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Original Research

Vaccination hesitancy among adults in the United Arab Emirates: A vaccine attitudes examination scale study

Hiba Jawdat Barqawi, Teba Al-Khalidi, Sarah Hag-Ali, Zainab Suhail, Kamel A. Samara

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Abstract

Background: Vaccine hesitancy has been on the rise leading to a resurgence of multiple vaccine-preventable diseases. Results on vaccine hesitancy are scarce, both globally and in the United Arab Emirates (UAE). This study aims to explore the level of vaccine hesitancy and its determinants in the UAE's community, as well as the general attitudes and practices towards adult vaccination. **Methods:** An online cross-sectional study using the was conducted using convenience sampling. The questionnaire used the Vaccine Attitudes Examination (VAX) scale and was distributed between June and August 2021. The responses were imported into python for statistical analysis, including univariate, bivariate, and multivariate analysis. **Results:** 1072 responses were included in the final analysis. 28.82% had received the influenza vaccine (n=309) and 75.47% received the COVID-19 vaccine (n=809). The most common vaccine knowledge source reported was official health authorities at 63.43% (n=680) followed by healthcare professionals (57.09%, n=612), and internet/social media (41.7%, n=447). The two main worries about the vaccines were about long-term effects (46.92%, n=503) and the vaccine being developed too fast (33.49%, n=359). VAX scale showed that more vaccine hesitancy was driven by worry about future side effects and preference for natural immunity. Multivariate analysis showed that vaccine hesitancy decreased with the willingness to receive influenza, using the internet as a knowledge source, being a non-local Arab, being married, and having taken the influenza vaccine as an adult. On the other hand, higher educational level and being middle-aged predicted higher vaccine hesitancy. **Conclusion:** Vaccine hesitancy exists in the UAE and is a function of many variables. Public health interventions are needed to expand vaccine uptake and coverage, including addressing the public concerns of safety, efficacy, and side effects.

INTRODUCTION

Vaccination has been consistently shown to be cost-effective, reducing both disease morbidity and mortality as well as medical expenses.[19] However, back in 2019, the World Health Organization identified vaccine hesitancy as one of the top ten threats to global health that need to be addressed (World Health Organization, 2019). Sadly, hesitancy has been on the rise, and this has led to a resurgence of multiple vaccine-preventable diseases (VPDs), a phenomena compounded by healthcare disruptions by the pandemic.[18] This is due to vaccination programs' dependence on high uptake levels to achieve successful reduction in prevalence and incidence of VPDs, at which point herd immunity has been attained.[8] Vaccine hesitancy and all its drivers can undermine achieving herd immunity and contribute to the increase in VPDs.[17]

Hiba Jawdat BARQAWI*. Research Institute of Medical and Health Sciences, University of Sharjah, Sharjah 27272, United Arab Emirates. Department of Clinical Sciences, College of Medicine, University of Sharjah, Sharjah 27272, United Arab Emirates. hbarqawi@sharjah.ac.ae
Teba AL-KHALIDI. MBBS. Al Qassimi hospital, Emirates Health Services, Sharjah, UAE. U16103274@sharjah.ac.ae
Sarah HAG-ALI. MBBS. Cleveland Clinic Abu Dhabi, Abu Dhabi, UAE. U16103206@sharjah.ac.ae
Zainab SUHAIL. MBBS. Al-Jalila Children's Specialty Hospital, Dubai Health, Dubai, UAE. U16103784@sharjah.ac.ae
KAMEL A. SAMARA. MBBS. Department of Clinical Sciences, College of Medicine, University of Sharjah, Sharjah 27272, United Arab Emirates. U17103231@sharjah.ac.ae

Vaccine hesitancy is defined as "the delay in acceptance or refusal of vaccination despite availability of services,"[15] as such, it represents a complex phenomena influenced by contextual, individual, and vaccine factors all while encapsulating varying levels of hesitancy as opposed to a dichotomous feature. MacDonald and the Strategic Advisory Group of Experts on Immunization (SAGE) put forth the 3C model to explain the overarching themes driving hesitancy: confidence, complacency, and convenience.[15] Pre-COVID-19, most literature focused on either parental vaccine hesitancy or hesitancy related to specific vaccines such as influenza or HPV. Additionally, most instruments for vaccine hesitancy are geared towards pediatric vaccines, such as the Parent Attitudes about Childhood Vaccines (PACV) and the Vaccine Hesitancy Scale (VHS).[21,26]

