Basic Knowledge, Attitude, and Practice of Middle East and North African Populations toward COVID -19

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Abstract

Objective: This study aimed to assess the basic knowledge, attitude, and practice among people from nine Middle Eastern and North African countries about COVID-19 symptoms, modes of transmission, acceptance of recovered patients, and practice of some basic preventive measures.

Methods: In this cross-sectional study, data was collected from 3515 participants in nine Middle Eastern and North African countries using an online self-administered questionnaire to assess participants' basic knowledge, attitude, and practice of some preventive measures related to COVID-19.

Results: In this study, most of the participants were aware of the basic preventive measures against coronavirus. Despite this awareness, the practice of these measures was low, with a significant variation among participating countries and gender. Social media was the major source of their information. More than half of participants (53.2%) would

not accept recovered patients in the community without protective measures, and the majority (84%) of them believed that people living in hot and sunny areas are less susceptible and affected by COVID-19.

Conclusion: Our findings indicate that participants of Middle Eastern and North African countries have relatively good knowledge and attitudes regarding COVID-19. Still, they have unsatisfactory preventive practices, and more than half of them refuse to accept recovered patients as normal in the community without protective measures.

Keywords: SARS-CoV-2, COVID-19, Awareness, preventive measures

Introduction

Coronavirus disease 19 (COVID-19) is caused by a new coronavirus called SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2). Ever since SARS-CoV-2 first discovery in Wuhan city, China, in December 2019[1] the virus has spread all over the world. The World Health Organization (WHO) first announced COVID-19 a pandemic disease on March 11, 2020[2]. As of 3 July 2020 and according to WHO reports, there were 10,710, 005 cases and 517,877deaths in 188 countries and territories globally [3]. The virus is very contagious and can spread very fast from cases and at a very low rate from asymptomatic carriers [4]. Transmission occurs through direct close contact and respiratory droplets while speaking, coughing, and sneezing. In addition, SARS-CoV-2 can be transmitted by touching an infected surface then touching any face opening[5].

COVID-19 patients show a wide range of symptoms from mild to severe illness, the majority of the cases are milder [6]. These symptoms begin 2-14 days after exposure to the virus. They include fever, shortness of breath, fatigue, myalgia, anosmia (loss of smell) and ageusia (loss of taste), and headache. Furthermore, they may include congestion, sore throat, nausea, vomiting, or diarrhea[7]. Severe illness leads to hospitalization, admission to the intensive care unit, intubation or ventilation, and finally, may cause death. Patients with serious heart conditions[8,9], chronic kidney diseases[10], chronic obstructive pulmonary disease (COPD)[8,10], obesity (BMI>30)[11], type 2 diabetes[12], organ transplant[13,14], sickle cell disease [15,16], and hypertension[8] are at higher risk of severe illness. Furthermore, there is evidence that smoking and pregnancy can increase the risk of the severe illness of COVID-19[17-20].

The outcomes of COVID-19 pandemic are thought to be powerfully controlled by the population's practices and attitude, which, in turn, is influenced by people knowledge and believes about this disease[21]. Most of the previously mentioned measures have been implemented, to various extents, in the participating countries, yet COVID-19 continues to spread[3,22]. One of the suggested reasons behind the limitation of control programs against infectious disease outbreak is the fact that individuals or communities do not believe they can be harmed by the virus. People who are in charge of setting policies in response to an outbreak should estimate the needs of those individuals and communities, and they must make sensible efforts to ensure that these needs are precisely met[23].

The knowledge, attitudes, and practices (KAP) toward COVID-19 is a cornerstone step for emphasizing the community's willingness to adopt behavioral change measures. KAP studies provide basic and ground information to determine and speed up the type of intervention that may be needed to change misconceptions about the virus [24].

In the current study, in order to assess the basic knowledge, attitude, and practices, we are using a self-administered questionnaire about COVID -19 symptoms, modes of transmission, and preventive measures in nine Middle Eastern and North African countries.

Methods

Recruitment procedure

This is a cross-sectional study of a convenient sample. The study sample was recruited through online social media (such as Facebook, Instagram, WhatsApp and Twitter) relying on authors professional and personal networks, from the general population of

nine different Arab and African countries (Lebanon, Algeria, Sudan, Egypt, Libya, Morocco, Tunisia, Jordan, and Chad), during the period from April 13, 2020, to May 13, 2020.

Ethical considerations

This study was approved by the research ethics committee of each participating country (Lebanon: Institutional Review Board Of Beirut Arab University; Algeria: Comité Consultatif d'Ethique du Centre Hospitalo-Universitaire de Betna; Sudan: Research Ethics Committee of Sudan University of Science and Technology; Egypt: Research Ethics Committee of Faculty of Pharmacy in Alexandria University; Libya: Research Ethics Committee of Libyan International Medical University; Morocco: Research Ethics Committee, Polydisciplinary Faculty of Taroudant, IBN ZOHR University; Tunisia: Comité d'Ethique de la recherche de la Faculté de Médecine de Monastir, Monastir University; Jordan: Institutional Review Board of The Hashemite University; Chad: Direction de la Recherche et de l'Innovation, Ministère de l'Enseignement Supérieur, de la Recherche et de l'Innovation).

Description of the questionnaire

A questionnaire was designed in Arabic as part of the current study using Google survey forms, and was distributed through social media; only one response was accepted from each participant. An informed consent covering letter was attached to the questionnaire, explaining the purpose of the study, names, and affiliations of the researchers. The questionnaire contained two main sections: the first section covered the demographic data of the participants, including age, gender, marital status, educational level, and occupation. The second section contained multiple option questions developed to

measure participants' knowledge of the SARS-CoV-2 mode of transmission and preventive measures to avoid the infection. Participants were also asked about their attitudes towards people recovered from COVID-19.

Statistical analysis

Statistical analysis of the data was carried using Statistical Package for Social Sciences (SPSS) 16.0. Pearson chi-square test was used to determine the statistically significant difference between variables. Measures of central tendency, including means, as well as frequencies and percentages, were calculated to determine the differences between different countries in relation to the questions. The statistical significance level was set at p-value< 0.05.

