

TITLE:

Publications in ISI-indexed public health journals from mainland China, Hong Kong and Taiwan during 1999–2008

ABSTRACT:

BACKGROUND: There has been a steady increase in China's annual research output. We aimed to investigate the research output in public health from 3 major regions of China: mainland China (ML), Hong Kong (HK) and Taiwan (TW). **MATERIAL/METHODS:** We retrieved papers published in 105 public health-related journals from ML, HK and TW with the applications of the ISI Web of Knowledge database. The total papers, impact factor, times cited, papers published in the highest impact factor journals, and most often published journals were analyzed for quantity and quality comparisons among the 3 regions. **RESULTS:** Totally, 2587 papers were published during 1999–2008, including 1089 (42.1%) from ML, 471 (18.2%) from HK, and 1027 (39.7%) from TW. The total annual number of papers from the 3 regions increased significantly, from 140 in 1999 to 424 in 2008. The average impact factor of papers from TW (2.588) was higher than those from HK (2.531) and ML (1.568). The average number of times cited of each paper from TW was 8.84, followed by 8.34 from HK and 5.90 from ML. Excluding publications in Biomedical and Environmental Sciences, papers from ML had higher average IF and average times cited. TW had the most articles published in the highest impact factor journals, and HK had the highest total IF of most often published journals. **CONCLUSIONS:** The total number of papers in public health from China increased significantly during 1999–2008. ML contributed the highest annual paper output compared with HK and TW, but papers from ML are more often locally published and less frequently cited.

Background:

In the past 50 years, China has made great advances in controlling infectious diseases and improving public health and hygiene. In recent years, the public health system of China has been greatly impacted by the outbreaks of severe acute respiratory syndrome (SARS), avian influenza, and Influenza A (H1N1). Accordingly, the concept of public health and the capacity to respond to public health emergencies has improved in the public health system, but there also are greater difficulties than ever before [1]. Despite the great improvements in public health status in the whole country, scientific research in the field and publication output are unknown. ScienceWatch.com (updated weekly) provides a behind-the-scenes look at the scientists, journals, institutions, nations, and papers selected by Essential Science IndicatorsSM from Thomson Reuters and other products of the Research Services Group. According to ScienceWatch.com in December 2009, China ranked 5th place in number of papers in all fields and the 9th place in total citations [2]. The research productivity by various world regions has been studied for several biomedical fields [3,4]. Several studies have also investigated the scientific production of China in various biomedical fields [5–9]; however, there have been no studies evaluating the quantity and quality of Chinese research production in public health. The present study aimed to evaluate the contributions of China in the field of public health, focusing on the 3 major regions: mainland China (ML), Hong Kong (HK), and Taiwan (TW).

Search strategy :: Material and Methods:

We performed our study with the applications of “Journal Citation Report” and “Web of Science” in the ISI Web of Knowledge database, which is a searchable multidisciplinary science database covering influential or high-quality medical journals from around the world. For each paper “Web of Science” defines the “Reprint Address” as the first affiliation, which is often the institution where the study was carried out and also the most important affiliation for multi-affiliation papers; therefore, we selected the papers with the first affiliation located in ML, HK and TW and analyzed them accordingly. Meanwhile, we searched all papers with any affiliated author from 1 of the 3 regions for international cooperation analysis.

From the ISI Web of Knowledge database, we selected all 105 public health-related journals covered by the “2008 JCR Science Edition” under the subject category of “Public, environmental & occupational health”. This category covers resources dealing with epidemiology, hygiene, and health; parasitic diseases and parasitology; tropical medicine; industrial medicine; occupational medicine; infection control; and preventive medicine.

