Original Article

Bibliometric Studies of Most-Cited Medical Papers: A Bibliometric Analysis

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Abstract

Aims: The purpose of this study is the analysis of bibliometric studies of the medical most-cited papers. **Materials and Methods:** This applied and the scientometric study was conducted using retrospective bibliometric analysis methods. A Scopus search was conducted and 883 articles were retrieved. After reviewing the titles and abstracts, 432 articles related to the purpose of this research were identified. Items such as year, journal, country, and institution were considered. Medical subject heading and NLM were applied for the subject categorization of articles. Given the dynamics of subject areas over time, only the content of 117 articles published in 2020 and 2021 were analyzed. These 117 articles have been reviewed with 11,700 most-cited articles. By reviewing 117 articles, the most productive journal, country, and institute in producing 11,700 articles were identified. **Results:** The findings have shown a significant number of these publications review 100 most-cited articles in the field of medicine. Articles pertaining to the *Nervous System*, *Musculoskeletal System*, *Dentistry*, *Radiology*, and *Cardiovascular System* are the most numerous among the publications. **Conclusion:** The results of this study allow readers to know the most productive countries, institutions, and journals of various subject areas, as well as the most influential fields and research trends in that subject area. The results of this study also identify subject areas for which the characteristics of their core articles have not yet been explored to plan future research.

Keywords: Bibliometric, biomedical research, medicine in literature

Introduction

Quantitative and qualitative evaluation of scientific and research findings helps authorities, stakeholders, and government to efficiently use human and financial resources and optimize the socioeconomic structure of the societies. Therefore, financial and organizational planning of the research system requires the evaluation of research activities through scientometric methods.[1] In addition, the study of scientific production provides an efficient tool for appropriate policymaking and planning by having a clear view of past scientific research. As a result, it leads to making purposeful scientific activities, setting research priorities, and identifying weaknesses and deficiencies in the production of scientific information.[2] One of the most effective ways to study the scientific output and particularly the general state of the research, is to review the articles indexed in reliable and trusted databases. In this type of study, the quantitative assessment of scientific production can partly determine the contribution made by each country, institution, scientific discipline, researcher, and its process in different subject areas.

Moreover, citation analysis is regarded as an integral component of current scientometric research as well as a crucial indicator. The number of citations received affects the impact factor of the journal in which the article is published and also identifies

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the credibility, impact, quality, or reputation of the article and the authors who have contributed to the article.[3-6] It is obvious that the most-cited articles are considered a turning point in all subject areas and can specifically affect research and clinical procedures. One hundred most-cited articles in each subject area are regarded as the most influential articles in that area. Scientometric analysis of the most influential articles in each subject area contributes to enhancing our knowledge of the studies, topics, and research trends of each subject domain. This type of analysis, which has received special attention in recent years, represents the procedure of dissemination, evolution of knowledge, and evidence-based performance of subject or field over several years. A collection of the most-cited articles can help specialists in each field better understand the nature of subject areas. Although the number of citations received by a publication is not a measurement of quality, it is used to measure the impact of the article on the scientific community so that high-quality research would lead to more citations than low-quality research.[7] Due to the importance of addressing this issue in recent years, several studies have been conducted in connection with the review of 100 most-cited articles in various subject areas, which reveals the need to pay more attention to this type of research. Therefore, considering the increasing applications of the scientometric method in evaluating and measuring the scientific productions of researchers, the purpose of this study is the analysis of bibliometric studies of medical most-cited papers. The results of this study provide the readership with in-depth insights into the subject area by acquainting them with the leading authors, countries, institutions, and journals of different subject areas, as well as the influential subjects and research trends of each field. The results of this study also point out subject areas for which the characteristics of their core publications have not yet been explored to plan future research.

Materials and Methods

The purpose of this study is the analysis of bibliometric studies of the medical most-cited papers in different subject areas in the Scopus database. This applied and scientometric study was conducted using Retrospective Bibliometric Analysis methods. In the TITLE-ABS field, the search keywords include (100 OR hundred) and (cited OR citation) were combined with the "W/5" proximity operator on February 18, 2021, and 883 records were retrieved. After reviewing these records, 432 articles related to the purpose of this research were identified and analyzed. Then, Medical Subject Heading (MeSH) (https://www.ncbi.nlm.nih.gov/mesh/) was used in order to categorize articles in the field of medical sciences, and NLM Classification (https://classification.nlm.nih.gov) was utilized to categorize articles thematically. MeSH is a controlled and hierarchically-organized vocabulary produced by the National Library of Medicine. It is used for indexing, cataloging, and searching of biomedical and health-related information. NLM Classification is a product of the National Library of Medicine for the arrangement of library materials in the field of medicine and related sciences used internationally. The one-or two-letter alphabetical codes in the NLM classification use a limited range of letters: only QS–QZ and W–WZ. The headings for the individual schedules are given in brief form (e.g., QW-Microbiology and Immunology; WG-Cardiovascular System), and together, they provide an outline of the subjects covered by the NLM classification.

