INSIGHTS-JOURNAL OF
LIFE AND SOCIAL SCIENCES

INSIGHTS-JLSS
Insights-Journal of Life and Social Sciences

ASSESSING THE DETERMINANTS AND ACCEPTANCY OF CORONA VIRUS VACCINE AMONG GENERAL POPULATION IN URBANIZED SETTING

Original Article

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Conflict of Interest: None

Grant Support & Financial Support: None

Acknowledgment: The authors express gratitude to all study participants for their valuable time and cooperation.

ABSTRACT

Background: Vaccine hesitancy remains a major public health concern, particularly in regions where misinformation and conspiracy theories influence healthcare decisions. The COVID-19 pandemic has intensified debates surrounding vaccine safety and efficacy, leading to varying acceptance rates worldwide. In Pakistan, myths and misconceptions have contributed to skepticism regarding international health campaigns. Understanding the factors influencing vaccine uptake is essential for designing targeted interventions to improve immunization coverage.

Objective: This study aimed to assess COVID-19 vaccine acceptance and explore the impact of myths and misconceptions among the general population in Peshawar, Pakistan.

Methods: A cross-sectional study was conducted in urban areas of Peshawar from August to November 2021. A total of 1000 individuals were recruited using a random sampling approach. Data were collected through a semi-structured, pretested, and self-administered questionnaire. Multivariable logistic regression analysis was performed to determine factors associated with vaccine acceptance. The adjusted odds ratio (AOR) with a 95% confidence interval (CI) was calculated, considering a p-value of ≤ 0.05 statistically significant.

Results: The overall vaccine acceptance rate was 68%. Males (59.9%) had a higher acceptance rate than females (45.1%). The highest acceptance was observed in individuals aged 21–30 years (46.4%), followed by 31–40 years (17.7%). Among vaccinated participants, 67.4% were Muslims, while 0.6% were Christians. Education level showed an inverse association, with higher acceptance among those with lower education (AOR=2.75, CI: 1.74–4.33, p<0.00). Common myths significantly associated with vaccine hesitancy included fears of death within two years (AOR=0.47, CI: 0.22–0.98, p<0.04), blood clot formation (AOR=0.35, CI: 0.16–0.78, p<0.01), and microchip implantation (AOR=0.28, CI: 0.12–0.64, p<0.00). The primary source of vaccine-related information was media (44.3%), followed by family discussions (11.2%).

Conclusion: Despite moderate vaccine acceptance, prevalent misconceptions contributed to hesitancy. Media played a crucial role in shaping public perception, both positively and negatively. Strengthening health communication strategies and addressing misinformation through targeted awareness programs are essential to improve vaccine uptake and public trust in immunization programs.

Keywords: COVID-19, Immunization, Misinformation, Public health, Pakistan, Vaccine hesitancy, Vaccination acceptance.

INTRODUCTION

The emergence of the novel coronavirus (SARS-CoV-2) from Wuhan, China, in late 2019 marked the beginning of a global health crisis that rapidly escalated into a pandemic. While China initially contained the outbreak, the virus quickly spread across the world, causing severe disruptions to public health and economies. By the end of January 2022, the World Health Organization (WHO) reported a staggering 315,345,967 confirmed cases and 5,510,174 deaths globally, whereas Pakistan recorded 1,315,834 cases and 28,999 fatalities (1,2). Despite facing significant challenges, Pakistan managed to mitigate the pandemic's severity compared to many other nations, implementing strategic interventions such as the introduction of "smart lockdowns" to balance public health safety with economic sustainability (3). However, the ultimate solution to controlling infectious disease outbreaks lies in vaccination, which has historically proven to be the most effective measure in reducing morbidity and mortality associated with vaccine-preventable diseases (4). The development of COVID-19 vaccines was an unprecedented scientific achievement, with global vaccination campaigns being launched in early 2021 (5). However, the success of any immunization program relies not only on the availability of vaccines but also on their acceptance within communities. Vaccine hesitancy remains a formidable challenge worldwide, fueled by concerns regarding safety, efficacy, and mistrust in health authorities (6,7). The rapid pace of COVID-19 vaccine development further exacerbated these concerns, leading to apprehensions regarding potential adverse effects and long-term consequences (5). In addition, misinformation and anti-vaccine propaganda, often disseminated through social media and other online platforms, have contributed to skepticism and reluctance towards immunization (6). The issue is particularly pronounced in Pakistan, where public mistrust of international health initiatives has been a persistent barrier to vaccination campaigns, as evidenced by resistance to polio and iodine deficiency disorder eradication efforts (8).

