Mapping the landscape of medical research in the Arab world countries

A comprehensive bibliometric analysis

Shadan Almuhaidib, MPH, *Rawan Alqahtani*, MPH, *Haifa F. Alotaibi*, MD, MPH, *Asma Saeed*, MPH, *Sahar Alnasrallah*, MPH, *Fayez Alshamsi*, MD, *Saleh A. Alqahtani*, MD, *Waleed Alhazzani*, MD, MSc.

ABSTRACT

الأهداف: تجري هذه الدراسة تحليلاً وصفياً لإنتاجية وأداء وتأثير البحوث الطبية في دول العالم العربي.

المنهجية: أجرينا تحليلاً بيليومتريًا باستخدام بيانات قواعد Clarivate Analytics من يناير 2017م حتى مارس 2023م. وقد قمنا بتقرير إنتاجية الأبحاث، وأنماط التعاون البحثي الوطني والدولي، وتأثير مخرجات البحوث الطبية العربية مقارنة بالمتوسط العالمي، كما قمنا بتحديد أكثر المجلات الطبية التي تنشر أبحاثًا من الوطن العربي، وأداء المؤسسات العربية الأكثر إنتاجية.

النتائج: ساهم العالم العربي بنسبة 2.72% في نشر البحوث الطبية عالميًا، بتأثير استشهاد بلغ 11.98 مقارنة بالتأثير العالمي البالغ 12.02. تصدرت قطر، لبنان، والمملكة العربية السعودية منشورات الأبحاث الطبية لكل مليون نسمة بين دول العالم العربي، حيث احتلوا المراكز 26، 36، و37 على الصعيد العالمي. زادت منشورات الأبحاث الطبية بنسبة 87% سنويًا من 2017 إلى 2022، حيث كان مصدر 70% من الأبحاث من المملكة العربية السعودية ومصر. وشكلت التعاونات الوطنية 15% من إجمالي منشورات العالم العربي، في حين مثلت التعاونات الدولية 66%. كان متوسط عامل التأثير لأفضل 20 مجلة طبية تحتوي على مؤلفين من العالم العربي هو 5.14، حيث كانت 50% من هذه المجلات في الربع الأول. كان متوسط عامل التأثير لأفضل 10 مجلات طبية من أصل عربي 3.13. 80% من أفضل 20 مؤسسة عربية كانت أكاديمية، بمتوسط عدد المنشورات 3,162.5 ومتوسط تأثير الاستشهاد 14.5.

الخلاصة: تقدم هذه الدراسة نظرة ثاقبة حول حالة البحوث الطبية في العالم العربي، مشيرة إلى وجود فرصة لتحسين البحث الطبي في المنطقة.

Objectives: To describe the productivity, performance, and impact of medical research in the Arab world countries.

Methods: We carried out a bibliometric analysis using Clarivate Analytics databases from January 2017 to March 2023. We reported research productivity, national and international research collaboration patterns, impact of Arab medical research output compared to the global average, top medical journals publishing Arab-affiliated research, and performance of the most productive Arab institutions.

Results: The Arab world contributed 2.72% to global medical research publication, with a citation impact of 11.98 compared to the global impact of 12.02. Qatar, Lebanon, and Saudi Arabia led medical research publications per million population among Arab countries, ranking 26th, 36th, and 37th globally. Medical research publications increased by 87% annually from 2017-2022, with 70% of research originating from Saudi Arabia and Egypt. National collaborations accounted for 15% of Arab world publications, while international collaborations represented 66%. The median impact factor across the top 20 medical journals with Arab-affiliated authors was 5.14, with 50% being quartile one journals. The top 10 Arab-origin medical journals had a median impact factor of 3.13. Approximately 80% of the top 20 Arab institutions were academic, with a median publication count of 3,162.5 and a median citation impact of 14.5.

Conclusion: The study provides insights into the state of medical research in the Arab countries, indicating room for improvement in the region's medical research.

Keywords: bibliometrics, biomedical research, Arabs, Arab World, publications

From the Scientific Research Center (Almuhaidib, Alotaibi, Saeed, Alnasrallah, Alhazzani), Ministry of Defense Health Services, from the Department of Business Intelligence and Information Management (Alqahtani), Rumah General Hospital, Riyadh Second Health Cluster, Ministry of Health, from the Organ Transplant Centre of Excellence (Alqahtani), King Faisal Specialist Hospital and Research Centre, from the Department of Critical Care (Alhazzani), College of Medicine, King Saud University, Riyadh, Kingdom of Saudi Arabia, from the Department of Internal Medicine (Alshamsi), College of Medicine and Health Science, United Arab Emirates University, Al Ain, United Arab Emirates, from the Division of Gastroenterology and Hepatology (Alqahtani), Johns Hopkins University, Baltimore, United States of America, and from the Department of Health Research Methods, Evidence, and Impact (Alhazzani), McMaster University, Hamilton, Canada.

