



## Original article

# Knowledge, attitude, and perception of public about participation in COVID-19 clinical trials: A study from Egypt and Saudi Arabia

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## ABSTRACT

**Background:** Pharmaceutical firms are striving to find potential treatments to prevent and treat COVID-19. One of the gold standards to evaluate treatment is a clinical trial; however, the difficulty in patient recruitment could act as a determinant. It is evident from the registry data that very few studies have been conducted involving the population of the Middle East and North Africa (MENA) region.

**Aim:** To document knowledge, perception, and attitude of the public from Two large countries in the MENA region (Egypt and Saudi Arabia) towards participation in clinical trials focused on evaluating potential COVID-19 treatments.

**Method:** A cross-sectional study was conducted that used a snowball sampling strategy for recruitment. General population 18 years old or older, who lived in Saudi Arabia or Egypt were invited. The survey was adopted from literature and was approved by an ethics committee.

**Results:** Out of 800 participants in the survey, 407 participants were from Egypt, and 393 were from Saudi Arabia. Most participants (48%) had moderate knowledge, i.e., >60% <80%. The results revealed poor attitude (88.5%) and poor perceptions (45.8%) regarding participation in COVID-19 clinical trials. Education and residence were identified as determinants of participants' knowledge, attitude, and perceptions. Participants' knowledge and understanding of COVID-19 trials did not impact their willingness to participate. This coupled with a poor attitude and perception among the masses drastically affects any potential for participation in future clinical trials.

**Conclusion:** A relatively small proportion of participants were interested in enrolling in COVID-19 studies. Increased collective engagement through social media and healthcare professionals can help improve attitudes and perceptions toward trial participation.

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## 1. Introduction

Coronavirus disease (COVID-19) pandemic affected more than 184,000,000 persons worldwide, with almost 4,000,000 deaths as of July 9, 2021 (World Health Organization, 2021). With this mas-

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sive number of confirmed COVID-19 cases, many scientists and companies worldwide are striving to find potential vaccines and treatments to prevent and treat COVID-19. Since late 2019, when it was detected in the city of Wuhan in China until July 9, 2021, more than 6000 studies for COVID-19 have been registered in a clinical trial registry such as ClinicalTrials.gov. These trials included different aspects of treatment, i.e., either vaccine-related or at least one drug intervention (ClinicalTrials.gov., 2021). The recruitment process into clinical trials is challenging (Trauth et al., 2000). Recruitment is critical to get a representative sample of the target population and to have the sample size required to achieve a powerful study (Umscheid et al., 2011). According to Williams et al. (2015), a low accrual rate is a leading reason for early termination among clinical trials registered on

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ClinicalTrials.gov (Williams et al., 2015). When the trial ends prematurely due to low recruitment, this can lead to scientific, ethical, and financial consequences. If the total sample size is not achieved, negative aspects such as affecting internal validity, failing to reach the targeted sample goal, and inadequate sample representativeness could occur. From an ethical perspective, if a study is prematurely terminated due to low accrual, this will not contribute to meaningful scientific knowledge. At the level of finance, the resources that have been allocated to the trial could have been used to support other trials (Williams et al., 2015; Fregni and Illigens, 2018).

Although the Middle East and North Africa (MENA) region has witnessed a rapid population growth and an increasing demand for medications, it only adds to less than 1% of global clinical trials (Nair et al., 2013). According to the Global Participation In Clinical Trials Report 2015–2016 released by the Food and Drug Administration (FDA), less than 2% of clinical trials participants enrolled by the pharmaceutical companies who later received FDA approval for new investigational products were enrolled from the MENA region (Food and Drug Administration, 2017). This study aims to assess the knowledge, perception and attitude towards participation in clinical trials among the public in Two large countries from the MENA region (Egypt and Saudi Arabia) focused on finding a cure or a vaccine for one of the most challenging pandemics in the 21st century. Our study results may have the potential to guide the regulatory authorities and pharmaceutical companies who are responsible for conducting COVID-19 clinical trials in Egypt and Saudi Arabia on the recruitment process. In addition, the results of this study may provide evidence to the policymakers to formulate guidelines for such endeavours.

## 2. Material and methods

### 2.1. Design and setting

This is a descriptive cross-sectional study conducted among the public from Egypt and Saudi Arabia. From October to November 2020, the study survey was distributed via social media.

### 2.2. Sampling and sample size

A snowball sampling strategy was followed for participants' recruitment. Accessible general population 18 years old or older, who lived in Saudi Arabia or Egypt and agreed to participate in the survey were enrolled. The figure for Saudi population is 34,218,169, and 100,937,419 for Egypt. The targeted representative sample size to be recruited was 768 participants, i.e., 384 each from Egypt and Saudi Arabia, based on a 95% confidence level and 0.05 margin of error. However, the final sample size was 800, distributed as 393 from Saudi Arabia and 407 from Egypt (Unified National Platform, 2020; Central Agency for Public Mobilization and Statistics, 2020).

