COVID-19 pandemic in the Middle East countries: coronavirus-seeking behavior versus coronavirus-related publications

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Abstract

The spread of COVID-19 has created a fundamental need for coordinated mechanisms responding to outbreaks in different sectors. One of the main sectors relates to information supply and demand in the middle of this pandemic in the digital environment. It could be called an infodemiology. It is known as a promising approach to solving the challenge in the present age. At this level, the purpose of this article is to investigate the COVID-19 related search process by field research. Data were retrieved from Google Trends in Middle Eastern countries alongside scientific research output of Middle Eastern scientists towards COVID-19 in Web of Science, Scopus, and PubMed. Daily COVID-19 cases and deaths were retrieved from the World Health Organization. We searched for descriptive statistical analyses to detect coronavirus-seeking behavior versus coronavirus releases in the Middle East in 2020. Findings show that people in the Middle East use various keyword solutions to search for COVID-19 in Google. There is a significant correlation between coronavirus confirmed cases and scientific productivity (January 2020–December 2020). Also, there is a positive association between the number of deaths and the number of scientific publications (except Jordan). It was a positive and significant association between online coronavirus-seeking behavior on Google (RSVs) and the confirmed cases (except Syria and Yemen). Furthermore, it was a positive relationship between RSVs and scientific productivity in the Middle East (except Bahrain and Qatar). From an infodemiological viewpoint, there is a significant correlation between coronavirus information demand and its information provision.

Keywords Coronavirus · Scientific productivity · Google Trends · Infodemiology · Middle East

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Introduction

On January 30, 2020, the Director-General of the World Health Organization (WHO), Tedros Adhanom, declared a public health emergency of international concern. COVID-19 is a respiratory infectious disease caused by SARS-COV-2 (Homolak, Kodvanj, & Virag, 2020). On March 11, 2020, the WHO announced a pandemic due to the worldwide outbreak of the pandemic (Belli, Mugnaini, Baltà, & Abadal, 2020). Since late June 2020, the pandemic has claimed more than 503,000 lives worldwide (https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports/).

Iran was the first Middle Eastern country affected by the pandemic, followed by Turkey, Saudi Arabia, Qatar, and Egypt (Baloch et al., 2020). In this region, as in other parts of the world, the public interest in COVID-19 reflects the people's attention and their tendency to follow preventive measures (Hu et al., 2020a, 2020b). With the increasing availability and use of the Internet in the Middle East, the public's attention to this fast-paced pandemic is often reflected in a digital environment. Such a fast-moving pandemic requires agile research techniques using real-time data collection (Walker, Hopkins, & Surda, 2020). As COVID-19 can be considered the first global pandemic of this magnitude in the digital age, digital health solutions, which have reached a certain level of maturity but have not been widely established and accepted, can play a significant role in our response to the crisis (Fagherazzi, Goetzinger, Rashid, Aguayo, & Huiart, 2020). One of the digital health solutions in the twenty-first century is Google Trends (GT), which can act as an online search engine tracking system on the Internet (Heerfordt & Heerfordt, 2020; Hu et al., 2020a, 2020b; Walker et al., 2020). GT has a tremendous potential to act as an Internet search behavior for public users (SeyyedHosseini, Asemi, Shabani, & CheshmehSohrabi, 2018).

Undoubtedly, the COVID-19 pandemic has had a significant impact on people's lives including their Health Information Search Behavior (HISB). This concept is described as purposeful behavior performed by an individual to find health information (Ebrahim et al., 2020). Theoretically, the HISB relates to Health Information Distribution (HID). HID monitors the health information trends and gaps between information supply and demand by applying recent ICTs (Eysenbach, 2006). Eysenbach (2002) introduced these types of studies as infodemiology, which can be defined as the epidemiology of information to address public health and policy decisions (Hu et al., 2020a, 2020b). Nonetheless, researchers can survey affected factors on health information in the digital age using an infodemiological approach.

Online data show that millions of people in the Middle East are infected with the coronavirus. It leads to web search displays in the GT, a valuable source of information on public health trends (Heerfordt & Heerfordt, 2020). The health policy-makers can illustrate a logical health information supply and demand process by analyzing Google searches for COVID-19, plus the scientific productivity of the pandemic (Zhang, Zhao, Sun, Huang, & Glänzel, 2020).

With this in mind, we look at the COVID-19 search trends by query data retrieved from Google Trends in Middle Eastern countries. Also, we explore the scientific findings of Middle Eastern scientists on COVID-19 in the Web of Science, Scopus, and PubMed.

Methods and materials

Select area

The study population included all countries in the Middle East region. These 16 countries include Bahrain, Cyprus, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, Turkey, the United Arab Emirates, and Yemen. Due to the purpose of the study, verified cases were examined. Furthermore, COVID-19-related deaths, the relative search volume index (RSV) in Google Trends related to the pandemic, and the scientific extraction of Middle Eastern scientists related to COVID-19 were explored from January 1, 2020, to December 31, 2020.

Google trends search strategy

The authors used a systematic approach to select database search terms. It should be borne in mind that people search the pandemic with various languages and calligraphy on Google. So, Google's Middle East keywords with different names and spelling were entered in Google Trends. The official languages, plus the commonly spoken languages of the region, were retrieved in English, Arabic, Persian, Turkish, Hebrew, Greek, Kurdish, French, and Russian. Key concepts were presented to the research team, and the initial search list terms were entered using the designation COVID-19. As shown in Table 1, extracted keywords including crown, coronavirus, Covid19, Covid-19, Covid 19, 2019-nCOV and SARS-COV-2 (in English), Firus Korona, Korona, Kofid 19, Kofid-19, Kofid 19, كوفيد 19، كوفيد-19، كوفيد19، كوفيد، كورونا، كورونا، فيروس كورونا (in Arabic), Corona, Coronavirus, Covid19, Covid-19, Covid 19, کرونا، ویروس کرونا، کووید19، کووید-19، کووید 19 (in Persian), korona, korona virüs, kovid19, kovid-19, kovid 19 (in Turkish), הנורוק, הנורוק, Covid19, Covid19, Covid 19 (in Hebrew), κορωνοϊός, κορωνοιος, κορονοιος, Covid19, Covid-19, Covid 19 (in Greek), vîrusa koronayê (in Kurdish), коронавирус, Корона вирус (in Russian), Coronavirus, Corona virus, Covid 19, Covid19, Covid-19 (in French). Keywords were selected with the consultation of some expert linguistics plus the natives, as the most common terms related to COVID-19 Middle Eastern countries. Then, Google Trends was used to explore the relative search volume (RSV) that "the share of requests for a particular term for a given location and period is normalized, with the highest share of queries from that term over time series and presented on a scale of 0 to 100" (Walker et al., 2020). In other word, search results are normalized to the time and location of a query by the following process[1]:

- Each data point is divided by the total searches of the geography and time range it represents to compare relative popularity. Otherwise, places with the most search volume would always be ranked highest.
- The resulting numbers are then scaled on a range of 0 to 100 based on a topic's proportion to all searches on all topics.
- Different regions that show the same search interest for a term don't always have the same total search volumes.