METHODOLOGY

Questionnaire Development

The online survey tool was created on and distributed using Google Forms; it made use of the 12-item Vaccine Attitudes Examination scale (VAX)[21] and selective items of the WHO-SAGE's 10-item Vaccine hesitancy scale (VHS).[14] The survey comprised 36 close-ended questions in total, which consisted of Likert scales and multiple-choice questions. It was split into three main sections: demographics, general vaccine knowledge, attitudes, and practices, and vaccine hesitancy. The survey was then translated to Arabic and reviewed for consistency by language experts. A pilot study in both languages was carried out on 15 individuals of the general public who were not included in the data analysis. All feedback was reviewed, and appropriate changes were done. A participant information

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sheet (PIS) was presented before starting the questionnaire, and filling the questionnaire indicated written consent to participate in the study. Finally, the collected data was available only to the investigators to ensure confidentiality, and no identifying data was collected.

Research Design

A quantitative, cross-sectional study was conducted to assess vaccine hesitancy and general vaccine attitudes in the UAE population. A sample of Arabic and English-speaking adults were selected from June to August 2021 using a non-probability, convenience, snowball sampling method. Based on a 5% margin of error and 50% prevalence, a minimum sample size of 385 was calculated using the Cochran's sample size formula: $n= 4\times p\times(1-p)/SE^2$, where n is the sample size, p is the expected prevalence, and SE represents the sampling error. The inclusion criteria consisted of English and Arabic speakers, above the age of 18, residing in the UAE. The survey was self-administered voluntarily to participants of the seven Emirates (Abu Dhabi, Dubai, Sharjah, and the Northern Emirates). The survey was shared via social media platforms, specifically WhatsApp, Facebook, Twitter, Instagram, Reddit, and Telegram. Approval of the study was granted by the Research Ethics Committee, of the Medical Colleges, at the University of Sharjah. (REC-21-06-06-03-S).

Statistical Analysis

Data was exported from Google Forms to CSV format and processed in python-3 using the Matplotlib-v3.3.4, pandas-v1.2.4, and statsmodels-v0.12.2 packages for analysis and interpretation. The dataset had no missing values. Frequency distributions were calculated for categorical variables and age was binned into three groups. A VAX score was calculated for each participant by taking the weighted average of each of the twelve items in the VAX scale. The mistrust items were reversed during score calculation due to their positive wording (such that higher responses indicated higher hesitancy). The average VAX score was 3.31 with a standard deviation of 1.00; it was non-normal (p-value <0.0005 using the Shapiro-Wilk test) and as such non-parametric techniques were used for bivariate analysis. Specifically, Mann–Whitney U and Kruskal–Wallis H-tests were used, the former for binary variables and the latter for those with more than two categories. The cut-off for significance was a $P < 0.05$. Significant predictors were then fed into a Multivariate Ordinary Least Squares regression model. The minimum number of cases was met, which was calculated using 50 + 8m, where m is the number of predictors. No interactions were explored. F score and R-squared values were calculated for the model. All P-values reported are two-sided and all confidence intervals are profile confidence intervals.

RESULTS

Demographics

Of a total of 1,166 responses collected, 1072 met the inclusion criteria set and were included in the final analysis. 69.2% (n=742) of participants were females, with a mean age of 30 years (μ=30.3,σ=11.9). Only 39.4% were married (n=422) and nearly two-thirds were non-local Arabs. The majority of participants were college graduates, with those with a bachelor's degree or higher comprising 62.9% (n=674) of the sample. Healthcare workers were only 9.1% (n=98) of the sample while non-healthcare workers were more than half, at 53.9% (n=578). 70.3% (n=754) had health insurance and 78.5% (n=842) rated their health to be very good or excellent. Finally, 14.4% (n=154) reported having some long-term medical condition such as hypertension or diabetes. A complete listing of the entire demographic profile can be found in Table 1.

General vaccine attitudes, practices, and perceived knowledge

Participants were asked some questions related to general adult vaccination. When asked about their knowledge level, more than half reported a good or higher perceived knowledge (with 16.32% (n=175) reporting being very knowledgeable). The most common knowledge source reported was official health authorities at 63.43% (n=680) followed by healthcare professionals (57.09%, n=612), and internet/ social media (41.7%, n=447). 28.82% had received the influenza vaccine (n=309), 75.47% received the COVID-19 vaccine (n=809), and nearly a fifth reported receiving some other adult vaccine. 47.29% (n=507) also reported no change to vaccination