Results

A total of 3515 responses were received from the different countries, the distribution of participants was the following: Lebanon 968 (27.5%), Algeria 479 (13.6%), Sudan 479 (13.6%), Egypt 437 (12.4%), Libya 392 (11.2%), 386 Morocco (11%), Tunisia 147 (4.2%), Jordan 134 (3.8%), and Chad 93 (2.7%). Almost half of participants (49.9 %) were aged less than 30 years, followed by 30-39 (26.6%), 40-49 (15.2%), 50-59 (6%), and 60+ years of age (2.3%) (Table S1). Females represented 58.2% and males 40.7% of all participants, while 1.1% preferred not to report their gender. Most participants (53.7%) were single or married (43.4%) (Table S2). Based on the university qualification of participants, around half of them were graduates (49%), or postgraduates (37.9%). Most of the participants (84.1%) were in a non-medical profession (Table 1).

Social media was the main source of knowledge for 32.2% of the participants, followed by official data (ministry of health releases) in 31.5% of cases, television (20.7%), families and friends (7.8%), newspapers (5.6%), or other sources (1.9%), and 0.2 had no previous knowledge of COVID-19, with significant differences within participating countries (*p*-value =0.000) (Figure 1 and Table S3).

When the participants were asked about COVID-19 mode of transmission, about 92% of them correctly identified droplets from patients during sneezing and coughing or from contaminated objects as a source of infection. There was a significant difference (*p*-value=0.000) in responses between participating countries regarding these modes of transmission, in Tunisia and Egypt, the majority of participants (99% and 95.4% respectively) agreed, while in Chad and Algeria, only 77% and 88% agreed respectively. Only 20% identified fever, fatigue, dry cough, muscle aches, shortness of breath with no blockage or runny nose, and sneezing as the main symptoms of COVID-19 (Table 2).

Most of the participants (82.5%) stated that COVID-19 could be transmitted from asymptomatic individuals. More than half of the participants (53.2%) disagreed that it is safe to deal with recovered patients without precautionary measures, but those who agreed that it is safe to deal with them without such measures varied significantly within the participating countries (*p*-value = 0.001). Among Libyans, 26.5%, Egyptians 25.4%, and Jordanians, only 17.2% agreed (Table 3). Significant variations in responses were observed among the different age groups (*p*-value = 0.000), we noticed that acceptance of recovered patients is increasing with increasing of age. Men (24.4%) are more accepting of the recovered people than women (21.4%) (*p*-value = 0.018). Singles (19.4%) are the less accepting of the recovered patients than married (25.7%), followed by divorced

(32.4%) and widowers (33.3%) (*p*-value = 0.000). Respondents from the medical field (27.3%) were more accepting of the recovered people than non-medicals (21.6%) (*p*-value = 0.004).However, a large part of medical professionals (52.3%) were not accepting. No significant variation was observed according to the education levels of participants (*p*-value = 0.056) (Table S5).

The majority (84%) of participants believed that people living in hot and sunny areas are less susceptible and affected by COVID-19, with a significant variation (p-value =0.00) between participating countries that is driven by Chad having a low 77% agreement compared to the rest of countries between 88 and 81% (Table 4).

In this study, when the participants were asked about those most likely to experience complications of COVID-19, ninety-eight percent believed that older people with chronic diseases are most susceptible, followed by 26.9% who believed pregnant women were at higher risk, and only 11.8% believed that children are most likely to be exposed to complications (Table 5).

As shown in figures 2, 4, and table 6, we found significant variations (p-value = 0.00) in participant's knowledge about some preventive measures and their commitment to practice these measures. The majority of participants (92.8%) agreed with and practiced handwashing with soap and water or using a sanitizer containing at least 60% alcohol for a minimum period of 40 seconds after being in a public place. Significant variation (p-value = 0.000) was observed between knowledge and practice regarding wearing masks in public, and for patients and their contacts, where 82.9% agreed, while only 53.4% practiced it. In addition, we noticed significant variation (p-value = 0.01) between males (59%) and females (50%) concerning the practice of wearing masks. A total of 87.6%

agreed with, whereas only 22.6% practiced the isolation of infected people and their contacts for two weeks to limit the spread of the virus. On questions concerning staying home and avoiding crowded places like markets and places of worship, etc., 87.6% of participants agreed, and 85.9% performed this preventive measure, which shows more consistency of belief and practice for this measure. When asked whether children and young people should follow the same precautionary measures to avoid the infection, there was a significant difference (p-value = 0000) between those who agreed (93.7%) and those who practiced this preventive measure 55%.

The majority of the participants (87.2%) agreed, and (82%) of them practiced the preventive measure of avoiding handshaking, hugging, and kissing as a way of greeting and used an alternative approach.

Most of the participants (86.3%) agreed with sterilization of surfaces that are subjected to touch daily (tables, door handles, light switches, holders, keyboard, cell phones, desktops, bathroom surfaces, and sinks), as a preventive measure from COVID-19, whereas only 75.5% practiced it (p-value = 0.04). Females (80%) sterilized surfaces more significantly than males (69%), (p-value = 0.01).

Table (1). Distribution of study participants according to their educational level and professions

Country	Educational level			Profession		Total
	Undergraduate	Graduate	Postgraduate	Non-medical	Medical	
Lebanon	197 (20.4)	543(56.1)	228 (23.6)	889 (91.8)	79 (8.2)	968
Algeria	56 (11.7)	133(27.8)	290 (60.5)	425 (88.7)	54 (11.3)	479

Sudan	26 (5.4)	218(45.5)	235 (49.1)	296 (61.8)	183 (38.2)	479
Egypt	48 (11)	287(65.7)	102 (23.3)	373 (85.4)	64 (14.6)	437
Libya	45 (11.5)	268(68.4)	79 (20.2)	289 (73.7)	103 (26.3)	392
Morocco	49 (12.7)	95 (24.6)	242 (62.7)	351(90.9)	35(9.1)	386
Tunisia	14 (9.5)	33 (22.4)	100 (68)	122(83)	25(17)	147
Jordan	25 (18.7)	86 (64.2)	23 (17.2)	127(94.8)	7 (5.2)	134
Chad	2 (2.2)	59 (63.4)	32 (34.4)	83 (89.2)	10 (10.8)	93
Total	462 (13.1)	1722 (49)	1331 (37.9)	2955 (84.1)	560 (15.9)	3515
p-value	0.000			0.000		

Table (2). The participant's knowledge about the mode of transmission and the main symptoms of coronavirus.

