EDITORIAL

Scientometric Analysis of Toxicology in Asia Pacific Region: Signs of Growth

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Abstract

Background: In recent decades, the science of toxicology in Asia Pacific (AP) region has been expanding. In this study, the productivity of the science of toxicology in the timeframe of the years 1996 to 2013 in AP region was evaluated and was compared with Northern America (NA) region.
Methods: The SCImago portal was accessed to obtain the scientific indicators of toxicology science. The subject category of "toxicology" was used. In the SCImago portal, the AP region is divided into three sub-regions, Asiatic (AS), Pacific (PA) and Middle East (ME). To standardize the results, number of documents and citations of AP sub-regions in each time point were divided by their corresponding information from NA region.
Results: In 1996, 3674 toxicology documents were published from NA region while in the same time 1308 documents were published from AS, 130 from PA and 144 from ME. These figures increased to 3985, 3893, 354 and 788 in the year 2013. While the total number of publications per year remained relatively stable in NA region over this 18-year period, this figure increased for AS and PA regions by about 3 times and for ME by about 5 times. The number of citations in the field of toxicology in AS, ME and PA regions, however, is still far behind NA. The percentage of toxicology documents that were produced through international collaboration in PA region was considerably higher than NA, AS and ME regions.
Conclusion: The productivity of toxicology science in AP region has been increased over the past 18 years, though the level of citations is low compared to NA countries. International collaborations should be seriously considered and strengthen in AP countries.

Keywords: Asia; Bibliometrics; International Cooperation; Oceania; Toxicology

How to cite this article: Afshari R. Scientometric Analysis of Toxicology in Asia Pacific Region: Signs of Growth. Asia Pac J Med Toxicol 2014;3:92-6.

INTRODUCTION

Each aspect of science including toxicology (medical and basic) is growing worldwide. In order to have a better understanding, it is important to evaluate the trend of science production and the impact of scientific literature through the time, and to compare geographical regions with each other (1), in a process that is called scientometrics. Although scientometric analysis (SA) is useful to appreciate the evolution of science, its output is controversial. SA can produce surrogates of science production, and make science production comparative and competitive. Nevertheless, SA may sacrifice quality at the expense of quantity of scientific products and may encourage publishing low-quality papers, or even discourages production of applied science that is less likely to be cited.

In recent decades, the science of toxicology in Asia Pacific (AP) region has been expanding as the infrastructures of this science has been established and developed (2,3). In this study, the productivity of the science of toxicology in AP region was evaluated over the period of the past 18 years and was compared with Northern America (NA) region.

METHODS

The SCImago portal that includes scientific indicators developed from the information by the Scopus® database (Elsevier B.V., Amsterdam, Netherlands) was accessed to obtain the scientific indicators of toxicology science (4). As no subject category for "medical toxicology" or "clinical toxicology" was available in this portal, the subject category of "toxicology" was alternatively used.

The establishment of medical toxicology in AP region is in part relied upon the activities of Asia Pacific Association of Medical Toxicology (APAMT) that brings prominent medical toxicologists together and acts as a platform to share their capabilities and knowledge. In the SCImago portal, the area related to the APAMT is divided into three sub-regions, Asiatic (AS), Pacific (PA) and Middle East (ME). It should be noted that scientific documents of Turkey, Egypt and Israeli State are illustrated in output of the ME region in SCImago, though they are not included in the APAMT. For comparing growth ratios, Northern America (NA) region was considered as the baseline. The analysis was done on the timeframe of the years 1996 to

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2013. To standardize the results, number of documents and citations of AP sub-regions in each time point were divided by their corresponding information from NA region. Country ranking of toxicology science production in the AP region was also reported independently.

RESULTS

Science production

In 1996, only one Asian country (Japan; which was ranked 2nd) was among the first 7 productive countries in toxicology science. However, up to 2013 the spectrum has drastically shifted towards Asia, in which 4 out of 7 leading countries were Asian including China (2nd), India (3rd), Japan (5th) and South Korea (7th).

