ORIGINAL ARTICLE

ATTITUDES TOWARD COVID-19 BOOSTER DOSE VACCINES ACCEPTANCE AMONG HEALTHCARE STUDENTS, KARACHI: A CROSS-SECTIONAL ANALYSIS

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ABSTRACT

Objective: This research aims to evaluate the attitude and perception of medical students of Karachi towards to Standard Operating Procedure (SOP) and guidelines for COVID-19 booster dose vaccines.

Methods: In May 2022, a cross-sectional study was conducted among Pakistani medical and dental students at Dow University of Health Science (DUHS). The questionnaire collected demographic, COVID-19 vaccine characteristics, attitude towards COVID-19 booster dose. Independent sample t-test and ANOVA test was used to compare the mean attitude score with groups by using SPSS. Level of significance was set on 5% for this study.

Result: A total of 310 medical students participated in the study with the age range of 18 years to 28 years and majority of the participants were female 224(72.3%). The infection rate of COVID-19 among the participants came out to be 98(31.6%) with only 15(4.8%) reported hospital admissions and 268(86.5%) have relatives who are infected with COVID-19. Two hundred seventy-eight (89.7%) of the individuals believe that the emergence of continuously new variants followed by 244(78.7%) not following the measures per CDC guidelines regarding vaccination and incomplete dosage 223(71.9%) to be the major causes of breakthrough infections.

Conclusion: The study concludes that the future healthcare students show a concerning level of hesitancy and rejection towards COVID-19 booster doses. The detrimental attitude towards COVID-19 vaccination and booster dose suggested the mass awareness is intensely required to enhance the level of immunity amongst health care students.

Keywords: COVID-19 vaccines; Immunization; Booster dose; Medical students; Karachi

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INTRODUCTION

The COVID-19, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-COV-2), is a debilitating infection of the respiratory tract, declared as global pandemic by WHO [1]. By October 2023, COVID-19 is responsible for 6,881,955 deaths worldwide. In Pakistan, 1.57 million cases have been reported with 30,644 deaths [2]. The infection spreads via airborne droplets and contaminated surfaces. It typically involves the respiratory system resulting in mild to severe symptoms, commonly fever, cough, shortness of breath, fatigue, body ache, sore throat, congestion, nausea vomiting, diarrhea, and loss of taste or smell [3]. Lymphopenia, eosinopenia, thrombopenia, D-dimers increased, lactate dehydrogenase, C-reactive protein, troponin, and low zinc levels are associated with severity of the disease [4].

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The pandemic has shown to exert its effects on global economy, politics and on health systems, subsequently affecting the quality of life. The emergence of new variants of COVID-19, such as Belta, Delta, and Omicron variant, highlights the importance that the virus is mutating, therefore, increasing the risk of reinfection [5]. The scientific world considered vaccines as the mainstay in limiting the COVID-19 spread. Moderna, Pfizer, CanSino, Sputnik V, AstraZeneca, Sinopharm, and Sinovac vaccines are available in Pakistan [6]. The vaccine was shown to reduce the risk of severe COVID-19 and COVID-19-related deaths [7], however, the efficacy of vaccines towards the emerging variants is unpredictable [8].

The emergency of new variants of COVID-19, unpredictable efficacy of vaccines towards new variants, and Ignorance towards SOPs and COVID-19 guideline can lead to new endemic or even a pandemic. A survey regarding hesitancy towards COVID-19 vaccine among Healthcare workers (HCWs) was conducted in 2021 in the USA and it showed that 7.9% of respondents were vaccine-hesitant [9]. Factors like young age (18-40 years) and low level of educational attainment were significant predictors of higher hesitancy. HCWs with vaccine hesitancy showed mistrust in government authorities (48.6%), and pharmaceutical companies (50%) [9]. A study conducted in Qatar showed that 12.9% of the HCWs were hesitant towards vaccines [10]. Female respondents concerned with the safety and efficacy of vaccines were more likely vaccine-hesitant. Xu et al., conducted a similar survey in China and 23.3% of HCWs were vaccine-hesitant. Study participants with a chronic disease, working in a tertiary hospital and lacking a social connection to communicate COVID-19 vaccination were more hesitant [11]. Similar results have been published in cross-sectional studies among HCWs of Nigeria and Germany [12,13]. The acceptance of Boosters among Czech HCWs was 71.3%, while 12.2% were hesitant and 16.6% were against the current regimen of boosters. HCWs perception towards booster efficacy, the severity of disease, and symptomatic illness were significantly associated with its acceptance [14].