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[1] . https://support.google.com/trends/answer/4365533?hl=en&ref_topic=6248052

Table 1 Search Queries in Google Trends on COVID-19 in Middle Eastern Countries

Countries	Keywords (based on Official Language as well as Commonly Spoken Language in Middle Eastern Countries)
Bahrain	Coronavirus + Coronvirus + Corona + Covid 19 + Covid19+ كۆرۆنا + كۆرۆنا سۆرۆس 19 كوۆيد + 19كوۆيد + كۆرۆنا + 19كوۆفيد + كوۆفيد + كۆرۆنا
Cyprus	Corona virus + Coronvirus + Corona + Covid 19 + Covid19 + kovid 19 + kovid19 + korona + κορωνοϊός + korona virus + koronavirüs
Egypt	+Coronavirus + Corona virus + Corona + Covid 19 + Covid19 فيروس 19كوۆيد + 19كوۆفيد + كۆرۆنا + كۆرۆنا
Iran	+Coronavirus + Corona virus + Corona + Covid 19 + Covid19 + فيروس كوۆيد+19+كوۆرۆنا + 19كوۆيد + 19كوۆفيد + كۆرۆنا + كۆرۆنا 19korona + kovid19 + kovid 19 + korona + virüskoronavirüs +
Iraq	+Coronavirus + Corona virus + Corona + Covid 19 + Covid19 فيروس 19 كوۆيد+19+كوۆرۆنا + 19كوۆيد + 19كوۆفيد + كۆرۆنا + كۆرۆنا
Israel	Coronavirus + Corona virus + Corona + Covid 19 + Covid19+ فيروس דיבוק+19 דיבוק+הנורוק+כۆرۆنا + 19كوۆيد + 19كوۆفيد + كۆرۆنا + كۆرۆنا 19
Jordan	Coronavirus + Corona virus + Corona + Covid 19 + Covid19+ فيروس דיבוק+19 דיבוק+הנורוק+كۆرۆنا + 19كوۆيد + 19كوۆفيد + كۆرۆنا + كۆرۆنا 19
Kuwait	Coronavirus + Corona virus + Corona + Covid 19 + Covid19+ فيروس كۆرۆنا + 19كوۆيد + 19كوۆفيد + كۆرۆنا + كۆرۆنا 19
Lebanon	Coronavirus + Corona virus + Corona + Covid 19 + Covid19+ فيروس كۆرۆنا + 19كوۆيد + 19كوۆفيد + كۆرۆنا + كۆرۆنا 19 דיבוק+ 19 דיבوק+הנורוק+
Oman	Coronavirus + Corona virus + Corona + Covid 19 + Covid19+ فيروس كۆرۆنا + 19كوۆفيد + 19كۆرۆنا + كۆرۆنا
Qatar	Coronavirus + Corona virus + Corona + Covid 19 + Covid19+ فيروس דיבוק+19 דיבوק+הנורוק+كۆرۆنا + 19كوۆيد + 19كوۆفيد + كۆرۆنا + كۆرۆنا 19
Saudi Arabia	Coronavirus + Corona virus + Corona + Covid 19 + Covid19 + + فيروس كۆرۆنا + 19كوۆفيد + 19كۆرۆنا + كۆرۆنا
Syria	Coronavirus + Corona virus + Corona + Covid 19 + Covid19+ فيروس كۆرۆنا + 19كوۆفيد + 19كۆرۆنا + كۆرۆنا
Turkey	Coronavirus + Corona virus + Corona + Covid 19 + Covid19+ فيروس كۆرۆنا + 19كوۆيد + 19كۆرۆنا + 19كوۆفيد + كۆرۆنا 19 דיבوק+ 19 דיبوק+הנورוק+
United Arab Emirates	Coronavirus + Corona virus + Corona + Covid 19 + Covid19+ فيروس كۆرۆنا + 19كوۆيد+19كۆرۆنا + 19كوۆفيد + كۆرۆنا 19 + korona + kovid19 + kovid 19 + korona virus + koronavirüs
Yemen	Coronavirus + Corona virus + Corona + Covid 19 + Covid19+ فيروس 19 كوۆيد+19كۆرۆنا + + 19كوۆفيد+كۆرۆنا+كۆرۆنا Korona + Koronavirus + Korona virus

We used the "+" feature to include several terms in one search in all languages containing special characters and accents. If necessary, we applied quotation marks, plus synonyms, regional variations, and language diversity in a given country to extract related keywords. For instance, in Cyprus, queries in Greek, Turkish, and English may be relevant; in Lebanon, French, Arabic, and English could be relevant; in Iran, Persian, Kurdish, English, Arabic, and Turkish will be related.

Table 2 Search strategies for publications on COVID-19

Database	Search strategy
WoS	TS = ("2019-nCov" OR "2019 novel coronaviru*" OR "2019 novel-coV" OR "COVID-19" OR "SARS-CoV-2")
PubMed	Search ((((("2019-nCov") OR "novel coronaviru") OR "2019 novel-coV") OR "COVID-19") OR "SARS-CoV-2"
Scopus	TITLE-ABS-KEY ("2019-nCov" OR "2019 novel coronaviru*" OR "2019 novel-coV" OR "COVID-19" OR "SARS-CoV-2")

Data were retrieved in daily-level on the time unit in Google Trends. Also, our search had no category restriction, and the field "All categories" was selected.

Selected databases

Confirmed cases of COVID-19 mortality in Middle Eastern countries, during the study period, were taken from the World Health Organization (WHO) website. These data were normalized on a scale of 0 to 100 to provide comparisons with search terms. The database search was reviewed, and, as mentioned earlier, part of the data was collected from Google Trends. This data can be used as a measure of public interest over time. Google Trends data was retrieved for web search queries for the term COVID-19, and its synonym in other official languages in the Middle East, for mapping information search behavior from January 1, 2020, to December 31, 2020.

Article databases

We selected Web of Science, Scopus, and PubMed as the three most prominent and well-known databases (Belli et al., 2020; Falagas, Ntziora, Makris, Malietzis, & Rafailidis, 2009) for medical publications, especially Covid-19. Using a scientometric approach, we formulated a search strategy in the given databases during the study period as shown in Table 2.

The authors read the articles' abstracts carefully to ensure that all the retrieved documents being relevant. One of the most important inclusion criteria was that these documents have at least one Middle Eastern scholar as co-author. If any articles were authored by scholars from more than one Middle Eastern country, that document was counted for each country separately. The inclusion criteria of the manuscripts in the study were the online publishing date. All types of retrieved documents (original paper, review, etc.) were included in the study. Since some of the recovered records may overlap, we imported them into Endnote software, then enabled the "Duplicate discard" icon. Finally, after removing duplicates, 16,655 articles were retrieved from these three databases.

