Coronavirus Pandemic

COVID-19 booster dose acceptance, hesitancy and concerns among the elderly population: A cross-sectional study

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Abstract

Introduction: The COVID-19 pandemic that originated in Wuhan, China in December 2019 results in respiratory and gastrointestinal infections. Elderly patients are at high risk. Preventive measures like avoiding contact with COVID-19 patients and wearing N95 masks can contribute to reducing the risk of infection, but vaccination remains crucial.

Methodology: A cross-sectional survey-based study was conducted among the elderly population ($\geq$ 50 years) in Pakistan. A 16-items questionnaire explored the socio-demographic profile of the participants, including questions about their age, gender, etc. The other sections included questions regarding vaccine registration, vaccine acceptance, and hesitation and fears towards vaccines. The items were developed to collect the data on the basis of the Likert scale.

Results: There was a total of 3059 respondents. The majority of the participants (n = 2726, 89.1%) were aged below 70 years, while 10.9% (n = 333) were aged above 70 years. Many participants (47.1%) expressed their concerns about the efficacy of COVID-19 vaccine booster dose. Despite their willingness to vaccinate with the cOVID-19 vaccine, 24.7% female participants expressed concerns related to the safety of the vaccine. Among all the respondents, 23.1% participants had no concerns about the cOVID-19 vaccine booster dose. The study identified a reluctance and lack of confidence in the efficiency of the COVID-19 booster dose.

Conclusions: The alarming situation is rigidity towards vaccination among the elderly population. Necessary measures must be taken by the health department of Pakistan to manage this reluctant behavior and increase confidence on the efficiency of the COVID-19 booster dose.

Key words: COVID-19; booster dose; elderly; reluctance; acceptance.

Introduction

The severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) epidemic began in December 2019 in China leading to a pandemic around the world [1]. This pandemic caused a variety of challenges worldwide including deaths, global lockdown, hospitalizations, financial burdens, traveling ban, and severe effects on mental health [2]. Diverse treatments were tested and vaccine development was initiated to counter COVID-19. Research has shown that vaccination plays a crucial part in infection prevention, and reducing illness and the number of deaths. Vaccines were developed by Moderna, Pfizer BioNTech, Janssen, Oxford–AstraZeneca, Sinopharm, and Sinovac to reduce the transmission and severity of COVID-19 [3]. Vaccination has shown around 50% efficacy in decreasing the frequency of COVID-19 and controlling the disease course [4].

Despite the need, urgency, and importance of COVID-19 vaccination, it was observed that there was a lack of awareness, low acceptance and reluctance towards vaccination. The World Health Organization (WHO) has recognized vaccine refusal and reluctance as one of the topmost dangers to worldwide health and it is still a challenge for many countries [5,6]. Various research studies were conducted to evaluate the trend of

vaccination acceptance and reluctance in different populations, and communities. Numerous studies were conducted to identify the reluctance of health professionals regarding COVID-19 vaccination including during the pandemic months when no vaccine was available and the time when various vaccines were available for use. The study of this high-risk population is of utmost importance as they were the first receivers of the vaccines and their behavior and attitudes toward vaccines eventually affected the behavior of communities and patients [7]. It was found that in most countries, the main reason for vaccine hesitancy was the absence of trust and faith in the safety of the COVID-19 vaccine. Since many people refused the vaccine, authorities in schools, workplaces, and other institutions required proof of vaccination for travelling and social activities. These steps played a positive role in increasing the number of vaccinations [8]. Research claimed that factors for vaccination reluctance included physician guidance and vaccine accessibility; in addition, age, education, area, living and financial status also played an important role in vaccine approval and reluctance [9]. A study conducted in urban areas identified other factors such as lack of awareness and knowledge, individual beliefs and misunderstandings that COVID-19 only affected patients with comorbidity, and myths about the vaccine that it leads to infertility [10]. Similar studies were conducted in Pakistan to identify the trend of vaccination acceptance.