Sociocultural and religious beliefs play a significant role in shaping vaccine acceptance in Pakistan. Conspiracy theories, such as those suggesting that COVID-19 vaccines are part of a Western plot to sterilize Muslim populations or that they contain haram ingredients, have gained traction among certain segments of the population, further undermining immunization efforts (9). Additionally, lack of health literacy, limited education, and skepticism towards government policies have been linked to increased vaccine hesitancy (10,6). The influence of family dynamics, social interactions, and perceived risks versus benefits of vaccination also contribute to individuals' decisions regarding immunization (11). Given these barriers, understanding the factors that determine vaccine acceptability is crucial for designing effective public health strategies. In Pakistan, government-imposed restrictions on non-vaccinated individuals were introduced to encourage uptake; however, resistance persisted, highlighting the need for targeted interventions to address public concerns (12). This study aims to assess the determinants of COVID-19 vaccine acceptance among the general population in an urbanized setting. By identifying key factors influencing vaccine hesitancy and acceptance, this research seeks to provide insights that can inform policy decisions and public health strategies to enhance immunization coverage and combat misinformation effectively.

METHODS

This study was conducted in Peshawar, the capital of Khyber Pakhtunkhwa (KP) province, Pakistan, located in northern Pakistan (34°02′N; 71°37′E). The district spans a total area of 1,257 square kilometers, with a population of 4,269,079 as per the 2017 census, comprising approximately 52% males and 48% females. The population of the area has increased by nearly 52% over the last 19 years, highlighting significant demographic growth (1,2). A cross-sectional study design was employed to assess the acceptance and uptake of the coronavirus vaccine among the general population. A convenience sampling method was used for participant selection, and data collection was conducted through face-to-face interviews. A structured, self-administered questionnaire was developed, adapted from previous validated studies and frameworks to ensure the reliability and validity of the data collection instrument (3). The questionnaire consisted of three sections: the first section included ten questions covering socio-demographic variables such as age, location, education level, and average monthly household income; the second section assessed the presence of non-communicable diseases, including hypertension, diabetes, hypersensitivity, heart disease, and stroke; and the final section evaluated participants' knowledge, attitudes, and perceptions regarding COVID-19 and the COVID-19 vaccine. Additionally, it contained specific items assessing participants' decisions regarding vaccine uptake, as well as common myths, rumors, and misconceptions surrounding the coronavirus vaccine (13).

The data collection period spanned from August to November 2021 and was conducted in urban settings of Peshawar. Three locations were purposively selected to ensure diverse population representation: Phase-3 Chowk near Hayatabad, Grand Trunk (GT) Road, and Khyber Bazaar near Lady Reading Hospital (LRH). Hayatabad was selected as it is a metropolitan locality inhabited by the socioeconomic elite of the region, whereas GT Road represented a semi-urban area with a relatively lower literacy rate. Khyber Bazaar, being the primary business hub of the old city, was chosen to capture perspectives from a central urban commercial setting. This selection

strategy ensured the inclusion of individuals from varied socioeconomic and educational backgrounds, facilitating a comprehensive assessment of vaccine acceptance. Participants who responded "yes" to the question, "Would you accept coronavirus vaccination?" were classified in the acceptance group, while those who responded "no" were categorized as vaccine-hesitant. The refusal rate for study participation was 20% (14,15). To ensure ethical compliance, all participants provided written informed consent after receiving a detailed explanation of the study's purpose, objectives, and confidentiality measures. Ethical approval was obtained from the formal Ethics Committee of Islamia College Peshawar, in accordance with the principles outlined in the Declaration of Helsinki. The approval reference number should be specified if available (16).