Data analysis

In the last step, we examined the data graphically and then formally tested it with the Kolmogorov–Smirnov test. As data were not normally distributed, the Spearman rank

correlation was used to test the strength of the association between RSV and scientific productivity. We used daily data for all variables. In scientific publications data, we counted the publications monthly and then calculated the mean of the publications per day. Then we designed the map of the number of search terms related to the coronavirus. The data analysis process was performed using SPSS software.

Findings

Number of confirmed cases and deaths related to COVID-19 in the Middle East countries

As shown in Table 3, the first confirmed cases of COVID-19 during the study period were identified in the Middle East in January 2020 in the UAE. However, since February 2020, as the pandemic grew increasingly, the number of confirmed cases increased significantly, too.

According to Table 3, the first established case of COVID-19 in the UAE was reported in January 2020 with eight patients. Other rankings were Iran (February 18), Israel and Lebanon (February 21), Iraq, Kuwait and Oman (February 24), Bahrain (February 25), and Qatar (February 29) in May 2020, respectively. Approved cases had been experienced a varied fluctuation during the period of the study. Turkey, Iran, and Iraq had the highest number of confirmed cases in 2020, accordingly.

The first Covid-19 death was reported on 18 February 2020 from Iran. According to Table 4, the number of deaths had been experienced various fluctuation during the study. Previously, this was happening to the confirmed cases. Iran, Turkey, and Iraq had the highest number of deaths, respectively.

The information-seeking behavior of the middle east people on Google relating to the COVID-19 from Jan 1, 2020, to Dec 31, 2020

We have drawn the key cases of the corona virus that Google searched for in the Middle East. As shown in Fig. 1, GT was used to extract the data.

As shown in Fig. 1, RSVs of the COVID-19 outbreak in the middle east countries has been experienced the highest frequency in April 2020 ($n=7$). The highest RSVs for each country during the period of the study is listed below: Bahrain (9 Apr), Cyprus (3 Aug), Egypt (1 Apr), Iran (22 Feb), Iraq (1 Apr), Israel (14 Mar), Jordan (6 Apr), Kuwait (7 Apr), Lebanon (26 Jul), Oman (6 Apr), Qatar (13 Jul), Saudi Arabia (1 Jul), Syria (14 Mar), Turkey (25 Nov), United Arab Emirates (6 Jul), Yemen (10 Apr). The graphs indicated that there was a fluctuating flow in coronavirus-related searches between January to December 2020.

The distribution of the scientific productivity of the middle east scholars on scientific databases relating to the COVID-19 from Jan 1, 2020, to Dec 31, 2020

Of 16,655 coronavirus-related articles published by middle east scholars, Iranian scholars had the highest number of publications relating to the COVID-19 ($n=3,854$) from Jan 1,

Table 3 The number of confirmed cases relating to the COVID-19 in the Middle East countries from Jan 1, 2020, to Dec 31, 2020

Middle East Countries	Confirmed cases												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Bahrain	0	38	523	2470	7756	15,446	14,516	50,482	39,663	11,044	5321	5638	152,897
Cyprus	0	0	230	613	100	53	3401	3672	2507	3624	6112	11,656	31,968
Egypt	0	0	651	4881	17,912	43,305	27,003	4565	4240	4306	7798	20,050	134,711
Iran	0	597	44,009	50,034	52,028	76,255	76,325	72,040	76,331	154,992	318,689	296,356	1,217,656
Iraq	0	17	613	1373	4176	40,972	74,112	109,914	113,335	117,067	79,802	44,007	585,388
Israel	0	11	4620	10,921	1321	6749	44,689	45,042	119,833	80,134	21,575	79,092	413,987
Jordan	0	0	268	185	277	394	207	690	7110	61,573	145,443	78,760	294,907
Kuwait	0	49	240	3735	22,168	19,332	21,005	18,107	19,990	20,769	17,102	7872	150,369
Lebanon	0	11	452	271	466	554	2599	11,941	20,867	40,520	47,910	52,359	177,950
Oman	0	10	182	2156	8075	28,637	40,084	6389	13,041	15,849	9010	5235	128,668
Qatar	0	5	688	12,716	41,853	39,844	15,354	8115	6933	6730	6289	4923	143,450
Saudi Arabia	0	0	1563	21,190	60,631	103,052	87,783	39,692	20,265	12,625	10,649	5473	362,923
Syria	0	0	10	33	79	147	479	1965	1447	1535	2117	3547	11,359
Turkey	0	0	10,827	106,767	45,514	35,510	51,468	247,285	250,531	284,512	387,408	793,843	2,213,665
United Arab Emirates	8	15	641	11,817	21,415	15,076	12,731	9410	23,400	37,305	33,883	38,012	203,713
Yemen	0	0	0	5	308	818	579	232	85	26	18	22	2,093

Table 4 The number of deaths relating to the COVID-19 in the Middle East countries from Jan 1, 2020, to Dec 31, 2020

