

COVID-19 Vaccine Acceptance, Barriers and Facilitators among Healthcare Workers in Pakistan

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Abstract

Background: Vaccines are one of the main cornerstones in the global initiatives to control the COVID-19 pandemic. National vaccination programs largely depend on vaccine availability and acceptance by a large proportion of the population to confer a measurable impact on SARS-CoV-2 transmission. In this study we determine the acceptance, barriers and facilitators of COVID-19 vaccination amongst healthcare workers (HCWs) in Pakistan.

Methods: A structured and validated questionnaire was used in an online cross-sectional study. Health care workers residing in Pakistan were invited between 31st January to 9th February to participate in this survey.

Results: A total of 436 health-care workers took part in this survey and among those 327 (75%) were doctors. 260 (60%) health-care workers indicated that they would accept vaccination against COVID-19. 308 (71%) were completely confident or confident in using USA, UK manufactured COVID-19 vaccine. The acceptance concerning a potential Chinese vaccine was 267 (61%). 292 (67%) strongly agreed or agreed that they are concerned about the efficacy of COVID-19 vaccination while the concerns for safety were 293 (67%).

Conclusions: About a third of HCWs, a group generally biased towards early acceptance of health interventions – expressed concerns or refusal of vaccination against COVID-19 in this survey. A dedicated communication plan and information campaign addressing the issues of efficacy, quality, logistics and religious concerns is needed to address these hurdles to allow for a successful national vaccination campaign.

Keywords: COVID-19; Vaccine acceptance; Health care workers; Infectious disease

Introduction

The recent pandemic of COVID-19 caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a major threat globally and particularly to Southeast Asian countries [1,2]. The pandemic demands for intervention on many fronts, from prevention to testing to treatment. Vaccines are among the most effective public health interventions in preventing morbidity, mortality and public health costs caused by infectious diseases [3] and are therefore a cornerstone in the control measures of the global COVID-19 pandemic.

Since the very beginning of COVID-19 pandemic, researchers around the globe have been working tirelessly on countermeasures to contain the pandemic. While it was not yet possible to identify particular highly efficacious antiviral drugs, there was significant progress in the development of a vaccine to fight the disease [4]. Several different vaccines, all with promising efficacy and protection, are produced at a record pace of less than a year after the pandemic begins [5]. Arguably, vaccine hesitancy and rejection by a majority of the population are among the prime concerns for a successful vaccination campaign aiming at achieving herd immunity [6]. Studies from different countries including affluent nations have shown discouraging results on the effectiveness of vaccination programs [7]. It is therefore of high importance to identify potential barriers to vaccine uptake early on in the fight against COVID-19.

Pakistan has a history of problems with vaccine uptake and acceptability [8–10]. Low coverage rates of regular immunization programs and the large number of individuals who fail to vaccinate their children in polio immunization campaigns, despite stringent by-laws and vigorous anti-polio drives, highlight this reality.

Healthcare workers (HCWs) are particularly exposed to and a main source of nosocomial transmission of COVID-19, which makes them an important target group for vaccination [11]. It is based on

this understanding that HCW will constitute the priority group for the national COVID-19 vaccination program in Pakistan. This program is conceived as a multi-phase program due to shortage of available vaccines. Vaccine uptake and addressing of concerns observed in the first vaccinated groups will prove crucial for the further success of the vaccination program as HCW may act as main influencers of the general public in adapting any healthy behavior. This study therefore set out to investigate the acceptance, perceptions and concerns of HCW in Pakistan about the imminent national COVID-19 vaccine program.

Material and Methods

A cross-sectional study was conducted inviting healthcare workers in Pakistan during January 2021 via online social media platforms. The target population was healthcare workers aged ≥ 21 years with a valid registration in Pakistan with their respective regulatory body. The survey was advertised via three social media platforms (Facebook, WhatsApp and Twitter). Data was collected using self-reported, structured questionnaire adapted from Lin et al. [12]. Data were collected via an online Google form. The survey was open for response between 31st January to 9th February. The identity of health care personnel validated by their registration number, which was kept confidential.

Data analysis: Data were extracted from the online Google forms, transferred and analyzed by using STATA Version 14. All the categorical variables (gender, professional role, vaccine acceptance

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etc) were described as frequencies and percentages. Group-testing was performed using chi square test with $p \leq 0.05$ considered significance.

Results

A total of 436 responses were received in the two weeks period. Of these, 327 (75%) were medical doctors, 34 (7.80%) were nurses, 39 (8.94%) were paramedical staff and 36 (8.26%) were other health staff (Table 1).