Address correspondence and reprint request to: Dr. Waleed Alhazzani, Scientific Research Center, Ministry of Defense Health Services, Riyadh, Kingdom of Saudi Arabia. E-mail: waleed.al-hazzani@medportal.ca
ORCID ID: https://orcid.org/0000-0001-8076-9626

Medical research is an important compass in determining the country's milestones and contributions to the healthcare system.[1,2] Ultimately contributing to the enhancement of living standards, economic growth, and quality of life.[3,4] However, Arab countries face challenges in elevating their contributions to global research.[2] This is primarily due to a lack of funding and the scarcity of skilled researchers.[1,5]

The advancement of research and development is influenced by several factors, such as socioeconomic conditions, educational institutions, professional researchers, and political dedication.[5] Several studies described the slow progress of medical research in Arab countries.[1,2,6-8]

Bibliometric analysis is crucial for understanding the evolution of academic fields over time. By employing statistical and mathematical methods to assess publication patterns, bibliometrics facilitates the examination of a substantial number of publications across different levels. This approach has gained prominence in the study of medical academic publishing as it provides valuable insights into research trends over time. Using visualization tools, bibliometric analysis delivers comprehensive perspectives, evaluates the academic influence of publications, and assists researchers in recognizing historical focal points and trends within specific research topics. Importantly, this method diminishes potential biases among researchers, rendering it a valuable instrument for assessing the advancement of knowledge across a broad spectrum of publications.[9] Moreover, bibliometric analysis is instrumental in evaluating research in many domains. By analyzing bibliometrics across countries and institutions, we can determine variations in research themes, capacity, and collaborative effort.[10] Additionally, universities and academic institutions increasingly rely on scientific assessments, such as bibliometric indicators, to inform decisions regarding hiring, promotions, tenure, funding, and salary increases.[11]

The most recent publication evaluating medical research in Arab countries covered the period between 2007-2016. Although this study showed an increase in the medical research output in Arab countries over the span of 10 years, the proportion of research contribution was small compared to the rest of the world.[1]

We aimed to assess the state of medical research in Arab nations from 2017 to the first quarter of 2023.

This analysis used objective tools while adhering to transparent and stringent selection criteria. The study's focused on quantifying research productivity, performance, and impact in these countries.

Methods. The study was designed to carry out a retrospective bibliometric analysis of medical research in the Arab world, executed using Clarivate Analytics' InCites, Web of Science Database, Essential Science Indicators, and Journal Citation Reports.

The search was initially carried out based on all world countries, as well as 22 Arab world countries.[12] Our research focused on 8 broad medical-related areas, using research area schema as defined by the Clarivate Analytics' Essential Science Indicator database: biology and biochemistry, clinical medicine, immunology, microbiology, molecular biology and genetics, neuroscience and behavior, pharmacology and toxicology, and psychiatry and psychology.

The search was limited to the period from January 2017 to March 2023. Only 'articles' and 'reviews' were considered for publication types, as they are the most used documents for research evaluation, as stated by the Indicators Handbook by Clarivate Analytics.[13] According to Clarivate, 'articles' are defined as new and original research works, including various types of research papers, such as full papers, brief communications, technical notes, chronologies, and case reports. While 'reviews' summarize previously carried out studies, including reviews, review of literature, mini-reviews, and systematic reviews.[14]

All publication sources were included, in addition to publications of Arab-origin sources. For organizations (namely, institutions), we included all types of organizations except entities not mentioned in the authors' affiliation in the published article.

For all countries worldwide, the collected data were the number of publications, citation counts, and citation impact (defined as the ratio of citation counts to the total number of publications). Then, the most recent population size (2021) data for all countries were obtained from the World Bank DataBank and matched with their respective countries in the Clarivate database.[15] Data were collected for both aggregate and individual years to assess changes over time, covering the period from January 2017 to March 2023. We filtered the data for the 22 Arab world countries. The collected information included the number of publications, collaborations with national and international co-authors, citation impact, and impact relative to world.

We filtered the data based on researchers' locations for the 22 countries in the Arab world. The same search parameters were applied to all countries to ascertain the overall funded publications in the Arab world and the global research landscape.

The data for organizations were filtered based on the 22 Arab world countries. The collected data included organization type, country, number of publications, citation counts, publications per institution, corresponding authors, citation impact, H-index, publications in the top 25% journals (Q1), the 90th and 99th percentiles by publication citations, and publications with international collaborations. Our analysis concentrated on the top 10 and top 20 most productive institutions.

For publication sources (medical research journals), we filtered the data by country for the 22 Arab world countries, comprising publications from all sources worldwide. We focused on publication sources (journals) originating from these countries, including filtered and unfiltered data based on countries.

The collected data included journal names, publication sources' country, number of publications, citations count, the journal impact factor quartile, journal impact factor (2021), 5-year impact factor, and citation impact.

Statistical analysis. We carried out the statistical analysis using Excel and Statistical Package for Social Sciences, version 29.0 (IBM Corp., Armonk, NY, USA) software. We included countries with a population of at least 1,000,000 to ensure accurate representation of publications per one million people. We included the publication counts from all countries worldwide (n=207). The total number of publications from the United Kingdom included contributions from Scotland, England, Wales, and Northern Ireland; hence, they were considered a single country.

We used several metrics to describe and rank countries according to their medical research productivity including: I) publications per one million people (defined as the total number of publications produced by the country divided by the country's population number multiplied by 1,000,000); II) publications world share (defined as the country's publications number divided by the total number of publications by all countries across the world multiplied by 100); III) publications Arab world share (defined as the number of publications from an individual Arab country divided by the total number of publications from all Arab countries in aggregate multiplied by 100); IV) proportion of the world population (defined as the country's population size divided by the total

world population); V) citation impact (defined as citation counts divided by number of publications for each country, journal, or institution); VI) country's impact relative to the world (defined as the country's citation impact divided by the average citation impact of the world; VII) percentage of publications from Arab countries in Arab-origin journals (defined as the number of publications from Arab world researchers divided by the total number of publications from the same journal); and VIII) proportion of national contributions for a single institution (defined as the number of publications per institution divided by the total number of publications from the same country).

We calculated the proportion of funded publications in relation to the total number of publications during the same period for the 22 Arab countries and globally. Furthermore, we reported the publication proportions for each of the selected 8 medical areas, presenting the total number of publications from each area as a proportion of the overall publication count.

