

Knowledge, attitude, and practices of front line health workers after receiving a COVID-19 vaccine: a cross-sectional study in Pakistan

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Background Globally, there is an increased risk of COVID-19 infection among front-line health workers (FHW). This study aimed to evaluate the knowledge, attitude, and practices of FHW of Pakistan after receiving the COVID-19 vaccine. **Methods** A population web-based survey on COVID-19 vaccine was conducted on 635 FHW in Pakistan between April 15, 2021, and July 15, 2021. The survey focused on four main sections consisting of socio-demographic data, knowledge, attitude, and practices after receiving the COVID-19 vaccine. The data was analyzed on SPSS. $p < 0.05$ was considered significant. **Results** Overall, 60% of FHW were nervous before getting vaccinated, with the leading reason to get vaccinated being their concern to protect themselves and their community (53.4%). A majority of FHW had fear about the unseen side effects of the COVID-19 vaccine (59.7%) used in Pakistan, with the most common side effect reported as soreness at the injection site (39%). It has been noted that almost all of the FHW observed preventive practices after getting vaccinated. The results showed that married respondents had favorable practices towards COVID-19 vaccines ($B = 0.53$, $p < .01$). It was also found that more informational sources ($B = 0.19$, $p < .01$), higher knowledge of vaccination ($B = 0.15$, $p < .001$), and favorable attitude toward vaccine ($B = 0.12$, $p < .001$) significantly predicted favorable practices toward COVID-19 vaccination. **Conclusion** The findings reflect that FHW, though they were worried about its side effects, have good knowledge and a positive attitude after getting the COVID-19 vaccine. This study is significant as the FHWs are a symbol for guidance, a reliable source of information, and an encouraging means of receiving COVID-19 vaccine for the general public. This study also reported that post-

vaccination side effects were mild which will aid in reducing the vaccine hesitancy among the general Pakistani population.

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34 **Introduction**

35 Globally, all parts of life have been affected because of the COVID-19 pandemic (Huynh et al.,
36 2021). According to the World Health Organization (WHO), there have been 308,458,509 confirmed
37 cases of COVID-19, including 5,492,595 deaths, and a total of 9,194,549,698 vaccine doses have
38 been administered worldwide till January 11, 2022 (WHO, 2022b). WHO has listed FHWs as a
39 priority group for COVID-19 vaccination (Gagneux-Brunon et al., 2021), as they are at increased
40 risk because of their direct contact with patients with COVID-19 (Dhahri et al., 2020). Initially, 10%-
41 20% of FHW have been identified with the COVID-19 infection; therefore, protecting them from
42 COVID-19 infection plays a vital role in the conservation of the healthcare system (Nguyen et al.,
43 2020).

44 The COVID-19 infection is extremely contagious and involves the worldwide population; therefore,
45 the most useful approach to protect the population from COVID-19 infection is vaccination, which
46 is a significant public health measure (Cascella et al., 2022). Ten COVID-19 vaccines have been
47 registered by WHO and distributed in different countries so far, with almost 33 vaccines being
48 approved by at least one country worldwide (Covid-19 vaccines, 2022a). The FHWs are suggested
49 as the top priority for vaccination in contrast to the general population (Malik et al., 2021; WHO,
50 2022c). Therefore, it is significant for them to attain early vaccination coverage that will assure a
51 sufficient workforce to treat the infected patients (Thorsteinsdottir and Madsen, 2021).

52 The accessibility of COVID-19 vaccines might be the only means to control the COVID-19 infection,
53 as, in several countries, long-term lockdown is not possible because of economic crisis. Thus, in
54 addition to following the COVID-19 Standard Operating Procedures (SOP), there is an essential need
55 to be vaccinated against COVID-19 infection to limit the COVID-19 community transmission in
56 Pakistan (Malik et al., 2021). To evaluate the beliefs and intentions about the past vaccination, the
57 health belief model is a beneficial method that evaluates perceived susceptibility and severity,
58 perceived barriers, benefits, and signs of action (Giao et al., 2019). Regarding the safety of the
59 COVID-19 vaccine, the doubts of FHW must be satisfied soon, as they are the first ones to receive
60 the vaccine (Huynh et al., 2021). Literature search has revealed that percentages of knowledge and
61 acceptance of COVID-19 vaccines in FHW vary among countries, which were 73.9% in Europe,
62 40% in Hong Kong, and only 27.7% in Congo accordingly (Nzaji et al., 2020; Wang et al., 2020b).
63 Globally, the prevalence of COVID-19 vaccination hesitancy among FHW ranged from 4.3% to 72%

