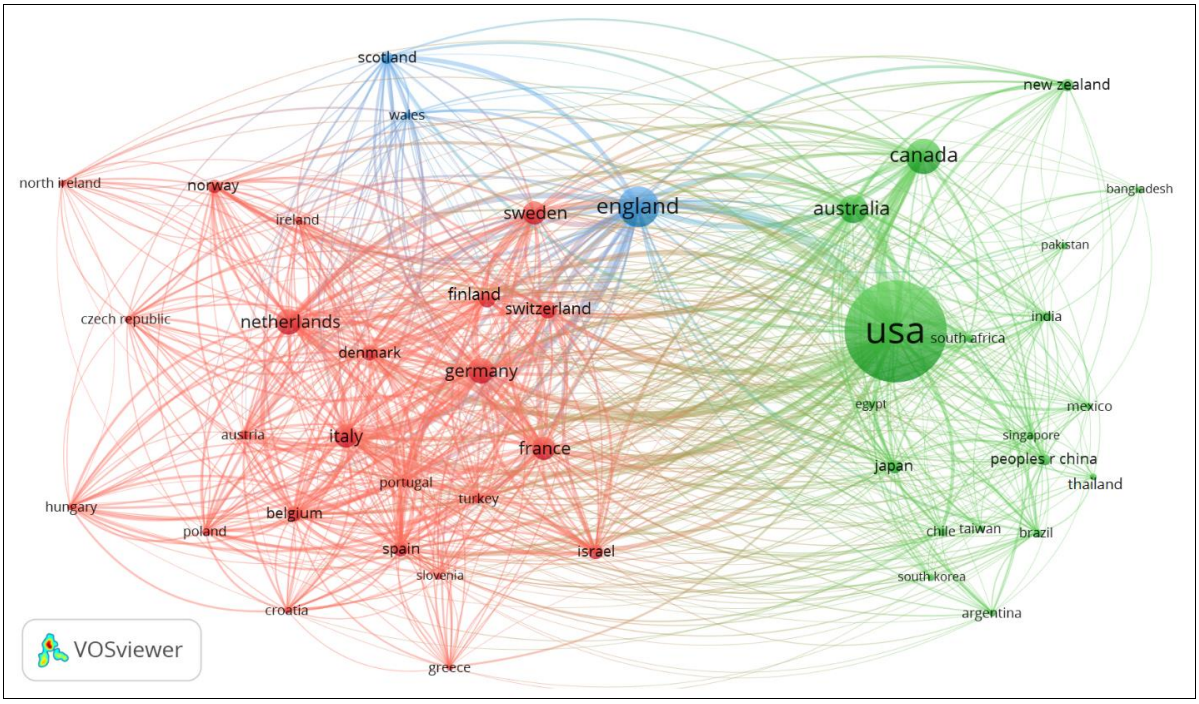

Fig. 2: Collaboration network of countries publishing in pediatrics (1990-2020)

The countries included in the map published at least ten most-cited papers during the study time span. The names of some countries may not be observable due to overlap. Nodes or font sizes show the paper frequencies. The thickness of lines between the two nodes represents the collaboration power between the two countries. The shorter the distance between the two nodes, the more the number of collaboration between the two countries.

3-11. Journal co-citation network

10000 most-cited papers on pediatrics were published in 136 journals. 92, 74 and 58 journals published at least 5, 10 and 20 papers, respectively. **Fig. 3** depicts the co-citation network of 30 journals with having at least 50 published papers. Four clusters can be seen. The numbers in parentheses show the total link strength, i.e. the importance of co-citing journals in making scientific impact. Within the first cluster (in red) including 10 journals, the Journal of Pediatrics (4274) and ADCCDMCN (Archives of Disease in Childhood, Child Developmental Medicine and Child Neurology) (1226) were the top highly-impacted journals. In the second cluster (in green), with 8 journals, Pediatrics (10188) and Pediatric Research (1356) were highlighted. Within the third cluster (in blue), 6 journals can be seen with the Journal of the American Academy of Child and Adolescent Psychiatry (2250) and the Journal of Child Developmental and Behavioral Pediatrics (790) as the most impacted ones. Including 6 journals, the fourth cluster (in yellow) had Archives of Pediatric & Adolescent Medicine (2599) and the Journal of Adolescent Health (927) as the top highly-impacted journals.