Pakistan initiated its vaccination drive gradually, starting with health professionals. A study was conducted on Pakistani pharmacists to evaluate their attitude and acceptance towards vaccination. It was found that the majority of the pharmacists were willing to get vaccinated. However, the respondents mentioned that fear of unknown adverse reaction and inadequate data on efficacy and safety of vaccines played an important role in deciding whether to get vaccinated or not. The unwilling respondents shared their fear, rumors and myths regarding the COVID-19 vaccine [11]. Another study identified fear among the young population due to lack of data and reliability of available Chinese vaccines [12].

In almost all countries, elderly people have been associated with a higher chance of getting affected by COVID-19. Older people with comorbidities were at specific risk of severe infection, complications, hospitalization, and death [13]. All countries planned to vaccinate the elderly as a priority. However, the data on COVID-19 vaccines' safety and efficacy in older people were very limited as these patient groups were mostly not included in clinical trials [14]. Therefore, it is very important to understand the behavior and attitude of the elderly towards COVID-19 vaccination. The current study aimed to evaluate the behavior of the elderly population (≥ 50 years) towards COVID-19 vaccination including vaccine registration, acceptance, and reluctance, and to identify the reasons for their reluctance toward the COVID-19 vaccine.

Methodology

The objective of the study was to investigate the behavior of the elderly population towards COVID-19 vaccination in Pakistan. The study design was cross-sectional. The sample size was measured by a sample size calculator [15] with 95% confidence level and 3% margin of error. The sample size was calculated to be a minimum of 1900 elderly individuals (≥ 50 years). The duration of the study was 5 months, from August to November 2021.

The convenience sampling technique was used for data collection as it is the most preferred method to collect data from a large number of participants. The study focused on the registration, acceptance, and reluctance patterns of study participants regarding the COVID-19 vaccine booster dose. Only those participants were considered eligible who had received two doses of the COVID-19 vaccine and were eligible for a booster dose at the time of data collection/survey but had not yet taken the booster dose.

The research tool used for data collection was a structured questionnaire. The questionnaire was established after various iterations and an extensive literature review [16,17]. The questionnaire was prepared in English. The questionnaire was sent through emails, WhatsApp, and various other social media platforms to different groups, families, and friends. Young people were asked to assist the elderly if they required any help. Reminders were also sent frequently through emails and on different social media platforms to collect more data and to obtain the required sample size. The survey questionnaire was prepared in a manner that it could only be accessed and filled out after the consent of the participants. The data collected was kept anonymous and was recorded with codes assigned to each participant to maintain the confidentiality and privacy of all the respondents. The data files were kept safe as password protected computer files while the hard copies of any data file were kept locked during the study and were disposed of properly and safely later.

The questionnaire had a total of 18 questions and was divided into sections. The first section of the questionnaire explored the socio-demographic profile

of the participants including questions about their age, gender, marital status, education, nationality, profession, work experience, and workplace. The other sections concentrated on questions regarding vaccine registration, vaccine acceptance, and reluctance and fears towards a vaccine. Questions were developed to collect the data on the basis of the Likert scale. The scale ranged from strongly disagree to strongly agree (Likert scale 1 to 5). Neutral option in the Likert scale considered that the participant does not fully agree with the statement, expressing a lack of strong opinion or uncertainty about it. Mean scores for the data were calculated. A mean score was derived from the items, excluding those that were dichotomous with a yes/no response. Yes/no responses were not included in the calculation.

The data for the study were analyzed by Statistical Package for Social Sciences (SPSS, version 23). Descriptive statistics and frequency were used to report continuous and categorical data. The categorical data were expressed as a number (n), frequency, and percentage (%) throughout the manuscript. Continuous variables were analyzed using a two-tailed t-test for parametric variables and a Mann-Whitney U test for non-parametric variables. All the variables were found statistically significant ($p\ value < 0.05$). The items with multiple responses were analyzed as percent response and percent of cases response.

The study was approved by the Institutional Review Committee of Iqra University North Campus (IU/IRC/22-023), Karachi, Pakistan.

