

# Period-Prevalence and Publication Rate of Health Research Productivity in Seven Arabian Gulf Countries: Bibliometric Analysis from 1996 to 2018

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## ABSTRACT

**Background:** Despite the worldwide increase in health research, few studies have evaluated the health research productivity in member states of the Gulf Health Council (GHC). This study aimed to solicit the period-prevalence and publication rates of health research productivity in the seven GHC countries.

**Methods:** Scopus database was utilized for the prescribed period (1996–2018). The targeted information was attained through the portal of the SCImago Journal and Country Rank. Using a set of qualitative (citation-based) and quantitative (document recount) indicators, complementary data was derived. Overall and country-specific period-prevalence and publication rates were estimated and standardized to the corresponding overall GCC population and country-specific population size.

**Results:** Overall, a total of 112,409 articles were enumerated during the study period from 1996 to 2018. The majority (59.8%) of which were from Saudi Arabia, followed by UAE (11.9%). The

GCC publications were associated with 1,315,778 citations, which revealed a Hirsch-index (H-index) of 46.0. The period-prevalence of health publications for the overall GCC region was 1320 publications per million population (PPMP) over 22 years, and the publication rate estimate was 13.2 (95%CI 13.1, 13.3) publication per 10,000 population. The highest publication rate estimate was noted in Qatar (36.5; 95%CI 35.8, 37.3), followed by Kuwait, Bahrain, Saudi Arabia, UAE, Oman, and Yemen.

**Conclusions:** To our knowledge, this study is the first study in the context of GCC to utilize period-prevalence and publication rates to chart health research productivity in the GCC region. Concerted efforts are required to improve the quality and quantity of the health research output in the GCC region.

**Keywords:** Publications, Gulf Cooperation Council, Health research, Period-prevalence

## **Introduction**

Advancing health research agenda is becoming a national priority for most of the developing and industrialized countries of Western Europe, North America and some countries in Asian-Pacific rims (1). Data from *Global Observatory on Health Research & Development* indicate Western Europe, North America, Australia and the so-called 'Asian Tiger' and more recently with the entrance of China are disproportional dominating research out compared to emerging economies or societies in transition (2). Moreover, research and development often hinge on multiple factors including social and economic variables, the presence of academic institutions and full-time researchers, and political commitment.

The Gulf Cooperation Council (GCC) brings together six Arab countries that have similar socio-economic characteristics and political outlooks- United Arab Emirates (UAE), Bahrain,

Saudi Arabia, Oman, Qatar, and Kuwait. In addition to these six countries, Yemen is also a member of the Gulf Health Council (GHC) which is the executive arm of the Council of Ministers of Health in the GCC region (3).

Healthcare systems and research institutions in the GCC region have witnessed significant growth over the last five decades and GCC has been widely lauded to have adequate healthcare systems (4). This growth has been accompanied by increased healthcare burden along with the scarcity of available evidence to support proper response to the emerging pattern of disease and changing demography (5). Therefore, it is crucial to generate and disseminate new knowledge, address health issues, their distributions, and root causes.

Despite the known increase in health research productivity worldwide, scant attention has been geared toward the bibliometric analysis of the health research patterns in the GCC region that are equipped to shed light on the period-prevalence and publication rates within the population denominator. Bibliometric studies have been utilized to assess the scientific output of different world regions in several scientific fields (6). The few that have emerged in the GCC have focused on specific subspecialties and barely any of them have focused on period-prevalence within the confound of the nation's population (7–10). An extensive literature search indicated only one study that has traced the medical research productivity over a prescribed period (7). Noteworthy, this study did not take account of period-prevalence. With the broader part of the Arab part of the world, bibliometric indicators suggested general paucity in productivity and reduced visibility compared to other regions (7,11–15).

Within the aforementioned literature and the entailed implications, this study has embarked to fulfill inter-related objectives: 1) to estimate the cumulative frequency and citation indices of health research publications, the period-prevalence and publication rate standardized to population

size; and 2) to assess the period-prevalence trends over prescribed time intervals of the GCC countries and Yemen. These countries share geographical proximity, cultural heritage and all are located in the Arabian Peninsula.