We identified the top 20 most productive institutions according to the total number of publications between January 2017 and March 2023. We then ranked the top 20 institutions by citation number and publication ranked in the top 10% most cited.

For the 10 most productive institutions, percentages were calculated as follows: we first identified the number of publications with corresponding authors from the institution. Then, from those publications, we counted the number of papers published in Q1 journals and the publications ranked in the top 10% most cited (90th percentile by citation) and divided them by the total number of publications from the same institution.

We identified the number of publications with international collaborations (defined as publications with at least one international co-author), counted the number of those publications with corresponding authors from the institution, and divided them by the total number of publications from the same institution.

We were unable to ascertain the normality of distribution required for such an analysis, as data were compiled cumulatively rather than individually. We calculated median and range values for key metrics.

Results. We carried out an analysis of global medical research production from January 2017 to March 2023, resulting in a total of 4,462,205 publications. Among these, 121,485 were contributed by Arab world countries, accounting for a global publication share of 2.72%. The total citation impact for Arab world countries was 11.98, compared to the global citation impact of 12.02. Switzerland ranked first when ranking

world countries based on publications per one million people, while the United States had the largest global publication share at 30%.

Qatar was the only Arab country among the top 30 countries with the highest medical research production per million population, ranking 26th globally. Regarding intra-Arab research production, Table 1 displays their rankings relative to one another and worldwide. Qatar was first in the Arab world in publications per million population, followed by Lebanon and Saudi Arabia. Saudi Arabia had the largest number of research publications (44,288 publications), followed by Egypt with 40,790 publications. Figure 1

shows the annual medical research publications from the Arab world compared to the rest of the world for the years 2017 through 2022. The Arab world increased its research output across the years by 87%.

Approximately 25% of publications in Arab countries were funded, compared to 44% of global publications during the same period. When analyzing the data annually from 2017-2022, funding for Arab publications ranged from 23.5-27.9%. In contrast, global proportions ranged from 41.5-47%. Both Arab and global publications reached their peak funding proportion in 2017. The year with the lowest amount of funding for Arab publications was 2021.

Table 1 - Total medical research production by all Arab countries from January 2017 to March 2023 (countries ranked in descending order by publications per one million people [world ranking is out of 159 countries; population size >1,000,000 people]).

Arab world country ranking	World country ranking	Countries	Publications per one million*	Publications (n)†	Publications' World share (%)‡	Publications' Arab world share (%)§	Population (n)§	Times cited (n)	Citation impact**
1	26	Qatar	2,844	7,646	0.171	6.29	2,688,235	153,793	20.11
2	36	Lebanon	1,295	7,240	0.162	5.96	5,592,631	152,345	21.04
3	37	Saudi Arabia	1,232	44,288	0.993	36.46	35,950,396	565,165	12.76
4	40	United Arab Emirates	1,057	9,900	0.222	8.15	9,365,145	163,704	16.54
5	45	Bahrain	763	1,117	0.025	0.92	1,463,265	37,021	33.14
6	48	Kuwait	673	2,860	0.064	2.35	4,250,114	59,770	20.9
7	49	Jordan	635	7,079	0.159	5.83	11,148,278	114,667	16.2
8	55	Tunisia	541	6,638	0.149	5.46	12,262,946	87,072	13.12
9	56	Oman	536	2,425	0.054	2.00	4,520,471	41,448	17.09
10	60	Egypt	373	40,790	0.914	33.58	109,262,178	484,400	11.88
11	71	Palestine	264	1,301	0.029	1.07	4,922,749	37,831	29.08
12§§	96§§	Morocco	99	3,679	0.082	3.03	37,076,584	61,401	16.69
12§§	96§§	Libya	99	669	0.015	0.55	6,735,277	16,105	24.07§§
14	99	Iraq	95	4,157	0.093	3.42	43,533,592	74,378	17.89
15	117	Algeria	58	2,576	0.058	2.12	44,177,969	65,037	25.25
16	128	Sudan	42	1,921	0.043	1.58	45,657,202	18,865	9.82
17	136	Syria	34	717	0.016	0.59	21,324,367	7,646	10.66§§
18§§	139§§	Yemen	30	1,003	0.022	0.83	32,981,641	29,434	29.35
18§§	139§§	Djibouti	30	33	0.001	0.03	1,105,557	278	8.42§§
20	144	Mauritania	21	96	0.002	0.08	4,614,974	936	9.75§§
21	154	Somalia	10	176	0.004	0.14	17,065,581	789	4.48§§
-	-	Arab World††	266	121,485	2.72	-	456,520,777	1,455,870	11.98
-	-	World	566	4,462,205‡‡	-	-	7,888,408,686††	53,647,524	12.02