The respondents belong to all provinces and regions of Pakistan but the majority participated from the province Khyber Pakhtunkhwa (KPK) 335 (77%). 47 (11%), 27 (6%), 12 (3%), 11 (3%) were from Punjab, Sindh, Federal and Baluchistan respectively. Two third of the respondents were in the age category 19-39 years, $n=293$ (67%). The most frequently reported category for years of experience was 0–5 years reported by, $n=176$ (40%). Most of them $n=180$, (41%) worked in tertiary care hospitals while $n=99$ (23%), $n=44$ (10%), $n=44$ (10%) worked in secondary care hospital, primary care hospitals and emergency operation centers respectively. Respondent’s further details on the characteristics are provided in Table 1.

Out of 436 respondents, $n=133$ (31%) had tested COVID-19 positive. Total 68 (16%) respondents have an existing chronic disease such as cardiovascular disease, diabetes and chronic respiratory tract disease. When asked, about if they had adequate information regarding the COVID-19 vaccine, only 202 (46%) of the health-care workers

agreed with having adequate information.

260 (60%) health-care workers responded that they would accept receiving vaccine against COVID-19 if available, 136 (31%) would wait and see and 16 (4%) would categorically refuse vaccination. 308 (71%) were completely confident or confident in using USA, UK manufactured COVID-19 vaccine, whereas 267 (61%) were completely confident or confident in using China manufactured COVID-19 vaccine.

326 (75%) strongly agreed or agreed that they will feel less worried about getting COVID-19 if vaccinated. 329 (75%) acknowledged that vaccination decreases their risk of contracting COVID-19 and its complications. 174 (40%) indicated that they are worried about possible side effects of COVID-19 vaccination.

Total 292 (67%) strongly agreed or agreed that they are concerned about the efficacy of COVID-19 vaccination whereas 293 (67%) are concerned about the safety of COVID-19 vaccination including 238 (54.5%) voicing concerns about potential fake and faulty COVID-19 vaccine.

320 (73.3%) indicated concerns about the cold chain maintenance of COVID-19 vaccine and 125 (28.6%) about the permissibility of COVID-19 vaccine on religious ground. 128 participants (29.3%) assumed that there might be hidden motives behind eagerness of authorities to administer/provide COVID-19 vaccine free. Respondent’s further details on the respondent’s characteristics are provided in Tables 2a-2c.

Variable	Categories	Health care groups				Total N=436 (100%)	P-value
		Doctors N=327 (75.00%)	Nurses N=34 (7.80%)	Paramedics N=39 (8.94%)	Others N=36 (8.26%)		
Location	Khyber Pakhtunkhwa	242(74.01)	29(85.29)	37(94.87)	27(75.00)	335(76.83)	0.70
	Punjab	38(11.62)	3(8.82)	0(0.00)	6(16.67)	47(10.78)	
	Sindh	23(7.03)	2(5.88)	1(2.56)	1(2.78)	27(6.19)	
	Baluchistan	10(3.06)	0(0.00)	0(0.00)	1(2.78)	11(2.52)	
	Azad Jammu and Kashmir	3(0.92)	0(0.00)	0(0.00)	0(0.00)	3(0.69)	
	Federal	10(3.06)	0(0.00)	1(2.56)	1(2.78)	12(2.75)	
	Gilgit Baltistan	1(0.31)	0(0.00)	0(0.00)	0(0.00)	1(0.23)	
Gender	Female	72(22.02)	19(55.88)	5(12.82)	5(13.89)	101(23.17)	<0.001
	Male	255(77.98)	15(44.12)	34(87.18)	31(86.11)	335(76.83)	
Category of age	19-39	200(61.16)	32(94.12)	30(76.92)	31(86.11)	293(67.20)	<0.001
	40-60	116(35.47)	2(5.88)	8(20.51)	5(13.89)	131(30.05)	
	61-81	11(3.36)	0(0.00)	1(2.56)	0(0.00)	12(2.75)	
Category of work experience in years	0-5 Years	117(35.78)	21(61.76)	22(56.41)	16(44.44)	176(40.37)	<0.001
	6-10 Years	76(23.24)	10(29.41)	5(12.82)	14(38.89)	105(24.08)	
	Above 10 Years	134(40.98)	3(8.82)	12(30.77)	6(16.67)	155(35.55)	
Working at which health care level?	COVID-19 Facility/Hospitals	3(0.92)	0(0.00)	6(15.38)	1(2.78)	10(2.29)	<0.001
	Emergency operation center(National, provincials and districts)	50(15.29)	0(0.00)	1(2.56)	3(8.33)	54(12.39)	
	Primary health care facility	34(10.40)	0(0.00)	9(23.08)	1(2.78)	44(10.09)	
	Secondary health care facility	71(21.71)	14(41.18)	7(17.95)	7(19.44)	99(22.71)	
	Tertiary health care facility	143(43.73)	18(52.94)	10(25.64)	9(25.00)	180(41.28)	
	Other	26(7.95)	2(5.88)	6(15.38)	15(41.67)	49(11.24)	
Are you working at facility/ward dedicated for COVID-19 patients?	No	153(46.79)	11(32.35)	17(43.59)	20(55.56)	201(46.10)	0.01
	Yes	109(33.33)	16(47.06)	20(51.28)	6(16.67)	151(34.63)	
	Both	65(19.88)	7(20.59)	2(5.13)	10(27.78)	84(19.27)	