Studies in the USA and Australia reveal that a significant portion of the population remains hesitant, with factors such as gender, age, and perceptions about disease risk playing prominent roles. Emerging data from studies conducted in the USA, Australia, and Turkey demonstrate consistent patterns in vaccine hesitancy. Women, older adults, and individuals skeptical about disease severity are more likely to resist vaccination [15,16]. Though healthcare workers show higher vaccine acceptance compared to the general population with Wang et al. reporting acceptance rates of 76.98% in HCWs while it was 52.5% in Turkish study, yet challenges persist in addressing hesitancy across all groups [17,18].

The emergence of new COVID-19 variants, coupled with the uncertain efficacy of vaccines against these variants and widespread disregard for SOPs and COVID-19 guidelines, underscores the urgent need to address factors contributing to vaccine hesitancy and non-compliance. However, hesitancy among healthcare workers to receive booster doses, combined with lax adherence to preventive guidelines, poses a significant risk to their health and the broader community. These challenges could pave the way for recurring outbreaks, potentially escalating into a new endemic or even another pandemic.

This study aims to explore these critical issues and their implications for public health. The purpose of our research is to evaluate the attitude of medical students toward the booster dose acceptance and guidelines of the Government of Pakistan and World Health Organization regarding COVID-19, and the development of sense of security after COVID vaccine and infection.

METHODS

The objective of this cross-sectional study was to assess the attitude toward COVID-19Êbooster dose acceptanceÊamong Pakistani medical students. A survey questionnaire was created and data was filled in at the Dow University of Health Science (DUHS), Karachi. The sampleÊsize was calculated by using

OpenEpi online software. After taking 76.98% of healthcare workers who accepted the COVID-19 vaccine [17], 5% Confidence limits, and 95% confidence level. The total calculated sample size was 270, after adding 15% of non-respondents 314 participants were selected.

The non-probability, consecutive sampling method was used to select the 314 study participants and data was collected from February 2022 to March 2022. All MBBS and BDS students (>18 years of age) were studying at Dow Medical College (DMC) and Dow Dental College (DDC), DUHS, who were vaccinated with the COVID-19 vaccine or were previously infected with COVID-19 were included in this survey after taking their verbal informed consent, irrespective of the age, gender, and year of the study participants. Those students were excluded, if they were not vaccinated or had never been infected with COVID-19. Currently, infected students were not included. Online as well as manual questionnaires were designed for the collection of data.

The questionnaire was comprised of multiple questions falling into different categories including demographic and COVID-19 related characteristics, and attitude towards COVID-19 booster dose with multiple options questions with multiple choices, multiple options questions with a single choice, and Likert scale questions formats. In this research, theÊauthor used 10 attitude questions with 3 reverse score questions in the Likert scale format with a minimum 1 score and maximum 5 score and responses (from Strongly Disagree to Strongly Agree). The total possible attitude score ranges from 0-50. The higher attitude score having a positive attitude towards COVID-19 booster dose.

Data was entered and analyzed into the Statistical Package for the Social Sciences (SPSS) version 20.0. For descriptive analysis of categorical variables such as gender, were presented as absolute frequencies and percentages. Mean and standard deviation for continuous variables such as age. First check the normality of the attitude score by using the Kolmogorov-Smirnov test. Independent sample t-test and ANOVA test were used to compare the mean attitude score with groups. The level of significance was set at 5% for this study.