## **Methods**

### *Study design*

This cross-sectional descriptive study (bibliometric review) was conducted from January to March 2020 to assess the status and evolving trends of health research publication productivity in the GCC region including the seven member states of the Gulf Health Council and to assess the level of visibility in comparison to the international context.

### *Data source*

Data were obtained from the free access SCImago Country & Journal Rank (SCJR) portal (SCImago Group 2007). The SCJR is a publicly available portal that amassed all major publishers (16,17). The portal also allows one to calculate a country's rankings as well as to compare it with others. Journals collapsed into 27 main subject areas and 313 specific subject categories. Citation data is calculated from > 34,100 periodic derived > 5,000 publishers. The portal is equipped to display biometrics from 239 countries. Data from SCJR portal was collected independently by two investigators among the research team. The information was reviewed by two senior investigators and the discrepancies were resolved in light of the source at the SCJR portal.

Moya-Anegón *et al* have suggested that the SCJR portal has more geographic coverage and breadth and depth of global publishers including those covering medical sciences (18). For the

present context, accrued data were standardized to the number of publications per million of the population (PPMP) in each of the countries. Data on each country's population was accessed via the World Bank's portal (19).

The included thematic distribution corresponded to the following five categories: Medicine, Nursing, Health professions, Pharmacology and Dentistry. The period chosen was from 1996 to 2018 (22 years). Data were retrieved for the seven-state members in the Gulf Health Council: United Arab Emirates, Bahrain, Saudi Arabia, Oman, Qatar, Kuwait, and Yemen.

Information was retrieved for the following indicators related to the cumulative frequency of publications and citation indices: total number of health articles published between 1996 and 2018, number of citations, number of self-citations, number of citations per article, and Hirsch-index (H-index) which was used as a measure of impact. H-index was defined as the number of documents of a country with citations (16).

### ***Data analysis***

Period-prevalence and publication rates were calculated as measures of the occurrence of cumulative health publications. Period-prevalence was calculated, as detailed elsewhere (20), by dividing the number of published articles during the specified period over the mid-year average population size for the overall GCC region and each specific country during that specified period. The period-prevalence was then multiplied by one million and was reported as publication per million population (PPMP). The publication rate was calculated by allotting the number of publications by the population size and then multiplied by 10,000, so it was reported as publication per 10,000 population. The 95% confidence intervals (95%CI) of publication rate were calculated using Poisson approximation to the binomial distribution for the prevalence rates (21). *Episheet*

software was used for the calculation of the confidence intervals (22). Descriptive data analysis and depiction of graphs were generated using Microsoft Excel (Microsoft Office 365).

## Results

Table 1 shows the cumulative frequency of health research articles published in GCC countries over the period from 1996 to 2018 (22 years). Overall, a total of 112,409 articles were enumerated. The majority (59.8%) were from Saudi Arabia, followed by UAE (11.9%), Kuwait (9.0%), Qatar (9.0%), Oman (5.8%), Bahrain (2.8) and then Yemen (1.7%).

Table 1 also shows the citation indices of health research articles published in GCC countries. Overall, the GCC publications were associated with a total of 1,315,778 citations, of which 11.3% were self-citations. Subsequently, the overall citations per article rate were 11.7, and the Hirsch-index (H-index) was 46.0. Generally, the distribution of the number of citations per country was proportionate to that of the number of articles. The highest H-index ranged from 86.0 to 22.8. The highest was noted in Saudi Arabia (86.0), followed by UAE (55.6), Kuwait (52.8), Qatar (46.0), Oman (34.6), Bahrain (24.4), and then Yemen (22.8).

