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Mothers' Intention to Vaccinate Their Children Aged 5–11 Against COVID-19: A Cross-sectional Survey

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ABSTRACT

Objectives: COVID-19 vaccines lower the risk of infection hospitalization, and death. Despite the safety and effectiveness of COVID-19 vaccines, some caregivers are hesitant to vaccinate their children against COVID-19. In this study, we explored the factors that influence Omani mothers' intentions to vaccinate their 5–11 year-old children. ***Methods***: Of the 954 mothers approached, 700 (73.4%) participated in a cross-sectional face-to-face interviewer-administered questionnaire in Muscat, Oman, between 20 February and 13 March 2022. Data on age, income, level of education, trust in doctors, vaccine hesitancy, and intention to vaccinate their children were collected. Logistic regression was used to assess determinants of mothers' intention to vaccinate their children. ***Results:*** Most mothers had 1–2 children (n = 525, 75.0%), had a college degree or higher education (73.0%), and were employed (70.8%). More than half (n = 392, 56.0%) reported that they were likely or very likely to get their children vaccinated. The intention to get children vaccinated was associated with older age (odds ratio (OR) = 1.05, 95% CI: 1.02–1.08; $p = 0.003$), trust in their doctor (OR = 2.12, 95%, CI: 1.71–2.62; $p < 0.001$), and low vaccine hesitancy (OR = 25.91, 95% CI: 16.92–39.64; $p < 0.001$). ***Conclusions:*** Understanding the factors that influence caregivers' intentions to vaccinate their children against COVID-19 is important for the development of evidence-based vaccine campaigns. To increase and sustain high vaccination rates for COVID-19 vaccination in children, it is critical to address the factors that cause caregiver hesitation about vaccines.

The World Health Organization estimates that > 500 million people have been infected with COVID-19 since the beginning of the pandemic, and slightly > 6 million have died.[1] As for the impact of the COVID-19 pandemic on children, the United Nations Children's Fund (UNICEF) declared that "COVID-19 has affected children at an unprecedented scale, making it the worst crisis for children UNICEF has seen in its 75-year history".[2]

Immunizing children against COVID-19 is important for their own and their caregivers' health. COVID-19 infection in children can lead to multisystem inflammatory syndrome[3] and several other long-term sequelae. Furthermore, around 16–19% of children can be asymptomatic and thus may be silent spreaders of the virus.[4]

A review of the literature revealed a scarcity of research on caregivers' intention to vaccinate children against COVID-19 from the Arab world and Oman in particular.[5,6] In Oman, vaccinations for adults > 18 years, started in December 2020 and was widely accepted. Oman's Ministry of Health implemented a standardized electronic system 'Tarassud' as a vaccination registry, and passive vaccine adverse event surveillance and reporting were done using the same system. Vaccinations for children aged 12–18 started in August 2021 utilizing schools and the national exhibition center as sites for vaccination.

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The vaccination coverage for this age category is > 98%. There were no major adverse reactions reported or linked to the utilization of the COVID-19 vaccines in Oman.[7]

Vaccines against COVID-19 for children aged 5–11 years old have been offered in the USA and other countries since late 2021.[8,9] Some countries, including Oman, an Arab country with almost five million inhabitants, have not started vaccination campaigns for this age group. Oman, however, is considering offering COVID-19 vaccines to this age group soon. Omani parents' acceptance to vaccinate their 5–11 year-old children was unexplored.