### 2.3. Study instrument

This study survey was designed after adopting published surveys on this topic from Jordan and Korea. (Choi et al., 2016; Gharaibeh et al., 2020). The survey was composed of five sections written in Arabic and English language namely:

1. Agreement to participate in the survey anonymously.
2. Sociodemographic characteristics of the participants.
3. Knowledge about ongoing COVID-19 clinical trials. (5 items)
4. Attitude towards participation in COVID-19 clinical trials related to vaccine or treatment. (8 items)

5. Perception towards participation in COVID-19 clinical trials related to vaccine or cure. (7 items)

Responses to the questions assessing knowledge, attitude, and perception about COVID-19 trials were extracted. The following answers to the "Knowledge" section were considered correct: "Yes" for the first and fourth, and "No" for the third and fifth questions, while the second question was not graded. A high score means more knowledge.

The following answers to the "Attitude" section were considered correct:

"Yes" answer for the second to the last questions, while the first question wasn't graded. A high score means a more positive attitude.

The following answers to the "Perception" section were considered correct: "Yes" for the first, second, third, sixth, and seventh questions, and "No" for the fourth and fifth questions. A high score means excellent perception.

Each correct answer in the knowledge, attitudes, and perceptions section was awarded 2 points. Each section had a percentage score. Based on previous studies and Bloom's cut-off point criteria, levels of knowledge, attitude, and perception were classified in the following manner, i.e., high (above 80%), moderate (60% to 79%), and low (less than 60%) (A. Nahida. Knowledge, attitude and practice of dengue fever prevention among the people in male, Maldives, Published Master's Dissertation. Chulalongkorn, University, Thailand, 2007).

A pilot pre-test sample of thirty participants and experts' feedback about the content were used for content validation. After feedbacks and pre-test, some questions were simplified and articulated using more transparent language. The reliability of the survey was assessed by calculating Cronbach's alpha ( $\alpha$ ) for the pre-test sample responses. The Cronbach's  $\alpha$  was 0.79 for the "Knowledge" section, 0.69 for the "Attitude" section, and 0.7 for the section dedicated to documenting "Perceptions".

### 2.4. Statistical analysis plan

The numeric data were be presented as mean  $\pm$  SD, or as median and range according to the type of distribution, i.e., normal/non-normal. Besides, for categorical variables, percentages were used. The correlation between knowledge score, attitude score, and perception was measured using the spearman rank correlation coefficients. A regression model was used to measure the association between sociodemographic characteristics and scores of knowledge, attitude, and perception.

## 3. Results

### 3.1. Basic characteristics of the study population in Egypt and Saudi Arabia

Out of 800 participants in the survey, 407 participants were from Egypt, and 393 were from Saudi Arabia. Of the total study, 62.5% were females, and 37.5% were males. Most participants were married; 55.13% and 41% were single. The participants mainly had bachelor's degrees 54.37 while 31.63% were participating in post-graduate studies. Furthermore, 47.63% of participants were healthcare professionals, and 22.5% were from a non-healthcare background. In addition, 75.13% of respondents had a friend or family member diagnosed with COVID-19. From all basic characteristics, only education, employment, and having a friend or family member diagnosed with COVID-19 were significantly different between Egypt and Saudi Arabia with p-values (<0.001, <0.001, 0.045) respectively (Table 1).

**Table 1**  
Comparison of basic characteristics of the COVID-19 survey between Egypt and Saudi Arabia.

Basic characteristics	Egypt n (%)	Saudi Arabia n (%)	Total n (%)	P-value*
Age (Mean, SD)	32.1 (9.5)	31.5 (8.6)		0.308
<b>Sex</b>				0.898
Female	253 (62.2)	247 (62.8)	500 (62.50)	
Male	154 (37.8)	146 (37.2)	300 (37.50)	
<b>Nationality</b>				
Egyptian	402 (98.8)	79 (20.1)	481 (60.13)	
Saudi	0 (0.0)	263 (66.9)	263 (32.88)	
Jordan	0 (0.0)	3 (0.8)	3 (0.38)	
Lebanon	0 (0.0)	1 (0.3)	1 (0.13)	
Pakistani	0 (0.0)	5 (1.3)	5 (0.63)	
Philippine	0 (0.0)	19 (4.8)	19 (2.38)	
Indian	0 (0.0)	2 (0.5)	2 (0.25)	
Sudanese	3 (0.7)	15 (3.8)	18 (2.25)	
Syrian	0 (0.0)	1 (0.3)	1 (0.13)	
United Kingdom	0 (0.0)	2 (0.5)	2 (0.25)	
United States	2 (0.5)	0 (0.0)	2 (0.25)	
Yemen	0 (0.0)	3 (0.8)	3 (0.38)	
<b>Marital status</b>				0.089
Married	207 (50.9)	234 (59.5)	441 (55.13)	
Separated	13 (3.2)	12 (3.1)	25 (3.13)	
Single	183 (45.0)	145 (36.9)	328 (41.00)	
Widow	4 (1.0)	2 (0.5)	6 (0.75)	
<b>Education</b>				<0.001
Undergraduate	59 (14.5)	53 (13.5)	112 (14.00)	
Graduate	190 (46.7)	245 (62.3)	435 (54.37)	
Postgraduate Student	158 (38.8)	95 (24.2)	253 (31.63)	
<b>Employment</b>				<0.001
Healthcare profession	164 (40.3)	217 (55.2)	381 (47.63)	
Non-healthcare profession	123 (30.2)	57 (14.5)	180 (22.50)	
Housewife	37 (9.1)	29 (7.4)	66 (8.25)	
Un-employed	18 (4.4)	23 (5.9)	41 (5.13)	
Student	65 (16.0)	67 (17.0)	132 (16.50)	
<b>Health Condition</b>				0.201
COVID-19 active status	1 (0.25)	1 (0.25)	2	
Never had COVID-19	324 (79.8)	333 (84.52)	657	
Never had COVID-19, Having chronic condition (e.g., Hypertension, Diabetes, etc.)	39 (9.61)	22 (5.58)	61	
Recovered from COVID-19, No Chronic condition (e.g., Hypertension, Diabetes, etc.)	42 (10.34)	38 (9.64)	80	
Do you have a friend or a family member who has been diagnosed with COVID 19?				0.045
No	114 (28.0)	85 (21.6)	199 (24.88)	
Yes	293 (72.0)	308 (78.4)	601 (75.13)	
Have you ever been asked to participate in a clinical trial for a new medication or vaccine for COVID-19?				0.405
No	389 (95.6)	381 (96.9)	770 (96.25)	
Yes	18 (4.4)	12 (3.1)	30 (3.75)	