| Middle East Countries	Deaths												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Bahrain	0	0	4	4	9	67	62	44	61	66	19	13	349
Cyprus	0	0	7	13	5	2	0	2	1	4	23	73	130
Egypt	0	0	41	351	521	1959	1902	625	1905	344	392	889	8,929
Iran	0	43	2855	3130	1649	2936	5899	4893	4283	8699	12,657	8000	55,044
Iraq	0	0	46	46	103	1644	2832	2286	1980	1810	1362	584	12,693
Israel	0	0	17	195	73	34	209	381	617	928	330	453	3,237
Jordan	0	0	5	3	2	0	2	4	38	715	1894	1121	3,784
Kuwait	0	0	0	26	179	145	95	85	76	166	105	57	934
Lebanon	0	0	12	12	2	8	23	114	193	259	376	452	1,451
Oman	0	0	0	11	31	127	252	256	258	414	89	79	1,517
Qatar	0	0	1	9	26	77	58	25	17	18	5	8	244
Saudi Arabia	0	0	10	152	318	1119	1225	998	896	626	521	320	6,185
Syria	0	0	1	1	1	5	29	68	88	118	128	291	730
Turkey	0	0	168	2906	1434	600	555	652	1805	2047	3388	7084	20,639
United Arab Emirates	0	0	6	99	157	54	37	32	34	73	72	95	659
Yemen	0	0	0	0	78	227	182	78	22	12	7	5	611
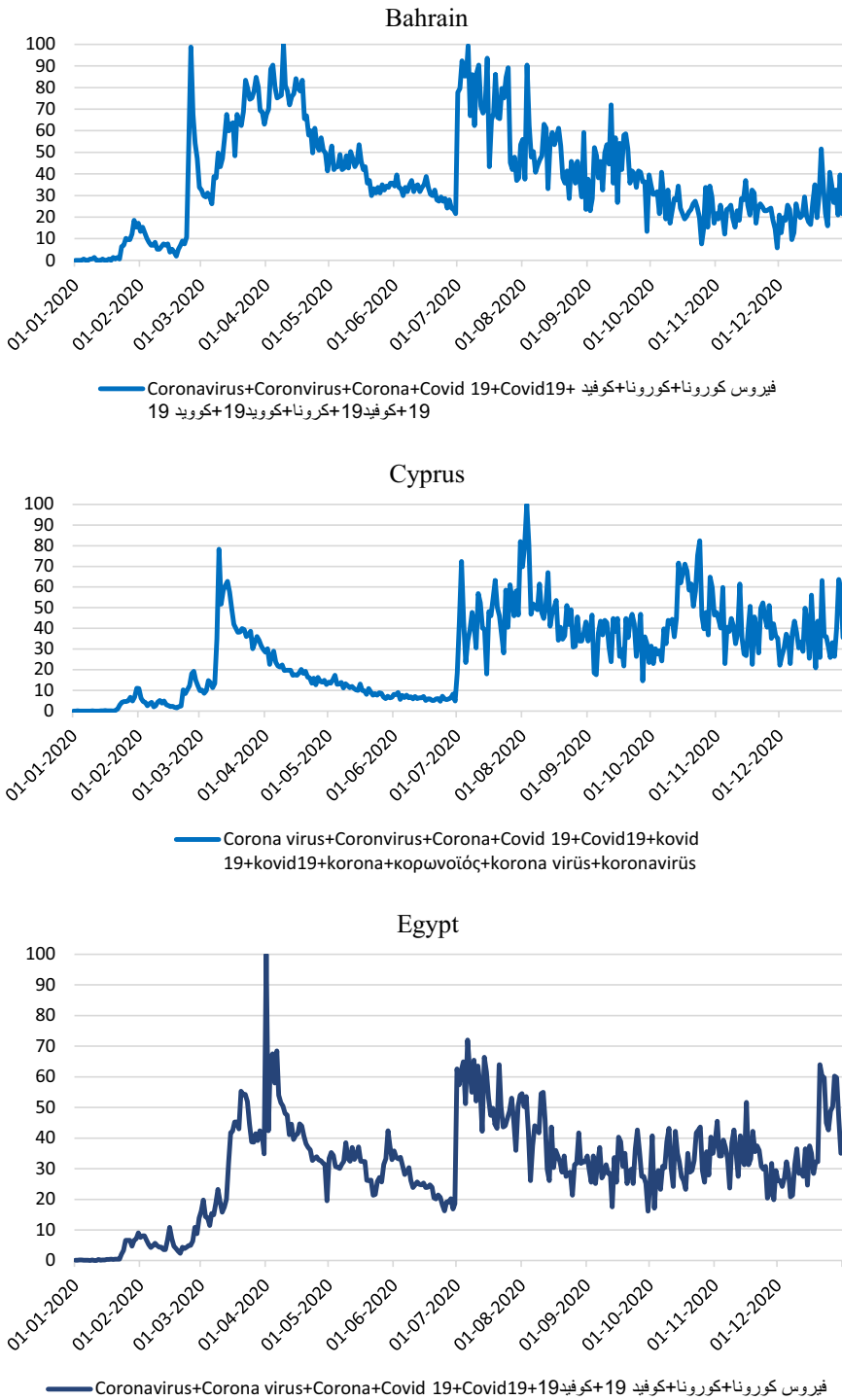
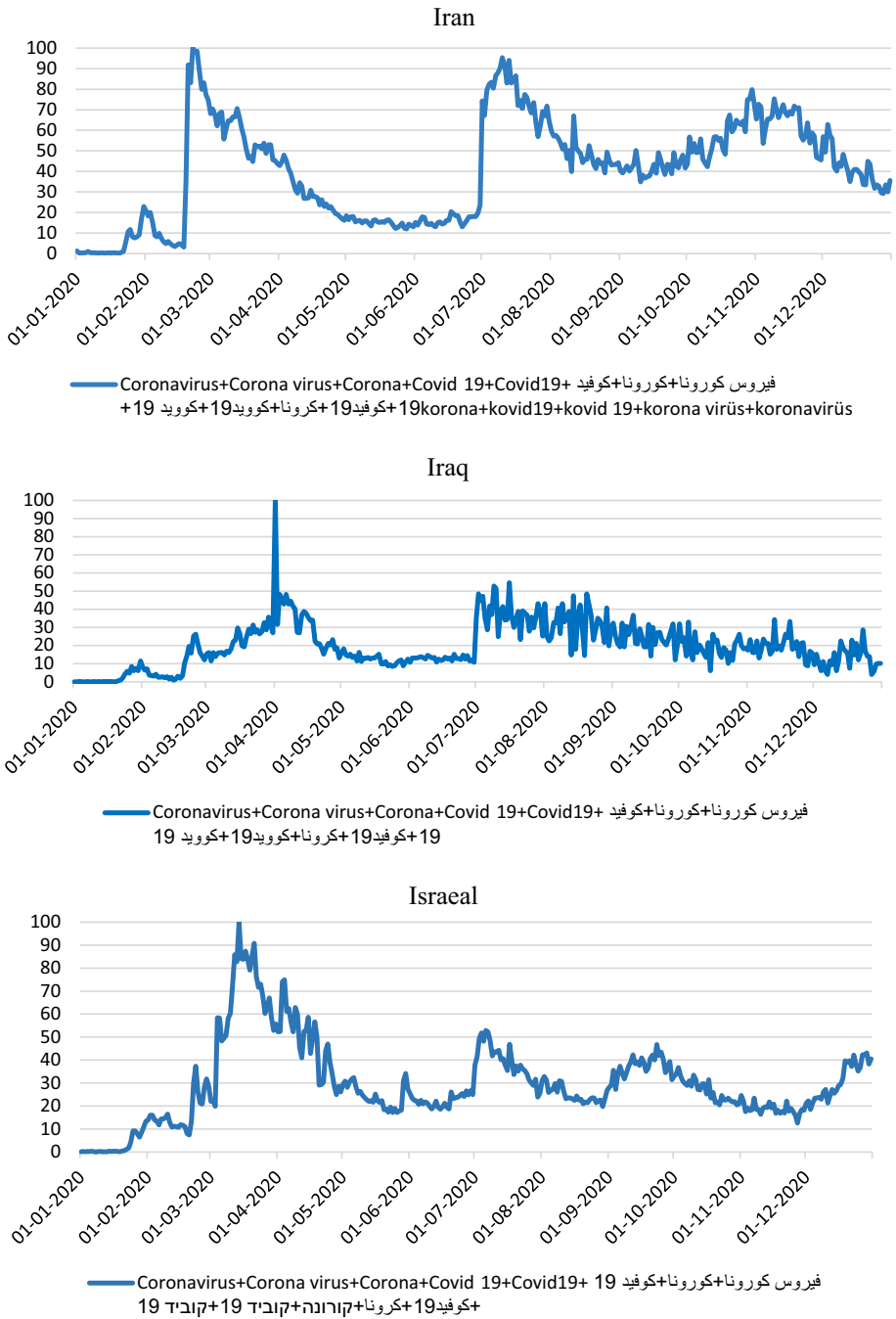**Fig. 1** The relative search volumes (RSVs) on Google relating to the COVID-19

Fig. 1 (continued)

Jordan

Coronavirus+Corona virus+Corona+Covid 19+Covid19+ 19 كوفيد+كورونا فيروس كورونا
كوفيد19+كرونا+كورونا+كوبيد 19+كوبيد 19