RESULTS

The response rate of study participants was 98.7%. A total of 310 students participated in the study with the age range of 18 years to 28 years with mean (21.91±1.635) years, out of which 212(68.3%) are MBBS students while the rest belong to BDS. The majorityÊof the participants are female, 224(72.3%),Êwhile male represented with 86(27.7%). The infection rate of COVID-19 among the participants came out to be 142(45.8%) with only 15(4.8%) hospital admissions reported and of the total participants 34(11%) are suffering from chronic illness and 268(86.5%) friends and family members of students who were infected with COVID-19. The resultÊindicated 274(88.4%) participants got vaccinated against the virus and 102(32.9%) had taken the booster dose too, Pfizer being chosen as the most appropriate 120(38.7%) while sputnik chosen the least 1(0.3%). Moreover, 159(51.3%) are still reluctant as shown in Table 1

Table 01:Demographic and COVID-19 related characeteristics of medical students

Demographic	Frequency (n)	Percentage (%)
Age (years)	21.91±1.635*	
Gender		
Male	86	27.7
Female	224	72.3
Education Program		
MBBS	212	68.4
BDS	98	31.6
Chronic illness		
Yes	34	11.0
No	276	89.0
Relative who Infected with		
Covid-19		86.5
Yes	268	13.5
No	42	
Infected with COVID-19		
No	145	46.8
Yes	142	45.8
Don't know	23	7.4
How many times infected with		
COVID-19		
None	168	54.2
One time	104	33.5
Two times	29	9.4
Three times	9	2.9
Vaccinated COVID-19		
Yes	274	88.4
No	11	3.5
Partially	25	8.1
Hospitalized due to		
COVID-19		
Yes	15	4.8
No	208	67.1
Receive a booster (third)		
dose (n=310)		
2 doses	102	32.9
1st dose	35	11.3
No	173	55.8
Booster dose (n=137)		
Moderna	26	8.4
Pfizer	88	28.4
Cansino	3	1.0
Sinopharm	11	3.5
Sinovac	5	1.6
Sputnik	1	0.3
Astrazeneca	3	1.0
Not applicable	173	55.8

*Mean± Standard deviation

The study findings indicated that 264(85.2%) students believe Pfizer to be the most appropriate booster dose followed by Moderna 202(65.2%), Sinopharm 144(48.5%), Sinovac 119(38.4%), AstraZeneca 37.7%(n=117), Cansino 77 (24.8%) and Sputnik 75(24.5%) shown in Figure 1.