\*All P-values are based on chi-square analysis of numbers in Egypt and Saudi Arabia categories.

### 3.2. Knowledge about ongoing COVID-19 clinical trials in Egypt and Saudi Arabia

Regarding the knowledge about ongoing COVID-19 clinical trials in Egypt and Saudi Arabia, most participants (N = 464, 58%) heard about it. Assuming this figure as a 100%, more than half (N = 241, 51.9%) mentioning social media as a medium of information. Regarding the knowledge score of the participants, the majority (46%) had a moderate knowledge score (Table 2).

### 3.3. Attitude towards participation in COVID-19 clinical trials

Regarding the attitude towards participation in COVID-19 trials, most respondents (N = 744, 93%) indicated that they were never approached before. The majority was negative about participating in a trial for a new potential medication (N = 680, 85%) and potential vaccine candidate (N = 660, 82.5%) for COVID-19. The majority of participants (89%) had a poor attitude score (Table 3).

### 3.4. Perception towards participation in COVID-19 clinical trials in Egypt and Saudi Arabia

Regarding perception towards participation in COVID-19 trials, the majority (N = 730, 91.25%) had a point of view that clinical research is essential to develop a new vaccine for COVID-19. Most responded negatively to the notion that clinical research information from pharmaceuticals can be trusted (N = 443, 55.37%). The majority (45.8%) had a poor perception score (Table 4).

### 3.5. Correlation between knowledge, attitude, and perception

The degree of correlation was fair between knowledge-perception and attitude-perception in employment categories, i.e., healthcare professionals, non-healthcare professionals, as well as residence categories, i.e., Egypt and Saudi Arabia. However, the degree of correlation between knowledge-attitude was weak in all categories ( $r_s < 0.1$ ). The correlations between knowledge-attitude and knowledge-perception in healthcare professionals were higher than non-healthcare professionals; however, the

**Table 2**  
Knowledge about ongoing COVID-19 clinical trials in Egypt and Saudi Arabia.

Variable	n (% of participants)
1. Have you heard about any COVID-19 clinical trials in your country of residence?	
No	336 (42)
Yes	464 (58)
2. If you heard about the COVID-19 clinical trial in your country of residence, how did you hear about it?	
Social media	241 (51.9)
TV	104 (22.4)
Friends/Relative	54 (11.6)
Your healthcare provider	27 (5.8)
Newspaper	14 (3)
Search engine	9 (2)
Email	9 (2)
Radio	6 (1.3)
3. In diseases like COVID-19, do you think your physician can give you a new drug under investigation without your approval?	
No	705 (88.1)
Yes	95 (11.9)
4. Have you heard about an Institutional Review Board in your country of residence?	
No	361 (45.1)
Yes	439 (54.9)
5. Suppose that you have been enrolled in a COVID-19 clinical trial, do you think your confidential information will be published?	
No	649 (81.1)
Yes	151 (18.9)
Knowledge score	
More than 80% (excellent knowledge)	(21.9)
<80% and >60% on the knowledge score (moderate knowledge)	(46)
Less than 60% (poor knowledge)	(32.1)

correlation between attitude-perception was higher in non-healthcare professionals than healthcare professionals. In the residence category, data from Saudi Arabia showed higher correlations between knowledge-attitude and knowledge-perception than in Egypt. However, in Saudi Arabia, the correlation between attitude and perception was lower than in Egypt (Table 5).