64 which varies because of several socio-demographic features (Biswas et al., 2021). To develop trust
65 among FHW, self-governing committees and trusted bodies should deliver reliable knowledge and
66 information regarding COVID-19 vaccines and their safety (Kasozi et al., 2021). Currently, many
67 vaccines are available that are believed to be safe and effective, though doubts in evaluating the
68 efficacy of these vaccines still exist (Ledda et al., 2021). In Pakistan, WHO has declared that there
69 have been 1,345,801 confirmed cases of COVID-19 with 29,042 deaths, and that 169,131,246
70 vaccine doses have been administered till January 21, 2022 (WHO Coronavirus, 2022c). Currently,
71 several rumors regarding the COVID- 19 vaccine are spreading in Pakistan, with these rumors
72 including that, with the vaccine, nano-chips are inserted in the bodies to achieve control of the

73 individuals through 5g towers (Khan et al., 2020), in addition, that the vaccine was a magnificent
74 trick to target the Islamic nations and was formed to allow the Jews to take control of the world.

75 Accordingly, FHW play a significant role both in delivering knowledge regarding the source of
76 COVID-19 vaccine and its effects in the upcoming years, as well as in serving as role models for the
77 general population in encouraging them to get vaccinated against COVID-19 infection. As data on
78 the knowledge, attitude, and practices after getting vaccinated against COVID-19 among FHW of
79 Pakistan are rare, this study aims to assess the role of socio-demographic characteristics, knowledge,
80 and attitude of FHW in predicting practices after getting the COVID-19 vaccine. In addition, it aims
81 to develop policies with the help of this survey to have a helpful and continuous vaccination rollout
82 plan for COVID-19 infection by the government of Pakistan.

83

84 **Materials and Methods**

85 **Design**

86 A cross-sectional study was conducted to assess the knowledge, attitude, and practices of FHW of
87 Pakistan after getting the COVID-19 vaccine from April 15, 2021, to July 15, 2021. Because of the
88 third wave of COVID-19 in Pakistan, it was not possible to perform the community-based survey;
89 therefore, a semi-standardized electronic questionnaire was designed to collect the data using an
90 online secure Google survey tool, and a shareable link was produced
91 ([https://docs.google.com/forms/d/e/1FAIpQLSe7fGJHOLxYvmhduuJ1ccUgf7j5ZODQ5VFAn](https://docs.google.com/forms/d/e/1FAIpQLSe7fGJHOLxYvmhduuJ1ccUgf7j5ZODQ5VFAnUVHlbFrskQ4g/viewform?usp=sfink)
92 [UVHlbFrskQ4g/viewform?usp=sfink](https://docs.google.com/forms/d/e/1FAIpQLSe7fGJHOLxYvmhduuJ1ccUgf7j5ZODQ5VFAnUVHlbFrskQ4g/viewform?usp=sfink)) and disseminated through multiple social media such as a
93 personal social network, Facebook, and WhatsApp with mandatory email addresses to ensure one
94 response per individual so that results may not be compromised. The survey includes an introduction
95 that specified the purpose of the study. The data were collected anonymously, and email addresses
96 were kept confidential. The biasness of the study with respect to participation was decreased by
97 keeping the survey open for 3 months which provided ample time for people to participate in the
98 survey.

99 **Ethical Declaration**

100 The current study was conducted following the principles for human investigations (i.e., Helsinki
101 Declaration) and has passed the ethical approval from the institutional review board of Akhtar
102 Saeed Medical and Dental College (M-21/069/-Oral Pathology). All the respondents participated
103 willingly in the survey. The respondents were assured that their information will be kept
104 confidential.

105 **Inclusion and Exclusion Criteria**

106 The inclusion criteria of the study participants were being a Pakistani resident, FHW, and having
107 internet access. The exclusion criteria included an incomplete survey.

108 **Sample Size**

109 The sample size was calculated using the following equation:

$$110 \quad n = \frac{z^2 pq}{d^2}$$

$$n = \frac{1.99^2 \times 5 \times (1 - .5)}{.05^2}$$

$$n = 396.01$$

where,

n = number of samples

$z = 1.96$ (95% confidence level)

p = prevalence estimate (50% or 0.5%) (Islam et al., 2021)

$q = (1 - p)$

d = precision limit or proportion of sampling error (0.05).

As there is no earlier similar study on FHW concentrating on knowledge, attitudes, and practices after getting the COVID-19 vaccine in Pakistan, the best assumption (p) made for the present study would be 50%. A sample size of 396.01 participants was assessed, assuming a 10% non-response rate. Our sample size exceeded this estimate.