Table 1. Demographics of participants

Feature	Distribution (n=1072)
Sex	
Female	n=742 (69.2%)
Male	n=330 (30.8%)
Age	
Younger than or equal to 25 years	n=533 (49.7%)
Between 25 and 50 years, exclusive	n=445 (41.5%)
Older than or equal to 50 years	n=94 (8.8%)
Citizenship	
UAE national	n=225 (21.0%)
Other Arab	n=682 (63.6%)
Non-Arab	n=165 (15.4%)

Marital Status	
Married	n=422 (39.4%)
Single or other	n=650 (60.6%)
Place of Residence	
Sharjah and other Northern Emirates	n=597 (55.7%)
Dubai	n=301 (28.1%)
Abu Dhabi	n=174 (16.2%)
Highest Degree Obtained	
Diploma/ bachelor's degree	n=553 (51.6%)
Middle or high school	n=398 (37.1%)
Postgraduate degree (MSc PhD, etc.) or higher	n=121 (11.3%)
Field of work	
Non-healthcare	n=578 (53.9%)
Student (health sciences, medicine, dentistry etc.)	n=290 (27.1%)
Student (other non-health related majors)	n=106 (9.9%)
Healthcare (nurses, doctors, dentists, pharmacists, healthcare administration etc.)	n=98 (9.1%)
Pregnancy status	
Has been/ currently is pregnant.	n=286 (26.7%)
Never been pregnant/ Not applicable; I am a male.	n=786 (73.3%)
Do you have health insurance?	
Yes	n=754 (70.3%)
No	n=318 (29.7%)
How would you rate your health?	
Very good/ excellent	n=842 (78.5%)
Average	n=211 (19.7%)
Poor/ very poor	n=19 (1.8%)
Do you have any long-term medical conditions (such as high blood sugar, high blood pressure, liver disease, kidney disease, etc.)?	
Yes	n=154 (14.4%)
No	n=918 (85.6%)

attitudes during the COVID-19 pandemic, with 41.88% (n=449) reporting more positive attitudes. Yet, 51.03% (n=547) planned on not getting the influenza vaccine the next year; moreover, only 42.07% reported having no reason to take the COVID-19 vaccine (n=451). The two main reasons reported were worry about long term effects (46.92%, n=503) and the vaccine being developed too fast (33.49%, n=359). Finally, when asked what would increase the willingness to take the COVID-19 vaccine, further research was the most frequent response at 60.26% (n=646); only a fifth chose to take it only if it was compulsory. Table 2 details all the responses for these six questions.

Vaccine Hesitancy

Univariate Analysis

Table 3 shows the distribution of responses for the 12 items of the VAX scale as well as the four additional independent items. Looking at the first subgroup which deals with mistrust of vaccines, while results are overall positive (for example, only 26.96% (n=289) disagreed with "I feel protected after getting vaccinated"), the level of trust is not overwhelming (only 24.25% strongly agreed with the previous statement). Similar patterns are seen with the other two statements with less than a third showing strong support and trust in vaccines. The same pattern can be seen across the other groups, with the most hesitancy being seen in the second subgroup which focuses on worries regarding unforeseen future effects. 30.6% (n=328) reported strongly worrying about unknown side effects of vaccines and 31.9% (n=342) believed that there may be problems with vaccines that we have not yet discovered.

Concerns about commercial profiteering were not very common, with the most commonly agreed-with statement dealing with the financial returns that vaccines make for pharmaceutical companies (43.9% (n=471) agreed with this). Figure 1 takes the mean of responses for each statement and displays the average hesitancy level shown for each statement. It highlights that when it came to mistrust of vaccine benefit and concerns about commercial profiteering, the level of hesitancy was below the average and vice-versa for future side effects worry and preference for natural immunity (both of

Table 2. General and COVID-19-specific adult vaccination practices, attitudes, and perceived knowledge of participants