Given the dynamics of subject areas over time, only the content of 117 articles published in 2020 and 2021 were analyzed. These 117 articles have been reviewed in 11,700 most-cited articles in various subject areas of medical sciences. By reviewing 117 articles, the most productive journal, country, and institute in producing 11,700 articles were identified [Figure 1].

Results

The results showed that 432 articles have reviewed and analyzed 100 most-cited articles in various subject areas. The number of published articles has increased from 1987 to 2021. Findings showed that about half of the articles (47.46%) were published between 2019 and 2021. In terms of institutions, The University of British Columbia and Hallym University were found to be the most productive institution, with 15 and 14 articles, respectively. In terms of country, 118 articles originate from the *United States*. The results showed that 432 articles were published in 318 journals. *World Neurosurgery* and *Medicine (United States)* published the most articles, with 20 and 12, respectively. The results showed that 432 analyzed articles have been cited 5429 times. The average number of citations to nonzero events is 16.

In terms of the subject area, a significant number of articles reviewed the top 100 articles in the field of medical sciences. These Articles were categorized using MeSH and NLM Classification. Figure 2 shows these articles based on subject category.

As can be concluded from Figure 2, the WL schedule (*Nervous System*) and WE schedule *(Musculoskeletal System)* were ranked first and second, respectively. There are also 35 articles on the WU schedule *(Dentistry and Oral Surgery*).

Given the dynamics of subject areas over time, only the content of 117 articles published in 2020 and 2021 were analyzed. These 117 articles have been reviewed 11,700 most-cited articles in various subject areas of medical sciences. By reviewing 117 articles, the most productive journal, country, and institute in producing 11,700 articles were identified. The results showed that the *New England Journal of Medicine*, the *Journal of Neurosurgery*, and the *Journal of Clinical Oncology* have been introduced as journals with the most contribution [Figure 3].

According to Figure 3, The *Journal of Urology* and the *Lancet* have been identified as the next most productive journals. Figure 4 shows the most productive countries in publishing 100 most-cited articles.

