ABSTRACT

Objectives: Respiratory disease remains one of the leading causes of morbidity and mortality in China. However, little is known about the research status of respiratory disease in three major regions of China—Mainland (ML), Hong Kong (HK) and Taiwan (TW). A 10-year survey of literature was conducted to compare the three regions’ outputs in the research of respirology.

Design: A bibliometric study.

Participants and outcome measures: A literature search in PubMed database, updated as of September 2012, led to the identification of the related articles from 2000 to 2009. The number of total articles, randomised controlled trials, case reports, meta-analysis, impact factors (IF), citations and articles published in top general medicine journals was collected for quantity and quality comparisons.

Results: 2208 articles were collected, 814 from ML, 909 from TW and 485 from HK. The total number of articles from the three regions has increased significantly from 2000 to 2009. The number of articles published per year from ML has exceeded that from HK in 2005 and TW in 2008. The accumulated IF of articles from TW (3192.417) was much higher than that from ML (2409.956) and HK (1898.312). HK got the highest average IF of respirology articles and the majority of articles were published in top general medicine journals.

Conclusions: The total number of published articles from the three major regions of China has increased notably from 2000 to 2009. The annual number of publications by ML researchers exceeded those from TW and HK. However, the quality of articles from TW and HK is better than that from ML.

INTRODUCTION

Pulmonary diseases are a matter of concern for all the countries. Lung disease accounts for 15% of disability-adjusted life years1 and may be the first cause of mortality in the world.2,3

In China, under the influence of the dramatic economic evolution and urbanisation progress, the levels and patterns of outdoor and indoor air pollutants have greatly changed. Hundreds of cities suffer the sub-standard air quality according to the WHO guidelines.4 Besides, with a population of 1.3 billion, China has become a major contributor to the worldwide respiratory disease burden.5,6 In terms of the mortality rate, respiratory disease comes the first in rural areas and the fourth in urban areas in China. However, little is known about the research status of respirology in the three major regions of China—Mainland (ML), Hong Kong (HK) and Taiwan (TW).7 We, therefore, conducted a 10-year survey of literature and compared these three regions’ outputs in the research of respirology.

MATERIALS AND METHODS

A total of 46 journals related to respirology were selected from the ‘respiratory system’ category of Science Citation Index Expanded (SCIE) subject categories by the Institute for Scientific Information (ISI).8 The category covers resources dealing with the diagnosis...
and treatment of respiratory disease and focuses on prevention, pharmacology, surgery, transplantation and research. *Annals of Thoracic Medicine, COPD* and *Portuguese Journal of Pulmonology (Revista Portuguesa de Pneumologia)* were not indexed by PubMed, so they were excluded. A computerised literature search was conducted in the PubMed database on 10 September 2012 (http://www.ncbi.nlm.nih.gov/pubmed/).

Articles from ML, TW and HK from January 2000 to December 2009 in these journals were elicited, respectively. We used the ISSN to perform searches in PubMed. The search terms used were (1040–0605 OR 1073–449X OR 1041–1549 OR 1817–1737 OR 0003–4975 OR 0300–2896 OR 1198–2241 OR 0012–3692 OR 1752–6981 OR 0272–5231 OR 1541–2555 OR 1070–5287 OR 1010–7940 OR 0903–1936 OR 0190–2148 OR 0147–9563 OR 1027–3719 OR 1806–3713 OR 1941–2711 OR 0277–0903 OR 1053–0770 OR 1569–1993 OR 1053–2498 OR 0022–5225 OR 1556–0864 OR 0341–2040 OR 0169–5092 OR 1828–695X OR 1526–0542 OR 8755–6863 OR 1094–5539 OR 0025–7931 OR 0020–1324 OR 0954–6111 OR 1569–9048 OR 1465–9921 OR 1323–7799 OR 0873–2159 OR 0761–8417 OR 0761–8425 OR 1124–0490 OR 1069–3424 OR 1520–9512 OR 0171–6425 OR 0040–6376 OR 1472–9792 AND TAIWAN [AD] AND 2000[DP] AND ‘Hong Kong [AD]’, ‘Taiwan [AD]’, and ‘China [AD] NOT Hong Kong [AD] NOT Taiwan [AD]’. Articles that showed the first author’s affiliation (AD) with these three regions were considered as research outputs from the regions. Articles in the fields of randomised controlled trials (RCT), review, meta-analysis and case reports were generated, respectively, according to the publication types by PubMed.