AP sub-regions: In 1996, 3674 documents were published from NA region while in the same time, 1308 documents were published from AS, 130 from PA and 144 from ME. These figures increased to 3985, 3893, 354 and 788 in the year 2013 (Figure 1). While the total number of publications per year remained relatively stable in NA region over this 18-year period, these figures increased for AS and PA regions by about 3 times and for ME by about 5 times. When the figures of AP sub-regions in each year were standardized based on NA region, a similar pattern existed (Figure 2). The number of citations in the field of toxicology in AS, ME and PA regions, however, is still far behind NA (Figure 3). When the NA standardized citation figures of AP sub-regions were considered, a similar pattern to number of documents was observed (Figure 4 vs. 2).

The pattern of these increments; however, were not reflected in the citation per documents. It is also worth mentioning that 2013 H-indices in toxicology stood at 253 in NA, 133 in AS, 92 in PA and 79 in ME.

Country-wise: The ranking of AP countries in production of toxicology science is shown in table 1. As can be seen, ten leading countries were as follow [country (number of documents; 2013 H-index)]: Japan (12223; 107), China (9693; 83), India (8046; 75), South Korea (4402; 67), Australia (3164; 85), Taiwan (2704; 65), Iran (1351; 40), Hong Kong (793; 57), New Zealand (708; 50) and Thailand (536; 34). It should be noted that the ranks will be slightly changed when the H-index is taken into account instead of number of documents.

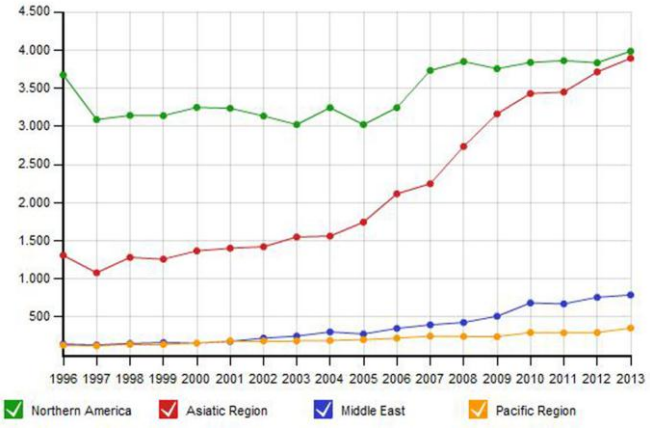

Figure 1. Number of documents in the field of toxicology per year in each region. SCImago Research Group [image on the Internet]. 2014 [cited 2014 Aug 9]. Available from: http://www.scimagojr.com

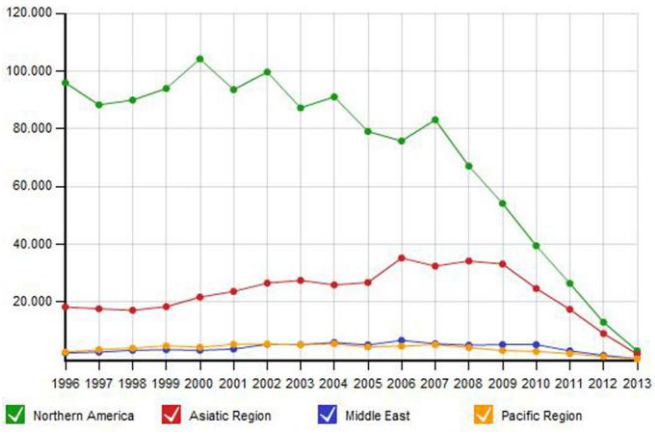

Figure 3. Number of citations in the field of toxicology per year in each region. SCImago Research Group [image on the Internet]. 2014 [cited 2014 Aug 9]. Available from: http://www.scimagojr.com