Country	**COVID-19 mode of transmission droplet infection, hand to face from contaminated surfaces) No (%)**			**The main symptoms of COVID-19 are fever, fatigue, dry cough, muscle aches and shortness of breath with no blockage or runny nose and sneezing No (%)**			Total
	Agree	Neutral	Disagree	Agree	Neutral	Disagree	
Lebanon	887 (92)	72 (7)	9 (1)	168(17)	365(38)	435 (45)	968
Algeria	422 (88)	50 (10)	7 (2)	90 (19)	185(38.5)	204(42.5)	479
Sudan	451 (94)	24 (5)	4 (1)	119(25)	175(36.5)	185(38.5)	479
Egypt	417 (95.4)	19 (4.3)	1 (0.3)	82 (19)	190 (43)	165 (38)	437
Libya	356 (91)	31 (8)	5 (1)	59 (15)	112 (29)	221 (56)	392
Morocco	345 (92)	27 (7)	4 (1)	86 (22)	151 (39)	149 (39)	376
Tunisia	145 (99)	2 (1)	0	27 (18)	53 (36)	67(46)	147
Jordan	124 (93)	6 (4)	4 (3)	28 (21)	45 (33.5)	61 (45.5)	134
Chad	72 (77)	15 (16)	6 (7)	41 (44)	32 (34.5)	20 (21.5)	93
Total	3219 (92)	256 (7)	40 (1)	700(20)	1308 (37)	1507 (43)	3515
p-value	0.000			0.000			

Table (3). The participant's knowledge about the transmission of coronavirus from asymptomatic individuals and tolerance for patients recovered from coronavirus infection.

Country	**Asymptomatic patients cannot transmit the disease of COVID-19 No (%)**			**It is safe to contact COVID-19 recovered patients in the community without precautionary measures No (%)**			Total
	Agree	Neutral	Disagree	Agree	Neutral	Disagree	
Lebanon	75 (8)	98 (10)	795 (82)	222 (22.9)	241(24.9)	505 (52.2)	968
Algeria	41 (9)	57 (12)	381 (79)	74 (15.4)	131(27.3)	274 (57.2)	479
Sudan	31 (6)	33 (7)	415 (87)	118 (24.6)	109(22.8)	252 (52.6)	479
Egypt	15 (3.5)	37 (8.5)	385 (88)	111 (25.4)	113(25.9)	213 (48.7)	437
Libya	19 (5)	43 (11)	330 (84)	104 (26.5)	88 (22.4)	200 (51)	392
Morocco	31 (8)	38 (10)	317 (82)	86 (22.3)	92 (23.8)	208 (53.9)	386
Tunisia	18 (12)	13 (9)	116 (79)	34 (23.1)	31 (21.1)	82 (55.8)	147
Jordan	9 (7)	7 (5)	118 (88)	23 (17.2)	19 (14.2)	92 (68.7)	134
Chad	26 (28)	24 (26)	43 (46)	20 (21.5)	30 (32.3)	43 (46.2)	93
Total	265 (7.5)	350 (10)	2900(82.5)	792 (22.5)	854(24.3)	1869 (53.2)	3515
p-value		0.000			0.001		

Table (4). Perception of participants of some local beliefs.

	Do you think people living in hot and sunny areas are less susceptible and/or affected by COVID-19			Total
Country	Agree	Neutral	Disagree	
Lebanon	803(83)	98 (10)	67 (7)	968
Algeria	402 (84)	56 (12)	21 (4)	479
Sudan	405 (84.5)	33 (7)	41 (8.5)	479
Egypt	370 (85)	40 (9)	27 (6)	437
Libya	318 (81)	43 (11)	31 (8)	392
Morocco	333 (86)	41 (11)	12 (3)	386
Tunisia	125 (85)	16 (11)	6 (4)	147
Jordan	118 (88)	11 (8)	5 (4)	134
Chad	72 (77)	9 (10)	12 (13)	93
Total	2946 (84)	347 (10)	222 (6)	3515
p-value				0.000

Table (5). The participant's knowledge about the most vulnerable groups to COVID-19

Country	Who do you think of the following categories most likely to experience complications when infected by Covid-19? No (%)			Total
	Older people with chronic diseases	Pregnant women	Children	
Lebanon	959 (99.1)	190 (19.6)	107 (11.1)	968
Algeria	472 (98.5)	157 (32.8)	48 (10)	479
Sudan	456 (95.2)	137 (28.6)	70 (14.6)	479
Egypt	426 (97.5)	168 (38.4)	69 (15.8)	437
Libya	387 (98.7)	75 (19.1)	25 (6.4)	392
Morocco	382 (99)	133 (34.5)	61 (15.8)	386
Tunisia	143 (97.3)	42 (28.6)	8 (5.4)	147
Jordan	134 (100)	34 (25.4)	16 (11.9)	134
Chad	84 (90.3)	8 (8.6)	11 (11.8)	93
Total	3443 (98)	944 (26.9)	415 (11.8)	3515
p-value				0.000

Table (6). The participant's knowledge and practice of some preventive measures from COVID-19.

Country		Which of the following precautionary measures may you agree with?							Total
		A	B	C	D	E	F	G	
Lebanon	Agree	910 (94)	795 (82.1)	861 (88.9)	845 (87.3)	902 (93.2)	846 (87.4)	834 (86.2)	968
	Practice	903 (93.3)	630 (65.1)	307 (31.7)	838 (86.6)	640 (66.1)	825 (85.2)	772 (79.8)	
Algeria	Agree	433 (90.4)	387 (80.8)	416 (86.8)	437 (91.2)	451 (94.2)	426 (88.9)	410 (85.6)	479
	Practice	444 (92.7)	219 (45.7)	110 (23)	427 (89.1)	296 (61.8)	396 (82.7)	357 (74.5)	
Sudan	Agree	440 (92.1)	389 (81.4)	409 (85.6)	394 (82.4)	461 (96.5)	403 (84.3)	406 (84.9)	478
	Practice	436 (91)	236 (49.3)	92 (19.2)	374 (78.1)	163 (34)	320 (66.8)	302 (63)	
Egypt	Agree	411 (94.1)	365 (83.5)	376 (86)	395 (90.4)	393 (89.9)	373 (85.4)	399 (91.3)	437
	Practice	406 (92.9)	189 (43.2)	88 (20.1)	384 (87.9)	196 (44.9)	364 (83.3)	349 (79.9)	
Libya	Agree	357 (91.1)	309 (78.8)	345 (88)	333 (84.9)	376 (95.9)	344 (87.8)	323 (82.4)	392
	Practice	365 (93.1)	172 (43.9)	72 (18.4)	328 (83.7)	232 (59.2)	315 (80.4)	300 (76.5)	
Morocco	Agree	363 (94)	357 (92.5)	353 (91.5)	363 (94)	373 (96.6)	353 (91.5)	350 (90.7)	386
	Practice	356 (92.2)	232 (60.1)	65 (16.8)	362 (93.8)	163 (42.2)	357 (92.5)	306 (79.3)	
Tunisia	Agree	141 (95.9)	127 (86.4)	141 (95.9)	136 (92.5)	145 (98.6)	140 (95.2)	140 (95.2)	147
	Practice	145 (98.6)	76 (51.7)	20 (13.6)	136 (92.5)	104 (70.7)	143 (97.3)	123 (83.7)	
Jordan	Agree	127 (94.8)	116 (86.6)	120 (89.6)	118 (88.1)	119 (88.8)	122 (91)	117 (87.3)	134

