



## Original Article

# Trends in publication and collaboration of health-themed systematic reviews before and during the COVID-19 pandemic: A bibliometric study

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## Abstract

The presence of global threats such as coronavirus disease 2019 (COVID-19) pandemic could potentially affect the research landscape, particularly that of systematic reviews. The aim of this study was to examine disparities between countries and the role of funding availability in the publication of health-themed systematic reviews. Metadata of published literature was collected from the Scopus database as of June 30, 2023. The dataset was divided into 'pre-COVID-19 (2017–2019)' and 'during COVID-19 (2020–2022)' by utilizing filter feature of the Scopus search engine. Network visualization of co-authorship was carried out on VoSviewer to identify collaborative patterns between countries. Our results suggest that most of the systematic reviews were published by authors from the United States of America (USA), both in pre-COVID-19 (n=29,463; Total link strength, TLS=32,832) and during COVID-19 (n=35,520; TLS=45,616). During COVID-19, the trend was not much different with the USA (14.6%), the UK (8.8%), and Australia (5%) in the top position among high-income countries. China (12.3%) and Iran (2.4%) topped the upper-middle-income and low-income countries groups. Publications by those who were from low-income countries were in a concerning low number; Ethiopia ranked first in this group only occupied 0.4% of the total publications (n=1,047). Furthermore, the number of publications was proportional to the number of funded studies (as observed in the top countries). However, during COVID-19 pandemic, the proportionality between funded publications and total publications was observed less. Taken altogether, our findings stress the importance of capacity building and providing more funds for on-desk research to close the disparity among countries.

**Keywords:** Public health crisis, research trend, Scopus, systematic review, VoSviewer

## Introduction

Systematic review, alongside its quantitative counterpart, meta-analysis, stands as a cornerstone in the establishment of evidence-based medicine [1]. These research methodologies offer a systematic and comprehensive synthesis of existing evidence, providing clinicians and



healthcare practitioners with evidence for informed decision-making. Through the meticulous process of aggregating data from diverse studies and rigorously evaluating their quality, systematic reviews ensure that medical interventions and treatments are firmly rooted in the highest quality evidence available [1]. This methodical approach enables researchers to pinpoint areas where evidence may be lacking or inconclusive, thus guiding future research priorities and directing resources towards addressing crucial gaps in knowledge [2]. Furthermore, systematic reviews play a pivotal role in the development of clinical practice guidelines and the formulation of healthcare policies, serving as a robust foundation for setting standards of care and shaping public health initiatives [3]. Additionally, meta-analysis enhances the generalizability of evidence by integrating data from various sources, enabling broader insights into the effectiveness of interventions across diverse populations and settings, including those on a global scale [4,5].

Given its critical role in providing the basis for evidence-based medicine, it is imperative to scrutinize the trends surrounding systematic reviews and discern factors contributing to the proliferation of such studies. One effective approach is using bibliometric analysis, which enables the comprehensive examination of vast quantities of metadata from published literature within a relatively condensed timeframe [6]. The application of bibliometric analysis has gained significant traction across subject areas in medicine and health, encompassing broader topics in general medicine to more specialized fields such as diabetology or neurology [7-9]. Notably, this analytical approach has been increasingly utilized to explore emerging topics, including the intersection of spectroscopic techniques and omics, or the amalgamation of polymer technologies with research on coronavirus disease 2019 (COVID-19) [10,11].

Furthermore, prior research has underscored the efficacy of bibliometric analysis in elucidating the impact of the COVID-19 pandemic on specific research subjects [12]. Historically, bibliometrics has been intertwined with medicine-related research, serving as a means to accurately trace the historical roots of scientific inquiry [9]. In light of this, our study embarks on a multifaceted analysis aimed not only at evaluating the trajectory and landscape of systematic reviews in health and medicine-related subject areas but also at scrutinizing the ramifications of the COVID-19 pandemic, which has reverberated across various sectors, including academia and research. This study is the first to undertake a bibliometric analysis of systematic reviews, thereby illuminating two fundamental research methodologies that form the bedrock of scientific investigation in the fields of medicine and health.