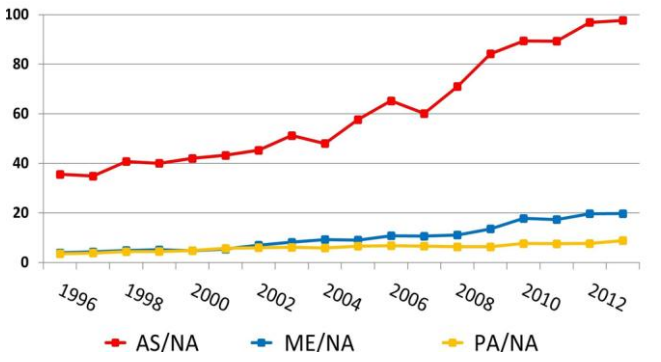

Figure 2. Ratio of toxicology science production in Asia Pacific region to Northern America region (Documents per year in each Asia Pacific sub-regions/Documents per year in Northern America region × 100)

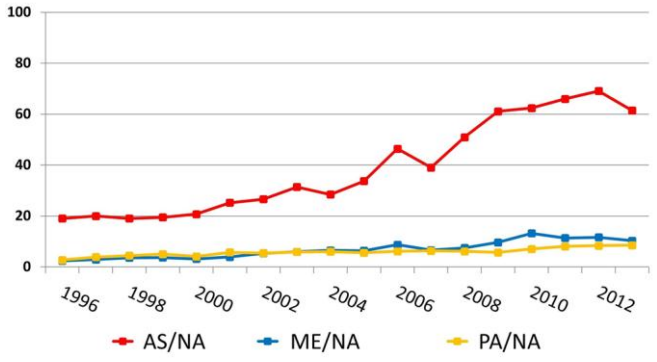

Figure 4. Ratio of citations in the field of toxicology in Asia Pacific region to Northern America region (Citations per year in each Asia Pacific sub-regions/Citations per year in Northern America region × 100)

Table 1. Country rankings of toxicology science production in countries related to the Asia Pacific Association of Medical Toxicology from 1996 to 2013 (Retrieved from: http://www.scimagojr.com)

Rank	Country	Sub-region	Documents	Citations	H-index
1	Japan	AS	12,223	154,125	107
2	China	AS	9,693	83,747	83
3	India	AS	8,046	73,902	75
4	South Korea	AS	4,402	44,255	67
5	Australia	PA	3,164	56,414	85
6	Taiwan	AS	2,704	35,572	65
7	Iran	ME	1,351	10,272	40
8	Hong Kong	AS	793	15,666	57
9	New Zealand	PA	708	12,314	50
10	Thailand	AS	536	5,547	34
11	Saudi Arabia	ME	487	4,039	30
12	Malaysia	AS	477	3,254	28
13	Pakistan	AS	316	2,869	25
14	Singapore	AS	309	5,099	36
15	United Arab Emirates	ME	196	2,512	24
16	Lebanon	ME	115	1,693	22
17	Bangladesh	AS	111	1,056	18
18	Sri Lanka	AS	109	817	14
19	Jordan	ME	103	1,258	17
20	Kuwait	ME	98	908	18
21	Vietnam	AS	85	1,133	20
22	Indonesia	AS	76	1,012	17
23	Philippines	AS	64	1,207	20
24	Uzbekistan	AS	53	121	7
25	Oman	ME	48	776	13
26	Qatar	ME	35	165	7
27	Palestine	ME	33	212	8
28	Iraq	ME	32	136	8
29	Nepal	AS	24	107	6
30	French Polynesia	PA	19	337	10
31	Syria	ME	19	193	8
32	New Caledonia	PA	17	224	9
33	Kazakhstan	AS	13	51	5
34	Yemen	ME	12	162	6
35	Cambodia	AS	10	228	7
36	Macao	AS	9	32	3
37	Mongolia	AS	9	27	3
38	Guam	PA	8	55	4
39	Bahrain	ME	8	13	2
40	North Korea	AS	7	115	4
41	Papua New Guinea	PA	7	48	4
42	Fiji	PA	5	29	3
43	Afghanistan	AS	5	27	3
44	Tajikistan	AS	5	19	1
45	Laos	AS	4	45	3

Table 1. Continued.

