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April 2021

## Medical Research in Pakistan; A Bibliometric Evaluation from 2001 to 2020

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# Medical Research in Pakistan; A Bibliometric Evaluation from 2001 to 2020

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## Abstract

**Aim:** This study aimed to present the research productivity of Pakistan in the field of medical sciences as reflected in the Scopus database.

**Methods:** The retrospective research method was used on the retrieved dataset at the King Saud bin Abdulaziz University for Health Sciences, Saudi Arabia on the 2nd of March 2021. We collected bibliometric data on medical sciences produced by the authors affiliated to Pakistan during the first two decades of the 21st century from January 2001 to December 2020, using the Scopus-Elsevier database. We downloaded the total number of published papers on nine broad categories of medical sciences with at least one author affiliated to Pakistan. The data was distributed by years and by subject categories, further, top-ten authors, journals, institutions, and collaborative countries were presented in tabular form. VOS viewer software was applied to visualize the co-occurrence pattern of authors and keywords.

**Results:** Pakistan produced 54,717 documents related to medical sciences in the targeted period with 2,735 papers per year. The majority of research was done on the subject category of Medicine and Zulfiqar A. Bhutta was found the most prolific researcher. Slightly less than half of the documents were published in top-ten national journals. The Aga Khan University and Hospital have emerged as the most productive research producing organization and most of the research was carried out in collaboration with the United States.

**Conclusion:** Out of the total research productivity for twenty years, more than one-fourth (27%) of total research was related to medical sciences. Pakistan shared 0.58% of the global research output in 2019. There is a need to articulate a practicable strategic plan to boost the research culture in the country.

**Keywords:** Research productivity, Health sciences research, Pakistan

## Introduction

Research is an organized and systematic approach to discover answers to questions. This process involves the collection of data or information, analysis, and interpretation of data to find a suitable answer to a certain query or solve a question or contribute to existing knowledge. One of the main objectives of medical education and practical training is to develop the curiosity to explore, conduct, and capacity to share scholarly ideas through publication (AlJundi, Riba & Baskaradoss, 2016, p-3). Research is considered an important component of knowledge. It is valuable intellectual and academic activity to enhance the existing reserve of knowledge and improve the existing theories. Medical research is directly linked with the overall quality of human life comprising physical, mental, and emotional health. The practitioner can learn the skills of literature search, collecting and

analyzing the dataset, and critical evaluation of the evidence through research activity (Haq, Elahi & Dana, 2018; Farooq & Zulqernain, 2019).

The reasonable growth of publications has been observed in every branch of knowledge in Pakistan, after the restructuring of the higher education sector in 2002. New medical universities have been established and upgraded the existing medical institutions. The allocation of the research budget was increased significantly, and the project of the National Digital Library has been initiated to support the researchers and academicians. Participation in continuing professional development activities and research publications became mandatory for promotion and up-gradation for faculty and practitioners (Meo, Almasri, & Usmani, 2013). Many studies recorded their concerns about the low medical research productivity in Pakistan (Khurram, 2012; Jawad, 2015; Gaffar et al., 2013; Ahmed, 2018)

Pakistan, the fifth largest country in the world, is the home of 211.17 million people. There were two medical and one dental college in 1947, now this number of medical colleges reaches 117 (45 in public and 72 in the private sector) and the number of dental colleges reaches 59 (17 in public and 42 in the private sector (<https://www.pmc.gov.pk/>) According to the Factbook of United States, Central Intelligence Agency (2021) the government of Pakistan is spending more than 3% of its gross domestic product (GDP) on health expenditure having 0.89 physicians for 1,000 populations (Central Intelligence Agency, 2021), whereas the Pakistan Economic Survey of 2019-2020 reported that the government allotted health 421.8 billion for health expenditure during the financial year 2019, that was 1.1% of total GDP. (p-216).