### 3.6. Effect of sociodemographic factors on the KAP score of participation in COVID-19 clinical trials

#### 3.6.1. Univariate and multiple logistic regression of the associations between sociodemographic variables of the study population and KAP score (excellent vs. poor)

In the univariate analysis, increased odds of having excellent knowledge if the participant lived in Saudi Arabia compared to Egypt (OR: 1.53; 90% CI: 1.06–2.22,  $P < 0.05$ ) was observed. Also, increased odds of having excellent knowledge if the participant was an undergraduate compared to being a postgraduate (OR: 2.22; 90% CI: 1.21–4.10,  $P < 0.05$ ) was observed. Furthermore, decreased odds of having an excellent attitude if participants lived in Saudi Arabia compared to Egypt (OR: 0.55; 95% CI: 0.32–0.92,  $P < 0.05$ ) was seen and, decreased odds of having an excellent attitude if they were graduates compared to postgraduate (OR: 0.56; 95% CI: 0.32–0.98,  $P < 0.05$ ) was reported. Furthermore, increased odds of having an excellent perception if the participant lived in Saudi Arabia compared to Egypt (OR: 1.73; 90% CI: 1.25–2.38,  $P < 0.05$ ) was seen and increased odds of having an excellent perception if the participant was a graduate compared to postgraduates (OR: 1.78; 90% CI: 1.08–2.97,  $P < 0.05$ ) was reported from the data (Table 6). In multivariate logistic regression analysis, being an undergraduate increased the odds of having excellent knowledge compared to postgraduates (aOR: 2.25; 90% CI: 1.02–

**Table 3**  
Attitude towards participation in COVID-19 clinical trials in Egypt and Saudi Arabia.

Variable	Total n (%)
1. If you have been invited to participate in the COVID-19 clinical trial, what happened?	
I declined to take part in the trial	43 (5.38)
I have never been approached before	744 (93)
I took part and completed the trial	10 (1.25)
I took part but withdrew before the end	3 (0.38)
2. Are you interested in learning more about taking part in COVID-19 clinical trials?	
No answer	7 (0.87)
No or not sure	422 (52.75)
Yes	371 (46.38)
3. Would you like to participate in a clinical trial for a new MEDICATION for COVID-19?	
No or not sure	680 (85)
Yes	120 (15)
4. Would you like to participate in a clinical trial for a new VACCINE for COVID-19?	
No or not sure	660 (82.5)
Yes	140 (17.5)
5. Do you agree with having a family member participate in COVID-19 clinical trials?	
No or not sure	690 (86.25)
Yes	110 (13.75)
6. Would you be prepared to participate in a COVID-19 clinical trial where treatment can be active or placebo?	
No or not sure	679 (84.88)
Yes	121 (15.12)
7. Would you be prepared to participate in a COVID-19 clinical trial where treatment will be assigned at random?	
No or not sure	693 (86.63)
Yes	107 (13.37)
8. Suppose that you have been enrolled in a random choice study if the treatment you were receiving did not suit you for any reason, you could always leave the study, and your doctor would then give you whatever other treatment might be appropriate for you. Would that encourage you to take part?	
No or not sure	552 (69)
Yes	248 (31)
Attitude score	
More than 80% (excellent attitude)	(8.4)
<80% and >60% on the knowledge score (moderate attitude)	(2.6)
Less than 60% (poor attitude)	(89)

5.01,  $P < 0.05$ ). In addition, decreased odds of having an excellent attitude were observed if the participants were graduates compared to postgraduates (aOR: 0.51; 90% CI: 0.27–0.93,  $P < 0.05$ ). Also, as in univariate analysis, only increased odds of having an excellent perception were reported if the participant lived in Saudi Arabia compared to Egypt (aOR: 1.78; 90% CI: 1.27–2.51,  $P < 0.05$ ) (Table 6).

#### 3.6.2. Univariate and multiple logistic regression of the associations between sociodemographic variables of the study population and KAP score (good vs poor)

In the univariate analysis, increased odds of having moderate knowledge were seen if being a male participant compared to being a female (OR: 1.51; 90% CI: 1.08–2.11,  $P < 0.05$ ). Also, we found increased odds of having a moderate knowledge if the participants were single compared to married (OR: 1.53; 90% CI: 1.10–2.14,  $P < 0.05$ ) and increased odds of having a moderate knowledge if the participant was a graduate compared to postgraduates (OR: 2.02; 90% CI: 1.19–3.51,  $P < 0.05$ ). Similarly, we found increased odds of having a moderate perception if the participant lived in Saudi Arabia compared to Egypt (OR: 1.90; 90% CI: 1.32–2.75,  $P < 0.05$ ) (Table 7). In multivariate logistic regression analysis, we found increased odds of having a moderate knowledge if being



**Table 4**  
Perception towards participation in COVID-19 clinical trials in Egypt and Saudi Arabia.

Variable	Total n (%)
1. From your point of view, clinical research is an essential step in developing a new treatment vaccine for COVID-19.	
No or not sure	70 (8.75)
Yes	730 (91.25)
2. From your point of view, hospitals that participate in COVID-19 clinical trials provide better healthcare.	
No or not sure	322 (40.25)
Yes	478 (59.75)
3. From your point of view, clinical research information provided by pharmaceutical companies can be trusted.	
No or not sure	443 (55.37)
Yes	357 (44.63)
4. If you decide not to participate in a COVID-19 clinical trial, you will expect that your doctor will not give you good care.	
No or not sure	614 (76.75)
Yes	186 (23.25)
5. From your point of view, human participants in the COVID-19 clinical trial will be treated like experimental animals.	
No or not sure	545 (68.12)
Yes	255 (31.88)
6. From your point of view, volunteers in COVID-19 clinical trials will get adequate compensation for their participation.	
No or not sure	432 (54)
Yes	368 (46)
7. From your point of view, volunteers in the COVID-19 clinical trials will get adequate information about the trial they participate in.	
No or not sure	328 (41)
Yes	472 (59)
Perception score	
More than 80% (excellent perception)	(32.6)
<80% and >60% on the knowledge score (moderate perception)	(21.6)
Less than 60% (poor perception)	(45.8)