Questionnaire

A 30-item online self-administered questionnaire was made from earlier studies according to the objectives of the current study (Danabal et al., 2021; Islam et al., 2021). The Google form consists of four key focus areas, including socio-demographic data, knowledge about COVID vaccine, post-vaccination attitude, and practices along with informed consent. Each section consists of a range of options from multiple choices to forced-choice (yes/no) questions depending on the subject matter. All the questions were compulsory. In the first section, respondents were asked nine questions regarding their socio-demographic characteristics such as age and gender. The key independent variables were knowledge and attitude related to COVID-19 vaccine. Knowledge of COVID-19 vaccine was assessed using four items with three possible responses (i.e., Yes, No, and Don't know). A sample item used to assess knowledge included: Vaccine is important to end the COVID-19 pandemic. A higher score on the scale showed higher knowledge of COVID-19 vaccine. Attitude toward COVID-19 vaccine was assessed using 10 items with five possible responses (i.e., *Strongly disagree*, *Disagree*, *Neutral*, *Agree*, and *Strongly agree*), which were later recoded to three responses (*Disagree*, *Neutral*, and *Agree*). A sample item used to assess attitudes included: Do you believe that the benefits of COVID-19 vaccination are greater in comparison to its risk? A higher score on the scale showed favorable attitudes toward COVID-19 vaccine. The dependent variable included in the study was practiced after getting the COVID-19 vaccine, which was assessed using six items with three possible responses (i.e., Yes, No, and

Don't know). A sample item used to assess practices included: Do you still follow COVID-19 basic prevention guidelines after getting vaccinated? A higher score on the scale showed favorable practices toward COVID-19 vaccine.

Participants

The target population of the current study was FHW, including physicians, dental surgeons, pharmacists, physiotherapists, laboratory technicians, nurses, hospital administrative staff, and undergraduate medical and allied health sciences students from all over Pakistan. A total of 635 responses were obtained.

Statistical Analysis

The data cleaning, editing, and sorting were done on the Microsoft Excel version (2014). The data were then imported on SPSS version 20 (IBM Corp., Armonk, NY, USA) spreadsheet where the coding of data and analysis was done. The quantitative data are presented in the form of descriptive statistics as frequencies and percentages. First-order analyses such as the chi-square test and Fisher exact test were completed to check the association among socio-demographic characteristics (age and gender), attitude, and practices after COVID-19 vaccine.

To predict practices after getting the COVID-19 vaccine from socio-demographic and key independent variables (knowledge and attitude), a multivariate linear regression analysis was conducted. To test for multicollinearity, tolerance values and VIF () values were considered which showed that multicollinearity was not a threat. A p-value <0.05 was considered statistically significant with a 95% confidence interval.

Results

Demographic Data

A total of 704 respondents from all over Pakistan participated in this study, out of which 69 were excluded because of an incomplete responses, and thus, the response rate for the study was 90.2%. Table 1 gives an outline of their socio-demographic characteristics. Most of the respondents (n = 296, 46.3%) were young (20-30 years), females (373, 58.7%), single (349, 55%), and completed a bachelor degree in dental surgery (289, 45.5%). The majority of the participants collected information about the COVID-19 vaccine via social media and television (241, 38%). The most frequently reported minor side effects were soreness at the injection site (n = 246, 39%), followed by body aches (n = 95, 15%) (Figure 1).

Information regarding COVID-19

The results showed that, with more than half of the respondents (60%) stating that they were nervous before getting the COVID-19 vaccine, 31% of the respondents had been diagnosed previously with COVID 19 infection.

Data regarding COVID-19 Vaccine Knowledge

The participant's responses regarding knowledge about the COVID-19 vaccine are summarized in Table 2. The most common reason for getting the COVID-19 vaccination was their concern to protect themselves and their community (53.4%). Intriguingly, 88.5% were aware that people can catch COVID-19 infection even if they are vaccinated.

Data regarding Belief and Attitude about COVID-19 Vaccine

Table 3 shows the distribution of participants regarding the belief and attitudes of FHW after getting the COVID-19 vaccine. Of 635 respondents, 356 (56%) agreed that the newly developed COVID-19 vaccine is not safe as it is developed in an emergency. However, despite their concerns regarding the unseen effects of the COVID-19 vaccines (59.7%), most of the respondents still believed that it will not discourage them from getting vaccinated (84.5%). When it comes to trust in the measures taken by the Ministry of Health of Pakistan to ensure vaccine safety, only 59 (9.3%) did not have trust. The responses of participants are summarized in Table 3.