Investment in the health science sector has a direct effect on the well-being of the people (Haq & AlFouzan, 2017). According to Times Higher Education World University Ranking 2020, 14 Pakistani universities have been reached in the list of 1400 universities of 92 countries, only, Quaid-e-Azam University reaches in top 500 universities of the world. Pakistan stands on 34th position in global research productivity with 24,312 publications (global share 0.58%) during 2019, having 101 source publications as indexed in Scimago Journal and Country Rank (2020). Amongst the 12,838 journals indexed in Web of Science, Journal Citation Reports (JCR)-2019 of Clarivate Analytics, eleven Pakistani journals indexed in JCR.

The culture of continuous medical research and revision of curriculum are integral parts of the quality health care system. The periodic appraisal of medical research productivity will be helpful to highlight the strong and weak areas of research. The statistical analysis of literature and evaluation of research publications provides insight data for policymaking, allocation of funds, and monitoring the existing policies. This data has also been used by different agencies for the grading of regions, countries, and institutions (Haq & Al Fouzan, 2017; Haq et al., 2020).

The bibliometric method has been recurrently applied to get the desired data of research output. In this method, the different variables of publications have been assessed by year, subject, institution, research collaboration, citation count, source publication and funding agencies, etc. (Ibrahim & Jan 2015). Two commercial subscription-based databases, the Web of Science and Scopus are comprehensively used for this purpose, even the world university ranking molded their results on research indicators by using these databases (Vieira, & Gomes, 2009). Two open-access databases, PubMed and Google Scholar are also applied by the different scholars to evaluate the research publications on different fields of knowledge and highlight the characteristics of publications (Anders, & Evans, 2010). A synonym term scientometrics has also been used to assess the scientific publications (Ibrahim & Jan 2015).

Bibliometric studies have been very common around the globe to assess the various attributes of publications. Library and information science (LIS) professionals of Pakistan are actively contributing their valuable share in this research format. Usually, their studies are limited to the bibliometric evaluation of a single medical journal (Memon, 2019; Ullah, Butt & Haroon 2009; Baladi et al., 2018).

Some research papers evaluated the research productivity of different medical institutions of Pakistan, as Army Medical College, Shifa Tameer-e-Millat University, King Edward Medical University, and Aga Khan University Medical College (Haq, Ullah & Tanveer, 2020; Latif & Haq, 2020, Ahmad, 2020; Ali, Gatiti & Haq, 2021).

Mushtaq, Abid, and Qureshi (2012) examined the research output of Pakistani medical institutions published from 2007 to 2010 based on the data retrieved from the Higher Education Commission (HEC) of Pakistan. HEC maintained the quality data that was published in JCR indexed journals. Twenty-four universities produced 5,889 articles related to medical sciences. Almost one-fourth of the research was created by the University of Karachi, followed by The Aga Khan University and the National University of Sciences and Technology. More than half of the publications were produced by researchers affiliated with Karachi.

Meo, Almasri, and Usmani (2013) investigated the research productivity of Pakistan from 1996 to 2012. A total of 58,133 records were produced by Pakistan and 25,604 (44%) of the research related to various branches of medical sciences. The study suggested establishing a comprehensive strategic plan and increasing the budget of higher education to improve the research productivity in the country.

Farooq & Zulqernain (2019) study examined the research output on mental health that was contributed by the medical colleges of Pakistan till 2017 based on the PubMed database. A total of 118 articles were found and 56% of the articles were produced after 2013. The Journal of Pakistan Medical Association (JPMA) was found a most preferred source of publications with 33 articles and the majority of articles (n=101) were written on the subject of depression.

Nisar and Ahmed (2018) scrutinized the global research productivity on Zika Virus during 2008-2017. A total of 3,384 records were found and 89% of the records were published during the last two years of the targeted period. The United States was found the most productive country with 47% of publications, while low research output (n=38; 0.71%) was discovered by Pakistan.

A 2012 study revealed the 62 publications on neurosurgical research in Pakistan published from 2003 to 2008, 48 papers were published in local journals while 14 papers were published in international journals (Shamim, Enam & Kazim 2011).