a male participant compared to being a female (aOR: 1.56; 90% CI: 1.10–2.20,  $P < 0.05$ ) and increased odds of having a moderate knowledge if the participants were single as compared to being married (aOR: 1.60; 90% CI: 1.06–2.43,  $P < 0.05$ ). Similarly, we found decreased odds of having an excellent attitude if the participants were graduates compared to postgraduates (aOR: 0.51; 90% CI: 0.27–0.93,  $P < 0.05$ ). Also, as in univariate analysis, we found only increased odds of having a moderate perception if the participant lived in Saudi Arabia as compared to Egypt (aOR: 2.04; 90% CI: 1.39–3.01,  $P < 0.05$ ) (Table 7).

#### 4. Discussion

To our knowledge, there is a scarcity of data pertaining to knowledge, attitude, and perception towards participation in clinical trials among the public from this region. A lot of published

literature report data from the healthcare settings in the region (Al-Dakhil et al.,2016; Altaf et al.,2019; Gharaibeh et al.,2020; Lawati et al., 2018; Nasef et al.,2014). This study highlighted that only 15–17.5% of the surveyed people were willing to participate in COVID-19 clinical trials. However, there was a difference in the eagerness according to the intervention type. In our survey, vaccine trials appeared more appealing for participant enrollment than treatment-related trials (17.5% vs. 15%). The mentioned percentage is lower than the percentage reported from previous surveys conducted to assess people's agreement to participate in any clinical trial in the MENA region (Al-Rawashdeh et al.,2019; Altaf et al.,2019; Gharaibeh et al.,2020; Lawati et al., 2018;Nasef et al.,2014). A public survey conducted in Saudi Arabia demonstrated that 26.9% of the participants were willing to participate in clinical trials (Al-Rawashdeh et al.,2019). In previous surveys conducted in healthcare settings, the willingness to participate in clinical trials ranged from 27.5 to 53.2% between patients or their relatives (Altaf et al.,2019; Gharaibeh et al.,2020; Lawati et al., 2018;Nasef et al.,2014). An important aspect to consider when interpreting the low enrollment results from our study is the presence of rumors and smear campaigns surrounding the vaccines and treatment related to COVID-19 that would not have been in the case of previous studies. It has been observed that inappropriate perception towards pharmaceuticals could significantly affect the attitude towards participation (Madsen, Holm & Riis, 2007). Since participants in our study also held such perception, there is a likelihood that this would have hindered their intent to participate in such trials. However, it has not been thoroughly investigated.

#### 4.1. Knowledge and approach

A total of 464 (58%) of the study population heard about ongoing COVID-19 clinical trials in their countries of residence. Around Fifty-three percent of the participants are potential candidates as they reported their interest in learning more about taking part in COVID-19 related clinical trials. It was noticed that most of the population circles were not approached. This highlights an opportunity for increasing the recruitment rate. Counseling the public and more illustrations about the nature of current trials can increase enthusiasm about participation and change public perception towards involvement in such studies (George et al., 2015). Our study population received information mainly from social media. As social media becomes a part of people's daily lives, media platforms and their user analytics can be used as a powerful enrollment tool for COVID-19 trials. Such media-based approaches have shown potential in amplifying patient recruitment for HIV vaccine clinical trials (Sitar et al., 2009).

Although there are some ethical issues associated with this approach for recruitment, such as the privacy of user's information, there is legislative guidance that regulates these aspects and helps

**Table 5**  
Correlation between knowledge, attitude, and perception (KAP) scores based on employment and residence.

Variables	$r_s$ with 95 %CI			$r_s$ with 95 %CI			$r_s$ with 95 %CI
	Healthcare professional (n = 381)	Not Healthcare professional (n = 419)	P-value	Egypt (n = 407)	Saudi Arabia (n = 393)	P-value	
Knowledge-attitude	0.080 (-0.020–0.180)	0.052 (-0.042–0.146)	0.692	0.048 (-0.05–0.147)	0.084 (-0.012–0.179)	0.610	0.066 (-0.003–0.134)
Knowledge-perception	0.245 (0.147–0.343)	0.133 (0.035–0.230)	0.102	0.144 (0.046–0.241)	0.206 (0.105–0.307)	0.367	0.186 (0.117–0.256)
Attitude-perception	0.256 (0.164–0.348)	0.368 (0.284–0.451)	0.080	0.351 (0.267–0.436)	0.279 (0.189–0.368)	0.260	0.314 (0.252–0.376)

All P-values are based on Fisher's R- to- Z transformation of correlation coefficients in Egypt, Saudi Arabia, Healthcare professionals' and non-healthcare professionals' categories.