Recently, JAMA Pediatrics (398) has made more co-citation with top-cited journals, followed by Pediatric Blood and Cancer (67) and European Child and Adolescent Psychiatry (420), respectively.

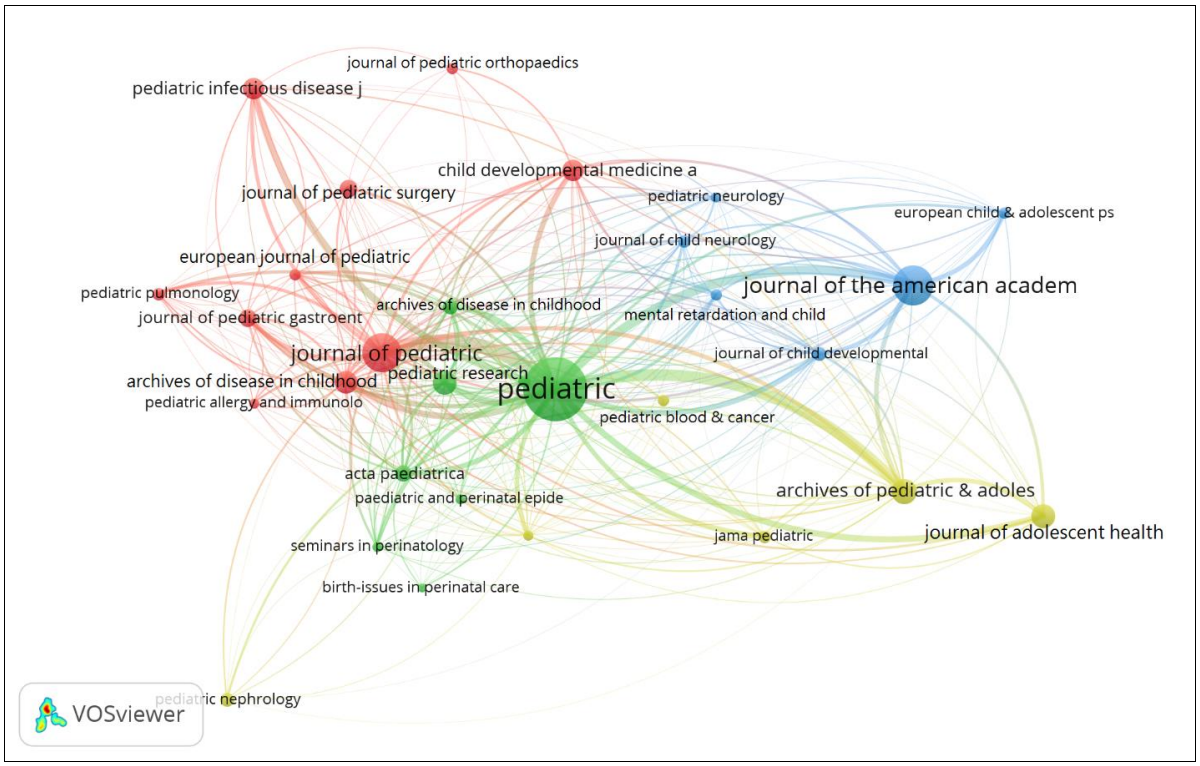

Fig. 3: Co-citation network of journals publishing in pediatrics (1990-2020)

The map included the journals with at least 50 most-cited papers in the field. The titles of some journals may not be observable in the map due to overlap. Nodes or font sizes show the paper frequencies. The thickness of lines between the two nodes represents the co-citation power between the two journals. The shorter the distance between the two nodes, the more the number of co-citations between the two journals.