Table 1: Demographic information of health care workers Pakistan.

Variables	Categories	Health care groups					Total N=436 (100%)	P-value
		Doctors N=327 (75.00%)	Nurses N=34 (7.80%)	Paramedics N=39 (8.94%)	Others N=36 (8.26%)			
Have you ever tested positive for COVID-19?	No	223(68.20)	22(64.71)	30(76.92)	28(77.78)	303(69.50)	7(20.59)	
	Yes	104(31.80)	12(35.29)	9(23.08)	8(22.22)	133(30.50)	7(20.59)	
Do you have an existing chronic disease such as cardiovascular disease, diabetes, chronic respiratory tract disease?	No	268(81.96)	32(94.12)	36(92.31)	32(88.89)	368(84.40)	7(20.59)	
	Yes	59(18.04)	2(5.88)	3(7.69)	4(11.11)	68(15.60)	7(20.59)	
You believe you have adequate information regarding COVID-19 vaccines?	I am not sure	103(31.50)	14(41.18)	15(38.46)	11(30.56)	143(32.80)	7(20.59)	
	No	71(21.71)	9(26.47)	3(7.69)	8(22.22)	91(20.87)	7(20.59)	
	Yes	153(46.79)	11(32.35)	21(53.85)	17(47.22)	202(46.33)	7(20.59)	
If vaccines against COVID-19 infection are available would you take it?	I am not sure	17(5.20)	3(8.82)	2(5.13)	2(5.56)	24(5.50)	7(20.59)	
	I will wait and see	96(29.36)	14(41.18)	12(30.77)	14(38.89)	136(31.19)	7(20.59)	
	No	10(3.06)	1(2.94)	1(2.56)	4(11.11)	16(3.67)	7(20.59)	
	Yes	204(62.39)	16(47.06)	24(61.54)	16(44.44)	260(59.63)	7(20.59)	
Rate your confidence in using UK,USA manufactured (imported) COVID-19 vaccines?	Completely confident	64(19.57)	6(17.65)	12(30.77)	12(33.33)	94(21.56)	7(20.59)	
	Completely not confident	23(7.03)	11(32.35)	4(10.26)	5(13.89)	43(9.86)	7(20.59)	
	Confident	178(54.43)	10(29.41)	15(38.46)	11(30.56)	214(49.08)	7(20.59)	
	Not confident	62(18.96)	7(20.59)	8(20.51)	8(22.22)	85(19.50)	7(20.59)	
Rate your confidence in using China manufactured COVID-19 vaccine?	Completely confident	50(15.29)	3(8.82)	16(41.03)	11(30.56)	80(18.35)	7(20.59)	
	Completely not confident	27(8.26)	10(29.41)	3(7.69)	5(13.89)	45(10.32)	7(20.59)	
	Confident	145(44.34)	15(44.12)	14(35.90)	13(36.11)	187(42.89)	7(20.59)	
	Not confident	105(32.11)	6(17.65)	6(15.38)	7(19.44)	124(28.44)	7(20.59)	

Table 2a: COVID-19 Vaccine acceptance, barriers and facilitators amongst health care workers of Pakistan.