Statistical analyses were performed using STATA software, version 14.2 (Stata Corporation LLC, Texas, United States). Descriptive statistics were applied to summarize socio-demographic variables, risk perception, pandemic impact, and vaccine acceptance. The chi-square test was used to determine the significance of associations between vaccine acceptance and categorical variables. Multivariate logistic regression analysis was conducted to identify factors influencing vaccine acceptance, with results reported as odds ratios (OR) and 95% confidence intervals (CI). A p-value of <0.05 was considered statistically significant (17,18).

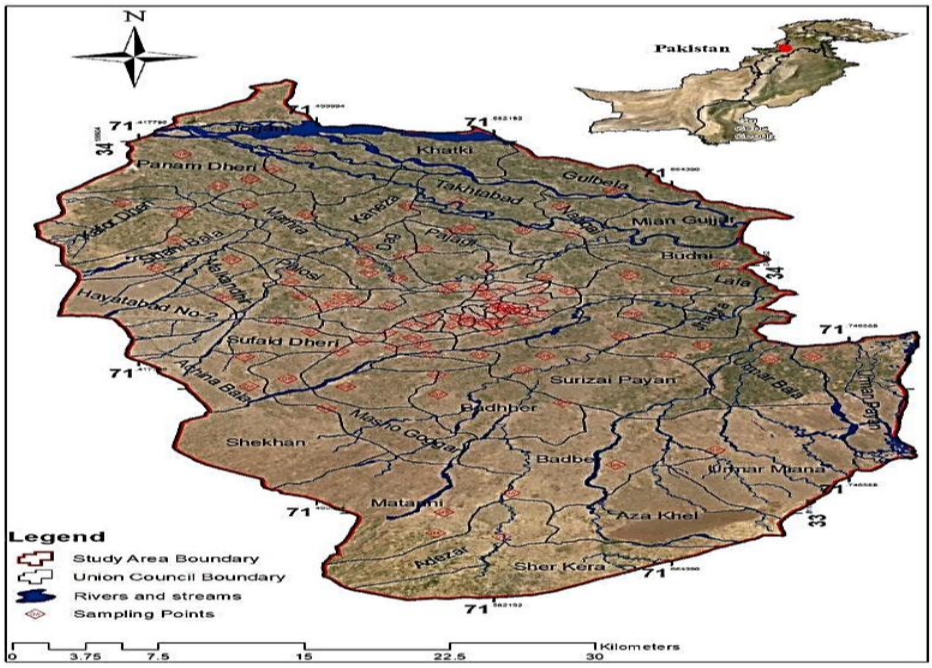


Figure: 1. Geographical Map of Peshawar (lgkp.gov.pk).

RESULTS

The study included 1000 participants, of whom 549 (59.9%) were male and 451 (45.1%) were female. The majority of the respondents belonged to the 21–30-year age group, comprising 464 (46.4%) individuals, followed by the 31–40-year group with 177 (17.7%). Most participants (524, 52.4%) resided in a nuclear family system, while 476 (47.6%) lived in a joint family system. A vast majority of respondents (992, 99.2%) were Muslim, with only 8 (0.8%) identifying as Christian. Among all participants, 577 (57.7%) were unmarried, while 374 (37.4%) were married, 37 (3.7%) were widowed, and 12 (1.2%) were divorced. A high proportion of the participants (839, 83.9%) were educated, with 365 (36.5%) being undergraduates and 251 (25.1%) postgraduates. In terms of profession, students comprised the largest group (430, 43%), followed by housewives (124, 12.4%), teachers (99, 9.9%), servants (90, 9%), and health workers (70, 7%). Regarding the economic distribution, the majority of participants belonged to the lower middle class (353, 35.3%) and upper lower class (265, 26.5%), while only 99 (9.9%) identified as upper class. Among the participants, 904 (90.4%) had resided in Peshawar for more than five years, while 95 (9.5%) had been there for exactly five years, and only 1 (0.1%) had been a resident for less than five years.

