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REVIEW

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Hesitancy toward vaccination against COVID-19: A scoping review of prevalence and associated factors in the Arab world

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ABSTRACT

Despite widespread availability of vaccines against SARS-CoV-2 virus, the cause of Coronavirus Disease 2019 (COVID-19), its uptake in many Arab countries is relatively low. This literature review aimed to scope evidence on COVID-19 vaccine hesitancy (VH) in the Arab world. A total of 134 articles reporting prevalence of COVID-19 VH and associated factors, conducted in any of the 22 Arab League countries, were reviewed. COVID-19 VH prevalence ranged from 5.4% to 83.0%. Female gender, young age, low education level and lack of previous influenza vaccine uptake were most commonly reported to be associated with COVID-19 VH. The most-reported personal concerns contributing toward VH were related to the rapid development, safety and side effects of vaccine, as well as an overall lack of trust in government policies toward pandemic control and widespread conspiracy theories. Tailored interventions to enable the distribution of trusted information and enhance public acceptance of immunization are warranted.

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Scoping review; COVID-19; SARS-CoV-2; pandemic; Vaccine hesitancy; Arab world

Introduction

During December 2019, several cases of acute pneumonia of unknown etiology were diagnosed in Wuhan-China, with spread and severity so substantial that it rapidly drew global attention. Consequently, the new virus genome sequence was identified as severe acute respiratory syndrome Coronavirus 2 (SARS-CoV-2), causing the ongoing COVID-19 pandemic.[1] The pandemic has infected over 758 million confirmed cases worldwide and caused over 6.86 million deaths as of February 2023.[2]

As different measures were taken to curb the worst effect of virus, pharmaceutical industries were also urged to develop vaccines immediately to limit the escalating infection rates.[3] The new awaited vaccines were predicted to reduce incidence, virulence, and morbidity. However, despite the eager anticipation of vaccine availability worldwide, the urgency of the development, coupled with the unknown side effects, triggered vaccine hesitancy, refusal, and antivaccine movements.[4] According to WHO, vaccine hesitancy (VH) is defined as a "delay in the acceptance or refusal of vaccination despite the availability of vaccination services."[4] Even long before the COVID-19 pandemic, vaccine hesitancy has hindered the global effort to control outbreaks affecting thousands of vulnerable individuals to the extent that the World Health Organization (WHO) considers it as one of the top public health challenges, that needs to be tackled, along with poverty and HIV.[5] The scope of vaccine acceptance ranges from accepting the vaccine without any doubts to rejecting it altogether. Accepting and taking some, refusing others, and delaying vaccination are all counted toward VH.[6]

With a total population of over 440 million, the Arab world comprises 22 countries extending from the Arabian Sea in the east to the Atlantic Ocean in the west.[7] Despite the significant disparities in cultural, environmental, and socio-economic determinants of health in the Arab world, it has been affected by the COVID-19 in a way similar to that of the rest of the world. The pandemic has infected over 14.1 million individuals and caused around 173.3 thousand deaths as of February 2023 in the Arab world.[8] Several types of vaccines have been introduced in the region to control the pandemic (refer to Table S1 for vaccines used in each country), including RNA-based vaccines such as Pfizer-BioNTech and Moderna, non replicated viral vector vaccines such as Oxford-AstraZeneca, Jcovden, CanSino, Sputnik V and Sputnik Light, whole inactivated virus-based vaccines such as Sinopharm, Sinovac, Covaxin and Valneva and protein subunit based vaccines such as Recombinant-SARSCoV-2 Vaccine.[9] The expedited production and approval processes, along with wide variations in the vaccine brands, have led to an increase in uncertainty regarding effectiveness of the vaccines. In addition, the distribution of vaccines in the Arab world faced some initial challenges, especially with supply, accessibility, and storage, that were overcome to ensure availability for all individuals.[10]

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Despite the wide availability and accessibility of vaccines in most of the countries in the Arab world, VH was very common, particularly in the initial phases of vaccination campaigns.[11,12] Early cross-sectional surveys showed variable attitudes toward COVID-19 vaccination ranging from high acceptance rates in some countries to increased hesitancy rates in others.[10,12] Sociodemographic factors that could have contributed to VH and personal views that might influence vaccination decisions were investigated.[11] Several reviews have been carried out within the last three years summarizing the COVID-19 vaccination uptake and affecting factors in several regions of the world.[13,14] However with the emergence of more studies in relation to this topic, targeting different populations and using different models, there is a consistent need to review the findings of these papers to provide policy makers with latest evidence on best vaccination programs and approaches. This scoping review summarizes evidence from the published literature investigating prevalence of the hesitancy toward vaccination against COVID-19 and/or factors associated with the hesitancy in the Arab world. The review also explores the most common personal perspectives acting as barriers, leading to hesitancy against vaccination to COVID-19 in this region.

Materials and methods

Search strategy

This review was conducted and is reported in accordance to the guidelines set by Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR).[15] Refer to Table S2 for PRISMA-ScR checklist. The protocol for the review was registered with Open Science Framework (OSF; Digital Object Identifier https://doi.org/10.17605/OSF.IO/K83ZX). Review was performed following five key steps of Arksey O'Malley framework.[16] PubMed, Scopus, and Embase databases were searched between October 2021 and February 2023, for articles with studies based on cross-sectional design, reporting prevalence of hesitancy against vaccination to COVID-19. A search strategy using appropriate combination of key words and MESH terms, developed by the authors and reviewed by expert librarian was used. Search terms related to COVID-19, vaccine, and vaccine hesitancy, in addition to the list of the 22 Arab countries (Algeria, Bahrain, Comoros, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, United Arab Emirates (UAE), and Yemen) were included. Refer to Table S3 for the search strategy used in the PubMed. Study search was conducted by two independent reviewers (SM, ZA).