		Doctors N=327 (75.00%)	Nurses N=34 (7.80%)	Paramedics N=39 (8.94%)	Others N=36 (8.26%)	Total N=436 (100%)	P-value
Vaccination is a good idea because I feel less worried about getting COVID-19?	Agree	149(45.57)	16(47.06)	18(46.15)	15(41.67)	198(45.41)	0.12
	Disagree	11(3.36)	0(0.00)	1(2.56)	1(2.78)	13(2.98)	
	Neutral	67(20.49)	11(32.35)	3(7.69)	6(16.67)	87(19.95)	
	Strongly agree	95(29.05)	7(20.59)	15(38.46)	11(30.56)	128(29.36)	
	Strongly disagree	5(1.53)	0(0.00)	2(5.13)	3(8.33)	10(2.29)	
Vaccination decreases my chance of getting COVID-19 or its Complications?	Agree	171(52.29)	12(35.29)	22(56.41)	14(38.89)	219(50.23)	<0.001
	Disagree	15(4.59)	1(2.94)	1(2.56)	6(16.67)	23(5.28)	
	Neutral	57(17.43)	15(44.12)	3(7.69)	5(13.89)	80(18.35)	
	Strongly agree	83(25.38)	6(17.65)	11(28.21)	10(27.78)	110(25.23)	
	Strongly disagree	1(0.31)	0(0.00)	2(5.13)	1(2.78)	4(0.92)	
I am worried that the possible side effects of COVID-19 vaccination would interfere with my routine activities?	Agree	92(28.13)	18(52.94)	17(43.59)	12(33.33)	139(31.88)	0.009
	Disagree	83(25.38)	3(8.82)	7(17.95)	5(13.89)	98(22.48)	
	Neutral	117(35.78)	10(29.41)	9(23.08)	10(27.78)	146(33.49)	
	Strongly agree	24(7.34)	3(8.82)	2(5.13)	6(16.67)	35(8.03)	
	Strongly disagree	11(3.36)	0(0.00)	4(10.26)	3(8.33)	18(4.13)	
I am concerned about the efficacy of the COVID-19 vaccination?	Agree	167(51.07)	14(41.18)	20(51.28)	19(52.78)	220(50.46)	0.04
	Disagree	30(9.17)	3(8.82)	0(0.00)	1(2.78)	34(7.80)	
	Neutral	70(21.41)	15(44.12)	10(25.64)	7(19.44)	102(23.39)	
	Strongly agree	56(17.13)	2(5.88)	7(17.95)	7(19.44)	72(16.51)	
	Strongly disagree	4(1.22)	0(0.00)	2(5.13)	2(5.56)	8(1.83)	
I am concerned about the safety of the COVID-19 vaccination?	Agree	150(45.87)	18(52.94)	17(43.59)	19(52.78)	204(46.79)	0.10
	Disagree	37(11.31)	2(5.88)	4(10.26)	1(2.78)	44(10.09)	
	Neutral	69(21.10)	12(35.29)	6(15.38)	4(11.11)	91(20.87)	
	Strongly agree	66(20.18)	2(5.88)	10(25.64)	11(30.56)	89(20.41)	
	Strongly disagree	5(1.53)	0(0.00)	2(5.13)	1(2.78)	8(1.83)	
I am concerned of the faulty/ fake COVID-19 vaccination?	Agree	126(38.53)	4(11.76)	12(30.77)	15(41.67)	157(36.01)	<0.001
	Disagree	61(18.65)	12(35.29)	13(33.33)	6(16.67)	92(21.10)	
	Neutral	66(20.18)	15(44.12)	5(12.82)	1(2.78)	87(19.95)	
	Strongly agree	64(19.57)	2(5.88)	6(15.38)	9(25.00)	81(18.58)	
	Strongly disagree	10(3.06)	1(2.94)	3(7.69)	5(13.89)	19(4.36)	

Table 2b: COVID-9 vaccine acceptance, barriers and facilitators amongst health care workers of Pakistan.