	Practice	124 (92.5)	71 (53)	21 (15.7)	119 (88.8)	91 (67.9)	112 (83.6)	109 (81.3)	
Chad	Agree	80 (86)	68 (73.1)	59 (63.4)	59 (63.4)	74 (79.6)	56 (60.2)	55 (59.1)	93
	Practice	82 (88.2)	53 (57)	21 (22.6)	53 (57)	47 (50.5)	50 (53.8)	36 (38.7)	
Total	Agree	3262 (92.8)	2913 (82.9)	3080 (87.6)	3080 (87.6)	3294 (93.7)	3063 (87.2)	3034 (86.3)	3514
	Practice	3261 (92.8)	1878 (53.4)	796 (22.6)	3021 (85.9)	1932 (55)	2882 (82)	2654 (75.5)	
p-value									0.000

*Abbreviations:**A.** Washing hands with soap and water or a hand sanitizer containing at least 60% alcohol for a minimum period of at least 40 seconds, after being in a public place. **B.** Wearing of masks for infected persons or those taking care of symptomatic or infected patients, or those who were in crowded areas. **C.** Isolating infected people and their contacts for two weeks. **D.** Avoiding going out to crowded places like markets and places of worship, etc.**E.** Children and young people must follow the same preventive measures for protection from infection. **F.** Avoiding handshaking, hugging, and kissing as a way of greeting and using an alternative approach such as welcoming from a distance and elbow bump. **G.** Sterilizing surfaces that are subjected to touch on a daily basis, for example, tables, door handles, light switches, holders, keyboards, cell phones, desktops, bathroom surfaces, and sinks.*