*Publications per one million is publications number divided by country's population multiplied by 1,000,000. †Source: Essential Science Indicator. Includes Web of Science content indexed from January 2017 to March 2023. ‡Publications' world share is country's publications number divided by total publications by all countries across the world multiplied by 100. §The Arab world share is country's publications number divided by total publications by the Arab world in aggregate multiplied by 100. §Source: World Bank Databank (most recent year 2021). **Citation impact is times cited divided by publications number from the same country. §§Equal ranking was assigned due to having identical number of publications per one million people. §§The total number of publications from these countries are less than 1,000; thus, citation impact might not be accurate. ††Comoros is one of the 22 Arab world countries; however, its population size is less than one million people, hence, it was removed from this table. Publications per one million = 33; publications number = 27; publications world share = 0.0006%; publications Arab world share = 0.02%; population size = 821,625; times cited = 767; and citation impact = 28.41. ‡‡Including all publications count from all countries worldwide (total = 207 countries); Source: Essential Science Indicator. Includes Web of Science content indexed from January 2017 to March 2023. ††Source of the total world population size: World Bank Databank (most recent year 2021).
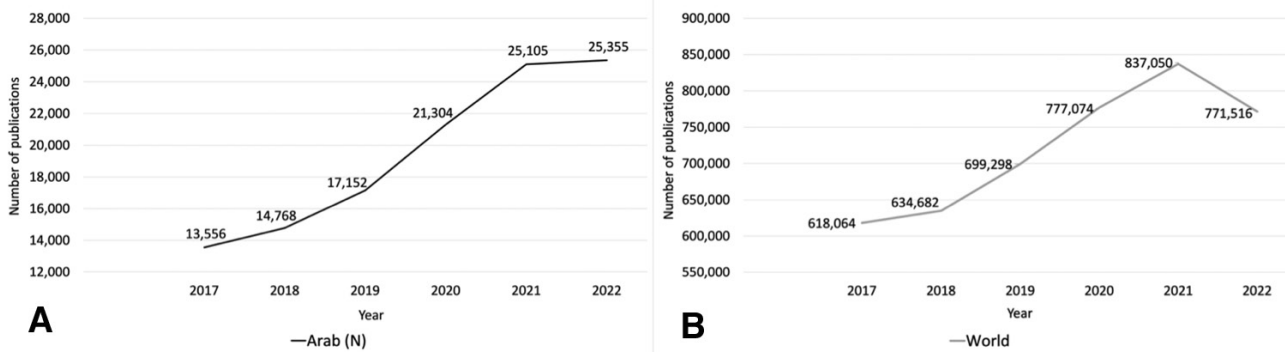
Figure 1 - The total number of medical research publications in: **A)** all Arab countries combined versus **B)** the world per year between 2017-2022. Data for 2023 is not displayed; it only represents the first quarter of the year. The number of publications in the first quarter of 2023 in Arab countries = 4,245 vs. all world countries = 124,521.

When looking at the details of publications, 46% of the Arab publications were in the field of clinical medicine, 15% in biology and biochemistry, 15% in pharmacology and toxicology, 6% in molecular biology and genetics, 5% in immunology, 5% in neuroscience, 5% in microbiology, and 3% in psychiatry and psychology.

In terms of collaboration, 15% of Arab world publications had national collaboration, while 65.9% involved international collaborations. Tunisia had the highest national collaboration (26.3% of publications), followed by Morocco (21.5%) and Egypt (18.3%). Moreover, among Arab countries with over 1,000 publications, Yemen had the highest international collaboration (94.6% of publications), followed by Sudan (91.5%) and the United Arab Emirates (86.9%).

The number of publications and the citation impact ratio of Arab research, relative to the world average, are compared in Figure 2. While Saudi Arabia and Egypt had the highest research publications, their relative impacts were 1.06 for Saudi Arabia and 0.99 for Egypt. However, Bahrain ranked first in impact relative to the world with an impact ratio of 2.76, followed by Yemen and Palestine, despite their individual research contributions in the Arab world amounting to approximately less than 1% each and their global share being less than 0.03%, as previously shown in Table 1.

We summarized in Table 2 the top 20 journals ranked by the number of papers published by Arab researchers from 2017 to the first quarter of 2023. Out of those, 6 journals originated from Switzerland, 4 from England, 4 from the United States, 3 from Saudi Arabia, 2 from France, and one from the Netherlands. The median impact factor across the top 20 journals was 5.14 (range: 1.42-8.03), and the median citation impact was 9.42 (range: 2.83-25.4). The median number of publications

per journal by Arab researchers was 608.5 publications (range: 467-1,852). Among these journals, 10 (50%) were classified as Q1, 7 (35%) as Q2, 2 (10%) as Q3, and 1 (5%) as Q4.

Among the top 10 medical journals of Arab origin, 7 originated from the United Arab Emirates and 3 from Saudi Arabia (Table 3). The median impact factor across these journals was 3.13 (range: 1.42-4.74), and the median citation impact was 9.43 (range: 4.57-12.75). The median number of publications by Arab researchers was 154 (range: 40-1,852), while the median number of total publications was 1,017.5 (range: 793-2,900). The proportion of medical publications from Arab countries was 12.4% (range: 4.31-78.14%). None of the journals were classified as Q1; 4 (40%) journals were classified as Q2, 4 (40%) as Q3, and 2 (20%) as Q4. The Current Medicinal Chemistry journal had the highest citation impact factor at 12.75, which also had the lowest publication share from Arab countries at 4.31%. On the other hand, the Saudi Medical Journal had the highest publication share from Arab researchers (namely, 78.14% of its publications).