Practices After Getting COVID-19 Vaccine

The frequencies of practices among the respondents after getting the COVID-19 vaccine are presented in Table 4. It was observed that a large number of participants (95%) showed a positive attitude toward the preventive COVID-19 practices. The COVID-19 vaccine acceptance is related to the idea of recommending the vaccine to friends and family. Of note, a large majority of the respondents (93.9%) will recommend the COVID-19 vaccine to their friends and family. Females (n = 181, 58.4%) were more knowledgeable regarding the duration to build the immunity than males (n = 129, 41.6%), with a significant association between them ($p = 0.034$). There were significant differences in belief and attitude after getting the COVID-19 vaccine among both genders. It was observed that females (n = 112, 72.3%) were significantly more nervous before getting vaccinated than males (n = 43, 27.7%). Furthermore, female respondents were more likely

204 to follow COVID-19 practices than males. It was observed that 50% of females wear a mask in
 205 comparison to males (40.4%) after getting the COVID-19 vaccine, which was found to be
 206 significantly associated ($p = 0.046$) (Table 5).

207 Out of 197 respondents who had a previous history of COVID-19 infection, it was observed that
 208 most of them were between 20 and 30 years old ($n = 83$, 42.1%), followed by 31–40 years old (n
 209 $= 71$, 36%), with a positive correlation among them ($p = 0.036$). When participants have inquired
 210 about the reason for getting vaccinated, it was seen that a majority of the respondents of 20–30
 211 years old ($n = 161$, 47.5%) want to protect themselves and their community ($p = 0.017$). The level
 212 of nervousness before getting vaccinated was significantly associated ($p = 0.000$) among different
 213 age groups, i.e., decreasing with increasing age predominantly seen in 20–30 years ($n = 71$,
 214 45.8%), followed by 31–40 years ($n = 61$, 39.4%), 41–50 years ($n = 18$, 11.6%), 51–60 years ($n =$
 215 2 , 1.3%), and above 60 years ($n = 3$, 1.9%) accordingly. Regarding practices among different age
 216 groups, it was found that all age groups followed the basic SOP of COVID-19 infection and
 217 individuals above 41 years old (100%) were more likely to wear a mask than those of younger age
 218 groups after their vaccination. The model predicting favorable attitudes after getting the COVID-
 219 19 vaccine was statistically significant, $F(13, 621) = 4.609$, $p < 0.001$, adj. $R^2 = 0.069$. The value
 220 of adjusted R^2 showed that approximately 7% of the variation in favorable attitudes after getting
 221 the COVID-19 vaccine was predicted by the independent variables of the study. The results
 222 showed that favorable attitudes after getting the COVID-19 vaccine increased with age by 0.37
 223 but the change was statistically insignificant. Another finding of the study was that the favorable
 224 attitudes after getting the COVID-19 vaccine increased by 0.46 units in those respondents who
 225 were not currently practicing but it was statistically insignificant. The results further showed that
 226 with a one unit increase in knowledge of respondents for the COVID-19 vaccine, favorable
 227 attitudes after getting the COVID-19 vaccine increased by 0.34 units ($B = 0.34$, $p < 0.001$).

228 Favorable attitude toward COVID-19 vaccine increased by 0.85 units in respondents who were
 229 nervous before getting COVID vaccine ($B = 0.85$, $p < 0.01$). The remaining variables included in
 230 the model were statistically insignificant ($p > 0.05$) (Table 6). Table 6 shows that the model
 231 predicting favorable practices after getting the COVID-19 vaccine was statistically significant, F
 232 $(14, 620) = 10.10$, $p < 0.001$, adj. $R^2 = 0.167$. The value of adjusted R^2 showed that 16.7% of the
 233 variation in favorable practices toward COVID-19 vaccine was predicted by the independent
 234 variables of the study. The results of multivariate regression analysis further showed that females
 235 were less likely to have favorable practices after getting the COVID-19 vaccine than males

though the relationship was statistically insignificant ($B = -0.24, p > 0.05$). A significant finding of the study was that the favorable practices toward COVID-19 vaccine increased by 0.49 units in married respondents ($B = 0.49, p < 0.01$). Another significant finding of the study was that the favorable practices toward vaccines increased by 0.16 units with one unit increase in sources of information ($B = 0.16, p < 0.05$). This shows that respondents with multiple sources of information adopted favorable practices after getting the COVID-19 vaccine compared to those with fewer sources of information. The results also showed that those who had been previously infected with COVID-19 displayed poor practices toward the COVID-19 vaccine ($B = -0.55, p < 0.01$). Both key independent variables included in the study were statistically significant. The results showed that with a one unit increase in knowledge of respondents with respect to COVID-19 vaccine, favorable practices after getting the COVID-19 vaccine increased by 0.34 units ($B = 0.34, p < 0.001$). Furthermore, one unit increase in favorable attitudes after getting the COVID-19 vaccine increased favorable practices toward COVID-19 vaccine by 0.10 units ($B = 0.10, p < 0.001$).