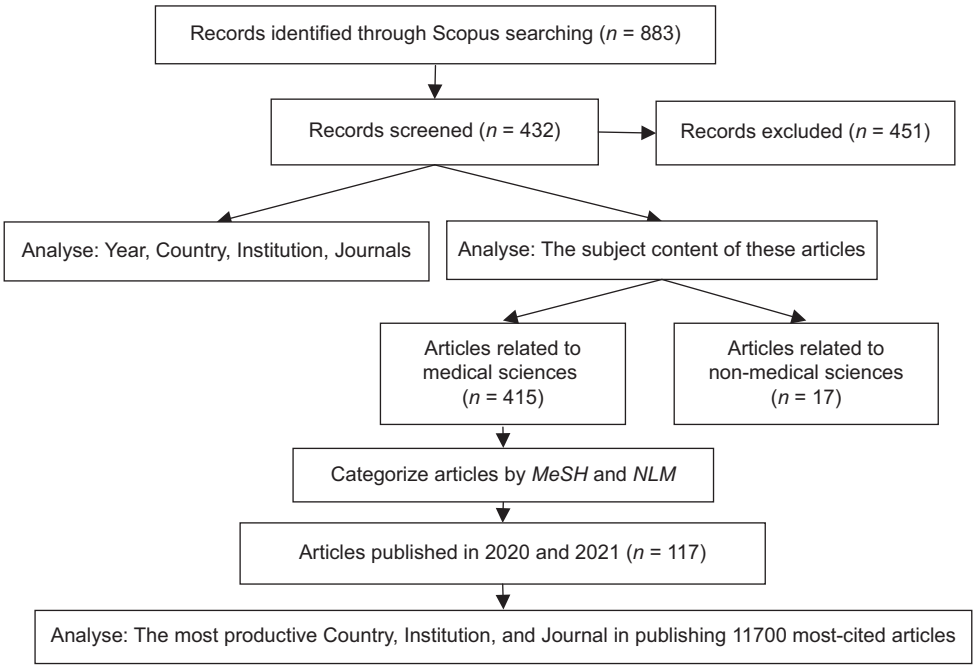

Figure 1: Flowchart of present study process

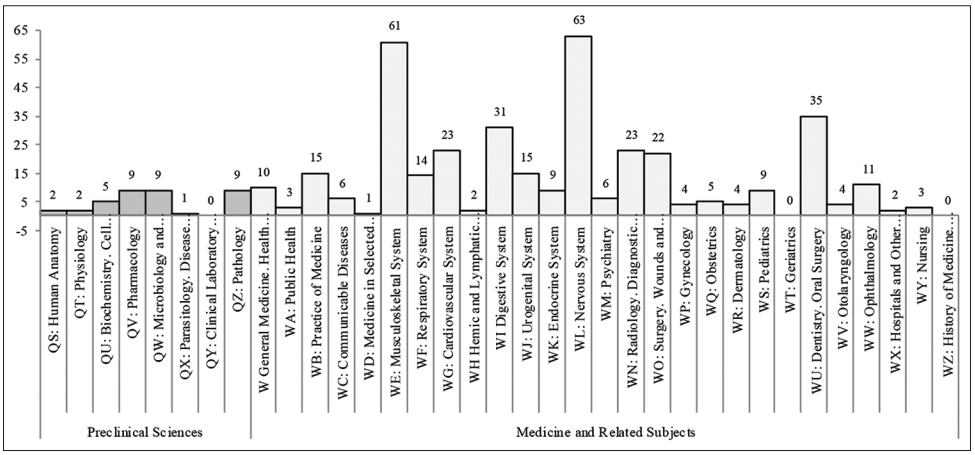

Figure 2: Classification of medical articles

As Figure 4 shows, The *USA* is the most productive country in terms of publishing articles in various subject areas with 108 articles. Regarding the most productive institution/university, the results showed that the University of Cambridge, Harvard University, Mayo Clinic, University of Michigan, and the University of Toronto have been the largest contributors in publishing the most-cited articles.

Discussion

The purpose of this study is to review 432 articles that have analyzed 100 most-cited studies in various subject areas. These articles were published between 1978 and 2020. The number of published articles has been increasing over the past years, and about half of these articles (205 articles) have been published between 2019 and 2021. Furthermore, the number of published articles has grown rapidly since 2012, with only 6% of them published before 2012. These results indicate that in recent years, the analysis of the most-cited articles in various subject areas has attracted researchers' attention. The first article is a study by *Garfield, E.*, which analyzed the 100 most-cited articles in The *Journal of the American Medical Association* and was published in this journal in 1987.[8] The results showed that the average number of citations to nonzero events is 16. The most-cited study is an article that analyzed 100 most-cited articles published in journals related to "general surgical." This article was published in 2002 in the *World Journal of Surgery* and received 281 citations.[3] This article also ranks third in terms of citation density. The article that analyzed the most-cited studies in the "Building Information Modeling" field ranks first in terms of citation density and 7th in terms of receiving citations (118 citations).[9] Top-ranked articles in terms of citation density have often