Upon examining the 20 most productive institutions in the Arab region, the Egyptian Knowledge Bank was ranked as the top organization in the number of published papers. However, it was excluded because it did not meet our inclusion criteria for an institution/affiliation. Of the top 20 institutions, 16 (80%) were categorized as academic institutions, 2 (10%) were health institutions, one was a nonprofit, and the other was a research institute. Among these institutions, 9 were from Egypt, 5 from Saudi Arabia, 3 from Qatar, and the rest from Lebanon, Tunisia, and Jordan. The median number of publications across the top 20 institutions was 3,162.5 (range: 2,307-11,973), with a median of 43,884 citations (range: 13,675-169,433). The median citation impact was 14.5 (range: 5.93-28.5).
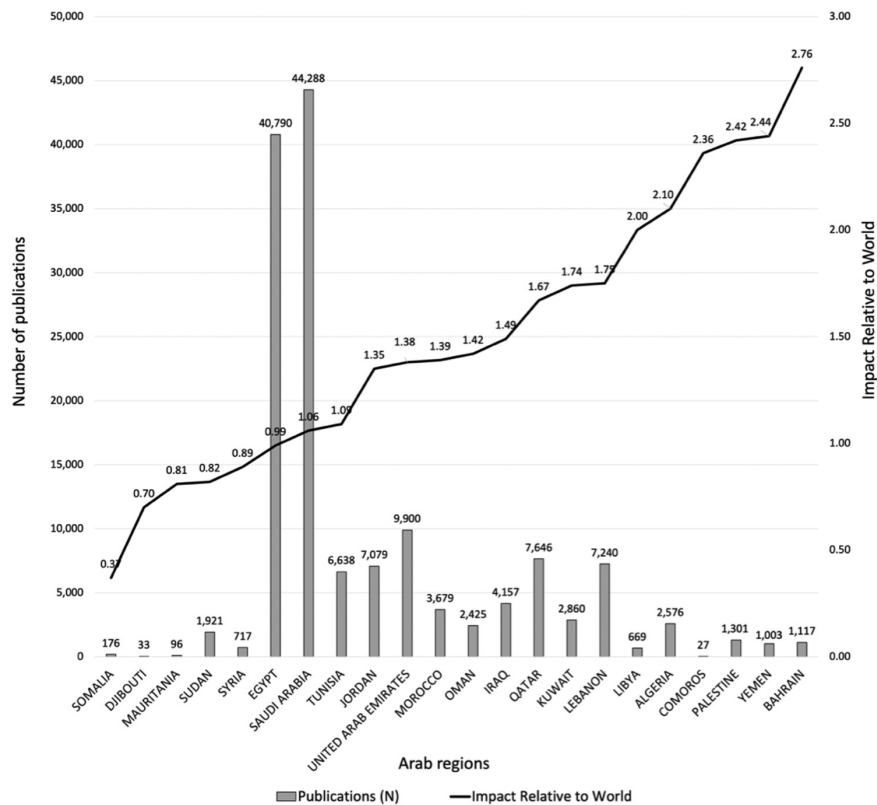
Figure 2 - The total number of medical research publications in Arab world countries and their impact relative to the world. Countries ranked from left to right in ascending order by their impact relative to the world. Impact relative to the global average is equal to the country's citation impact divided by the world citation impact baseline (World citation impact = 12.02). This metric provides insight into relative research performance. If the value is >1, it suggests that the publications are performing better than the global average. Conversely, if the value is <1, the publications are performing lower than the global average.

The national contribution and number of citations per institution for the most productive institution and limited to the top 10 in terms of citation times are presented in Table 4. The median number of publications per institution was 4,320 (range: 2,347-11,973), the median number of citations per institution was 83,759.50 (range: 45,882-169,433), and the median proportion of national contribution per institution was 19.83% (range: 7.38-50.84%). King Saud University, Riyadh, Saudi Arabia, ranked first for the number of publications and citations.

Among the top 20 productive institutions, the median proportion of publications in the top 10% of journals was 13.6% (range: 11.86-17.79%). For the top 1% of journals, the median proportion was 2% (range: 0.93-3.28%). Additionally, the median proportion of publications in Q1 journals was 34.1% (range: 25.47-47.09%). Nearly 18% of the papers published by authors affiliated with the Qatar Foundation were among the top 10% of most cited publications; 3.28%

were among the top 1%, making it the highest-ranking institution among the top 20 productive entities.

Of the 10 most productive Arab institutions from January 2017 to March 2023, only the American University of Beirut, Beirut, Lebanon, had over 50% of its publications with corresponding authors from their organization. Besides, it had the highest rate of publications in Q1 journals with corresponding authors from their institution at 13%. However, the National Research Center, Dokki, Egypt, had the highest proportion of publications in the top 10% most cited, at 6%. Additionally, we examined the international collaboration pattern, where 2 institutions from Saudi Arabia, King Saud University, Riyadh and King Abdulaziz University, Jeddah, had an international collaboration proportion exceeding 70%.

Discussion. This study serves as a continuation of knowledge aimed at mapping the progression of medical research in Arab countries, building on previous

Table 2 - Top 20 target medical research journals for researchers in Arab countries have published their work (ranked in descending order by number of publications in the journal with at least one author affiliated with one of the Arab countries, out of a total of 4261 journals).

Ranks	Journal names	Publication sources	Publications (n)	Times cited (n)	JIF quartile	Journal IF*	5 year IF	Citation impact†
1	Saudi Journal of Biological Sciences	Saudi Arabia	1,852	16,266	Q2	4.05	4.25	8.78
2	PLOS One	United States of America	1,828	18,911	Q2	3.75	4.07	10.35
3	Scientific Reports	England	1,812	23,790	Q2	5.00	5.52	13.13
4	International Journal of Biological Macromolecules	Netherlands	1,381	35,078	Q1	8.03	7.63	25.40
5	BioMed Research International	United States of America	827	6,321	Q3	3.25	3.77	7.64
6	Saudi Medical Journal	Saudi Arabia	772	3,650	Q4	1.42	2.12	4.73
7	Biomedicine & Pharmacotherapy	France	746	14,528	Q1	7.42	6.58	19.47
8	Bioorganic Chemistry	United States of America	740	13,341	Q1	5.31	5.32	18.03
9	Saudi Pharmaceutical Journal	Saudi Arabia	713	6,897	Q2	4.56	5.09	9.67
10	Frontiers in Microbiology	Switzerland	609	10,194	Q1	6.06	6.84	16.74
11	Pharmaceutics	Switzerland	608	5,577	Q1	6.53	7.23	9.17
12	Healthcare	Switzerland	565	1,600	Q2	3.16	3.46	2.83
13	Antibiotics-Basel	Switzerland	538	3,755	Q1	5.22	5.40	6.98
14	Journal of Infection and Public Health	England	521	7,300	Q1	7.54	6.21	14.01
15	Journal of Drug Delivery Science and Technology	France	519	4,665	Q2	5.06	4.62	8.99
16	Frontiers in Pharmacology	Switzerland	519	7,737	Q1	5.99	6.46	14.91
17	Life Sciences	England	493	6,791	Q1	6.78	6.04	13.77
18	Pharmaceuticals	Switzerland	480	2,376	Q1	5.22	5.71	4.95
19	Computational Intelligence and Neuroscience	United States of America	473	1,930	Q2	3.12	3.88	4.08
20	Natural Product Research	England	467	3,129	Q3	2.49	2.51	6.70