$r_s$ : Spearman rank correlation coefficients.

CI: Confidence intervals.

**Table 6**

Multiple logistic regression analysis showing predictors of knowledge, attitude, and perception levels (excellent vs. poor).

Dependent variable	Independent variable	Categories	Poor (<60% of right answers)	Excellent (>80% of right answers)	OR (90% CI)	P-value	aOR (90% CI)	P-value
Knowledge	Age	Mean (SD)	32.4 (9.0)	31.2 (8.8)	0.98 (0.96–1.00)	0.129	1.00 (0.98–1.03)	0.789
		Sex	Female	186 (60.8)	120 (39.2)	–	–	–
	Residence	Male	89 (55.6)	71 (44.4)	1.24 (0.84–1.82)	0.283	1.25 (0.83–1.87)	0.285
		Egypt	153 (64.0)	86 (36.0)	–	–	–	
	Marital status	Saudi Arabia	122 (53.7)	105 (46.3)	1.53 (1.06–2.22)	0.025	1.44 (0.98–2.13)	0.064
		Married	167 (62.3)	101 (37.7)	–	–	–	
	Profession	Single	95 (53.7)	82 (46.3)	1.43 (0.97–2.10)	0.070	1.36 (0.83–2.22)	0.220
		Separated	11 (61.1)	7 (38.9)	1.05 (0.38–2.76)	0.919	1.16 (0.41–3.10)	0.775
		Widower	2 (66.7)	1 (33.3)	0.83 (0.04–8.74)	0.877	0.85 (0.04–9.96)	0.898
	Education level	Not Healthcare professional	144 (59.3)	99 (40.7)	–	–	–	
		Healthcare professional	131 (58.7)	92 (41.3)	1.02 (0.71–1.48)	0.910	1.29 (0.83–1.99)	0.258
		Postgraduate Studies	101 (65.2)	54 (34.8)	–	–	–	
	Perception	Graduate	147 (58.3)	105 (41.7)	1.34 (0.88–2.03)	0.171	1.34 (0.84–2.15)	–
		Undergraduate	27 (45.8)	32 (54.2)	2.22 (1.21–4.10)	0.010	2.25 (1.02–5.01)	0.045
Attitude	Age	Mean (SD)	32.0 (9.1)	30.1 (7.9)	0.97 (0.94–1.00)	0.093	0.97 (0.93–1.01)	0.197
		Sex	Female	444 (91.7)	40 (8.3)	–	–	–
	Residence	Male	264 (90.7)	27 (9.3)	1.14 (0.67–1.88)	0.627	1.13 (0.67–1.91)	0.637
		Egypt	352 (89.1)	43 (10.9)	–	–	–	
	Marital status	Saudi Arabia	356 (93.7)	24 (6.3)	0.55 (0.32–0.92)	0.025	0.61 (0.35–1.04)	0.076
		Married	395 (92.3)	33 (7.7)	–	–	–	
	Profession	Single	282 (89.2)	34 (10.8)	1.44 (0.87–2.39)	0.153	1.04 (0.54–1.96)	0.916
		Separated	25 (100.0)	0 (0.0)	NA	–	NA	–
		Widower	6 (100.0)	0 (0.0)	NA	–	NA	–
	Education level	Not Healthcare professional	366 (90.1)	40 (9.9)	–	–	–	
		Healthcare professional	342 (92.7)	27 (7.3)	0.72 (0.43–1.20)	0.211	0.71 (0.39–1.29)	0.265
		Postgraduate Studies	221 (89.1)	27 (10.9)	–	–	–	
	Perception	Graduate	394 (93.6)	27 (6.4)	0.56 (0.32–0.98)	0.042	0.51 (0.27–0.93)	0.029
		Undergraduate	93 (87.7)	13 (12.3)	1.14 (0.55–2.28)	0.708	0.63 (0.25–1.59)	0.335
Perception	Age	Mean (SD)	32.6 (9.5)	31.1 (8.9)	0.98 (0.96–1.00)	0.041	0.99 (0.97–1.01)	0.375
		Sex	Female	226 (57.7)	166 (42.3)	–	–	–
	Residence	Male	140 (59.6)	95 (40.4)	0.92 (0.66–1.28)	0.637	0.88 (0.62–1.23)	0.454
		Egypt	215 (64.6)	118 (35.4)	–	–	–	
	Marital status	Saudi Arabia	151 (51.4)	143 (48.6)	1.73 (1.25–2.38)	0.001	1.78 (1.27–2.51)	0.001
		Married	204 (58.6)	144 (41.4)	–	–	–	
	Profession	Single	142 (56.6)	109 (43.4)	1.09 (0.78–1.51)	0.617	0.86 (0.56–1.29)	0.458
		Separated	15 (68.2)	7 (31.8)	0.66 (0.25–1.61)	0.379	0.65 (0.24–1.62)	0.376
		Widower	5 (83.3)	1 (16.7)	0.28 (0.01–1.78)	0.252	0.44 (0.02–3.10)	0.472
	Education level	Not Healthcare professional	192 (58.5)	136 (41.5)	–	–	–	
		Healthcare professional	174 (58.2)	125 (41.8)	1.01 (0.74–1.39)	0.931	1.03 (0.71–1.48)	0.884
		Postgraduate Studies	115 (57.5)	85 (42.5)	–	–	–	
	Perception	Graduate	213 (62.8)	126 (37.2)	0.80 (0.56–1.14)	0.221	0.71 (0.48–1.04)	0.078
		Undergraduate	38 (43.2)	50 (56.8)	1.78 (1.08–2.97)	0.026	1.60 (0.84–3.04)	0.152

the institutions and their research boards to regulate the involvement of social media in clinical trial recruitment (Gelinas et al., 2017).

