

# The Impact of Health Status of Academic Staff on Attitudes towards COVID-19 Vaccination

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## Research Article

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# Abstract

**Background** The outbreak of COVID-19 has had overwhelming effects on human lives, properties, and access to essential services in the society. Consequently, the manufacturing of vaccine was envisaged a milestone in effort towards 'normalizing' the world. With discourses around the efficacy of the vaccines, it is unclear whether having a health condition could influence once decision to accept the vaccine or encourage others to receive the vaccine. This study attempted to contribute towards this debate by assessing the impact of health status on attitude towards the COVID-19 vaccine. **Methods** A questionnaire, known as, the Attitude towards COVID-19 Vaccination Scale was developed to collect data from participants at school contexts. A total of 1047 participants completed questionnaire from 22 countries. The data was subjected to a two-way factorial analysis of variances. **Results** The result showed a direct effect of health status of individuals on attitude towards COVID-19 vaccination. It appears that healthier individuals are more willing to accept the vaccine than those who indicated they had minor or chronic health conditions. Also, individuals who were vaccinated appears to be more receptive towards the vaccine than those who were yet to receive the vaccine. Moreover, it emerged that the more the educated individuals have, the more likely they would hold favourable disposition, less hesitant and open to vaccination than those with little or no education. **Conclusions** The results call for more deliberate approach by countries to promote the use of the vaccines especially among those underlying health condition. Other implications of the study are discussed in more detail.

## Background

The global outbreak of the novel coronavirus disease (COVID-19) has had devastating impact on lives, provision of essential services and industries [1-9]. The COVID-19 disease is caused by severe acute respiratory syndrome coronavirus 2 (SAR-COV-2) [10-12]. The major symptoms include but not limited to respiratory difficulties, fever, cough, and muscle pain [13-17]. According to WHO, as of August 10, 2021, a total of 202,608,306 confirmed cases of COVID-19 has been reported globally with a total death of 4,293,591 [18]. The most affected areas with high incidence of infection and deaths are the Americas, Europe and South-East Asia [18, 19, 20]. Interventions such as social distancing, regular washing of hands and the use of masks have been widely accepted as measures to curb the spread of the disease [20]. After a year of research studies, vaccines have been manufactured to help protect the global population from the effect of the disease [21, 22]. While inequalities in accessing the vaccine have been well noted [23], in some countries, anecdotal evidence shows that there are intense campaigns and media outrage over the effects of the vaccines on individuals. These skepticisms and anti-COVID vaccination have contributed to resistance and hesitance in a large section of the population towards COVID-19 vaccinations. As part of the efforts towards promoting vaccination among the populace, there is a need to understand whether individual's health status could influence attitudes towards COVID-19 vaccination.

The COVID-19 pandemic has become public health emergency in almost all countries [9]. While precautionary measures are in place, at the height of the pandemic, there was lack of vaccines to treat

infected persons and promote the larger population. Consequently, a body known as COVID-19 vaccines Global Access Facility (COVAX) which is a collaboration of GAVI, Vaccine Alliance, Coalition for Epidemic Preparedness Innovation and WHO, teamed up to facilitate the manufacture as well as equitable distribution of the vaccines [18, 21-23]. COVAX raised over \$700 million for manufacturing COVID-19 vaccines. This effort, together with governmental support have led to breakthrough with the advent of vaccines such as Pfizer Covid-19 vaccine, AstraZeneca, Sinopharm, Sputnik and Moderna COVID-19 vaccines [9, 21]. Indeed, manufactures who have history of manufacturing drugs as well as new entrants into the pharmaceutical market worked towards developing COVID-19 vaccines. However, it remains unclear as to whether the type of available vaccine(s) in a given context could have impact on its uptake among the population.