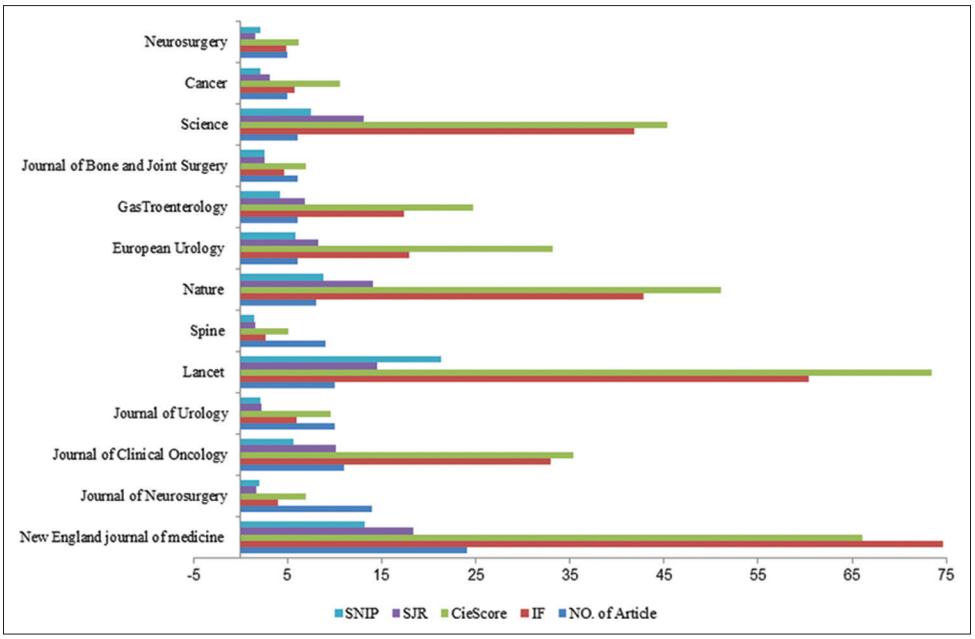

Figure 3: Most productive Journals in publishing most-cited articles

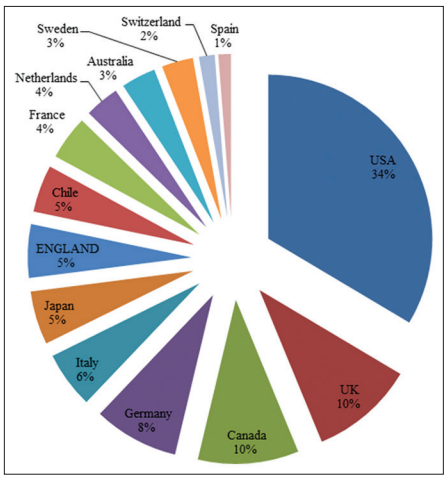

Figure 4: Most productive Countries in publishing most-cited articles

been published in recent years. This result indicates an increase in the quality of recently published articles, so much so that they have been able to receive more citations in a short period of time. One hundred and fifty-nine authors have contributed to the publishing of these articles. The finding showed that the most productive authors were mostly from the Departments of Neurology and Radiology. Yoon, Daeyoung from Hallym University (h-index 21), and Khosa, Faisal from the University of British Columbia (h-index 22) were ranked first and second, respectively, in terms of contribution to the publication of these articles. Among the most-cited articles authored by Yoon and Daeyoung are articles that have analyzed the 100 most-cited articles on Neuroimaging,[10] Headache Disorders,[11] and Neurointervention.[12] Moreover, an article by *Yoon* analyzed the 100 most-cited articles in 12 journals of radiology[13] published in 2013 and received 65 citations. *Khosa* and *Faisal* have analyzed the most-cited studies in the fields such as Radiology of Trauma,[14] Cardiac Computed Tomography,[15] Cardiovascular Magnetic Resonance.[16] In terms of organizational affiliation, authors from the University of British Columbia and Hallym University were ranked first and second with 15 and 14 articles, respectively. The results showed that 432 articles were published in 318 journals. More than 20% of the articles have been published in 19 journals, among which 7 journals were with CiteScore Quartile 1 and 7 with CiteScore Quartile 2. The *journal World Neurosurgery*, published by *Elsevier*, was ranked first with 20 articles published in it. Fifty-five countries contributed to the publication of 432 reviewed articles. The *United States* was the most productive, ranking first with 118 articles. The results revealed that more than half of these articles were published by the contributions made by four countries, including *the USA*, *China*, the *UK*, and *Canada*. According to the Scopus subject classification, 432 articles have been published in 25 subject areas. Medicine has the largest number of articles, with 336 articles, while a significant percentage of the articles are related to other medical subjects, such as Dentistry, Neuroscience, Health Professions, and Nursing.