#### 4.2. Willingness to participate in COVID-19 clinical trials

We can divide our surveyed sample into two groups; the first group represented the people who were willing to participate in COVID-19 clinical trials, while the second group represented the people who were unwilling to participate. There should be a plan to reach the first group and approach them for participation. Most participants do not expect to receive adequate compensation from participation in any COVID-19 clinical trial. In addition, they do not trust the information provided by pharmaceutical companies.

There should be a plan to change the public mindset and improve their understanding of participating in a clinical trial. As reported in the literature from the MENA region, the main reasons for participation in clinical trials are to offer help to others, providing access to medical care, religious beliefs, and altruism. The main objections to participation in clinical trials reported from the MENA region are fear of adverse effects of the new intervention, absence of financial compensation, and time constraints (Al-Dakhil et al., 2016; Gharaibeh et al., 2020; Tohid et al., 2017).

Based on our results and the mentioned motivations and objections, we suggest some strategies that can help in developing a plan for changing culture toward COVID-19 clinical trials:

- 1- Decreasing the time commitment needed for follow-up by scheduling virtual out-patient department (OPD) appointments and home lab tests.
- 2- Ensuring adequate compensation for COVID-19 trial's participants under full control of institutional review boards (IRBs) to avoid affecting the decision of participation.
- 3- Targeting the friends and relatives of COVID-19 recovered patients and counseling them about the importance of clinical trials in helping their beloved people find a life-saving cure or vaccine.
- 4- Including religious institutions in an awareness campaign may play a fundamental role in motivating the population to learn more about clinical trials and change their attitudes.
- 5- Including the clinical trials culture as a part of student's curriculums.
- 6- Improving the public's understanding of the use of social media in activities involved in conducting clinical trials.

#### 4.3. Healthcare professional

A notable aspect of this study is that the odds of having an excellent or good knowledge, attitude, and perception did not increase in the case of being a healthcare professional. We assume

**Table 7**  
Multiple logistic regression analysis showing predictors of knowledge, attitude, and perception levels (moderate vs. poor).