Eligibility criteria

Articles were included if they were based on a study with cross-sectional design, with a primary aim to investigate the prevalence of COVID-19 vaccination; and/or factors associated with vaccine hesitancy, in any of 22 Arab countries, regardless of the studied population (refer to Table S4 for the eligibility criteria). Articles published in Arabic or English language were considered eligible. Mixed method studies were included if the quantitative component in the study was based on a cross sectional design. Articles based on studies in non-Arabic countries, with other than cross-sectional study designs, and those addressing VH for non-COVID-19 viruses were excluded. Only articles reporting VH and associated factors and attitudes among adults were included, with those addressing parents' views regarding VH among children excluded. Articles were eligible if they were published from October 2021, as the vaccine was widely available for the majority of the populations by that time. Original peer-reviewed articles were included whereas conference proceedings and abstracts with incomplete data were excluded.

Study selection and data extraction

After removal of duplicate records, titles and abstracts of the retrieved articles were screened for their full or potential eligibility. Full texts of the eligible articles were screened and assessed for inclusion against the pre-set inclusion criteria. Title/abstract screening and full-text screening were carried out by two reviewers (SM, ZA) independently and any conflicts were resolved by mutual discussion or involvement of the third reviewer (IE). The bibliography of the included articles was also hand-searched for any additional eligible studies that might have been missed in the database search.

From the articles that were deemed eligible for inclusion, data were extracted using a predetermined extraction tool. The extraction tool included fields on the basic characteristics of studies as well as methodological aspects, such as author and year of publication, study setting, type of population, sample size, and mode of data collection. Study outcomes in terms of calculated or calculable data on the prevalence of and factors associated with hesitancy against COVID-19 vaccination as well as personal beliefs leading to VH acting as barriers for vaccine uptake were also extracted. Only data on factors found to be statistically significant as reported in the studies, based on regression modeling were included. Data on the outcomes were then summarized narratively.

Results

Study selection

A total of 622 articles were identified from the database search, including PubMed (260), Embase (200) and Scopus (162) (Figure 1). After removal of duplicates and screening the records for title/abstract and full text, 156 articles remained. 22 records were excluded via full-text screening due to irrelevant outcomes i.e., parents' hesitancy toward vaccination of children (6), irrelevant populations such as Arab immigrants in non-Arabic countries (3), wrong vaccine types such as that for Influenza (5), irrelevant geographical locations (2), wrong study design i.e., qualitative (3) and nonavailability of full text (3). Resultingly, 134 articles met the inclusion criteria and were included in the review.

Characteristics of the included studies

Characteristics of the included studies are summarized in Table 1, with detail of individual studies provided in Tables 2 and 3.

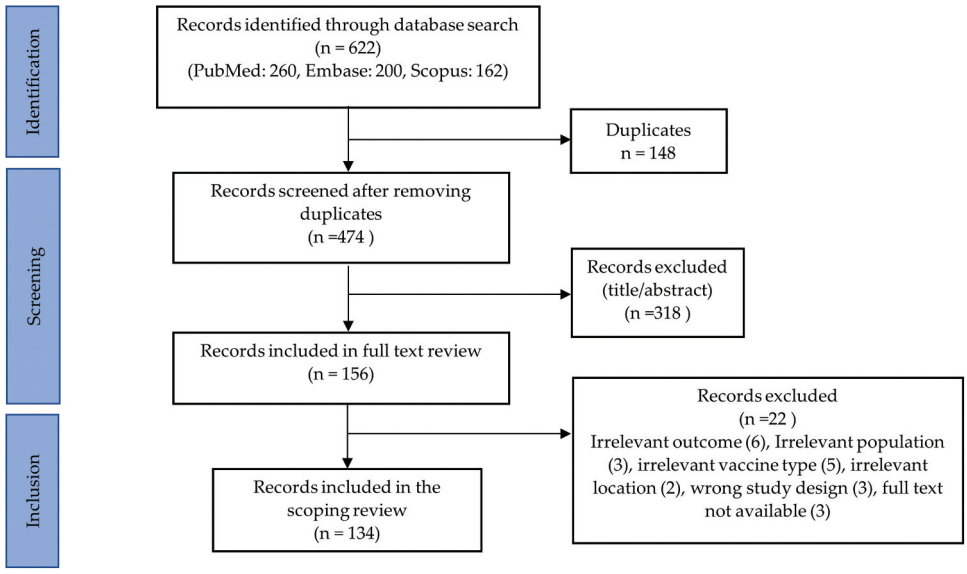

Figure 1. PRISMA flow chart illustrating study selection.

Table 1. Summary of the included studies based on characteristics.

Study characteristics	Number of articles (%) (Overall = 134)
Number of study participants	
100–1000	69 (52.6)
1001–2000	34 (25.2)
2001–3000	11 (8.1)
3000 and more	6 (4.4)
4000 and above	14 (9.6)
Patient populations	
General public	76 (55.5)
Healthcare workers	32 (25.5)
University staff and student	14 (10.4)
Refugees	4 (2.7)
Older adults	2 (1.5)
Patients with cancer	1 (0.7)
People with chronic illness	4 (3.0)
Air travelers	1 (0.7)
Dental patients	1 (0.7)
Pregnant and lactating women	7 (1)
Mothers in last two years	1 (5)
Methodology of data collection	
Online survey	122 (91.1)
Telephone calls	2 (1.5)
Personal interview	5 (3.7)
Online survey and personal interview	1 (0.7)
Online survey and printed questionnaire	3 (2.2)
Printed Questionnaire	1 (0.7)
Year of publication	
2021	70 (51.1)
2022	61 (46.7)
2023	3 (2.2)

Overall most of the studies (132) were cross-sectional, with two of mixed method design.[77,87] Of the included articles, 123 addressed hesitancy against primary COVID-19 vaccination whereas 10 addressed against that of booster vaccination and one addressed both.[106] Studies were conducted in 18 (81.8%) out of the 22 Arab countries. The majority of the included studies were conducted in Saudi Arabia (29.8%), followed by Egypt and Jordan (11.9% each), multiple countries (11.1%), Lebanon (5.2%), Iraq, Qatar and UAE (4.5% each), Kuwait (3.7%), Palestine (3.0%), Sudan (2.2% each), Algeria and Oman (1.5% each), Morocco, Somalia, Syria, Yemen, Tunisia and Libya (0.7% each), (Figure 2).

