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Global research status of gastroenterology and hepatology

A bibliometrics study

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Abstract

Background: There are no reports on global research status of gastroenterology and hepatology (GI). This study was conducted to reveal the current global research status and trends in GI.

Methods: Articles published during 2009 to 2018 in international GI journals were retrieved from the PubMed database. The top 20 countries by output were determined. The gross domestic product (GDP) of each country was also retrieved to figure out the correlation between outputs in GI and economy. The 5 highest-ranking countries were compared in the number of total articles, articles per capita, articles published in top journals, the accumulated impact factor (IF), and average IF. Total articles and articles per capita of the 5 countries were conducted time-trend analysis. The frequently-used terms in titles and abstracts of articles published in 2009 and 2018 were retrieved to conduct co-occurrence analysis to figure out the change of research highlights in GI.

Results: A total of 120,267 articles were included, of which 116,485 articles were from 20 highest-output countries. There was a positive correlation between output and GDP ($r = 0.921$, $P < .001$). The USA, Japan, China, Italy, and the UK were the 5 highest-ranking countries. The USA was the largest contributor with 26,215 articles, accounting for 17.4% of the total, but with no significant increasing trend ($P = .122$). Other 4 countries all showed increasing trends (all $P < .001$). For articles per capita, Italy ranked 1st among the 5 countries with 1591.0 articles per 10 million. The USA showed a decreasing trend ($P = .026$), other 4 countries all showed increasing trends (all $P < .001$). The UK had the highest average IF (6.685). For change of research highlights, it is more inclined to research of endoscopy, inflammatory bowel diseases, and nonalcoholic fatty liver disease.

Conclusion: It is delightful that the global research output in GI field would be continuingly increased as the major highest-output countries showed increasing trends. However, the developing countries fell behind both in quantity and quality when compared with developed countries.

Abbreviations: AIS = article influence score, GDP = gross domestic product, GI = gastroenterology and hepatology, HCV = hepatitis C virus, IBD = inflammatory bowel diseases, IF = impact factor, Iml = immediacy index, JCR = Journal Citation Reports, NAFLD = nonalcoholic fatty liver disease, RCTs = randomized controlled trials.

Keywords: impact factor, journal citation reports, randomized controlled trial, research, science citation index expanded

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The datasets generated during and/or analyzed during the current study are publicly available.

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1. Introduction

Gastroenterology and hepatology (GI) are the branches of medicine that incorporate the study of stomach, intestine, liver, gallbladder, and pancreas as well as the managements of their disorders. Gastrointestinal and liver diseases have lots of varieties and considerable prevalence rate worldwide, especially the malignant tumors and viral hepatitis. A global study found that in 2016, 3 of top 10 cancers originated from digestive system, namely-colon and rectum cancer, stomach cancer and liver cancer, with totally 3.9 million incident case and almost 2.5 million deaths.[1] Chronic hepatitis B virus infection was reported up to 250 million persons worldwide and caused nearly 900,000 deaths per year.[2] Inflammatory bowel diseases (IBD) is a disease that progresses with industrialization. In western world, it is now in the stage of compounding prevalence, with a stable incidence of 12 to 26 per 100,000 persons, but with a steeply rising prevalence which will be 1% by 2030 in many regions.[3] Nonalcoholic fatty liver disease (NAFLD) is one of the major metabolic that occur in almost 1 in every 4 people of the world.[4] Thus, the study on GI field has always been a pivotal part of medicine research.

Recent years, benefiting from the advancement of modern medicine, some breakthroughs were achieved in research of GI field. Such as the development of direct-acting antivirals for hepatitis C virus (HCV),[5,6] the discovery of special effects of gut microbiota to human body,[5,7] the new treatments for irritable bowel syndrome based on mechanistic discoveries[5,8] and development of capsule endoscopy in diagnosing and screening for large-bowel neoplasia. However, there were still considerable mysteries and challenges to be solved, such as the pathogenesis of major complications of cirrhosis, treatment of the deadliest gastrointestinal cancers, limitations of capsule endoscopy in locating the lesion site and taking biopsy samples at the spot.[5,9] For decades, global gastroenterologists and hepatologists have been dedicated to figure out various issues and found new challenges in GI fields. Their outcomes were showed as publications on lots international medicine journals. This study aimed to reveal the global research status and each country's contribution in GI field based on a 10-year survey of publications.

2. Materials and methods

This study was a bibliometrics study which did not involve any clinical trials and patient consent. Therefore, there was no need for approval of ethics committee or institutional review board.