Dependent variable	Independent variable	Categories	Poor (<60% of right answers)	Moderate (<80% and greater than 60% right answers)	OR (90% CI)	P-value	aOR (90% CI)	P-value
Knowledge	Age	Mean (SD)	32.4 (9.0)	31.6 (9.2)	0.99 (0.97–1.01)	0.254	1.01 (0.99–1.03)	0.486
		Sex	Female	186 (48.9)	194 (51.1)	–	–	–
	Residence	Male	89 (38.9)	140 (61.1)	1.51 (1.08–2.11)	0.016	1.56 (1.10–2.20)	0.012
		Egypt	153 (47.7)	168 (52.3)	–	–	–	–
	Marital status	Saudi Arabia	122 (42.4)	166 (57.6)	1.24 (0.90–1.71)	0.189	1.25 (0.89–1.76)	0.193
		Married	167 (49.1)	173 (50.9)	–	–	–	–
	Profession	Single	95 (38.6)	151 (61.4)	1.53 (1.10–2.14)	0.012	1.60 (1.06–2.43)	0.026
		Separated	11 (61.1)	7 (38.9)	0.61 (0.22–1.60)	0.325	0.74 (0.27–1.96)	0.557
		Widower	2 (40.0)	3 (60.0)	1.45 (0.24–11.10)	0.687	1.52 (0.23–12.58)	0.665
		Not Healthcare profession	144 (45.0)	176 (55.0)	–	–	–	–
Education level	Healthcare profession	131 (45.3)	158 (54.7)	0.99 (0.72–1.36)	0.935	1.13 (0.79–1.63)	0.505	
	Graduate	147 (44.5)	183 (55.5)	1.28 (0.90–1.83)	0.166	1.32 (0.90–1.93)	0.154	
	Postgraduate Studies	101 (50.8)	98 (49.2)	–	–	–	–	
	Undergraduate	27 (33.8)	53 (66.2)	2.02 (1.19–3.51)	0.011	1.88 (0.98–3.65)	0.061	
Attitude	Sex	Female	444 (96.5)	16 (3.5)	–	–	–	–
		Male	264 (96.7)	9 (3.3)	0.95 (0.40–2.13)	0.896	0.90 (0.37–2.08)	0.814
	Residence	Egypt	352 (96.7)	12 (3.3)	–	–	–	–
		Saudi Arabia	356 (96.5)	13 (3.5)	1.07 (0.48–2.41)	0.866	0.95 (0.41–2.20)	0.900
	Marital status	Married	395 (96.8)	13 (3.2)	–	–	–	–
		Single	282 (95.9)	12 (4.1)	1.29 (0.57–2.89)	0.529	0.99 (0.34–2.79)	0.979
	Profession	Separated	25 (100.0)	0 (0.0)	NA	–	NA	–
		Widower	6 (100.0)	0 (0.0)	NA	–	NA	–
		Not Healthcare professional	366 (96.6)	13 (3.4)	NA	–	NA	–
		Healthcare professional	342 (96.6)	12 (3.4)	0.99 (0.44–2.21)	0.976	1.45 (0.55–3.95)	0.454
Education level	Graduate	394 (96.6)	14 (3.4)	1.57 (0.59–4.91)	0.392	1.70 (0.60–5.61)	0.341	
	Postgraduate Studies	221 (97.8)	5 (2.2)	–	–	–	–	
	Undergraduate	93 (93.9)	6 (6.1)	2.85 (0.84–10.11)	0.090	3.27 (0.67–16.88)	0.147	
Perception	Age	Mean (SD)	32.6 (9.5)	31.1 (8.2)	0.98 (0.96–1.00)	0.071	0.99 (0.96–1.02)	0.452
		Sex	Female	226 (67.7)	108 (32.3)	–	–	–
	Residence	Male	140 (68.3)	65 (31.7)	0.97 (0.67–1.41)	0.879	0.96 (0.65–1.42, p = 0.849)	–
		Egypt	215 (74.4)	74 (25.6)	–	–	–	–
	Marital status	Saudi Arabia	151 (60.4)	99 (39.6)	1.90 (1.32–2.75)	0.001	2.04 (1.39–3.01)	<0.001
		Married	204 (68.7)	93 (31.3)	–	–	–	–
	Profession	Single	142 (64.8)	77 (35.2)	1.19 (0.82–1.72)	0.358	1.14 (0.71–1.83)	0.595
		Separated	15 (83.3)	3 (16.7)	0.44 (0.10–1.37)	0.201	0.44 (0.10–1.40)	0.206
		Widower	5 (100.0)	0 (0.0)	NA	–	NA	–
		Not Healthcare professional	192 (67.8)	91 (32.2)	–	–	–	–
Education level	Healthcare professional	174 (68.0)	82 (32.0)	0.99 (0.69–1.43)	0.975	0.95 (0.62–1.44)	0.802	
	Graduate	213 (68.9)	96 (31.1)	0.98 (0.65–1.47)	0.914	0.82 (0.52–1.28)	0.379	
	Postgraduate Studies	115 (68.5)	53 (31.5)	–	–	–	–	
	Undergraduate	38 (61.3)	24 (38.7)	1.37 (0.74–2.50)	0.308	0.97 (0.45–2.05)	0.933	

that this can be attributed to the negative psychological consequences of the healthcare crisis on the providers of healthcare who have more stress and anxiety levels than the general population (Alkhamies et al., 2020).

Healthcare professionals play a vital role in the successful recruitment process for COVID-19 trials. Patients usually trust their physicians, and they will be inclined to participate in clinical trials if their primary physicians extended the invitation for enrolment (Al-Dakhil et al., 2016). This is consistent with our results that most participants believed that their physicians would not give them a new treatment under investigation without their approval. Thus, the majority did not expect that their refusal to participate in a COVID-19 trial offered by their physicians would affect the quality of care provided.

In our study population, more than 13% can change their status from declining to the agreement in case of discussion with their

healthcare provider about the nature of randomized COVID-19 clinical trials and their right to withdraw at any time and receive the appropriate management. Therefore, healthcare professionals should take the lead in fostering a culture of openness towards trials and change public perception towards COVID-19 clinical trials. Based on our results, the increase in the knowledge of healthcare professionals about the COVID-19 clinical trials correlates with a more positive attitude than the non-healthcare professionals.

#### 4.4. Female representation

It was interesting to find no difference between females and males in the prediction factors associated with perception and attitude. This provides a good opportunity to overcome the issue of the under-representation of women in clinical research (Feldman et al., 2019).

#### 4.5. Limitations

As the sampling technique was done using the snowball strategy, this may affect the selection and presentation of the actual population. For example, there is an over-representation of healthcare professionals in our sample. Despite the study conduction in two large countries in the MENA region (Egypt and Saudia Arabia), the results may not be generalizable to the whole region.

#### 5. Conclusions

This study highlights that a relatively small proportion of participants were interested in enrolling in such studies. Despite most participants having moderate knowledge and understanding of COVID-19 trials, many had poor attitudes and perceptions. Participants' knowledge and understanding of COVID-19 trials did not impact their willingness to participate. This coupled with a poor attitude and perception among the masses drastically affects any potential for participation in future clinical trials. Additionally, the study highlights the existence of potential misunderstandings regarding COVID-19 treatments, which may foster a negative attitude and perception toward study enrollment. Finally, the study recommends that increased collective engagement through social media and healthcare professionals can help improve attitudes and perceptions toward trial participation.

#### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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