Number of participants in the included studies ranged from 111–36,220.[35,81] The general public was the most commonly addressed population (76 studies), followed by healthcare workers (HCWs) including physicians, nurses and dentists (32 studies), university students (14 studies) and pregnant/lactating women (14 studies). Other populations subgroups addressed in the studies included patients with cancer and chronic illnesses, refugees, older adults, dental patients and air travelers. Participants suffering from chronic diseases included those with diabetes, rhematic disease, HIV and on hemodialysis.[61,119,129,139]

For data collection, the majority of the studies used online surveys (122), whereas few used printed questionnaires (14). Telephone calls and in-person interviews were also used for data collection sparingly.[35,36,47,111] Most of the questionaries used in the survey were self-developed by the researchers or based on those used in previous studies. However, few studies developed their questionnaires on validated existing tools such as the WHO-SAGE survey tool,[72–77] the GRA Vax scale[21,22] and the 5C scale.[31,85] Few included studies also used Health Belief Model (HBM) to guide data collection.[24,67,93,127]

Prevalence of hesitancy toward vaccination against COVID-19

Study-based prevalence of hesitancy against primary COVID-19 vaccination is described in Table 2 whereas that against booster vaccination in Table 3. COVID-19 VH varied considerably across the 130 articles reporting VH, included in this review. Hesitancy levels ranged from as high as 83.0% in a large multinational survey of 22 Arab countries[82] to just 5.4% among the general population in Saudi Arabia.[130] Some articles included studies focused on the attitude toward vaccination and did not report data about the hesitancy rates[26,56,57,85] (Tables 2 and 3). Reported VH ranged between 12%-83% for general population, 14%-79% for HCWs, 20.1%-49.1% for pregnant and lactating mothers, 13%-

Table 2. Summary of 124 articles with studies reporting hesitancy against primary COVID-19 vaccination.

First author, Year	Country	Studied Population	Mode of data collection	Sample size	Vaccine Hesitancy	Factors reported to be associated with VH
El-Sokkary, 2021[17]	Egypt	Health Care Workers	Online survey	308	74.0%	Income, years of experience
Elgendy, 2021[18]	Egypt	General Population	Online survey	871	12.0%	N/A
Fares, 2021[19]	Egypt	Health Care Workers	Online survey	358	79.0%	Having heard of anyone with bad reaction toward vaccine, lack of trust in pharmaceutical companies to develop safe and effective vaccine, belief that side effects are not openly discussed, belief in need of vaccine for immunity, belief in community responsibility to get vaccinated
Omar, 2021[20]	Egypt	General Population	Online survey	1,011	75.0%	Gender, residence and concerns on unforeseen vaccine side effects
Saied, 2021[21]	Egypt	University staff and Students Medical	Online survey	2,133	52.0%	Educational level, COVID-19 knowledge, self-perceived health status
Hammam, 2021[22]	Egypt	University staff	Online survey	187	45.4%	N/A
Abdulah, 2021[23]	Iraq	General Population	Online and and in person interview	926	53.2%	Educational level, professional category, concerns on vaccine side effects
Al-Metwali, 2021[24]	Iraq	General Population	Online survey	1,680	38.3%	Professional category, previous Influenza vaccine uptake, attitude toward vaccination in general and HBM constructs (preventive measures, perceived benefit, perceived barriers, cue to action, subjective norm)
Al-Rawashdeh, 2021[25]	Jordan	General Population	Online survey	281	60.1%	Gender, professional category, self-perceived health status, perception on government measures' adequacy, perceived susceptibility and attitudinal score toward COVID-19 vaccination
Abu-Farha, 2021[26]	Jordan	General Population	Online survey	1,287	N/A	Nationality, previous infection with COVID-19 and knowledge of someone to have passed away due to COVID-19
Al-Qerem, 2021[27]	Jordan	General Population	Online survey	1,144	63.2%	Gender, educational level, risk perception of COVID-19, marital status
El-Elimat, 2021[28]	Jordan	General Population	Online survey	3,100	62.6%	Gender, educational level, previous Influenza vaccine uptake
Sallam, 2021[29]	Jordan	University Students	Online survey	1,106	65.1%	Gender, educational level, Influenza vaccine uptake, conspirational claims
Al-Ayyadhi, 2021[30]	Kuwait	General Population	Online survey	7,274	74.3%	Age, gender, educational level, Previous Influenza vaccine uptake
Al-Sanafi, 2021[31]	Kuwait	Health Care Workers	Online survey	1,019	16.7%	Gender, workplace, 5C psychological determinants: confidence, constraints, calculation, collective responsibility
Al-Awadhi, 2021[32]	Kuwait	General Population	Online survey	7,241	32.7%	Age, gender, previous Influenza vaccine uptake, fear and worry regarding COVID-19, frequency of informing oneself of COVID-19, trust in doctors
Alqudeimat, 2021[33]	Kuwait	General Population	Online survey	2,368	46.9%	Gender, previous Influenzas vaccine uptake, self-perceived health status
Burhamah, 2021[34]	Kuwait	General Population	Online survey	2,345	17.0%	N/A
Salibi, 2021[35]	Lebanon	Syrian refugee beneficiaries aged 50 years and above	Telephone calls	1,037	34.2%	Vaccine safety, vaccine effectiveness
Moujaess, 2021[36]	Lebanon	Patients With Cancer	In person interviews	111	45.0%	N/A
Hamdan, 2021[37]	Lebanon	University Students	Online survey	3,805	13.0%	Belief that symptomatic cases are the only infection carriers, concerns on vaccine safety, attitude toward vaccine
Al Halabi, 2021[38]	Lebanon	General Population	Online survey	579	78.6%	Gender, marital status
Nasr, 2021[39]	Lebanon	Health Care Workers	Online survey	529	14.0%	Previous Influenza vaccine uptake, frequency of medical visits, COVID-19 vaccination knowledge, fear of infection contraction
Elhadi, 2021[40]	Libya	General Population, Health Care Workers	Online survey	15,087	20.4%	Age
Khamis, 2021[41]	Oman	Health Care Workers	Online survey	433	60.1%	N/A
Zawahrah, 2021[42]	Palestine	General Population	Online survey	1,080	36.3%	Age, marital status, COVID-19 knowledge, attitudinal score toward COVID-19 vaccination
Maraqa, 2021[43]	Palestine	Health Care Workers	Online survey	1,159	62.2%	Age, Gender, professional category, practice setting, previous Influenza vaccine uptake

(*Continued*)

Table 2. (Continued).