**Table 1: Cumulative frequency and citation indices of health research publications in the Gulf Cooperation Council countries, 1996 to 2018.**

Country	Articles	Citations	Self-citations	Citations per article	Hirsch index
	N (%)	N (%)	N (%)		
<b>Overall GCC</b>	<b>112,409</b>	<b>1,315,778</b>	<b>148,935 (11.3)</b>	<b>11.7</b>	<b>46.0</b>
Saudi Arabia	67,185 (59.8)	736,419 (56.0)	100,176 (13.6)	11.0	86.0
Kuwait	10,092 (9.0)	138,006 (10.5)	11,718 (8.5)	13.7	52.8
UAE	13,358 (11.9)	180,207 (13.7)	13,844 (7.7)	13.5	55.6

Oman	6,489 (5.8)	73,193 (5.6)	6,602 (9.0)	11.3	34.6
Qatar	10,167 (9.0)	123,255 (9.4)	12,672 (10.3)	12.1	46.0
Bahrain	3,203 (2.8)	40,161 (3.1)	2,058 (5.1)	12.5	24.4
Yemen	1,915 (1.7)	24,537 (1.9)	1,865 (7.6)	12.8	22.8

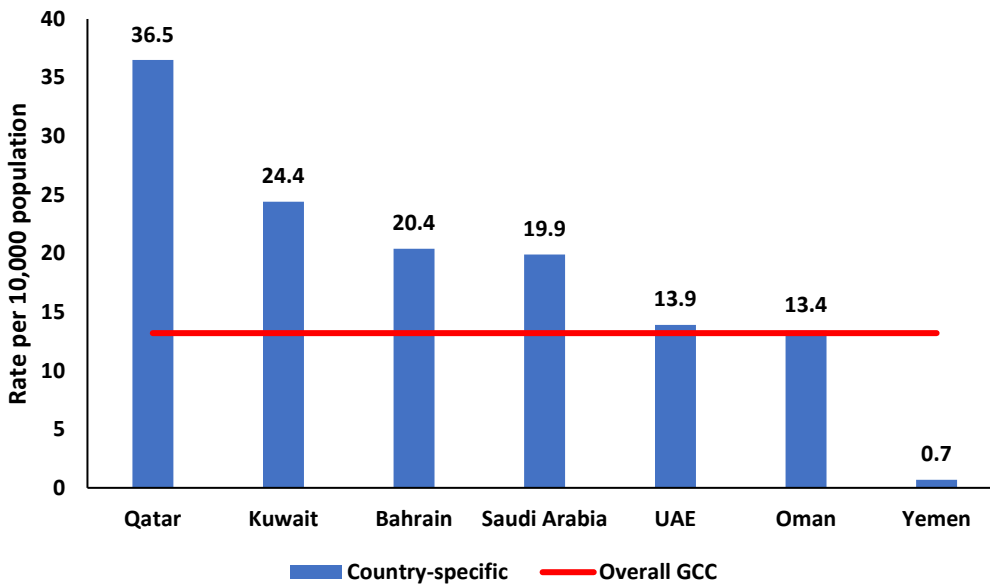
Table 2 shows the measures of the occurrence of cumulative health publications in the GCC countries over the period from 1996 to 2018. The period-prevalence of health publications for the overall GCC region was found to be 1320 publications per million population (PPMP) over 22 years (from 1996 to 2018). This period-prevalence yielded a publication rate estimate of 13.2 (95%CI 13.1, 13.3) publication per 10,000 population. The highest estimated period-prevalence (measured as PPMP) was observed in Qatar (3655), followed by Kuwait, Bahrain, Saudi Arabia, UAE, Oman, and then Yemen. Consequently, the highest publication rate estimate was noted in Qatar (36.5; 95%CI 35.8, 37.3), followed by Kuwait, Bahrain, Saudi Arabia, UAE, and Oman; while the least publication rate estimate was noted in Yemen (0.7; 95%CI 0.6, 0.7). Figure 1 depicts the publication rate estimates for GCC countries to the overall publication rate estimate for the GCC region.