Results

Data from 3059 participants were collected and analyzed for the study. More than 50% of the respondents were male (n = 1607, 52.5%) and the remaining were females (n = 1452, 47.5%). Majority of the participants (n = 2726, 89.1%) were aged below 70 years, while 10.9% (n = 333) were aged above 70 years. The education level of 41.6% (n = 1270) respondents was below graduation, whereas 58.4% (n = 1789) were graduates or postgraduates. The marital status of the participants indicated that a major fraction (n = 1736, 56.8%) were married while the remaining (n = 1323, 43.3%) were either single, divorced, or widowed. The participants of the study suffered from common comorbidities, among which hypertension was frequently reported by 26.1% (n = 797) individuals. The detailed demographic data is represented in Table 1.

When asked about their reluctance/acceptance towards the administration of a booster dose of COVID-19 vaccines, 37.69% (n = 1153) of the participants expressed reluctance toward the COVID-19 vaccine booster dose. The graduate participants had less reluctance as compared to non-graduate participants as the mean reluctance score for graduate participants were significantly less as compared to non-graduate participants (2.86 ± 0.028 vs 2.95 ± 0.024; p = 0.016). The male participants were more concerned with the rushed pace of testing and side effects associated with the COVID-19 vaccine booster with significantly lower mean scores compared to the female participants. The analysis for items related to reluctance of COVID-19 vaccine booster dose is summarized in Table 2. The lowest acceptance mean score was among participants with diabetes and chronic respiratory illness. The mean acceptance score of participants with different comorbidities is summarized in Figure 1.

The overall mean score of 5-items related to the participants' perception of acceptance was 2.65 ± 0.025 (SD = 1.21). The participants with ages > 70 years, graduates and female participants were more confident and willing to get vaccinated themselves and their family members with COVID-19 vaccine booster dose as compared to their respective counterparts. Table 3 summarizes the descriptions of 5-items related to the acceptance of the COVID-19 vaccine booster dose.

Table 1. Demographic characteristics of respondents.

Characteristics	n (%)
Age (years)	
Mean ± SD	60.57 ± 6.54
50-60	2055 (67.2)
61-70	671 (21.9)
Above 70	333 (10.9)
Gender	
Male	1607 (52.5)
Female	1452 (47.5)
Level of education	
Doctorate	184 (6.0)
Masters	486 (15.9)
Graduation	1119 (36.6)
Matric	727 (23.8)
Less than matric	543 (17.8)
Marital status	
Single	269 (8.8)
Married	1736 (56.8)
Widowed	702 (22.9)
Divorced	352 (11.6)
Common comorbidities	
Hypertension	797 (26.1)
Acute/Chronic kidney diseases	173 (5.7)
Congestive heart failure	314 (10.3)
Endocrine disorders	516 (16.9)
Respiratory complications	188 (6.14)
Arthritis	160 (5.20)
Chronic liver diseases	183 (5.9)
Others	728 (23.7)

A large number of participants (47.1%) expressed their concerns about the efficacy of the COVID-19 vaccine booster dose. Despite their willingness to vaccinate with the COVID-19 vaccine, around one-fourth of the female participants expressed concerns related to the safety of the vaccine. Among all respondents, only one-fourth of participants had no concerns about the COVID-19 vaccine booster dose. Concerns related to the COVID-19 vaccine are summarized in Table 4. Very significant results were obtained concerning the safety of the vaccine. Females were more satisfied with the safety of the vaccine as compared to males (Table 4). Regarding concerns about the vaccine, a significant result proved non-graduates have more concerns than graduates.

Some of the respondents suffered from different commonly occurring comorbidities. These respondents were evaluated for the degree of acceptance of vaccine doses. The respondents who had diabetes and respiratory disorders showed more acceptance for the COVID-19 vaccines, as compared with participants with other associated comorbidities.