First author, Year	Country	Studied Population	Mode of data collection	Sample size	Vaccine Hesitancy	Factors reported to be associated with VH
Zaidi, 2021[44]	Qatar	University staff and Students	Online survey	364	31.9%	N/A
Al-Mulla, 2021[45]	Qatar	University staff and Students	Online survey	262	37.4%	Gender, education, previous Influenza vaccine uptake, worries on rushed pace of COVID-19 vaccine development, belief on failure to detect potential side effects, length of testing the vaccine
Alabdulla, 2021[46]	Qatar	General Population	Online survey	7,821	40.0%	Gender, migrant status, professional category, marital status, worry on vaccine side effects, previous Influenza vaccine uptake, belief in natural immunity
Khaled, 2021[47]	Qatar	General Population	Telephone calls	1,912	57.3%	Gender, ethnicity, migrant status, concern about vaccine side-effects
Kumar, 2021[48]	Qatar	Health Care Workers	Online survey	1,546	37.9%	Gender, concerns on vaccine safety and efficacy, understanding of disease and vaccine
Samannodi, 2021[49]	Saudi Arabia	Women aged 18 years and above	Online survey	431	60.0%	Pregnancy or intended pregnancy
Narapureddy, 2021[50]	Saudi Arabia	General Population	Online survey	782	33.1%	N/A
Barry, 2021[51]	Saudi Arabia	Health Care Workers	Online survey	1,512	30.0%	Gender, belief that vaccines were rushed without evidence-informed testing
Altulahi, 2021[52]	Saudi Arabia	General Population	Online survey	8,056	47.6%	Age, gender, educational status, previous Influenza vaccine uptake
AlSaeed, 2021[53]	Saudi Arabia	General Population	Printed questionnaire	486	30.5%	Nationality, income, having acquired COVID-19 infection, knowledge about vaccine safety, registration for vaccine, following friends and family members for vaccine uptake (Social cognitive theory)
Alghamdi, 2021[54]	Saudi Arabia	Patients with Chronic illness	Online survey	310	48.0%	N/A
Aldosary, 2021[55]	Saudi Arabia	Health Care Workers	Online survey	334	29.3%	N/A
Alamer, 2021[56]	Saudi Arabia	General Population	Online survey	655	33.0%	N/A
Alshahrani, 2021[57]	Saudi Arabia	Air travelers	Online survey	2,236	N/A	Gender, frequency of traveling, concern about contracting infection
Al-Hanawi, 2021[58]	Saudi Arabia	Older Adults aged 50 years and above	Online survey	488	N/A	Gender, educational level, previous refusal of general vaccine uptake, concern on infection contraction
Mansour, 2021[59]	Saudi Arabia	General Population	Online survey	1,935	30.7%	Age, nationality, monthly income, having chronic diseases, vaccine knowledge and concerns about vaccine safety
Al-Mohaithef, 2021[60]	Saudi Arabia	General Population	Online survey	658	46.7%	Risk perception, trust in healthcare system
Aldossari, 2021[61]	Saudi Arabia	Patients with diabetes	Online survey	709	63.8%	Gender, duration of illness, previous history of Influenza vaccine uptake
Alfageeh, 2021[62]	Saudi Arabia	General Population	Online survey	2,137	52.0%	Residence, previous general vaccine refusal, concern on infection contraction
Almaghasla, 2021[63]	Saudi Arabia	General Population	Online survey	862	52.0%	N/A
Almalki, 2021[64]	Saudi Arabia	UniversityStudents	Online survey	407	9.6%	Previous Influenza vaccine uptake
Alshahrani, 2021[65]	Saudi Arabia	General Population	Online survey	758	18.3%	Previous Influenza vaccine uptake, perception on vaccine effectiveness, source of health information and intention for international travel
Magadmi, 2021[66]	Saudi Arabia	General Population	Online survey	3,101	55.3%	Age, gender, previous Influenza vaccine uptake
Mahmud, 2021[67]	Saudi Arabia	General Population	Online survey	1,387	42.4%	Age, professional category, previous Influenza vaccine uptake, HBM constructs (perceived susceptibility, severity, benefits and barriers)
Noushad, 2021[68]	Saudi Arabia	General Population	Online survey	879	44.0%	Age, nationality, Updating self on vaccine development
Qattan, 2021[69]	Saudi Arabia	Health Care Workers	Online survey	736	49.5%	Gender, risk perception, belief in vaccine compulsion for all citizens
Zahid, 2021[70]	Saudi Arabia	General Population	Online survey	1,599	20.8%	Age, gender, nationality
Ahmed, 2021[71]	Somalia	General Population	Online survey	4,543	23.2%	Gender, professional category, protective measure adherence score
Mohamad, 2021[72]	Syria	General Population	Online survey	3,402	64.1%	Age, gender, residence, smoking, fear of COVID-19, perceived severity, belief on origin of disease, general vaccine hesitancy

(*Continued*)

Table 2. (Continued).