**Table 2: Measures of occurrence of cumulative health publications in the Gulf Cooperation Council countries, 1996-2018.**

Country	Cummulative Articles	Population size (million)	Period- prevalence <sup>a</sup>	Publication rate <sup>b</sup>
	N (%)	N (%)	PPMP	Rate (95% CI)
<b>Overall GCC</b>	<b>112,409</b>	<b>85,147,501</b>	<b>1320</b>	<b>13.2 (13.1, 13.3)</b>
Saudi Arabia	67,185 (59.8)	33,699,947 (39.6)	1994	19.9 (19.8, 20.1)
Kuwait	10,092 (9.0)	4,137,309 (4.9)	2439	24.4 (23.9, 24.9)
UAE	13,358 (11.9)	9,630,959 (11.3)	1387	13.9 (13.6, 14.1)

Oman	6,489 (5.8)	4,829,483 (5.7)	1344	13.4 (13.1, 13.8)
Qatar	10,167 (9.0)	2,781,677 (3.3)	3655	36.5 (35.8, 37.3)
Bahrain	3,203 (2.8)	1,569,439 (1.8)	2041	20.4 (19.7, 21.1)
Yemen	1,915 (1.7)	28,498,687 (33.5)	67	0.7 (0.6, 0.7)

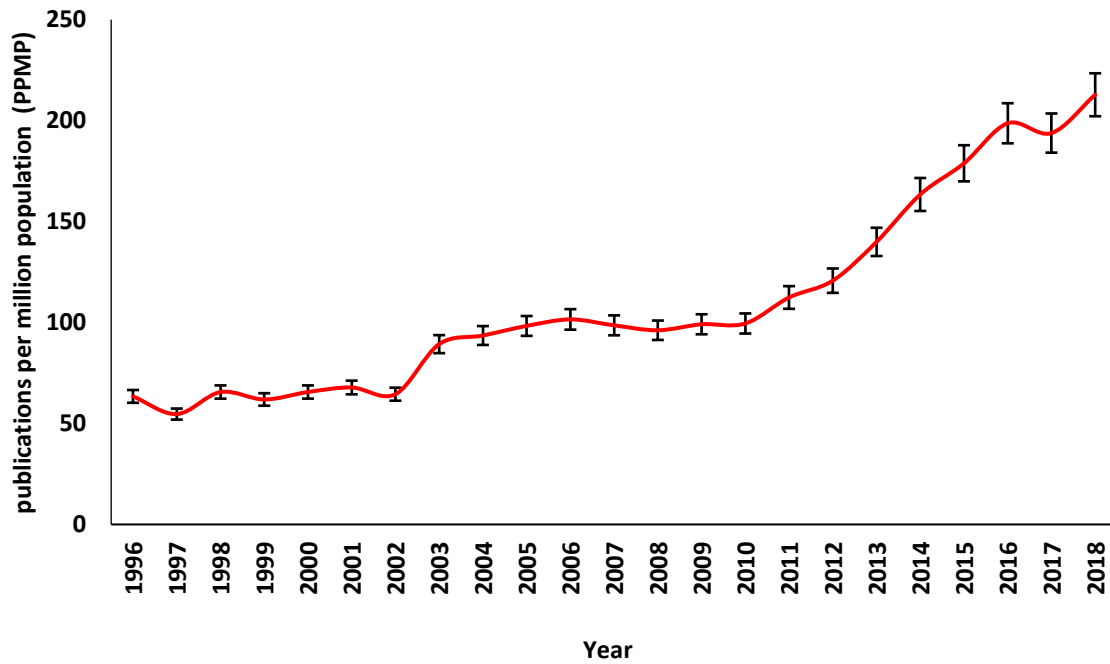
<sup>a</sup> Period prevalence is per million population (PPMP); <sup>b</sup> Publication rate is per 10,000 population