Haq, Elahi, and Dana (2019) evaluated the publications output on medical microbiology in Pakistan from 2013 to 2017 indexed in PubMed. A total of 333 papers were examined in the study and remarkable growth of publications found from 23 papers in 2013 to 110 papers in 2017 was found with an average annual growth rate of 31.29. The Aga Khan University has emerged as a prolific institution with 35 papers based on the affiliated address of the first author. The Pakistani authors collaborated with 29 countries in 39% of papers, the United States was found on the top with 35 (11%) papers.

Memon (2019) analyzed the 7,245 documents (original articles and review articles only) of the JPMA published from 1965 to 2018 as reflected in the Scopus database. The researchers affiliated to Pakistan, produced 4,190 (58%) documents while the rest of the documents (42%) were contributed by international researchers, Turkey (n=443) was on the top, followed by India (n=198), Iran (n=196), and Saudi Arabia (n=195). The citation analysis found that 7,245 documents received 18,292 citations with an average of 4.36 citations per document. Zuberi, S. J., and The Aga Khan University were found the most productive author and institution with 155 and 1,884 (26%) documents, respectively.

Earlier, Ibrahim and Jan (2015) examined the 913 articles that were published in the JPMA from 2009 to 2013. Maximum, 481 (52.7%) articles were contributed by the authors affiliated to Sindh Province. All articles were classified into 53 medical specialties and Community Medicine (n=140; 15.3%) was found the most preferred area of research.

A bibliometric study on the Journal of Ayub Medical College (JAMC) from 1997 to 2006 revealed that 572 papers were published, and 9,968 references were used with an average of 17.43 references per paper. The majority of papers (47%) followed the range between 11-20 references per paper. Muhammad Tayyab and Waris Qidwai were found to be the productive authors with seven papers each. The majority of papers were written on the subject of Internal Medicine (29%) followed by Pathology (13%) and Surgery (12%). Among the most productive institutions, more than one-third (35%) of the papers were contributed by the publishing institute of JAMC, the Ayub Medical College and Hospital Complex (Ullah, Butt & Haroon 2008).

Haq et. al. (2020) assessed the health sciences research productivity in Saudi Arabia from 2008 to 2017. The study revealed that Saudi Arabian authors produced 35,291 documents and the King Saud University produced more than one-fourth (29%) of the publications. In international research collaboration, Egypt and United States were found most preferred countries.

A scientific study on medicine research in India revealed that a total of 29,153 papers were published from 2009 to 2018 with an average of 15.07 citations per paper. All India Institute of Medical Sciences emerged as the productive institute with 2,209 (8%) papers and the Indian Journal of Medical Research was found the preferred source of publication (Chaman, Dharani & Biradar 2018).

Ranasinghe, Jayawardena, & Katulanda (2012) analyzed the medical research output of Sri Lanka from 2000 to 2009. A total of 1,740 articles were identified in the Scopus database. More than half of the articles (54%) were published in international journals. These articles were cited 9,708 times, with an average of 5.6 citations per paper.

El Rassi et al., (2018) reported that a total of 76,978 research papers on medical sciences were produced by 22 Arab countries during the period of ten years from 2007 to 2016, which counted 1.6% of the global production. Egypt and Saudi Arabia contributed 60% of the total.

Mohammad et al., (2010) conducted the 30-year research productivity of Iran and revealed that a total of 11,901 publications were found in the Web of Science database from 1978 to 2007 with an average of 396.7 papers per year. Mazboudi (2010) presented a total of 1964 papers on the medical sciences that were found produced by Lebanon during the 20 years from 1985 to 2004 as indexed in the PubMed database.

This paper aims to evaluate the research productivity of Pakistan in the field of medical sciences published from 2000 to 2019 based on data retrieved from the Scopus database with the following objectives.

1. To assess the chronological growth of publications on medical sciences by Pakistan.
2. To segregate the retrieved publications by nine broad subject categories and highlight the preferred areas of research.
3. To present the ten-topmost productive authors and institutions in medical research in Pakistan.
4. To calculate the type of research and frequently used journals by Pakistani medical researchers.
5. To show the trends of international research collaboration in medical sciences.