*Journal impact factor source: Journal Citation Reports (2021). †Citation impact is times cited divided by publications number from the same journal.
JIF: journal impact factor, IF: impact factor, Q: quartile

studies.[1,7] A previous bibliometric study found the number of medical research publications in the Arab world from 2007-2016 was 189 per million people; our study reveals an increase of 40.74% between 2007-2023, reaching 266 papers per million people.[1] Despite this increase, Arab countries still fall short compared to the rest of the world, with only 2.72% of the global share. This finding is supported by various bibliometric studies focused on the Arab world.[2,6,8] In some Arab countries, critical factors such as political instability have disrupted infrastructure development, limited resources, and emigration of skilled professionals.[1,5]

This study unveils new insights, with Qatar making significant progress in its productivity, moving from 69th to 26th place per million people among all countries worldwide.[1] Consistent with previous findings, Saudi Arabia has maintained its first-place position in medical research production.[7]

Multiple factors could have contributed to the recent improvement, such as increased funding for research, forthcoming supportive government policies, and the availability of educated and motivated researchers.[1,16,17] On the other hand, the COVID-19 pandemic might have played a role in the surge of medical research during the past period. Global medical journals have accelerated their publication process by almost 50%.[18,19] A previous study investigated the contribution of Arab nations to COVID-19 publications and revealed that most of the Arab publications were from Saudi Arabia, Egypt, and the United Arab Emirates.[6] In our study, we observed that the number of publications during the COVID-19 pandemic had a notable increase. However, it is noteworthy that this change showed a consistent and gradual rise compared to the pattern observed in previous years.

Medical publications by Arab researchers that received funding were 19% below the global proportion during the same period. This disparity may contribute to the observed differences in global citation impact and the overall lower publication counts compared to global publications. In a previous bibliometric study analyzing nursing research production, authors found that 22% of global nursing research was funded, similar to what we found in this study.[20]

We found that the highest proportion of medical publications in the Arab world was in clinical medicine,

Table 3 - Top 10 target Arab medical research journals for researchers in Arab countries (ranked in descending order by number of publications, out of a total of 43 journals).

Rank	Journal names	Publication sources	Total publications (n)*	Publications from Arab countries (n)	% Of publications from Arab countries†	Times cited (n)	JIF quartile	Journal IF‡	5 year IF	Citation impact§
1	Saudi Journal of Biological Sciences	Saudi Arabia	2,900	1,852	63.86	26,068	Q2	4.05	4.25	8.99
2	Current Pharmaceutical Design	United Arab Emirates	2,671	237	8.87	27,484	Q3	3.31	3.55	10.29
3	Current Medicinal Chemistry	United Arab Emirates	2,066	89	4.31	26,343	Q2	4.74	5.05	12.75
4	Anti-Cancer Agents in Medicinal Chemistry	United Arab Emirates	1,320	179	13.56	9,090	Q3	2.47	2.84	6.89
5	Saudi Pharmaceutical Journal	Saudi Arabia	1,047	713	68.10	12,069	Q2	4.56	5.09	11.53
6	Saudi Medical Journal	Saudi Arabia	988	772	78.14	4,515	Q4	1.42	2.12	4.57
7	Mini-Reviews in Medicinal Chemistry	United Arab Emirates	854	81	9.48	8,429	Q2	3.74	4.06	9.87
8	Current Pharmaceutical Biotechnology	United Arab Emirates	846	95	11.23	5,812	Q3	2.83	2.78	6.87
9	Current Drug Targets	United Arab Emirates	837	40	4.78	8,746	Q3	2.94	3.60	10.45
10	Endocrine, Metabolic & Immune Disorders - Drug Targets	United Arab Emirates	793	129	16.27	4,108	Q4	2.39	2.47	5.18

Note: Arab countries that have at least one medical research journal: Saudi Arabia, Egypt, United Arab Emirates, Qatar, Lebanon, Jordan, Tunisia, Iraq, Morocco, Kuwait, Algeria, Bahrain, and Libya; Arab countries that do not have any medical research journals indexed in Web of Science: Sudan, Oman, Palestine, Syria, Djibouti, Comoros, Yemen, Mauritania, and Somalia. *Publications from all world countries (including Arab countries). †The number of publications from Arab world researchers divided by the total number of publications from the same journal. ‡Journal impact factor source: Journal Citation Reports (2021). §Citation impact is times cited divided by publications number from the same journal. JIF: journal impact factor, Q: quartile, IF: impact factor

while the lowest was in psychiatry and psychology. A recent bibliometric study has highlighted the scarcity of publications in psychiatry and psychology.[21]