Variables	Categories	Health care groups					P-value
		Doctors N=327 (75.00%)	Nurses N=34 (7.80%)	Paramedics N=39 (8.94%)	Others N=36 (8.26%)	Total N=436 (100%)	
I am concerned about the cold chain maintenance of COVID-19 vaccine?	Agree	148(45.26)	17(50.00)	15(38.46)	14(38.89)	194(44.50)	0.12
	Disagree	21(6.42)	2(5.88)	2(5.13)	2(5.56)	27(6.19)	
	Neutral	58(17.74)	9(26.47)	10(25.64)	9(25.00)	86(19.72)	
	Strongly agree	99(30.28)	6(17.65)	10(25.64)	11(30.56)	126(28.90)	
	Strongly disagree	1(0.31)	0(0.00)	2(5.13)	0(0.00)	3(0.69)	
I am concerned about permissibility of COVID-19 vaccine on religious grounds?	Agree	56(17.13)	12(35.29)	10(25.64)	10(27.78)	88(20.18)	0.005
	Disagree	121(37.00)	9(26.47)	7(17.95)	11(30.56)	148(33.94)	
	Neutral	83(25.38)	12(35.29)	12(30.77)	8(22.22)	115(26.38)	
	Strongly agree	24(7.34)	1(2.94)	8(20.51)	4(11.11)	37(8.49)	
	Strongly disagree	43(13.15)	0(0.00)	2(5.13)	3(8.33)	48(11.01)	
There might be hidden motives behind eagerness of authorities to administer/provide vaccine free for all health workers?	Agree	47(14.37)	16(47.06)	9(23.08)	11(30.56)	83(19.04)	<0.001
	Disagree	111(33.94)	4(11.76)	9(23.08)	8(22.22)	132(30.28)	
	Neutral	83(25.38)	8(23.53)	10(25.64)	7(19.44)	108(24.77)	
	Strongly agree	26(7.95)	6(17.65)	8(20.51)	5(13.89)	45(10.32)	
	Strongly disagree	60(18.35)	0(0.00)	3(7.69)	5(13.89)	68(15.60)	

Table 2c: COVID-19 vaccine acceptance, barriers and facilitators amongst health care workers of Pakistan.

The majority of respondents were from the KPK province of Pakistan. Further details of the KPK respondent's characteristics are provided in Tables 3a-3c.

A separate analysis was run for total 133 respondents who were COVID-19 positive among which a majority were doctors and working at tertiary care hospitals 67(50%) of Pakistan.

72 (54%) responded that they are willing to take a COVID-19 vaccine if available. 95 (71%) strongly agreed or agreed that they would feel less worried of contracting COVID-19 if vaccinated. 31 (23%) were concerned about permissibility of COVID-19 vaccine on religious grounds. The details given in Table 4.

Variable	Categories	Health care groups				Total N=335 (100%)	P-value
		Doctors N=242 (72.24%)	Nurses N=29 (8.66 %)	Paramedics N=37 (11.04 %)	Others N=27 (8.06 %)		
Gender	Female	41(16.94)	15(51.72)	3(8.11)	3(11.11)	62(18.51)	<0.001
	Male	201(83.06)	14(48.28)	34(91.89)	24(88.89)	273(81.49)	
Category of age	19-39	166(68.60)	28(96.55)	28(75.68)	25(92.59)	247(73.73)	0.01
	40-60	68(28.10)	1(3.45)	8(21.62)	2(7.41)	79(23.58)	
	61-81	8(3.31)	0(0.00)	1(2.70)	0(0.00)	9(2.69)	
Category of work experience in years	0-5 Years	100(41.32)	19(65.52)	21(56.76)	15(55.56)	155(46.27)	0.006
	6-10 Years	62(25.62)	8(27.59)	4(10.81)	9(33.33)	83(24.78)	
	Above 10 Years	80(33.06)	2(6.90)	12(32.43)	3(11.11)	97(28.96)	
Working at which health care level?	COVID-19 Facility/Hospitals	3(1.24)	0(0.00)	6(16.22)	1(3.70)	10(2.99)	<0.001
	Emergency Operation Center(National, provincials and districts)	26(10.74)	0(0.00)	1(2.70)	2(7.41)	29(8.66)	
	Primary Health Care Facility	29(11.98)	0(0.00)	9(24.32)	0(0.00)	38(11.34)	
	Secondary Health Care Facility	60(24.79)	11(37.93)	7(18.92)	3(11.11)	81(24.18)	
	Tertiary Health Care Facility	106(43.80)	16(55.17)	9(24.32)	7(25.93)	138(41.19)	
	Other	18(7.44)	2(6.90)	5(13.51)	14(51.85)	39(11.64)	
Are you working at facility/ward dedicated for COVID-19 patients?	No	109(45.04)	10(34.48)	15(40.54)	15(55.56)	149(44.48)	0.03
	Yes	87(35.95)	13(44.83)	20(54.05)	4(14.81)	124(37.01)	
	Both	46(19.01)	6(20.69)	2(5.41)	8(29.63)	62(18.51)	

Table 3a: Demographic information of respondents from Province Khyber Pakhtunkhwa Pakistan.

