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Determinants of COVID-19 vaccine acceptance in the Arab world: a cross-sectional study

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Abstract

Background: The Arab region is highly affected by the COVID-19 pandemic. Local governments have already started to act against the disease. However, only a few countries provided COVID-19 vaccination. Compliance with vaccination is a major topic affecting proper coverage. Thus, we aim to explore vaccine acceptance among Arab populations, and compare it with the global numbers.

Methods: An internet-based survey using social media platforms was conducted, targeting adults who were able to read and understand Arabic, had access to the internet, and from all 22 Arab league countries. Due to the response rate variation between participants, the countries were grouped into four categories based on their income: Low income, Lower-middle income, Upper-middle income, and High-income economies. Data about demographics, previous COVID-19 infection, and vaccine acceptance tendency were collected and analyzed using Chi-squared (χ2) test and Logistic regression.

Results: A total of 870 participants completed the survey. 59.3% of the participants were male, 53.3% were between 25 and 44 years, and 69.9% were Arabs who live inside of their home country. The COVID-19 vaccine acceptance rate was 62.4%. A significant higher tendency toward vaccination was identified in males (65.4%, $P = 0.04$) and people living outside their home countries (67.9%, $P = 0.02$). However, age group, level of education, and previous COVID-19 infection were all factors with insignificant effect. Citizens of High-income countries were more likely to accept the vaccine (70.2%).

Conclusions: Less than two-thirds of Arabs are compliant with COVID-19 vaccination. This proportion is relatively lower than the global rate. It is important to develop strategies to promote vaccine acceptance and reach the ideal coverage needed to achieve efficient immunization.

Keywords: COVID-19, Vaccination, Vaccine hesitancy, Arab world

Background

Over the past decade, Arabian countries have witnessed two coronavirus related outbreaks. Following MERS-CoV-2 [1], the Novel SARS-CoV-2 (COVID-19) infection which first reported in Wuhan, China [2] has spread extensively reaching the Middle East. The earliest reports indicated the first two confirmed cases in the region were in Bahrain and United Arab Emirates (UAE) [3, 4]. In nearly 1 month, all Arab countries reported having at least one case. This includes countries that suffer from conflicts like Syria and Yemen [5]. Initially, trends of transmission and incidence were relatively low [6], nevertheless, this was attributed to lower sensitivity in detecting such newly emerging infection which resulted in a false reflection of the situation [5]. There are 4,259,756 of total confirmed COVID-19 cases and

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72,950 reported deaths related to COVID-19 as of the beginning of March, 2021 [7].

Although most governments responded to the pandemic and implemented measures of protection and early warning, healthcare systems in some countries lack the proper up to date training to detect and manage the overwhelming burden of the disease [5]. The United Nations Economic and Social Commission for Western Asia (ESCWA) estimated that a loss of $42 billion could affect the Arab region due to the COVID-19, with 1.7 million job losses [5].

As of January 25, 2021, there are over 98 million cases of COVID-19 confirmed worldwide with over 2 million deaths [8]. There are 82 vaccines in development and among them 20 in Phase III [9]. Many Arab countries have started vaccinating against COVID-19, including UAE, Saudi Arabia, Bahrain, Egypt, and Jordan [10–14]. In addition, the World Health Organization (WHO) issued an emergency use for the Pfizer/BioNTech vaccine and added it to the WHO's Emergency Use Listing (EUL) [15].

However, according to the World Health Organization (WHO), vaccine hesitancy still presents one of the top ten challenges facing the health systems around the world [16]. The World Health Organization Strategic Advisory Group of Experts (SAGE) defines vaccine hesitancy as "*delay in acceptance or refusal of vaccination despite availability of vaccination services. Vaccine hesitancy is complex and context specific, varying across time, place and vaccines. It is influenced by factors such as complacency, convenience and confidence.*" [17]. It can be related to personal beliefs, motivation, knowledge, and awareness [18]. In addition, communications between healthcare providers and vaccine recipients are critical in making a vaccination shared decision [19]. Multiple studies suggested the need to promote new policies and engage in more programs to increase vaccine acceptance [20–22]. The aim of this study is to assess and understand the COVID-19 vaccine acceptance in the Arab world, and to compare these findings with other countries.

Methods
Study design
This cross-sectional study was done using an anonymous internet-based questionnaire from December 26, 2020 to January 14, 2021. Recruitment was performed using targeted advertising on social media platforms (Facebook, Instagram, and Twitter). Data were collected, using Google Forms (Google, Mountain View, CA). The questionnaire distribution was based on two different sampling process: convenience and snowball sampling. Eligible participants were 18 years of age or older, from Arab League Countries, able to read and understand Arabic, and had access to the internet.