A total of 80 journals were selected from the "Gastroenterology and Hepatology" category established by the Institute for Scientific Information, Journal Citation Reports (JCR) 2017.[10] To determine the contribution for all countries, a total of 193 member states of the United Nations were included.[11]

The "PubMed" database was searched in May 2019 to determine the global number of articles and the number of articles from each country published from January 2009 to December 2018.[12] The ISSN (International Standard Serial Number) was used to perform the search in "PubMed." The search terms were "0016-5085 OR 1759-5045 OR 0017-5749 OR 0168-8278 OR 0270-9139 OR 0002-9270 OR 1542-3565 OR 0269-2813 OR 0016-5107 OR 1873-9946 OR 0013-726X OR 0944-1174 OR 1436-3291 OR 1089-3261 OR 2155-384X OR 1478-3223 OR 1078-0998 OR 1352-0504 OR 1756-283X OR 0272-8087 OR 1083-4389 OR 1936-0533 OR 1350-1925 OR 1527-6465 OR 1521-6918 OR 0012-3706 OR 0815-9319 OR 2050-6406 OR 2304-3881 OR 2093-0879 OR 1386-6346 OR 0267-1379 OR 0915-5635 OR 2303-9027 OR 1007-9327 OR 0193-1857 OR 1590-8658 OR 0889-8553 OR 1948-5204 OR 1365-182X OR 0192-0790 OR 1747-4124 OR 0885-3177 OR 1868-6974 OR 1976-2283 OR 0163-2116 OR 1091-255X OR 1757-4749 OR 1462-8910 OR 1424-3903 OR 0277-2116 OR 1471-230X OR 1442-2050 OR 2052-0034 OR 0036-5521 OR 2210-7401 OR 0179-1958 OR 0942-8925 OR 1123-6337 OR 0012-2823 OR 0253-4886 OR 0954-691X OR 1841-8724 OR 1687-6121 OR 1735-143X OR 1130-0108 OR 1751-2972 OR 2291-2797 OR 0044-2771 OR 1665-2681 OR 1319-3767 OR 1499-3872 OR 2093-582X OR 1531-0043 OR 0210-5705 OR 1612-9059 OR 1300-4948 OR 1687-1979 OR 1784-3227 OR 1042-895X," "country[ad]." The numbers of clinical trials and randomized controlled trials (RCTs) were determined using the "Article types" category established by PubMed. The shares of each country in total articles, clinical trials and RCTs were then calculated.

The 20 countries with the highest output were determined according to the number of total articles from each country. To figure out the correlation between the outputs and economic development level of 20 highest-outputs countries, the gross domestic product (GDP) was used as the indicator of economic status and each country's GDP was retrieved from World Bank Open Data.[13] The 5 highest-output countries were selected for quantity and quality comparisons. The annual numbers of articles, clinical trials and RCTs from these 5 countries were retrieved. The populations of the 5 countries from 2009 to 2018 were extracted[13] and then used to calculate the total and annual number of articles per capita. The number of total articles and the number of articles per capita for all 5 countries were evaluated by time-trend analyses.

To compare the quality of the articles from the 5 countries, 3 methods were used. First, the impact factor (IF) of each journal was retrieved from JCR 2017, and each country's number of articles published in every journal was also determined. Then, the accumulated IFs of each country were calculated by summing the IFs of all the articles. The average IF was calculated by dividing the accumulated IFs by the total number of articles. Second, journals with IFs of more than 10 (Gastroenterology, Nature Reviews Gastroenterology & Hepatology, Gut, Journal of Hepatology, Hepatology, American Journal of Gastroenterology) were identified to determine the number of publications from the 5 countries in high-quality journals. The numbers of articles published in these journals from the 5 countries were then retrieved. Third, the accumulated immediacy index (ImI), average ImI, accumulated article influence score (AIS) and average AIS of articles of the 5 countries were calculated. In addition, according to the number of articles published by the 5 countries in every journal, the 5 most popular journals were determined for each country.

To figure out the change of research highlights in GI, the frequently-used terms in titles and abstracts of articles published in 2009 and 2018 were retrieved from the Science Citation Index Expanded database of Web of Science[14] and then were conducted co-occurrence analysis using VOS viewer.[15] The keywords (defined as words that were used more than 30 times in titles and abstracts of all articles) were retrieved and 60% most relevant keywords were further identified to generated the final co-occurrence map. Using the same method, the main research topics of the 5 countries in 2018 were also analyzed.

Statistical analyses were performed using SPSS 21.0.[16] Regression analysis was used to determine whether there was any significant change in China's share over the time period. Pearson test

Table 1

Share of articles in gastroenterology and hepatology for 20 highest-ranking countries.