## Methodology

The descriptive research method has been used in this paper. All types of publications on medical sciences with at least one author affiliated to Pakistan were retrieved from the Scopus-Elsevier database on the 2nd of March 2020 at the library of College of Dentistry, King Saud bin Abdulaziz University for Health Sciences, Saudi Arabia. The timespan of documents was selected from 2001 to 2020. The bibliographical records and summary were downloaded in a Microsoft Excel file for evaluation of the selected bibliometric meters set in the objectives of the paper. The data was examined and presented in a tabular shape.

## Limitation

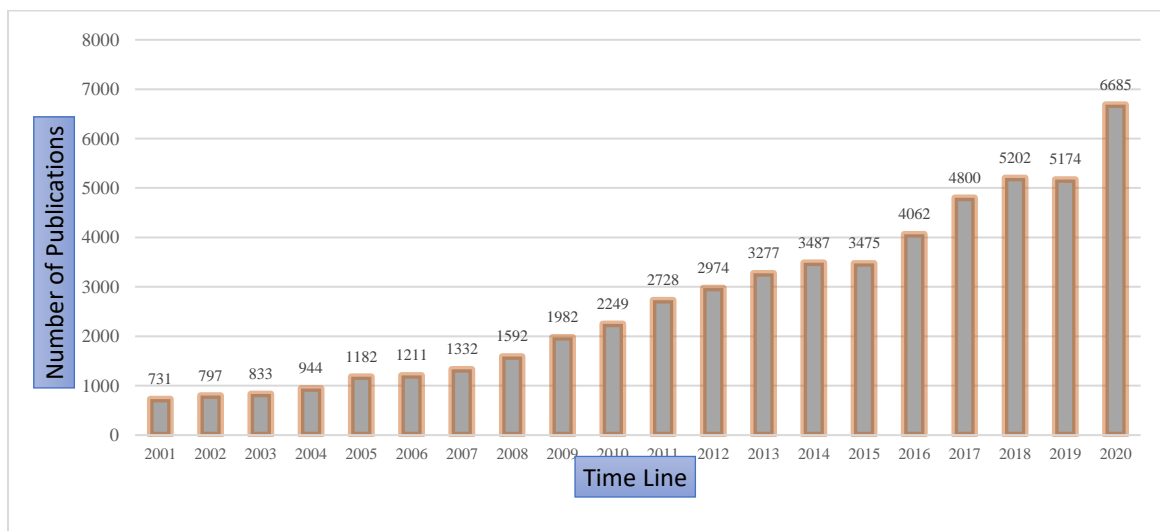
The findings of this paper are limited to the results of the Scopus database. The articles published in other than Scopus indexed sources have not been included in this paper.

## Results

### *Chronological growth*

Pakistan contributed 2,01,807 documents during the period of twenty years from the year 2001 to 2020 in all the fields of knowledge as reflected in the Elsevier-Scopus database on 2nd March 2021. The share of medical sciences comprises more than one-fourth (n=54,717; 27%), with an average of 2735.85 documents per year. There has been a remarkable growth of documents from 731 in the year 2001 to 6,685 in the year 2020 as shown in Figure No. 1. The graph of documents has been mounting except for the years 2015 and 2019. Almost 23.48% of the documents are produced during the first ten years (2001-2010), while 76.52% of the documents in the last ten years (2011-2020). The year 2020 is marked as the most productive year, with 6,685 (12.21%) documents.

**Figure 1, Chronological distribution of publications (n=54,717)**



### *Segregation of documents by broad subject categories*

A total of 54,717 documents of medical sciences have been further divided into nine broad medical subjects as shown in Table 1. A majority of research has been carried out on the subject of Medicine, followed by Biochemistry, Genetics & Molecular Biology, and Pharmacology, Toxicology & Pharmaceutics. Fewer documents have been written on neuroscience, psychology, dentistry, and health professions as compared to other subject areas.