Kuwait

Coronavirus+Corona virus+Corona+Covid 19+Covid19+ 19 كوفيد+كورونا فيروس كورونا
كوفيد19+كرونا+كوويد19+كوويد 19

Lebanon

Coronavirus+Corona virus+Corona+Covid 19+Covid19+ 19 كوفيد+كورونا فيروس كورونا
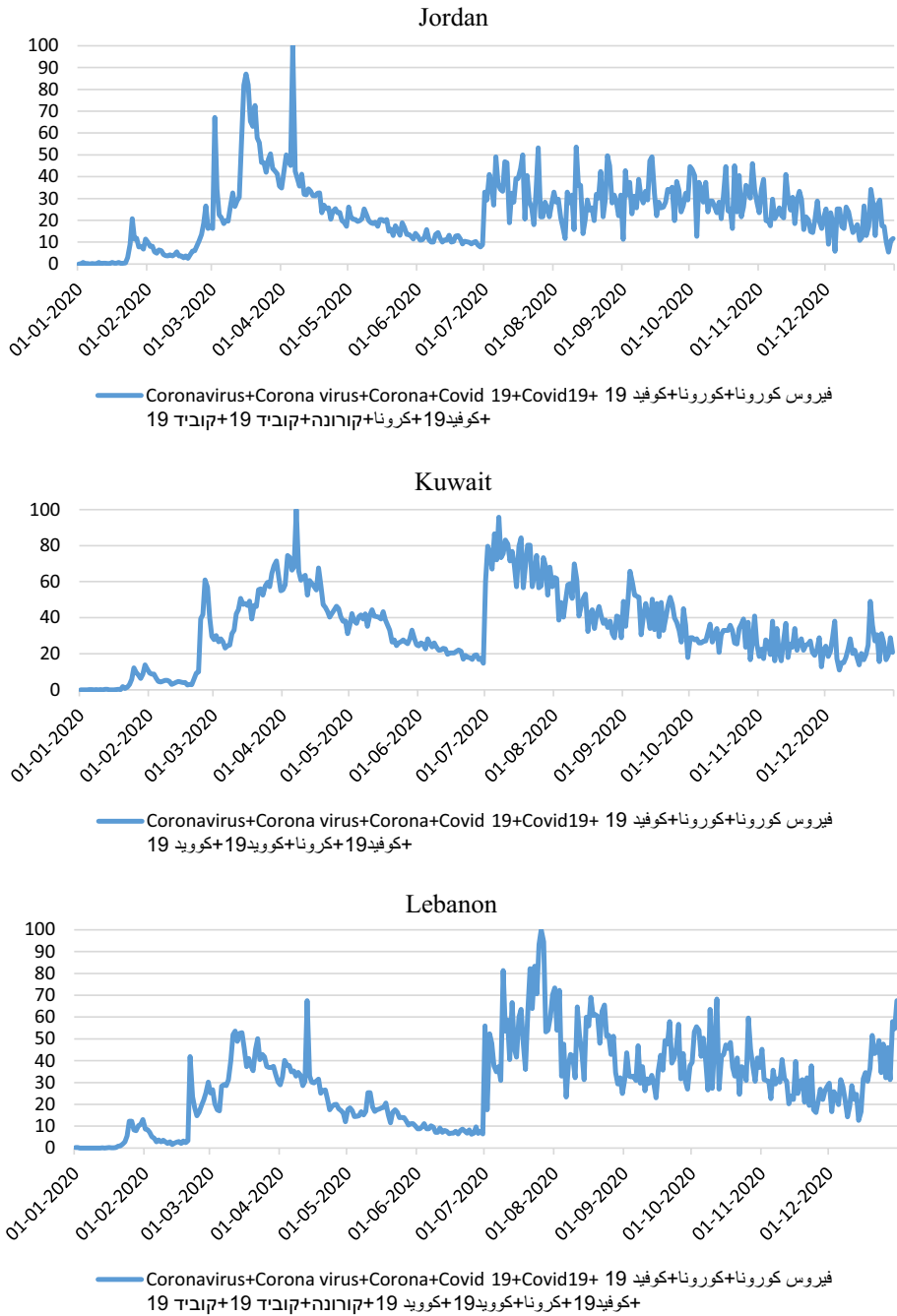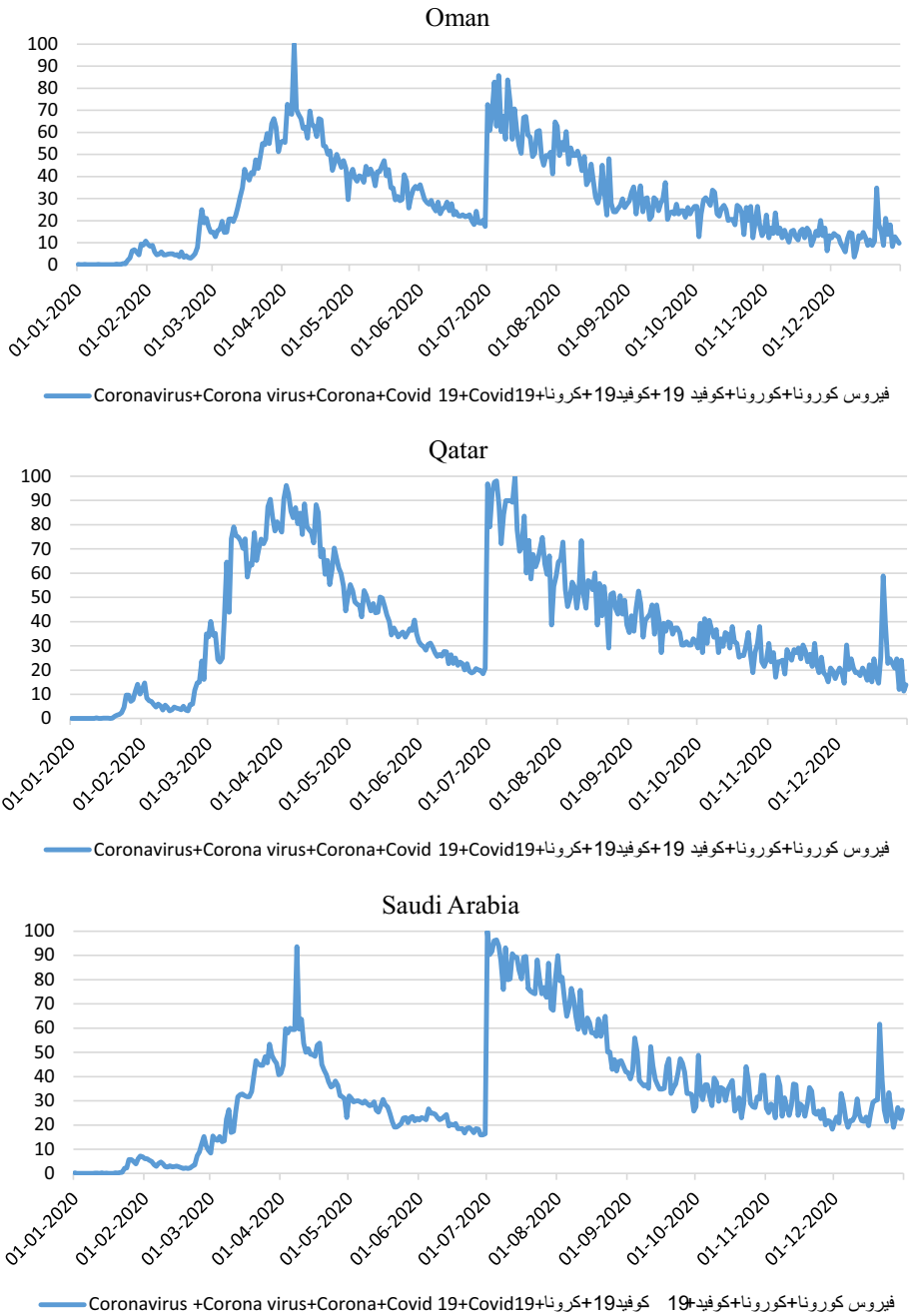كوفيد19+كرونا+كوويد19+كوويد 19+كورونا+كوبيد 19+كوبيد 19
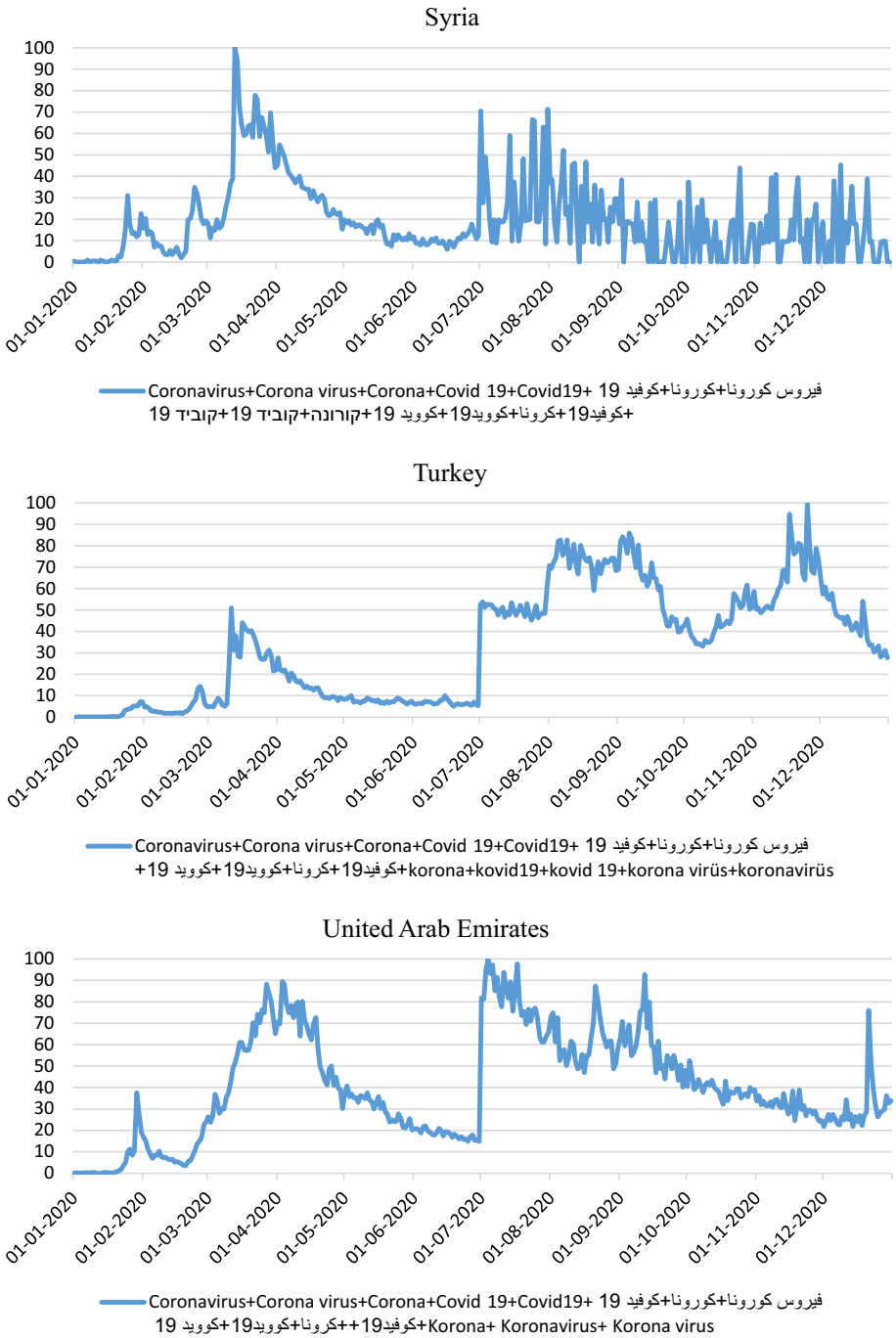
Fig. 1 (continued)