	All articles (n = 120267)			Clinical trials (n = 7141)			Randomized controlled trials (n = 4900)		
Rank	Country	Number	Percentage (%)	Country	Number	Percentage (%)	Country	Number	Percentage (%)
1	USA	26215	17.4	USA	1255	16.7	USA	894	17.6
2	Japan	13779	9.2	Japan	927	12.3	Japan	538	10.6
3	China	13379	8.9	Italy	578	7.7	China	385	7.6
4	Italy	9433	6.3	China	545	7.2	Italy	365	7.2
5	UK	7536	5.0	Germany	506	6.7	Germany	330	6.5
6	Germany	7100	4.7	Netherlands	409	5.4	Netherlands	292	5.8
7	France	5905	3.9	France	382	5.1	UK	268	5.3
8	Spain	4673	3.1	UK	380	5.1	France	249	4.9
9	Netherlands	4508	3.0	Spain	288	3.8	Spain	186	3.7
10	Canada	4235	2.8	Canada	236	3.1	Canada	177	3.5
11	Australia	3592	2.4	Belgium	230	3.1	Australia	170	3.4
12	India	2275	1.5	Australia	227	3.0	Belgium	168	3.3
13	Belgium	2243	1.5	Sweden	178	2.4	Sweden	133	2.6
14	Israel	2163	1.4	Denmark	167	2.2	Denmark	129	2.5
15	Sweden	1981	1.3	Israel	149	2.0	India	127	2.5
16	Denmark	1828	1.2	India	148	2.0	Israel	94	1.9
17	Switzerland	1764	1.2	Switzerland	115	1.5	Switzerland	91	1.8
18	South Korea	1720	1.1	South Korea	109	1.4	South Korea	83	1.6
19	Portugal	1164	0.8	Austria	93	1.2	Austria	65	1.3
20	Austria	992	0.7	Portugal	26	0.3	Portugal	18	0.4

was used to determine whether there was any correlation between outputs and GDP of each country. The test for significance was two-tailed, and $P < .05$ was considered significant.

3. Results

3.1. Numbers of total articles, clinical trials, and RCTs

A total of 120,267 articles were published from January 2009 to December 2018 in GI journals, of which 116,485 articles were from the 20 highest-ranking countries, accounting for 96.86% of the total (Table 1). These countries are mainly located in West Europe, North America, and East Asia. China and India are the only 2 developing countries (Fig. 1). There was a significant positive correlation between the outputs and GDP of each country ($r = 0.921$, $P < .001$, Fig. 2). The USA ranked 1st, with 26,215 articles, accounting for 17.4% of the total, but there was no significant increasing trend ($P = .122$). Japan, China, Italy, and the UK ranked 2nd, 3rd, 4th, and 5th, with 13,779 (9.2%), 13,379 (8.9%), 9433 (6.3%), and 7536 (5.0%) articles, respectively. All showed increasing trends (all

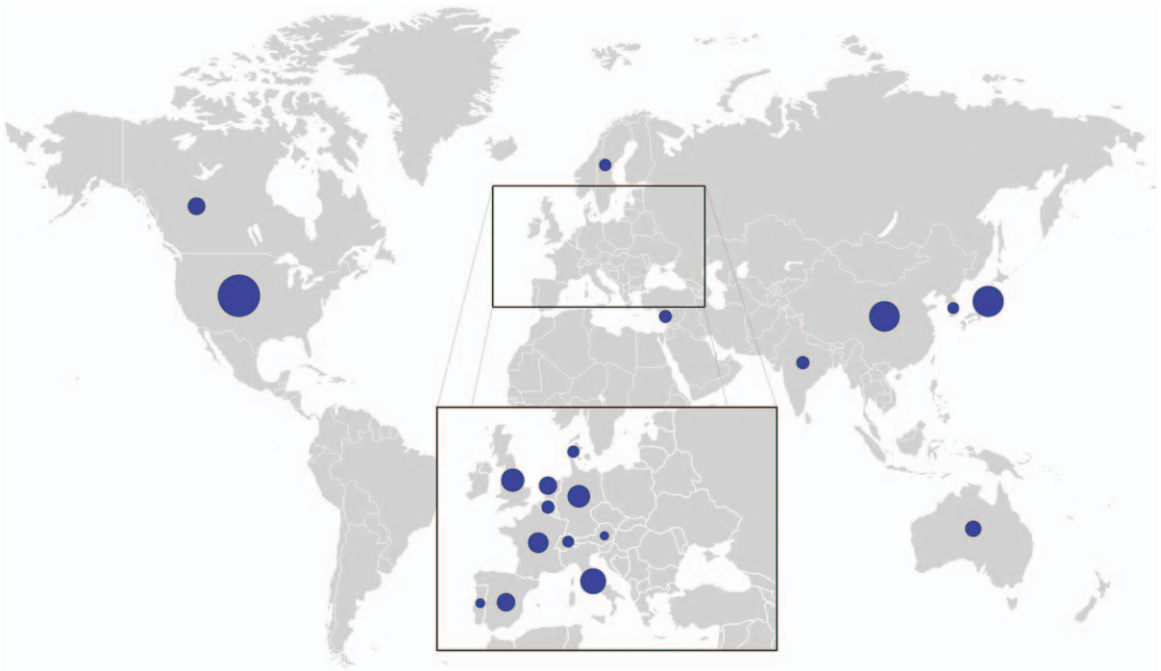

Figure 1. The 20 highest-output countries.