First author, Year	Country	Studied Population	Mode of data collection	Sample size	Vaccine Hesitancy	Factors reported to be associated with VH
Ahamed, 2021[73]	UAE	General Population	Online survey	1,003	57.0%	N/A
Albahri, 2021[74]	UAE	General Population	Online survey	2,705	40.9%	Age, gender, nationality, residence, educational status, risk perception, previous Influenza vaccine uptake, trust in authorities
Albahri, 2021[75]	UAE	Health Care Workers	Online survey	176	40.9%	Nationality, professional category
Alremeithi, 2021[76]	UAE	General Population	Online survey	1,867	35.5%	Age, gender, nationality, COVID-19 knowledge
Alzubaidi, 2021[77]	UAE	University Students	Online survey	669	31.8%	Attitudes and beliefs toward vaccination, perceived side effects, perceived access to vaccination center, perception on adherence to distancing guidelines
Harapan, 2021[78]	Multiple countries (Egypt, Sudan, Tunisia)	General Population	Online survey	466	49.1%, 34.8%,45.3%	Gender, professional category previous Influenza vaccine uptake
Anjorin, 2021[79]	Multiple countries (Egypt, Sudan, Morocco)	General Population	Online survey	1361	28–35%	Age, gender, employment status, income, residence, rural versus urban settlement
Kaadan, 2021[80]	22 Mutiple Arab countries	General Population	Online survey	870	37.6%	Gender, migrant status
Abu-Farha, 2021[81]	4 Mutiple countries	General Population	Online survey	2,925	70.6%	Nationality, previous COVID-19 infection, having known someone with COVID-19
Sallam, 2021[82]	Multiple Arab countries	General Population	Online survey	3,414	70.6%	Gender, educational level, residence, history of chronic disease, conspirational beliefs
Qunaibi, 2021[83]	23 Mutiple Arab countries	General Population	Online survey	36220	83.0%	Gender, professional category, previous Influenza vaccine uptake, knowledge of vaccine type
Qunaibi, 2021[84]	21 multiple Arab countries	Health Care Workers	Online survey	6043	74.2%	Gender, previous Influenza vaccine uptake, knowledge of vaccine type, previous COVID-19 infection
Abdou, 2021[85]	13 Multiple Arab countries	General Population	Online survey	4474	N/A	5C psychological determinants: confidence, constraints, calculation, collective responsibility
Sitarz, 2022[86]	Egypt among multiple countries	Students	Onlie survey	566	39.4%	N/A
Waheed, 2022[87]	Egypt	Health Care Workers	Online and printed questionnaire	500	23%	Educational level, previous influenza vaccine, belief on vaccine safety and effectiveness and sufficient evidence on vaccine
Alhneiti, 2022[88]	Jordan	Health Care Workers	Online survey	1594	34.2%	Age, knowledge, compliance
Saikarthik, 2022[89]	Multiple countries including Saudi Arabia	General population	Online survey	302	55.7%	Gender, development of infection after previous vaccine, levels of depression, anxiety, and perceived need for mental health support before and after COVID-19
Amer, 2022[90]	Egypt	Health Care workers	Online survey	436	52.1	Residence, concerns about future side effects, trust regarding vaccine benefit, preference for natural immunity
Majer, 2022[91]	Palestine, Gaza strip	General population,Health Care Workers Health Care Workers	Online survey	1075	34.08%	Gender, age, educational level, common source of information, belief in possibility of serious illness, and belief on vaccine safety
Baklouti,2022[92]	Tunisia	Health Care Workers	Online survey	300	34.7%	Age, residence, medical professional category, not having cared for COVID patient.
Ali, 2022[93]	Lebanon	Refugees Lebanese nationals Lebanese nationals	Two in-person surveys, pre and post vaccine rollout	39274174 4174	75.6% 55.6%	Age, refugee status, HBM constructs
Noushad, 2022[94]	Yemen	General population	Online survey	5329	49.9%	Gender, following updates about COVID-19 vaccines, risk perception, anxiety about contracting COVID-19, concerns on COVID-19 vaccines side effects, access to COVID-19 vaccine
El-Ghitany,[95]	Egypt	General populationHealth Care Workers	In person iterview	2919	33.5%	Gender, residence, educational level, client facing job category,

(*Continued*)

Table 2. (Continued).

First author, Year	Country	Studied Population	Mode of data collection	Sample size	Vaccine Hesitancy	Factors reported to be associated with VH
Hatamleh, 2022[96]	Jordan	Palestenian refugees, Jordanian citizens (general population)	In person interview	992501491 501 491	45.9% 54.1%	Gender, educational level of education. age
El-Qerem, 2022[97]	Jordan	Young adults 18-30 yrs	Online survey	1897	80.1%	Gender, risk perception, ICOVID-19 knowledge, COVID-19 preventive measures' practice score, specific vaccine knowledge score
Mahmud, 2022[98]	Jordan	General population	Online survey	2307	16.3%	Gender, residence, previous infection with COVID 19, professional category.
Shehata, 2022[99]	Egypt	Health Care workers	Online survey	1268	75.7%	Age, gender, educational level, prior COVID-19 infection, direct contact with patients, practice settings
Elbadawi, 2022[100]	Sudan	Health Care workers	Online survey	930	31.4%	N/A
Lataifeh, 2022[101]	Jordan	Health Care workers	Online survey	364	37.1%	N/A
Sharaf, 2022[102]	Egypt	Dental teaching staff, Health Care workers	Online survey	171	54.4%	Gender, practice setting, intention to travel internationally, having anyone sick in the immediate social circle, anxiety about COVID-19
Boshra, 2022[103]	Egypt	General population	Online survey	390	42.3%	N/A
Al-Awaidy, 2022[104]	Oman	Health Care workers	Online survey	608	57%	Gender, trust in government, COVID-19 vaccine knowledge, attitudes toward vaccination
AbdelKadir, 2022[105]	Egypt	Nursing students	Online survey	500	24%	N/A
Abuhammad, 2022[106]	Jordan	Pregnant and lactating women	Online survey	413	49.1%	N/A
Noushad 2022,[107]	Yemen	Health Care Worker	Online and printed questionnaire	1581	38.3%	Having a systemic disease, following the updates about COVID-19 vaccines, risk perception, compliance with preventive guidelines, anxiety about contracting COVID-19, previous COVID-19 infection, concern about the side effects of COVID-19 vaccine, access to COVID-19 vaccine
Talafha, 2022[108]	Jordan	Syrian refugees	Online survey	230	10.4%	N/A
Shareef, 2022[109]	Iraq	General population	Online survey	1221	43.8	Gender, old age. Residence
Nemr, 2022[110]	Egypt	Health Care Workers	Online survey	451	59.2%	N/A
Tharwat, 2022[111]	Egypt	Health Care Workers	In person Interviews	455	29.5%	N/A
Bhat, 2022[112]	Saudi Arabia	General population	Online survey	756	22.1%	N/A
Raja, 2022[113]	Sudan	Medical Students	Online survey	281	44.2%	Previous history of COVID-19 infection, Belief in the general safety of vaccines, trust in COVID-19 vaccine to end pandemic, previous vaccination for other diseases in the last five years
Luma, 2022[114]	Iraq	Health Care Workers	Online survey	1704	27.9%	Gender, educational level, preexisting chronic disease, and self-perceived poor health status
Abdullah, 2022[115]	Jordan	General population	Online survey	1607	45.5%	Gender, income, educational level, risk perception
Darweesh, 2022[116]	Iraq	Health Care Workers	Online survey	2202	10.03%	N/A
Nusair, 2022[117]	Jordan	General populatin	Online survey	2268	27.7%	Gender, age, risk perception score, having children
Yassin, 2022[118]	Sudan	Health Care workers	Online survey	400	36.2%	N/A
El Kibbi, 2022[119]	Multiple countries	Health Care Workers Rheumatic disease patients	Online survey	3176	Patients 37% HCWs 28%	Income, belief that it is important to be personally vaccinated, concern regarding the vaccine side-effects, concerns about vaccination in general, previous influenza vaccine uptake, fear of COVID-19, and concerns about the risk of autoimmune flare
Kacimi, 2022[120]	Algeria	General population	Online survey	1019	47%	N/A
Kurdee, 2022[121]	Saudi Arabia	General population	Online survey	922	43.2%	Marital status
Salman, 2022[122]	Multiple Countries Saudi Arabia, Sudan Egypt	General population	Online survey	1393	39%	N/A