COVID-19 vaccine acceptance was assessed using established questionnaires [23–25]; however, it was modified to keep it short, concise, and easy to understand. The final questionnaire comprised two sections with a total of 9 items. The first section consists of general demographics questions, including: sex, age, education, nationality, and place of residence. Whereas the second section comprised questions related to COVID-19, such as previous exposure, family member death due to SARS-CoV-2, willingness to get a COVID-19 vaccine if available for free, and hesitancy related to the source of the vaccine.

There are 22 counties in the Arab world as defined by the World Bank [26]. These countries share common characteristics including culture, language, and religion. Due to the response rate variation between countries, the countries were grouped into four categories based on their income: Low income (Syria, Sudan, Yemen, Somalia), Lower-middle income (Algeria, Djibouti, Egypt, Morocco, Tunisia, West Bank and Gaza, Mauritania, Comoros), Upper-middle income (Iraq, Jordan, Lebanon, Libya), and High-income economies (Bahrain, Oman, Qatar, Saudi Arabia, United Arab Emirates, Kuwait) [27, 28].

Statistical analysis
Statistical analysis was performed using Stata version 16 (StataCorp, College Station, TX: StataCorp LLC). Statistical significance was considered for a two-tailed $p < 0.05$. Frequencies and percentages were calculated for the sample demographic characteristics and COVID-19 vaccine acceptance. Chi-squared (χ^2) test was used to analyze associations between accepting the vaccine and participants characteristics. Logistic regression was used to assess the odds ratios and their 95% confidence intervals of demographic factors and COVID-19 vaccine acceptance.

Results
Response rate variation between countries
Our sample comprised 870 participants from 17 countries. Response rate varied between countries; Syria 267 (30.7%), Egypt 118 (13.6%), Lebanon 107 (12.3%), Algeria 83 (9.5%), Libya 75 (8.6%), Saudi Arabia (KSA) 43 (4.9%), Iraq 39 (4.5%), Morocco 39 (4.5%), Tunisia 28 (3.2%), Kuwait 21 (2.4%), West Bank and Gaza 21 (2.4%), Yemen 21 (2.4%), Jordan 10 (1.1%), Sudan 6 (0.7%), Bahrain 2 (0.2%), Mauritania 2 (0.2%), UAE 1 (0.1%).

Sample characteristics
Of 870 participants, 471 were males (54.1%). Age groups varied in distribution; most of the sample 464 (53.3%)

Table 1 Sociodemographic and Other Characteristics of the Study Population (N = 870)

Sociodemographic Characteristics		N (%)
Gender	Male	471 (54.1)
	Female	399 (45.9)
Age	18–24	119 (13.7)
	25–44	464 (53.3)
	45–64	248 (28.5)
	> 65	39 (4.5)
Education	Graduate school	200 (23.0)
	College	472 (54.3)
	High school	142 (16.3)
	No high school	56 (6.4)
Place of Residence	Inside home country	608 (69.9)
	Outside home country	262 (30.1)
Previous COVID-19 infection	Yes	170 (19.5)
	No	700 (80.5)
Family death due to COVID-19	Yes	232 (26.7)
	No	638 (73.3)
COVID-19 Vaccine Acceptance	Yes	543 (62.4)
	No	327 (37.6)