There are inequalities between countries in terms of the vaccine being made accessible to the global population [21, 23, 24]. Although over 4 billion doses have been administered globally, large segment of population remain unvaccinated [18]. While uptake of the vaccine appears to be high in advanced countries, in some countries, governments are struggling to raise funds to purchase the vaccine for their population [24]. In many countries such as sub-Saharan African countries and certain areas and states in Australia, USA, uptake of the vaccination is still low, with advocacies by civil society groups, politicians and religious bodies exhorting citizens against vaccination. Although some known side effects of the vaccines have been reported which has influenced the decision of people against vaccination, there are others who thinks that the vaccines have been developed to cleanse the world population. Although, COVID-19 continue to be a public health risk however, the ongoing discussions on the vaccination has raised questions as to whether COVAX target of vaccinating a total of 80% of the world population by the end of 2021, can be achieved.

Consistently, it has been argued that individuals with underlying health conditions are at risk of acquiring COVID-19 [13-17, 25-29]. For example, in a review, Al-Quteimat et al. [13] noted that cancer patients were at susceptible to COVID-19, severe complications, and at risk of dying from cancer. Ehmsen et al. [16] reported that cancer patients are more prone to COVID and poorer prognoses outcome. This was attributed to the underlying cancer condition that leadto immunosuppression. Also, Sinha and Kundu [30] noted that acquisition of COVID-19 by cancer patients could enhance the development and weaken the individual. In relation to patients with solid tumor, Farooque et al. [17] reported a higher mortality among them compared to the general population. The psychological impact of COVID-19, in the form of anxiety, fear, stress and distress, on the general population and affected persons have been noted with a call for further attention paid to enhancing the well-being of the populace [31-35]. The risk of individuals with underlying health conditions probably lends support to study their extent of acceptance of the vaccine.

The attitude towards the COVID-19 vaccination has received some scholarly attention [36-39]. For instance, in a Chinese study, Wang et al. [38] used a cross-sectional design to explore the acceptance of the COVID-19 vaccine among adult Chinese. Majority of the study participants were willing to accept the vaccines, as according to them, it would help prevent the spread of the disease. The results also showed that males and married couples were more likely to receive the vaccination. Also, individuals with

a compromised medical history and at risk of infection were more likely to accept the vaccination. Other factors such as vaccine the safety of the vaccine and price could be a barrier to vaccination.

Unfortunately, this study was conducted before a breakthrough vaccine had been developed. The collection of data in China alone could affect generalization of the study findings. In a more recent study, Quinaibi et al. [39] compared the vaccine hesitancy between Arab speaking health workers and others. While the rate of acceptance of the vaccines were lower among Arab health workers, most participants were concerned about the side effect of the vaccine and the safety of the vaccines. The findings may be unacceptable because the authors compared the perspectives at item level. In fact, it is more appropriate to aggregate the attitudes in order to identify the factors that may influence acceptance of the extent of acceptance of the vaccine. To the best of our knowledge, attitudes of schools and universities staff toward COVID-19 vaccination is unresearched. With the outbreak of COVID-19 culminating in close down of schools and the risk of persons with underlying health conditions, this study recruited both teaching and non-teaching staff across the globe to develop insight into their attitudes towards vaccination. The following question guided the study reported here:

- Do available type of vaccine in a given context influence schools and universities staff attitudes towards COVID-19 vaccination?
- Do health status of schools and universities staff impact their attitude toward uptake of COVID-19 vaccine?
- Will health status and type of vaccine have influence on schools and universities staff attitude towards vaccination?

## Methods

### Study participants

The outbreak of COVID-19 has had devastating impact on education with most schools closing down or adopting online learning. With the advent of CoVID-19 vaccines, schools are slowly embracing the idea of a hybrid system of education. However, it is recommended that staff and adult students are vaccinated in order to protect lives and prevent the spread of the disease. In view of this, the target population for this study was individuals working at all levels of education (primary, secondary and university). In order to develop a snapshot of impact of health status on attitudes toward vaccination, potential participants were recruited from many countries. The inclusion criteria for the study were as follows: a) staff working in a schools and universities b) having access to internet to complete the questionnaire and; c) above 18 years of age and d) provide consent to participate in the study.

The online link to the question were shared on social media platforms such as Facebook, WhatsApp, LinkedIn and sent directly to personal email addresses of staff for onwards sharing with colleagues. A total of 1067 participants completed the online questionnaire. We decided to group the participants based on continent for better understanding of the findings. However, only few data were

collected from North America and South America and as such, informing the decision to delete those entries, leaving 1047 responses from 22 countries, for consideration for this study.