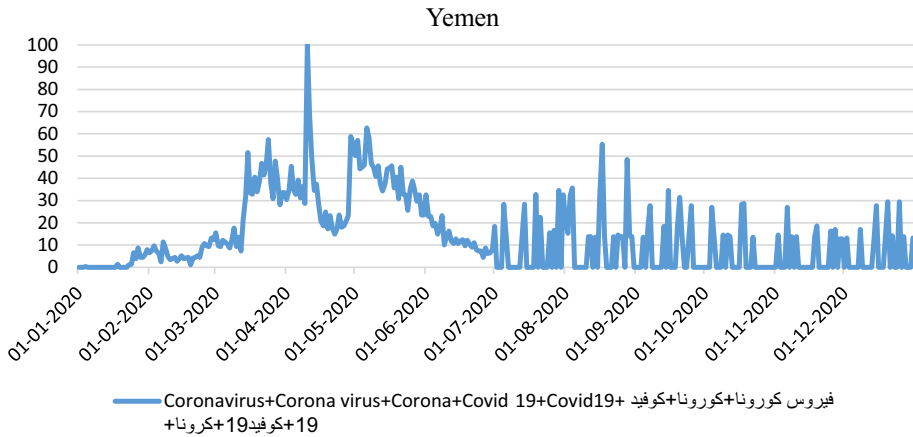Fig. 1 (continued)

Fig. 1 (continued)

Fig. 1 (continued)

2020, to Dec 31, 2020, in Web of Science (WoS), Scopus, and PubMed (Table 5). Other ranks belonged to Turkey ($n=3,409$) and Saudi Arabia ($n=2,705$), respectively. Furthermore, the mean scientific productivity of the middle east scholars per country was 1040.93.