were between 25 and 44 years, whereas 248 (28.5%) were among 45–64 age group, and 119 (13.7%) were 18–24 years old. Only 9 individuals (3.6%) were over 65 years (Table 1). Additionally, most individuals were college degree holders 472 (54.3%), followed by 200 (23%) graduate school degree holders, 142 (16.3%) high school degree holders, and 56 (6.4%) with no high school degree. Almost one third of the sample 262 (30.1%) were Arabs who live outside of their home country.
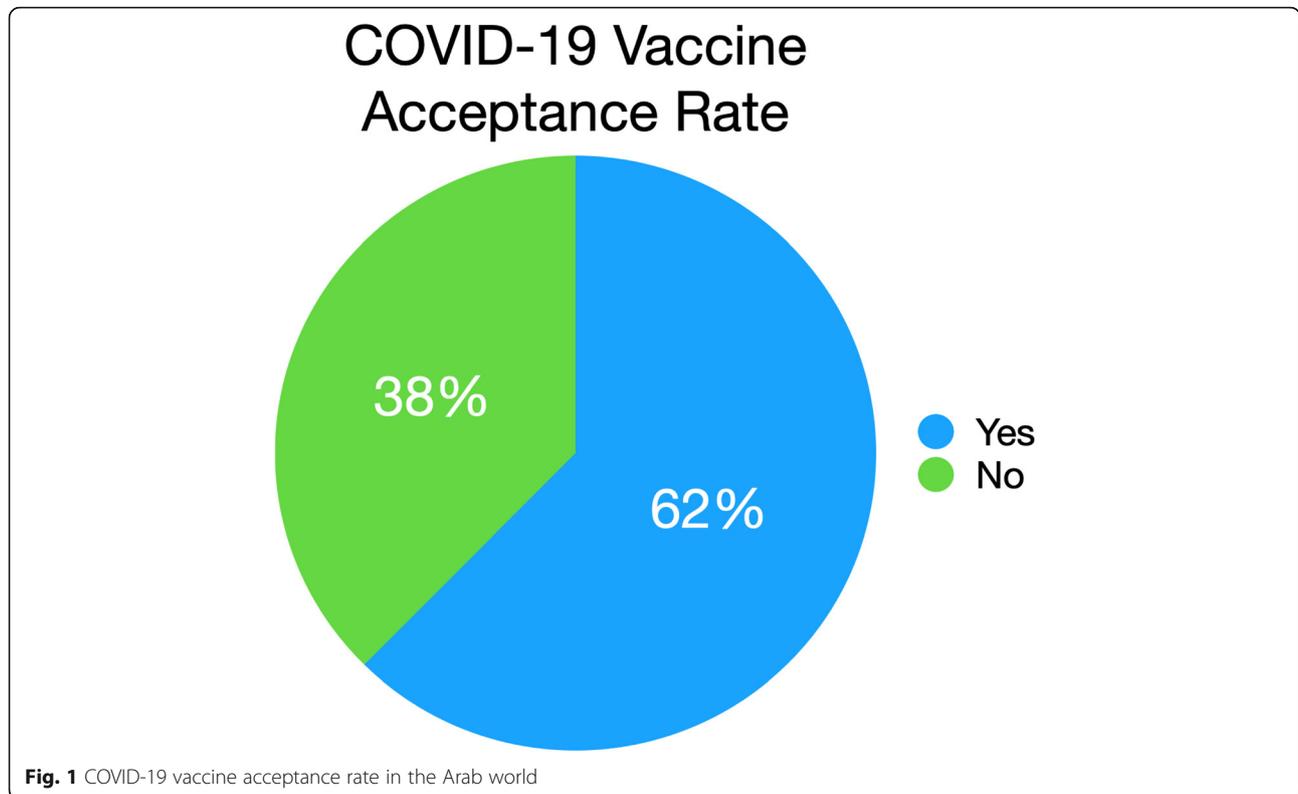
Main findings

During our study period, 170 (19.5%) individuals indicated that they were infected with COVID-19 before, and few more 232 (26.7%) had lost a relative or family member because of COVID-19. 543 (62.4%) of the participants would accept COVID-19 vaccine if it became available free of charge (Fig. 1). More males (65.4%) than female (58.9%) would accept getting the vaccine ($P <$ 0.04) (Table 2).

The highest accepting rate is among 45–64 age group (64.1%), followed by (62.3%) and (60.5%) among 25–44 and 18–24 groups respectively ($P <$ 0.87). In addition, participants with no high school found to have higher acceptance rate compared to graduate school or High school

Table 2 Bivariate Associations Between Respondents Characteristics and COVID-19 Vaccine Acceptance (N = 870)

Variables	COVID-19 Vaccine Acceptance n (%)		
	Yes	No	*p*-value
Gender			
Male	308 (65.4)	163 (34.6)	0.04
Female	235 (58.9)	164 (41.1)	
Age			
18–24	72 (60.5)	47 (39.5)	0.87
25–44	289 (62.3)	175 (37.7)	
45–64	159 (64.1)	89 (35.9)	
> 65	23 (59.0)	16 (41.0)	
Education			
No High school	36 (64.3)	20 (35.7)	0.13
High school	86 (60.6)	56 (39.4)	
College	297 (62.9)	175 (37.1)	
Graduate school	124 (62.0)	76 (38.0)	
Place of Residence			
Inside home country	365 (60.0)	243 (40.0)	0.02
Outside home country	178 (67.9)	84 (32.1)	
Previous COVID-19 infection			
No	445 (63.6)	255 (36.4)	0.15
Yes	98 (57.6)	72 (42.4)	
Family death due to COVID-19			
No	387 (60.7)	251 (39.3)	0.07
Yes	156 (67.2)	76 (32.8)	