To compare the quality of the research articles, three methods were used: (1) the accumulated impact factors (IF) and the average IF were generated according to Journal Citation Reports (JCR) 2010 established by the ISI (http://isiknowledge.com); (2) citation reports of articles showing an affiliation with a Chinese institution were conducted; (3) articles published in top general medicine journals (The New England Journal of Medicine (NEJM), Journal of the American Medical Association (JAMA), The Lancet and British Medical Journal (BMJ)) were also generated. Articles related to respirology were first extracted independently by two reviewers (T-TD and L-HH), and any disagreement between the reviewers was resolved by viewing the titles, abstracts and full text if necessary. The number of articles published by each region in the top 10 high-impact respiratory journals was also compared. We determined the 10 most popular respiratory journals containing articles from the three regions of China according to the number of such articles published by each journal.

**Statistical analysis**

Statistical analyses were performed using STATA V.11.0. The non-parametric test for trend and time series analysis was performed to established change of the total numbers over the period of time. Kruskal-Wallis test was used for detecting the difference among the three regions, and rank-sum test between two if necessary. The test for significance was two-tailed and the value of \( p<0.05 \) was considered significant.

**RESULTS**

**Total number of articles**

A total number of 83 787 articles were published in the selected 46 journals within the period 2000–2009 worldwide. There were 2208 articles (2208/83787, 2.64%) from ML (814/2208, 36.9%), TW (909/2208 41.1%) and HK (485/2208, 22.0%). The numbers increased significantly from 2001 to 2010 in the three regions (from 13 to 273, \( p=0.004 \) for trend, 39 to 151, \( p=0.003 \), 36 to 62, \( p=0.047 \), respectively, figure 1). From 2005 onwards, the number of articles from ML has exceeded that from HK and in 2008 ML exceeded TW. The share of articles was on the rise in ML (\( p=0.001 \)) and TW (\( p=0.040 \)), but not in HK (\( p=0.813 \), figure 2).

**Randomised controlled trial, review, meta-analysis and case report**

In respect of randomised controlled trial (figure 3), it shows no difference among the three regions (ML vs TW
vs HK, p = 0.3662). In respect of review, ML and TW (ML vs TW p = 0.7591), although less than HK, showed no significant difference (ML vs HK p = 0.0331; TW vs HK p = 0.0038). Besides, we found a number of meta-analysis from ML since 2006, but few from TW and HK. However, as per this case report, ML and HK (ML vs HK p = 0.6215) were equal to each other, while less than TW (TW vs HK P = 0.0006; TW vs ML P = 0.0064).

Impact factors
According to the JCR, 43 journals in the ‘respiratory system’ had IF in 2010 (http://isiknowledge.com). Three journals in our study had no IF. Excluding them, the accumulated IF of articles from TW (3192.417) was much higher than that from ML (2409.956) and HK (1898.312, p = 0.038). However, HK took the highest average IF of 3.914, followed by TW of 3.512 and ML of 2.961 (p = 0.003, table 1).

Citation reports of articles published in the respiratory journals
The ISI has not set up a function for finding a citation report of articles by limiting the department of the corresponding author, so in this citation reports, the articles included were affiliated with a Chinese institution, more than the previous search results in PubMed.10 According to our analysis, TW had the highest total citations of 6390 (1064 articles), followed by HK with 5232 total citations in 700 articles and ML with 5232 citations in 1122 articles. These differences among the three regions were not significant (p = 0.772; figure 4).

High-impact respiratory journals and top general medicine journals
Of 1014 articles from these three regions, which were published in the 10 top-ranking respiratory journals, 40.33% (409/1014) were in American Journal of Respiratory and Critical Care Medicine, Thorax, Chest and European Respiratory Journal. TW published 456 articles in the high IF respiratory journals, while ML and HK had 336 and 222 articles, respectively, in the top 10 journals (table 2). A total number of 271 articles (ML 81, TW 71 and HK 119) were published in the four top general medicine journals (NEJM, Lancet, JAMA and BMJ). Fifty-five articles in the field of respirology were selected by the two reviewers. HK owned the most articles, with a total of 31 (original articles 23 including 1 RCT and 1 guideline, review 1, case reports 2, others 5; NEJM 6, JAMA 1, Lancet 16 and BMJ 8), ML had 16 articles (original articles 12 including 3 RCTs, case report 1, others 3; NEJM 3, JAMA 1, Lancet 10 and BMJ 2) and TW had 8 articles (original articles 3, case reports 5; NEJM 5, JAMA 1 and Lancet 2).

Popular respiratory journals
The most popular journals in the three regions are shown in table 3. Chest ranked the first in HK and TW, while Annals of Thoracic Surgery ranked the first in ML. Annals of Thoracic Surgery, European Journal of CardioThoracic Surgery, Respirology, The International Journal of Tuberculosis and Lung Disease and Chest are all ranked top 10.