The multivariate logistic regression analysis demonstrated significant associations of vaccine acceptance with sex (p<0.01, OR=1.39, CI: 1.05–1.83), profession (p<0.02, OR=1.07, CI: 1.00–1.14), age (p<0.00, OR=1.03, CI: 1.01–1.04), and family type (p<0.04, OR=0.75, CI: 0.57–0.98). However, education level (p>0.53, OR=0.95, CI: 0.83–1.09) and duration of residence in the study area (p>0.52,

OR=1.08, CI: 0.84–1.37) did not show a statistically significant relationship with vaccine acceptance. Interestingly, individuals with no formal education or only primary-level education had significantly higher odds of accepting the vaccine (p<0.00, OR=2.75, CI: 1.74–4.33) compared to those with higher education (p<0.00, OR=0.58, CI: 0.41–0.80). Younger individuals (13–20 years) were more likely to accept the vaccine (p<0.04, OR=0.54, CI: 0.29–0.98) than those in the 21–30-year group (p<0.00, OR=0.41, CI: 0.23–0.71). In terms of occupation, housewives (p<0.00, OR=7.44, CI: 2.09–26.45), servants (p<0.00, OR=6.62, CI: 1.83–23.95), marketing managers (p<0.02, OR=5.32, CI: 1.38–20.49), and those with no profession (p<0.02, OR=4.26, CI: 1.16–15.57) exhibited significantly higher vaccine acceptance than students, teachers, and engineers. Longer residence in Peshawar was also associated with vaccine acceptance, with individuals residing in the city for more than five years displaying significant association (p<0.00, OR=0.47, CI: 0.41–0.55) compared to those who had been there for a shorter duration. Among economic classes, only those belonging to the middle class showed a significant association with vaccine acceptance (p<0.01, OR=0.35, CI: 0.16–0.78).

Significant differences were observed between individuals who had knowledge about the coronavirus vaccine and those who did not. Among vaccinated individuals (680, 68%), 397 (39.7%) believed that vaccinated individuals could still transmit the virus, while 283 (28.3%) believed otherwise. Similarly, among non-vaccinated participants (320, 32%), 153 (15.3%) believed vaccinated individuals could spread the virus, while 167 (16.7%) did not share this belief. No statistically significant differences were found regarding the necessity of vaccination for individuals who had recovered from COVID-19 (p>0.09). However, significant differences were observed in attitudes toward following standard operating procedures (SOPs) post-vaccination, with 648 (64.8%) vaccinated participants considering SOPs important compared to 32 (3.2%) who did not. The main sources of vaccine-related information were media (443, 44.3%), family (112, 11.2%), social interactions, and scientific articles. When assessing the impact of non-communicable diseases on vaccine acceptance, only individuals with a combination of hypertension and lung disease showed a significant association (p<0.00, OR=1.732, CI: 0.03–29.80), while other conditions such as diabetes, asthma, and heart disease showed no association.

Perceptions regarding the COVID-19 vaccine's purpose and effects influenced vaccine acceptance. Individuals who believed that vaccines caused harmful effects exhibited a strong negative association with vaccine acceptance (p<0.00, OR=19.72, CI: 4.19–92.72). In contrast, perceptions regarding vaccine protection (p>0.06, OR=0.25, CI: 0.05–1.07) and physician recommendations (p>0.76, OR=0.79, CI: 0.17–3.53) were not significantly associated with vaccine acceptance. The belief that vaccines provided lifelong immunity was significantly associated with vaccine acceptance (p<0.00, OR=0.27, CI: 0.10–0.72), whereas perceptions of short-term immunity (few months, one year, or two years) did not exhibit a strong relationship. Among reasons for vaccine acceptance, government-imposed restrictions (p<0.00, OR=0.07, CI: 0.03–0.18), protection against COVID-19 (p<0.00, OR=0.01, CI: 0.00–0.01), and recommendations from physicians (p<0.00, OR=0.13, CI: 0.05–0.34) significantly influenced decision-making. Conversely, among reasons for vaccine refusal, the belief that vaccines could cause harmful effects in the future was strongly associated with hesitancy (p<0.00, OR=7.4, CI: 2.00–27.37), while concerns about death within two years, autism, blood clotting, religious beliefs, or microchip implantation did not show significant associations.

Individuals who believed in myths about the COVID-19 vaccine were significantly less likely to accept vaccination (p<0.00). Specific myths, such as the vaccine causing death after two years (p<0.04, OR=0.47, CI: 0.22–0.98), blood clotting (p<0.01, OR=0.35, CI: 0.16–0.78), and microchip implantation (p<0.00, OR=0.28, CI: 0.12–0.64), had strong negative associations with vaccine acceptance, whereas myths about forbidden ingredients in Islam (p>0.41, OR=0.73, CI: 0.34–1.55) and DNA alteration (p>0.06, OR=0.47, CI: 0.21–1.03) showed no significant impact.