**Table 1, Distribution of documents by subject area**

Ranks	Subject Area	Frequency of Documents (%)
1.	Medicine	42,423 (66.13)
2.	Biochemistry, Genetics & Molecular Biology	7,382 (11.51)
3.	Pharmacology, Toxicology & Pharmaceutics	6,560 (10.23)
4.	Immunology & Microbiology	3,449 (5.38)
5.	Nursing	1,907 (2.97)
6.	Neuroscience	914 (1.42)
7.	Psychology	710 (1.11)
8.	Dentistry	409 (0.64)
9.	Health Professions	403 (0.63)

***Most influential authors***

Table 2 reveals the list of most productive Pakistani authors in the field of medical sciences during the targeted period. Zulfiqar A. Bhutta was found the most productive author with 686 documents. He was bestowed with the Pride of Performance Award in 2018 for his valuable contribution to medical sciences. Muhammad Iqbal Choudhary of H.E.J Research Institute of Chemistry, Karachi was the second most productive researcher followed by Wasim Ahmad of Quaid-e-Azam University, Ghulam Murtaza of the University of Agriculture, Faisalabad, and Anwar H. Gilani of The Aga Khan University. Amongst the ten most productive authors, four authors belong to The Aga Khan University, Pakistan.

**Table 2, Ten topmost productive authors**

Researchers' Name	Affiliated institution	Documents
Zulfiqar A. Bhutta	Hospital for Sick Children University of Toronto, Canada & The Aga Khan University, Pakistan	686
Muhammad Iqbal Choudhary	University of Karachi, H.E.J. Research Institute of Chemistry, Karachi, Pakistan	255
Wasim Ahmad	Quaid-i-Azam University, Pakistan	228
Ghulam Murtaza	University of Agriculture, Faisalabad, Pakistan	214
Anwar H. Gilani	The Aga Khan University, Karachi, Pakistan	202
Wasim Haider Jafri	The Aga Khan University, Pakistan	187
Haroon Khan	Abdul Wali Khan University Mardan, Pakistan	184
Ziagham Abbas	The Aga Khan University, Pakistan	172
Ammad Ahmad Farooqi	Institute of Biomedical and Genetic Engineering (IBGE), Islamabad	168
Muhammad Mubarak	Sindh Institute of Urology and Transplantation, Pakistan	158





**Table 4, Most preferred journals**

S.No.	Name of Journal	Documents	SJR
1.	Journal of the Pakistan Medical Association	4,989	0.24 (Q3)
2.	Journal of the College of Physicians and Surgeons Pakistan	4,327	0.20 (Q3)
3.	Pakistan Journal of Medical and Health Sciences	4,014	0.12 (Q4)
4.	Medical Forum Monthly	3,027	0.11 (Q4)
5.	Journal of Ayub Medical College Abbottabad	1,862	0.19 (Q3)
6.	Pakistan Journal of Medical Sciences	1,838	0.32 (Q3)
7.	Pakistan Journal of Pharmaceutical Sciences	1,616	0.23 (Q2)
8.	Rawal Medical Journal	1,285	0.11 (Q4)
9.	Journal of Postgraduate Medical Institute	7,59	0.13 (Q4)
10.	Journal of Pakistan Association of Dermatologists	701	0.17 (Q4)

***Most productive research producing institutions***

The breakdown of the productive institutions in terms of the number of documents produced from 2001 to 2020 is presented in Table 5. The Aga Khan University has emerged as a top-ranked institution with 5,415 documents, followed by The Aga Khan University Hospital and the University of Karachi with 4,558 and 2,488 documents, respectively. The top-six institutions produced more than 2,000 documents each while eight institutions produced the range between 1,000 to 2,000 documents. Among the top-ten institutions, two hospitals are also included.