Fig. 1 COVID-19 vaccine acceptance rate in the Arab world

degree holders; (64.3% vs. 62.0% or 60.6% respectively) ($P < 0.13$). However, none of the last to two relationships were statistically significant. In terms of infection history, those who had no previous COVID-19 infection history had higher COVID-19 acceptance rate than those with no infection history (63.6% vs. 57.6%), however this relationship was not statistically significant ($p < 0.15$). Furthermore, no association was found between countries' incomes and their acceptance of COVID-19 vaccine ($p = 0.12$). However, a higher rate of acceptance was noted (Table 3) in countries with upper-middle income and high-income (65.4 and 70.2%, respectively).

Binary logistic regression analysis was performed (Table 4) to predict COVID-19 vaccine acceptance among Arab countries. It was noted, in our multivariate model, that females were less likely to accept the vaccine

(OR: 0.76; 95% CI: 0.57–0.99; $p = 0.04$) than males. Additionally, individuals who reside outside of their home countries found 1.41 (95% CI: 1.03–1.91; $p = 0.02$) times likely to accept COVID-19 vaccine compared with those who reside in their home countries.

Discussion

The overall COVID-19 vaccine acceptance rate among Arabs who participated in this survey is 62.4%. However, this rate varied between countries' category groups. There was a wide range of acceptance rate among participants; those who live in High-Income countries had the highest acceptance rate (70.2%), whereas those who live in Lower-Middle Income countries had the lowest acceptance rate (57.4%). This rate variation was also reported in other countries [29].

Table 3 Bivariate Associations Between Respondents Characteristics and COVID-19 Vaccine Acceptance ($N = 870$)

Variables	COVID-19 Vaccine Acceptance n (%)		
	Yes	**No**	***p*-value**
Country Groups			
Low-Income	178 (63.3)	103 (36.6)	0.12
Lower-Middle Income	167 (57.4)	124 (42.6)	
Upper-Middle Income	151 (65.4)	80 (34.6)	
High-Income	47 (70.2)	20 (29.8)	

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Table 4 Binary Logistic Regression for COVID-19 Vaccine Acceptance by Respondents Characteristics. ($N = 870$)

Variables	OR	SE	95% CI	*p*-value
Gender				
Male	REF	REF	REF	
Female	0.76	0.11	0.57–0.99	0.04
Age				
18–24	REF	REF	REF	
25–44	1.07	0.22	0.71–1.62	0.72
45–64	1.16	0.26	0.74–1.82	0.50
> 65	0.93	0.35	0.44–1.95	0.86
Education				
No high school	REF	REF	REF	
High school	0.85	0.27	0.44–1.62	0.62
College	0.94	0.27	0.52–11.68	0.84
Graduate school	0.90	0.28	0.48–1.67	0.75
Place of Residence				
Inside home country	REF	REF	REF	
Outside home country	1.41	0.22	1.03–1.91	0.02
Previous COVID-19 infection				
No	REF	REF	REF	
Yes	0.77	0.13	0.55–1.09	0.15
Family death due to COVID-19				
No	REF	REF	REF	
Yes	1.33	0.21	0.96–1.82	0.07

COVID-19 vaccine acceptance rate variation between countries

The COVID-19 vaccine acceptance rate in our study is lower than the rate previously reported in China (91.3–72.6%) [30–33], Indonesia (93.3%) [34], Israel (75.0%) [35], Ecuador (97.0–71.9%) [32, 36], Malaysia (94.3%) [37], Denmark (80.0%) [38], UK (90.1–64.0%) [32, 38–42], Portugal (75.0%), Netherland (73.0%) [38], Germany (68.4–70.0%) [32, 38], Canada (68.7–80.0%) [32, 43], Turkey (69.0%) [39], Brazil (85.4%), South Africa (81.6%), South Korea (79.8%), Mexico (76.3%), India (74.5%), Spain (74.3%), Singapore (67.9%), Sweden (65.2%), Nigeria (65.2%) [32], and Australia (77.3%) [44]. However, it is higher than Poland (56.3%), Russia (54.9%) [32], and Chile (49%) [45], as reported in other studies. In addition, France (58.9–77.1%) [32, 38, 46, 47], the United States (56.9–75.4%) [25, 32, 43, 48, 49], and Italy (77.3–53.7%) [32, 38, 50] have wider range of acceptance rate than the Arab countries depending on the studies. This comparison demonstrates that the hesitancy toward COVID-19 vaccine is higher in the Arab countries compared to the majority of other parts of the world. Therefore, more studies warranted to explore further this phenomenon. In addition, regional health policy makers need to take immediate actions to reduce the disease burden in a region that has the fourth highest cases prevalence after the USA, Brazil and Russia [7]. This can be done when local governments provide free of charge vaccination, especially for those with low income to make it more acceptable [51]. Furthermore, this willingness to pay for vaccine also depends on other different factors including employment status and preexistence chronic diseases [52]. Additionally, raising the public awareness, and enhancing the knowledge about the disease risk may create more responsible behavior among the public [53]. These interventions would increase the vaccine acceptance rate.