Table 1: Selected Baseline Characteristics of Study Participants

Variables	Category	n(%)
Sex	Male	549 (59.90)
	Female	451 (45.10)
Age	13-20	184 (18.50)
	21-30	464 (46.40)
	31-40	177 (17.70)
	41-50	111 (11.10)
	51-60	60 (6.00)
	61-65	3 (0.30)
Family system	Joint	476 (47.60)
	Nuclear	524(52.40)

Variables	Category	n(%)
Religion	Islam	992 (99.20)
	Christianity	8 (0.80)
Marital status	Unmarried	577 (57.70)
	Married	374 (37.40)
	Widow	37 (3.70)
	Divorced	12 (1.20)
Educational status	Primary	65 (65.50)
	Higher secondary	158(15.80)
	Undergraduate	365 (36.50)
	Postgraduate	251 (25.10)
	Uneducated	161 (16.10)
Profession	Teaching	99 (9.90)
	Student	430 (43.00)
	Engineer	37 (3.70)
	Servant	90 (9.00)
	Health worker	70 (7.00)
	Labor	22 (2.20)
	Housewife	124 (12.40)
	Marketing	46 (4.60)
Time since residing	From five year	95 (9.50)
	Less than five years	1 (0.10)
	More than five years	904 (90.40)
Economic status	UC	99 (9.90)
	UMC	139 (13.90)
	MC	93 (9.30)
	LMC	353 (35.30)
	ULC	265 (26.50)
	ALC	43 (4.30)
	ELC	8 (0.80)

upper class(UC) upper middle class (UMC) middle class (MC) lower middle class (LMC) upper lower class (ULC) average lower class (ALC) extremely lower class (ELC).

Table 2: Difference Between Vaccine Acceptance to Coronavirus/Vaccine Knowledge Related Factors

Characteristics	Category	Vaccinated Yes n (%)	No n (%)	Total	P-value
Do you know about coronavirus		1000 (100)	0	1000	0
Do you know corona vaccine		1000 (100)	0	1000	0
Do you think a vaccinated person can be a source of transmission?	Yes	397 (39.7)	283 (28.3)	680	0
	No	153 (15.3)	167 (16.7)	320	
Do you think a recovered person should get vaccination?	Yes	564 (56.4)	116 (11.6)	680	0.09
	No	143 (14.3)	177 (17.7)	320	
Is it important to follow SOPs after vaccination?	Yes	648 (64.8)	32 (3.2)	680	0
	No	291 (29.1)	29 (2.9)	320	

	Odds Ratio (95% CI)	
Can you still be infected by the virus COVID-19 if you are vaccinated?	1.35 (0.92-1.97)	0.11
people who have recovered from COVID-19, should they be vaccinated?	3.19 (2.20-4.63)	0.08

For difference between variable chi-square test was used. P-value was generated from Chi-square test.

Table 3: Multivariate Analysis for Testing Association of Vaccine Acceptancy to Demographic Characteristics

Characteristic	Odds Ratio (95% CI)	P-value
Sex	1.39 (1.05-1.83)	0.01
Age	1.03(1.01-1.04)	0.00
Education status	0.95 (0.83-1.09)	0.53
Since reside	1.08 (0.84-1.37)	0.52
Profession	1.07 (1.00-1.14)	0.02
Family type	0.75 (0.57-0.98)	0.04