Discussion

COVID-19 vaccine is an ideal way to end the COVID-19 infection. The government of Pakistan has already started the COVID-19 vaccination rollout in February 2021 creating hope as part of the pandemic solution (Siddiqui et al., 2021). To date, very limited studies have investigated the response of FHWs regarding their knowledge and attitude after getting vaccinated. Playing an important role in the general population vaccine acceptance, this study provides first-hand and novel information about the knowledge, attitude, and practices of FHW in Pakistan after getting the COVID-19 vaccination. Important in developing health-related education and awareness programs, the results show that a few socio-demographic, knowledge, and attitude variables influence the practices after getting the COVID-19 vaccine. Currently, social media plays an important role in creating awareness and spread of messages across the masses. In our study, the majority of the participants have acquired knowledge from social media and television regarding the importance of the COVID-19 vaccine (Alwi et al., 2021; Shekhar et al., 2021). In addition, the government of Pakistan has taken all the appropriate steps for providing facts and figures regarding COVID-19 prevention and recommendations to the public, where a study from Saudi Arabia stated that the majority of the participants obtain information about the COVID-19 vaccine through social media (Othman et al., 2022). Mobile applications related to healthcare and

informative television campaigns have played an immense role in creating awareness about vaccination programs and are also useful for policymakers regarding the COVID-19 vaccine information in Pakistan.

There is a lot of debate on social media regarding vaccine safety, its adverse effects, effectiveness, and approval by authorities. It has created a number of concerns and a large amount of anxiety even in FHW. More than 60% of the respondents were nervous before getting the vaccine, which is consistent with previous studies (Malik et al., 2020; Shekhar et al., 2021). This might be because of a high level of concern as there is clear uncertainty regarding COVID-19 safety. The new technique involves mRNA-based vaccines, which have been developed in an emergency, i.e., less than a year has created doubts among the general population, thereby decreasing the acceptance rate (El-Elimat et al., 2021). Despite these concerns, 84.5% of FHWs were willing to get the vaccine, which might be related to good knowledge about the severity of COVID-19 infection and trust in the health ministry of Pakistan, which is in accordance with the studies conducted in Pakistan, Saudi Arabia, and France (Detoc et al., 2020; Tahir et al., 2021), who found that the majority of FHW expressed willingness for the COVID-19 vaccine (Barry et al., 2020). Likewise, the present study is in line with the study conducted in Australia (Dodd et al., 2021), where concern about the vaccine safety was 36%, and 85.5% were willing to get the vaccination. However, vaccine hesitancy is fueled by anti vaccinationists because of the new technology and the short duration of vaccine development. Such misleading information on social media can shape participants' refusal or acceptance of the COVID-19 vaccine.

In our study, 59.7% of the participants were worried that the vaccine currently being used in Pakistan could have some side effects, which are similar to the national and international data (Callaghan et al., 2020.; Elharake et al., 2021; Malik et al., 2021). Literature search has revealed that the leading cause for vaccine hesitancy was fear of the adverse effects of the COVID-19 vaccines (Callaghan et al., 2020; Wang et al., 2020a; Alwi et al., 2021; Elharake et al., 2021; Malik et al., 2021). Nearly all reported side effects were mild, and with there being multiple conspiracy theories linked with the vaccine efficacy and its associated side effects, most frequently reported minor side effect is shown to be soreness at the injection site, which is in agreement with another local study (Siddiqui et al., 2021). Therefore, it is significant to take relative measures to reduce such rumors that will ultimately increase the willingness to get vaccinated (Shekhar et al., 2021; Pogue et al., 2020).

299 Misconception and lack of trust are contributing factors to COVID-19 vaccine acceptance. The
 300 finding of this study (77.2%) is aligned with the study conducted by Benis et al. reflecting that the
 301 majority of participants have complete trust in their government regarding the COVID-19 vaccine
 302 (Benis et al., 2021). Data from previously performed local and international studies revealed that
 303 a population with an increased level of trust is linked with a high rate of vaccine acceptance
 304 (Vasilevska et al., 2014; Qamar et al., 2021). Such a high level of trust in the government reflects
 305 good policies of the government in handling the pandemic.