## Tool for data collection

This study was guided by a cross-sectional design which is usually conducted to understand the perspective of a section of the population about a given phenomenon at a point in time. Amidst current wave of COVID-19 and its impact on the education system, it was appropriate to focus on the uptake of COVID-19 vaccine among the working staff in schools. This would give a snapshot of how staff in schools and universities are embracing the COVID-19 vaccine.

In order to develop holistic understanding of attitudes toward vaccination, a quantitative approach was deemed appropriate to enable the collection of a large data for this study. Since there is lack of comprehensive tool which captures key issues concerning attitudes towards COVID-19 vaccination, a new tool known as Attitude towards COVID-19 Vaccination Scale (ACVS) was developed. The processes involved in obtaining content reliability, validation of the instrument and psychometric properties have been reported in Safi et al. (40).

The tool used for data collection consisted of two sections. The first section is made up of the demographic variables which included: gender, age, qualification, place of residence, health status, vaccine type available, COVID-19 acquisition status and vaccination status.

The second part in the ACVS which is made up of 26-items and is anchored on a five-point Likert Scale, ranging from 1 (do not agree) to 5 (strongly agree). The scale is made up of two sub-scales known as Opinion towards Vaccination Scale (OVS;  $n=6$ ) and Perceived Hesitancy Scale (PHS;  $n=20$ ). While three items were positively worded (in the OVS), the remaining 23 were negatively worded (in the PHS). During analysis, the negatively worded statements were reverse coded.

The mean score which is the sum mean divided by number of items, were computed for this study. On the OVS, a mean score of at least three were interpreted as favourable opinion towards vaccination. Also, on ACSC and PHS, mean score of at most 3 was interpreted as more favourable and less hesitant to receive vaccination, respectively. The computation of the reliability of the scale using Cronbach Alpha yielded the following psychometric properties: ACVS (.90), OVS (.93) and PHS (.76).

## Procedure

The Social Sciences Ethics Committee at United Arab Emirates University approved this study (approval number ERS\_2021\_7322). Due to the current wave of COVID-19, google forms which an online platform for data collection was used for data collection. Information statement about the study and links to the questionnaire was sent to institutional heads for onward sharing with members of their staff. Weekly reminders were sent to institutional heads and other individuals in order to encourage participation.

Social media platforms (such as WhatsApp, Facebook, LinkedIn, Instagram and twitter) were also used to conduct a digital campaign targeting a convenience sample in several countries from all around the world. Individually, the research team members shared the information statement of the study and link to the google forms on their social member platforms. An English and Arabic version of the questionnaire were used for data collection between April 2021 and June 2021. Data were collected anonymously, and no personal information about participants were collected. Informed consent was obtained from each participant before they took part in the study. Neither reimbursement nor financial reward was given to the participate who took part in this study.

## Data analysis

After the three months, the online platform was locked to avoid further completion of the questionnaire. The data was transferred to Microsoft excel for screening. Afterwards, the data were transferred to SPSS for further analysis. Since the data were normally distributed, the research team used parametric tests to answer the research questions.

To answer research questions 1 and 2, a two-way analysis of variance was used to understand the moderation effect of available vaccine type and health status on other demographic variables as well as on attitudes towards vaccination. Here, homogeneity variance was assessed using Levene's. Also, the weight of each result was assessed using the effect size which was interpreted as follows: small (.01 - .05), moderate (.06 - .09) and large (at least .1) [41].

To answer research question 3, hierarchical multiple regression was computed to assess whether vaccine type and health status will have direct influence on attitude towards vaccination. Vaccine type and health status were entered and other demographic variable were added in the model in step 2. The following checks were made to ensure that the data met the following assumptions: homogeneity of variance, homoscedasticity and multicollinearity [41].