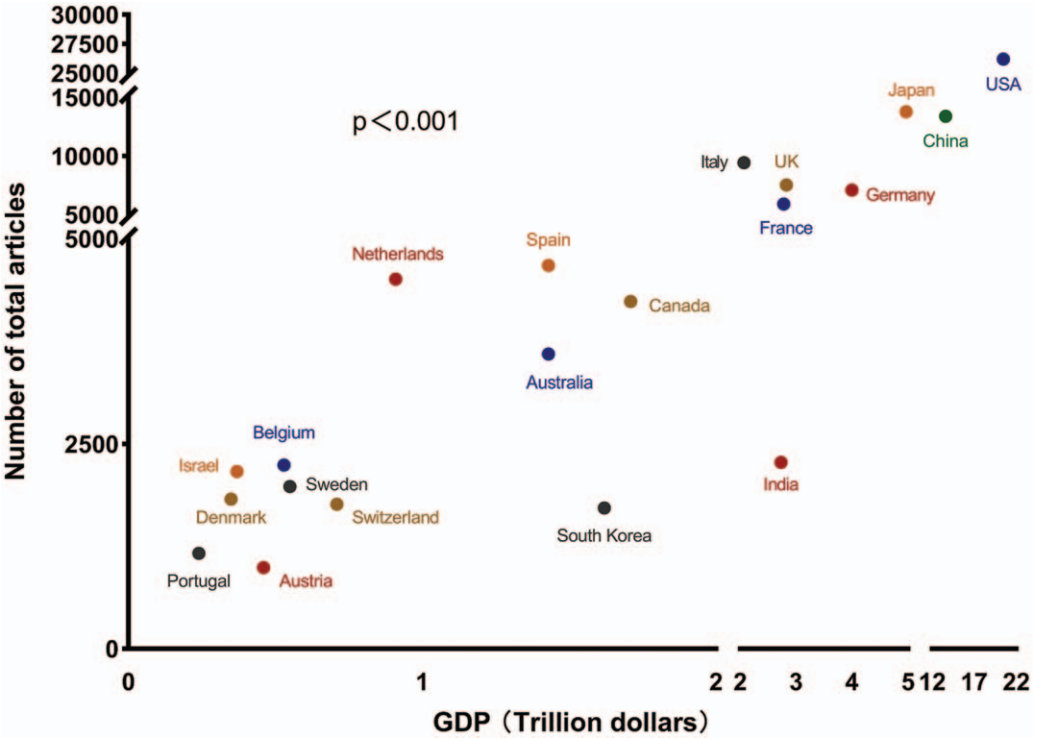

Figure 2. The correlation between total articles and GDP from 20 highest-output countries.

$P < .001$, Fig. 3). For clinical trials, the USA published 1255 articles, accounting for 16.7% of the total. Japan, Italy, China, and the UK ranked 2nd, 3rd, 4th, and with 927 (12.3%), 578 (7.7%), 545 (7.2%), and 380 (5.1%) articles, respectively. With regards to RCTs, the USA, Japan, China, Italy, and the UK ranked 1st, 2nd, 3rd, 4th, and 7th, with 894 (17.6%), 538 (10.6%), 385 (7.6%), 365 (7.2%), and 268 (5.3%) articles, respectively.

In addition, the share of RCTs in clinical trials in China was 70.64% (385/545), more than Japan (58.04%, 538/927), Italy (60.15%, 365/578), and the UK (70.53%, 268/380) and only slightly less than the USA (71.23%, 894/1255).