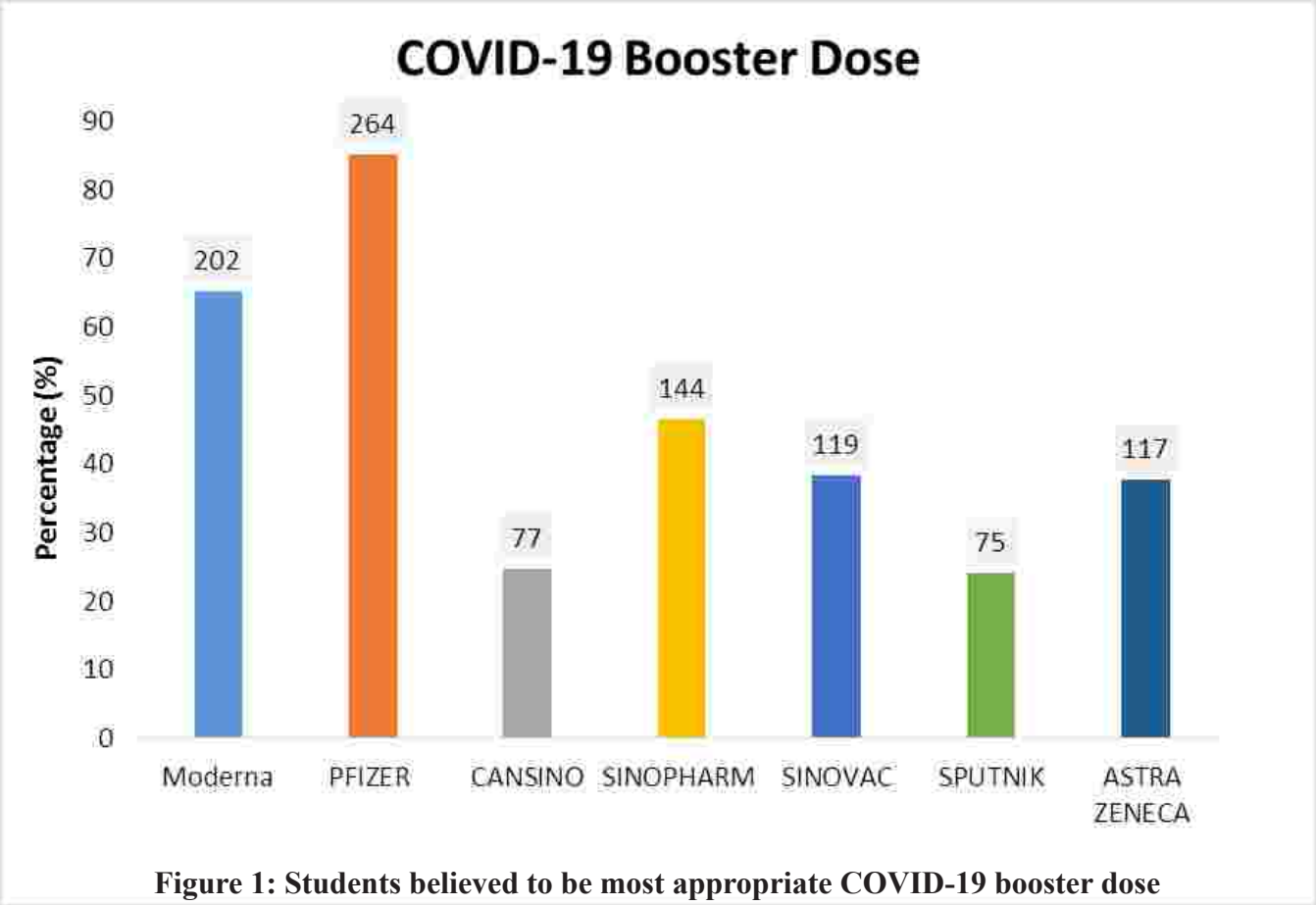

Figure 1: Students believed to be most appropriate COVID-19 booster dose

Table 2: Participants Attitude towards COVID-19 Boosters Dose

Attitude	Strongly Agree n(%)	Agree n(%)	Neutral n(%)	Disagree n(%)	Strongly Disagree n(%)
Boosters can increase your immunity against the virus	2(0.6)	5(1.6)	21(6.8)	119(38.4)	163(52.6)
Booster doses are safe and is not dangerous for health	4(1.3)	15(4.8)	53(17.1)	113(36.5)	125(40.3)
Booster dose can cause allergic reactions (reverse scored)	39(12.6)	135(43.5)	111(35.8)	20(6.5)	5(1.6)
Booster can increase the risk of autoimmune diseases (reverse scored)	17(5.5)	66(21.3)	135(43.5)	70(22.6)	22(7.1)
I will take the booster dose OR I took the booster dose without any hesitation	9(2.9)	21(6.8)	69(22.3)	99(31.9)	112(36.1)
I will encourage my family, friends and relative to get a booster dose	5(1.6)	14(4.5)	66(21.3)	103(33.2)	122(39.4)
Booster dose will help to eradicate the virus completely	12(3.9)	39(12.6)	101(32.6)	92(29.7)	66(21.3)
I worry about the long-term effects of booster dose in future	41(13.2)	88(28.4)	117(37.7)	42(13.5)	22(7.1)
I believe the two doses of vaccines are enough for my protection (reverse scored)	44(14.2)	93(30.0)	107(34.5)	52(16.8)	14(4.5)
Vaccine booster dose (COVID-19 vaccine) is safe and effective	39(12.6)	135(43.5)	111(35.8)	20(6.5)	5(1.6)

