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Short Communication

Oral cancer research in Taiwan and mainland China: Scientometric analysis with emphasis on distinctive characteristics

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Abstract Scientometric analysis of a disease is often conducted to recognize research hotspots and investigate latest trends. In this brief report, we provide a scientometric overview of oral cancer research in Taiwan and mainland China. There were 1924 and 3853 articles on oral cancer research originating from Taiwan and mainland China, respectively. In Taiwan, the risk factors including areca/betel quid chewing, tobacco smoking, and alcohol use were the distinctive keywords. For basic research, genotype, reactive oxygen, p53, mitochondria and caspase-9 were the distinctive keywords. In mainland China, experiment methods such as genetic transfection, gene silencing, colony formation, tumor xenograft were the distinctive keywords. Epithelial mesenchymal transition, long untranslated RNA, protein function, uvo-morulin, and Bcl-2 were the distinctive keywords of basic research. Collectively, we hope that these scientometric characteristics will aid clinicians and researchers for obtaining information on oral cancer and can be of guidance for future studies.

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Introduction

Oral cancer is a major cause of cancer morbidity and mortality worldwide. In mainland China, the incidence and mortality of oral cancer increased stably in the past decade.¹ In Taiwan, cancer of oral cavity, oropharynx and hypopharynx is the sixth highest incidence of malignancy, and the incidence also substantially increased during 1979–2016.² Thus, there is a need for comprehensive knowledge and strategy to prevent oral cancer. Although people in both regions share the main ethnic origin of Han nationality, they have distinct political regimes, economic status, and health care systems. Notably, life habits of betel nut chewing and cigarette smoking as the notorious risk factors for oral cancer prevail in Taiwan, particularly among the males.² These characteristics may lead to different scientific research productivity output in both regions. Additionally, many socioeconomic factors including gross domestic product (GDP) and expenditure investment on healthcare correlate to research productivity.

Bibliometric analysis is a useful tool that utilizes citation data to measure scientific output of an individual and institution or country in a particular field.^{3–5} Scientometric overview of a disease is often conducted to recognize study hotspots and investigate latest trends in specific research fields^{4,5}. Bibliometrics based on citation data have been analyzed in various fields of Dentistry, Oral Surgery and Medicine. For instance, bibliometric analysis has been performed in an individual disease, such as oral sensitivity disorder and oral potentially malignant disorders^{6,7}. Besides, the analysis has also been performed in individual country/region such as dental research in Spain and scientific interest in oral cancer in Europe^{8,9}. However, the analysis focused on oral cancer research in Taiwan and mainland China has not been reported so far. Therefore, we provide a comprehensive overview of scientometric characteristics of all the original articles on oral cancer research in Taiwan and mainland China for the consideration of the investigators and readership.

Materials and methods

As per the methodology described previously,^{6,7} the articles on oral cancer from Taiwan and mainland China were retrieved on 03 April 2022 from the Scopus database. We used medical subject term “oral” and “cancer” and the synonyms in the Title, and selected “China” or “Taiwan” in the filter of Country/Region. Then, original “article” in the filter of Document type and “English” in the filter of Language were included. Repeated publications were identified using the following the authors and the authors’ affiliations. The “Reprint Address” for the articles were considered as research output from the regions. In order to be of comparability of scientific output between Taiwan and mainland China, we further selected the Beijing, Shanghai, and Guangzhou regions from mainland China compared to Taiwan. In this context of rapid economic development of mainland China, the GDP, population size, and per capital GDP of the 3 regions slowly approach those of Taiwan.¹⁰

Titles and abstracts or full texts of the articles were screened and re-evaluated to confirm the eligible articles.

Data search and extraction were performed independently by two investigators (W.L. and H.S.), and discrepancy of results was resolved in a consensus symposium. The scientometric characteristics of all the eligible articles were reviewed and recorded the following information: title, keyword, citation count, citation density, publication year, authorship, affiliation, and country/region of origin. Descriptive statistics and associations were calculated for scientometric characteristics. The Bibliometrix Biblioshiny R-package software (<https://www.bibliometrix.org/home/>; K-Synth Srl Inc., Naples, Italy) was used to analyze the relevant bibliometric data.

Results

Citation characteristics

With the search strategy algorithm, 1924 articles on oral cancer research originated from Taiwan from 1976 to the time of the search. As presented in Fig. 1A, the total count of citations was 45,763 and the *h* index was 83. The maximum and mean count of citations was 593 and 23.8, respectively. On the other hand, 3853 eligible articles originated from mainland China from 1982 to the time of the search. The information on title, publication year, citation count, citation density, authors, affiliation, and keywords of top-100 most cited articles from Taiwan and mainland China are shown in supplementary Table S1. In Guangzhou region, 542 eligible articles were identified with the total of 9963 citations and *h* index of 46. In Shanghai region, 497 eligible articles were identified with the total of 9440 citations and *h* index of 48. In Beijing region, 436 eligible articles were identified with the total of 6703 citations and *h* index of 39 (Fig. 1A).