**Table 5, Most productive institutions**

S.No.	Institution's Name	Frequency of Documents
1.	The Aga Khan University	5,415
2.	The Aga Khan University Hospital	4,558
3.	University of Karachi	2,488
4.	Dow University of Health Sciences Pakistan	2,274
5.	University of the Punjab, Lahore	2,181
6.	Quaid-i-Azam University	2,062
7.	COMSATS University Islamabad	1,525
8.	Liaquat National Hospital	1,372
9.	King Edward Medical University Lahore	1,153
10.	Khyber Medical College	1,094

***Trends of international research collaboration***

Pakistani authors have been actively collaborating with international authors in medical research. Amongst the most preferred countries, the United States has been on the top with 4,972 documents followed by United Kingdom (n=3,294), China (n=2,556), Saudi Arabia (n=2,401), and Canada (1,622). There are four countries with mutual research collaboration having more than 2,000 documents (Figure 3). Most of the Pakistani medical practitioners and postgraduate students have been pursuing their higher studies from United States, United Kingdom, China, Canada, and

Germany, so the collaborative research activities are at the peak with these countries. As far as Saudi Arabia is concerned, most of the Pakistani doctors are involved therein teaching, research and practice, so they are collaborating with the local researchers.

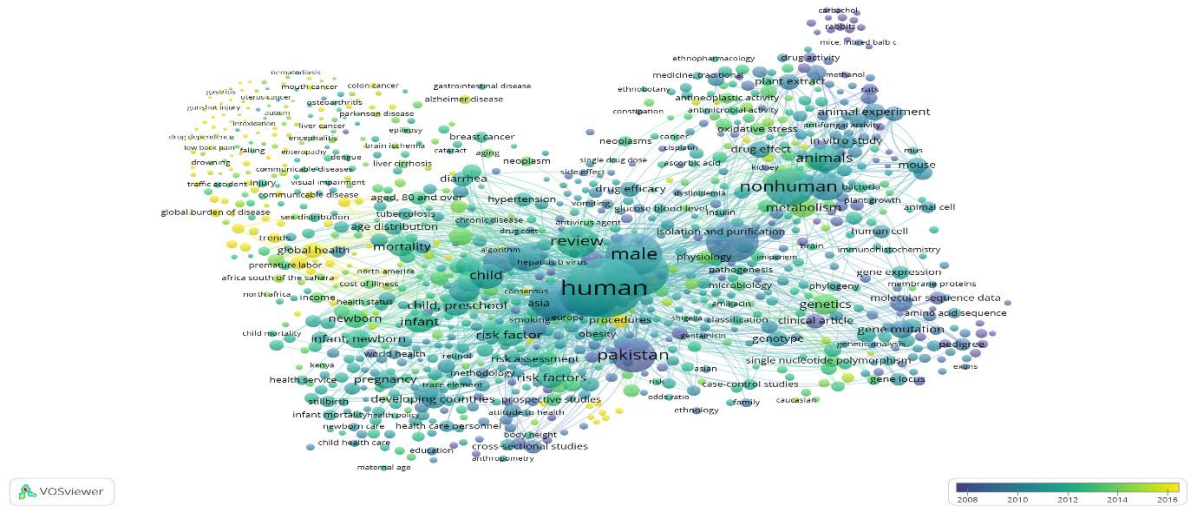
**Figure 3, International research collaboration**



**Co-Occurrence of keywords**

Figure 4 presents that a total of 19,998 keywords are used in 54,717 documents, the most occurring keywords are *human* (1,530 times, with total link strength 34,050), *female* (908 times, with total link strength 24,061) *controlled study* (698 times, with total link strength 16,204), *Pakistan* (496 times, with total link strength 11,547), and *child* (285 times, with total link strength 8,734). Out of 19,998 keywords, 3,020 keywords met the threshold with the occurrence of the minimum five times.

**Figure 4, Frequently used keywords**



## Discussion

Research has been considered a very important component of every branch of knowledge. It is valuable intellectual and academic activity to enhance the existing reserve of knowledge and improve the existing theories. Medical research is directly linked with the overall quality of human life comprising physical, mental, and emotional health. The practitioner can learn the skills of literature search, collecting and analyzing the dataset, and critical evaluation of the evidence through research activity (Haq, Elahi & Dana, 2018).