Vaccine hesitancy is defined as a "delay in acceptance or refusal of vaccination despite availability of vaccination services".[10] Vaccine hesitancy is complex and context-specific, varying across time and countries.[11] Over the past two years, studies have documented the prevalence of and reasons for COVID-19 vaccine hesitancy among adults and caregivers before and after the development of COVID-19 vaccines.[12] Reasons for vaccine hesitancy include political ideology[13]; belief in conspiracy theories[14]; mistrust in government, medical authorities, and the pharmaceutical industry[15]; and doubts about the safety, efficacy, and side effects of vaccines.[16] COVID-19 vaccine hesitancy tends to be more prevalent among some populations, such as pregnant and lactating women[17] and caregivers of young children.[18,19] Data from multiple surveys showed that 42–66% of parents were either hesitant about or opposed to vaccinating their 5–11 year-old children.[20] Variables that predict a pediatric higher level of vaccination hesitancy include caregivers' gender (female),[20,21] pregnant women,[22–26] and caregivers with a low level of education[20,22,27] tend to have lower acceptance of vaccinations.

Thus, the aim of the current study was to identify factors that would influence mothers' intentions to vaccinate their 5–11 year-old children if vaccines for children were to become available. Understanding these factors is important for the development of an evidence-based well-designed, persuasive vaccination campaign. The results of this study will assist policymakers, healthcare providers, and public health officials in designing public health strategies to encourage mothers to vaccinate their young children against COVID-19.

METHODS

A cross-sectional study was conducted from 20 February to 13 March 2022 among mothers attending seven primary health centers in Muscat governorate, the capital of Oman, for medical care.

Only mothers who are Omani citizens of children aged 5–11 years old and consented to take the survey were eligible to participate in the study. A face-to-face interviewer-administered questionnaire was conducted with a convenience sample. To determine a representative sample size for mothers, we assumed that 50% of mothers are hesitant about their views ($p = 0.500$). A minimum of 550 participants would be needed based on the sample size formula, an interval of confidence of 99% (z value of 2.58), a margin of error of 5% (delta value of 0.05), and a participation refusal rate of 20%.

Fourteen general physicians working in primary health care were recruited and trained on the objectives of the study and data collection. A total of 954 eligible mothers were approached, and 700 completed the surveys (response rate = 73.4%). They were assured of the confidentiality of the collected information, and that their participation in the study was voluntary. The study questionnaire was written and administered in Arabic and piloted on 25 mothers. The pilot study suggested minor word changes and deletion of two items.

The study protocol was approved by the Regional Study Approval and Ethical Review Committee (MoH/CSR/22/25452) at the Directorate General of Health Services in Muscat governorate.

The survey consisted of two parts. The first part contained questions intended to gather socio-demographic data while the second part included three measures that gauged trust in doctors, vaccine hesitancy, and intention to vaccinate children.

Data were collected on the mothers' age, household income, education level, number of children aged 5–11, employment status, and COVID-19 vaccination status as well as their spouse's vaccination status. Education level was gauged by one item that asked participants to indicate the highest level of education they obtained. They were provided with six response options that ranged from 1 (did not attend school) to 6 (postgraduate degree). Employment status was assessed by one question with two responses: currently employed or not employed.

Regarding mothers' and their spouses' COVID-19 vaccination status, we asked whether they had received one dose, two doses, two doses and a booster shot, or no vaccines against COVID-19.

Trust in doctors was measured by one item that asked, "Generally speaking, to what extent do you trust your doctor?" A five-point Likert scale was used with responses ranging from 1 (do not trust at all) to 5 (always trust). Higher scores indicate greater trust in doctors.

We developed a 10-item vaccine hesitancy scale [Table 1], drawing on previous theoretical models and research on COVID-19 vaccine hesitancy.[28,29] Examples of items include "COVID-19 vaccines for children are effective" and "It is important to vaccinate all children 5–11 years old against COVID-19." All items were scored on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). After reverse scoring two positively worded items, all items were averaged to create the vaccine hesitancy scale, with higher scores indicating higher vaccine hesitancy.

A single item was used to measure mothers' intention to vaccinate their children against COVID-19: "What is the likelihood that you would get your 5–11 year-old children vaccinated against COVID-19 if such a vaccine became available in Oman?" Response options ranged from 1 (very unlikely) to 5 (very likely). Higher scores signified greater intention to vaccinate children against COVID-19.