P-value obtained from multivariate logistic regression analysis

Table 4: Association of Vaccine Acceptancy with Demographic Characteristics

Characteristics	Category	Yes n (%)	No n (%)	P-value
Sex	Males	390 (39%)	159 (15.9%)	0.000
	Females	290 (29%)	161 (16.1%)	
Religion	Islam	674 (67.4%)	316 (31.6%)	0.71
	Christianity	6 (0.6%)	2 (0.2%)	
			Odds Ratio (95% CI)	P value
Age	13-20		0.54 (0.29-0.98)	0.04
	21-30		0.41 (0.23-0.71)	0.00
	31-40		0.62 (0.34k-1.13)	0.12
	41-50		1.24 (0.66-2.33)	0.66
	51-60		1 omitted	
	61-65		1 empty	
Education status	Primary		1.77 (0.99-3.18)	0.05
	Higher secondary		0.58 (0.41-0.80)	0.00
	Under Graduate		0.54 (0.36-0.81)	0.00
	Post Graduate		0.34 (0.21-0.55)	0.00
	Illiterate		2.75 (1.74-4.33)	0.00
Profession	Teacher		1.22 (0.32-4.61)	0.76
	Students		2.42 (0.70-8.33)	0.16
	Engineering		1.22 (0.27-5.48)	0.79
	Servant		6.62 (1.83- 23.95)	0.00
	Health worker		0.93 (0.22-3.80)	0.92
	Housewife		7.44 (2.09-26.45)	0.00
	Marketing manager		5.32 (1.38-20.49)	0.01
	None		4.26 (1.16-15.57)	0.02
Time since residing in Peshawar	From five years		0.78 (0.49-1.25)	0.31
	Less than five years		Ref	
	More than five years		0.47(0.41-0.55)	0.00
Economic status	UC		0 .90 (0.43-1.86)	0.78
	UMC		0.78 (0.38-1.56)	0.48
	MC		0.35 (0.16-0.78)	0.01
	LMC		0.59 (0.31-1.13)	0.11

Characteristics	Category	Yes n (%)	No n (%)	P-value
	ULC	0.64 (0.33-1.24)		0.19
	ELC	1.38 (0.30-6.30)		0.60

(UC) upper class, (UMC) upper middle class, (MC) middle class ,(LMC) lower middle class, (ULC) upper lower class, (ELC) extremely lower class.

Table 5: Frequency Distribution Between Acceptance and Non-Acceptance of Coronavirus/Vaccine Through Sources of Information of Study Participants

Category	Yes n (%)	No n (%)	Total
Family	112 (11.2)	103 (10.3)	215
Friends	60 (6)	23 (2.3)	83
Doctors/physicians	59 (5.9)	22 (2.2)	81
Media	443 (44.3)	172 (17.2)	615
Scientific article	6 (0.6)	0	6

Effect Size of Vaccine Acceptancy with Non-Communicable Diseases and Coronavirus/Vaccine Knowledge Related Factors

Table 6: Effect Size of Non-Communicable Diseases on Vaccine Acceptancy

Diseases	Odds Ratio (95%CI)	P-value
Hypertension	0 .63 (.03-10.47)	0.74
Hypersensitivity	0.33 (0.02-5.69)	0.45
Asthma	0.26 (0.01-5.26)	0.38
Diabetes	0.59 (0.03-10.05)	0.71
Depression	0.68 (0.04-11.58)	0.79
Arthritis	0.83 (0.04-16.99)	0.90
Lung diseases	1.55 (0.08-28.14)	0.76
Stroke	1	
Cancer	1	
Kidney disease	0.58 (0.03-10.07)	0.71
Heart disease	2.59 (0.13-50.04)	0.52
Hypertension, Hypersensitivity	1	
Hypertension, lung diseases	1.732 (0.03-29.80)	0.00
Hypertension, diabetes	0.66 (0.02-18.05)	0.81
Hypertension, kidney diseases	1	

Table 7: Effect Size of Coronavirus/Vaccine Knowledge Related Factors on Vaccine Acceptancy

Characteristics	Category	Odds Ratio (95%CI)	P-value
What is the effect of corona vaccine	Provides protection against COVID-19	0.25 (0.05-1.07)	0.06
	Doctor/Physician recommended	0.79 (0.17-3.53)	0.76
	Family decision	0.45 (0.10-2.09)	0.31
	Natural immunity lasts longer	3.25 (0.70-15.00)	0.13
	It cause harmful effects	19.72 (4.19-92.72)	0.00
	Any other reason	1.85 (0.34-10.04)	0.47
How long does the COVID-19 vaccine work	Few months	1.03 (0.36-2.92)	0.94
	One year	0.43 (0.17-1.06)	0.06
	Two year	0.81 (0.25-2.56)	0.72
	Whole life	0.27 (0.10-0.72)	0.00
	Don’t know	1.70 (0.69-4.21)	0.24