The latest edition of the Pakistan Economic Survey 2019-20 stated the total figure of registered doctors in Pakistan was 233,261 and these doctors contributed to 5,174 documents, if we suppose that one doctor contributed in one paper each, so 2.21% of the total doctors contributing in the research process. Although, it is stated that the Scopus database doesn't provide a complete picture of research productivity we can say this fraction of publications may be considered as a big snapshot of research output. Khan, Khan, and Iqbal (2009) carried out a study to understand the perception of postgraduate medical trainees at the Aga Khan University, Pakistan regarding health care research. The majority of the respondents demonstrated inadequate knowledge and moderate attitudes towards medical research. The study suggested modification in curriculum and encouragement to cultivate a productive research culture.

The data for this study has been obtained from Scopus, a globally trusted database. This database provides comprehensive coverage of scholarly and scientific literature. Pakistan produced 54,717 documents on Medical Sciences during the period of 20 years from 2001 to 2020 with an average of 2,735 documents per year. The upward trends of publication found in the targeted period except for the years 2015 and 2019. A 2013 study conducted by Meo, Almasri, and Usmani reported that 25,604 papers on medical science were produced by Pakistan from 1996 to 2012 with an average of 1,506 papers per year. Our study proved that the annual ratio of publication has been increased. An average ratio of papers per year on medical sciences was found 2,915 and 3,529 in India and Saudi Arabia, respectively (Chaman, Dharani, & Biradar, 2018; Haq et al., 2020). As far as the medical community of India and the investment of Saudi Arabia in medical sciences are concerned, the growth of medical publications in Pakistan is found promising.

In our research findings, the United States, United Kingdom, Saudi Arabia, and China were found the topmost research collaborative countries. The paper is written by Iqbal, Mahmood, and Iqbal (2018) also confirmed similar results. They examined the features of research growth and visibility of Pakistan from 1981 to 2015 as indexed in the Web of Science. A total of 74,755 documents were identified and the share of Clinical, Pre-Clinical, and Health was 17,316 (23%). Out of the total research, more than one-third (36.51%) had resulted with international collaboration, the United States was found on the top, followed by United Kingdom, China, and Saudi Arabia. The study concluded that the collaboration research gained more citations as compared to papers written by less than five-author pattern. This study declared that the share of medical sciences was 23% while our study stated 27%. Both studies used different retrieval sources and dissimilar time duration, even then the results are very closed to each other.

In our study, more than two-thirds (66%) of the total research was carried out on the subject of Medicine and Dr. Zulfiqar A. Bhutta was found most prolific researcher with 686 documents. The analysis of research-type revealed that 84% of the research consisted of original research articles. All ten most preferred journals are published from Pakistan, 45% of the total documents published in these journals, and the JPMA was found the most trusted source with 4,989 (9.11%) papers. The Aga Khan University was found the productive medical research organization in Pakistan during the last twenty years with 5,415 (9.89%) documents. Pakistan made extraordinary progress in the field of medical research from 731 documents in 2001 to 6,685 documents in 2020. Twenty-seven percent of

the total national research productivity has been comprised of medical sciences. The United States found the favorite country in international research collaboration with 4,972 (9%) documents.

There is a dire need to teach and train young medical practitioners in the art of conducting and writing research papers. Even undergraduate students should be encouraged to participate in the research process with their seniors, this kind of activity provides the opportunities to facilitate familiarity and self-confidence. Our results can be used to formulate a research policy for medical and health sciences. Further, the publication and collaboration patterns, as well as highlighted the strong and weak areas of research, help the policymaker to revisit their priorities and research allocation.

Our study is purely quantitative, quality indicators such as citation analysis and impact factor of journals were not examined. Future studies may add these features to their research. Other databases like the Web of Science, PubMed, and Google Scholar may have more records but this study is limited to the results of the Scopus database.

## Conclusion

It is very encouraging that 28% of the total research output of Pakistan has been related to medical sciences but we still need to do more. The present bibliometric analysis of medical research could be helpful for policymakers in their decision-making process. The economic growth of the country has been directly linked with the physical, mental, and spiritual health of the citizen, so the investment in the health sector could be returned in the form of sustainable economic development of the country. There is a dire need to formulate a practicable strategic plan to cultivate the research culture in the country, further the implementation and the monetarization of a plan with a dedicated team.

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