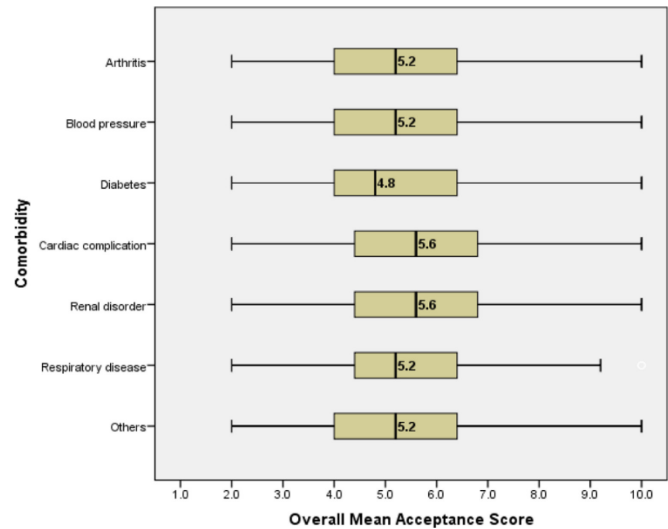**Figure 1.** Overall mean acceptance score distribution based on participants' comorbidity.

Table 2. Response distribution of COVID-19 vaccine booster dose reluctance.

Parameter	Mean ± SEM (SD)	*p* value	Strongly agree N (%)	Agree N (%)	Neutral N (%)	Disagree N (%)	Strongly disagree N (%)
I am reluctant to get a booster COVID-19 vaccine							
Overall (n = 3059)	2.91 ± 0.018 (1.020)		0 (0)	1153 (37.69%)	793 (25.92%)	800 (26.15%)	313 (10.23%)
Age							
≤ 70 years (n = 2726)	2.91 ± 0.019 (1.016)	0.98	0 (0)	1024 (37.56%)	706 (25.90%)	725 (26.60%)	271 (9.94%)
> 70 years (n = 333)	2.91 ± 0.058 (1.055)		0 (0)	129 (38.74%)	87 (26.13%)	75 (22.52%)	42 (12.61%)
Gender							
Male (n = 1607)	2.90 ± 0.026 (1.043)	0.59	0 (0)	615 (38.27%)	400 (24.89%)	406 (25.26%)	186 (11.57%)
Female (n = 1452)	2.92 ± 0.026 (0.993)		0 (0)	538 (37.05%)	393 (27.07%)	394 (27.13%)	127 (8.75%)
Education							
Graduate (n = 1789)	2.95 ± 0.024 (1.023)	0.016	0 (0)	711 (39.74%)	451 (25.21%)	447 (24.99%)	180 (10.06%)
Non-graduate (n = 1270)	2.86 ± 0.028 (1.013)		0 (0)	442 (34.80%)	342 (26.93%)	353 (27.80%)	133 (10.47%)
I am worried that the rushed pace of testing the new booster COVID-19 vaccine may have failed to detect potential side effects or dangers							
Overall (n = 3059)	3.30 ± 0.020 (1.115)		395 (12.91%)	1074 (35.11%)	855 (27.95%)	509 (16.64%)	226 (7.39%)
Age							
≤ 70 years (n = 2762)	3.28 ± 0.021 (1.100)	0.045	326 (11.80%)	965 (34.94%)	781 (28.28%)	458 (16.58%)	196 (7.10%)
> 70 years (n = 333)	3.41 ± 0.067 (1.228)		69 (20.72%)	109 (32.73%)	74 (22.22%)	51 (15.32%)	30 (9.01%)
Gender							
Male (n = 1607)	3.25 ± 0.027 (1.102)	0.026	183 (11.39%)	554 (34.47%)	479 (29.81%)	266 (16.55%)	125 (7.78%)
Female (n = 1452)	3.34 ± 0.030 (1.127)		212 (14.60%)	520 (35.81%)	376 (25.90%)	243 (16.74%)	101 (6.96%)
Education							
Graduate (n = 1789)	3.27 ± 0.026 (1.097)	0.143	208 (11.63%)	628 (35.10%)	532 (29.74%)	286 (15.99%)	135 (7.55%)
Non-graduate (n = 1270)	3.33 ± 0.032 (1.139)		187 (14.72%)	446 (35.12%)	323 (25.43%)	223 (17.56%)	91 (7.17%)
I am worried about the possible side effects of a booster COVID-19 vaccine for myself							
Overall (n = 3059)	3.20 ± 0.19 (1.063)		300 (9.81%)	1000 (32.69%)	988 (32.30%)	567 (18.54%)	204 (6.67%)
Age							
≤ 70 years (n = 2762)	3.19 ± 0.020 (1.044)	0.105	242 (8.88%)	902 (33.09%)	899 (32.98%)	510 (18.71%)	173 (6.35%)
> 70 years (n = 333)	3.29 ± 0.066 (1.207)		58 (17.42%)	98 (29.43%)	89 (26.73%)	57 (17.12%)	31 (9.31%)
Gender							
Male (n = 1607)	3.16 ± 0.027 (1.067)	0.009	156 (9.71%)	485 (30.18%)	532 (33.11%)	325 (20.22%)	109 (6.78%)
Female (n = 1452)	3.26 ± 0.028 (1.056)		144 (9.92%)	515 (35.47%)	456 (31.40%)	242 (16.67%)	95 (6.54%)
Education							
Graduate (n = 1789)	3.18 ± 0.025 (1.053)	0.12	158 (8.83%)	582 (32.53%)	594 (33.20%)	331 (18.50%)	124 (6.93%)
Non-graduate (n = 1270)	3.24 ± 0.030 (1.076)		142 (11.18%)	418 (32.91%)	394 (31.02%)	236 (18.58%)	80 (6.30%)