Table 1 The accumulated and average impact factor of articles from Mainland (ML), Taiwan (TW) and Hong Kong (HK)

<table>
<thead>
<tr>
<th>Year</th>
<th>Accumulated impact factor</th>
<th>Average impact factor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ML</td>
<td>HK</td>
</tr>
<tr>
<td>2000</td>
<td>54 895</td>
<td>167 831</td>
</tr>
<tr>
<td>2001</td>
<td>66 619</td>
<td>78 862</td>
</tr>
<tr>
<td>2002</td>
<td>38 238</td>
<td>133 937</td>
</tr>
<tr>
<td>2003</td>
<td>50 552</td>
<td>194 997</td>
</tr>
<tr>
<td>2004</td>
<td>109 898</td>
<td>244 190</td>
</tr>
<tr>
<td>2006</td>
<td>242 293</td>
<td>308 506</td>
</tr>
<tr>
<td>2008</td>
<td>533 500</td>
<td>172 982</td>
</tr>
<tr>
<td>2009</td>
<td>802 387</td>
<td>240 543</td>
</tr>
<tr>
<td>TOTAL</td>
<td>24 09956</td>
<td>18 98312</td>
</tr>
</tbody>
</table>
DISCUSSION

To the best of our knowledge, this is the first report that showed clearly the contributions of Chinese authors in major regions of China—ML, HK and TW—to the worldwide research in the field of respiratoryology. Our study results showed that the number of published articles from ML China had increased significantly in the past 10 years, and surpassed HK in 2005 and TW in 2008. However, when impact factors (IF), citation reports and articles published in top general medicine journals were taken into quality comparisons, the gap among the three regions appeared wide. HK had the highest average IF of 3914, followed by TW of 3512 and ML of 2961, mainly because the readers worldwide preferred English, which gave HK an advantage over the other two regions. The number of articles from China in the ‘respiratory system’ category ranked 11 worldwide in total (2.64% for share), although a substantial number of high-quality articles were in Chinese. In addition, the situation that the articles increased in the field of respiratoryology was also found in other fields, such as Cardiology, Cardiovasology and Gastroenterology.\(^\text{11, 12}\)

The three regions equal to each other in terms of randomised controlled trial for the past decades. However, ML has gradually come to the fore since 2007. In 2008, ML released more reports than TW and HK, indicating its obvious superiority of large population and relatively low research cost.\(^\text{13}\)

However, the published essays, in fact, are just a small part of randomised controlled trials achievements. The reasons are as follows: the records were dispersed not only in the Chinese Clinical Trial Register (ChiCTR), but also in other WHO International Clinical Trials Registry Platform (ICTPR) primary registries or International Committee of Medical Journal Editors (ICMJE) approved registries.\(^\text{15}\) Besides, part of the results were released in Chinese or in the journals not indexed by PubMed. Moreover, the randomised controlled trials in China showed a lower to an average publication rate.\(^\text{16, 17}\)

China, in recent years, is prospering rapidly economically to become the second largest economy in the world after the USA. However, air pollution, especially hazes, followed this prosperity. The Global Burden of Disease Study 2010 found that particulate matter with an aerodynamic diameter of less than 2.5 \(\mu\)m (PM 2.5) has become the fourth biggest threat to the health of the Chinese people.\(^\text{18}\) Although smoking has fallen in China, the prevalence of lung cancer has increased, most probably due to air pollution.\(^\text{19}\) China, currently, faces an arduous task of addressing the challenges of environmental pollution.\(^\text{20}\) The pace of life is increasing with technological advancements, and this leads to hypertension and decreased exercise in people’s daily life. All of these risk factors obviously will increase the morbidity of respiratory diseases. There is a price that developing countries must pay for modernisation. However, let the price of the Chinese pay not exceed the benefits from modernisation. Therefore, government, scientific association and doctors pay more attention to the study about respiratory diseases.\(^\text{21, 22}\)

The data in our study mainly came from two sources: the PubMed search system and the JCR. The PubMed