The association of the scientific productivity of the middle east scholars on scientific databases relating to the COVID-19 and the coronavirus-seeking behavior of the middle east people on Google from Jan 1, 2020, to Dec 31, 2020

According to the result of the Kolmogorov–Smirnov test, we used the Spearman rank correlation to test the strength of the association between the RSVs for the information-seeking behavior towards the COVID-19 on Google and the scientific productivity of the scholars in the middle east countries.

As shown in Table 6, there was a positive and significant association (except Syria and Yemen) between the coronavirus-seeking behavior on Google and the scientific productivity of the middle east scholars on scientific databases relating to the COVID-19 ($P<0.001$). In Syria and Yemen, this association was negative and significant. There was no significant association between the coronavirus-seeking behavior and the scientific productivity in Bahrain ($P=0.4$) and Qatar ($P=0.07$). Similarly, there was a positive and significant association (except Syria with $P=0.13$ and Yemen with $P=0.56$) between the coronavirus-seeking behavior on Google and the confirmed cases ($P<0.001$ except United Arab Emirates with $P=0.02$). The results indicated that there was a positive and significant association (except Yemen with $P=0.48$ and the United Arab Emirates with $P=0.09$) between the coronavirus-seeking behavior on Google and the number of deaths relating to COVID-19 ($P<0.001$ except Jordan with $P=0.003$ and Kuwait with $P=0.02$). Furthermore, there was a positive and significant association (except Jordan with $P=0.74$) between the scientific productivity of the middle east scholars and the number of deaths relating to COVID-19 ($P<0.001$). Also, there was

Table 5 The scientific productivity of the middle east scholars on scientific databases relating to the COVID-19

Middle East Countries	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Mean per Month	Mean	SD
Bahrain	0	0	0	1	1	4	10	9	17	23	18	19	102	8.5	1040.93	1238.938
Cyprus	1	1	3	6	5	22	15	27	36	40	59	32	247	20.58		
Egypt	4	3	12	33	64	95	125	149	251	258	273	268	1525	127.08		
Iran	8	12	71	213	203	294	489	661	475	323	661	444	3854	321.17		
Iraq	0	0	3	7	14	14	50	50	74	58	54	69	393	32.75		
Israel	2	1	12	47	161	116	177	207	210	212	222	223	1590	132.5		
Jordan	0	1	6	10	17	29	47	43	99	81	77	128	538	44.83		
Kuwait	1	0	1	10	8	9	17	21	39	28	38	39	211	17.58		
Lebanon	0	0	3	15	28	49	45	37	70	70	64	64	445	37.08		
Oman	1	0	0	12	7	15	31	38	24	26	21	25	206	17.17		
Qatar	0	0	8	4	21	32	59	48	66	92	79	77	486	40.50		
Saudi Arabia	4	6	24	44	91	121	317	317	562	385	403	431	2705	225.42		
Syria	0	0	0	0	3	3	2	4	4	2	5	5	28	2.33		
Turkey	10	4	16	109	181	320	504	465	500	439	430	435	3409	284.08		
United Arab Emirates	0	1	3	11	31	39	99	92	136	131	124	151	818	68.17		
Yemen	0	0	2	0	4	1	16	7	20	10	11	27	98	8.17		

Table 6 The association between the scientific productivity of the middle east scholars on scientific databases relating to the COVID-19, the confirmed cases and deaths, and the coronavirus-seeking behavior of the middle east people on Google

Middle East countries	Search on GT and articles		Search on GT and confirmed Cases		Search on GT and deaths		Deaths and Articles		Confirmed cases and articles	
	R	P	R	P	R	P	R	P	R	P
Bahrain	−0.04	0.4	0.31	<0.001	0.17	<0.001	0.43	<0.001	057	<0.001
Cyprus	0.62	<0.001	0.55	<0.001	0.18	<0.001	0.29	<0.001	0.55	<0.001
Egypt	0.38	<0.001	0.35	<0.001	0.37	<0.001	0.45	<0.001	0.42	<0.001
Iran	0.27	<0.001	0.43	<0.001	0.59	<0.001	0.74	<0.001	0.84	<0.001
Iraq	0.33	<0.001	0.42	<0.001	0.44	<0.001	0.60	<0.001	0.68	<0.001
Israel	0.25	<0.001	0.43	<0.001	0.27	<0.001	0.70	<0.001	0.79	<0.001
Jordan	0.34	<0.001	0.27	<0.001	0.15	0.003	0.24	0.74	0.73	<0.001
Kuwait	0.21	<0.001	0.31	<0.001	0.12	0.02	0.43	<0.001	0.49	<0.001
Lebanon	0.41	<0.001	0.51	<0.001	0.43	<0.001	0.66	<0.001	0.72	<0.001
Oman	0.30	<0.001	0.38	<0.001	0.20	<0.001	0.50	<0.001	0.36	<0.001
Qatar	0.37	0.07	0.41	<0.001	0.20	<0.001	0.20	<0.001	0.22	<0.001
Saudi Arabia	0.48	<0.001	0.46	<0.001	0.49	<0.001	0.67	<0.001	0.39	<0.001
Syria	−0.20	<0.001	0.08	0.13	0.17	<0.001	0.67	<0.001	0.70	<0.001
Turkey	0.83	<0.001	0.71	<0.001	0.46	<0.001	0.43	<0.001	0.65	<0.001
United Arab Emirates	0.34	<0.001	0.12	0.02	0.09	0.09	0.45	<0.001	0.67	<0.001
Yemen	−0.31	<0.001	0.31	0.56	0.04	0.48	0.16	<0.001	0.26	<0.001

a positive and significant association between the scientific productivity and the confirmed cases relating to COVID-19 ($P < 0.001$).

Discussion

Infodemiology is a rapidly growing field, which studies trends in online search behavior and internet activity. It provides new insights into population behavior and health-related phenomena, particularly during infectious disease outbreaks (Wong et al., 2021). The unprecedented rate at which scientific publications related to the COVID-19 are emerging (Haghani, Bliemer, Goerlandt, and Li, 2020), and the vast increasing growth of the peoples' online searches on search engines concerning this pandemic, makes synthesizing health information demand as well as health information supply more significant than ever. The health information-seeking behavior on the web and public search queries on search engines could be considered health information demand. On the other hand, the scientific productivity of the scholars in scientific databases can be defined as health information supply (SeyyedHosseini et al., 2018). If we accepted the assumption that health information supply should be aligned with the health information demand, it would be desirable that the scholars' activities will have the same direction as the public's trend. In this context, we strived to explore online searches of the middle east

people on Google relating to the COVID-19. Simultaneously, we aimed to investigate the scientific productivity of the scholars in prominent scientific databases in 2020.

According to the results, the middle east people utilized different keywords for searching the COVID-19 pandemic. It could be related to the diversity of spoken languages in this region. The most frequently used keywords by people in the middle east related to COVID-19 was described as follows: "coronavirus" in Bahrain, Cyprus, Jordan, Kuwait, Lebanon, Oman, Qatar, Syria, and United Arab Emirates; "انوروک" in Egypt, Iraq, and Yemen; "انورک" in Iran; "הנורוק" in Israel; "انوروک" and "coronavirus" in Saudi Arabia; and "corona" in Turkey. The high use of some English keywords in the middle east region could be related to the outspread interactions with English-spoken countries. Another reason could be associated with the English-spoken citizens' attendance in the middle east countries.