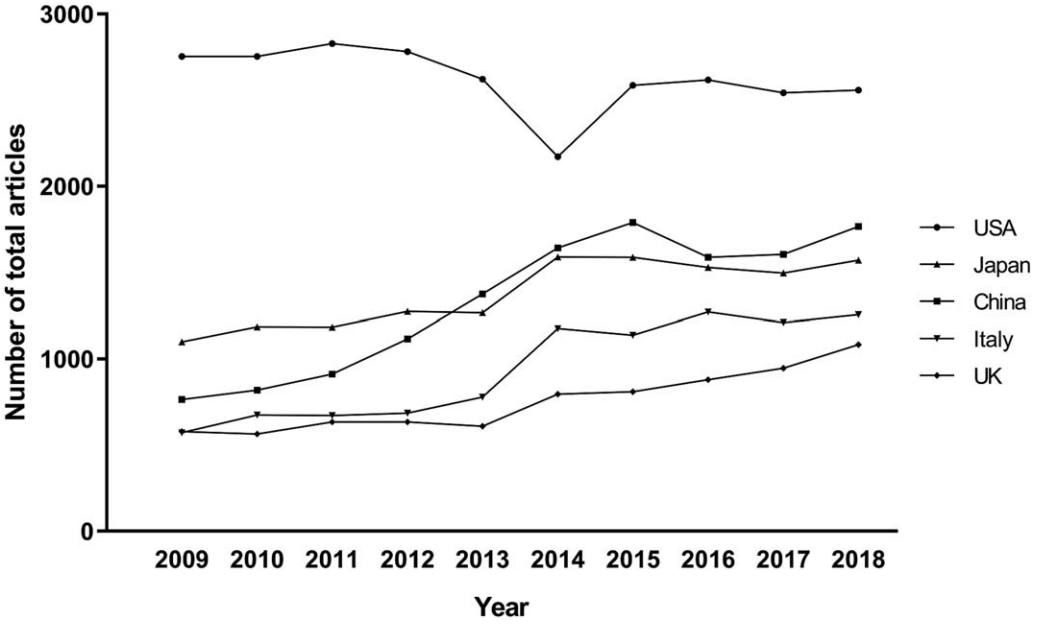

Figure 3. The trends of the all articles from 5 highest-output countries during the past 10 years.

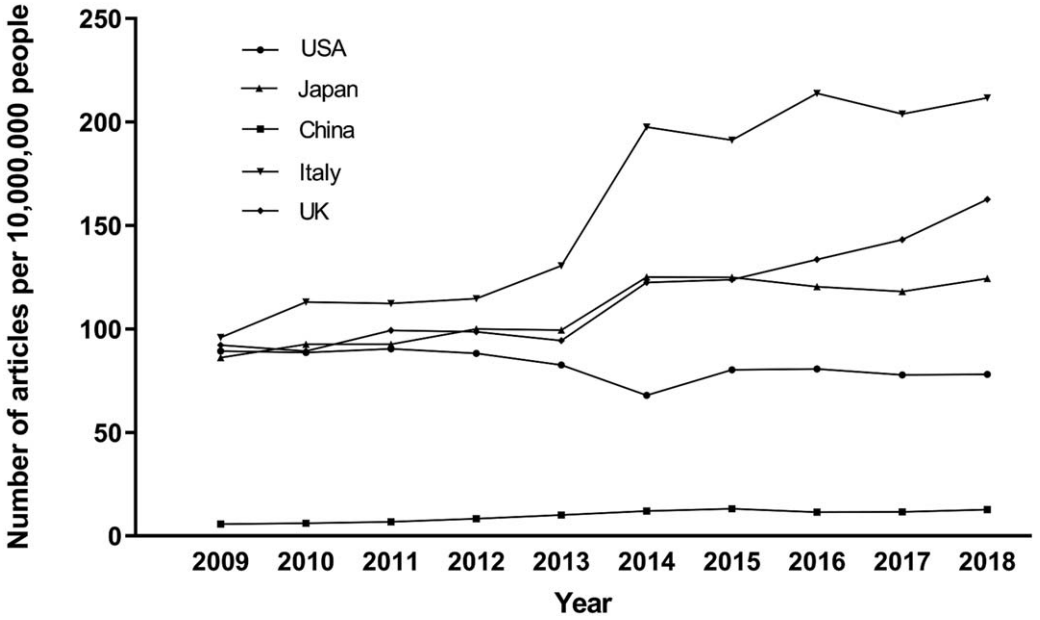

Figure 4. The trends of numbers of articles per 10,000,000 people from 5 highest-output countries during the past 10 years.

3.2. Number of articles per capita

In terms of the number of articles per capita, Italy had the most articles per capita among the 5 countries, with 1591.0 articles per 10 million. The UK, Japan, and the USA had 1132.0, 1091.5, and 799.5 articles per 10 million, respectively. China was at the bottom, with 95.9 articles per 10 million. Italy, the UK, Japan, and China all showed increasing trends (all $P < .001$), but the USA showed a decreasing trend ($P = .026$, Fig. 4).

3.3. Articles published in high-quality journals

The 5 highest-ranking countries published a total of 11,202 articles in the 6 highest-IF GI journals. The USA was the top contributor with 5369 articles. The UK, Italy, China, and Japan published 1833, 1603, 1383, and 1014 articles, respectively. The USA was the top contributor to all 6 journals. China published the least number of articles in Gastroenterology, Nature Reviews Gastroenterology & Hepatology and American Journal of Gastroenterology (241, 14, and 121) among the 5 countries. Japan published the least number of articles in Gut and Journal of Hepatology (147 and 181). The UK published the least number of articles in Hepatology (224). China's share of high-quality articles among its total output was 10.34% (1383/13,379), less than the USA (20.48%, 5369/26,215), Italy (16.99%, 1603/9433) and the UK (24.32%, 1833/7536) but more than Japan (7.36%, 1014/13779, Table 2).

3.4. Accumulated IFs, average IF, and other indicators

The USA had the highest accumulated IF (166,823.9), accumulated ImI (52,312.5) and accumulated AIS (52,645.8). The UK had the highest average IF (6.685), average ImI (2.319), and average AIS (2.099). China ranked 3rd in accumulated IF (60,353.8) and accumulated AIS (17,262.2) and ranked 5th in accumulated ImI (16,270.7). However, China had the lowest average IF, average ImI, and average AIS among the 5 countries (Table 3).