<table>
<thead>
<tr>
<th>Rank</th>
<th>Journal published on the 10 most influential journals from Mainland (ML), Taiwan (TW) and Hong Kong (HK)</th>
<th>2009 IF</th>
<th>ML (%)</th>
<th>TW (%)</th>
<th>HK (%)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Am J Respir Crit Care</em></td>
<td>10.689</td>
<td>8</td>
<td>15</td>
<td>20</td>
<td>38</td>
</tr>
<tr>
<td>2</td>
<td>Thorax</td>
<td>7.041</td>
<td>9</td>
<td>15</td>
<td>18</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>Chest</td>
<td>6.360</td>
<td>28</td>
<td>13</td>
<td>127</td>
<td>58</td>
</tr>
<tr>
<td>4</td>
<td><em>Eur Respir J</em></td>
<td>5.527</td>
<td>17</td>
<td>22</td>
<td>24</td>
<td>31</td>
</tr>
<tr>
<td>5</td>
<td><em>J Thorac Oncol</em></td>
<td>4.547</td>
<td>19</td>
<td>59</td>
<td>9</td>
<td>28</td>
</tr>
<tr>
<td>6</td>
<td><em>Am J Respir Cell Mol</em></td>
<td>4.319</td>
<td>12</td>
<td>29</td>
<td>21</td>
<td>51</td>
</tr>
<tr>
<td>7</td>
<td><em>Am J Physiol Lung C</em></td>
<td>4.043</td>
<td>7</td>
<td>29</td>
<td>16</td>
<td>67</td>
</tr>
<tr>
<td>8</td>
<td><em>Ann Thorac Surg</em></td>
<td>3.644</td>
<td>115</td>
<td>44</td>
<td>109</td>
<td>42</td>
</tr>
<tr>
<td>9</td>
<td><em>J Heart Lung Transpl</em></td>
<td>3.541</td>
<td>9</td>
<td>32</td>
<td>15</td>
<td>54</td>
</tr>
<tr>
<td>10</td>
<td>Lung Cancer</td>
<td>3.140</td>
<td>112</td>
<td>51</td>
<td>97</td>
<td>44</td>
</tr>
</tbody>
</table>

search system is a comprehensive database run by the National Center for Biotechnology Information (NCBI) at the National Library of Medicine in Bethesda, Maryland, containing articles from high-quality medical journals. The JCR, published by the Institute for Scientific Information in 1975, represents the most comprehensive citation index to the scientific literature and covers more than 7000 journals at 2010. Although IF is not the optimal parameter for determining the quality of articles, it is, at present, the best available parameter for judging the quality of studies.

Our study has its limitations, however. A few journals covered resources beyond respiratory even selected from the respiratory system of SCIE. Besides, some related journals not shown in SCIE were not collected. Some related respiratory medicine research articles are published in journals not shown in SCIE. Besides, some related resources beyond respiratory even selected from the respiratory system of SCIE. Although IF is not the optimal parameter for determining the quality of articles, it is, at present, the best available parameter for judging the quality of studies.

Our study has its limitations, however. A few journals covered resources beyond respiratory even selected from the respiratory system of SCIE. Besides, some related research articles are published in journals not shown in SCIE. Although IF is not the optimal parameter for determining the quality of articles, it is, at present, the best available parameter for judging the quality of studies.

<table>
<thead>
<tr>
<th>Rank</th>
<th>ML (n=814)</th>
<th>N</th>
<th>TW (n=909)</th>
<th>N</th>
<th>HK (n=485)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ATS</td>
<td>115</td>
<td>Chest</td>
<td>127</td>
<td>Chest</td>
<td>65</td>
</tr>
<tr>
<td>2</td>
<td>LC</td>
<td>112</td>
<td>ATS</td>
<td>109</td>
<td>Respirology</td>
<td>62</td>
</tr>
<tr>
<td>3</td>
<td>EJCT</td>
<td>68</td>
<td>LC</td>
<td>97</td>
<td>IJTLD</td>
<td>42</td>
</tr>
<tr>
<td>4</td>
<td>JTCSC</td>
<td>68</td>
<td>JTCSC</td>
<td>93</td>
<td>ATS</td>
<td>37</td>
</tr>
<tr>
<td>5</td>
<td>Respiratory</td>
<td>57</td>
<td>EJCT</td>
<td>59</td>
<td>ERJ</td>
<td>36</td>
</tr>
<tr>
<td>6</td>
<td>Respiration</td>
<td>41</td>
<td>Respirology</td>
<td>42</td>
<td>Thorax</td>
<td>33</td>
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<tr>
<td>7</td>
<td>IJtLD</td>
<td>34</td>
<td>IJtLD</td>
<td>39</td>
<td>RM</td>
<td>30</td>
</tr>
<tr>
<td>8</td>
<td>Chest</td>
<td>28</td>
<td>PP</td>
<td>36</td>
<td>PP</td>
<td>25</td>
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<tr>
<td>9</td>
<td>RR</td>
<td>23</td>
<td>TCS</td>
<td>36</td>
<td>AJRCC</td>
<td>24</td>
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<tr>
<td>10</td>
<td>PPT</td>
<td>22</td>
<td>JA</td>
<td>29</td>
<td>EJCT</td>
<td>19</td>
</tr>
</tbody>
</table>


**Table 3** The 10 most popular respiratory journals in Mainland (ML), Taiwan (TW) and Hong Kong (HK)

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**Competing interests** None.

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