Some of these articles review and analyze 100 most-cited articles published in a particular journal. These studies analyzed articles published by the Journal of the American Medical Association,[8] Medical Journal Armed Forces India,[17] Journal of Dental Research,[18] Environmental Research Letters.[19] Some articles have been reviewed articles in journals of a specific subject category, including Core Dental Public Health,[20] Prosthodontic,[21] Knowledge Management,[22] Emergency Medicine,[23] Radiology,[24] Paediatric Dentistry,[25] Allergy,[26] Primary Health Care,[27] and General Medical.[28]

Some of these articles reviewed articles from a specific country. For instance, there is a study that has analyzed 100

most-cited articles in *Turkey* in 40 orthopedic journals.[29] Other studies have analyzed Turkish articles on Respiratory systems[30] and Abdominal Wall Hernias.[31] Another article reviews the 100 most-cited articles published in dental journals by at least one author from *Brazil*.[32] Furthermore, a study has reviewed and analyzed articles from *India* and *China*.[33] A study also analyzed 100 most-cited medical and surgical articles published in the journals of the *Republic of Ireland or Northern Ireland*.[34] Some of these articles also review specific types of articles. A study analyzed 100 most-cited systematic reviews and meta-analysis articles.[35] There are also studies that reviewed 100 most-cited Randomized Controlled Trials, Systematic Reviews, and Meta-Analysis articles published in journals of a specific subject category such as Endodontic[36] and Dentistry.[37]

Most of the 432 reviewed articles have analyzed 100 most-cited articles in a specific subject area, of which medical science has attracted the focus of a significant percentage of these articles and only 37 articles analyzed other areas. Most of the articles that analyzed the 100 most-cited articles in medical science dealing with the Nervous System and Musculoskeletal System subject categories. The nervous system includes subjects such as Skull Base Neurosurgery,[38] Spinal Deformity Surgery,[39] Pediatric Traumatic Brain Injury,[40] Traumatic Spinal Cord Injury,[41] and Brain Metastases.[42] Subjects such as Hip And Knee Arthroplasty[43] and Back Pain[44] are also related to the Musculoskeletal System. Dentistry and Oral Surgery, Radiology, Surgery, and Cardiovascular System are also in the next ranks in terms of the number of articles. The review of most-cited articles pertaining to oral and dental fields, including Dental Caries,[45] Dental Stem Cells,[46] Endodontics,[47] and Oral Leukoplakia[48] has also attracted the attention of many researchers. The results showed that most of the medical articles focused on Medicine and Related Subjects, and a small percentage of the articles has analyzed topics related to Preclinical Sciences. Among the subject categories related to Preclinical Sciences, OW, OV, and QZ have the largest number of articles. These articles are related to Pathology, Pharmacology, Microbiology, and Immunology. The analysis of the most-cited articles in the area of the History of Medicine, Geriatrics, Nursing, Hemic and Lymphatic Systems, Medicine in Selected Environments, Parasitology, Anatomy, and Physiology has received less attention from researchers.

To further analyze the content of these studies, out of 432 reviewed articles, 117 were selected. The reason for selecting these articles is their publication in 2020 and 2021 and their focus on analyzing the most-cited medical sciences articles. The results showed that the 100 most-cited studies reviewed in these 117 articles were mostly retrieved from WoS and Scopus citation databases.

The results of bibliographic analyses, such as the most productive author, journal, institute, and country in each subject area, are presented in Supplement 1. Out of 18 journals that have been introduced in more than four studies as the most productive journals in publishing 100 most-cited articles in different subject areas, 17 journals are Q1 based on impact factor, and all 18 journals are Q1 based on the CiteScore index. The results showed that the New England Journal of Medicine, the Journal of Neurosurgery, and the Journal of Clinical Oncology were introduced as the most productive journals in publishing most-cited articles in various subject areas. According to the IF and SJR index, "The New England Journal of Medicine" was ranked first (IF = 74.699 and SJR = 18.291), and in terms of CiteScore and SNIP index, "Lancet" was ranked first (CiteScore index = 73.4 and SNIP = 21.313). Based on H-Index, "Nature" and "Science" were ranked first and second with 1159 and 1124, respectively. The USA contributed 108 studies and is considered the most productive country thanks to its publication of articles on various subject areas; therefore, among 101 articles, the United States ranks first in terms of publishing 100 most-cited articles.

Conclusion

A review of research that has analyzed the bibliographic information of 100 most-cited articles in various subject areas can provide valuable information to researchers in these subject areas. Researchers and experts can use the results of this research to recognize the most productive authors, journals, countries, and institutions in publishing high-quality articles in various subject areas. Moreover, the analysis carried out in the mentioned articles covered the subjects that have received the most attention in the most-cited articles in the field. Knowing these areas of research can be used to determine research priorities because these subjects have been able to receive more citations as well as more attention from researchers in that field. Furthermore, the result of this research was able to identify subject areas that have not been researched in connection with the analysis of the most-cited articles.

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Conflicts of interest

There are no conflicts of interest.

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