Table 3 presents, a comparison of mean attitude scores about COVID-19 booster dose according to demographics and COVID-19-related characteristics. The average attitude score was 33.24±5.21% with a 95% confidence interval (CI) [32.67, 33.81]. The bivariate analysis revealed that the mean attitude scores of COVID-19 booster doses were significantly differences with gender (P = 0.005), and vaccinated against COVID-19 (P < 0.001).

Table 3: Comparison of mean attitude scores about COVID-19 booster dose with demographic and COVID-19 related factors among medical students

Groups	Options	Mean	SD	t-test p-value
Gender	Male	30.39	4.01	0.005*
	Female	33.47	5.14	
Education Program	MBBS	33.41	5.06	0.391
	BDS	32.87	5.25	
Chronic Illness	Yes	33.22	4.48	0.954
	No	33.25	5.36	
Relative who Infected with Covid-19	Yes	33.34	5.11	0.368
	No	32.50	5.29	
**Ever infected with Covid-19	No	33.35	5.12	0.899
	Yes	33.10	5.26	
	Don't know	33.47	4.36	
**Vaccinated against Covid-19	No	28.00	5.09	0.001*
	Yes	33.58	5.06	
	Partially	31.92	4.44	
Hospitalization due to Covid-19	No	32.12	5.50	0.125
	Yes	33.42	5.05	
Believe in re-infection and breakthrough	Yes	33.33	5.02	0.202
	No	31.60	6.76	

*p-value was significant; ** applied ANOVA

DISCUSSION

This cross-sectional study was performed to assess the attitudes toward the COVID-19 vaccine and booster dose among medical students of Karachi. In this study, we found that only 9.7% of participants intended to take the booster dose while 90.3% of participants were either hesitant or neutral about receiving the booster dose. In the current study conducted among medical and dental students in Karachi, 72.3% of participants were female, with a mean age of 21.91 years. This aligns with the national trend of higher female enrollment in healthcare-related education. In our study females mean scored higher on booster vaccine-related belief (mean: 33.47) compared to males 30.39, which is significant. Similarly, the nationwide study among healthcare workers also reflected a higher vaccine acceptance among females (55.1%) compared to males (49.2%), with males showing a higher rejection rate (29.1%) [19]. This contrasts with findings from other studies where females exhibited a more negative attitude toward the COVID-19 vaccine [20-21]. This difference may be attributed to their higher reliance on non-pharmaceutical preventive measures, such as social distancing and mask-wearing, rather than placing trust in a novel vaccine.

Our study showed notably lower acceptance and

higher rejection rates for the COVID-19 booster dose compared to other studies. Only 2.9% of participants strongly agreed, and 6.8% agreed they would take the booster dose without hesitation, while 31.9% disagreed and 36.1% strongly disagreed. This aligns with findings from Egypt and Bahrain, where 47.9% of healthcare workers and 46.1% of physicians, respectively, were unwilling to take the booster dose [22-23]. Similarly, Arshad et al. highlighted significant concerns about safety and efficacy, reporting 34.7% refusal, 24.2% hesitancy, and 52.1% willingness among healthcare workers to take the booster [19]. In contrast, studies from Poland and Saudi Arabia reported much higher acceptance rates, with 75% and 71.1% of healthcare workers willing to receive the booster vaccine, respectively [24,25]. In a similar study performed among USA healthcare workers, overwhelming number of participants agreed to take a booster dose while only 7.9% respondent were hesitant [9].

Our findings indicate a significant stark contrast in vaccine-related beliefs between vaccinated participants mean score (33.58 ± 5.06) and those who were unvaccinated (28.00 ± 5.09). This is consistent with the observation in nationwide study higher acceptance (51.7%) among vaccinated individuals was seen compared to the unvaccinated group, where rejection and hesitancy dominated [19].