To concretize the trends of research output in Taiwan and mainland China, we assess the annual number of articles and accumulated citation count during 2006–2021. For Taiwan, the number of articles increased stably from 31 to 170 during 2006–2021, and accumulated citations increased from 498 to 5979 during this period. Interestingly, the number of articles from Mainland China exceeded that from Taiwan in 2012. From that year, the annual number of articles from Mainland China showed a linear increase during 2013–2021 (Fig. 1B). Although the GDP, population size, and per capital GDP of Guangzhou, Shanghai, and Beijing slowly approach those of Taiwan, both annual number of articles and accumulated citations of the 3 regions remained obviously behind those of Taiwan during 2006–2021 (Fig. 1C). Besides, we recognized the contributing authors, institutions of origin, and journal of publication on oral cancer research from Taiwan and mainland China in the bibliometric analysis (Fig. 2A).

Study design and topic

Based on the frequency of keywords in all included articles from Taiwan and mainland China, we highlight the analysis of study topic and design of oral cancer research. A total of 160 keywords are automatically recognized in the order of highest to lowest frequency by the database. We identified the top-10 study designs were among these keywords.

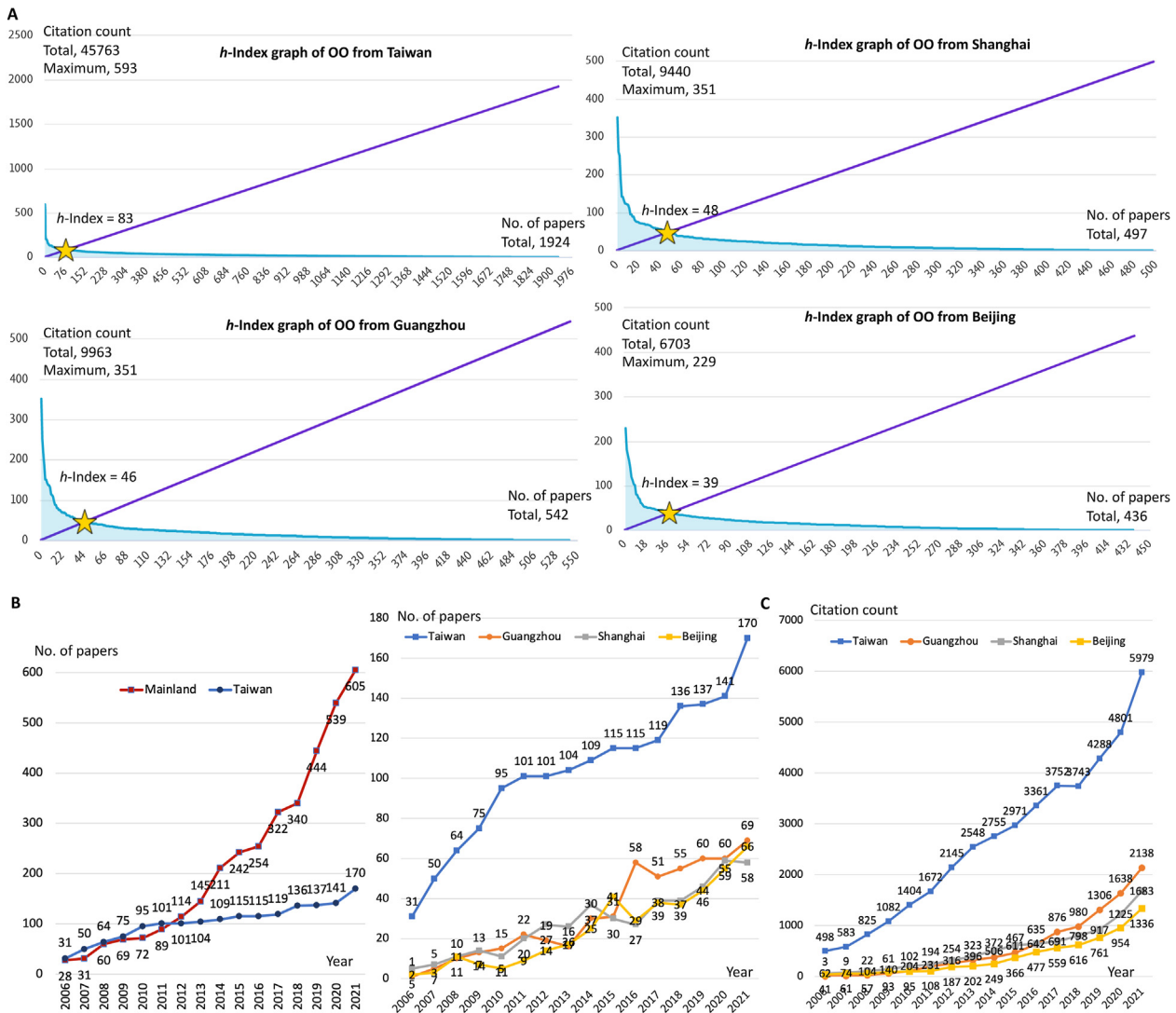


Figure 1 Citation characteristics of the articles on oral cancer from Taiwan and mainland China. (A) The *h*-index graphs in Taiwan, Shanghai, Guangzhou, and Beijing. (B) The annual number of articles from Taiwan and mainland China including Shanghai, Guangzhou, and Beijing during 2006–2021. (C) The accumulated citations of Taiwan, Shanghai, Guangzhou, and Beijing during 2006–2021.

Controlled study, major clinical study, and human cell study were the most 3 types of designs in both Taiwan and mainland China. Next, the frequencies of animal experiment and in vitro study in mainland China were higher than those in Taiwan. While the frequencies of retrospective study and follow up study in Taiwan were higher than those in mainland China. Strikingly, the frequencies of randomized controlled trial were very little in both 2 regions (Fig. 2B).

For the topic or area of study, we identified top-20 distinctive topics among 160 keywords in both Taiwan and mainland China, respectively (Fig. 2C). In Taiwan, the risk factors including areca/betel quid chewing, tobacco smoking, and alcohol use were the distinctive keywords. For basic research, genotype, reactive oxygen, protein p53, mitochondria and caspase 9 were the distinctive keywords. Cancer chemotherapy, neck dissection, and chemo-radiotherapy were the distinctive keywords of therapeutic

aspect. In mainland China, experiment methods such as genetic transfection, gene silencing, colony formation, tumor xenograft were the distinctive keywords. Epithelial mesenchymal transition, long untranslated RNA, protein function, uvomorulin, and protein Bcl-2 were the distinctive keywords of basic research aspect.

Discussion

In recent years, the rapid increase in the number of oral cancer articles originated from Mainland China. First, a central reason may be the rapid development of China's economy, which has induced increasing funds to the field of cancer research. Second, the number and ability of clinicians and researchers have been improved in mainland China. Third, research institutions and relevant infrastructures are also increasingly being established. These