3-12. Country co-citation network

Fig. 4 depicts the co-citation map of 45 co-citing countries publishing at least 10 most-cited papers on pediatrics. The network consisted of 4 clusters. The numbers in parentheses show the total link strength, i.e. the importance of co-citing countries in the network. In the first cluster (in red) with 19 countries, five Western European countries, including Germany (4123), Italy (3408), France (2945), Switzerland (2371) and Spain (1754) along with countries such as Israel, Belgium, Poland, Japan, Hungary, China, Chile, Croatia, Brazil, Greece, Taiwan, Singapore and Thailand co-cited more. The second cluster (in green) comprised 11 countries including USA (6158), Finland (156) and India (53) as well as South Africa, Mexico, Argentina, Slovenia, Pakistan, South Korea, Egypt and Bangladesh. In the third cluster (in blue), 8 co-citing countries were included: UK (974), Canada (760), Netherlands (415), Australia (491) as well as Scotland, New Zealand, Ireland and Wales. The fourth cluster (in yellow) encompassed 7 European countries, including Sweden (319), Denmark (146), Norway (121), North Ireland (32), Austria (67), Turkey (53) and Czech Republic (24).

Five countries, including Croatia, Hungary, India, Czech Republic, and China have been recently more active in making co-citation. However, five countries, including Mexico, Japan, Sweden, New Zealand and USA have been recently less active in co-citing.

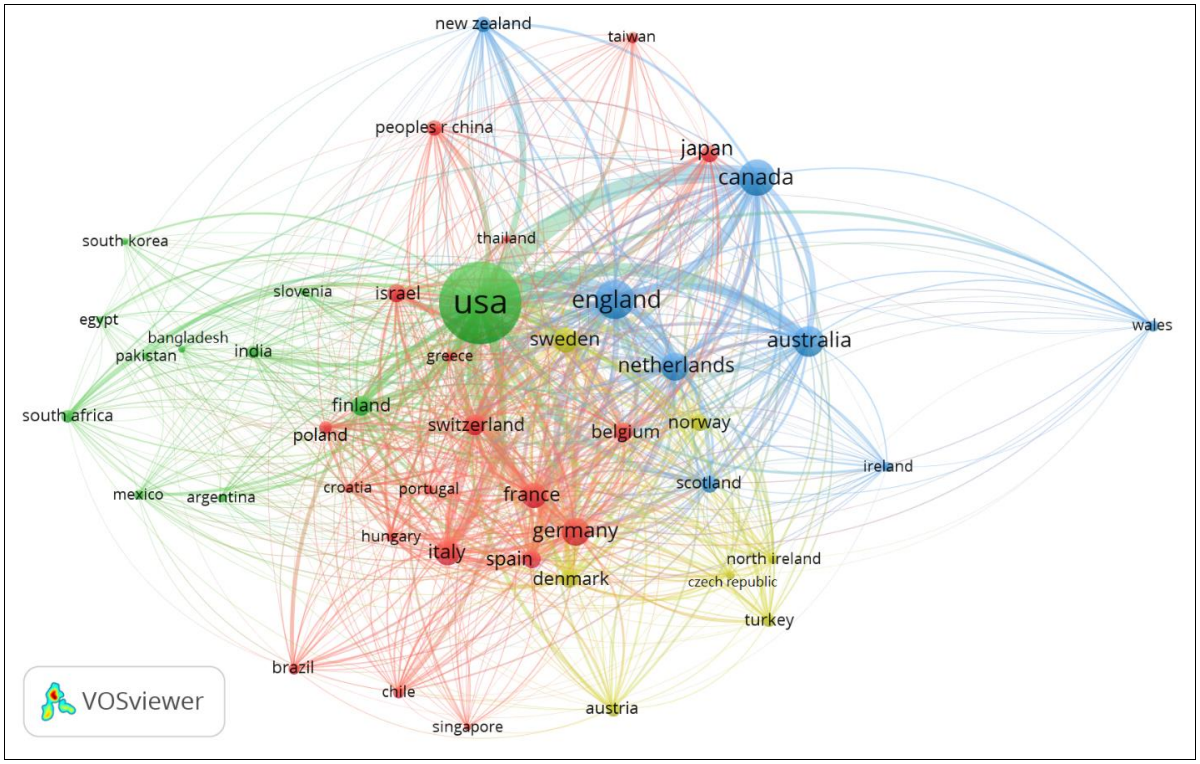

Fig. 4: Co-citation network of countries publishing in pediatrics (1990-2020)

The map consisted of countries with at least 10 most-cited papers in pediatrics. The names of some countries may not be observable due to overlap. Nodes or font sizes show the paper frequencies. The thickness of lines between the two nodes (here, countries) represents the co-citation power between the two countries. The shorter the distance between the two nodes, the more the number of co-citations between the two countries.