### Table 1. Demographic Characteristics of study participants

<b>Demographics</b>	<b>Frequency</b>	<b>Percentages</b>
<b><i>Gender</i></b>		
Male	338	32%
Female	709	68%
<b><i>Age</i></b>		
18-25	159	15%
26-35	426	41%
36-45	337	32%
46 years and above	125	12%
<b><i>Qualification</i></b>		
High school	467	45%
Certificate	262	25%
Bachelor's degree	259	24%
At least Master's degree	59	6%
<b><i>Place of Residence</i></b>		
Africa	209	20%
Asia	688	66%
Europe	150	14%
<b><i>Health Status</i></b>		
Very Healthy	296	28%
Minor/Chronic health issues	851	72%
<b><i>COVID-19 acquisition status</i></b>		
Yes	173	17%
No	874	83%
<b><i>Vaccination status</i></b>		
Already vaccinated	639	61%
Not yet but intend to	278	26%
Not yet and won't	130	13%
<b><i>Vaccine available in my area (n = 1045)</i></b>		
Western Vaccine	474	45%

Non-western Vaccine	382	37%
Both	189	18%

## Results

Table 1 summarizes the demographic characteristics of participants who took part in this study. A total of 1047 participants from three continents working in schools and universities took part in this study. In terms of gender, 68% were females compared to 32% who were males. On age, 41% were 26-35 years, 32% were 36-45 years, and 12% were at least 46 years. On educational qualification, while 45% had high school qualification, 24% had Bachelor's degree, and 6% had at least master's degree (see Table 1 for more details).

## Interaction effect of vaccine type attitudes

A two-way between groups analysis of variance was conducted to explore whether available vaccine type in a given context will moderate the relationship between other variables and attitudes (see Table 2 for details). First, there was interaction effect between vaccine type and age on opinion about vaccination only,  $F(6, 1033) = 3.24, p = .004$ , small effect size, partial eta squared = .02. Post-hoc comparison using Tukey HSD test found no difference between the participants.

Second, there were interaction effect of available vaccine and gender of perceived hesitancy [ $F(2, 1039) = 5.83, p = .003$ , partial eta squared = .01] and attitude towards vaccination [ $F(2, 103) = 4.84, p = .008$ , partial eta squared = .009]. The results of the mean score showed that females were less hesitant and more positive towards the vaccination than males.

Third, available vaccine moderated the relationship between educational qualification of participants and, opinion [ $F(6, 1033) = 2.25, p = .04$ , partial eta squared = .01], perceived hesitancy [ $F(6, 1033) = 9.33, p = .001$ , with a moderate effect size, partial eta squared = .05] and attitudes toward vaccination [ $F(6, 1033) = 7.87, p = .001$ , partial eta squared = .04]. Post-hoc comparison using Tukey HSD test showed that the higher the education of participants, the more they would be less hesitant and positive towards receiving the vaccine than those with less qualification.

### Table 2. Interaction effect of vaccine available on attitudes

Variable	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	$\eta^2$
<b><i>Vaccine available X Age</i></b>					
<i>OVS</i>	6	46.01	3.24	.004**	.02
<i>PHS</i>	6	573.32	1.93	.07	.01
<i>ACVS</i>	6	647.59	1.88	.08	.01
<b><i>Vaccine available X Gender</i></b>					
<i>OVS</i>	2	34.96	2.45	.09	.005
<i>PHS</i>	2	1757.26	5.83	.003**	.01
<i>ACVS</i>	2	1705.06	4.84	.008**	.009
<b><i>Vaccine available X Qualification</i></b>					
<i>OVS</i>	6	32.01	2.25	.04*	.01
<i>PHS</i>	6	2681.37	9.33	.001**	.05
<i>ACVS</i>	6	2642.46	7.87	.001**	.04
<b><i>Vaccine available X Place of residence</i></b>					
<i>OVS</i>	3	10.31	.73	.53	.002
<i>PHS</i>	3	1433.67	5.22	.001*	.02
<i>ACVS</i>	3	1228.62	3.78	.01*	.01
<b><i>Vaccine available X Health Status</i></b>					
<i>OVS</i>	2	53.97	3.77	.02*	.007
<i>PHS</i>	2	713.63	2.37	.09	.005
<i>ACVS</i>	2	479.78	1.37	.26	.003
<b><i>Vaccine available X COVID-19 acquisition status</i></b>					
<i>OVS</i>	2	87.56	6.15	.002**	.01
<i>PHS</i>	2	201.65	.661	.52	.001
<i>ACVS</i>	2	283.83	.80	.45	.002
<b><i>Vaccine available X Vaccination status</i></b>					
<i>OVS</i>	4	23.38	1.78	.13	.007
<i>PHS</i>	4	835.97	3.13	.01**	.01
<i>ACVS</i>	4	976.33	3.01	.02*	.01