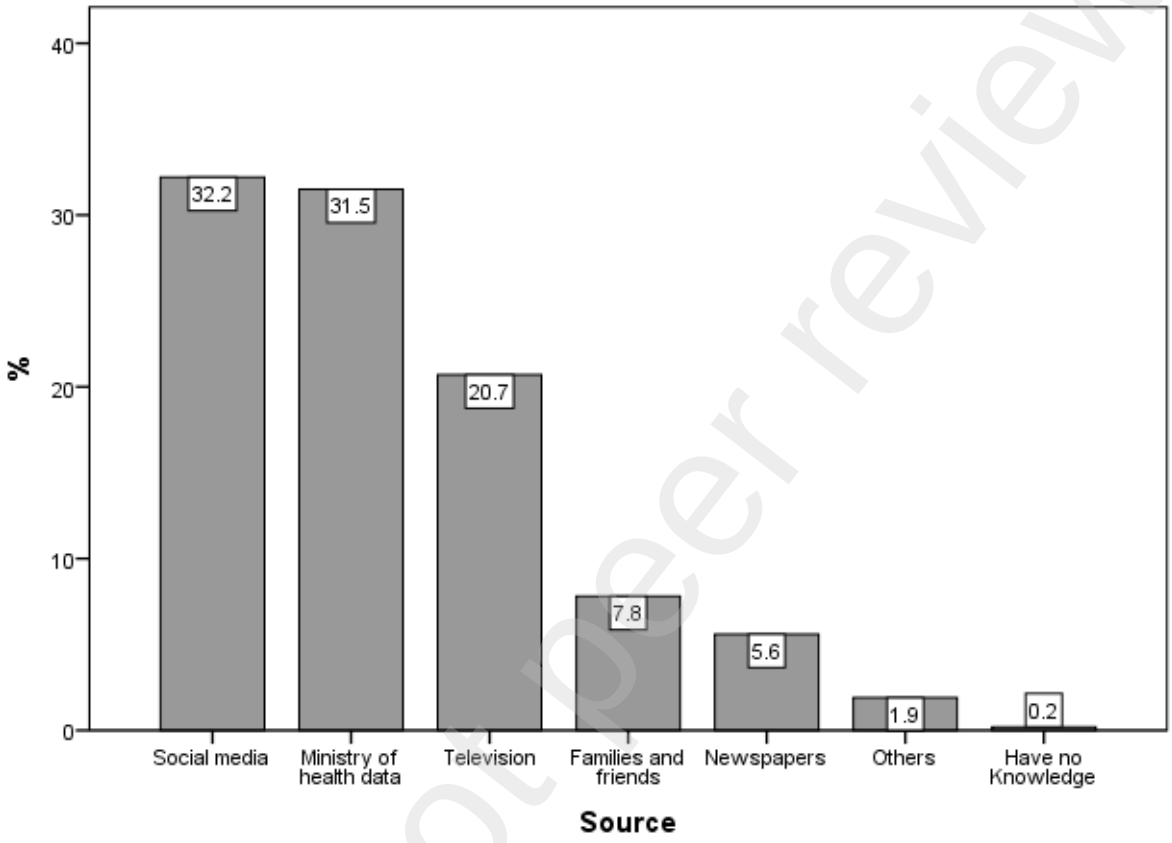

Figure (1). The main source of participant's knowledge about COVID-19

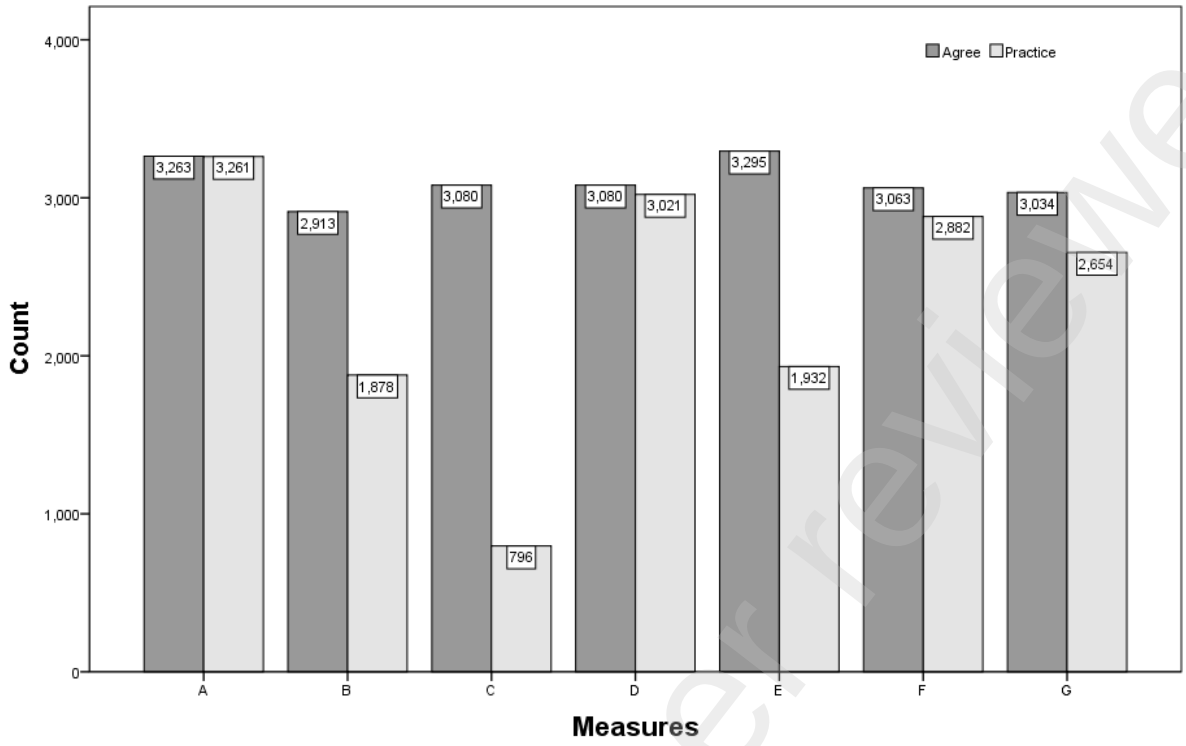

Figure 2.Comparison between participant's knowledge and practice of some preventive measures from coronavirus infection.

*Abbreviations: **A**. Washing hands with soap and water or by hand, sanitizer contains at least 60% alcohol for a minimum period of at least 40 seconds, after being in a public place. **B**. Wearing of masks for infected persons or those taking care of symptomatic or infected patients, or those who were in crowded areas. **C**. Isolating infected people and people who contact them for two weeks is an effective way to limit the spreading of the virus. **D**. Avoiding going out to crowded places like markets and places of worship, etc. **E**. Children and young people must follow the preventive measures for protection from infection. **F**. Avoiding handshaking, hugging, and kissing as a way of greetings and using an alternative approach such as welcoming from a distance and gestures using the elbow. **G**. Sterilizing surfaces that are subjected to touch daily, for example, tables, door handles, lighting switches, holders, keyboards, mobiles, desktops, bathrooms, and sinks.*

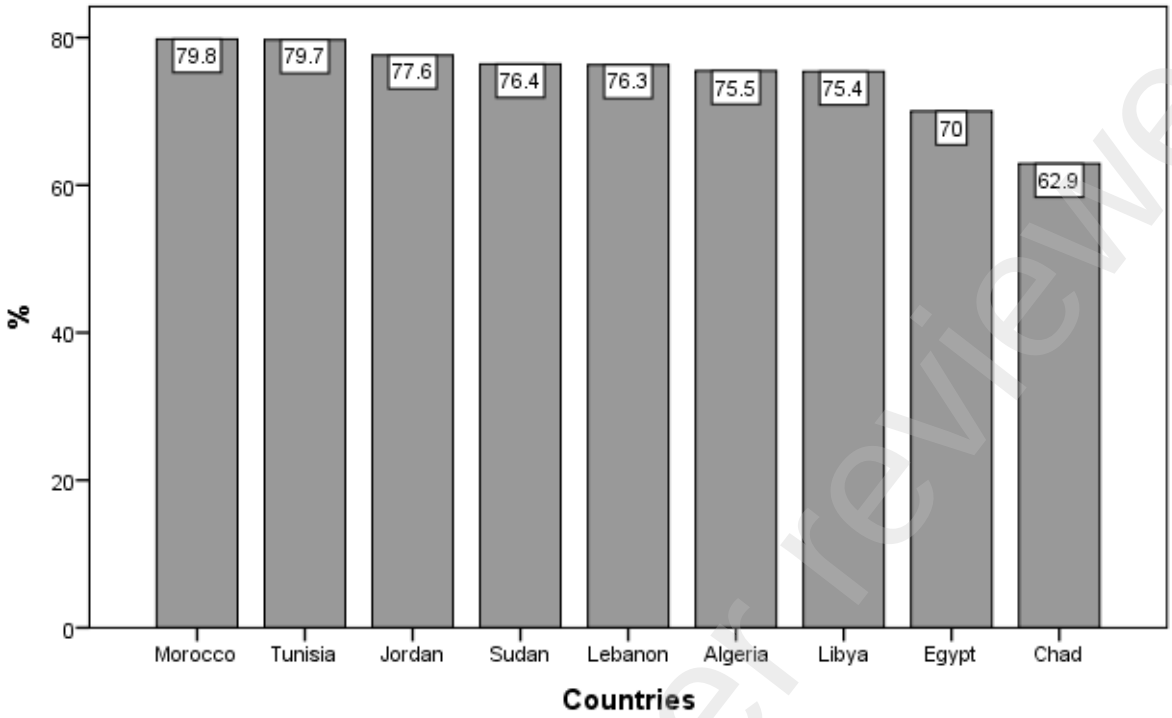

Figure 3. The overall knowledge among participating countries

Discussion

Ever since the first appearance of the COVID-19 in China in late 2019 and up to this date (18 July 2020), the number of reported cases worldwide has exceeded 14 million [3],with the disease proving to be difficult to control. Although most countries took strict measures to reduce the spread of the virus, the number of new cases remains high. However, it seems that at least in some countries, compliance was not always guaranteed for a variety of reasons, including a general sense of safety/immunity from infection, which could reflect a lack of proper awareness[25]. This observation drove the design of the current study to evaluate the awareness of the general public of key transmission routes of coronavirus and the main preventive measures to limit its spread. Moreover, we

evaluated how this awareness would be reflected in the practice of the precautionary measures; since failure to follow the recommended preventive measures has a significant impact on increasing the number of cases[26].

