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Assessing the national productivity in subspecialty critical care medicine journals: A bibliometric analysis☆,☆☆

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Abstract

Purpose: In recent years, significant growth has been seen in the subspecialty critical care medicine. However, the national productivity to the subspecialty critical care medicine remains unknown. We therefore intended to reveal the national contribution in the subspecialty critical care medicine journals.

Materials and Methods: Articles published in 20 highly cited journals in subspecialty critical care medicine from 2006 to 2010 were retrieved from Web of Science and PubMed. The number of total articles and randomized, controlled trials, the per capita numbers, total impact factors (IFs), and citations were tabulated to assess the contribution of different countries.

Results: A total number of 17 667 articles were published in the 20 journals from 2006 to 2010 worldwide. North America, West Europe, and East Asia were the most productive regions. High-income countries published 89.68% of the total articles. The United States published the most number of articles in 2006 to 2010 (6659/17 667, or 37.69%), followed by United Kingdom, Germany, France, and Australia. Besides, the United States also had the most number of randomized, controlled trials (260), the highest total impact factors (27 206.55), and the highest total citations (84 170). When normalized to population size, Australia had the highest number of articles per million population, followed by Netherlands, Switzerland, Austria, and Belgium.

Conclusion: The United States is the most productive country in the subspecialty critical care medicine. When normalized to population size, Australia and some European countries might be more productive.

1. Introduction

In recent years, significant growth has been seen in the subspecialty critical care medicine, along with the progress of other branches of biomedical research. The number of original articles published by a country or an institution is an important indicator of their contribution to the production of new knowledge in subspecialty critical care medicine [1].

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Because of the rapid advancement of Internet technology, communication in scientific information of biomedical research is much more convenient than before, especially after the wide use of some databases, including the PubMed and Web of Science. Based on the available search tools, large-size bibliometric analysis is feasible now.

In 2005, Michalopoulos et al [2] analyzed the worldwide research productivity in critical care medicine journals between 1995 and 2003. This literature survey aimed to quantify national contribution in the subspecialty critical care medicine worldwide based on the databases, Web of Science, and PubMed.

2. Methods

A total of 23 journals related to the subspecialty critical care medicine were selected from the "critical care medicine" category of Science Citation Index Expanded subject categories in Journal Citation Reports (JCR) 2010 established by the Institute for Scientific Information [3]. We only included the journals published in English, and therefore, 3 non-English journals were excluded (*Medicina Intensiva*, *Anasthesiologie & Intensivmedizin*, and *Anasthesie, Intensivtherapie, Notfallmedizin*). Finally, 20 journals were included in this study and are listed in Table 1.

A computerized literature search was conducted in Web of Science during December 10, 2011, to December 20, 2011. Articles published in the 20 journals from January 2006 to December 2010 were elicited, respectively. Only the original articles and reviews were included; letters were excluded. The titles of the journals were used to perform searches in Web of Science and PubMed. Articles that identified the first author's affiliation were considered as research output.

The primary outcome was the number of original articles attributed to each country. Countries were ranked in order of their productivity. For other secondary outcomes, we calculated the proportion of articles that was attributed to high income, upper middle-income, lower middle-income, and low-income countries, as categorized by the World Bank [3]. This categorization is according to gross national income per capita and includes high income, $12 276 or more; upper middle income, $3976 to $12 275; lower middle income, $1006 to $3975; and low income, $1005 or less [4].

To reveal the contribution of different countries, we analyzed the publication of the main productive countries and the 20 selected journals in 2006 to 2010, including the total numbers; the per capita numbers; numbers of randomized, controlled trials (RCTs); total impact factors (IF) (the number of publications multiplied by their IFs); and citations. Country-specific data were gathered from the United Nations Populations Division for the most recent reported period for each country [5].

We further made comprehensive analysis of the publication from the productive countries (countries that produced at least 1% of the total publications). The accumulated IFs and the average IF for each country were generated according to 2010 JCR. Afterwards, citation reports of the articles were also conducted. Besides, the publication from the top 5 countries was also generated. Finally, the top 5 countries in the high-impact journals (IF >4) were listed.