Although the first confirmed case relating to the COVID-19 was observed on Jan 29, 2020, in the United Arab Emirates, we should remember that on this date, it might be other cases in the middle east that had not been confirmed by health agencies. In 2020, some middle east countries reached a peak of the COVID-19 one time; Bahrain (August), Iraq (October), Qatar (May), Saudi Arabia (June). Others reached a peak two times or more. On the whole, we can see a fluctuating growth of the COVID-19 confirmed cases. Previously, some studies pointed to the growing number of the confirmed cases relating to the COVID-19 pandemic in 2020 (Sarkodie & Owusu, 2020; Riberio et al. 2020; Lau et al., 2020). Alnaser, Abdel-Aty and Al-Ubaydli (2020) believed that the number of actual cases, especially in Bahrain, Saudi Arabia, and Egypt, might be attributed to several factors, including ambient temperature, population density, absolute humidity, lifestyle, physical immunity (type of nutrition), the accuracy of measurements, and the number of tests made. However, the first death relating to the COVID-19 was reported in February 2020 in Iran. Mortality had a swinging flow in middle eastern countries. The number of the confirmed cases and deaths in the Middle East region in 2020 could be associated with the more availability of diagnostics kits and health care facilities (Bi et al., 2020). Other reasons that cause the coronavirus-mortality could have related to the more densely populated areas (Xie & Zhu, 2020), air pollution, and the aged population (Cristea, Noja, Stefea, & Sala, 2020).

The relative search volumes of the middle east peoples' online search relating to the COVID-19 on Google showed an interesting output for each country. In Bahrain and Qatar, we could see about three peaks between February 2020 and July 2020. In Iran, Kuwait, Oman, Saudi Arabia, and Syria, we could observe two peaks nearly. Other countries had been experienced one prominent apex of coronavirus-seeking in 2020. Investigating the coronavirus-seeking behavior flow on Google showed that the pandemic search speed and acceleration reduced during the second half of 2020. It might be related to individuals' high sensibility toward the COVID-19 outbreak during the first six months of 2020. It might be attributed to other factors, including severe information needs and lack of awareness on coronavirus. Among the Middle East countries, Turkey is an exception. In Turkey, we could observe the fluctuating flow of coronavirus-seeking behavior. Despite other countries in the Middle East region, Turkish people sought coronavirus and its related keywords, on Google, especially in the second six months of 2020 (July, August, September, and November). Previously, findings indicated that the relative search volume of "kaplıca", a Turkish term that means spas, during the COVID-19 pandemic, was statistically significantly decreased in the March 15–May 30, 2020; May 31–July 25, 2020; and July 26–September 19, 2020. Public interest in spas showed a moderate increase during the June–August period (Kardes, 2021). Our study approved the association between the RSVs on Google Trends and the number of confirmed cases and deaths relating to the

COVID-19. In other previous studies, this association had been approved (Effenberger et al., 2020; Higgins et al., 2020; Husain et al., 2020; Mavragani, 2020; Rajan et al., 2020; Sharma & Sharma, 2020; Sousa-Pinto et al., 2020). Some other researches indicated that Google Trends has the undeniable potential to map the information-seeking behavior of the users over the period (Ayers, Althouse, Noar, & Cohen, 2014; Brigo et al., 2014; Kuehn, 2013; Otte, van Diessen, Bell, & Sander, 2013; Pelat, Turbelin, Bar-Hen, Flahault, & Valleron, 2009; Van Campen et al., 2014; Willard & Nguyen, 2013).

Despite the growth of the confirmed cases relating to the COVID-19 in 2020, the number of searches on Google decreased. Some other coronavirus-related studies approved this previously (Mavragani, 2020; Rajan et al., 2020). It could be related to different reasons like increasing public awareness toward the pandemic, reducing coronavirus-related mortality, and improving the treatment methods. Therefore, it seems that the rate of attention of the Middle East people toward the COVID-19 decreased throughout the year 2020. It might be related to the gradual fading of the COVID-19 pandemic in the news box and media reports. Earlier, some studies highlighted the significant role of TV programs and national awareness in creating anxiety and panic among the public (Dehkordy, Carlos, Hall, & Dalton, 2014; DeVilbiss & Lee, 2014; Higgins et al., 2020; Walker & Sulyok, 2020).

The scientific productivity of the middle east scholars in Wos, Scopus, and PubMed showed an increasing growth, with some fluctuation, in 2020. The highest number of scientific productivity belonged to Iran, Turkey, and Saudi Arabia, accordingly. The lowest number of scientific productivity belonged to Syria. It could be associated with Syrian difficulties in socio-economic concerns and civil war.

In the last step, the findings indicated a significant association between the confirmed cases and the scientific productivity of Middle East scholars. There was a positive and significant association between the number of deaths and the number of scientific publications (except Jordan). Also, there was a positive and significant association between online coronavirus-seeking behavior on Google (RSVs) and the confirmed cases (except Syria and Yemen). Furthermore, it was a positive relationship between RSVs and scientific productivity in the Middle East (except Bahrain and Qatar). From an infodemiological viewpoint, there is a significant correlation between coronavirus information demand and its information provision. Previously, some studies demonstrated the positive relationship between health information supply and demand for stomach cancer (SeyyedHosseini et al., 2018) and breast cancer (SeyyedHosseini, S., Shabani, Asemi, and CheshmehSohrabi, 2017).

Conclusion

Today, using an infodemiological approach, researchers could gain a better perception of the publics' needs. The actual scientific development occurs when the focus is on the real information need of the society. Infodemiology can play a crucial role in the initial drawing roadmap for future projects involving scientists and policymakers. With the onset of the COVID-19 pandemic worldwide, the importance of identifying peoples' needs in all aspects of the new virus is becoming more apparent than ever.

Limitations

Several inherent limitations of our research should be mentioned. (1) we only use the single search engine, Google, to retrieve data from the middle east countries. Thus, selection bias

will be existing as Google only gathering the data of people who chose to get the information by using this search engine. (2) the detailed information about the procedures that Google implements to analyze this search behavior remains unclear. Therefore, controlling other factors that may affect our results would be impossible. (3) RSVs estimate relative changes in online interest and do not represent the interest of people with no Internet access. (4) A simple correlation between Google Trends (or the number of cases/deaths) may not be adequate, as there is an expectable time lag mirroring the period needed for a publication to be completed, peer-reviewed, accepted for publication, and published. (5) Internet penetration, government internet monitoring, and freedom of the press could be factors that affect the validity of the results in certain countries. These factors were out of the scope of our study. (6) The current investigation focuses on the selected keywords which directly related to the pandemic. So, the terms which may be relevant indirectly to the COVID-19 were not considered (e.g., if they search for preventive measures such as "social distancing" or "masks").

Declarations

Conflict of interest The authors have no conflict of interests to declare that are relevant to the content of this article.

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