Characteristics	Category	Odds Ratio (95%CI)	P-value
How long will it take to build immunity against coronavirus vaccine after getting the COVID-19 vaccine?	Within a week	1.17 (0.66-2.05)	0.58
	Two weeks	0.24 (0.15-0.37)	0.09
	A month	0.36 (0.18-0.73)	0.00
	Don't know	3.72 (2.30-6.0)	0.00

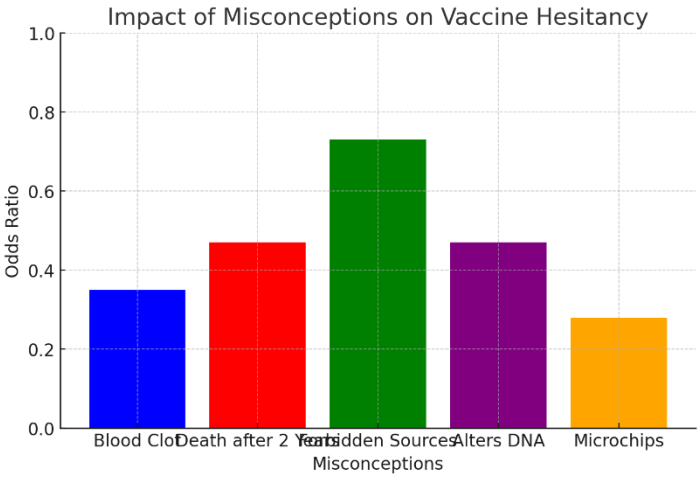
Table 8: Association of Vaccine Acceptancy with Coronavirus/Vaccine Practice Related Factors

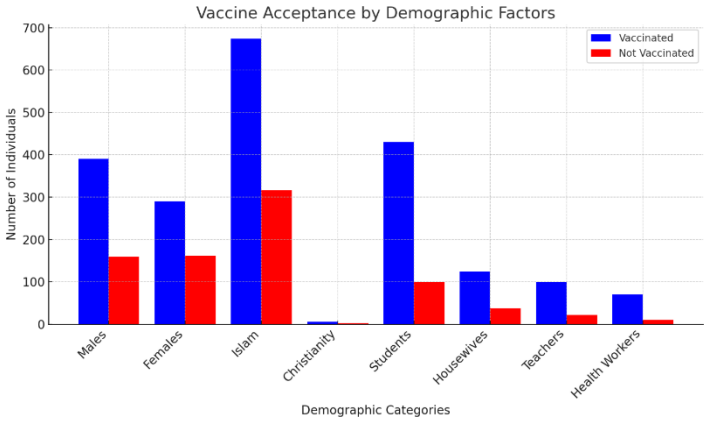
Characteristics	Category	Odds Ratio (95%CI)	P-value
Why would you go for corona virus vaccination	Due to govt restrictions	0.07 (0.03-0.18)	0.00
	Provides protection against COVID-19	0.00 (0.00-0.01)	0.00
	Doctor/Physician recommendation	0.13 (0.05-0.34)	0.00
	Family decision	0.01 (0.00-0.05)	0.00
	Natural immunity lasts longer	1	
	COVID-19 vaccine causes allergic reactions	1	
	Any other reason	1 (0mitted)	
Why you are not going for COVID-19 vaccination	Causes autism	0.21 (0.03-1.24)	0.08
	Causes blood clot	0.71 (0.18-2.79)	0.62
	Will cause death after two Years	1.75 (0.22-4.37)	1.00
	Derived from forbidden sources in Islam	2.75 (0.50-14.85)	0.24
	Inserts microchips or nano-particles into a human body	1.33 (0.26-6.80)	0.72
	It causes harmful effects in the future	7.4 (2.00-27.37)	0.00
	Any other reason	0.12 (0.03-0.45)	0.00

Data was analyzed through logistic regression analysis.