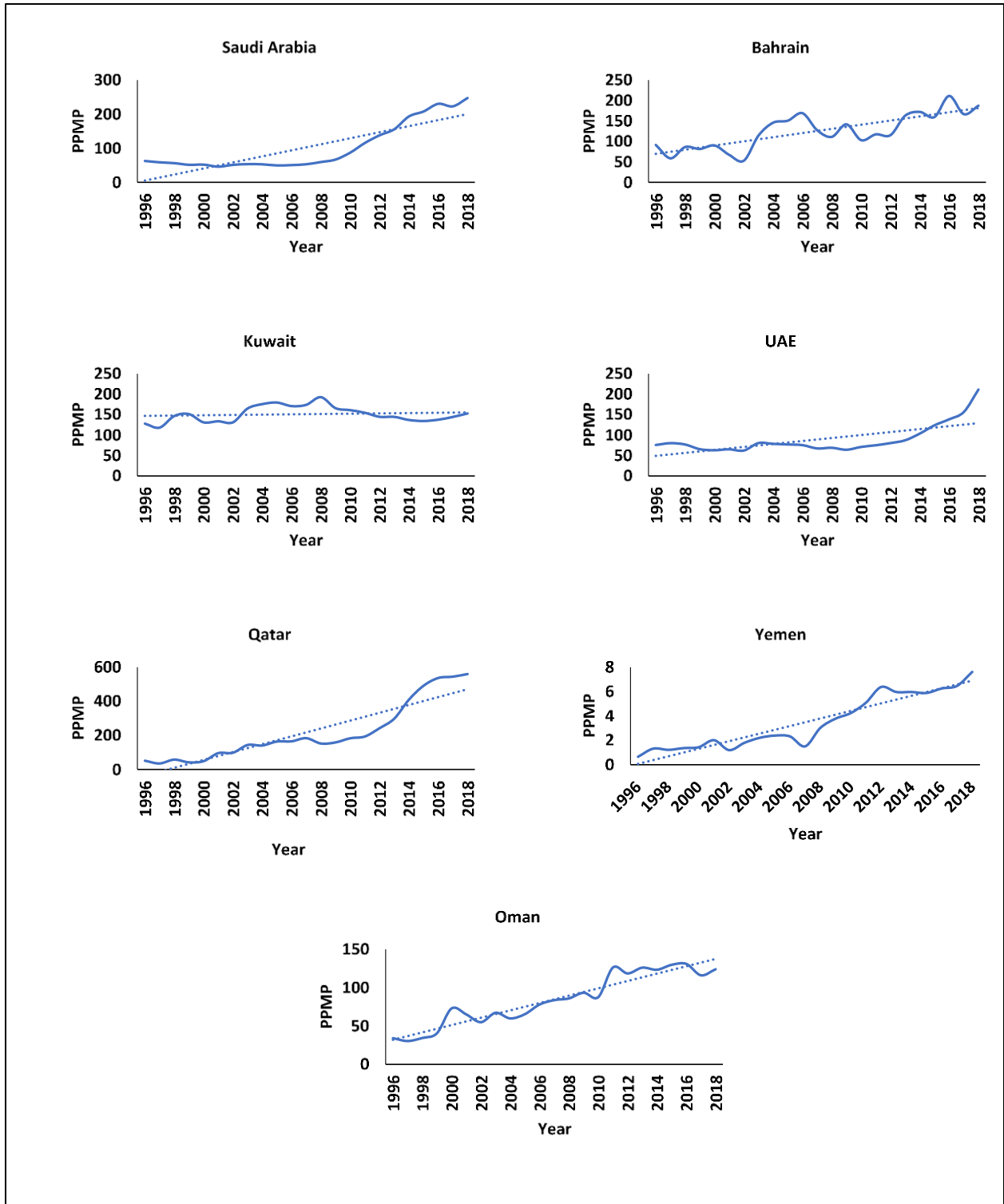
**Figure 1: Publication rate estimates (per 10,000 population) for Gulf Cooperation Council countries, 1996-2018.**

Figure 2 depicts the year-specific period-prevalence trend of health publications for the overall GCC region, measured in publication per million population (PPMP), over 22 years (from 1996 to 2018). Generally, the GCC region witnessed an increasing trend in period-prevalence over the years. The trend plateaued from 1996 to 2002 and then spurted in 2010. From 2011 onwards the period-prevalence trend continued to accelerate steeply.