After identification of the 105 journals, we ran the “Web of Science” application in the ISI Web of Knowledge database. Advanced search was applied in the ISI database using the following terms: SO = (the full name of 1 of the above journals) AND PY = (1999–2008) AND (AD=(China NOT Hong Kong)) for papers from ML, SO = (the full name of 1 of the above journals) AND PY = (1999–2008) AND (AD=(Hong Kong)) for papers from HK, and SO = (the full name of 1 of the above journals) AND PY = (1999–2008) AND (AD = (Taiwan)) for papers from TW. After entering the keywords, the search engine produced a list of papers. We then downloaded the search results, including all available abstracts. The above procedure was performed in exactly the same way for all of the 105 journals on February 27, 2010. Subsequently, we analyzed the Countries/Territories of all the papers from each of the 3 regions using the “Combine Search History” and “Refine Results” functions on “Web of Science”. Publication types were limited to Article, Review, Editorial, and Letter. Then, we manually selected the downloaded papers with the first author affiliation located in ML, HK, and TW with the aforementioned publication types. For each selected paper, the times cited current to the date of February 27, 2010 was recorded.

Searching results analysis ::: Material and Methods:

To compare the quantity and quality of research papers from the 3 regions, we applied the following measures. First, the numbers of papers from the 3 regions during the 10-year period were counted and analyzed for international cooperation status. Second, the average impact factor (IF) was generated according to the Journal Citation Report (JCR) 2009 established by the ISI [10]. Third, total times cited and times cited per paper based on the literature searching date (February 27, 2010) were calculated for each of the 3 regions. In addition, papers published in the top10 highest impact factor public health journals were generated; the top10 public health journals in which authors published most often among the 3 regions were determined according to the numbers of published papers. Both data searching and paper selection processes were performed independently by 2 authors (Zheng ML and Yang LL). Discrepancies were resolved by consensus.

Statistical analysis ::: Material and Methods:

All data collection and calculation were performed in MS Excel 2003. Statistical analyses were performed using SPSS 16.0, except the trend test, which was performed in SAS 8.0. The Cochran-Armitage trend test was used to determine whether the total numbers of papers increased significantly over the 10-year period in each of the 3 regions. The Kruskal-Wallis test was used to detect the difference among the 3 regions. The test for significance was 2-tailed, and P values less than 0.05 were considered statistically significant.

Total number of papers ::: Results:

A total of 112 473 papers were published worldwide in the 105 selected journals during 1999–2008. There were 2587 (2.3%) papers with the first affiliation from the 3 regions of China, including 1089 (42.1%) from ML, 471 (18.2%) from HK, and 1027 (39.7%) from TW. These papers comprised 57.3% (1089/1902), 80.8% (471/583), and 88.2% (1027/1164) of the total papers with any affiliation order from ML, HK and TW. The total number of papers from the 3 regions increased from 140 in 1999 to 424 in 2008. The numbers of papers increased significantly over the 10 years in each of the 3 regions: from 44 to 226 in ML, from 28 to 61 in HK, and from 68 to 137 in TW (all $P < 0.001$ for trend) (Figure 1). Article was the most predominant publication type in all 3 regions, comprising 96.1% (1047/1089), 87.5% (412/471), and 94.7% (973/1027) of the total publications from ML, HK and TW, respectively. HK had the lowest annual paper output during the period, TW had the most papers annually contributed between 1999 and 2003, while ML took the place of TW in contributing the most papers annually during 2006–2008. In 2008, the number of papers from ML (226) exceeded the combined number of papers from HK (61) and TW (137).

International cooperation ::: Results:

Between 1999 and 2008, 1902, 583 and 1164 papers with any author order were published from ML, HK and TW, respectively, among which 994 (52.3%), 198 (34.0%) and 265 (22.8%) papers, respectively, showed international cooperation. ML's researchers cooperated with colleagues in 87 countries, while researchers from HK and TW both cooperated with colleagues in 37 countries, indicating a higher level of international cooperation in ML researchers. The USA, as the most important collaborating partner in the 3 regions, contributed to 60.7% (603), 32.3% (64) and 83.0% (220) of papers with international cooperation in ML, HK and TW, respectively. Japan and Australia were the second and third most important collaborating partners in ML, contributing in

13.1% (130) and 8.8% (87) papers with international cooperation, respectively. England and Australia were the second and third most important collaborating partners both in HK and TW. ML and HK cooperated in 30 papers, ML and TW cooperated in 9 papers, and HK and TW cooperated in 5 papers.