3-13. Keyword co-occurrence map

Out of 11652 unique keywords in pediatrics used in the studied papers, the minimum frequencies of 1107, 468 and 197 unique keywords were 5, 10 and 15. The density map of 86 keywords with at least 30 frequencies is depicted in **Fig. 5**. Among the 5 clusters, the first (in red) including 29 keywords focused on diseases with meta-analyses and systematic reviews as main research methods. The second cluster (in green) with 21 co-occurred keywords focused on metabolism with emphasizing survey methodology of longitudinal type. The third cluster (in blue) with 15 keywords mainly considered neurology with a focus on the laboratory-based methodologies. The fourth cluster (in yellow) consisted of 12 keywords considering psychiatry along with children and adolescent mental disorders. The fifth cluster (in pink) with its 9 keywords highlighted immunology. From a time-spot perspective, the keywords in the first cluster (such as systematic review, meta-analysis and probiotics) and second cluster (such as bullying, mental health and physical activity) were more recent than those in the other clusters. Papers including the keywords "overweight" in the second cluster (CPP= 333.4), "body mass index" in the second cluster (CPP= 312.2), psychopathology in the fourth cluster (CPP= 303.9), "intervention" in the third cluster (CPP= 286.5) and "mortality" in the first cluster (CPP=277.6) had the highest CPPs, respectively.

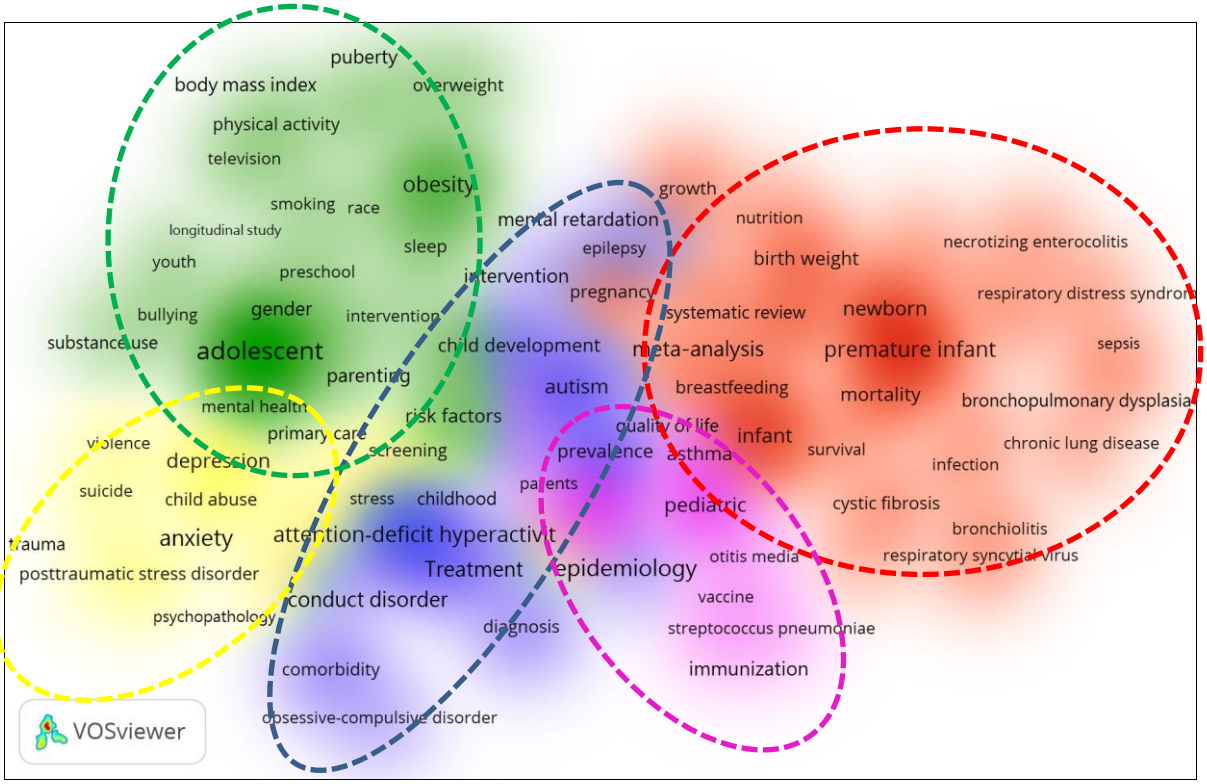

Fig. 5: Keyword co-occurrence density map of papers published in pediatrics (1990-2020)