Variables	Categories	Health care groups					P-value
		Doctors N=242 (72.24%)	Nurses N=29 (8.66 %)	Paramedics N=37 (11.04 %)	Others N=27 (8.06 %)	Total N=335 (100%)	
Have you ever tested Positive for COVID-19?	No	166(68.60)	19(65.52)	28(75.68)	20(74.07)	233(69.55)	0.74
	Yes	76(31.40)	10(34.48)	9(24.32)	7(25.93)	102(30.45)	
Do you have an existing chronic disease such as cardiovascular disease, diabetes, Chronic Respiratory tract disease?	No	203(83.88)	28(96.55)	34(91.89)	24(88.89)	289(86.27)	0.18
	Yes	39(16.12)	1(3.45)	3(8.11)	3(11.11)	46(13.73)	
You believe you have Adequate information regarding the Covid19 Vaccine?	I am not sure	82(33.88)	12(41.38)	14(37.84)	10(37.04)	118(35.22)	0.40
	No	53(21.90)	8(27.59)	3(8.11)	5(18.52)	69(20.60)	
	Yes	107(44.21)	9(31.03)	20(54.05)	12(44.44)	148(44.18)	
If vaccine against COVID-19 infection is available would You take it?	I am not sure	13(5.37)	3(10.34)	2(5.41)	1(3.70)	19(5.67)	0.35
	I will wait and see	75(30.99)	12(41.38)	11(29.73)	12(44.44)	110(32.84)	
	No	8(3.31)	1(3.45)	1(2.70)	3(11.11)	13(3.88)	
	Yes	146(60.33)	13(44.83)	23(62.16)	11(40.74)	193(57.61)	
Rate your confidence in using UK,USA manufactured (imported) COVID-19 vaccine?	Completely confident	47(19.42)	6(20.69)	11(29.73)	7(25.93)	71(21.19)	0.002
	Completely not confident	20(8.26)	10(34.48)	4(10.81)	5(18.52)	39(11.64)	
	Confident	131(54.13)	8(27.59)	14(37.84)	8(29.63)	161(48.06)	
	Not confident	44(18.18)	5(17.24)	8(21.62)	7(25.93)	64(19.10)	
Rate your confidence in Using China manufactured COVID-19 vaccine?	Completely confident	39(16.12)	3(10.34)	15(40.54)	7(25.93)	64(19.10)	<0.001
	Completely not confident	21(8.68)	9(31.03)	3(8.11)	5(18.52)	38(11.34)	
	Confident	107(44.21)	13(44.83)	14(37.84)	8(29.63)	142(42.39)	
	Not confident	75(30.99)	4(13.79)	5(13.51)	7(25.93)	91(27.16)	

Table 3b: COVID-19 Vaccine acceptance, barriers and facilitators amongst health care workers of Province of Khyber Pakhtunkhwa Pakistan.

Variables	Categories	Health care groups					P-value
		Doctors N=242 (72.24%)	Nurses N=29 (8.66 %)	Paramedics N=37 (11.04 %)	Others N=27 (8.06 %)	Total N=335 (100%)	
Vaccination is a good idea because I feel less worried about getting COVID-19?	Agree	112(46.28)	15(51.72)	17(45.95)	10(37.04)	154(45.97)	0.30
	Disagree	6(2.48)	0(0.00)	1(2.70)	1(3.70)	8(2.39)	
	Neutral	49(20.25)	7(24.14)	3(8.11)	5(18.52)	64(19.10)	
	Strongly agree	70(28.93)	7(24.14)	14(37.84)	8(29.63)	99(29.55)	
	Strongly disagree	5(2.07)	0(0.00)	2(5.41)	3(11.11)	10(2.99)	
Vaccination decreases my chance of getting COVID-19 or its Complications?	Agree	123(50.83)	12(41.38)	20(54.05)	10(37.04)	165(49.25)	0.002
	Disagree	12(4.96)	1(3.45)	1(2.70)	6(22.22)	20(5.97)	
	Neutral	42(17.36)	10(34.48)	3(8.11)	3(11.11)	58(17.31)	
	Strongly agree	64(26.45)	6(20.69)	11(29.73)	7(25.93)	88(26.27)	
	Strongly disagree	1(0.41)	0(0.00)	2(5.41)	1(3.70)	4(1.19)	
I am worried that the possible side effects of COVID-19 vaccination would interfere with my routine activities?	Agree	66(27.27)	16(55.17)	16(43.24)	9(33.33)	107(31.94)	0.07
	Disagree	58(23.97)	3(10.34)	7(18.92)	3(11.11)	71(21.19)	
	Neutral	90(37.19)	7(24.14)	9(24.32)	9(33.33)	115(34.33)	
	Strongly agree	18(7.44)	3(10.34)	2(5.41)	3(11.11)	26(7.76)	
	Strongly disagree	10(4.13)	0(0.00)	3(8.11)	3(11.11)	16(4.78)	
I am concerned about the efficacy of the COVID-19 vaccination?	Agree	128(52.89)	10(34.48)	20(54.05)	14(51.85)	172(51.34)	0.02
	Disagree	23(9.50)	3(10.34)	0(0.00)	1(3.70)	27(8.06)	
	Neutral	48(19.83)	14(48.28)	9(24.32)	6(22.22)	77(22.99)	
	Strongly agree	40(16.53)	2(6.90)	6(16.22)	4(14.81)	52(15.52)	
	Strongly disagree	3(1.24)	0(0.00)	2(5.41)	2(7.41)	7(2.09)	
I am concerned about the safety of the COVID-19 vaccination?	Agree	113(46.69)	14(48.28)	17(45.95)	14(51.85)	158(47.16)	0.20
	Disagree	24(9.92)	2(6.90)	4(10.81)	1(3.70)	31(9.25)	
	Neutral	52(21.49)	11(37.93)	5(13.51)	3(11.11)	71(21.19)	
	Strongly agree	50(20.66)	2(6.90)	9(24.32)	8(29.63)	69(20.60)	
	Strongly disagree	3(1.24)	0(0.00)	2(5.41)	1(3.70)	6(1.79)	
I am concerned of the faulty/fake COVID-19 vaccination?	Agree	88(36.36)	2(6.90)	11(29.73)	11(40.74)	112(33.43)	<0.001
	Disagree	47(19.42)	12(41.38)	13(35.14)	4(14.81)	76(22.69)	
	Neutral	50(20.66)	12(41.38)	5(13.51)	1(3.70)	68(20.30)	
	Strongly agree	50(20.66)	2(6.90)	5(13.51)	6(22.22)	63(18.81)	
	Strongly disagree	7(2.89)	1(3.45)	3(8.11)	5(18.52)	16(4.78)	