Compared to the results of prior studies, international collaboration among Arab countries has increased from 49% to nearly 66%. Establishing international linkages for sharing and disseminating knowledge has improved citation impacts for most Arab nations.[1] Through external collaboration, authors gain unique perspectives, funding and grant opportunities, and access to advanced technology.[1,3,22] In addition to previous evidence, Bahrain demonstrated the second-highest impact among Arab countries in science and medical research. In contrast, in the current study, Bahrain ranked first for its impact on medical research among Arab nations. Notably, previous findings in science and medical research showed variability in overall citation impact when comparing Arab nations to the world (9.84:14.72).[7] However, this study found the collective Arab citation impact to be closer to that of the world, indicating their development and growth compared to previous findings. It is worth noting that publication counts do not always signify a better impact, as their impact might have different directions. This

highlights the importance of research quality in addition to publishing in high-quality indexed journals.[23,24]

Our study explored the top medical journals that Arab researchers frequently publish in, and having Saudi Arabian journals at the top of the list is a significant milestone both for the Saudi context and the Arab region.

Our findings align with previous reports on institutions' productivity; both King Saud University and King Abdulaziz University in Saudi Arabia have exhibited the highest publication counts.[25] The results from Qatar revealed that over the past 2 decades, the country has transitioned into a better position in healthcare services.[26] Moreover, the American University of Beirut in Lebanon has shown a substantial impact by collaborating with international researchers, significantly improving the quality of their publications.[27] Overall, enhancing inter-institutional collaborations, encouraging knowledge-sharing, joining research projects, and developing robust funding mechanisms for long-term prosperity are critical.[28]

To unlock the full potential of the Arab world's medical research system, it is essential to incentivize and empower institutions to invest in research and

Table 4 - Proportion of national contribution and citation times for the most productive institutions in Arab countries from January 2017 to March 2023 (ranked descending by times cited).

Rank	Institution names*	Organization types	Countries	Times cited	Publications per institution	Publication per country	% National contribution†	Citation impact‡	H-index
1	King Saud University	Academic	Saudi Arabia	169,433	11,973	44,288	27.03	14.15	119
2	Cairo University	Academic	Egypt	139,094	9,289	40,790	22.77	14.97	106
3	King Abdulaziz University	Academic	Saudi Arabia	136,934	7,479	44,288	16.89	18.31	117
4	American University of Beirut	Academic	Lebanon	104,920	3,681	7,240	50.84	28.50	99
5	Mansoura University	Academic	Egypt	83,875	4,448	40,790	10.90	18.86	85
6	Ain Shams University	Academic	Egypt	83,644	4,743	40,790	11.63	17.64	92
7	Qatar Foundation	Nonprofit	Qatar	70,901	2,839	7,646	37.13	24.97	95
8	Alexandria University	Academic	Egypt	56,258	4,192	40,790	10.28	13.42	69
9	King Saud Bin Abdulaziz University for Health Sciences	Academic	Saudi Arabia	56,211	3,268	44,288	7.38	17.20	87
10	Hamad Medical Corporation	Health	Qatar	45,882	2,347	7,646	30.70	19.55	77

*Most productive institutions in the Arab world were ranked based on the total number of publications for the period between January 2017 and March 2023 and limited to the top 20. †Number of publications per institution divided by the total number of publications from the same country. ‡Citation impact is times cited divided by publications number from the same institution.

development and support researchers to work on innovative projects. This will foster a diverse and dynamic research environment contributing to the global healthcare system.

Study's strengths & limitations. This study has several strengths, such as focusing on a descriptive analysis of the Arab region's medical research productivity and using a consistent methodology to previous studies. Our updated findings offer researchers, funding agencies, and legislative bodies an opportunity to assess the current state of Arab medical research productivity by identifying the medical research publications, impact, and collaboration patterns. It also helps validate previous findings, contributing to a more reliable understanding of the landscape.

Despite the interesting results of this study, there are several limitations worth mentioning. Our study focused on medical literature, limiting the applicability of our findings to other scientific fields. It is also important to acknowledge that bibliometric databases used in our research may introduce a certain level of selection bias. These databases primarily rely on formal publications in indexed journals, potentially excluding research from non-indexed journals, grey literature, and non-peer-reviewed sources. This omission could result in an incomplete representation of the entire body of medical research. Additionally, the preference for citing known authors, institutions, or journals may influence the representation of knowledge and its perceived impact. Citation impact and citation practices may not serve as reliable indicators of an article's scholarly merit, as citations can signal either commendation or criticism, and this nuance is not typically captured in bibliometric analysis studies.

In conclusion, our bibliometric analysis has provided key findings regarding the productivity, performance, and impact of medical research in the Arab world. We found that the Arab world accounted for 2.72% of the global publication share in medical research from 2017 to the first quarter of 2023. The total citation impact of these publications was 11.98, comparable to the global citation impact of 12.02. Qatar ranked first among Arab countries in terms of medical research publications per million population, followed by Lebanon and Saudi Arabia. However, globally, Qatar was ranked 26th, followed by Lebanon at 36th, and Saudi Arabia at 37th. Moreover, we observed an 87% increase in annual medical research publications in the Arab world from 2017-2022. These findings highlight the progress and areas for further improvement in medical research within the Arab region.

References

1. El Rassi R, Meho LI, Nahlawi A, Salameh JS, Bazarbachi A, Akl EA. Medical research productivity in the Arab countries: 2007-2016 bibliometric analysis. *J Glob Health* 2018; 8: 020411.