The map included keywords with at least 30 occurrences. Some keywords may not be observable due to overlap. Nodes or font sizes show the keyword frequencies. The thickness of lines between the two co-occurred keywords represents the co-occurrence power between the two keywords. The shorter the distance between the nodes, the more the number of co-occurrences between the keywords.

4- DISCUSSION

In this study, a bibliometric overview of the global research trend in "pediatrics" during recent 30-year time span (1990-2020) was presented. To the best of our knowledge, no bibliometric study has been conducted in this regard and our study is the first one.

An ever-increasing trend in the number of papers during the study time span (especially from 2015 onwards) reflects real concerns of scientific community about pediatrics medicine and its worldwide importance. This has been facilitated and sped by increased number of specialized publishing journals and professional producing institutes in the World as well as governmental and non-governmental funding on research. Such a trend has been detected in some subfields of pediatrics (11, 16, 17, 19). There was a dramatic increase in publications in the field during the three last decades indicating the importance of the field worldwide. The high mean h-index of the papers in the field shows that the field and related topics within it are attractive and interesting to many professional researchers and research communities. As the majority of papers are original articles, some innovative approaches and concerned issues are under consideration in the field. The fact that English is a predominant language in writing pediatrics papers clearly reflects the research

popularity and worldwide consideration of the area.

In the top cited papers, some topics were highlighted such as childhood overweight and obesity, cerebral palsy, and body-mass index. The core journals publishing in pediatrics are mostly well-known and the majority of them have a relatively high IF, as confirmed in the historical perspective of pediatric publications (11). These core journals publish research papers on different aspects and subfields such as blood, cancer, pulmonology and nephrology, and so on. The majority of highly-cited and hot papers were published in these core journals, too.

The contribution of various publishing countries demonstrates that the USA and European countries are more active than Asian and American countries. This is true in case of child mal treatment (19) and pediatric cancer (16). All 20 most productive research institutes are affiliated with USA, UK, France and Canada as their countries of origin. However, when GPD indicator is considered, some other countries such as Israel and Turkey are highlighted in making collaboration and contribution. This may be due to the fact that these countries are spending more on research and utilize more resources in producing and disseminating research outputs. It is needed that more authors, institutes, countries and regions from Asia and Africa, especially low and middle income countries begin to contribute in the field for resolving world-affected issues.

The co-authorship and co-citation networks show the domination of European countries in pioneering the research and highly-impacted journals in the field and in making international collaborations. Collaboration is important for more scientific development; and needs to be adopted by Asian and African researchers so that they can have more involvement in resolving the related problems in the field. Further research is needed for deep consideration of these citation networks.

We found 5 main subject clusters in the keyword co-occurrence analysis, covering all main research areas in the field, each with its own research methodologies and highlighted keywords. Some highlighted keywords are common with those found in other related studies **(**13, 16, 19**)**. These clusters and most occurred keywords can be a guide for authors to concentrate on heavily concerned and hot topics in pediatrics.

5- CONCLUSION

With its developing trend, global research on pediatrics found its way worldwide, as its bibliometric indicators depict. Our study is the first to give a comprehensive bibliometric visualization of research publications in pediatrics worldwide. It made contribution to the literature in this field and recognized important journals, authors, institutions, countries, journals and areas as well as the main considerable keywords and subject clusters. These analyses reveal that research on pediatrics is ever-increasingly cumulated. Research on pediatrics has gained considerable attention worldwide. Being as a reference study for conducting similar bibliometric analyses, this study is beneficial to authors seeking best agents for making collaboration and contributions. In general, this study not only presents the status of global research in pediatrics, but also can contribute to bibliometric studies in other medical fields and subfields, and be of interest to those dealing with research policy-making in pediatrics medicine.