Table 1 Journals included in search from 2006 to 2010

Journal	Abbreviation	2010 IF	No. of articles	RCT (%)
American Journal of Respiratory and Critical Care Medicine	*AJRCCM*	10.191	1470	166 (11.29)
Critical Care Medicine	*CCM*	6.254	2087	194 (9.30)
Intensive Care Medicine	*ICM*	4.996	1242	108 (8.70)
Critical Care	*CC*	4.595	1658	98 (5.91)
Resuscitation	*Res*	4.177	1158	128 (11.05)
Journal of Neurotrauma	*JN*	3.426	849	20 (2.36)
Shock	*Sho*	3.203	976	11 (1.13)
Journal of Trauma	*JT*	3.129	2237	69 (3.08)
Pediatric Critical Care Medicine	*PCCM*	2.672	512	23 (4.49)
Current Opinion in Critical Care	*COCC*	2.551	452	0 (0)
Seminars in Respiratory and Critical Care Medicine	*SRCCM*	2.492	325	0 (0)
Neurocritical Care	*NC*	2.353	514	21 (4.09)
Critical Care Clinics	*CCC*	2.284	244	1 (0.41)
Injury	*Inj*	2.269	1199	29 (2.42)
Journal of Critical Care	*JCC*	2.077	405	30 (7.41)
Burns	*Bur*	1.718	755	41 (5.43)
American Journal of Critical Care	*AJCC*	1.593	236	12 (5.08)
Respiratory Care	*RC*	1.534	502	26 (5.18)
Anaesthesia and Intensive Care	*AIC*	1.128	664	106 (15.96)
Critical Care Nurse	*CCN*	0.928	182	0 (0)

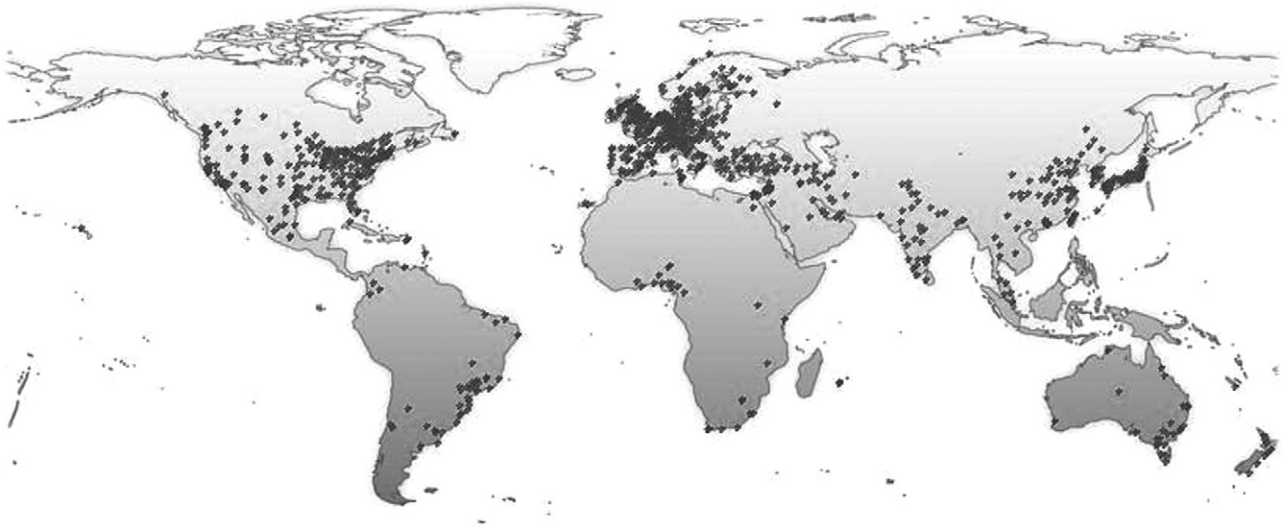

Fig. 1 The geographic distribution of the productive regions in 2006 to 2010 (in black).

2.1. Statistical analysis

Because our only goal is to describe trends and not to test hypotheses about the relative contribution of different countries, only simple descriptive statistics (eg, sum or average) are used.

3. Results

A total number of 17 667 articles were published in the 20 journals from 2006 to 2010 worldwide. Fig. 1 shows the world map of the productive areas, which showed that North America, West Europe, and East Asia were the most productive regions.

In our data set from 2006 to 2010, high-income countries published 15 844 articles (89.68%) (Fig. 2). Taken together, middle-income countries (sum of lower middle-income and upper middle-income countries) published 1804 articles (10.21%). However, low-income countries published just 19 articles (0.11%).