## Methods

### Study design

Bibliometric analysis of published systematic reviews in medical and health sciences was carried out. This study assessed publication trends, collaboration patterns, and the influence of funding institutions on research productivity in health-themed systematic reviews, including their impact on the quantity and quality of published systematic reviews. By performing bibliometric investigation, we aimed to answer the following research questions: (1) What was the trend of systematic review publications across countries? (2) What were the collaboration patterns between countries? (3) What was the trend of funding health-themed systematic review research? (4) Did the presence of funding institutions affect the publication quantity? (5) How did COVID-19 pandemic affect these patterns or trends? The analysis was carried out by observing the number of publications as the productivity parameter and co-authorship network visualization as the collaboration parameter.

### Search strategy

The search was performed on the Scopus database for publications indexed as of June 30, 2023. To obtain relevant bibliometric data, the search was performed using a combination with 'systematic review' and 'meta-analysis' as keywords which were connected by Boolean operator 'OR' and applied to the article title section. Using the feature available on Scopus search engine, we limited the search to the following subject areas: medicine, nursing, neuroscience, pharmacology, toxicology, pharmaceuticals, psychology, health professions, immunology, microbiology, and dentistry. Exclusions were made for the following document types: letter,

erratum, retracted publication, note, editorial, short survey, conference review, and data paper. The search was not limited to particular languages.

### **Dataset preparation**

Two datasets were acquired from the database. The first dataset was assigned as 'pre-COVID-19' comprising data from January 2017 to December 2019. The second dataset was labeled as 'during COVID-19' which comprised of literature published between January 2020 to December 2022. Metadata from published articles were downloaded as .csv file. As for the numbers of publications per country and funding institution, the data were extracted manually and transferred to an excel file. The number of publications of a specific county was divided by the total publication in a particular dataset and multiplied by 100% to obtain the publication rate. Funding institutions were categorized as government agencies, industries, or NGOs based on the information provided on their official website. High-income, upper-middle-income, lower-middle-income, and low-income countries were categorized based on World Bank's criteria [13].

### **Bibliometric visualization**

Number of publications from each country was presented in a distribution map using Datawrapper (<https://app.datawrapper.de/>). Network visualization for co-authorship analysis was performed on VoSviewer using the .csv file acquired from the database.

The study was performed to analyze the international collaboration among researchers or research institutions. We also looked deeper into the possible association between the funding institution (i.e., government agencies, industries, or NGOs) and the research productivity. The minimum thresholds applied for in the analysis were  $n \geq 100$  and  $n \geq 25$  for number of documents and citations, respectively. Total link strength (TLS), a value of cumulative strength of connections between items in a network, was computed to observe the association.

## **Results**

### **Distribution of systematic review publications**

As many as 108,029 and 172,281 systematic reviews were included in pre-COVID-19 and during COVID-19 datasets, respectively. Distribution maps of the systematic review publications in pre-COVID-19 and during COVID-19 are presented in **Figure 1**. Most of the publications were reported by authors from the United States of America (USA), China, the United Kingdom (UK), Canada, and Australia. In addition to China, some other non-Western countries, namely South Korea, India, Iran, and Brazil had considerable number of publications. On the other hand, the publications rate of countries in Africa was very low. The top 20 countries with the most systematic review publications are presented in **Figure 2**. In pre-COVID-19 dataset, USA, UK, and Australia topped the high-income countries group with publications rate of 17.2%, 10.3%, and 5.7%, respectively. Among upper-middle-income, lower-middle-income, and low-income countries, China (11%), Iran (1.8%), and Ethiopia (0.2%) ranked first, respectively. No apparent change of publication trend was observed between pre-COVID-19 and during COVID-19 period.