The survey of the sources where participants got information about COVID-19 in the current study revealed that social media were the main sources (32.2%), similar findings were previously reported in Jordan [27], and Egypt [28], while in Italy [29] TV was the main source of knowledge.

A specific concern in this open-source of information is the spread of "infodemic" a term that has been widely used because of the misinformation that can spread on social media and other platforms that may be associated with non-preventive behaviors by the society members. Besides its role in monitoring the rapid spread of novel coronavirus disease (COVID-19), WHO is also using its "myth busters" page to fight the pandemic of misinformation that represents a serious problem for the public health sector and delays the delivery of correct information[21,30].

It is generally believed in many African and Arab countries that SARS-CoV-2 cannot survive well in a warm climate [31]. The majority of participants in this study (84%) believed that people living in hot and sunny areas are less susceptible and less affected by COVID-19. This belief is supported by Wang et al. [32], who reported that SARS-CoV-2 survived longer in cold countries than warm ones. In contrast, a Chinese study demonstrated that continuous cold weather might result in the elimination of the virus rather than its spread and that the warm, humid weather presents the optimal environment for the virus spread (Bu *et al,* 2020). However, one of the reasons for the smaller number of reported cases in African countries could be the average young age of most of their

populations compared to Europe and the USA (Rosenthal *et al*, 2020). Another reason could be under-testing as a result of limited lab testing capacity in many of the participating countries.

Although people were suitably aware of the transmission routes of the virus, more than half of the participants (53.2%) would not interact with recovered patients in the community without protective measures. This could be due to fear of contracting the infection [33], and a lack of adequate knowledge of virus transmission [34]. The lack of acceptance varied with age, gender, marital status, and profession. Older people, males, married participants, and those in the medical field were more accepting of recovered patients. Still, a large part of medical professionals (52.3%) were not accepting to interact with recovered patients, which could be explained by their awareness of the literature which described 50% of the recovered patients as potentially infectious after initial recovery, necessitating that they are treated as asymptomatic patients [33](WHO, 2020). This discrimination could prompt possible social isolation of groups that could increase disease spreading [35].The social refusal of previously infected individuals may set the alarm for further and more rigorous analysis to assess the extent of this expressed intent to discriminate against recovered people.

In this survey, 74.8% of participants were relatively aware of the precautionary measures against coronavirus (figure 3). The highest knowledge percent was scored by participants from Morocco and Tunisia (79.8% and 79.7 % respectively), while Egypt and Chad with lower scores (70.7, and 62.9, respectively). The education level might play an essential role in increasing knowledge percent in Morocco and Tunisia, in which about two-thirds of participants were postgraduate. Moreover, there was a significant association between

the participant's countries and the educational level, medical vs. non-medical profession, and source of knowledge with ($P < 0.05$). These findings were supported by previous studies carried out in Wuhan, Egypt, and Nigeria [36-40].

Knowledge is closely related to and influencing the correct attitudes and practices[41,42]. In our study, it was reported that some practices are not aligned with knowledge among many participants who were able to recognize the preventive measures but not practicing it, this may be because of the social discouragement, personal beliefs, misinformation, financial limitations, and powerlessness of the authorities to implement strict measures including total lock-down, not allowing gatherings, physical distancing, and compulsory use of face mask while leaving the house.

The possible explanation for the unresponsiveness of communities is the low percentage of infected individuals at the time of data collection (0.0009% to 0.15%). A fewer number of COVID-19 positive cases may lead to a false sense of safety among the communities in which the virus is not highly spreading. As similarly reported in a study conducted among residents in non-Hubei districts of China [39] in which a significantly higher risk of not practicing knowledge like wearing a face mask when leaving homes in some regions of China was attributed to the less serious situation of the COVID-19 pandemic. Another study carried out in Nigeria supported this hypothesis, suggesting that due to the fewer numbers of COVID-19 positive cases within north-central Nigeria, citizens were convinced that they were at lower risk of getting COVID-19 [38].The practicing of these precautionary measures was higher in some countries, such as Tunisian and Lebanese (73% in both), whereas in Sudan (58%) and Chad (52%), they were low. A possible explanation for this observation is that during data collection, the

number of cases in Tunisia (in range of 780-1035) and Lebanon (in range of 658-891) are higher than Sudan (32-442) and Chad (23-428). Also, participants from countries (such as Chad and Sudan) with low compliance/adherence rate is related to most of the citizens are young with day jobs that require daily work [38].

Interestingly, in our study, the wearing of face masks raised a mixed response. Almost half of the participants did not wear a face mask when leaving their homes, a finding that has been reported by another study in Malaysia [24]with similar outcomes and the suggested reasons were that the age and financial limitations or due to the global shortage of personal protective equipment were the key factors. While Chinese (98.0%)[39], American(95%) [43] people showed a high commitment to wore masks when going out.

Moreover, the practice of some other preventive practices didn't always matchthe knowledge level in our study like isolating infected individuals and their contacts for at least two weeks, applying preventive measures among children and young adults, as well as applying appropriate disinfectants and sterilizing exposed surfaces. It was suggested in previous studies that men and adolescents are more likely to engage in risk-taking behaviors[38,39]. In contrast to these previous findings, in Malaysia Azlan et al. [24]reported that people above the age of 50 might attempt behavior that exposes them to the pandemic, for example, in our participating countries, people would attempt to continue religious rituals and social gathering because of the cultural norms in such communities. These findings support the importance of the involvement of religious and social leaders to correct the misunderstanding of COVID-19 among their followers.

These findings require urgent attention by the governments and scholars toward investigating the knowledge gaps and possibilities of misconceptions among

underprivileged individuals, illiterates, and other community members using customized analysis and further studies with open-ended questions, in-depth interviews, or focus group discussion for sufficient evaluation of attitudes and practices of the population towards COVID-19.

Limitations of this study

The study targeted people who use social media, which implies a level of education and introduces an element of bias, as the survey didn't include a great proportion of the population, which is technology illiterate. Furthermore, due to the lack of internet access and low distribution of questionnaire responses, rates from some countries were low.