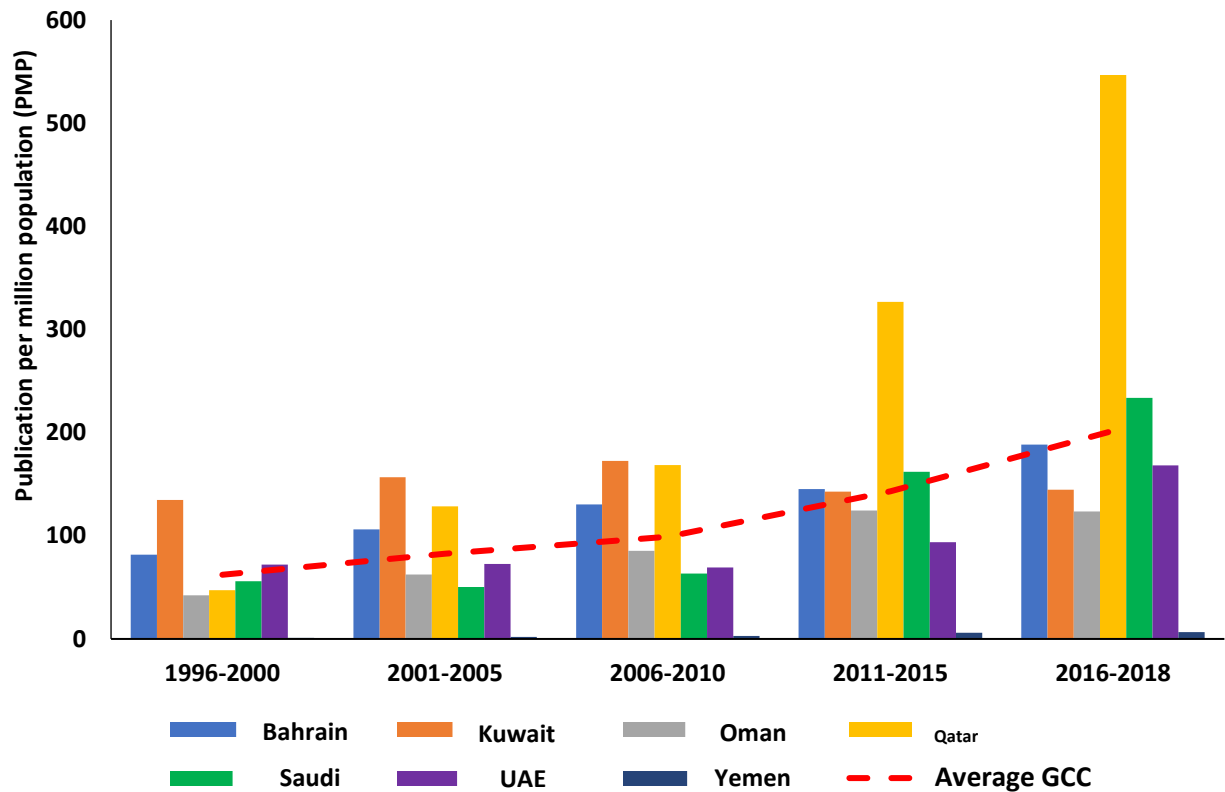
**Figure 2: Year-specific period-prevalence trend of health publications in the overall Gulf Cooperation Council region, 1996-2018.**



**Figure 3: Year-specific period-prevalence trend of health publications (measured in PPMP; publication per million population) in individual GCC countries, 1996-2018.**

Figure 4 depicts the five-year period-prevalence trend of health publications for the GCC region measured in publication per million population (PPMP) from 1996 to 2018. Generally, the overall GCC region showed an increasing trend in the 5-year period-prevalence over the follow-up period. All countries showed an increasing trend, except Kuwait where the 5 years prevalence indicated relatively a slight decline from 2011 onwards compared to the period before 2011. The most striking increase is observed in Qatar from 2010 onwards, followed by Saudi Arabia and the UAE. Oman also showed a steady increase from 2010 onwards but within ostensibly lesser vigor compared to Qatar, Saudi Arabia, and UAE. Bahrain maintained a steady but relatively slow increase over the years. Yemen showed a slow increase over the years, but it was relative to a lesser magnitude compared to the remaining countries.