Table 3c: COVID-19 Vaccine acceptance, barriers and facilitators amongst health care workers of Province of Khyber Pakhtunkhwa Pakistan.

Variables	Categories	Health care groups					P-value
		Doctors N=242 (72.24%)	Nurses N=29 (8.66 %)	Paramedics N=37 (11.04 %)	Others N=27 (8.06 %)	Total N=335 (100%)	
I am concerned about the Cold Chain maintenance of COVID-19 vaccine?	Agree	109(45.04)	13(44.83)	14(37.84)	12(44.44)	148(44.18)	0.32
	Disagree	14(5.79)	2(6.90)	2(5.41)	2(7.41)	20(5.97)	
	Neutral	45(18.60)	8(27.59)	10(27.03)	7(25.93)	70(20.90)	
	Strongly agree	73(30.17)	6(20.69)	9(24.32)	6(22.22)	94(28.06)	
	Strongly disagree	1(0.41)	0(0.00)	2(5.41)	0(0.00)	3(0.90)	
I am concerned about permissibility of COVID-19 vaccine on religious grounds?	Agree	42(17.36)	10(34.48)	10(27.03)	7(25.93)	69(20.60)	0.03
	Disagree	84(34.71)	9(31.03)	6(16.22)	8(29.63)	107(31.94)	
	Neutral	70(28.93)	9(31.03)	11(29.73)	7(25.93)	97(28.96)	
	Strongly agree	17(7.02)	1(3.45)	8(21.62)	2(7.41)	28(8.36)	
	Strongly disagree	29(11.98)	0(0.00)	2(5.41)	3(11.11)	34(10.15)	
There might be hidden motives behind eagerness of authorities to administer/provide vaccine free for all health workers?	Agree	40(16.53)	14(48.28)	9(24.32)	8(29.63)	71(21.19)	0.001
	Disagree	81(33.47)	3(10.34)	7(18.92)	6(22.22)	97(28.96)	
	Neutral	63(26.03)	7(24.14)	10(27.03)	6(22.22)	86(25.67)	
	Strongly agree	20(8.26)	5(17.24)	8(21.62)	2(7.41)	35(10.45)	
	Strongly disagree	38(15.70)	0(0.00)	3(8.11)	5(18.52)	46(13.73)	

Table 3d: COVID-19 vaccine acceptance, barriers and facilitators amongst health care workers of Province of Khyber Pakhtunkhwa Pakistan.