### **Global collaborative patterns**

Co-authorship networks indicating the collaborative patterns among countries in publishing health-themed systematic reviews in pre-COVID-19 and during COVID-19 period are presented in **Figure 3**. Most of the publications included in the study were published by authors from the United States of America (USA), both in pre-COVID-19 ( $n=29,463$ ;  $TLS=32,832$ ) and during COVID-19 ( $n=35,520$ ;  $TLS=45,616$ ). USA had the most predominant collaboration with the UK, Canada, and Australia in both pre- and during COVID-19, and stronger collaboration was observed between USA and Italy only during COVID-19. China had formed strong collaboration with the USA before the COVID-19 as the two countries were grouped in the same clusters. During COVID-19, the USA has a higher diverse collaboration, engaging new countries such as Indonesia, Vietnam, Nepal, and Egypt, thereby becoming the center of its own cluster. China, on the other hand, predominated its own cluster by maintaining the collaboration with Japan and Australia.

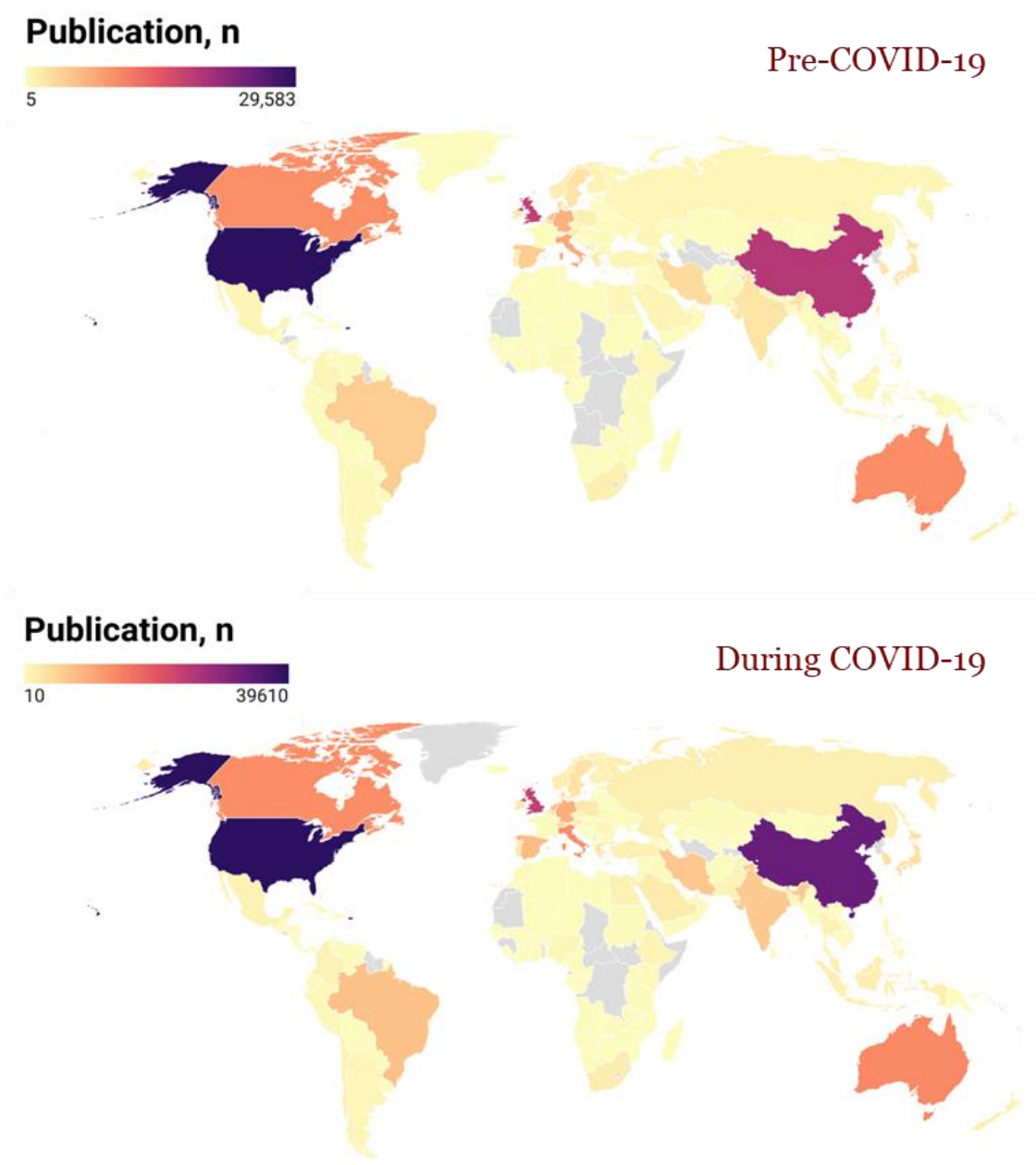


Figure 1. Geographic distribution of health-themed systematic review publications in pre- and during COVID-19. Visualized using Datawrapper.