306 Age, currently in practice, and knowledge were associated factors that determined the attitude of
 307 FHW after getting the COVID-19 vaccine (Table 6). The current study results showed that the
 308 older age group FHW had more positive attitudes than the younger age groups, which is in
 309 contrast with the studies from Pakistan and Uganda (Olum et al., 2020; Rehman et al., 2021).
 310 FHW who are currently in practice were more likely to have a favorable attitude even after
 311 getting the COVID-19 vaccine as these FHW were more prone to the infection than those who
 312 were not in practice, where this discrepancy on attitudes may be because older individuals have
 313 an increased risk of exposure to COVID-19 infection in contrast to young individuals, which is in
 314 line with the study conducted in Ethiopia (Ahmed et al., 2021). Therefore, it can be concluded
 315 that FHWs who were old and practicing had a more favorable attitude after getting the COVID-19
 316 vaccine.

317 In the present study, females showed a less likely positive attitude after getting the vaccine and
 318 prevention, which is in contrast with the studies conducted in Bangladesh (Ferdous et al., 2020) and
 319 Indonesia (Harapan et al., 2016) but in accordance with the study conducted in China (Wang et al.,
 320 2020a). Less attitude and prevention after getting the COVID-19 vaccine poses females at increased
 321 risk of acquiring the infection; therefore, importance should be given to maintaining precautions
 322 for this specific gender to control the spread of COVID-19 more effectively.

323 Overall, good hygiene practices and a positive attitude toward preventive measures were observed
 324 among the participants of the current study, which is in accordance with the earlier reported data
 325 on FHW from Pakistan and Vietnam (Huynh et al., 2020; Saqlain et al., 2020; Ladiwala et al., 2021)
 326 but in contrast to the study conducted in Uganda (Kamacooko et al., 2021). With the current study
 327 showing that knowledge and awareness play a significant role in the practices to prevent the risks
 328 of infection with COVID-19, good hygiene practices and preventive measures in FHW can be
 329 attributed to proper knowledge of the spread of disease and the importance of preventive measures
 330 in decreasing the risk for COVID-19. Concerns regarding the COVID-19 vaccine should be

addressed in the media and awareness campaigns are a must to shed light on the importance of vaccines to prevent COVID-19 infection.

There are a few limitations that should be addressed in the understanding of the results of the current study. First, a major limitation is that the survey was conducted online, which imposes methodological limitations because of the passive exclusion of inactive and non-social media users. Second, this study used a snowball sampling technique that might result in sampling bias; therefore, a study with random sampling is recommended in the future. Though the survey has been performed in the early days of the vaccination rollout campaign, its findings might be different once the mass vaccination program is conducted countrywide targeting the general population as well.

Conclusions

The findings of the present study showed an adequate knowledge and positive attitudes of FHWs after getting the COVID-19 vaccination in Pakistan. With this study also providing basic knowledge for confidence building and improvements in communication in relation to COVID-19 vaccines, also highlighted the number of socio-demographic factors influencing the knowledge, attitudes, and practices of FHWs that can give direction to healthcare authorities, policymakers, and public health experts in Pakistan in health services planning. Therefore, this study will be significant in developing COVID-19 vaccination-related awareness and health education programs in the future.

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Table 1 (on next page)

Descriptive statistics of socio-demographic characteristics

1 **Table 1:** Descriptive statistics of socio-demographic characteristics

Variables	N (%)
Age	
20 – 30	294 (46.3)
31 – 40	207 (32.6)
41 – 50	80 (12.6)
51 – 60	25 (3.9)
Above 60	29 (4.6)
Gender	
Male	262 (41.3)
Female	373 (58.7)
Marital status	
Married	286 (45)
Single	349 (55)
Education level	
MBBS	223 (35.1)
BDS	289 (45.5)
Pharmacy	39 (6.1)
Physiotherapy (DPT)	17 (2.7)
Graduation	51 (8)
Under graduation	16 (2.5)
Occupation	

Physician	136 (21.4)
Dental Surgeon	182 (28.7)
Pharmacist	37 (5.8)
Physiotherapist	17 (2.7)
Laboratory Technician	30 (4.7)
Nurse/Dispenser	15 (2.4)
Hospital Administrative	30 (4.7)
Medical Student	188 (29.6)
Are you currently in practice?	
Yes	314 (49.4)
No	321 (50.6)
Where did you receive information about the COVID-19 vaccine?	
Social Media (WhatsApp, Facebook)	120 (18.9)
Friends and Family	56 (8.8)
Television	26 (4.1)
Workplace	31 (4.9)
Government Helplines	22 (3.5)
SM, NP, WP	24 (3.8)
Friends, Government Helplines	13 (2.0)
Social Media and Television	241 (38.0)
Social Media, friends and family	37 (5.8)
All	65 (10.2)