(*Continued*)

Table 2. (Continued).

First author, Year	Country	Studied Population	Mode of data collection	Sample size	Vaccine Hesitancy	Factors reported to be associated with VH
Othman, 2022[123]	Saudi Arabia	General population	Online survey	504	5.4%	Pre-existing chronic condition, or concern about vaccine side effects
Okmi, 2022[124]	Saudi Arabia	General population	Online survey	1939	26.7%	Gender, professional category, risk of infection contraction and severity perception of vaccine benefits, belief on effectiveness of vaccine and that it is media advertisement, less cues to action
Faqihi, 2022[125]	Saudi Arabia	General population	Online survey	7188	36.2%	N/A
Saddik, 2022[126]	United Arab Emirates	Health Care Workers	Online survey	517	42%	Gender, previous influenza vaccine uptake, attitude, risk perception, concerns about inadequate data on vaccine safety, side effect, avoidance of vaccines in general
Khalafalla, 2022[127]	Saudi Arabia	University Students	Online survey	1039	16.4%	Age, perceived disease severity, benefit, cues to action, efficacy and barriers (HBM constructs)
Alshahrani, 2022[128]	Saudi Arabia	Pregnant and breast feeding women	Online survey	854	68.1% pregnant 14.1% High risk pregnancy 17.8% Breastfeeding	N/A
Mohamed, 2022[129]	Mutiple countries Egypt, Saudi Arabia and Tunisia	People living with HIV	Online survey	540	35.4%	Worry about COVID-19 transmission post-vaccination, belief in disease prevention by vaccine.
Almeshary, 2022[130]	Saudi Arabia	General population	Online survey	1658	28%	Gender, previous COVID-19 infection, income, employment, residence
Alshareef, 2022[131]	Saudi Arabia	Women aged 18 years and above	Online survey	910	59%	Age, educational level, refusal in previous vaccination uptake
Arraj, 2022[132]	Lebanon	Adult population	Online survey	1185	53%	N/A
Habib, 2022[133]	Saudi Arabia	Medical students	Online survey	1445	33.3%	N/A
Nour, 2022[134]	Saudi Arabia	General population	Online survey	507	28.8%	Gender, income, educational level, COVID-19 knowledge, previous influenza vaccine uptake, history of COVID-19
Al-Kafarna, 2022[135]	Palestine	General population	Online survey	6226	27.9%	N/A
Salem, 2022[136]	Egypt	General population	Online survey	1053	69.5%	Previous history of influenza vaccine uptake, perceived vaccine effectiveness, vaccine price and doctors' recommendation to take the vaccine
Ghamri, 2022[137]	Saudi Arabia	Pregnant/lactatting women	Online survey	300	20%	Risk perception, vaccine uptake by pregnant and breastfeeding/lactating womenLactating women: educational level, concern about efficacy and safety, recommendation by OB/GYN Lactating women: educational level, concern about efficacy and safety, recommendation by OB/GYN
Banyad, 2023[138]	Morocco	Mothers (given birth in last two years)	In person interview	458	36%	Income, health coverage
Reagu, 2023[139]	Qatar	General population	Online surveys	5340	20%	Personality traits of openness, conscientiousness, and neuroticism
Al-ghurabi, 2023[140]	Saudi Arabia	General population	Online surveys	444	38.3%	N/A

Table 3. Summary of 11 articles with studies reporting hesitancy against COVID-19 booster vaccination.

First author, Year	Country	Studied Population	Mode of data collection	Sample size	Hesitancy	Factors associated with hesitancy
El-Qerem, 2022[141]	Jordan	General population	Online survey	915	Booster 30.7%	Previous symptoms, imposition of law to get vaccinated
Abdullais, 2022[142]	Saudi Arabia	General population	Online survey	520	49.8% booster	N/A
Esra'O, 2022[143]	Jordan	Pregnant and lactating mothers	Online survey	584	booster 43.8	Income, residence, breastfeeding status, knowledge of pregnant/lactating women previously infected with COVID-19, commitment to routine immunization for children, previous influenza vaccine uptake, worry about contracting COVID-19
El-Qerem 2022[144]	Iraq	General population	Online survey	754	Booster 55.4%	Risk perception, belief in being infected with COVID-19 in next 6 months, knowledge score group, imposed laws vaccine type, age, practice level, knowledge of someone who had died due to COVID-19, side effects score
Lounis, 2022[145]	Algeria	General population	Online survey	656	30.5 Booster	Gender, professional category belief in natural origin of the pandemic, previous COVID-19 infection in family
Abuhammad, 2022[106]	Jordan	Pregnant and lactating women	Online survey	413	65.9%	N/A
Abullais, 2022[146]	Saudi Arabia	Dental patients	Online and printed questionnaire person	609	48.1% booster	N/A
Mugheed, 2022[147]	Multiple countries, Oman, Saudi Arabia	Nursing students	Online survey	216	24.5 Booster	N/A
Abouzid, 2022[148]	Multiple (MENA) countries	General vaccinated population	Online survey	222	Booster 24.4	Fear of COVID-19, immunocompromised status
Al Obaidi, 2022[149]	Saudi Arabi	Hemodialysis patients	In person interview	179	Booster 21.8%	Marital status, confidence in the locally manufactured vaccine, educational level, rating of health status
Vellapally, 2022[150]	Saudi Arabia	Health Care Workers	Online survey	303	33% booster	Belief in safety provided by pharmaceutical companies