How knowledgeable are you about adult vaccines? % (n)					
1 (I do not know anything at all)	**2**	**3**	**4**	**5**	**6 (Very knowledgeable)**
9.24% (n=99)	8.86% (n=95)	16.88% (n=181)	27.24% (n=292)	21.46% (n=230)	16.32% (n=175)
How have your attitudes to vaccination change during the COVID-19 pandemic? % (n)					
More negative		**No change**	**More positive**		
10.82% (n=116)		47.29% (n=507)	41.88% (n=449)		
Which of the following would you use to learn more about adult vaccination? n (%)					
Internet/ social media					n=447 (41.7%)
Official health authorities (e.g., CDC, WHO, MOHAP, DHA, DOH).					n=680 (63.43%)
Brochures & other printed materials					n=159 (14.83%)
Healthcare professionals					n=612 (57.09%)
Family, friends, and colleagues					n=187 (17.44%)
I do not want to learn more					n=89 (8.3%)
Which of the following have you taken as an adult (after you turned 18 years old)? n (%)					
Influenza vaccine					n=309 (28.82%)
COVID-19 vaccine					n=809 (75.47%)
Other adult vaccines (other than influenza or COVID-19).					n=208 (19.4%)
I have not taken any vaccines as an adult					n=181 (16.88%)
Which of the following is a reason to not take the COVID-19 vaccine? n (%)					
None, I have no reason to not take the vaccine					n=451 (42.07%)
I want a different type of vaccine than the one being offered.					n=60 (5.6%)
Even if I get COVID-19, the disease would not be serious.					n=81 (7.56%)
Inconvenient (long waiting time, health center far, etc.).					n=50 (4.66%)
I worry about the long-term effects.					n=503 (46.92%)
I do not believe in COVID-19.					n=14 (1.31%)
Vaccine was developed too fast.					n=359 (33.49%)
I do not trust vaccines.					n=69 (6.44%)
Other reason.					n=71 (6.62%)
Which of the following would encourage you to want to take the COVID-19 vaccine? n (%)					
Further research					n=646 (60.26%)
If someone I knew took it					n=165 (15.39%)
Fear of the pandemic					n=368 (34.33%)
If a friend or a family member got COVID-19					n=189 (17.63%)
Only if it becomes compulsory					n=224 (20.9%)
Other					n=160 (14.93%)

Table 3. Statements 1 through 12 are the results of the Vaccine Attitudes Examination (VAX) scale. Statements 13 through 16 are from the adapted Vaccine Hesitancy Scale (VHS)

Statement	**1 (Strongly Disagree)**	**2**	**3**	**4**	**5**	**6 (Strongly Agree)**
I feel protected after getting vaccinated*	n=72 (6.72%)	n=63 (5.88%)	n=154 (14.37%)	n=293 (27.33%)	n=260 (24.25%)	n=230 (21.46%)
I can rely on vaccines to stop serious infectious diseases*	n=40 (3.73%)	n=41 (3.82%)	n=95 (8.86%)	n=215 (20.06%)	n=290 (27.05%)	n=391 (36.47%)
I feel safe after being vaccinated*	n=66 (6.16%)	n=63 (5.88%)	n=126 (11.75%)	n=269 (25.09%)	n=286 (26.68%)	n=262 (24.44%)
I worry about the unknown effects of vaccines in the future	n=65 (6.06%)	n=105 (9.79%)	n=151 (14.09%)	n=196 (18.28%)	n=227 (21.18%)	n=328 (30.6%)

Vaccines can cause unpredicted problems in children	n=95 (8.86%)	n=154 (14.37%)	n=247 (23.04%)	n=216 (20.15%)	n=174 (16.23%)	n=186 (17.35%)
Although most vaccines appear to be safe, there may be problems that we have not yet discovered	n=31 (2.89%)	n=60 (5.6%)	n=127 (11.85%)	n=247 (23.04%)	n=265 (24.72%)	n=342 (31.9%)
Vaccines make a lot of money for pharmaceutical companies but do not do much for regular people	n=200 (18.66%)	n=210 (19.59%)	n=191 (17.82%)	n=198 (18.47%)	n=150 (13.99%)	n=123 (11.47%)
Authorities promote vaccination for financial gain not for people's health	n=254 (23.69%)	n=239 (22.29%)	n=194 (18.1%)	n=170 (15.86%)	n=109 (10.17%)	n=106 (9.89%)
Vaccination programs are a big con/ scam	n=479 (44.68%)	n=240 (22.39%)	n=135 (12.59%)	n=107 (9.98%)	n=52 (4.85%)	n=59 (5.5%)
Being exposed to diseases naturally is safer for the immune system than being exposed through vaccination	n=184 (17.16%)	n=178 (16.6%)	n=185 (17.26%)	n=215 (20.06%)	n=160 (14.93%)	n=150 (13.99%)
Natural immunity lasts longer than a vaccination	n=88 (8.21%)	n=87 (8.12%)	n=221 (20.62%)	n=232 (21.64%)	n=221 (20.62%)	n=223 (20.8%)
Natural exposure to viruses and germs gives the safest protection	n=147 (13.71%)	n=154 (14.37%)	n=207 (19.31%)	n=235 (21.92%)	n=177 (16.51%)	n=152 (14.18%)
Vaccines are important for the health of others in the community*	n=30 (2.8%)	n=25 (2.33%)	n=64 (5.97%)	n=134 (12.5%)	n=222 (20.71%)	n=597 (55.69%)
New vaccines carry more risk than older vaccines	n=122 (11.38%)	n=155 (14.46%)	n=243 (22.67%)	n=219 (20.43%)	n=170 (15.86%)	n=163 (15.21%)
Generally, I do what my doctor recommends about vaccines*	n=19 (1.77%)	n=30 (2.8%)	n=88 (8.21%)	n=222 (20.71%)	n=349 (32.56%)	n=364 (33.96%)
All vaccines offered by the health authority in my community are beneficial*	n=24 (2.24%)	n=36 (3.36%)	n=116 (10.82%)	n=254 (23.69%)	n=318 (29.66%)	n=324 (30.22%)