When Did You Get Vaccinated Against Covid-19?	
January 2021	19 (3)
February 2021	77 (12.1)
March 2021	150 (23.6)
April 2021	206 (32.4)
May 2021	69 (10.9)
June 2021	114 (18)

Table 2(on next page)

Frequencies and percentages regarding knowledge about Covid -19 vaccine

Table 2: Frequencies and percentages regarding knowledge about Covid -19 vaccine

Variables	N (%)
Which of the following best describes your reason for getting vaccinated against COVID-19?	
I want to protect myself and the community	339 (53.4)
I have increased exposure to the patients	65 (10.2)
I had COVID in the past and don't want to have it again	47 (7.4)
It can lower the chance of getting COVID-19	74 (11.7)
To be able to travel safely	19 (3.0)
It helps to stop the COVID-19 pandemic	51 (8.0)
It is a safer way to help build the protection	40 (6.3)
How long will it take to build immunity against COVID-19 after getting vaccinated?	
Immediately after the first dose	16 (2.5)
14 days after the first shot	141 (22.2)
Immediately after the second dose	47 (7.4)
14 days after the second dose	310 (48.8)
One to two months after the second dose	121 (19.1)
Have you ever been infected with COVID-19 infection?	
Yes	197 (31.0)
No	321 (50.6)
Don't know	117 (18.4)

Do you feel nervous before getting COVID-19 vaccination?	
No	254 (40)
Yes	381 (60)
After Getting a COVID-19 vaccine can you still catch Covid-19 infection and can also infect others	
Yes	482 (75.9)
No	55 (8.6)
Don't Know	98 (15.4)
A vaccine is important to end the COVID-19 pandemic	
Yes	562 (88.5)
No	38 (6)
Don't Know	35 (5.5)

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Table 3(on next page)

Belief and attitude of respondents after getting COVID-19 vaccine (n = 635)

1 **Table 3:** Belief and attitude of respondents after getting COVID-19 vaccine (n = 635)

Variables	Agree N (%)	Disagree	Neutral N (%)
Safety of a vaccine cannot be considered guaranteed	356 (56)	75 (11.8)	204 (32.2)
Worried about unseen effects of COVID-19 vaccine	379 (59.7)	86 (13.5)	170 (26.8)
Believe that the side effects of the vaccine are reasonable and will not discourage me from taking the vaccine	537 (84.5)	31 (4.9)	67 (10.6)
After getting a COVID-19 vaccine you are worried about getting the virus	360 (56.7)	149 (23.5)	126 (19.8)
Trust the Ministry of Health of Pakistan regarding vaccine safety	490 (77.2)	59 (9.3)	86 (13.5)
Concerned about COVID-19 vaccine efficacy	434 (68.4)	84 (13.2)	117 (18.4)
Believe that benefits of COVID-19 vaccine are greater than its risk	542 (85.4)	29 (4.5)	64 (10.1)
Believe that COVID-19 vaccine provides long term protection	269 (42.3)	177 (27.9)	189 (29.8)
Believe that COVID-19 vaccine is approved quickly	311 (48.9)	184 (28.9)	140 (22.2)
Have you ever had serious reaction after getting COVID-19 vaccine	11 (1.8)	624 (98.2)	0%

Table 4(on next page)

Detailed distribution of practices of respondents

1 **Table 4:**Detailed distribution of practices of respondents

Follow basic SOPS After Getting COVID-19 Vaccine	
Responses	Respondents n (%)
Yes	603 (95)
No	17 (2.7)
Don't know	15 (2.3)
Recommend COVID-19 Vaccine to Relatives and Friends	
Yes	596 (93.8)
No	15 (2.4)
Don't know	24 (3.8)
Recommend COVID-19 Vaccine to Immuno-Compromised Patients	
Yes	367 (57.8)
No	141 (22.2)
Don't know	127 (20)
Still Wear a Face Mask After COVID-19 Vaccination	
Yes	614 (96.7)
No	8 (1.3)
Don't know	13 (2)
Have You Completed Your Dosage Of COVID-19 Vaccine?	
Yes	343 (54)
No	292 (46)