COVID-19 vaccine acceptance rate variation based on gender

Similar to our findings, the acceptance rate differs between gender; men are more likely to accept COVID-19 vaccine compared to women [23, 30, 39, 47]. This gender hesitancy may be explained due to potentially higher fear of injection or side effects concerns in females [54]. Another possible explanation could be related the psychological differences between both genders. For example, depression and anxiety prevalence tends to be higher in women than men [55–58]. Furthermore, the source of information might play a great role in vaccination decisions. Females seem to rely more on the internet for health-related information [59–61]. On the other hand, males tend to use the internet to communicate with their physicians more than females [59].

COVID-19 vaccine acceptance rate variation based on place of resident

In this study, we noticed that participants who reside outside of their home countries are more likely to accept COVID-19 vaccine compared with those who reside in their home countries (OR: 1.41, 95% CI: 1.03–1.91; *p* = 0.02). Human nature tend to follow other individuals' behavior [62]. Therefore, the acceptance rate follows the general population where the individual resides in. Furthermore, Arab world tend to be among the tightest cultures in the world, compared to other countries [63], and tight cultures are associated with higher mortality rates compared to loose cultures [64]. Therefore, these differences in human behaviors may explain the COVID-19 vaccine acceptance variation between those who reside inside their home countries and outside their home countries [65].

Limitations

This study is a cross-sectional study and exploratory in nature, which was conducted at a specific time point. Also, we used an online questionnaire to collect our data, which may lead to selection bias and accessibility issues [66]. Another limitation is the limited sample size

and the unequal distribution of participants, where the majority of subjects reside in low-income and lower-middle income countries. Finally, younger adults were predominant in the study sample and the opinion of elderly and higher risk population was limited. Therefore, generalizability of the results is precluded, and further studies are needed in the Arab world. Our study is the first of its kind, explored the determinants of COVID-19 vaccine acceptance in the Arab world, and compared the acceptance rate with other countries. This report shed the light on a new emerging challenge related to COVID-19 vaccine hesitancy in the Arab world, and its consequence on the local health systems.

Conclusion

Our results found that less than two-third of Arabs who participated in this study would accept a COVID-19 vaccine if it becomes available. Men were more than women, and those who live abroad are more likely to accept the vaccine compared to those who live inside their home country. Additionally, acceptance rate varied between countries with individuals residing in high-income countries being the highest. Vaccination hesitancy was in-line with similar studies around the globe, but the acceptance rate in the Arab world is lower than the global rate. Therefore, strategies are needed to prompt COVID-19 vaccine locally, and new interventions shall be implemented to accomplish COVID-19 herd immunity in the Arab world.

Abbreviations
MERS-CoV-2: Middle East Respiratory Syndrome Coronavirus-2; SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus 2; COVID-19: Coronavirus Disease 2019

Acknowledgements
Not applicable.

Authors' contributions
MIK designed the study, analyzed, and interpreted the data. MIK, JA and MC wrote the manuscript. OZ and MAK collected the data. All authors reviewed, contributed, and approved the manuscript.

Availability of data and materials
The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The study was conducted in accordance with the Helsinki Declaration (1964). Study protocol was reviewed and approved by the Research Committee at the Faculty of Medicine, University of Aleppo. Participants were aware about the purpose of the study and provided informed consent prior to accessing the questionnaire and participated voluntarily. No compensation was provided, and all collected data stored securely.

Competing interests
The authors declare that there is no conflict of interest.