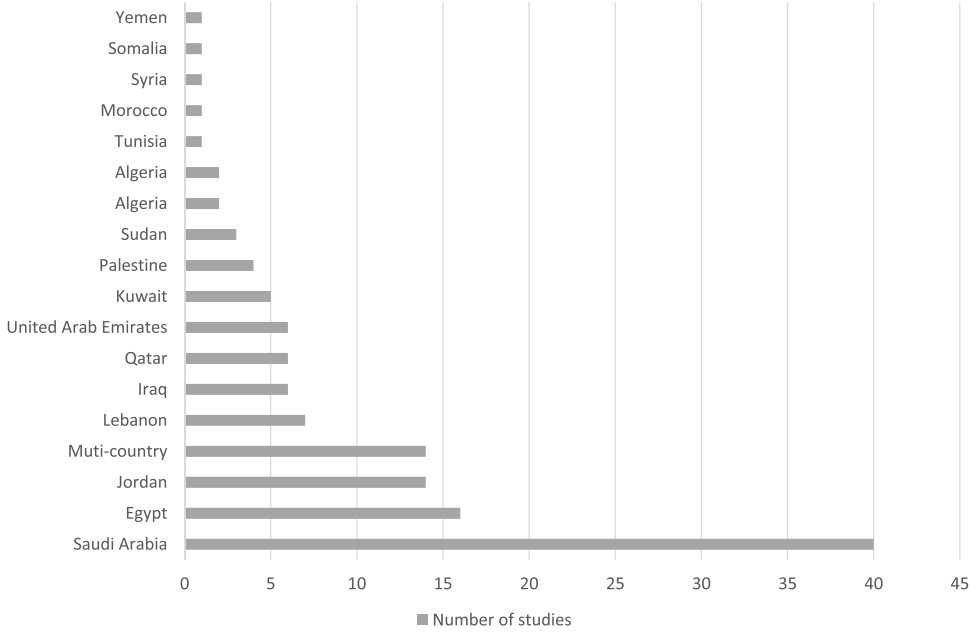

Figure 2. Distribution of the number of the included studies by country.

65.1% for students, 10.4%-75.6% for refugees, 45% for cancer patients and 37–63.8% for patients suffering from chronic diseases. When summarized on the basis of geographical location, VH prevalence was found to be 5.4%-63.8% (Saudi Arabia), 12%-79% (Egypt), 10.4%-80.1% (Jordan), 16.7%-74.3% (Kuwait), 13%-78.9% (Lebanon), 27.9%-62.2% (Palestine), 26%-57.3% (Qatar), 31.8%-57% (UAE), 57%-60.1% (Oman), 31.4%-44.2% (Sudan), 38.3%-49.9% (Yemen), 20.4% (Libya), 34.7% (Tunisia), 36%(Morocco), 47% (Algeria) and 24.5%-83% (multiregional). VH was

found to be 9.6%-83% in articles published in 2021, 5.4%-81.0% in articles in 2022 and 20%-38.3% in articles in 2023. 11 articles including studies that measured COVID-19 booster vaccine hesitancy found it to be 21.8% – 55.4%.[106–141–150]

Factors associated with hesitancy and acceptance toward vaccination against COVID-19

The factors most commonly reported to be associated with hesitancy toward vaccination against COVID-19 in the majority of the studies were female gender, young age, rural background, low level of educational attainment, low-income level, lack of previous Influenza vaccine uptake, lack of acquaintance with someone having suffered from COVID-19 infection, low COVID-19 vaccine knowledge, less fear and worry of contracting the infection and low risk perception. Other less commonly reported associated factors leading to low VH, identified from the studies, included healthcare sector-related profession, preexisting chronic disease, positive attitude toward general vaccination, COVID-19 vaccine access and price and migrant status. For healthcare workers, years of experience, practice setting, previous provision of care for COVD-19 patient and mode of contact (direct versus indirect) with patients were found to be associated with VH in the included studies. For pregnant and lactating women, pregnant or breastfeeding status, knowledge of other pregnant and breastfeeding women being infected with COVID-19 or having had the vaccine and recommendation by obstetrician/gynecologist were important predictors for VH.

Few articles based on studies assessing hesitancy via HBM showed that it was consistently associated with constructs including preventive measures, perceived benefit, perceived barriers, cues to action and subjective norms. Studies also reported that attitudinal scores and protective measure adherence scores were also associated with COVID-19 VH.[25,42,71,77] In terms of personal perspectives leading to COVID-19 VH, the worry regarding vaccine side effects, insufficient time for vaccine testing, belief in natural immunity, belief that symptomatic cases are the only infection carriers, mistrust in government authorities, healthcare system and pharmaceutical companies, concerns on vaccine safety and effectiveness, experience of contracting infection after previous vaccine, belief in origin of the pandemic, conspiracy theories related to COVID-19 vaccine development, belief in community responsibility and vaccine compulsion for all citizens, were identified from the included studies. For communication and sources of information, studies reported that participants relying on a trusted source of information were less vaccine hesitant compared to those dependant on social media for updated information regarding the vaccines. Acquiring online information through nonscientific resources was found to reduce the acceptability of the vaccine.[64,90]

Discussion

This review documented a wide variation (5.4% – 83%) of COVID-19 vaccine hesitancy among countries of the Arab world. Variations were obvious in studies conducted in different countries as well as among the studies conducted in the same country. Hesitancy for booster dose was found to be comparatively less (21.8% – 55.4%). The most commonly reported factors associated with hesitancy included female gender, younger age, previous influenza vaccine uptake, and low education and income level. The most-reported personal concerns were related to the rapid development, safety, and long-term side effects of the vaccine. Moreover, overall lack of trust in government policies toward pandemic control, widespread conspiracy theories about vaccines, and different misconceptions increased the probability of COVID-19 vaccine hesitancy among population in these countries.