A remarkable 88.4% of students in the Karachi study were vaccinated against COVID-19, with 32.9% having received a booster dose (BD). This booster dose uptake is comparable to the healthcare worker study, where mRNA vaccines were most preferred for BD (69.7%), aligning with the preference for Pfizer in the Karachi study (38.7%) [19].

The Karachi study further revealed that Pfizer was overwhelmingly considered the most appropriate booster by 85.2% of participants, followed by Moderna (65.2%), indicating a strong preference for mRNA vaccines. This trend reflects findings from the healthcare worker study, where mRNA vaccines were favored, emphasizing the perceived effectiveness and safety of this vaccine type [19]. Similar findings were observed in another study conducted across the country, where the majority 47.1% of respondents preferred the Pfizer vaccine as a booster [26].

In our study, we found that having close relatives infected by a virus and believing in reinfection and breakthrough are associated with a positive attitude towards the booster dose. According to Johns Hopkins, Pakistan reported, 1.57 million cases have been reported with 30,644 deaths [2]. To achieve herd immunity, >82% of the population has to be immune either through prior infection or vaccination [27]. In the UK, an RCT was conducted to assess the safety and immunogenicity of seven COVID-19 vaccines as a third dose (booster) following two doses of AstraZeneca or Pfizer BioNTech vaccines. Booster doses yielded a great increase in neutralizing antibodies and no safety concerns among the participants. Fatigue and pain were the most common side effects reported in this study [28].

An observational study from the United States (US) observed the association between receiving a third booster dose of the Moderna vaccine and symptomatic SARS-CoV-2 infection from Omicron and Delta variants of Covid-19. The booster dose of the mRNA COVID-19 vaccine offered better protection against symptomatic COVID-19 infection as compared to those who were unvaccinated or received complete doses of the vaccine [29]. Chenchula et al. conducted a systematic review including 27 studies on the effectiveness of a booster dose against the Omicron variant. Booster doses of vaccine were effective at decreasing the severity of the infection and have shown no safety concerns. They concluded that a third dose should at least be offered to all vulnerable and immune-compromised individuals [30].

Limitations and Recommendation: The study was conducted among medical and dental students from a specific institute, which may not represent the attitudes and perceptions of the broader population or healthcare professionals globally. The cross-sectional nature of the study captures attitudes at a

single point in time, limiting the ability to observe changes or trends over time. The data collection relies on self-reported information from participants and could introduce response biases, including social desirability bias, where participants may provide answers they believe are more socially acceptable. The result findings underscore the urgent need for targeted awareness campaigns and educational interventions to address misconceptions regarding the safety emphasized benefits of booster doses. Enhancing vaccine uptake among future healthcare professionals is crucial to ensuring their role as promoters of public health and preparedness for future pandemics.

CONCLUSION

The study concludes that future healthcare students show a concerning level of hesitancy and rejection towards COVID-19 booster doses. Concerns about vaccine safety, doubts regarding its efficacy, and a general lack of trust emerged as key factors contributing to high levels of vaccine hesitancy observed in our study.

Conflict of Interest: None.

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Authors' Contribution

AA: Concept & design, statistical analysis, editing of manuscript, responsible for integrity of research

BZ: Edited, review and final approval of manuscript
SA: Data collection and interpretation of data for the work

AA: Edited, review and final approval of manuscript

NS: Edited, review and final approval of manuscript

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Text

The text of observational and experimental articles is usually- but not necessarily- divided into sections with the headings Introduction, Methods, Results, and Discussion. Long articles may need subheadings within some sections, especially Results and Discussion, to clarify their content. Other types of articles, such as case reports, reviews, and editorials, are likely to need different formats. Authors should consult individual journals for further guidance.

Introduction

State the purpose of the article. Summarize the rationale for the study or observation. Provide only strictly pertinent references, and do not review the subject extensively. Do not include data or conclusions from the work being reported.