6- ETHICAL CONSIDERATIONS

This study has been ethically approved by the Ethics Committee of Hamadan University of Medical Sciences with the code number: IR.UMSHA.REC.1399.353

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8- REFERENCES

1. Agarwal A, Durairajanayagam D, Tatagari S, Esteves SC, Harlev A, Henkel R, Roychoudhury S, Homa S, Puchalt NG, Ramasamy R, Majzoub A, Ly KD, Tvrda E, Assidi M, Kesari K, Sharma R, Banihani S, Ko E, Abu-Elmagd M, Gosalvez J, Bashiri A. Bibliometrics: tracking research impact by selecting the appropriate metrics. Asian journal of andrology, 2016. 18(2): p. 296-309.

2. Rosas SR, Kagan JM, Schouten JT, Slack PA, Trochim WMK. Evaluating research and impact: a bibliometric analysis of research by the NIH/NIAID HIV/AIDS clinical trials networks. PloS one, 2011. 6(3): p. e17428-e17428.

3. Mahdiyoun, S., H. Mokhtari, and M. Esmaeilzadeh, Classic Papers in Critical Care: A Bibliometric Analysis. Library Philosophy and Practice, 2019.

4. Sweileh WM, Shraim NY, Al-Jabi SW, Sawalha AF, AbuTaha AS, Zyoud SH. Bibliometric analysis of global scientific research on carbapenem resistance (1986–2015). Annals of Clinical Microbiology and Antimicrobials, 2016. 15(1): p. 56.

5. Sweileh WM, Al-Jabi SW, Sawalha AF, Zyoud SH. Bibliometric profile of the global scientific research on autism spectrum disorders. SpringerPlus, 2016. 5(1): p. 1480-1480.

6. Al-Jabi, S.W., Global research trends in West Nile virus from 1943 to 2016: a bibliometric analysis. Globalization and health, 2017. 13(1): p. 55-55.

7. Sweileh, W.M., A bibliometric analysis of global research output on health and human rights (1900–2017). Global Health Research and Policy, 2018. 3(1): p. 30.

8. Zyoud, S.e.H., Global scientific trends on aflatoxin research during 1998-2017: a bibliometric and visualized study. Journal of occupational medicine and toxicology (London, England), 2019. 14: p. 27-27.

9. Zou, L.-X. and L. Sun, Global diabetic kidney disease research from 2000 to 2017: A bibliometric analysis. Medicine, 2019. 98(6): p. e14394-e14394.

10. Ma, C., H. Su, and H. Li, Global Research Trends on Prostate Diseases and Erectile Dysfunction: A Bibliometric and Visualized Study. Frontiers in oncology, 2021. 10: p. 627891-627891.

11. Quinn, N., O. Hensey, and D.T. McDowell, A historical perspective of pediatric publications: a bibliometric analysis. Pediatrics, 2013. 132(3): p. 406-12.

12. Chhapola V, Tiwari S, Deepthi B, Kanwal SK. Citation classics in pediatrics: a bibliometric analysis. World J Pediatr, 2018. 14(6): p. 607-614.

13. Yu Y, Wang D, Ma K, Zhang Y, Zou F. Research hot spots in the treatment of pediatric cerebral palsy based on bibliometric analysis. Int J Clin Exp Med, 2019. 12(7): p. 8239-8250.

14. Perazzo, M.F., et al., The top 100 most-cited papers in Paediatric Dentistry journals: A bibliometric analysis. International Journal of Paediatric Dentistry, 2019. 29(6): p. 692-711.

15. Watwood, C.L., Mapping the literature of pediatric nursing: update and implications for library services. Journal of the Medical Library Association : JMLA, 2016. 104(4): p. 278-283.

16. Syrimi E, Lewison G, Sullivan R, Kearns P. Analysis of Global Pediatric Cancer Research and Publications. JCO global oncology, 2020. 6: p. 9-18.

17. Schwimmer MH, Sawh MC, Heskett KM, Goyal NP, Newton KP, Schwimmer JB, A Bibliometric Analysis of Clinical

and Translational Research in Pediatric Gastroenterology From 1970 to 2017. Journal of pediatric gastroenterology and nutrition, 2018. 67(5): p. 564-569.