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References

1. Zaki AM, van Boheemen S, Bestebroer TM, Osterhaus ADME, RAM F. Isolation of a Novel Coronavirus from a Man with Pneumonia in Saudi Arabia. N Engl J Med. 2012;367(19):1814–20. Available from: https://pubmed.ncbi.nlm.nih.gov/23075143/.
2. WHO Statement regarding cluster of pneumonia cases in Wuhan, China. Available from: https://www.who.int/china/news/detail/09-01-2020-who-statement-regarding-cluster-of-pneumonia-cases-in-wuhan-china. Accessed 28 Jan 2021.
3. Alabdulkarim N, Alsultan F, Bashir S. Gulf Countries Responding to COVID-19. Dubai Med J. 2020;3(2):58–60.
4. Covid-19 in the Middle East: Coronavirus-affected countries. Available from: https://www.pharmaceutical-technology.com/features/coronavirus-affected-countries-middle-east-covid-19/. Accessed 28 Jan 2021.
5. COVID-19 pandemic | UNDP in the Arab States. Available from: https://www.arabstates.undp.org/content/rbas/en/home/coronavirus.html
6. Regional Economic Outlook Update: Middle East and Central Asia. Available from: https://www.imf.org/en/Publications/REO/MECA/Issues/2020/07/13/regional-economic-outlook-update-menap-cca#report. Accessed 28 Jan 2021.
7. Alwahaibi N, Al Maskari M, Al Dhahli B, Al Issaei H, Al Bahlani S. A review of the prevalence of COVID-19 in the Arab world. J Infect Dev Ctries. 2020; 14(11):1238–45.
8. WHO Coronavirus Disease (COVID-19) Dashboard | WHO Coronavirus Disease (COVID-19) Dashboard. Available from: https://covid19.who.int/. Accessed 28 Jan 2021.
9. Covid-19 Vaccine Tracker Updates: The Latest - The New York Times. Available from: https://www.nytimes.com/interactive/2020/science/coronavirus-vaccine-tracker.html. Accessed 28 Jan 2021.
10. Cyranoski D. Arab nations first to approve Chinese COVID vaccine - despite lack of public data. Nature. 2020;588:548.
11. Saudi Arabia ready to launch vaccine campaign | Arab News. Available from: https://www.arabnews.com/node/1775896/saudi-arabia. Accessed 28 Jan 2021.
12. Bahrain approves Chinese COVID-19 vaccine for use - ABC News. Available from: https://abcnews.go.com/Health/wireStory/bahrain-approves-chinese-covid-19-vaccine-74699175. Accessed 28 Jan 2021.
13. Egypt approves Chinese Sinopharm COVID-19 vaccine | Arab News. Available from: https://www.arabnews.com/node/1786531/middle-east. Accessed 28 Jan 2021.
14. Obeidat confirms arrival of first batch of | Roya News. Available from: https://en.royanews.tv/news/24726/2021-01-10. Accessed 28 Jan 2021.
15. WHO issues its first emergency use validation for a COVID-19 vaccine and emphasizes need for equitable global access. Available from: https://www.who.int/news/item/31-12-2020-who-issues-its-first-emergency-use-validation-for-a-covid-19-vaccine-and-emphasizes-need-for-equitable-global-access. Accessed 28 Jan 2021.
16. World Health Organization. Ten threats to global health in 2019. Available from: https://www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019. Accessed 10 Jan 2021.
17. MacDonald NE, Eskola J, Liang X, Chaudhuri M, Dube E, Gellin B, et al. Vaccine hesitancy: definition, scope and determinants. Vaccine. 2015;33(34): 4161–4.
18. Larson HJ, Jarrett C, Eckersberger E, Smith DMD, Paterson P. Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: A systematic review of published literature, 2007–2012. Vaccine. 2014;32:2150–9.
19. Leask J, Kinnersley P, Jackson C, Cheater F, Bedford H, Rowles G. Communicating with parents about vaccination: a framework for health professionals. BMC Pediatrics. 2012;12:154.