* indicates statements that are positively worded (as in higher scores indicate less hesitancy).

which people were more likely to agree with than disagree). The last four items in Table 3 were from the adapted VHS for general adult vaccination. They highlight a deep trust in vaccines importance (88.9%; n=953), physicians and their recommendations (87.2%; n=935), and health authorities and the vaccines they offer (83.6%; n=896).

Bivariate and Multivariate Analyses

For bivariate analysis, a total of eighteen predictors were used: all the demographic variables in Table 1, type of knowledge source used, type of vaccine received, perceived knowledge, and willingness to receive influenza the next year. Of those, only ten remained significant: age, marital status, citizenship, field of work, highest degree obtained, pregnancy status, willingness to take the influenza vaccine, having taken the influenza vaccine, and the internet as a knowledge source.

All these factors were fed into a multivariate least-squares regression model, the results of which can be seen in Table 4. Vaccine hesitancy decreased with the willingness to receive influenza (β=-0.424; p<0.0005) followed by using the internet as a knowledge source (β=-0.354; p<0.0005), being a non-local Arab (β=-0.302; p<0.0005), being married (β=-0.232; p=0.022) and having taken the influenza vaccine as an adult (β=-0.193; p=0.008). On the other hand, higher educational level predicted higher vaccine hesitancy (Bachelors: (β=+0.365; p<0.0005; Postgraduate and higher: (β=+0.235; p=0.041)) as well as being middle-aged (Between 25 and 50 years: (β=+0.223; p=0.037).

DISCUSSION

In this study, the Vaccine Attitudes Examination (VAX) scale was used to quantify and explore the level of vaccine hesitancy in the United Arab Emirates (UAE). With 1,072 responses, majority of which were young females across the various Emirates, the majority reported good knowledge about adult vaccination, two-thirds depended on healthcare authorities for their information, and three-quarters had already received the COVID-19 vaccine. VAX results were overly positive but clear signs of hesitancy emerged with non-negligible proportions disagreeing with the importance and utility of vaccines.

Table 4. Multivariate Results. The table presents the results of the multiple linear regression model predicting the VAX score. P values that are significant at the 5% level are bolded. CI refers to Confidence Interval; SE refers to Standard Error

Vaccine Hesitancy – Ordinary Least Squares Regression (OLS)						
Model Terms		**β -coefficient**	**95% CI**	**SE**	**t-Statistic**	**P value**
Intercept ()		**3.703**	**3.328 - 4.078**	**0.191**	**19.387**	**<0.0005**
Sex	Male	-	-	-	-	-
	Female	0.136	-0.011 - 0.283	0.075	1.809	0.071