With the emergence of COVID-19 virus and infections, vaccine hesitancy became a hot research topic that has been studied extensively all around the globe. Vaccine acceptance ranges from as high as 90% in China to just 55% in Russia, while countries like the USA and Canada reported acceptance rates of 69% and 76.5%, respectively.[151] Similar considerable disparity in vaccine acceptance rates in the Arab world was reported in our article. The willingness to receive the vaccine was higher in studies from Saudi Arabia and Kuwait compared to other Arab countries.[34,63] The regional and worldwide variations could be attributed to the countries' differences in the effectiveness of the health systems in dealing with the pandemic, severity of the infection, the number of cases, and the mortality rates across the countries.[10] On the other hand, political instability, unfavorable legislation, and financial issues as well as educational status of the people may adversely affect people's opinions regarding vaccination as evident from differences in VH prevalence between Arabic and Western countries.[11,12] Other reasons may include conspiracy theories rooted in religious concerns and misinformation disseminated through various media platforms.[14,152] Variations in vaccine hesitancy were also evident from studies within the same country. For example, studies in Egypt reported hesitancy rates ranging from 12%[21] to 79%[18] depending on the studied area, such as urban or rural background, and the studied population (general population vs university students).

Interestingly, the high levels of vaccine hesitancy were not reflected in the vaccination rates. For instance, in the UAE, despite relatively high hesitancy rates (31.8% –75.6%), the vaccination rates are very high.[72] This could be related to the carefully planned and implemented effective policies that ensured vaccination of all community members.[153] The reviewed studies listed various factors that influence vaccine hesitancy among the studied populations. It was found that younger age, female gender or low levels of education are associated with high hesitancy levels, while previous intake of Influenza vaccine was perceived to increase the motivation to accept COVID-19 vaccination. Other reasons for the increased uptake of COVID-19 vaccines such as working in healthcare related profession, preexisting chronic diseases, good knowledge of COVID-19 disease and immigrant status, were also reported in a previous review on global hesitancy.[151]

Previous studies have found a clear association between the female gender and hesitancy. It is suggested that the influence of gender on the decision is most probably related to high anxiety levels in females in general and fear of needles in particular.[157] Moreover, pregnancy and breastfeeding are sensitive health matters that require careful considerations and decisions for vaccine uptake in this population. The higher

vaccine hesitancy rates in younger individuals may be related to the focus of the vaccination campaign on the elderly, providing false assurance for the younger generation that they are immune to the disease.[62] Previous Influenza vaccination uptake was found to be associated with increased COVID-19 vaccine acceptance in this review, as reported in another study conducted in the UK.[154] A recent review summarizing the coverage of Influenza vaccine in sixteen countries of WHO Eastern Mediterranean region informed that the vaccine was available free of charge to general public or at risk groups in most (81%) of these countries. However, the availability depended upon the resources and socioeconomic status of the country.[155]

A commonly stated concern related to the vaccines was emergency authorizations of vaccines which may have triggered questions about the unknown long-term side effects. Other worries were related to mistrust in the governments in general, especially after the chaotic situation that challenged the health systems and exposed all the deficiencies in emergency planning. Some surveys reported that people believe in conspiracy theories related to vaccines' efficacy and safety, production sites of the vaccines, and the uncertainties around the origin of the disease.[29,81] Moreover, self-perception of poor health triggered hesitancy[25,114] in contrast to people with chronic illness (hypertension, diabetes, etc.) who were more willing to get vaccinated.[51,58,123]

Many countries in the Arab region have encountered enormous disasters and tragedies including wars, political conflicts, and natural disasters. COVID-19 pandemic has further deteriorated the conditions of poverty and accessibility to medical treatment as well as vaccination services.[156] However, in a study that examined older Syrian refugees living in Lebanon, it was found that the intention to receive the COVID-19 vaccine is higher among those living inside refugee camps compared to those living outside the tented settlement. The study also argued that the vaccination and educational campaigns are overlooking many of those who are not registered informal refugee camps.[35]

Despite the inclusion of many high-quality studies in this review, there were some limitations, inconsistencies were noted with the definition and scope of hesitancy, classifying hesitancy and refusal separately in many studies conducted in the Arab world, as the standard definition developed by WHO for hesitancy was not followed. However, in this review, we have reported hesitancy as defined by WHO and prevalence might not be very precise given the large variation in the reported data. Another limitation is that most of the surveys conducted in the studies included in this review were carried out online, which is justifiable given the social distancing measures. However, this means that a large number of individuals from the Arab population were underrepresented such as those who do not have internet access, those from the low socio-economic strata especially people with low levels of education and older adults. Future studies are warranted to investigate the prevalence of COVID-19 vaccine hesitancy and associated factors in all subgroups of the population. Critical appraisal of the included studies, as well as meta-analysis to measure strength of association between VH and its predictors was not conducted. It would have added further to the evidence, yet with the coverage of extensive number of studies and given objective of the review, it was not feasible. Additionally, the review did not address parents' attitudes toward vaccination in the children. These limitations could potentially be addressed in future reviews.

Conclusion

In summary this review provided an overview of evidence on COVID-19 VH levels in the countries of Arab world and most commonly reported factors associated with it. Results suggested varied COVID-19 VH prevalence across different Arab countries. Most common factors associated with COVID-19 VH as reported in the studies included female gender, young age, low educational level and lack of previous vaccination against Influenza. Strategies for proper information dissemination and clarification of misconceptions regarding the vaccine are required. This will lead to improvement in vaccination uptake, thus preventing mortality and morbidity from the infection when acquired, in the future.

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CRediT authorship contribution statement

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