20. Halpin C, Reid B. Attitudes and beliefs of healthcare workers about influenza vaccination. Nurs Older People. 2019;31(2):32-39.
21. Xiao X, Wong RM. Vaccine hesitancy and perceived behavioral control: a meta-analysis. Vaccine. 38:5131–8.
22. Eilers R, de Melker HE, Veldwijk J, PFM K. Vaccine preferences and acceptance of older adults. Vaccine. 2017;35(21):2823–30.
23. Sallam M, Dababseh D, Eid H, Al-Mahzoum K, Al-Haidar A, Taim D, et al. High rates of COVID-19 vaccine hesitancy and its association with conspiracy beliefs: a study in Jordan and Kuwait among other Arab countries. Vaccines. 2021;9(1):42.
24. Al-Mohaithef M, Padhi BK. Determinants of COVID-19 vaccine acceptance in Saudi Arabia: a web-based national survey. J Multidiscip Healthc. 2020;13:1657–63.
25. Malik AA, McFadden SAM, Elharake J, Omer SB. Determinants of COVID-19 vaccine acceptance in the US. EClinicalMedicine. 2020;26:100495.
26. Arab World | Data. Available from: https://data.worldbank.org/country/1A. Accessed 25 Jan 2021.
27. World Bank Country and Lending Groups – World Bank Data Help Desk. Available from: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519. Accessed 28 Jan 2021.
28. Ghandour R, Husseini A, Sibai AM, Abu-Rmeileh NME. Cardiovascular disease research in the Arab world: a scoping review from seven Arab countries (2000–2018). Public Health. 2019;175:36–42.
29. Sallam M. COVID-19 vaccine hesitancy worldwide: a systematic review of vaccine acceptance rates author. medRxiv. 2021;2020.12.28.20248950. Available from: https://doi.org/10.1101/2020.12.28.20248950. Accessed 25 Jan 2021.
30. Wang J, Jing R, Lai X, Zhang H, Lyu Y, Knoll MD, et al. Acceptance of covid-19 vaccination during the covid-19 pandemic in china. Vaccines. 2020;8(3):1–14.
31. Lin Y, Hu Z, Zhao Q, Alias H, Danaee M, Wong LP. Understanding COVID-19 vaccine demand and hesitancy: a nationwide online survey in China. Marques ETA, editor. PLoS Negl Trop Dis. 2020;14(12):e0008961.
32. Lazarus JV, Ratzan SC, Palayew A, Gostin LO, Larson HJ, Rabin K, et al. A global survey of potential acceptance of a COVID-19 vaccine. Nat Med. 2020:1–4.
33. Zhang KC, Fang Y, Cao H, Chen H, Hu T, Chen YQ, et al. Parental acceptability of COVID-19 Vaccination for Children Under the Age of 18 Years: Cross-Sectional Online Survey. JMIR Pediatr Parent. 2020;3(2):e24827.
34. Harapan H, Wagner AL, Yufika A, Winardi W, Anwar S, Gan AK, et al. Acceptance of a COVID-19 Vaccine in Southeast Asia: A Cross-Sectional Study in Indonesia. Front Public Heal. 2020;8:381. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7372105/.
35. Dror AA, Eisenbach N, Taiber S, Morozov NG, Mizrachi M, Zigron A, et al. Vaccine hesitancy: the next challenge in the fight against COVID-19. Eur J Epidemiol. 2020;35(8):775–9.
36. Sarasty O, Carpio CE, Hudson D, Guerrero-Ochoa PA, Borja I. The demand for a COVID-19 vaccine in Ecuador. Vaccine. 2020 Dec 3;38(51):8090–8.
37. Wong LP, Alias H, Wong PF, Lee HY, AbuBakar S. The use of the health belief model to assess predictors of intent to receive the COVID-19 vaccine and willingness to pay. Hum Vaccines Immunother. 2020;16(9):2204–14.
38. Neumann-Böhme S, Varghese NE, Sabat I, Barros PP, Brouwer W, van Exel J, et al. Once we have it, will we use it? A European survey on willingness to be vaccinated against COVID-19. Eur J Health Econ. 2020;21:977–82.
39. Salali GD, Uysal MS. COVID-19 vaccine hesitancy is associated with beliefs on the origin of the novel coronavirus in the UK and Turkey. Psychol Med. 2020:1–3.
40. Freeman D, Loe BS, Chadwick A, Vaccari C, Waite F, Rosebrock L, et al. COVID-19 vaccine hesitancy in the UK: The Oxford coronavirus explanations, attitudes, and narratives survey (Oceans) II. Psychol Med. 2020:1–15.
41. Bell S, Clarke R, Mounier-Jack S, Walker JL, Paterson P. Parents' and guardians' views on the acceptability of a future COVID-19 vaccine: a multi-methods study in England. Vaccine. 2020;38(49):7789–98.
42. Sherman SM, Smith LE, Sim J, Amlôt R, Cutts M, Dasch H, et al. COVID-19 vaccination intention in the UK: results from the COVID-19 vaccination acceptability study (CoVAccS), a nationally representative cross-sectional survey. Hum Vaccines Immunother. 2020.
43. Taylor S, Landry CA, Paluszek MM, Groenewoud R, Rachor GS, Asmundson GJG. A proactive approach for managing COVID-19: the importance of understanding the motivational roots of vaccination hesitancy for SARS-CoV2. Front Psychol. 2020;11:575950.