Conclusion

Our findings indicate that participants from the Middle Eastern and North African countries have relatively good knowledge and attitudes regarding COVID-19 but unsatisfactory preventive practices. We recommend immediate awareness programs targeting the public in the participating countries to promote knowledge and safe practice of basic public health measures in times of outbreaks.

Availability of data and materials

The dataset supporting the conclusions of this article is included as additional files.

Declaration of interest

All the authors have no conflict of interest to declare.

Authors' contribution

HNA, MAI designed the study, all authors contributed to data collection and questionnaire design. KRKG analyzed the data, and participated in drafting the paper. AAE, HNA, MAI, MME, ZO, and MBF contributed to manuscript writing and revised the questionnaire and manuscript. AAE critically reviewed preliminary results and commented on the manuscript. FSD, HNA, RG contributed to the introduction and discussion writing. ZO critically reviewed the manuscript. WAL revised the survey and provided direction on planning and drafting as the senior researcher.

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Supplementary files

Table S1. Age groups of respondents by country

Country	Age groups in years No (%)					Total
	18-29	30-39	40-49	50-59	60+	
Lebanon	642 (66.3)	144 (14.9)	111 (11.5)	51 (5.3)	20 (2.1)	968
Algeria	212 (44.3)	205 (42.8)	41 (8.6)	15 (3.1)	6 (1.3)	479
Sudan	144 (30.1)	180 (37.6)	104 (21.7)	38 (7.9)	13 (2.7)	479
Egypt	294 (67.3)	64 (14.6)	52 (11.9)	17 (3.9)	10 (2.3)	437
Libya	157 (40.1)	122 (31.1)	67 (17.1)	34 (8.7)	12 (3.1)	392
Morocco	164 (42.5)	113 (29.3)	65 (16.8)	31 (8)	13 (3.4)	386
Tunisia	36 (24.5)	57 (38.8)	46 (31.3)	6 (4.1)	2 (1.4)	147
Jordan	66 (49.3)	13 (9.7)	35 (26.1)	19 (14.2)	1 (0.7)	134
Chad	40 (43)	36 (38.7)	14 (15.1)	0	3 (3.2)	93
Total	1755 (49.9)	934 (26.6)	535 (15.2)	211(6)	80 (2.3)	3515 (100)

Table S2. The gender and marital status of respondents by country

Country	Gender No (%)			Marital status No (%)				Total
	Female	Male	Preferred not to say	Single	Married	Divorced	Widower	
Lebanon	(62.9) 609	351 (36.3)	8 (0.8)	619 (63.9)	332 (34.3)	9 (0.9)	8 (0.80)	968
Algeria	241 (50.3)	231 (48.2)	7 (1.5)	255 (53.2)	213 (44.5)	11 (2.3)	0	479
Sudan	277 (57.8)	196 (40.9)	6 (1.3)	168 (35.1)	288 (60.1)	18 (3.8)	5 (1)	479
Egypt	331 (75.7)	101 (23.1)	5 (1.1)	300 (68.6)	124 (28.4)	8 (1.8)	5 (1.1)	437
Libya	187 (47.7)	199 (50.8)	6 (1.5)	195 (49.7)	187 (47.7)	5 (1.3)	5 (1.3)	392
Morocco	181 (46.9)	200 (51.8)	5 (1.3)	198 (51.3)	171 (44.3)	16 (4.1)	1 (0.3)	386
Tunisia	106 (72.1)	39 (26.5)	2 (1.4)	46 (31.3)	99 (67.3)	2 (1.4)	0	147
Jordan	94 (70.1)	40 (29.9)	0	64 (47.8)	66 (49.3)	2 (1.5)	2 (1.5)	134
Chad	18 (19.4)	75 (80.6)	0	42 (45.2)	47 (50.5)	3 (3.2)	1 (1.1)	93
Total	2044 (58.2)	1432 (40.7)	39 (1.1)	1887 (53.7)	1527 (43.4)	74 (2.1)	27 (0.8)	3515

Table S3. The main sources of knowledge about COVID-19 No (%)

Country	The main sources of knowledge about COVID-19 No (%)							Total
	Ministry of health data	Social media	Television	Newspapers	Families and friends	Have no Knowledge	Others	
Lebanon	593 (28.3)	684 (32.7)	460 (22)	111 (5.3)	213 (10.2)	6 (0.3)	26 (1.2)	2093
Algeria	319 (30.5)	365 (34.9)	219 (21)	55 (5.3)	83 (7.9)	4 (0.4)	0	1045
Sudan	310 (33.2)	286 (30.6)	181 (19.4)	42 (4.5)	65 (7)	2 (0.2)	49 (5.2)	935
Egypt	274 (32.7)	275 (32.8)	138 (16.5)	40 (4.8)	57 (6.8)	0	54 (6.4)	838
Libya	237 (30.5)	276 (35.5)	168 (21.6)	40 (5.1)	54 (6.9)	0	3 (0.4)	778
Morocco	315 (34.2)	259 (28.1)	194 (21)	83 (9)	62 (6.7)	1 (0.1)	8 (0.9)	922
Tunisia	121 (37.1)	104 (31.9)	69 (21.2)	12 (3.7)	20 (6.1)	0	0	326
Jordan	93 (37.8)	77 (31.3)	58 (23.6)	8 (3.3)	10 (4.1)	0	0	246
Chad	52 (32.3)	41 (25.5)	36 (22.4)	17 (10.6)	11 (6.8)	4 (2.5)	0	161
Total	2314 (31.5)	2367 (32.2)	1523 (20.7)	408 (5.6)	575 (7.8)	17 (0.2)	140 (1.9)	7344
p-value								0.000

Table S4. Association between the demographic data and participants practice of some preventive measures from COVID-19No (%).