Age	Younger than or equal to 25 years	-	-	-	-	-
	Between 25 and 50 years, exclusive	**0.223**	**0.014 - 0.433**	**0.107**	**2.091**	**0.037**
	Older than or equal to 50 years	0.200	-0.088 - 0.488	0.147	1.365	0.173
Marital status	Single or Other	-	-	-	-	-
	Married	**-0.232**	**-0.431 - -0.033**	**0.101**	**-2.292**	**0.022**
Citizenship	Non-Arab	-	-	-	-	-
	Other Arab	**-0.302**	**-0.465 - -0.139**	**0.083**	**-3.626**	**<0.0005**
	UAE National	0.034	-0.110 - 0.178	0.073	0.467	0.640
Field of work	Healthcare (nurses, doctors, dentists, pharmacists, healthcare administration, etc.)	-	-	-	-	-
	Non-healthcare	-0.035	-0.242 - 0.171	0.105	-0.338	0.735
	Student (health sciences, medicine, dentistry, etc.)	0.020	-0.228 - 0.268	0.126	0.159	0.873
	Student (other non-health related majors)	0.116	-0.162 - 0.394	0.142	0.819	0.413
Highest Degree Obtained	High school or lower	-	-	-	-	-
	Diploma/ bachelor's degree	**0.365**	**0.219 - 0.512**	**0.075**	**4.899**	**<0.0005**
	Postgraduate degree (MSc., PhD., etc.) or higher	**0.235**	**0.010 - 0.460**	**0.115**	**2.049**	**0.041**
Pregnancy status	Has been/ currently is pregnant	-	-	-	-	-
	Never been pregnant/ I am a male	**-0.282**	**-0.490 - -0.075**	**0.106**	**-2.668**	**0.008**
Will take the influenza vaccine next year.		**-0.424**	**-0.535 - -0.312**	**0.057**	**-7.455**	**<0.0005**
Uses the internet or social media to learn more about adult vaccination.		**-0.354**	**-0.472 - -0.237**	**0.060**	**-5.912**	**<0.0005**
Has taken the influenza vaccine as an adult.		**-0.193**	**-0.335 - -0.050**	**0.073**	**-2.645**	**0.008**
R-squared: 17.5%	Adjusted R-squared: 16.3%		F (15, 1056) = 14.93; P < 0.0005			

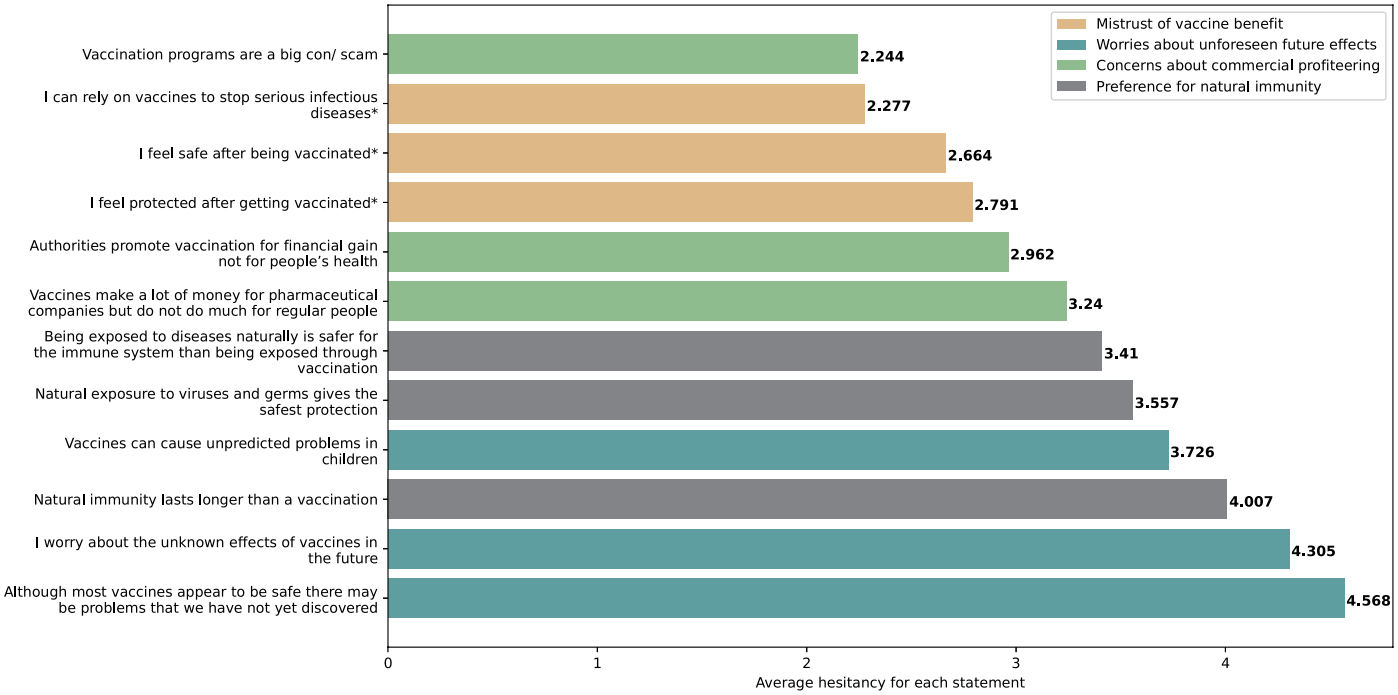

Figure 1. The average hesitancies for each statement. Note that results for items marked with an * were reversed due to their positive wording (such that higher scores indicate higher hesitancy)

Hesitancy was mostly driven by a worry of future side-effects followed by a preference for natural immunity; commercial profiteering ranked lower and was not relatively a major concern by the participants. Multivariate analyses showed willingness to receive and/or having already received the influenza vaccine, using the internet as a knowledge source, and being married to be significant in reducing hesitancy, while higher educational level and being middle-aged predicted

higher hesitancy.