44. Rhodes A, Hoq M, Measey MA, Danchin M. Intention to vaccinate against COVID-19 in Australia. Lancet Infect Dis. 2020;0.
45. Cerda AA, García LY. Hesitation and refusal factors in individuals' decision-making processes regarding a coronavirus disease 2019 Vaccination. Front public Heal. 2021;9:626852. Available from: http://www.ncbi.nlm.nih.gov/pubmed/33968880.
46. Ward JK, Alleaume C, Peretti-Watel P, Seror V, Cortaredona S, Launay O, et al. The French public's attitudes to a future COVID-19 vaccine: The politicization of a public health issue. Soc Sci Med. 2020;265:113414.
47. Detoc M, Bruel S, Frappe P, Tardy B, Botelho-Nevers E, Gagneux-Brunon A. Intention to participate in a COVID-19 vaccine clinical trial and to get vaccinated against COVID-19 in France during the pandemic. Vaccine. 2020; 38(45):7002–6.
48. Fisher KA, Bloomstone SJ, Walder J, Crawford S, Fouayzi H, Mazor KM. Attitudes toward a potential SARS-CoV-2 Vaccine : a survey of U.S. adults. Ann Intern Med. 2020;173(12):964–73.
49. Reiter PL, Pennell ML, Katz ML. Acceptability of a COVID-19 vaccine among adults in the United States: How many people would get vaccinated? Vaccine. 2020;38(42):6500–7.
50. La Vecchia C, Negri E, Alicandro G, Scarpino V. Attitudes towards influenza vaccine and a potential COVID-19 vaccine in Italy and differences across occupational groups, September 2020. Med Lav. 2020;111(6):445–8.
51. Cerda AA, García LY. Willingness to pay for a COVID-19 vaccine. Appl Health Econ Health Policy. 2021;19(3). Available from: https://pubmed.ncbi.nlm.nih.gov/33619688/.
52. García LY, Cerda AA. Contingent assessment of the COVID-19 vaccine. Vaccine. 2020;38(34):5424–9.
53. Xu Y, Lin G, Spada C, Zhao H, Wang S, Chen X, et al. Public knowledge, attitudes, and practices behaviors towards coronavirus disease 2019 (COVID-19) during a national epidemic—China. Front Public Heal. 2021;9:638430.
54. Sagor KH, AlAteeq MA. Beliefs, attitudes   and barriers associated with the uptake of the seasonal influenza vaccine among patients visiting primary healthcare clinics. Saudi Med J. 2018;39(7):690–6.
55. Leach LS, Christensen H, Mackinnon AJ, Windsor TD, Butterworth P. Gender differences in depression and anxiety across the adult lifespan: The role of psychosocial mediators. Soc Psychiatry Psychiatr Epidemiol. 2008;43(12):983–98.
56. McLean CP, Anderson ER. Brave men and timid women? A review of the gender differences in fear and anxiety. Clin Psychol Rev. 2009;29:496–505. Available from: https://pubmed.ncbi.nlm.nih.gov/19541399/.
57. Kessler RC. Epidemiology of women and depression. Journal of Affective Disorders. 2003;74(1):5–13.
58. Weissman MM, Bland R, Joyce PR, Newman S, Wells JE, Wittchen HU. Sex differences in rates of depression: cross-national perspectives. J Affect Disord. 1993;29(2–3):77–84.
59. Bidmon S, Terlutter R. Gender differences in searching for health information on the internet and the virtual patient-physician relationship in Germany: Exploratory results on how men and women differ and why. J Med Internet Res. 2015;17(6):e156.
60. Terlutter R, Bidmon S, Röttl J. Who uses physician-rating websites? differences in sociodemographic variables, psychographic variables, and health status of users and nonusers of physician-rating websites. J Med Internet Res. 2014;16(3):e97.
61. Iverson SA, Howard KB, Penney BK. Impact of internet use on health-related behaviors and the patient-physician relationship: A survey-based study and review. J Am Osteopath Assoc. 2008;108(12):699–711.
62. Huynh TLD. Does culture matter social distancing under the COVID-19 pandemic? Saf Sci. 2020;130:104872.
63. Dunaetz DR. Cultural tightness-looseness: Its nature and missiological applications. Missiology An Int Rev. 2019;47(4):410–21.
64. Harrington JR, Gelfand MJ. Tightness-looseness across the 50 united states. Proc Natl Acad Sci U S A. 2014;111(22):7990–5.
65. Cialdini RB, Goldstein NJ. Social influence: Compliance and conformity. Annu Rev Psychol. 2004;55:591–621.
66. Wright KB. Researching internet-based populations: advantages and disadvantages of online survey research, online questionnaire authoring software packages, and web survey services. J Comput Commun. 2006; 10(3):00.