*\*p<.05; \*\*p<.01; \*p<.05; \*\*p<.01; \*p<.05; \*\*p<.01; OVS = Opinion towards Vaccination Scale; PHS = Perceived Hesitancy Scale; ACCS = Attitude towards COVID-19 Vaccination Scale*

Fourth, there was interaction effect between vaccine type and place of residence on perceived hesitancy [F (3, 1037) = 5.22, p = .001, partial eta squared = .02] and attitudes [F (3, 1037) = 3.78, p = .01, partial eta squared = .01]. Post-hoc comparison using Tukey HSD test showed a significant difference between participants, with those in Africa more hesitant and less positive towards vaccination than their counterparts in Asia and Europe.

There was also interaction effect of vaccine type available and health status on opinion towards vaccination only, F (3, 1037) = 2.56, p = .05, partial eta squared = .007. Similarly, there was interaction effect of vaccine type on COVID-19 acquisition status and opinion towards vaccination only, F (2, 1039) = 6.15, p = .002, partial eta squared = .01. In terms of health status, the mean score showed that those with minor/chronic health issues had position opinion towards the vaccination than the others without health issues. Related to this, those who had been diagnosed with COVID-19 had positive opinion about vaccination than those who indicated otherwise.

Furthermore, there was interaction effect between vaccine type and vaccination status on perceived hesitancy [F (4, 1036) = 3.13, p = .01, partial eta squared = .01] and attitudes towards vaccination, [F (4, 1036) = 3.01, p = .02, partial eta squared = .01]. Post-hoc comparison using Tukey HSD test showed that those who had been vaccinated and intend to vaccinate were less hesitant and more positive on vaccination than those who indicated they did not intend to vaccinate.

## Impact of health status on attitudes

Table 3 summarizes the result of a two-way analysis of variance computed to ascertain the relationship between the interaction effect of health status on attitudes toward vaccination. First, there was interaction effect of health status on age and opinion towards vaccination only, F (3, 1038) = 8.26, p = .001, partial eta squared = .02. Post-hoc comparison using Tukey HSD test showed no relationship between the participants.

Second, there was interaction effect of health status and education qualification on perceived hesitancy [F (3, 1038) = 3.43, p = .02, partial eta squared = .01] and overall attitude towards vaccination [F (3, 1038) = 3.04, partial eta squared = .009]. Post-hoc comparison using Tukey HSD test showed that those with lower qualification were more hesitant and appears to have negative attitude towards vaccination than those who had higher qualifications.

### Table 3. Interaction effect of health status on attitudes

Variable	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	$\eta^2$
<b><i>Health Status X Age</i></b>					
<i>OVS</i>	3	116.51	8.26	.001**	.02
<i>PHS</i>	3	123.64	.42	.74	.001
<i>ACVS</i>	3	343.23	.57	.63	.002
<b><i>Health Status X Gender</i></b>					
<i>OVS</i>	1	50.44	3.53	.06	.003
<i>PHS</i>	1	21.59	.07	.79	.001
<i>ACVS</i>	1	6.03	.02	.90	.001
<b><i>Health Status X Qualification</i></b>					
<i>OVS</i>	3	14.55	1.02	.38	.003
<i>PHS</i>	3	1014.06	3.43	.02*	.01
<i>ACVS</i>	3	1042.32	3.04	.03*	.009
<b><i>Health Status X Place of residence</i></b>					
<i>OVS</i>	1	78.07	5.44	.02*	.005
<i>PHS</i>	1	920.27	3.09	.08	.003
<i>ACVS</i>	1	462.27	1.33	.25	.001
<b><i>Health Status X COVID-19 acquisition status</i></b>					
<i>OVS</i>	1	4.62	.32	.57	.001
<i>PHS</i>	1	11857.51	40.67	.001**	.04
<i>ACVS</i>	1	12330.28	36.28	.001**	.03
<b><i>Health Status X Vaccination status</i></b>					
<i>OVS</i>	2	65.61	5.02	.007**	.01
<i>PHS</i>	2	740.96	2.78	.06	.005
<i>ACVS</i>	2	699.46	2.16	.12	.004