Rank	Country	Sub-region	Documents	Citations	H-index
46	Kyrgyzstan	AS	4	5	1
47	Brunei	AS	3	126	3
48	Myanmar	AS	2	11	2
50	Micronesia	PA	1	23	1
51	Tonga	PA	1	14	1
52	Vanuatu	PA	1	9	1
53	Northern Mariana Islands	AS	1	2	1
54	Bhutan	AS	1	1	1
55	Cook Islands	PA	1	0	0

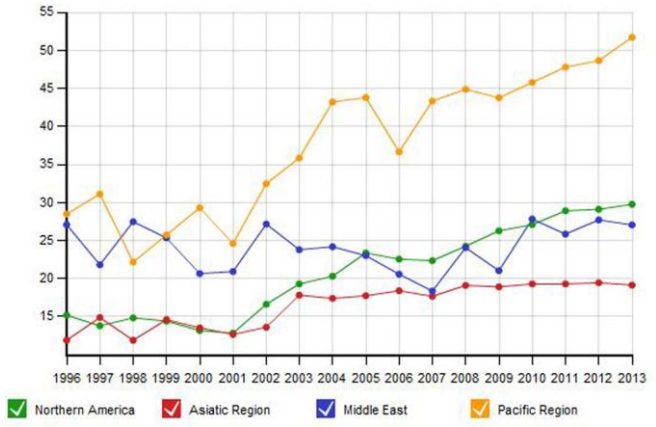

Figure 5. International collaboration in toxicology (Percentage of documents written by authors of more than one country per year in each region). SCImago Research Group [image on the Internet]. 2014 [cited 2014 Aug 9]. Available from: http://www.scimagojr.com

International collaboration

International collaboration has played a key role in growth of the science. The percentage of toxicology documents that were produced through international collaboration (documents whose affiliation includes more than one country address) for each AP sub-region is shown in figure 5.

As can be seen, international collaboration in PA region is considerably higher than NA, AS and ME regions. Moreover, in this 18-year period (from 1996 to 2013), international collaboration increased in NA (from 15.2% to 29.8%), PA (from 28.5% to 51.7%) and AS (from 11.9% to 19.1%) regions while it was relatively stable in ME region (from 27.1% to 27.0%).

DISCUSSION

The majority of the 7 most science productive countries in the field of toxicology in 2013 are from AP region. Number of documents in the field of toxicology in AP region has already overtaken NA. Within AP region, ME and PA sub-regions are far behind AS. The growth rate in science production as well as citations was higher in AS followed by ME and PA regions.

One of the goals of the APAMT is "the growth of the science of medical toxicology in the AP region" (2). Regarding the number of documents, it seems that this goal has been better achieved in this region compared to NA region, a fact that should be celebrated. However, for improvement of the level of citations much work should be done.

Production of science could be attributed to two independent variables including (a) structural and (b) contextual factors. In terms of structure, AP region is still expanding as the number of medical schools, toxicology graduates, journals and other infrastructure develop, hence the fast-paced growth of toxicology science. Nevertheless, the extent of science production in NA region was shown to be stable or in a better word settled. This is probably due to the fact that this region has already reached a certain level of development in science and the related infrastructures, which can be called "ceiling effect of science production quantity". Similar to NA, PA region has structurally achieved a certain level of development. Yet, in context, PA region has been successful in maintaining widespread international collaborations. Over 50% of PA documents are coauthored by scientists from other regions. This is what helped the scientific growth in PA region to be still increasing, which can be attributed to a phenomenon named "the rise of the rest" (5). It has been proven that the impact of papers produced by international collaborations is higher compared to papers authored solely by researchers of a single country (6). PA collaborative activities should therefore be taken as a model for entire AP region and in particular ME countries. These countries should "elevate themselves with the rest" to narrow the gaps and reach to the potential ceiling. It should be kept in mind that scientific south-south collaboration in conjunction with north-south collaboration would help to increase the rate of citations and in general the development of medical toxicology in the AP region (7).

CONCLUSION

The productivity of toxicology science in AP region has been increased over the past 18 years, though the level of citations is far behind NA countries. International collaborations should be seriously considered and strengthen

in AP countries. This forum is open for further discussions in next issues of the journal.

ACKNOWLEDGMENT

I would like to acknowledge the effective inputs of Dr. Seyed Mostafa Monzavi.

Conflict of interest: The author is currently serving as the president of the APAMT.

Funding and support: None.

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