Statistical analyses were performed using SPSS (IBM Corp. Released 2020. IBM SPSS Statistics for Windows, Version 27.0. Armonk, NY: IBM Corp.). A descriptive analysis was first conducted reporting frequencies and percentages of socio-demographic data and the study variables. The association between the intention to vaccinate children and each individual variable in the study was examined using bivariate and multivariable logistic regression analyses to assess determinants of higher level of intention to vaccinate children against COVID-19. The multivariable logistic regression was performed with 95% CI.

Before we conducted the logistic regression, education level was dichotomized into "high school or less" and "college degree or higher," and vaccine hesitancy scale scores were divided into "high hesitancy and "low hesitancy" based on the mean score on the scale (M = 2.96). We also grouped intention to vaccinate children into two categories. The responses "very likely" and "likely" were labeled "intends to vaccinate" and the responses "very unlikely," "unlikely," and "unsure" were labeled "does not intend to vaccinate." The dichotomizations of vaccine hesitancy and vaccination intention were done in previous studies.[21,30] Age and trust in doctors were not dichotomized.

Table 1: Mean and SD for the vaccine reluctance scale items.

Item	Mean	SD
Children's COVID-19 vaccines are effective.*	2.8	1.1
The COVID-19 vaccines for children might have serious side effects.	2.9	0.8
The pharmaceutical companies are more interested in profit than making sure that COVID-19 vaccines for children are safe.	3.2	1.1
The COVID-19 vaccines for children might cause unknown long-term serious health problems.	3.1	0.9
The development of the COVID-19 vaccines was fast which makes them unsafe.	3.1	1.0
I do not trust that the COVID-19 vaccines can protect children from COVID-19 disease	3.1	1.1
It is important to vaccinate all children 9-11 years old against COVID-19.*	2.8	1.2
The COVID-19 vaccines for children might cause serious side effects more than the disease itself.	2.9	0.9
The COVID-19 vaccines might negatively impact the fertility of children in the future.	2.8	0.9
Vaccinating children is a collective action to prevent the spread of COVID-19.*	2.5	0.7

**Items are reversed coded.*

The vaccine hesitancy scale was subjected to factor analysis using principal axis factoring with the Promax rotation (k = 4) and its reliability was tested using Cronbach's alpha.

Variables associated with the intention to vaccinate children < 0.10 were included in the multivariable logistic regression.[31] In both analyses, the odds ratio (OR) values and their 95% CI were calculated. The model fit of the multivariable logistic regression analysis was assessed using the Hosmer-Lemeshow goodness-of-fit test. A *p*-value of < 0.05 was deemed statistically significant for all tests.

Table 2: Characteristics of the study sample.

Characteristics	n (%)*
Age, mean ± SD, years	37.6 ± 5.2
Monthly income	
≤ 4679 USD (1802 Omani Riyals)	233 (46.9)
≥ 4681 USD (1724 Omani Riyals)	264 (53.1)
Gender of children	
Boys	486 (52.1)
Girls	447 (43.9)
Education	
College degree or higher	510 (73.0)
High school or less	189 (27.0)
Employment status	
Working	492 (70.8)
Not working	203 (29.2)
COVID-19 experience	
Tested positive	349 (50.1)
Never tested positive	299 (43.0)
Not sure/do not know	48 (6.9)
Mother vaccination status	
One dose	2 (0.3)
Two doses	429 (62.9)
Two doses and booster	251 (36.8)
Spouse vaccination status	
One dose	1 (0.1)
Two doses	385 (55.2)
Two doses and a booster	311 (44.7)