Effective, economical, and efficient, vaccines are one of humanity's greatest accomplishments and one of the most effective public health interventions that have driven a boom in global health outcomes. Yet, vaccine hesitancy, from mild mistrust and delay to outright vaccine refusal, has begun reversing the major strides attained in public health over the last century, with a resurgence of diseases like measles, mumps, and pertussis globally. Studies regarding vaccine hesitancy are sparse at every level, from global organizations to national and local bodies, the Middle East and North African (MENA) region being no exception. In fact, very few papers have looked at vaccination attitudes in the UAE, the majority of which either focus on pediatric vaccines or specific adult vaccines such as influenza, HPV, and more recently, COVID-19.[14] used the modified VHS to collect general vaccination attitudes in the United Kingdom and found substantial fractions that were hesitant about vaccination, with more than 90% having a hesitant attitude to one statement or domain.[14] In line with the general patterns, aversion to the risk of side effects remained one of the greatest barriers. Similar results in the UK were reported by Paul, Steptoe and Fancourt who found 16% of participants exhibiting high levels of vaccine mistrust in one or more domains, with worry about future side effects being a significant barrier.[22]

In the region, a Saudi pediatric vaccines study found a fifth of the participants to have vaccine hesitancy with 36% not having fully vaccinated their children; moreover, and in line with the general trends, safety concerns were the most frequent reason reported.[6] In Jordan and Kuwait, a study looked at COVID-19 and influenza acceptance rates around 30% with high rates of misinformation and belief in conspiracy beliefs.[24] Moreover, the study showed a high percentage lacking trust in governments and vaccine manufacturers, with most worry being directed towards side effects.[24] A UAE study found that vaccination drivers include governmental and/ or physician endorsement, with widespread vaccine availability and free of charge vaccination to also improve rates.[1] This is in line with results found previously, where the UAE population has shown high levels of trust in both governmental bodies and physicians, finding both to be highly trustworthy knowledge sources.[4]

Yet, results regarding COVID-19 vaccine attitudes can be highly variable. In a global review, Troiano and Nardi found the highest COVID-19 vaccine acceptance at 77.6% in the general population; for influenza, the rate dropped to 69%; hesitancy determinants were many, complex, and variable but the overall reasons to refuse vaccines included overall mistrust in vaccines and concerns about safety.[27] In contrast, an early 2021 Saudi study by Almaghaslah et al. found high levels of vaccine hesitancy and reluctance with nearly half stating that they would take the vaccine only if mandatory; the most common barriers reported were vaccine efficacy and safety,[5] in line with other studies as well.[2] Similar results were found by Al-Mohaithef who also found half of the participants reporting vaccine hesitancy and even outright refusal. Yet, and as of March 2023, 77.6% had received at least one dose (Johns Hopkins Coronavirus Resources Center, 2023). In fact, a scoping review by Machado et al. found a drop in vaccine acceptance as the pandemic progressed due to increased misinformation and worry regarding side effects, manifesting as a 20-point drop from 70% in January 2020 to <50% eight months later.[16] Domnich et al. showed a modest increase in the overall vaccination attitudes, with more participants agreeing that vaccines are fundamental and should be mandatory.[12]

This highlights how complicated and interrelated vaccine hesitancy, attitudes, and practices are.[6] hypothesized that in contrast with most Western countries, the Saudi community is more conservative, and that the parents' belief and desires are not the main driver behind children vaccination, but local regulations that may hinder the childrens' ability to receive schooling.[6] The UAE moved early when it came to providing and administering vaccines, ranking among the top globally in doses per person and percentage vaccinated.[21] A UAE COVID-19 vaccine study, vaccine and safety efficacy was the top driver for getting a vaccine, having been cited by more than half of the participants; similarly, 58% expected the vaccine to not have any side effects and three-fifths reported consulting governmental and health authority websites before making a final decision.[1]