\**p*<.05; \*\**p*<.01; \**p*<.05; \*\**p*<.01; \**p*<.05; \*\**p*<.01; *OVS* = *Opinion towards Vaccination Scale*; *PHS* = *Perceived Hesitancy Scale*; *ACVS* = *Attitude towards COVID-19 Vaccination Scale*

Third, there was interaction effect of health status on place of residence on opinion towards vaccination only, *F* (3, 1042) = 5.44, *p* = .02, partial eta squared = .005. Post-hoc comparison using Tukey HSD test

showed that those who indicated they were residing in Africa were less positive on opinion than those who indicated otherwise.

Fourth, there was interaction effect of health status on COVID-19 acquisition status and perceived hesitancy [ $F(1, 1042) = 40.67, p = .001, \text{partial } \eta^2 = .04$ ] and attitude,  $F(1, 1042) = 36.28, p = .001, \text{partial } \eta^2 = .03$ . The mean score showed that on perceived hesitancy, those who had been diagnosed with COVID-19 were less hesitant toward the vaccination than those who had not been diagnosed. However, on overall attitude, those who had acquired COVID-19 were less positive toward the vaccination compared to those who indicated otherwise.

Last, there was interaction effect of health status on vaccination status and opinion only, [ $F(2, 1040) = 5.02, p = .007, \text{partial } \eta^2 = .01$ ]. Post-hoc comparison showed that those difference between those who had vaccinated and those who did not intend to vaccinate, with the former having unfavorable opinion than the latter.

## **Influence of health status and vaccine type on attitudes**

A hierarchical multiple regression was computed to assess the ability of health status and available vaccination type on attitude towards overall vaccination while controlling for other demographics (see Table 4 for details). In step 1, health status and vaccination type were entered in the model. The two variables made a significant contribution of only 2% in the variance in attitude,  $F(2, 1041) = 7.05, p = .001$ . however, only health status ( $\beta = .11, p = .001$ ) made significant contribution in the variance in attitude.

### **Table 4. Summary of the results of hierarchical multiple regression**

<i>Category</i>	<i>B</i>	<i>Beta</i>	<i>t</i>	<i>p</i>
<b>Step 1</b>				
Health Status	4.45	.11	3.43	.001**
Vaccination available	.96	.04	1.23	.22
<b>Step 2</b>				
Health Status	4.07	.10	3.26	.001**
Vaccination available	.25	.01	.32	.75
Age	-.83	-.04	-1.25	.21
Gender	-.52	-.01	-.39	.70
Place of residence	-2.67	-.08	-2.10	.04**
Qualification	-.48	-.02	-.70	.48
COVID-19 acquisition status	.73	.01	.48	.63
Vaccination status	5.98	.22	6.53	.001**

In step 2, the addition of six more demographic variables contributed to 9% in the variance in attitudes. The overall model made contribution of 11% in the variance in attitudes,  $F(8, 1034) = 13.34, p = .001$ . In the second model, the largest contribution of the variance was vaccination status (beta = .22,  $p = .001$ ). Once again, health status (beta = .10,  $p = .001$ ) made a significant contribution in the variance in attitude. Also, place of residence made significant contribution in the variance in attitudes.

## Discussion

In this study, attempt was made to understand the impact of health status on attitudes towards COVID-19 vaccination. With schools and universities closed down to face to face education and slowly adopting a hybrid teaching and learning approach, it was vital to ascertain whether health status of school staff could have impact on their attitude towards the COVID-19 vaccination.