**Total percent may not sum to 100% because of missing responses.*
N = 700.

RESULTS

As shown in Table 1, the mean age of the mothers was 37.6±5.2. Most mothers (n = 525, 75.0%) had 1–2 children, while (n = 154, 22.0%) had 3–4 children. Slightly, more than half of the children (52.1%) were boys. Most of the respondents (73.0%) had a college degree or higher and 70.8% were working full-time at the time of data collection. Slightly, more than half (53.1%) reported a monthly income of 1802 Omani riyals (equivalent to 4681 USD) or higher, which is slightly higher than the average monthly income of about 1800 riyals per month. Half of the mothers (50.1%) said they had tested positive for COVID-19, 43.0% said they had never tested positive, and 6.9% were not sure. Two-thirds (62.9%) received two doses of a COVID-19 vaccine, one-third (36.8%) had received two doses and a booster shot, and 0.3% had received only one dose. Participants, report on their spouse's vaccination status showed that 55.2% had received two doses and 44.7% had received two doses and a booster shot. One spouse had received only one dose [Table 2].

Regarding mothers' intention to vaccinate their children against COVID-19, 56.0% (n = 392) reported that they were likely or very likely to get their children vaccinated, 25.0% said they were unlikely or very unlikely to get their children vaccinated, and 19.0% (n = 133) were not sure.

Bivariate analysis showed that age, income, education level, trust in doctors, and vaccine hesitancy were related to the mothers' intention to vaccinate their children [Table 3].

Employment status was not related to intention to vaccinate. Intention to vaccinate children was associated with older age (OR = 1.05, 95% CI: 1.02–1.08; $p = 0.003$), higher income (OR = 1.73, 95% CI: 1.20–2.49; $p = 0.003$), and a higher level of education (OR = 0.67, 95% CI: 0.48–0.94; $p = 0.020$).

Table 3: Odds ratio (OR) and 95% CI of intent to vaccinate children 5-11 years old by intention and demographic variables.

Variables	Univariable model, OR [95% CI]	*p*-value	Multivariable model OR [95% CI]	*p*-value
Age	1.05 [1.02–1.08]	0.003	1.07 [1.02–1.12]	0.004
Income (ref: < 1800)				
≥ 1800 OR	1.73 [1.20–2.49]	0.003	0.73 [0.41–1.30]	0.290
Education (ref: High school or less)				
College degree or higher	0.67 [0.48–0.94]	0.020	1.35 [0.71–2.58]	0.360
Employment (ref: Not working)				
Working	0.94 [0.68–1.30]	0.710		
Trust in doctor physician	2.12 [1.71–2.62]	< 0.001	1.63 [1.18–2.25]	0.003
Vaccine hesitancy (ref: High hesitancy)				
Low hesitancy	25.91 [16.92–39.64]	<0.001	19.23 [11.28–32.78]	< 0.001

Hosmer–Lemeshow test, chi-square: 3.68, p-value = 0.890.

Moreover, increased odds of intention to vaccinate children were associated with trust in doctors (OR = 2.12, 95% CI: 1.71–2.62; $p < 0.001$) and a lower level of vaccination hesitancy (OR = 25.91, 95% CI: 16.92–39.64; $p < 0.001$).

In the multivariable binary logistic regression, we included all the predictors analyzed in the univariable models except for employment status [Table 3]. Intention to vaccinate children was associated with older age (OR = 1.07, 95% CI: 1.02–1.12; $p = 0.004$), trust in doctors (OR = 1.63, 95% CI: 1.18–2.25; $p = 0.003$), and low level of vaccinate hesitancy (OR = 19.23, 95% CI: 11.28–32.78; $p < 0.001$).

DISCUSSION

The negative impact of COVID-19 on the well-being of children and adolescents has been documented in several studies. Vaccinating children against COVID-19 is critical for their mental and physical health and allows them to socialize with their peers. At the societal level, vaccinating younger children along with older children and adults is an effective preventive strategy for halting the spread of COVID-19. Understanding the factors that influence caregivers' willingness to vaccinate their children is crucial considering the expanding availability of COVID-19 vaccines for children aged 5–11 years old around the world.