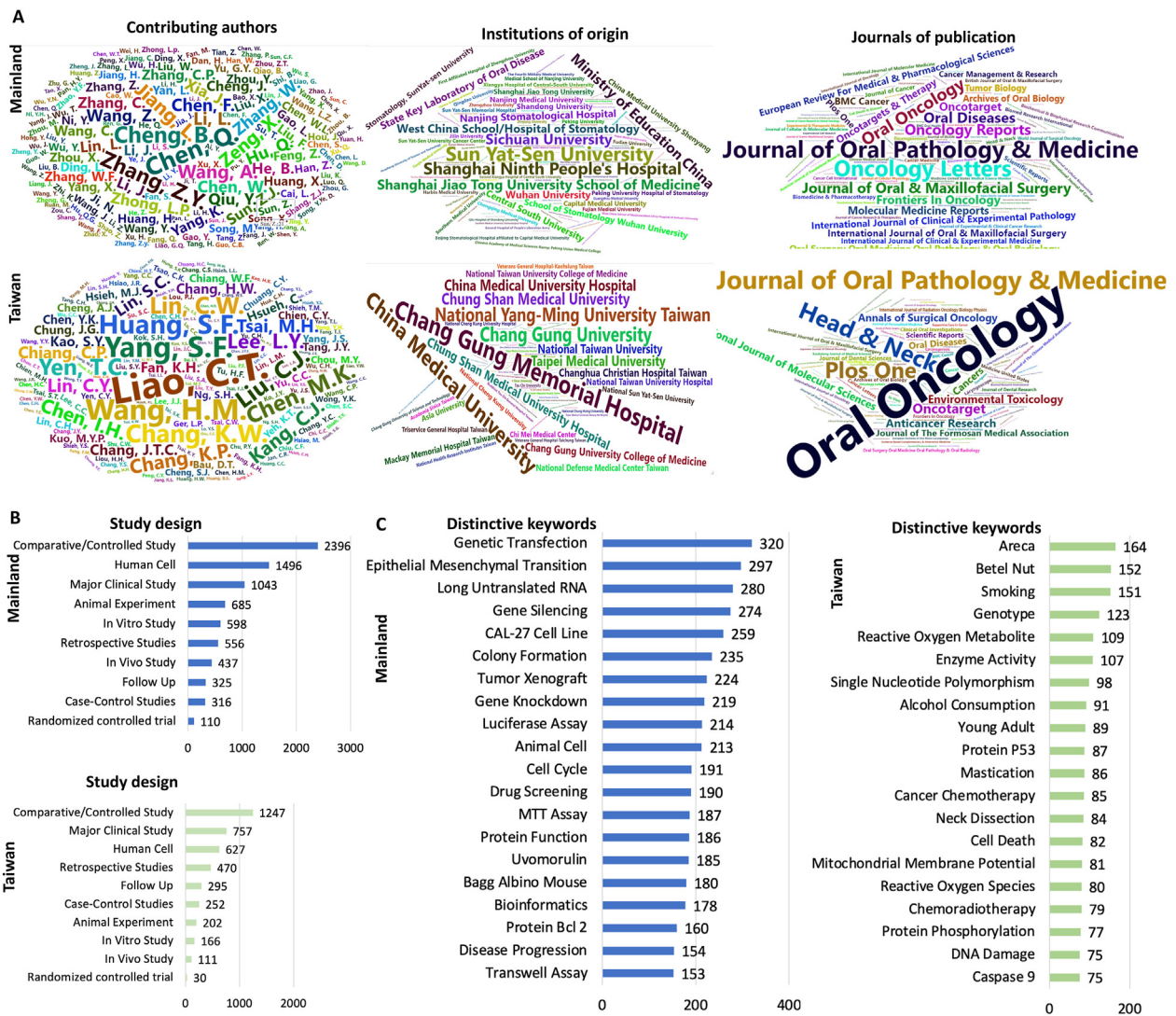


Figure 2 Scientometric characteristics of the articles on oral cancer from Taiwan and mainland China. (A) The cloud graphs of contributing authors, institutions, and journals of publication. In mainland China, the contributing author with largest number of articles is Chen Q. (n = 49), followed by Cheng B. (n = 44), Zhang Z.Y. (n = 43), and Jiang L. (n = 39). The contributing institution of origin with the maximum number is Sun Yat-Sen University (n = 326), followed by Shanghai Ninth People's Hospital (n = 275), Ministry of Education China (n = 242), and Sichuan University (n = 242). The journal of publication with largest number is *Journal of Oral Pathology & Medicine* (n = 136), followed by *Oncology Letters* (n = 129), *Oral Oncology* (n = 100), and *Oncology Reports* (n = 87). In Taiwan, the contributing author with largest number of articles is Liao C.T. (n = 151), followed by Yang S.F. (n = 116), Wang H.M. (n = 115), and Huang S.F. (n = 106). The contributing institution of origin with the maximum number is Chang Gung Memorial Hospital (n = 428), followed by China Medical University (n = 384), National Yang-Ming University (n = 320), and Kaohsiung Medical University (n = 277). The journal of publication with largest number is *Oral Oncology* (n = 165), followed by *Journal of Oral Pathology & Medicines* (n = 93), *Head & Neck* (n = 81), and *Plos One* (n = 76). (B) The ranks of study design. (C) The ranks of distinctive study topics based on the frequency of keywords.

elements may have prompted the oral cancer research output observed in this study. Although oral cancer research in mainland China has developed rapidly, the average level of oral cancer research is still relatively low. Even if compared to the most 3 developed regions, both the number of articles and citation count in Taiwan were obviously superior to those in Beijing, Shanghai, and Guangzhou regions.

We highlight the comparative analysis of study topic and design of oral cancer research between Taiwan and

mainland China, which may reflect the importance and concerned topics of research. In Taiwan, areca/betel quid chewing and tobacco smoking are important risk factors in oral cancer research. This reflect that the relatively high incidence of oral cancer is mainly because of betel nut chewing and cigarette smoking in Taiwan.² Meanwhile, we observe that the proportion of randomized controlled trial was very low, which may need to enhance the high-standard publications in this field. We are aware of certain limitations in this scientometric analysis. First, we

used only Scopus database not do other different databases for analysis, although Scopus database may be of more coverage and accuracy.⁶ Secondly, citation counts do not directly reflect quality of an article but enable a quantitative evaluation of the scientific impact in a designed field. Thirdly, there is definite time effect from publication to the time of the search in bibliometric analysis. And, authors tend to cite previous highly cited articles independently of content and quality through snowball effect.

Collectively, this bibliometric analysis helps in evaluating the historical citation and research trends in the oral cancer field that has undergone scientific evolution over the decades in Taiwan and mainland China. We hope that the scientometric overview of this analysis will be able of benefit to clinicians and researchers in obtaining information on oral cancer research and can be of guidance for future studies in Taiwan and mainland China.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jds.2022.05.015>.

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