3.5. Most popular journals

Gastrointestinal Endoscopy was the most popular journal in the USA, with 2313 articles published; Hepatology Research was the most popular in Japan, with 1,133 articles published; World

Table 2

Number of articles published in 6 highest-IF journals.

Rank	Journal	2017IF	Country					Total
			USA	Japan	China	Italy	UK	
1	Gastroenterology	20.773	1055	302	241	297	297	2192
2	NRGH	17.324	338	27	14	63	126	568
3	Gut	17.016	739	147	180	234	588	1888
4	JOH	15.040	680	181	279	461	400	2001
5	Hepatology	14.079	920	231	548	363	224	2286
6	AJG	10.231	1637	126	121	185	198	2267
Total			5369	1014	1383	1603	1833	11202

AJG = American Journal of Gastroenterology, JOH = Journal of Hepatology, NRGH = Nature Reviews Gastroenterology & Hepatology.

Table 3

Indicators of articles from 5 highest-ranking countries.

Country	Accumulated IF	Average IF	Accumulated Iml	Average Iml	Accumulated AIS	Average AIS
USA	166823.882	6.270	52312.482	1.966	52645.795	1.979
Japan	67431.559	4.764	21497.341	1.519	18717.155	1.322
China	60353.839	4.403	16270.725	1.187	17262.175	1.259
Italy	54964.318	5.686	17087.456	1.768	16707.293	1.728
UK	52447.352	6.685	18196.945	2.319	16470.074	2.099

IF = impact factor, Iml = immediacy index, AIS = article influence score.

Journal of Gastroenterology was the most popular journal in China, with 3310 articles published. Digestive and Liver Disease was the most popular in Italy, with 1064 articles published; and Colorectal Disease was the most popular in the UK, with 1055 articles published (Table 4).

3.6. Change of research highlights

For articles published in 2009, there were 2720 terms meeting the threshold of 30 and 1632 most relevant terms were extracted to generated the co-occurrence map (Fig. 5A). The terms were classified into 5 clusters: "gastrointestinal malignant lesions," "gastrointestinal benign lesions," "liver diseases," "animal study" and "gastrointestinal nervous system," painted in red, blue, yellow, green, and purple, respectively. For "gastrointestinal malignant lesions," the keywords were: carcinoma, complication, and surgery. For "gastrointestinal benign lesions," the keywords were: colitis, quality, and gastroesophageal reflux disease. For "liver diseases," the keywords were: HCV, fibrosis, and ribavirin. For "animal study", the keywords were: expression, effect and protein. For "gastrointestinal nervous system," the keywords were: secretion, antagonist, and contraction.

For articles published in 2018, there were 3102 terms meeting the threshold and 1861 most relevant terms were extracted to generated the co-occurrence map (Fig. 5B). The terms were classified into 6 clusters: "gastrointestinal malignant lesions," "liver diseases," "animal study," "functional gastrointestinal disorders," "endoscopy" and "IBD," painted in red, blue, green, yellow, purple, and indigo, respectively. For "gastrointestinal malignant lesions," the keywords were: safety, resection, and adenocarcinoma. For "liver disease," the keywords were: week, HCV, and NAFLD. For "animal study," the keywords were: expression, role, and gene. For "functional gastrointestinal disorders," the keywords were: irritable bowel syndrome, placebo, and esophagus. For "endoscopy," the keywords were: lesion, colonoscopy, and endoscopic ultrasonography. For "IBD," the keywords were: vedolizumab and remission.

3.7. Main research topics of each country

In 2018, American and Italy researchers both focused more on HCV and cirrhosis. Japanese researchers showed more interest on digestive systems tumors, such as gastric cancer and hepatocellular carcinoma. NAFLD and HBV were research focus of Chinese researchers. English researchers paid more attention to NAFLD and colorectal cancer.

4. Discussion

Correlation analysis showed that countries with higher GDP tend to had more outputs in GI field. These countries generally have advanced medical research institutions and top medicine researchers. The governments are capable to build a complete medical care system and provide abundant funds for medicine research. China's investment in research and development has exceeded that of any other countries except the USA, with funding increasing by 20% each year,[17] leading to significant progress in several medical research fields.[18–20]

In GI field, the USA was the largest contributor both in total articles and articles published on top journals. It is dominance mainly benefited from enormous research funding and high-level researchers.[21] However, the USA did not show an increasing trend in the total outputs and even had a decreasing trend in the output per capita. Some experts blamed it to the low success rates of grant submission and inappropriate allocation of funding resulting in the decline of the number of young physician-scientists.[5,22] As the only developing country among 5 highest-output countries, China published a total number of 13,379 articles in the last decade with a significant increasing trend, following the USA and Japan. Its continuously increasing funding

Table 4

Most popular Journals of 5 highest-ranking countries.