### Role of funding institutions

Publication rates based on the type of funding institutions before and during the COVID-19 are presented in **Figure 4A** and **Figure 4B**. Publication rates of funded studies may exceed that of overall studies because they were calculated by using the total of funded publications from all countries as the denominator. Both in pre-COVID-19 and during COVID-19 periods, government institutions remained the major source of funding, followed by industries, non-governmental organizations (NGOs), and academic institutions. Before the pandemic, publication rates in the USA were 17.64% and 17.17% for funded and total publications, respectively (**Figure 4B** and **Figure 4C**). Other than the USA, the number of funded publications (indication for funding allocation), was proportional with that of total publications. During the pandemic, however, the number of total publications tended to disregard the role of funding availability. There was around 6% gap between the rates of total publications and funded publications in the USA. The gap was even wider for China (8%) and UK (7%). Interestingly, despite lower rates of funded publications, the rates for total publications were higher as observed in Brazil, Germany, and Canada (**Figure 4B** and **Figure 4C**).

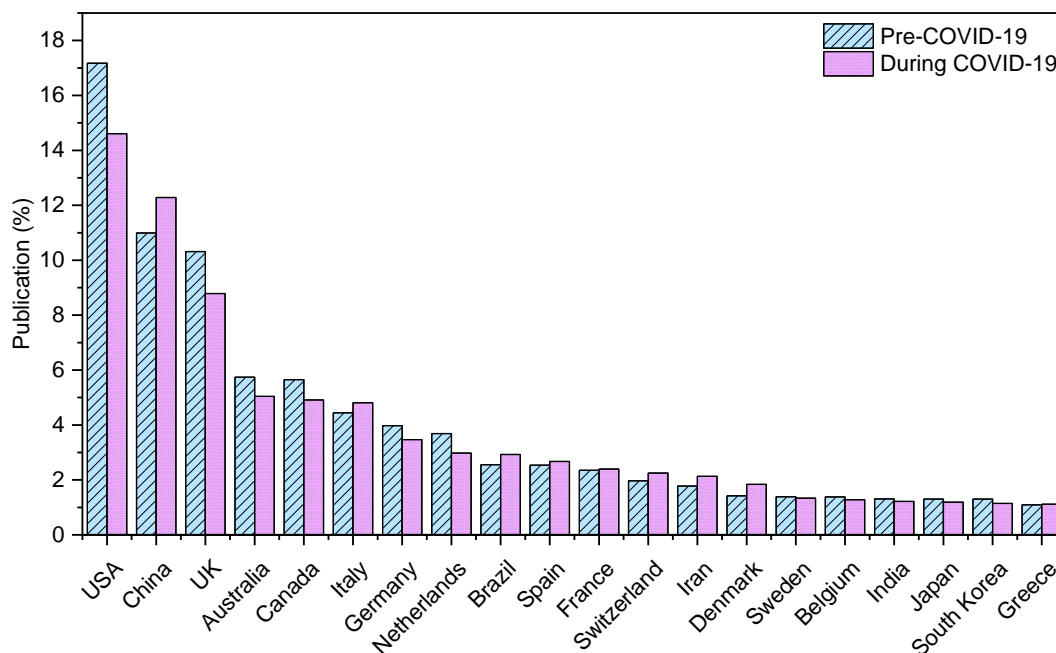


Figure 2. Publication rates of top 20 publishing countries in pre- and during COVID-19.