Variable	Categories	Status of COVID-19			P-value
		Negative N=303 (69.50%)	Positive N=133 (30.50%)	Total N=436 (100%)	
Health care worker status	Doctor	223(73.60)	104(78.20)	327(75.00)	0.42
	Nurse	22(7.26)	12(9.02)	34(7.80)	
	Paramedics	30(9.90)	9(6.77)	39(8.94)	
	Others	28(9.24)	8(6.02)	36(8.26)	
Working at which health care level?	COVID-19 Facility/ Hospitals	6(1.98)	4(3.01)	10(2.29)	0.05
	Emergency Operation Center(National, provincials and districts)	37(12.21)	17(12.78)	54(12.39)	
	Primary Health Care Facility	36(11.88)	8(6.02)	44(10.09)	
	Secondary Health Care Facility	71(23.43)	28(21.05)	99(22.71)	
	Tertiary Health Care Facility	113(37.29)	67(50.38)	180(41.28)	
Are you working at facility/ ward dedicated for COVID-19 patients?	No	154(50.83)	47(35.34)	201(46.10)	0.007
	Yes	99(32.67)	52(39.10)	151(34.63)	
	Both	50(16.50)	34(25.56)	84(19.27)	
	I am not sure	107(35.31)	36(27.07)	143(32.80)	
You believe you have adequate information regarding the COVID19 Vaccine?	No	54(17.82)	37(27.82)	91(20.87)	0.04
	Yes	142(46.86)	60(45.11)	202(46.33)	
	I am not sure	12(3.96)	12(9.02)	24(5.50)	
If vaccine against COVID-19 infection is available would you take it?	I will wait and see	90(29.70)	46(34.59)	136(31.19)	0.07
	No	13(4.29)	3(2.26)	16(3.67)	
	Yes	188(62.05)	72(54.14)	260(59.63)	
	Agree	132(43.56)	66(49.62)	198(45.41)	
Vaccination is a good idea because I feel less worried about getting COVID-19?	Disagree	11(3.63)	2(1.50)	13(2.98)	0.03
	Neutral	57(18.81)	30(22.56)	87(19.95)	
	Strongly agree	99(32.67)	29(21.80)	128(29.36)	
	Strongly Disagree	4(1.32)	6(4.51)	10(2.29)	
	Agree	72(23.76)	16(12.03)	88(20.18)	
I am concerned about permissibility of COVID-19 vaccine on religious grounds?	Disagree	103(33.99)	45(33.83)	148(33.94)	0.05
	Neutral	75(24.75)	40(30.08)	115(26.38)	
	Strongly agree	22(7.26)	15(11.28)	37(8.49)	
	Strongly Disagree	31(10.23)	17(12.78)	48(11.01)	

Table 4: Main characteristics of COVID-19 positive health care workers of Pakistan.

Discussion

Knowledge, attitude and practices of HCWs is important to understand to guide vaccination programs. Pakistan is a particularly complex region for population-based vaccination programs due to a history of vaccine hesitancy in the past. This survey therefore aimed to address proactively the major barriers for vaccine acceptance to help guide information management to effectively accompany the national COVID-19 response.

Importantly, about one third of health care workers in our survey indicated to postpone or refuse taking a COVID-19 vaccine. Given that these individuals are HCW, disproportionately young and well educated this seems a rather high proportion. This group of respondents is thought to be rather geared towards acceptance of evidence based interventions, which makes the significant proportion of hesitant individuals even more important. In similar studies done in health workers of other countries vaccine acceptance has been reported to be within a broad range from 28% in DRC, 40% in Hong Kong, 61% in Israel, 63% Hong Kong, up to 77% in France [6,13–16]. Interestingly, HCWs showed a trend towards more trust in US/UK manufactured vaccines than on a Chinese vaccine. This is important for the Pakistani context as two Chinese vaccines (Sinopharm, CanSino) are planned to be the main vaccines for the national control program. Concerns regarding logistics and quality assurance are justified concerns that need to be addressed both on the operation level as well as should be included in information campaigns. Importantly, one third of respondents also indicated issues with religious permissibility as a concern. This particular topic requires further investigation and engagement with religious leaders to potentially overcome this important hurdle in the effective implementation of the national COVID-19 vaccination program.

As mentioned above, this survey is probably not fully representative for the Pakistani population as it significantly over-represents young male HCWs with high education from one part of Pakistan. Nevertheless, it is important information from a country with history of vaccine hesitancy and a region with multiple health issues to tackle.

Conclusion

In summary, this survey indicates the overall acceptance of an anti-COVID-19 vaccination program and highlights important aspects to be included in engagement with national stakeholders and to be communicated in national information campaigns. Religious beliefs also need to be taken into account while planning a communication strategy.

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