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Table 5(on next page)

Effects of genders on respondents belief and attitudes after getting COVID-19 vaccine by applying Chi-square and Fisher exact test

- 1 **Table 5:** Effects of genders on respondents belief and attitudes after getting COVID-19 vaccine
- 2 by applying Chi-square and Fisher exact test

Gender	Strongly agree	Agree	Strongly Disagree	Disagree	Neutral	P > 0.05
Worry About Unseen Side Effects Of COVID-19 Vaccine						
Males	38 (14.5)	116 (44.3)	8 (3.1)	30 (11.5)	70 (26.7)	0.901
Females	53 (14.2)	172 (46.1)	7 (1.9)	41 (11)	100 (26.8)	
Concerned About Vaccine Efficacy						
Males	63 (24)	109 (41.6)	8 (3.1)	39(14.9)	43 (16.4)	0.040
Females	88 (23.6)	174 (46.6)	4 (1.1)	33 (8.8)	74 (19.8)	
Believe That Vaccine Side-Effects Are Reasonable						
Males	83 (31.7)	136 (51.9)	0	11 (4.2)	32 (12.2)	0.037
Females	90 (24.1)	228 (61.1)	5 (1.3)	15 (4)	35 (9.4)	
Trust the ministry of Health of Pakistan Regarding Vaccine Safety						
Males	68 (26)	151 (57.6)	5 (1.9)	12 (4.6)	26 (9.9)	0.000
Females	52 (13.9)	219 (58.7)	9 (2.4)	33 (8.8)	60 (16.1)	
Benefits are Greater than Risk						
Males	85 (32.4)	144 (55)	4 (1.5)	9 (3.4)	20 (7.6)	0.064
Females	87 (23.3)	226 (60.6)	7 (1.9)	9 (2.4)	44 (11.8)	
COVID-19 Vaccine Provide Long Term Protection						
Males	27 (10.3)	96 (36.6)	10 (3.8)	66 (25.2)	63 (24)	0.002
Females	16 (4.3)	130 (34.9)	5 (1.3)	96 (25.7)	126 (33.8)	

Table 6(on next page)

Multivariate regression analyses for models predicting attitudes and practices towards COVID-19 vaccine (N = 635)

Table 6: Multivariate regression analyses for models predicting attitudes and practices towards COVID-19 vaccine (N = 635)

Variables	Attitudes towards COVID-19 Vaccine†					Practices towards COVID-19 Vaccine‡				
	B	SE	t	β	p-value	B	SE	t	β	p-value
Age ^a	0.29	0.11	2.67	0.12	.008	0.03	0.07	0.44	0.02	.660
Gender ^b	-0.31	0.21	-1.48	-0.06	.141	-0.22	0.13	-1.69	-0.07	.092
Marital Status ^c	0.01	0.24	0.02	0.00	.983	0.53	0.15	3.43	0.16	.001
Education ^d	-0.26	0.33	-0.79	-0.03	.428	-0.02	0.21	-0.11	-0.01	.912
Occupation ^e	0.23	0.30	0.76	0.04	.445	-0.05	0.19	-0.27	-0.01	.789
Currently Practicing ^f	0.55	0.25	2.21	0.11	.028	-0.05	0.16	-0.33	-0.02	.742
Month of Vaccination ^g	-0.06	0.08	-0.80	-0.03	.426	-0.03	0.05	-0.68	-0.03	.497
Information sources	0.07	0.10	0.67	0.03	.505	0.19	0.07	2.86	0.11	.004
Knowledge	0.24	0.06	4.45	0.17	<.001	0.15	0.04	4.23	0.16	<.001
Attitude	---	---	---	---	---	0.12	0.03	4.61	0.18	<.001

Note: B = unstandardized regression coefficient; SE = Standard error; β = Standardized regression coefficient; ^a 1 = 20-30, 2 = 31-40, 3 = 41-50, 4 = 51-60, 5 = Above 60; ^b 1 = Male, 2 = Female; ^c 1 = Single, 2 = Married; ^d 1 = Graduation/Undergraduate, 2 = Minimum 16 years with medical specialization; ^e 1 = Medical Student, 2 = Medical Professional; ^f 1 = Yes, 2 = No; ^g 1-6 = January-June 2021; Bold and Italic indicates significant

† $F_{(9,625)} = 4.599; p < .001; R^2_{Adj.} = .049$

‡ $F_{(10,624)} = 9.507; p < .001; R^2_{Adj.} = .118$

Figure 1

Minor Side Effects of Respondents After Receiving COVID-19 Vaccine