SD: Standard deviation; SEM: Standard error mean.

Table 3. Response distribution of COVID-19 vaccine booster dose acceptance.

Parameter	Mean ± SEM (SD)	*p*-value	Strongly Agree N (%)	Agree N (%)	Neutral N (%)	Disagree N (%)	Strongly disagree N (%)
I believe that booster COVID-19 is important to combat the COVID-19 pandemic							
Overall (n = 3059)	2.67 ± 0.026(1.436)		626 (20.46%)	148 (4.84%)	663 (21.67%)	833 (27.23%)	789 (25.79%)
Age							
≤ 70 years (n = 2762)	2.67 ± 0.027 (1.433)	0.810	551 (20.21%)	138 (5.06%)	595 (21.83%)	736 (27.00%)	706 (25.90%)
> 70 years (n = 333)	2.69 ± 0.080 (1.459)		75 (22.52%)	10 (3.00%)	68 (20.42%)	97 (29.13%)	83 (24.92%)
Gender							
Male (n = 1607)	2.66 ± 0.035 (1.418)	0.701	315 (19.60%)	77 (4.79%)	372 (23.15%)	430 (26.76%)	413 (25.70%)
Female (n = 1452)	2.68 ± 0.038 (1.456)		311 (21.42%)	71 (4.89%)	291 (20.04%)	403 (27.75%)	376 (25.90%)
Education							
Graduate (n = 1789)	2.69 ± 0.034 (1.428)	0.448	365 (20.40%)	93 (5.20%)	388 (21.69%)	500 (27.95%)	443 (24.76%)
Non-graduate (n = 1270)	2.65 ± 0.041 (1.447)		261 (20.55%)	55 (4.33%)	275 (21.65%)	333 (26.62%)	346 (27.24%)
I think that the COVID-19 pandemic is a serious health condition in Pakistan							
Overall (n = 3059)	2.81 ± 0.026 (1.421)		670 (21.90%)	195 (6.37%)	731 (23.90%)	814 (26.61%)	649 (21.22%)
Age							
≤ 70 years (n = 2762)	2.80 ± 0.027 (1.417)	0.226	588 (21.57%)	173 (6.35%)	653 (23.95%)	732 (26.85%)	580 (21.28%)
> 70 years (n = 333)	2.90 ± 0.080 (1.457)		82 (24.62%)	22 (6.61%)	78 (23.42%)	82 (24.62%)	69 (20.72%)
Gender							
Male (n = 1607)	2.80 ± 0.035 (1.404)	0.698	337 (20.97%)	110 (6.85%)	392 (24.39%)	434 (27.01%)	334 (20.78%)
Female (n = 1452)	2.82 ± 0.038 (1.440)		333 (22.93%)	85 (5.85%)	339 (23.35%)	380 (26.17%)	315 (21.69%)
Education							
Graduate (n = 1789)	2.81 ± 0.033 (1.412)	0.848	388 (21.69%)	112 (6.26%)	424 (23.70%)	497 (27.78%)	368 (20.57%)
Non-graduate (n = 1270)	2.82 ± 0.040 (1.434)		282 (22.20%)	83 (6.54%)	307 (24.17%)	317 (24.96%)	281 (22.13%)
I am confident about the accuracy of the booster COVID-19 vaccine.							
Overall (n = 3059)	2.61 ± 0.021 (1.146)		269 (8.79%)	392 (12.81%)	710 (23.21%)	1244 (40.67%)	444 (14.51%)
Age							
≤ 70 years (n = 2762)	2.55 ± 0.021 (1.110)	< 0.001	204 (7.84%)	325 (11.92%)	640 (23.48%)	1153 (42.30%)	404 (14.82%)