2. Machaalani M, El Masri J, El Ayoubi LM, Matar B. Cancer research activity in the Arab world: a 15-year bibliometric analysis. *J Egypt Public Health Assoc* 2022; 97: 26.

3. Corsi M, D'Ippoliti C, Zacchia G. Diversity of backgrounds and ideas: the case of research evaluation in economics. *Res Policy* 2019; 48: 103820.

4. Raghupathi V, Raghupathi W. Healthcare expenditure and economic performance: insights from the United States data. *Front Public Health* 2020; 8: 156.

5. Chanbour H, El Masri J, Bsat S, Bsat A, Jiblawi A, Sunna T. A bibliometric analysis of neurosurgery research productivity in Arab countries between 2005-2019. *World Neurosurg* 2021; 154: e313-e319.

6. Zyoud SH. The Arab region's contribution to global COVID-19 research: bibliometric and visualization analysis. *Global Health* 2021; 17: 31.

7. Ahmad S, Ur Rehman S, Ashiq M. A bibliometric review of Arab world research from 1980-2020. *Sci Technol Libr* 2021; 40: 1-21.

8. Zeinoun P, Akl EA, Maalouf FT, Meho LI. The Arab region's contribution to global mental health research (2009-2018): a bibliometric analysis. *Front Psychiatry* 2020; 11: 182.

9. Kokol P, Blažun Vošner H, Završnik J. Application of bibliometrics in medicine: a historical bibliometrics analysis. *Health Info Libr J* 2021; 38: 125-138.

10. Oliveira OJ de, Silva FF da, Juliani F, Barbosa LCFM, Nunhes TV. Bibliometric method for mapping the State-of-the-Art and identifying research gaps and trends in literature: an essential instrument to support the development of scientific projects. [Updated 2019; 2019 Mar 14]. Available from: https://www.intechopen.com/chapters/69867

11. Aubert Bonn N, Bouter L. Research assessments should recognize responsible research practices. Narrative review of a lively debate and promising developments. In: [Updated 2023; 2024 Jan 7]. Available from: https://link.springer.com/chapter/10.1007/978-3-031-29455-6_27

12. League of Arab States. Country data. [Updated 2024; accessed 2023 May 10]. Available from: http://www.leagueofarabstates.net/ar/Pages/default.aspx

13. Clarivate Analytics. Indicators handbook. [Updated 2018; accessed 2023 May 17]. Available from: https://clarivate.com/webofsciencegroup/wp-content/uploads/sites/2/2020/03/InCites-Indicators-Handbook-June-2018.pdf

14. Clarivate. Document types [Updated 2023; accessed 2023 Aug 11]. Available from: https://webofscience.help.clarivate.com/en-us/Content/document-types.html

15. The World Bank. Population, total data [Updated 2022; accessed 2023 May 17]. Available from: https://data.worldbank.org/indicator/SP.POP.TOTL

16. Karaferis D, Aletras V, Raikou M, Niakas D. Factors influencing motivation and work engagement of healthcare professionals. *Mater Sociomed* 2022; 34: 216-224.

17. McKechnie DGJ, Al-Shakarchi N, Tackett SA, Young TM, Rashid MA. Sources of funding for research articles in medical education journals from 1999-2019. *Med Teach* 2023; 45: 1123-1128.

18. Horbach SPJM. Pandemic publishing: medical journals drastically speed up their publication process for COVID-19 [Updated 2020; accessed 2024 Jan 8]. Available from: https://www.biorxiv.org/content/10.1101/2020.04.18.045963v1

19. Grammes N, Millenaar D, Fehlmann T, Kern F, Böhm M, Mahfoud F, et al. Research output and international cooperation among countries during the COVID-19 pandemic: scientometric analysis. *J Med Internet Res* 2020; 22: e24514.

20. Kokol P, Železnik D, Završnik J, Blažun Vošner H. Nursing research literature production in terms of the scope of country and health determinants: a bibliometric study. *J Nurs Scholarsh* 2019; 51: 590-598.

21. Rudan D, Marčinko D, Degmečić D, Jakšić N. Scarcity of research on psychological or psychiatric states using validated questionnaires in low- and middle-income countries: a ChatGPT-assisted bibliometric analysis and national case study on some psychometric properties. *J Glob Health* 2023; 13: 04102.

22. Evans N, Miklosik A, Du JT. University-industry collaboration as a driver of digital transformation: types, benefits and enablers. *Heliyon* 2023; 9: e21017.

23. Aksnes DW, Langfeldt L, Wouters P. Citations, citation indicators, and research quality: an overview of basic concepts and theories. *SAGE Open* 2019; 9: 2158244019829575.

24. Fire M, Guestrin C. Over-optimization of academic publishing metrics: observing Goodhart's Law in action. *Gigascience* 2019; 8: giz053.

25. Ul Haq I, Ur Rehman S, Al-Kadri HM, Farooq RK. Research productivity in the health sciences in Saudi Arabia: 2008-2017. *Ann Saudi Med* 2020; 40: 147-154.

26. Zia N, Ibrahim MIM, Adheir F, Babar ZU. Identifying priority medicines policy issues for Qatar: exploring perspectives and experiences of healthcare professionals through a qualitative study. *BMJ Open* 2021; 11: e054150.

27. Alamah Z, AlSoussy I, Fakih A. The role of international research collaboration and faculty related factors in publication citations: evidence from Lebanon. *Economies* 2023; 11: 90.

28. Carter-Edwards L, Grewe ME, Fair AM, Jenkins C, Ray NJ, Bilheimer A, et al. Recognizing cross-institutional fiscal and administrative barriers and facilitators to conducting community-engaged clinical and translational research. *Acad Med* 2021; 96: 558-567.