18. Wilcox MA, Khan NR, McAbee JH, Boop FA, Klimo P. Highly cited publications in pediatric neurosurgery. Child's nervous system : ChNS : official journal of the International Society for Pediatric Neurosurgery, 2013. 29(12): p. 2201-2213.

19. Tran BX, Pham TV, Ha GH, Ngo AT, Nguyen LH, Vu TTM, Do HN, Nguyen V, Nguyen ATL, Tran T, Truong NT, Hoang VQ, Ho TM, Dam NV, Vuong TT, Nguyen HQ, Le HT, Do HT, Moir M, Shimpuku Y, Dhimal M, Arya SS, Nguyen TH, Bhattarai S, Latkin CA, Ho CSH, Ho RCM, A Bibliometric Analysis of the Global Research Trend in Child Maltreatment. International journal of environmental research and public health, 2018. 15(7): p. 1456.

20. Falagas ME, Pitsouni EI, Malietzis GA, Pappas G. Comparison of PubMed, Scopus, Web of Science, and Google Scholar: strengths and weaknesses. Faseb j, 2008. 22(2): p. 338-42.

21. Kulkarni AV, Aziz B, Shams I, Busse JW, Comparisons of citations in Web of Science, Scopus, and Google Scholar for articles published in general medical journals. Jama, 2009. 302(10): p. 1092-6.

22. Newman, M.E.J., Prediction of highly cited papers. EPL (Europhysics Letters), 2014. 105(2): p. 28002.

23. Bornmann, L., A.Y. Ye, and F.Y. Ye, Identifying "hot papers" and papers with "delayed recognition" in large-scale datasets by using dynamically normalized citation impact scores. Scientometrics, 2018. 116(2): p. 655-674.

24. Garfield, E., The history and meaning of the journal impact factor. Jama, 2006. 295(1): p. 90-3.

25. Reuters, T. Journal citation reports. 2021; Available from: https://jcr.clarivate.com.

26. Kumar, S., Co-authorship networks: a review of the literature. Aslib Journal of Information Management, 2015. 67(1): p. 55-73.

27. Fitzpatrick CL, Hobson EA, Mendelson TC, Rodríguez RL, Safran RJ, Scordato ESC, Servedio MR, Stern CA, Symes LB, Kopp M. Theory Meets Empiry: A Citation Network Analysis. BioScience, 2018. 68(10): p. 805-812.

28. Cheng FF, Huang YW, Yu HC, Wu CS. Mapping knowledge structure by keyword co-occurrence and social network analysis. Library Hi Tech, 2018. 36(4): p. 636-650.

29. World Population Review. GDP Ranked by Country 2021. Available from: https://worldpopulationreview.com/en/countries/countries-by-gdp.

30. Mongeon, P. and A. Paul-Hus, The journal coverage of Web of Science and Scopus: a comparative analysis. Scientometrics, 2016. 106(1): p. 213-228.

31. van Eck, N.J. and L. Waltman, Software survey: VOSviewer, a computer program for bibliometric mapping. Scientometrics, 2010. 84(2): p. 523-538.

32. van Eck, N.J. and L. Waltman, Citation-based clustering of publications using CitNetExplorer and VOSviewer. Scientometrics, 2017. 111(2): p. 1053-1070.

33. Kaufman J, Birmaher B, Brent D, Rao U, Flynn C, Moreci P, Williamson D, Ryan N, Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version (K-SADS-PL): initial reliability and validity data. J Am Acad Child Adolesc Psychiatry, 1997. 36(7): p. 980-8.

34. Adolescents, N.H.B.P.E.P.W.G.o.H.B.P.i.C.a., The

fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. Pediatrics, 2004. 114(2 Suppl 4th Report): p. 555-76.

35. Palisano R, Rosenbaum P, Walter S, Russell D, Wood E, Galuppi B. Development and reliability of a system to classify gross motor function in children with cerebral palsy. Dev Med Child Neurol, 1997. 39(4): p. 214-23.

36. Gartner LM, Morton J, Lawrence RA, Naylor AJ, O'Hare D, Schanler RJ, Eidelman AI, American Academy of Pediatrics Section on Breastfeeding. Breastfeeding and the use of human milk. Pediatrics, 2005. 115(2): p. 496-506.