The results showed that health status of individuals could have a possible impact on their attitude towards receiving or not receive the vaccine. It was evident that health status made a significant contribution in the variance in attitudes. This appears to suggest that as individuals become more healthier, the more they would be inclined to accept the COVID-19 vaccine. Inversely, it is possible that as individuals' health deteriorate, the more they would demonstrate unfavorable attitudes towards receiving the vaccine. Corpus of literature has reported that the intricate relationship between underlying health conditions and COVID-19 infection [25-29]. Also, as individuals with underlying conditions are diagnosed with COVID-19, they are more likely to die or suffer harsh consequences [17]. Unfortunately, the finding reported here had showed that those who are worse off may have unfavourable attitude towards the

vaccination. This pattern could be attributed to the fears they might have about the efficacy of the COVID-19 vaccine and probably its potential to weaken their immune system. This may have resulted in the healthiest population being more positive toward receiving the vaccine. Indeed, societies require healthy populace to support its development. However, the continuous spread of COVID-19 can have devastating effect on lives and properties. This potentially calls for more education towards alleviating the fears of individuals toward the COVID-19 vaccine.

The moderation effect of health status and vaccine type on vaccination status presented an interesting trend. For example, on health status, those who indicated they received vaccination had unfavourable opinion than those who had not vaccinated. Also, on vaccine type and vaccination status, those who had vaccinated and those intend to vaccinate were less hesitant and more positive on attitudes. To begin with, it appears that persons who had received the vaccine were not too concerned about whether the vaccine was manufactured, however, they were interested in taking them to boost their immune system. Probably, persons who had vaccinated or planned to do so understand the usefulness of the vaccine and committed towards receiving them. Conversely, the trend identified between health status and vaccination status could be attributed to the experience encountered by persons who had vaccinated and probably having health condition. It is evident that those with health condition are more likely to acquire COVID-19 as well as experience the devastating impact of the disease [25-29]. It is possible that those with health condition may be going through a relapse or their condition had worsen following receiving the vaccine. This probably calls for more studies using qualitative method to gather in-depth information about the experiences of individuals with chronic health problems who had received the vaccine.

The vaccination status of individuals had a direct effect on attitude towards vaccination. Specifically, individuals who had received the vaccine appears to be more receptive towards the vaccination. The effect of COVID-19 and society cannot be overemphasized. The availability of the vaccine should serve as a sigh of relief to humanity. However, there has been much discourse on the efficacy of the vaccine or even deliberations about its side effects [42, 43]. In other jurisdictions, conspiracy theories have been conjecturing that the vaccine has been developed to annihilate the global population. The finding here showed that those who had vaccinated have positive attitudes toward the vaccine as it may have enhanced their immune system and protect them from suffering the effect of COVID-19. These individuals could be at the frontline of public advocacy and sharing their stories to the general populace in order to change the minds of those who might have bought into the conspiracy theories. It is probably useful that they share their stories to increase public awareness of the benefits associated with the vaccination.

The continent of residence of participants provided useful insight into their attitude towards the vaccines. With respect to the interaction effect of vaccine type and health status, participants in Africa appears to be more hesitant, have unfavourable opinion and generally held negative attitude towards the vaccination. This is probably unsurprising because of the underlying poor health systems in Africa [44]. Potentially, African countries seemed not to have the financial muscle and the technology to develop its own vaccines [22, 23]. This appears to have led to a situation where less people have been vaccinated in

Africa compared to the other participants from Asia and Europe. Although COVAX appears to be working towards ensuring equitable access to vaccine to all [9], there appears to be limited vaccine in Africa to enable it to be accessible to all persons. The unavailability of the vaccine in Africa appears to have contributed to limited public education about the importance of the vaccine to the larger populace. It appears that Africa is behind when it comes to availability of the vaccine and public sensitization about mass vaccination. COVAX could expedite effort towards working with governments to make the vaccine available to the people in Africa. This could help change public perception and enhance public confidence towards receiving the COVID-19 vaccination.