> 70 years (n = 333)	3.08 ± 0.072 (1.317)		65 (19.52%)	67 (20.12%)	70 (21.02%)	91 (27.33%)	40 (12.01%)
Gender							
Male (n = 1607)	2.52 ± 0.029 (1.145)	< 0.001	134 (8.34%)	183 (11.39%)	337 (20.97%)	685 (42.63%)	268 (16.68%)
Female (n = 1452)	2.70 ± 0.030 (1.139)		135 (9.30%)	209 (14.39%)	373 (25.69%)	559 (38.50%)	176 (12.12%)
Education							
Graduate (n = 1789)	2.45 ± 0.026 (1.106)	< 0.001	131 (7.32%)	162 (9.06%)	409 (22.86%)	769 (42.98%)	318 (17.78%)
Non-graduate (n = 1270)	2.83 ± 0.033 (1.165)		138 (10.87%)	230 (18.11%)	301 (23.70%)	475 (37.40%)	126 (9.92%)
I am willing to get vaccinated immediately upon the availability of a booster COVID-19 vaccine.							
Overall (n = 3059)	2.59 ± 0.021 (1.161)		255 (8.34%)	448 (14.65%)	627 (20.50%)	1252 (40.93%)	477 (15.59%)
Age							
≤ 70 years (n = 2762)	2.54 ± 0.022 (1.128)	< 0.001	192 (7.04%)	386 (14.16%)	552 (20.25%)	1162 (42.63%)	434 (15.92%)
> 70 years (n = 333)	3.04 ± 0.072 (1.317)		63 (18.92%)	62 (18.62%)	75 (22.52%)	90 (27.03%)	43 (12.91%)
Gender							
Male (n = 1607)	2.51 ± 0.029 (1.164)	< 0.001	130 (8.09%)	210 (13.07%)	289 (17.98%)	691 (43.00%)	287 (17.86%)
Female (n = 1452)	2.69 ± 0.030 (1.150)		125 (8.61%)	238 (16.39%)	338 (23.28%)	561 (38.64%)	190 (13.09%)
Education							
Graduate (n = 1789)	2.42 ± 0.026 (1.116)	< 0.001	122 (6.82%)	192 (10.73%)	345 (19.28%)	793 (44.33%)	337 (18.84%)
Non-graduate (n = 1270)	2.83 ± 0.033 (1.181)		133 (10.47%)	256 (20.16%)	282 (22.20%)	459 (36.14%)	140 (11.02%)
I will vaccinate my children/spouse/family members if a booster COVID-19 vaccine is available immediately							
Overall (n = 3059)	2.57 ± 0.021 (1.189)		283 (9.25%)	409 (13.37%)	590 (19.29%)	1249 (40.83%)	528 (17.26%)
Age							
≤ 70 years (n = 2762)	2.51 ± 0.022 (1.159)	< 0.001	218 (8.00%)	353 (12.95%)	517 (18.97%)	1156 (42.41%)	482 (17.68%)
> 70 years (n = 333)	3.00 ± 0.073 (1.336)		65 (19.52%)	56 (16.82%)	73 (21.92%)	93 (27.93%)	46 (13.81%)
Gender							
Male (n = 1607)	2.50 ± 0.030 (1.194)	0.0025	151 (9.40%)	184 (11.45%)	294 (18.29%)	672 (41.82%)	306 (19.04%)
Female (n = 1452)	2.63 ± 0.031 (1.181)		132 (9.09%)	225 (15.50%)	296 (20.39%)	577 (39.74%)	222 (15.29%)
Education							
Graduate (n = 1789)	2.41 ± 0.027 (1.139)	< 0.001	134 (7.49%)	182 (10.17%)	331 (18.50%)	783 (43.77%)	359 (20.07%)
Non-graduate (n = 1270)	2.78 ± 0.034 (1.225)		149 (11.73%)	227 (17.87%)	259 (20.39%)	466 (36.69%)	169 (13.31%)