Figure 3 depicts the year-specific period-prevalence trend of health publications for individual GCC countries measured in publication per million population (PPMP) over 22 years (from 1996 to 2018). Generally, all countries showed an increasing trend in period-prevalence over the years. Nonetheless, the increase in trends across time and countries appears to fluctuate. The most ascending trend was observed in Qatar, Saudi Arabia, and Oman; while the least ascending trend was observed in Kuwait and UAE.



**Figure 4: Five-year period-prevalence trend of health publications in the Gulf Cooperation Council region, 1996-2018.**

## Discussion

Through the bibliometric assessment of the SCImago Journal & Country Rank (SCJR) portal, this study analyzed the quality and quantity of health research productivity in seven Arabian GCC countries covering 22 years. The study found that the overall period-prevalence was 1320 publications per million population. Overall, health research productivity in the GCC has gone through a steady increase during the study period. However, reading between the line, over the follow-up period, the obtained period-prevalence of health research publications indicated a paucity of health research productivity and reduced impact of the region compared to other regions (e.g Eastern Mediterranean Region) (7,11–15) and the rest of the world (North America, Western

Europe, and Asia-Pacific rim (23,24). Several factors may have contributed to the relative paucity of research contribution from the GCC region including inadequate research infrastructure, inadequate funding, and the fact that there is no effort to heighten research capacity-building, the significant research data ended up being published in the journals that are not featured in the Clarivate Analytics/Web of Science (26). Without such affiliation, the journals do not accrue the preferred impact factors (27,28).

Exploration of the cumulative frequency of health research articles in the GCC countries revealed that Saudi Arabia outshined other GCC countries. This view is consistent with the previous report where Saudi Arabia was applauded to have the highest “per capita” population progression in publications (26). In the context of GCC, Saudi Arabia ostensibly contributes to 60% of the research emanating from this particular region. Other studies are congruent with the present finding suggesting that Saudi Arabia to be making substantial healthcare research in the region (7,14). This may stem from the fact that Saudi Arabia has been the highest number of health research institutions (29, 30).

The overall H-index for the GCC region was 46.0, and the highest was in Saudi Arabia and the least was Yemen. The observed level of H-index reflects the overall citations per article rate which was 11.7 and the self-citations were 11.3% of the total citations. The H-index embraces the impact of published articles (31). The H-index has been generally exalted to present the best method to scrutinize research out but there are dissenting views (16,32). Saudi Arabia has had the highest H-index while Bahrain has had the lowest H index. Several reports showed that international collaboration was influential in increasing the citation rate, and hence the H-index (33,34). This finding has also corroborated the trend in the Arab countries where international collaboration has visibly increased and concurrently the citation rate of research publications three

folds increased (14). Overall, the presently observed H-index level of the GCC appears to be low compared to industrialized countries of western Europe, North America and 'Asian Tiger' (35).

The related aim of this study is to explore publication rates within a country-specific population size. The overall publication rate was 13.2 per 10,000 population, and the highest was in Qatar (36.5). Several reports indicated that Qatar had been the most rapidly developing country in the region (4). Qatar has embarked to enhance research and development (R&D) including the advancement of medical sciences (36). In contrast to its high-income neighbor, Yemen had a low research output and Yemen also fare less in many indices of human development (37).

The trend of period-prevalence of health publications in the GCC region was found to be increasing over the last 22 years with varying degrees of fluctuation, and the most rapid acceleration occurred from 2011 onwards. The country-specific trends of period-prevalence showed in an increasing trend in each country but with variant speed, with Qatar, Saudi Arabia, and UAE having the most ascending trends.