The level of education of individuals appears to have impact on their attitudes towards vaccination. Regardless of the health status or the vaccine type available in a given context, the education of individuals could play a fundamental role on whether or not they would accept the vaccine. The results of the study seemed to show that the more educated the individuals, the more likely they would have positive attitude towards the vaccine. This is probably expected because educated persons may read about the disease and the vaccines available in their environment. Once they are convinced about efficacy of the vaccines, they might be in a good position to accept the vaccine. However, the findings present a new challenge for governments and public health officials with respect to expediting public education. It may be fair to postulate that the less the education of individuals, the more they may hold erroneous perceptions and be more hesitant towards receiving the vaccine. This could be a result of limited understanding of the science and potency of the vaccine. These groups may also be susceptible to misinformation from anti-vaccination groups. In places such as Africa where significant number of the population are under educated [45], it calls for more targeted education and intense advocacy to change public perception towards the vaccination.

## Study limitations

The findings of this study maybe interpreted with caution because of a number of limitations. First, the trend reported here were based on self-report of the participants. It was beyond the scope of the study to verify whether participants had been vaccinated, had health condition or had acquired COVID-19. Since the links were shared with individuals on social media platforms, it is possible that individuals who did not meet the inclusion criteria participated in the study. Second, although the study attempted to develop global understanding of attitudes towards COVID-19 vaccination, there were very few participants from the Americas. The few who completed the survey from Canada and US were deleted as they were insufficient for any useful comparison. Participants from over 22 countries have given useful baseline information with respect to the factors that might impact vaccine uptake among staff at schools and universities. Third, similar to quantitative studies, deep insights into the experiences of participants could not be reported here. Especially, the experiences of participants who have underlying health conditions, after taking the vaccine need to be studied to provide first-hand information to policymakers. Overall, this study has used a standard survey tool to study the impact of health status on attitude towards COVID-19 vaccines.

# Conclusions

In the study reported here, attempt was made to understand the effect of health status on attitude toward COVID-19 vaccines. Drawing on participants from school context, the result showed that the health status of individuals could play a pivotal role in schools and universities effort towards promoting COVID-19 vaccination. It appears the healthier individuals would be more willing to accept the vaccine than those who have minor or chronic health conditions. Also, individuals who were vaccinated appears to be more receptive towards the vaccine than those who were yet to receive the vaccine. Moreover, it emerged that as individuals receive more education, the more likely they would go for the vaccine. Further, the participants from Africa appears to be less receptive, more hesitant and held unfavourable disposition towards the vaccines. The emergence of the COVID-19 has negatively affected way of life and communities. It is important for schools and universities communities to be safe for all. This probably call deliberate effort by governments and international organizations to work together to promote uptake of the vaccine in countries.

These findings appear to provide useful guidelines on ways through which countries and international body such as COVAX could expedite and support advocacy towards vaccination. For instance, there appears to be inequity and less public education towards the vaccination in especially Africa. This probably underscore the need for COVAX to extend access to vaccines and partner government to promote vaccination in communities. Second, advocacy could target individuals living in deprived communities who may be at risk of education. This is because education level appears to influence attitude towards vaccination and thus, the need for more target education in deprived areas. Third, public education towards vaccination could also target individuals with underlying health conditions as they might have concerns about taking the vaccine. The education could help change their attitude and enable them to uptake the vaccine.

# Declarations

## **Ethics approval and consent to participate**

The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Social Sciences Ethics Committee at United Arab Emirates University (approval number ERS\_2021\_7322, April 10, 2021).

Informed consent was obtained from each participant before they took part in the study. Neither reimbursement nor financial reward was given to the participate who took part in this study.

## **Consent for publication**

Not applicable.

## **Data Availability Statement:**

The datasets used during the current study are available from the corresponding author on reasonable request.

### Competing interests

The authors declare no conflict of interest.

### Funding

No funding was obtained for this study.

### Author Contributions:

Dr. Safi, Dr. Hemdan and Dr. Mustafa participated in the conceptualization, design, conduct and completion of the research. Dr. Opoku, Dr. Safi, and Dr. Hemdan participated in the data analysis. Dr. Opoku, Dr. Safi, Dr. Hemdan and Dr. Mustafa contributed to writing, editing and reviewing the manuscript. All authors approved this manuscript and agreed with submission to Vaccines.

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