SD: Standard deviation; SEM: Standard error mean.

Discussion

Despite mass vaccination against COVID-19, re-emergence of infection was observed. This comeback was caused either due to weakened immunity over time or due to new variants of COVID-19. To overcome the weakened immunity and to decrease the incidence of re-emerging cases, an extra dose or a booster dose of vaccine was needed [18]. This study aimed to evaluate the concerns and public perception about booster shots and the degree of acceptance and reluctance towards the COVID-19 booster vaccine among the elderly population in Pakistan.

The current study considered elderly population as those who were 50 years or older [19-21]. The proportion of participants who were in favor of and those who were against the booster dose administration was equal. A slightly greater percentage (37.69%) of respondents showed reluctance to get the booster vaccine for COVID-19 infection, whereas 36.38% of participants did not show hesitation. The remaining 25.92% of respondents maintained a neutral behavior when asked about their reluctance to booster dose vaccination. This was contradictory to the prior research conducted in various countries like Jordon and Saudi Arabia, in which a greater proportion of participants favored the COVID-19 booster dose administration [22]. The overall result demonstrated that a greater fraction of participants (56.52%) denied the vaccine booster dose.

The respondents were asked about their willingness to get vaccinated soon after the availability of the booster dose in the market. Only 673 (22.9%) respondents expressed their absolute willingness to receive COVID -19 vaccine booster dose. This is in contrast to the willingness reported by Walid *et al.*, among the Jordanian population, in which around 55% of the participants with age $\geq$ 50 years expressed willingness to get vaccinated with the booster dose [23]. Another study conducted among the elderly Taiwanese individuals by Chia-Yu *et al.* observed that 74.9% of participants were willing to take the booster dose. Willingness among the male elderly individuals was reported to be statistically significantly higher as compared to female participants [24]. However, in the current study, the female participants expressed significantly more willingness for booster dose as compared to the male participants (2.69 ± 1.15 vs. 2.51 ± 1.16; $p < 0.001$). Moreover, in the current study, graduate participants showed significantly more willingness with a higher mean score (2.83 ± 1.18 vs. 2.42 ± 1.11; $p < 0.001$) as compared to non-graduate participants. Similar results were reported in a study conducted on the elderly population of Hong Kong by Zixin *et al.*, in which the graduate participants showed significantly higher willingness as compared to the non-graduate participants [25], whereas participants < 70 years were more willing than participants aged > 70 years.

The main reason for the lack of willingness and reluctance towards the administration of booster doses was the fear of unidentified side effects due to the increased pace of vaccine testing. Around 42.5% of participants were concerned about the side effects associated with the booster dose of vaccine. Females

Table 4. Response distribution of COVID-19 vaccine booster dose concerns.