Age groups (*p*-value=0.591)	A	B	C	D	E	F	G
18-29 (N=1755)	1596 (91)	880 (50)	430 (25)	1502 (86)	955 (54)	1391 (79)	1299 (74)
30-39 (N=934)	880 (93)	515 (55)	199 (21)	806 (86)	496 (53)	771 (83)	699 (75)
40-49 (N=535)	509 (95)	301 (56)	102 (19)	461 (86)	313 (58)	464 (87)	428 (80)
50-59 (N=211)	199 (94)	133 (63)	42 (20)	184 (87)	130 (62)	189 (90)	163 (77)
60+ (N=80)	77 (96)	49 (61)	23 (29)	68 (85)	38 (48)	67 (84)	65 (81)
Total (N=3515)	3261 (93)	1878 (53)	796 (23)	3021 (86)	1932 (55)	2882 (82)	2654 (76)
Female (N=2044)	1898 (93)	1022 (50)	435 (21)	1805 (88)	1155 (57)	1696 (83)	1641 (80)
Male (N=1432)	1329 (93)	839 (59)	348 (24)	1181 (82)	759 (53)	1156 (81)	983 (69)
Preferred not to say (N=39)	34 (87)	17 (44)	13 (33)	35 (90)	18 (46)	30 (77)	30 (77)
Total (N=3515)	3261 (93)	1878 (53)	796 (23)	3021 (86)	1932 (55)	2882 (82)	2654 (76)
Single (N=1887)	1719 (91)	975 (52)	462 (25)	1616 (86)	1005 (53)	1519 (81)	1391 (74)
Married (N=1527)	1449 (95)	849 (56)	311 (20)	1319 (86)	880 (58)	1282 (84)	1186 (78)
Divorced (N=74)	69 (93)	40 (54)	18 (24)	63 (85)	33 (45)	61 (82)	57 (77)
Widower (N=27)	24 (89)	14 (52)	5 (19)	23 (85)	14 (52)	20 (74)	20 (74)
Total (N=3515)	3261 (93)	1878 (53)	796 (23)	3021 (86)	1932 (55)	2882 (82)	2654 (76)
Undergraduate (N=462)	403 (87)	209 (45)	90 (20)	381 (83)	251 (76)	354 (77)	327 (71)
Graduate (N=1722)	1603 (93)	908 (53)	411 (24)	1485 (86)	962 (56)	1404 (82)	1289 (75)
Postgraduate (N=1331)	1255 (94)	761 (57)	295 (22)	1155 (87)	719 (54)	1124 (84)	1038 (78)
Total (N=3515)	3261 (93)	1878 (53)	796 (23)	3021 (86)	1932 (55)	2882 (82)	2654 (76)
Non-medical (N=2955)	2729 (92)	1516 (51)	666 (23)	2548 (86)	1630 (55)	2426 (82)	2219 (75)
Medical (N=560)	532	362	130	473	302	456	435

	(95)	(65)	(23)	(84)	(54)	(81)	(78)
Total (N=3515)	3261 (93)	1878 (53)	796 (23)	3021 (86)	1932 (55)	2882 (82)	2654 (76)

*Abbreviations: **A**. Washing hands with soap and water or by hand, sanitizer contains at least 60% alcohol for a minimum period of at least 40 seconds, after being in a public place. **B.** Wearing of masks for infected persons or those taking care of symptomatic or infected patients, or those who were in crowded areas. **C.** Isolating infected people and people who contact them for two weeks is an effective way to limit the spreading of the virus. **D.** Avoiding going out to crowded places like markets and places of worship, etc. **E.** Children and young people must follow the preventive measures for protection from infection. **F.** Avoiding handshaking, hugging, and kissing as a way of greetings and using an alternative approach such as welcoming from a distance and gestures using the elbow. **G.** Sterilizing surfaces that are subjected to touch daily, for example, tables, door handles, lighting switches, holders, keyboards, mobiles, desktops, bathrooms, and sinks.*

Table S5. Association between demographic data and participant's tolerance of recovered patients

Age groups (*p*-value=0.00)	Agree	Neutral	Disagree
18-29 (N=1755)	333 (19)	444 (25.3)	978 (55.7)
30-39 (N=934)	239 (25.6)	223 (23.9)	472 (50.5)
40-49 (N=535)	140 (26.2)	136 (25.4)	259 (48.4)
50-59 (N=211)	57 (27)	37 (17.5)	117 (55.5)
60+ (N=80)	23 (28.8)	14 (17.5)	43 (53.8)
Total (N=3515)	792 (22.5)	854 (24.3)	1869 (53.2)
Female (N=2044)	437 (21.4)	477 (23.3)	1130 (55.3)
Male (N=1432)	349 (24.4)	363 (25.3)	720 (50.3)
Preferred not to say (N=39)	6 (15.4)	14 (35.9)	19 (48.7)
Total (N=3515)	792 (22.5)	854 (24.3)	1869 (53.2)
Single (N=1887)	366 (19.4)	480 (25.4)	1041 (55.2)
Married (N=1527)	393 (25.7)	353 (23.1)	781 (51.1)

Divorced (N=74)	24 (32.4)	18 (24.3)	32 (43.2)
Widows (N=27)	9 (33.3)	3 (11.1)	15 (55.6)
Total (N=3515)	792 (22.5)	854 (24.3)	1869 (53.2)
Undergraduate (N=462)	118 (25.5)	117 (25.3)	227 (49.1)
Graduate (N=1722)	377 (21.9)	442 (25.7)	903 (52.4)
Postgraduate (N=1331)	297 (22.3)	295 (22.2)	739 (55.5)
Total (N=3515)	792 (22.5)	854 (24.3)	1869 (53.2)
Non-medical (N=2955)	639 (21.6)	740 (25)	1576 (53.3)
Medical (N=560)	153 (27.3)	114 (20.4)	293 (52.3)
Total (N=3515)	792 (22.5)	854 (24.3)	1869 (53.2)

Table S6. The trend of COVID-19 cases among participating countries[44]

Country	Feb 15	Feb 29	Mar 15	Mar 30	Apr 15	Apr 30	May 15	May 30	Jun 15	Jun 30	Jul 15	Jul 30	Aug 6	Tot case
Lebanon	0	7	110	446	658	725	891	1191	1464	1778	2542	4334	5672	567
Algeria	0	1	54	584	2160	4006	6629	9267	11031	13907	20770	29831	33626	336 6
Sudan	0	0	1	6	32	442	1964	4800	7435	9257	10527	11496	11780	117 0
Egypt	1	1	126	656	2505	5537	11228	23449	46289	68311	84843	93757	95006	950 6
Libya	0	0	0	8	48	61	64	130	467	824	1589	3438	4879	487
Morocco	0	0	28	556	2024	4423	6652	7780	8885	12533	16262	23259	29644	296 4
Tunisia	0	0	20	362	780	994	1035	1076	1110	1174	1319	1319	1642	164
Jordan	0	0	12	268	401	453	596	734	979	1132	1201	1191	1232	123
Chad	0	0	0	5	23	73	428	759	850	866	885	935	942	942

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