In this study, 44.0% (n = 308) of mothers expressed reservations about vaccinating their children. This result is similar to percentages previously reported worldwide.[32] To illustrate, studies estimate that COVID-19 vaccine hesitancy among parents is 25% in Saudi Arabia,[33] 12% in the UAE,[34] 10%–30% in Western countries,[25–35] and 52.5% in China.[26] Furthermore, among the 22 Middle East/North African countries, the highest rate of vaccine acceptance was reported in Tunisia (92%), while the lowest rate was reported in Iraq (13%).[34]

The hesitation of mothers in this study to vaccinate their children could be attributed to concerns about the side effects and safety,[6] efficacy of the COVID-19 vaccine, or the misconception that COVID-19 is not a serious disease. Furthermore, the mothers could be concerned about the vaccine's long-term side effects on children, especially with widespread rumors in the community and misinformation in social media about the impact of the vaccine on women's fertility. These concerns should be addressed in the development of COVID-19 education and awareness for vaccine campaigns geared toward caregivers.

In the present study, 56.0% (n = 392) of mothers reported that they intended to vaccinate their children between the ages of 5 and 11 against COVID-19. This is much lower than the reported rates of 65.5% in Italy,[37] 80% in New Zealand,[38] and 91% in Brazil.[24] The low rate of intention to vaccinate children in our study might be because we only studied mothers, who often tend to be more reluctant to vaccinate their children against COVID-19 than fathers.[39,40]

Univariable analysis showed a significant association between mothers' older age, higher income, and higher level of education and their intention to vaccinate their children. These findings are consistent with prior published reports.[18,21,41–44] Mothers with a high level of education tend to have a higher perception of the risks associated with COVID-19 for their children and are less likely to be influenced by misconceptions; as shown in some studies greater trust in doctors and a lower level of vaccine hesitancy were significant predictors of intention to vaccinate children against COVID-19. In the vaccine literature, both variables have been shown to be associated not only with the intention to vaccinate children,[45,46] but with engaging in COVID-19 protective behaviors and uptake of COVID-19 vaccines.[47–50]

The findings of the present study suggest that public health intervention programs designed to increase caregivers' willingness to vaccinate their young children should focus on reducing misinformation about the safety and effectiveness of COVID-19 vaccines for children. Special attention should be directed toward younger and less educated caregivers. Furthermore, healthcare workers must be equipped with effective persuasive communication skills and information required to foster positive attitudes toward the COVID-19 vaccine among caregivers.

Although our study is one of the pioneer studies in the Arab world, it has some limitations. First, while our study included a large number of participants with diverse socio-demographic backgrounds, the exclusive focus on mothers limits the generalizability of the findings. It would be important for future studies to gauge the intention of both fathers and mothers to vaccinate their children. The second

limitation is related to the potential impact of participants' wishing to preserve their social desirability due to the mode of data collection. They may have exaggerated their intention to vaccinate their children against COVID-19 because they were interviewed by healthcare providers. Additionally, because the informed consent communicated the true purpose of the study, it might be possible that mothers with a strong positive or negative opinion about COVID-19 opted to participate in the study. Another limitation is related to the type of participants. Specifically, the participants were mothers who were seeking nonurgent care for their children at health care centers. Being at a health care center might have increased some mothers' concern about their children's well-being, either negatively or positively. Finally, like other studies on attitudes, this study focused on mothers' intention to vaccinate their children and not on their actual behavior.

CONCLUSION

More than half of the mothers in this study reported that they intended to vaccinate their children against COVID-19. Those who were older and had a higher income and level of education were more likely to say that they intended to vaccinate their children. The results of this study can be utilized to inform decision-makers, healthcare providers, and public health officials as they consider developing public health strategies to increase mothers' intention to get their children vaccinated and their follow-through in advance of the upcoming COVID-19 vaccination campaign for children aged 5–11 years in Oman.

Disclosure

The authors declared no conflicts of interest. No funding was received for this study.

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