The average impact factors ::: Results:

According to the JCR in 2009, the average IF of papers from TW (2.588) was significantly higher than those of HK (2.531) and ML (1.568) ($P < 0.001$) (Table 1).

Times cited of papers published in public health journals ::: Results:

Current to the searching date of February 27, 2010, TW had the most total times cited of 7603, followed by ML of 4949 and HK of 3432 ($P = 0.004$). Meanwhile, TW had the most times cited per paper (8.84), followed by HK (8.34) and ML (5.90), but the difference was not significant ($P = 0.279$, Table 2).

The journal Biomedical and Environmental Sciences ::: Results:

The Biomedical and Environmental Sciences (BES) was jointly established by the Chinese Center for Disease Control and Prevention and the Coulston International Corporation (CIC), USA in 1988, with the editorial office based in China. It has been covered by Web of Science since 1999. Between 1999 and 2008, only 5 papers from HK and none from TW were published in BES; however, 444 papers from ML were published in BES, accounting for 79.6% (444/558) of the journal's total publications and a large proportion of the total public health output from ML (444/1089, 40.8%). Excluding the publications in BES, ML had a lower level of increase in the number of annual papers, and only surpassed TW in the year 2008 (Figure 1). Excluding the publications in BES, the average impact factor of papers from ML was 2.257, in comparison to 1.568 when BES was included in the analysis (Table 1), and the average times cited per paper was 6.73 in comparison to 5.90 when BES was included (Table 2). The average impact factor and average times cited of papers from HK were also slightly higher when BES publications were not included in the analysis (Table 2).

High impacted public health journals ::: Results:

Excluding 3 annual review journals, a total of 320 papers were published in the top10 highest impact factor public health journals. Among them, 206 (64.4%) papers were published in Environmental Health Perspectives, Cancer Epidemiology Biomarkers & Prevention, American Journal of Epidemiology, and International Journal of Epidemiology. TW published 160 (50%) papers in these high-impact journals, while ML and HK published 89 (28%) and 70 (22%), respectively (Table 3).

Public health journals in which authors published most often ::: Results:

The journals in which authors published most often among the 3 regions are shown in Table 4. Biomedical and Environmental Sciences, Indoor and Built Environment, and American Journal of Tropical Medicine and Hygiene were the journals most often published in by authors from ML, HK and TW. No journal in which authors of all 3 regions were published in ranked among the top 10 journal lists. The accumulated IF of the top 10 journals in ML (18.610) was the lowest in comparison with HK (28.944) and TW (26.438) (Table 4).

Discussion:

The number of public health papers from the 3 regions of China greatly increased during this period. ML surpassed HK and TW in the number of annual papers published. ML exceeded both HK and TW in the annual number of papers from 2005 onward, showing a total growth of 414% over the 10 years, from 44 to 226. However, this is to be expected, given the very large population of ML compared to HK and TW. On a "per capita" (per total number of residents) basis, ML is significantly underperforming compared to HK and TW. Moreover, the large increase in ML was attributed to the ML-based journal BES, because 40.8% of ML's public health papers were published in BES. This reveals another interesting issue – more ML medical journals in the English language enter the ISI database [11], which causes a larger number of high-quality papers published from ML to be indexed by the ISI database, as reported in the field of gastroenterology by Gao et al [8]. Paraje et al. [12] revealed that China's increasing proportion of worldwide outputs addressing health topics can be attributed to specific changes in research policies. At least 1 paper indexed in SCIE is required for most academic promotions in ML China, and each paper is