Physicians and health authorities have been found to be important players when it comes to promoting vaccination. Yet, recent studies globally have found non-negligible levels of skepticism and vaccine hesitancy. Such results have predated COVID-19: a 2015 study showed vaccine mistrust among French GPs along with mistrust in health ministries and public health agencies.[28] Similarly, those who used official websites had the highest perception scores, followed by those also using social media; using social media alone correlated with lower scores.[2] In fact, a significant relationship was found between social media usage and vaccine safety doubt, with an abundance of disinformation campaigns on such platforms.[30] However, Mascherini and Nivakoski showed in a large cross-national survey across all EU countries that while social media significant impacts vaccine hesitancy, its effect varies depending on the reason of hesitancy: health concerns hesitancy were less influenced by social media while misinformation regarding COVID-19 existence and risks were more common among those who used social media.[17]

Vaccine hesitancy determinants are complex and variable.[11] Results from Europe highlight the involvement of a number of variables: a large UK study reported being female, and not having received a flu vaccine before to be significant predictors of COVID-19 vaccine refusal and hesitancy.[22] A French working-age population study found that being female, middle-aged, lower educational level, poor previous vaccine compliance and no chronic conditions to be associated with outright vaccine refusal and vaccine hesitancy.[25] Reported intention to receive the influenza vaccine the upcoming year. Being male, older, and having received the influenza or COVID-19 vaccine were predictors of stronger vaccine trust and intention to receive the influenza vaccine.[12] Even regionally, strong relations between influenza vaccine history was also illustrated in Al Naam's

Saudi study, with a quarter reporting previous vaccine refusal influencing their decision; factors predicting higher vaccination intent were being older, higher educational level, and higher socioeconomic status.[2]

Yet, the common theme across many papers has been the importance of consistent and reliable vaccination promotion campaigns that tackle and address the growing levels of misinformation on social media and other platforms.[4,7,4,11,14,16,24,27,30]. COVID-19 has put unprecedented pressures on governments to tackle these challenges head-on, with local, national, and supranational campaigns being undertaken, some even in line with World Health Organization's Strategic Communications Framework.[23] Researchers have even begun looking more closely at vaccination campaigns to evaluate their effectiveness: Bardus, Assaf and Sakr developed, implemented and evaluated a social marketing campaign promoting COVID-19 vaccines that resulted in a 98% vaccine uptake rate across their university campus.[9] However, opportunities abound and there is still much more to address, from tackling physician hesitancy and strengthening public health infrastructure to digitizing vaccination programs and incorporating them into eHealth strategies and programmes.[20] Governments and national organizations also need to be proactive in implementing reliable strategies that can combat misinformation and ensure the availability of accessible trustworthy information on those platforms.[17]

Limitations and Future Work

It is important to discuss possible limitations of this study. Given the rapid rate of progression of the COVID-19 pandemic as well as takes place during the first phase of the pandemic, a time when vaccines were still being introduced and hence, attitudes are liable to change and fluctuate frequently. Being a self-administered questionnaire also brings its own set of limitations such as sampling and self-selection bias. However, by being completely anonymous, the effect of these biases was hoped to be minimized. Further research can also explore risk perception and its effects on adult vaccination uptake, as well as the trust of governments and vaccine uptake. This can help provide more detailed results regarding hesitancy determinants and guide national strategies.

CONCLUSION

Vaccine hesitancy exists in the UAE and is a function of many variables including gender, ethnicity, educational status, and previous experience with vaccines. Public health interventions are needed to expand vaccine uptake and coverage, including addressing the public concerns of safety, efficacy, and side effects, all of which represented major components of hesitancy. A deep-seated trust in physicians and healthcare authorities was exhibited by the participants, one that has helped the UAE's COVID-19 vaccination campaign succeed. A more systematic and research-driven approach needs to be adopted to maintain the current trust and begin reducing hesitancy locally.

ETHICAL STATEMENTS

This study was reviewed and approved by the Research Ethics Committee at the University of Sharjah (Reference Number: REC-21-06-06-03-S) on 19-June-2021. It was performed in line with the principles of the Declaration of Helsinki.

Informed consent was obtained from all participants.

DATA AVAILABILITY

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

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AUTHORS' CONTRIBUTIONS

Conceptualization - HJB, KAS; Methodology - TAK, SHA, ZS, KAS; Validation – KAS, TAK, SHA, ZS; Writing - Original Draft Preparation, HJB; Writing - Review and Editing, HJB; Visualization, Supervision – HJB; Software, Formal Analysis – KAS. All authors have read and agreed to the published version of the manuscript.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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