The present data suggest that the noted research spurt from 2002 onwards could stem from the increased interest of (R&D) by GCC countries (38). The entry of GCC-originated journals onto Scopus and other indexed search engines could have contributed to the research in the region to be more visible and hence accruing impact factors. Despite the recent upsurge of interest on R&D for health research, the number of researchers is relatively low, a situation previously highlighted in the context of Latin America (24), and many researchers are expatriates who are likely to be more occupied with dispensing services such as teaching and clinical services rather than undertaking research. Rahman & Fukui explored the research productivity in 166 countries and suggested that quality and quantity of research productivity are influenced by various factors and most notable is the gross national product (GNP), availability of qualified researchers, public

health expenditure, and allocation of resources for R&D (39). The exploration of these factors to enhance research output in the GCC is therefore warranted.

In the GCC region, the expenditure on R&D appeared to play a pivotal role in health research productivity. Countries with the highest gross domestic product (GDP) per capita such as Qatar & UAE had high research productivity compared to other countries with low GDP per capita such as Yemen. According to Elborai *et al* , the resources allocated for R&D GCC including capital expenditures is meagre compared to other countries (4). For example, UAE and Bahrain barely allocated 0.9 and 0.1 percent of GDP to R&D respectively. By contrast, the countries with higher presentations in research output appear to allocated approximately 2.5 percent of GDP to R&D (4). To catch up assigned budget of The Organisation for Economic Co-operation and Development (OECD) countries, the GCC countries would need to heighten their investment in R&D. Thus, Saudi Arabia would be required to increase its R&D by popping up 1.7 percent of GDP to R & D. Parallel increment would also be desirable in other GCC countries including 1.6 percent for UAE, 2 percent for Qatar, 2.2 percent for Kuwait, 2.3 percent for Oman and 2.4 percent for Bahrain (4).

This study suggests each country had an increasing five-year period-prevalence of health publications except in Kuwait experienced windfall from 2011 onwards. Yemen showed a minute increase over the years, but relatively less compared to the remaining GCC countries. Mechanisms are needed to revamp the prevailing research culture in the GCC. In their systematic reviews for all types of research, Oliver *et al* have suggested the paramount importance of investment in capacity building that would be geared toward individuals, research teams, organizations, and countrywide (40). The rigorous capacity building needs to be seriously contemplated in the GCC. Along with the capacity building, El Rassi *et al* suggested that research culture would enormously

improve if national-level policies are contemplated including facilitating tenure, intramural funding programs, establishing doctoral and postdoctoral programs (14).

This study is not without limitations. The present data source (SCJR portal) includes publications from the sizeable number of health research journals. However, many articles from the GCC may not necessarily be featured in such an international database. Such a trend is testified by the growth of open access journals and some of them are labeled as ‘predatory journals (45). Similarly, while there is a sizable number of medical journals in the GCC, a significant number of them are not indexed either Scopus or Medline (46). Many journals in the region face difficulty in getting indexed (14). Despite these caveats relevant to the presently operationalized catchment of all publications, the present analysis is the first of its own to solicit period-prevalence and publication rates from the GCC.

In summary, this study has embarked to survey the Period-prevalence and publication rates in Seven Arabian Gulf Countries covering 22 years duration - 1996 to 2018. The GCC publications appear to have an H-index of 46.0, 1320 publications per million population and the publication rate 13.2 per 10,000 population. Although the health research output of the GCC countries appears to have shown exponentially increased over succeeding years, it still falls short in comparison to other countries or regional blocks. Therefore, this study calls for various governmental and non-governmental entities to coordinate efforts to increase health research productivity in the region. Capacity building in all its spheres would be essential to keep the GCC abreast with other countries and allocation of resources for R&D would be essential if not paramount for GCC to be part of the global map of R&D.



### **Availability of data and materials**

The datasets generated and/or analysed during the current study are available in the SCImago Country & Journal Rank repository, available at <https://www.scimagojr.com/countryrank.php>.

Further datasets and analyses are available from the corresponding author on reasonable request.

### **Competing interests**

The authors declare that they have no competing interests.

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### **Author contributions**

YF, NB, and MS were responsible for designing the study. NB and MB were involved in the acquisition of data. YF, AM, and SA contributed to the interpretation and the writing of results.

All authors read and approved the final manuscript.

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