37. Goodman, R., Psychometric properties of the strengths and difficulties questionnaire. J Am Acad Child Adolesc Psychiatry, 2001. 40(11): p. 1337-45.

38. Barlow, S.E., Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. Pediatrics, 2007. 120 Suppl 4: p. S164-92.

39. Merikangas KR, He JP, Burstein M, Swanson SA, Avenevoli S, Cui L, Benjet C, Georgiades K, Swendsen J. Lifetime prevalence of mental disorders in U.S. adolescents: results from the National Comorbidity Survey Replication--Adolescent Supplement (NCS-A). Journal of the American Academy of Child and Adolescent Psychiatry, 2010. 49(10): p. 980-989.

40. Shaffer D, Fisher P, Lucas CP, Dulcan MK, Schwab-Stone ME. NIMH Diagnostic Interview Schedule for Children Version IV (NIMH DISC-IV): description, differences from previous versions, and reliability of some common diagnoses. Journal of the American Academy of Child & Adolescent Psychiatry, 2000. 39(1): p. 28-38.

41. Strong WB, Malina RM, Blimkie CJR, Daniels SR, Dishman RK, Gutin B, Hergenroeder AC, Must A, Nixon PA, Pivarnik JM, Rowland T, Trost S, Trudeau F. Evidence based physical activity for school-age youth. J Pediatr, 2005. 146(6): p. 732-7.

42. Henter JI, Horne A, Aricó M, Egeler RM, Filipovich AH, Imashuku S, Ladisch S, McClain K, Webb D, Winiarski J, Janka G. HLH-2004: Diagnostic and therapeutic guidelines for hemophagocytic lymphohistiocytosis. Pediatric Blood & Cancer, 2007. 48(2): p. 124-131.

43. Rosenbaum P, Paneth N, Leviton A, Goldstein M, Bax M, Damiano D, Dan B, Jacobsson B. A report: the definition and classification of cerebral palsy April 2006. Dev Med Child Neurol Suppl, 2007. 109: p. 8-14.

44. Wang, Y. and T. Lobstein, Worldwide trends in childhood overweight and obesity. Int J Pediatr Obes, 2006. 1(1): p. 11-25.

45. Shonkoff, J.P. and A.S. Garner, The lifelong effects of early childhood adversity and toxic stress. Pediatrics, 2012. 129(1): p. e232-46.

46. Group, W.M.G.R.S. and M. De Onis, WHO Child Growth Standards based on length/height, weight and age. Acta Paediatrica, 2006. 95(S450): p. 76-85.

47. Dietz, W.H., Health consequences of obesity in youth: childhood predictors of adult disease. Pediatrics, 1998. 101(3 Pt 2): p. 518-25.

48. Black S, Shinefield H, Fireman B, Lewis E, Ray P, Hansen JR, Elvin L, Ensor KM, Hackell J, Siber G, Malinoski F, Madore D, Chang I, Kohberger R, Watson W, Austrian R, Edwards K. Efficacy, safety and immunogenicity of heptavalent pneumococcal conjugate vaccine in children. Northern California Kaiser Permanente Vaccine Study Center

Group. Pediatr Infect Dis J, 2000. 19(3): p. 187-95.

49. Simonoff E, Pickles A, Charman T, Chandler S, Loucas T, Baird G. Psychiatric Disorders in Children With Autism Spectrum Disorders: Prevalence, Comorbidity, and Associated Factors in a Population-Derived Sample. Journal of the American Academy of Child & Adolescent Psychiatry, 2008. 47(8): p. 921-929.

50. Kromeyer-Hauschild K, Wabitsch M, Kunze D, Geller D. Percentiles of body mass index in children and adolescents evaluated from different regional German studies. Monatsschrift Kinderheilkunde, 2001. 149: p. 807-818.

51. Boney CM, Verma A, Tucker R, Vohr BR. Metabolic Syndrome in Childhood: Association With Birth Weight, Maternal Obesity, and Gestational Diabetes Mellitus. Pediatrics, 2005. 115(3): p. e290-e296.

52. Cole, T.J., J.V. Freeman, and M.A. Preece, Body mass index reference curves for the UK, 1990. Archives of Disease in Childhood, 1995. 73(1): p. 25-29.