As shown in Table 1, there were 17 countries that produced at least 1% of total articles (Table 2). The 17 countries published 88.33% (15 606/17 667) of the total articles. The United States published the most number of articles from 2006 to 2010 (6659/17 667, or 37.69%), followed by the United Kingdom, Germany, Australia, and France. As for the production per capita, Australia had the highest number of articles per million population (38.84), followed by Netherlands, Switzerland, Austria, and Belgium.

Among the 17 countries, the United States had the highest total IFs (27 206.55), followed by the United Kingdom, Germany, France, and Canada. Spain had the highest mean IF (4.68), followed by Italy, France, Netherlands, and Canada. The United States had the highest total citations (84 170), followed by the United Kingdom, Germany, France, and Canada. Belgium had the highest mean citations (22.73), followed by Spain, Italy, Switzerland, and France.

The publication from the top 5 countries is shown in Table 3. Among the top 5 countries, the *Journal of Trauma* was the most popular journal in the United States, followed by *Injury* in the United Kingdom, *Critical Care* in Germany, *Anaesthesia and Intensive Care* in Australia, and *Intensive Care Medicine* in France. Besides, *Critical Care* appeared in 4 of the top 5 lists.

There were 5 high-impact journals (IF >4) among the 20 selected ones. The 5 most productive countries in the 5 high-impact journals are listed in Table 4. The United States was the most productive country in the 5 journals, except *Intensive Care Medicine*. France was the most productive country in *Intensive Care Medicine*. Besides, the United States and Germany appeared in the top 5 countries in all of the 5 journals. France appeared in the top 5 countries in 4 of the 5 journals.

The 20 journals published 1083 RCTs from 2006 to 2010. *Critical Care Medicine* published the most number of RCTs (194), followed by the *American Journal of Respiratory* and *Critical Care Medicine* (166), *Resuscitation* (128), *Intensive Care Medicine* (108), and *Anaesthesia and Intensive Care* (106). *Anaesthesia and Intensive Care*, *American Journal of Respiratory*, and *Critical Care Medicine* and *Resuscitation*

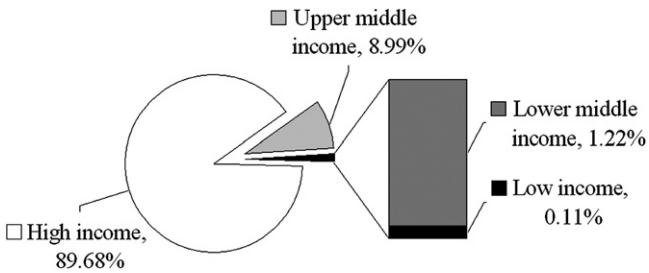

Fig. 2 Publications grouped by gross national income in 2006 to 2010.

Table 2 Publications from the most productive countries from 2006 to 2010

Country	N	Percentage	n per million population	RCT	Total IF	Mean IF	Total citation	Mean citation
United States	6659	37.69	21.57	260	27 206.55	4.09	84 170	12.64
United Kingdom	1195	6.76	19.61	68	4848.38	4.06	19 060	15.95
Germany	1033	5.85	12.58	70	4454.68	4.31	15 495	15.00
Australia	874	4.95	38.84	76	2588.22	2.96	10 820	12.38
France	862	4.88	13.17	67	3945.10	4.58	14 525	16.85
Canada	855	4.84	25.44	52	3763.08	4.40	14 236	16.65
China	819	4.64	0.59	47	2740.47	3.35	4169	5.09
Netherlands	623	3.53	37.76	49	2845.46	4.57	10 167	16.32
Italy	503	2.85	8.37	55	2331.86	4.64	8762	17.42
Japan	429	2.43	3.35	15	1841.05	4.29	5397	12.58
Belgium	284	1.61	27.58	22	1122.07	3.95	6455	22.73
Spain	282	1.60	6.04	22	1318.38	4.68	5550	19.68
Switzerland	270	1.53	34.84	19	1172.33	4.34	4639	17.18
Brazil	258	1.46	1.35	27	1036.65	4.02	3111	12.06
Austria	238	1.35	28.32	21	981.24	4.12	2823	11.86
Sweden	215	1.22	23.02	11	872.31	4.06	3382	15.73
Greece	207	1.17	18.30	19	781.71	3.78	2378	11.49

held the highest share of RCTs of the total articles. The United States published the most number of RCTs from 2006 to 2010 (260), followed by Australia (76), Germany (70), United Kingdom (68) and France (67).