## Discussion

Findings from the present study suggest that authors from the USA published the most systematic reviews in both pre- and during the COVID-19 pandemic. Authors with American affiliations showed frequent collaboration with Canada and Australia, while Italy appears as a prominent American partner during COVID-19. Italy was one of the countries most affected by the pandemic, where the death rate was only second to China [14]. The severity of the pandemic has drawn significant research attention to Italy, particularly due to its unique demographic characteristics by having the highest elderly population in Europe [15]. In line with the findings in the present study, the research trend of engaging authors from Italy is also reflected in the systematic review publications.

Among the high-income countries, the USA, UK, and Australia were the major players in systematic review publications, regardless of the COVID-19 event. China and Iran topped the ranking position among upper-middle-income and lower-middle-income, respectively, and the publication rate and the total publications of the two countries increased during the pandemic. Among the low-income countries, authors from Ethiopia were the most productive with 1,047 published systematic reviews. Most countries maintained their relative position in producing articles pre- and during COVID-19, suggesting a well-established research capacity in conducting health-themed systematic reviews. In comparison with previous bibliometric analyses, China and USA topped the ranking position for publishing research within a wide range of COVID-19-related topics [16]. Even when different scientific literature databases (i.e. Web of Science) were used, China and USA persisted as the top countries in research publications [17]. However, in terms of vaccine research, the number of publications in China was less than UK or India [18].

To investigate a possible contributing factor for the high number of publications among the top-ranking countries, we compared the proportion of total publications with that of funded publications. There was an indication for the role funding availability in systematic review productivity which was particularly observable in pre-COVID-19 period. During the COVID-19 pandemic, however, the proportionality between number of funded publications and total publications was observed less. Many investigations were performed and published as a quick response to the pandemic [19]. The widespread cancellation of national and international meetings during COVID-19 reduced the traditional avenue of researchers to present their data, which resulted in a substantial increase in the number of manuscripts submitted to medical journals. This was further influenced by publishers offering rapid review, accelerated publication processes and free open access publication [20]. Without the many subsequent systematic

reviews, it would have been difficult to synthesize this surge of research data, making implementation of the research recommendations difficult [21,22]. Though this hypothesis requires further confirmation, at the very least, systematic reviews play a critical role in gathering evidence during public health emergencies.