financially rewarded by means of cash or financial support. In addition, the rapid and steady economic growth in China promotes scientific research development. Besides the increased quantity of public health papers from the 3 regions, the average IF also showed improvement, but there were more gaps between the regions. TW had the highest scores in the average IF (2.588), total times cited (7603), and times cited per paper (8.84). In contrast, ML showed the lowest average IF (1.568) and times cited per paper (5.90). Excluding the publications in BES, the papers from ML showed higher average IF and average times cited per paper. In the top 10 highest impact factor public health journals, TW published 161 papers, accounting for 50% of the total from the 3 regions. Among the public health journals most often published in by authors from each region, HK showed the highest total IF. All these data indicate that although the papers from ML increased in number, those papers tended to appear in journals with lower IF and they were less frequently cited than papers from TW and HK. As the number of publications and citations are increasing worldwide, IF is expected to generally increase; consequently, it is not surprising to see the increased IF in the public health field in China. However, the papers from ML showed lower average IF compared with those from HK and TW, especially when BES was included in the analysis, which implies that BES articles are not often cited. Including publications from this journal in the statistics for ML could artificially lower the average number of times an article is cited and the average IF. Therefore, to increase the average IF of articles from ML, perhaps the best approach is to aim to publish in international journals that are more likely to be cited. Similarly, Chen et al. [13] revealed that research papers from TW with international collaboration usually appeared in journals with higher impact factors than those without international collaboration. On the other hand, there is regional disparity in the field of public health. TW and HK have been at the forefront of scientific and medical research for many years, whereas public health in ML has always been a weaker sector because of the large population and the relatively lower economic development. By investing 4.7% of the gross domestic product (GDP) in health care, HK developed health statistics comparable to those in leading Western nations, whereas ML's 3.6% of GDP expenditure on health produced health statistics similar to those found in most developing countries [14]. Compared with HK, the public health challenges in ML are massive, especially in terms of health inequalities between developed urban areas and less developed rural areas [15]. In view of such disparities, it can be expected that the research output from ML might be lagged behind HK, as research output requires further necessary financial funding and proper human resources. TW commenced early to emphasize the importance of preventive health, and has reaped many successes both in preventive health care and chronic disease control [16]. While all of the 3 regions face problems associated with their economic development and unique environment, ML faces the same challenge on a greater scale, compounded by various other problems, including poor capacity to respond to public health emergencies, severe inequality of health care services, and lagging development of public health information systems [4].

There have been various reports on scientific publications from ML, HK and TW in the fields of gastroenterology and hepatology, cardiology and cardiovascular, critical intensive medicine, infectious disease, and anesthesiology. All of these studies revealed that research output in the 3 regions of China increased dramatically over a 10-year period [5–9], which is consistent with the public health publication evaluated in the present study. Meanwhile, although ML exceeded TW and HK in the research output in gastroenterology and cardiology, ML kept the lower average IF score compared with HK and TW [6,8]. It is the same case in the public health publications in the present study, which implies that enthusiasm for scientific research in ML has grown in recent years, but there is room for improving researchers' skills in study design, writing and publishing, so as to promote more outstanding research output, in comparison with the conditions in HK and TW.

We should be aware that IF measures the "impact" of a journal and is not a good indicator of the quality of any one particular paper within that journal. With IF, all comparisons should include only journals and never individuals or departments. Only similar journals (particularly those dedicated to the same scientific specialty) should be compared, because the value of the impact factor varies greatly by discipline [17]. In the present study, IF was used as a rough measure of how influential a paper is. It may not be the optimal parameter for determining the quality of papers, but it is the best available parameter for determining the quality of studies.

Our study has certain limitations. We selected the public health-related journals in the subject category of "Public, environmental & occupational health" in SCIE, but some of the journals are multidisciplinary and also deal with subjects like environmental science, thus the included papers in such journals may not be public health-oriented. Since the ISI database only categorizes the

publication types into Article, Review, Editorial, Letter, and News, we cannot analyze the proportions of randomized clinical trials, clinical trials, and case reports in our selected papers. As Macau produced a very small number of papers during our pilot search, this region was not included in the final design, but the present study should reflect the exact status of public health-related output in the whole of China.

Conclusions:

We evaluated the research output in the field of public health in 3 major regions of China over a 10-year period. There was a significant increase in the annual output of papers in all 3 regions. While the quantity of papers from ML exceeded those from HK and TW, the overall quality of papers from ML lagged behind those from TW and HK. ML researchers should publish in international journals that are more likely to be cited.