4. Discussion

We found that authors from the United States published far more articles than any other country. As we all know, the United States has been recognized as the most productive country in biomedical research for about several decades. Besides, in critical care medicine, the United States also had overwhelming dominance in many other subfields of biomedical research, such as anesthesiology, gastroenterology, laboratory medicine, and other [6-8]. Compared with the production in 1995 to 2003 (39.5% of the world production), the United States maintained its overwhelming dominance in critical care in 2006 to 2010 [2].

Besides that the United States had the most number of articles and RCTs, the United States also had the highest accumulated IFs (27 206.55) and total citation (84 170). Most importantly, the United States also had high mean IF (4.09) and mean citation (12.64), which revealed that publication from the United States had not only large quantity but also high quality. Although the United States has a large population of about more than 300 million persons [5], the per capita numbers of articles from the United States remained one of the most numbers per million persons (21.57). These results documented that the United States was the most productive country in critical care medicine in the world.

In addition, when normalized to population size, some countries were more productive with largest number of articles per capita and high mean IF and citation, such as Australia, Netherlands, Switzerland, and Belgium. In fact, it may make more sense to normalize by the number of physicians in each country, not the population size. However, it is rather difficult to get the number of physicians in each country. Anyway, the productive countries are all developed ones. In fact, the high-income countries published nearly 90% of the total articles. In a way, the scientific publication might be a suggestive reflection of economy. Besides, it was remarkable that some countries with rapid economic development, such as China and Brazil, promoted their ranks in recent years. Our previous study showed that the number of articles published from Chinese authors increased markedly from 2000 to 2009 [9]. It could be forecasted that these countries with rapid economic development could further improve their critical care medicine research and promote their ranks in the future.

Table 3 Publication of the top countries

Rank	United States	United Kingdom	Germany	Australia	France
1	*JT* (1382)	*Inj* (270)	*CC* (162)	*AIC* (333)	*ICM* (238)
2	*CCM* (930)	*CC* (156)	*CCM* (144)	*Inj* (73)	*CCM* (172)
3	*AJRCC* (622)	*AJRCC* (141)	*ICM* (115)	*ICM* (64)	*CC* (161)
4	*RC* (376)	*Res* (128)	*Sho* (98)	*CC* (63)	*AJRCC* (73)
5	*NC* (350)	*Bur* (89)	*Res* (92)	*Bur* (56)	*COCC* (33)

Table 4 Top 5 countries in the high-impact journals

Rank	*AJRCC*	*CCM*	*ICM*	*CC*	*Res*
1	United States (400)	United States (930)	France (238)	United States (312)	United States (322)
2	United Kingdom (141)	France (172)	United States (134)	Germany (162)	United Kingdom (128)
3	Canada (106)	Germany (144)	Germany (115)	France (161)	Germany (92)
4	France (76)	Canada (123)	Italy (96)	United Kingdom (156)	Norway (53)
5	Germany (71)	Netherlands (86)	Netherlands (88)	Nertherlands (118)	Austria (34)

The most popular journals in the United States were *Journal of Trauma*, *Critical Care Medicine*, *American Journal of Respiratory and Critical Care Medicine*, *Respiratory Care*, and *Neurocritical Care*. Meanwhile, the most productive country of the 5 journals was the United States. In fact, these journals are almost all published in the United States.

This study only enclosed publications in English because it is well known that English is the international scientific language [10]. The Institute for Scientific Information and PubMed databases mainly include journals in this language, which renders it difficult for journals in other languages to gain high impact [11]. This mainly jeopardized Germany and Spain, whose journals (Germany: *Anasthesiologie & Intensivmedizin* and *Anasthesie, Intensivtherapie, Notfallmedizin*; Spain: *Medicina Intensiva*) were not included in this study because of their relative lower international impact.

There are some limitations of our study. Although the journals were selected from the critical care medicine category of the JCR, a few journals may cover disciplines beyond critical care medicine. In addition, some general medicine journals (such as *NEJM*, *JAMA*, *Lancet*, etc), which might also published a few articles related to critical care medicine, were not included in this study. Nevertheless, the 20 highly cited journals included in this bibliometric analysis could represent the major journals devoted to the discipline of critical care medicine. Finally, the literature search was based on the first author's affiliate, which surely undermined some multicenter, multinational studies with different first author affiliate and corresponding author affiliate.

In conclusion, the United States is the most productive country in the subspecialty critical care medicine. When normalized to population size, Australia and some European countries might be more productive.

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