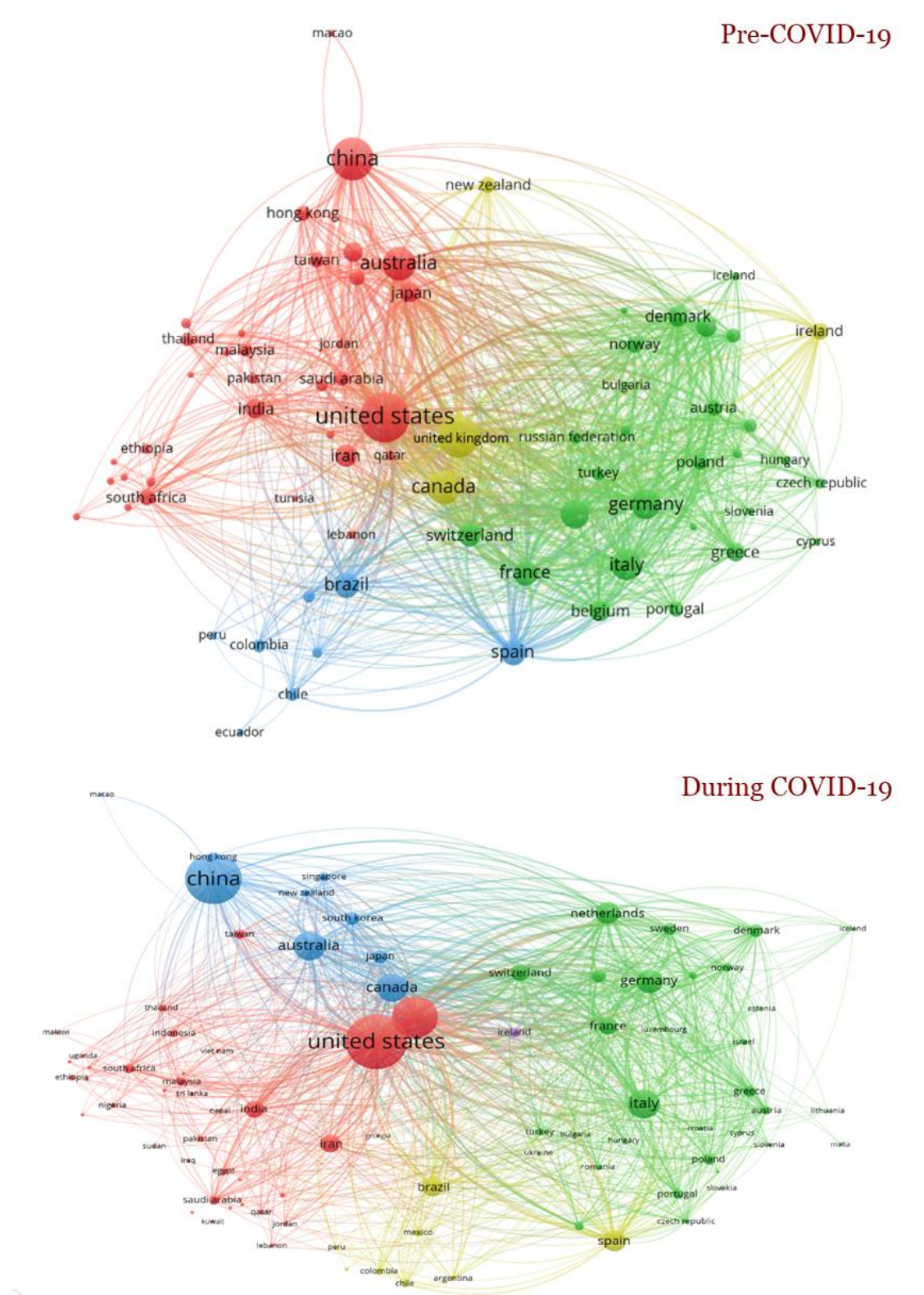


Figure 3. Network visualization of countries' co-authorship in pre- and during COVID-19 settings. The nodule size represents the number of publications and line thickness—collaboration. Nodules with the same color belong to the same cluster. Minimum threshold:  $\geq 100$  documents and  $\geq 25$  citations.