Rank	USA	N	Japan	N	China	N	Italy	N	UK	N
1	GIE	2313	HR	1133	WJG	3310	DLD	1064	CD	1055
2	DDS	2137	JOG	1110	DDS	666	WJG	867	APT	666
3	AJG	1637	WJG	1087	JGH	560	JOH	461	Gut	588
4	JGS	1563	DE	944	HPDI	557	Hepatology	363	JOH	400
5	Gastroenterology	1055	JGH	809	Hepatology	548	JPGN	340	Gastroenterology	297

GIE = gastrointestinal endoscopy, IF = 7.204; DDS = digestive diseases and sciences, IF = 2.819; AJG = American Journal Of Gastroenterology, IF = 10.231; JGS = Journal Of Gastrointestinal Surgery, IF = 2.813; gastroenterology, IF = 20.773; HR = Hepatology Research, IF = 3.418; JOG = Journal Of Gastroenterology, IF = 5.561; WJG = World Journal Of Gastroenterology, IF = 3.300; DE = digestive endoscopy, IF = 3.375; JGH = Journal Of Gastroenterology and Hepatology, IF = 3.483; HPDI = hepatobiliary & pancreatic diseases international, IF = 1.500; hepatology, IF = 14.079; DLD = digestive and liver disease, IF = 3.287; JOH = Journal Of hepatology, IF = 15.040; JPGN = Journal Of Pediatric Gastroenterology and Nutrition, IF = 2.752; CD = colorectal disease, IF = 2.778; APT = alimentary pharmacology & therapeutics, IF = 7.357; gut, IF = 17.016.