Items	Responses		Percent of cases
	N	Percent	
I have the following specific concerns(s) about the booster COVID-19 vaccine			
(a) Efficacy (overall)	1441	36.8%	47.1%
Male vs female		37.5% vs. 36.1%	47.1% vs. 47.1% [ns]
Less than 70 years vs. more than 70 years		36.8% vs. 36.9%	47.4% vs. 45% [ns]
Non-graduate vs. graduate		36.8% vs 36.8%	47.1% vs. 47.1% [ns]
(b) Safety (overall)	618	15.8%	20.2%
Male vs female		12.8% vs. 18.9%	16.1% vs. 24.7% [***]
Less than 70 years vs. more than 70 years		16% vs. 13.8%	20.6% vs. 16.8% [ns]
Non-graduate vs. graduate		15.2% vs. 16.2%	19.4% vs. 20.7% [ns]
(c) The newness of the vaccine (overall)	572	14.6%	18.7%
Male vs female		15.8% vs. 13.4%	19.8% vs. 17.5% [ns]
Less than 70 years vs. more than 70 years		14.5% vs. 15.2%	18.7% vs. 18.6% [ns]
Non-graduate vs. graduate		13.9% vs. 15.1%	17.8% vs. 19.3% [ns]
(d) Vaccine contents (overall)	556	14.2%	18.2%
Male vs female		14.5% vs. 13.9%	18.2% vs. 18.1% [ns]
Less than 70 years vs. more than 70 years		14.3% vs. 13%	18.5% vs. 15.9% [ns]
Non-graduate vs. graduate		13.7% vs. 14.6%	17.5% vs. 18.7% [ns]
(e) No concerns (overall)	726	18.6%	23.7%
Male vs female		19.4% vs. 17.7%	24.3% vs. 23.1% [ns]
Less than 70 years vs. more than 70 years		18.3% vs. 21.1%	23.5% vs. 25.8% [ns]
Non-graduate vs. graduate		20.4% vs. 17.3%	26.1% vs. 22.1% [*]
Total	3913	100%	127.9%

ns: *p* value > 0.05; * : $p \leq 0.05$; *** : $p \leq 0.001$.

were more concerned about post-vaccination adverse effects as compared to males. Nearly half of the participants (48.02%) with a mean score of 3.30 ± 0.020 showed reluctant behavior owing to the potential of undiscovered side effects. This data was further strengthened with the significant observation in which females and participants aged above 70 years were more hesitant about the side effects which remained undetected due to the rushed pace of vaccine testing. Moreover, females were also found to be more reluctant (mean value = 3.26 ± 0.028) as compared to males (mean value = 3.16 ± 0.027) to take booster shots due to the current adverse effects associated with the vaccine. Fear of experiencing unexpected side effects, demand for more results from the clinical studies, and assurance of not contracting the virus (COVID-19) were regarded as barriers to receiving extra doses of the COVID-19 vaccine among the people of Jordan [26]. The findings of Lounis *et al.* (2022) considered side effects after vaccination and the impact of booster doses on the immune system as the basic reasons for the rejection of booster dose administration [27]. These findings support the observation noted in our study.

An interesting observation was that there was a significantly higher reluctance towards the booster dose of the COVID-19 vaccine among the graduates (mean value: 2.95 ± 0.024). Non-graduates were less hesitant as compared to graduates. This indicates increased hesitation among individuals with higher education levels. This was supported by a similar study performed in Algeria stating that an increased acceptance was recorded for the booster shots among students of school and college as compared to university students and postgraduates [27]. Results of the current study showed that more than half of the participants (55.18%) were not confident about the accuracy of the booster vaccine. This contributed to the reluctance of respondents towards the administration of vaccines owing to the presence of side effects or lack of clinical data for the COVID-19 vaccine due to the rush of testing. A study performed by Lounis *et al.* (2022) highlighted the reasons for regret after vaccination. Among the various reasons, the inefficiency of the vaccine was the most frequently reported reason by the participants [22].

Conclusions

The COVID-19 pandemic has devastated the world, and the only way to get out of the situation is to get vaccinated. However, the current study shows vaccine reluctance among the majority of the population and their lack of confidence in the vaccine is increasing the threat from the disease. One major concern is that the elderly population has rigid negative opinion towards vaccination. Extensive awareness programs on the national level are required to overcome this reluctance. The health department of Pakistan must launch some awareness programs to educate the population.

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