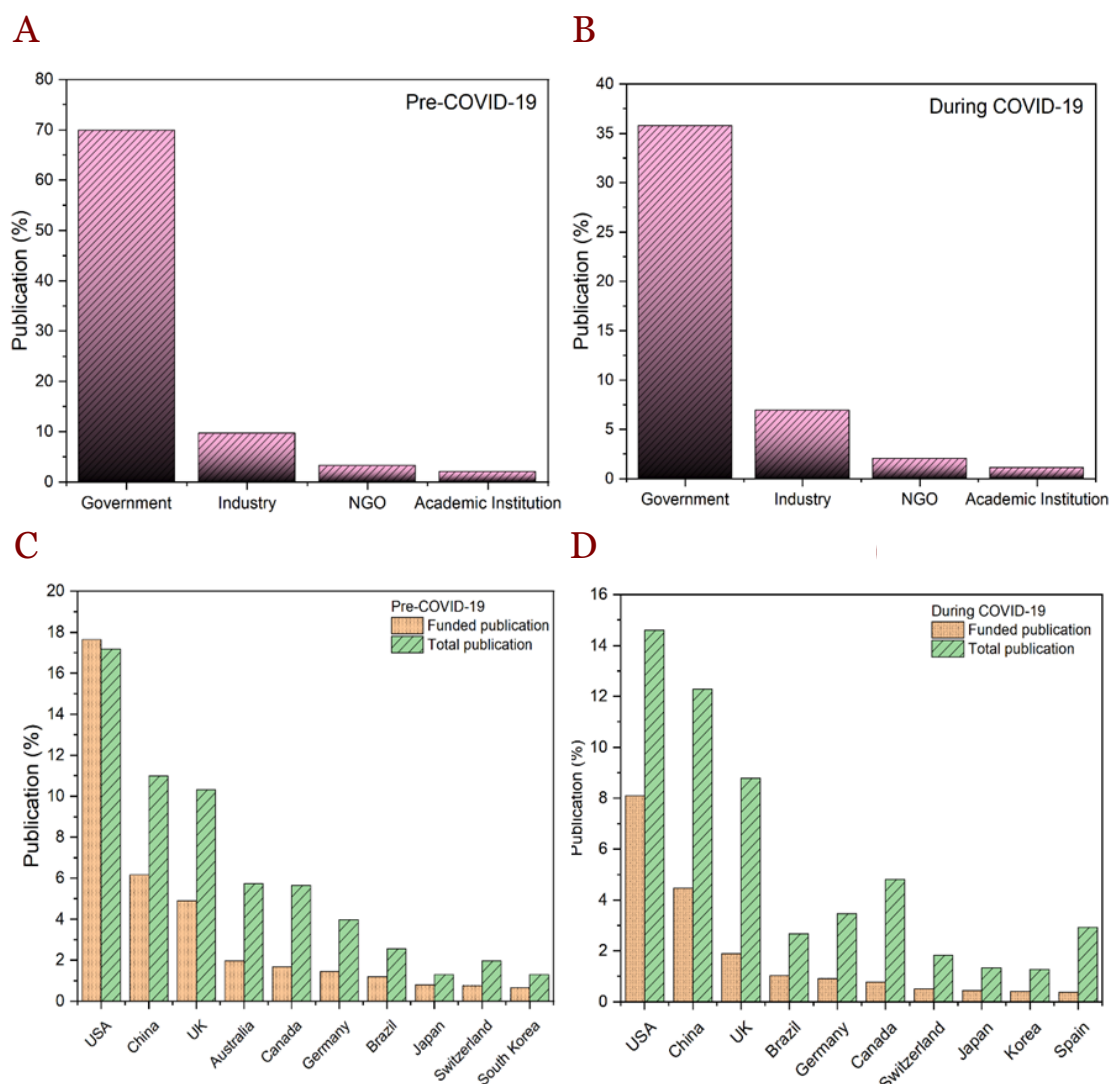


Figure 4. Funding sources for systematic review research in pre-COVID-19 (A) and during COVID-19 (B). Comparisons of funded publications and total publications based on the country in pre-COVID-19 (C) and during COVID-19 (D). The European union was excluded from this list for comparison purposes.

There are some limitations which warrant cautious interpretation of our findings. First, bibliometric data are not a direct indicator for research productivity. Researchers, particularly the non-academia, may perform systematic reviews, but their work may not be published. Second, we used a single database, where different databases may yield different results. Third, we acknowledged that publication date cut-off for during COVID-19 dataset might be inaccurate as the publication, including the delay in its process, may take six months. Unfortunately, the Scopus database only provides features to limit the publication year, not the precise publication date. Further, unlike systematic review that selects published articles meticulously, bibliometric analysis could be biased by the presence of irrelevant studies.

## Conclusion

Most systematic reviews are written authors from the USA, China or high-income countries. Among countries categorized as upper-middle income or lower-middle income, publishing systematic reviews is less common practice. Research policy should be designed to promote systematic review research to close the disparity between countries.

## Ethics approval

Not applicable.

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## Competing interests

The authors declare that there is no conflict of interest.

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## Underlying data

All data underlying the results are presented in this article.

## How to cite

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