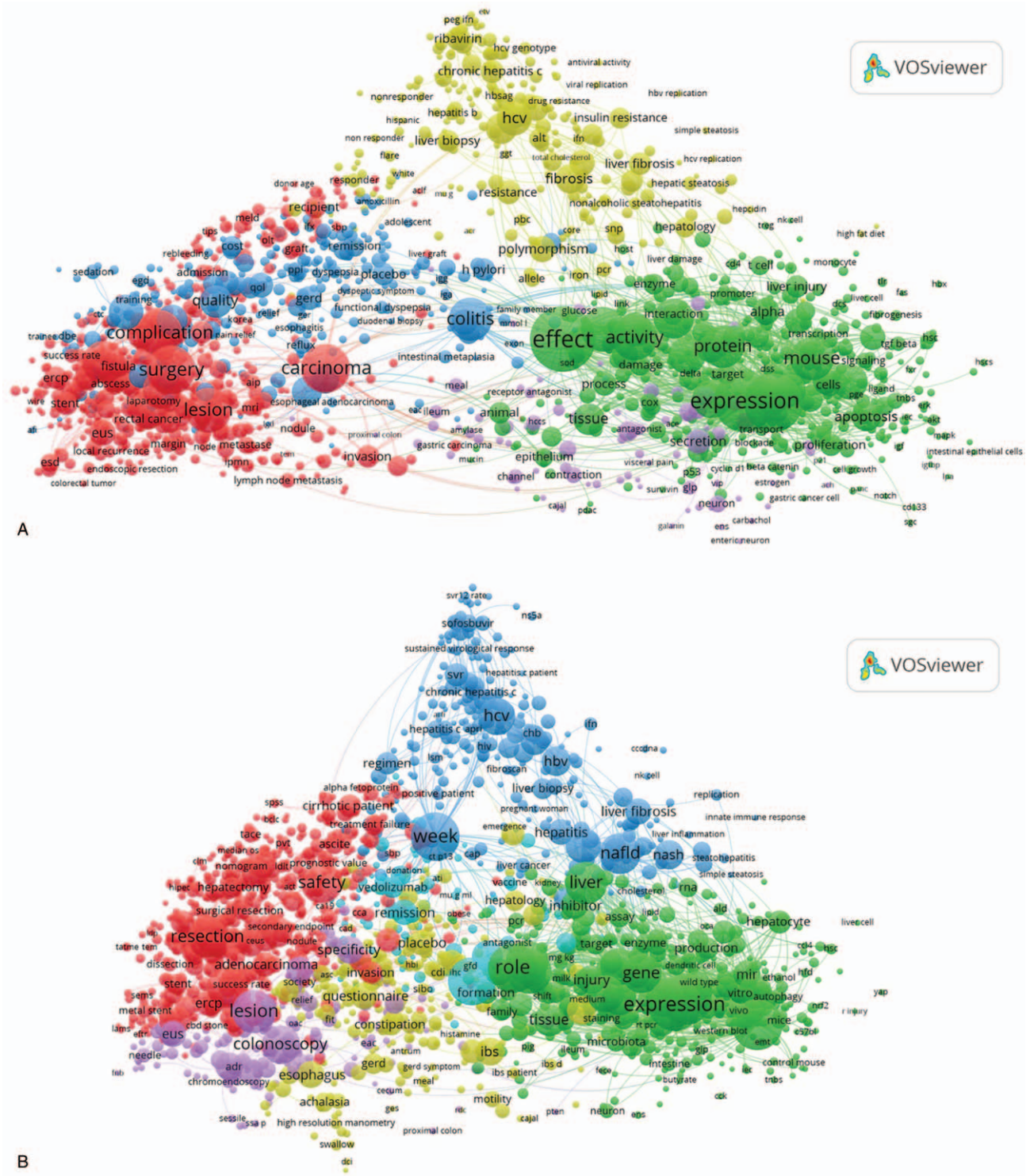

Figure 5. (A) The co-occurrence network map of researches in the field of gastroenterology and hepatology (GI) in 2009. (B) The co-occurrence network map of researches in GI in 2018. Each circle represents 1 term and terms with larger circles tend to be used more frequency. Terms shown with the same color mean the frequency of co-occurrence is higher and are listed together. The closer 2 terms in the map, the stronger their relation.

and number of medicine researchers were the main reasons for this progress. The number of projects in medical research funded by the National Natural Science Foundation of China increased from 3163 in 2010 to 4455 in 2017, and the funding per project increased from 314.6 thousand RMB in 2010 to 543.5 thousand RMB in 2017.[23] And the number of medical practitioners was nearly 2.83 million in 2017, with an increase of 48% from that in 2009,[24] which far exceeded the increase of China's general population during the same period. In addition, China has an advantage in recruiting participants for clinical trials due to the

large population with a high prevalence of digestive diseases.[24,25] This could also partly explain the gap between China and other countries regarding the share of RCTs in clinical trials.

The number of articles per capita may be influenced by population, the number, and research capacity of researchers. Italy had the most outputs per capita among 5 highest-output countries, nearly 16 times of that of China. In 2014, the number of clinician per 1000 people in Italy was 39.588, more than the USA (25.817), Japan (23.414), the UK (27.769), and China (16.989).[26] Apparently, the high proportion of medical workforce brings Italy enormous advantage in outputs per capita even compared with other developed countries. However, this seemly could not fully explain the huge gap between Italy and China. In fact, unlike developed countries in which clinicians generally receive at least 5 to 6 years of bachelor's degree education, among the 3 million clinicians in China, only half received a bachelor's degree[27] and a clinician generally began his research career only in graduate stage under the instruction of tutors. Thus, the proportion of clinicians capable to conduct medical research in China was lower and it is not surprising that China has lagged so far behind in output per capita.

For articles quality, the UK ranked 1st in the average IF, average ImI and average ACS. China was all at the bottom. In the UK, the medical education is more prone to interest-guided. Medical schools offer intercalated bachelor of science degree programs and focus on cultivating research skills. Junior doctors can gain research skills except for the compulsory foundation program and clinical competencies and have opportunities to begin academic career according to their interest and passion.[28] In China, medical education is more demand-oriented. At national level, due to the world largest population with a huge shortage of medical workforce, medical schools focus on students' basic clinical knowledge and skills so they can quickly serve the goal of elevating national health level proposed by government.[29] In consequence, Chinese junior doctors, especially in rural regions, generally lack research ability for high-quality study. On individual level, the academic evaluation system in China always focuses on the quantity of publications instead of quality, quantity is more meaningful to doctors or hospitals who want to apply for higher grade positions.[30,31] Besides, Western countries always focus on the medical humanities education which get less attention in China. It seems to have no direct association with medical research. But medical humanities education do have important meanings on cultivating students' professional, rigorous, honest, and responsible attitude required for high-quality research.[32]

In overall research highlights, the cluster of "gastrointestinal benign lesions" was turned into 2 main divisions: "functional gastrointestinal disorders" and "IBD". The cluster of "endoscopy" emerged. The cluster of "gastrointestinal nervous system" disappeared as huge progress in this field had been realized.[5] In specific fields, for liver disease, the NAFLD has got more attention as the most rapidly growing contributor to liver mortality and morbidity.[33] Regarding the IBD, since the clinical application of vedolizumab approved by Food and Drug Administration in 2013, many clinical researches had been conducted to verify its effect. Recent years, the researches were transferred to its safety.[34–36] For main research topics of 5 highest-ranking countries, viral hepatitis, NAFLD, and digestive system tumors were the focus due to their high prevalence or mortality worldwide. This result may predict the future direction of research and investment in GI field.

There were some limitations in this study. First, a small number of articles were not included in this research since the authors' affiliations were only recorded as city or state. Second, for China, we limited authors' affiliations to "China NOT Hong Kong NOT Taiwan," and only publications from Mainland China were retrieved. Third, we only retrieved journals from the "Gastroenterology and Hepatology" category established by JCR 2017. Some high-quality articles published in top general medicine journals were not captured by our search.

In conclusion, global output in GI field would be increasing due to the mainly highest-output countries' increasing trends in total output. The gap between developing countries and developed countries was still huge both in quantity and quality. Developing countries should be encouraged to conduct more high-quality researches in GI field.

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