Association of Vaccine Acceptance with Coronavirus/Vaccine-Related Myths

Characteristics	Category	Yes n (%)	No n (%)	Total	P- value
Do you believe in the myths?	Yes	53 (5.3%)	627(62.7%)	680	0.00
	No	50 (5%)	270 (27%)	320	
Myths	Odds Ratio (95%CI)				P-value
Causes blood clot	0.35 (0.16-0.78)				0.01
Will cause death after two Years	0.47 (0.22-0.98)				0.04
Derived from forbidden sources in Islam	0.73 (0.34-1.55)				0.41
Alters DNA	0.47 (0.21-1.03)				0.06
Inserts microchips or nano-particles into the human body	0.28 (0.12-0.64)				0.00
None of these	0.26 (0.10-0.68)				0.00





DISCUSSION

The overall vaccine acceptance rate against COVID-19 in the study was recorded at 68%, indicating a moderate willingness to receive vaccination among the general population. Several demographic factors influenced vaccine acceptance, including sex, profession, family type, lower level of education, younger age, extended exposure to metropolitan culture, and average socioeconomic background. Knowledge and adherence to preventive measures such as standard operating procedures (SOPs) were significantly associated with vaccine acceptance. The most common sources of information were media and family, highlighting the role of these channels in shaping public perception. Interestingly, individuals with comorbid conditions, except for those with both hypertension and lung disease, did not demonstrate a higher intent to receive the vaccine (19-21). Vaccination has long been recognized as the most effective strategy to control the spread of infectious diseases. The rapid development and deployment of COVID-19 vaccines were critical in curbing the pandemic, but vaccine uptake remained a significant challenge. The vaccine acceptance rate observed in this study aligns with findings from other global studies that reported similar rates of public willingness to receive COVID-19 vaccination. However, vaccine acceptance in this study was higher than that reported in several countries, including Russia, Saudi Arabia, Kuwait, Jordan, Italy, Poland, the United States, and France, but lower than in China, Canada, Australia, Ecuador, Malaysia, and Indonesia. This variation in vaccine acceptance may be attributed to differences in governmental policies, public trust in health institutions, perceived risk of infection, and historical experiences with vaccination campaigns. The relatively high acceptance rate in this study could be explained by government-imposed restrictions, including vaccination proof requirements for travel, access to public spaces, and essential services. Additionally, high COVID-19 mortality rates during early waves of the pandemic may have heightened risk perception and encouraged vaccine uptake (22-24).

The relationship between age and vaccine acceptance has been widely studied, with research suggesting that older adults are more likely to accept vaccination due to increased vulnerability to severe disease outcomes. In contrast, this study found higher vaccine acceptance among individuals aged 21–30 years, while acceptance was lower among both younger (13–20 years) and older (51–60 years) populations. This pattern may be explained by the fact that middle-aged individuals are more likely to be engaged in work or education, making vaccination a necessary requirement for professional and academic activities. The lower acceptance among older individuals deviates from trends observed in developed countries, where higher vaccine uptake has been reported in elderly populations. Cultural beliefs, mistrust in vaccine efficacy, and misconceptions about vaccine safety may have contributed to the reluctance of older individuals in this study (25-27). Gender differences in vaccine acceptance were also observed, with men demonstrating a higher willingness to receive vaccination than women. This finding aligns with studies that have reported lower vaccine acceptance among women due to concerns about vaccine safety, potential side effects, and distrust in health authorities. In contrast, some studies have shown higher vaccine acceptance among women, particularly in settings where they exhibit greater health-seeking behavior. The lower acceptance among women in this study may be influenced by prevailing myths, including concerns about infertility and long-term health consequences of vaccination. The higher acceptance among men may be linked to their increased perceived risk of exposure due to occupational and social mobility (28-31).

Economic status showed an inconsistent relationship with vaccine acceptance. Individuals from the middle socioeconomic class were significantly more likely to accept vaccination, whereas no clear trend was observed for other economic groups. Previous studies have reported conflicting findings on the role of income in vaccine acceptance, with some studies suggesting that lower-income populations

have lower vaccine uptake due to access barriers, while others indicate no significant impact of income on vaccination attitudes. The higher acceptance observed among middle-class individuals in this study may be related to their occupational status, as a large proportion were engaged in jobs requiring vaccination compliance (32-35). The presence of comorbid conditions has been identified as a key predictor of vaccine acceptance in many studies, as individuals with chronic illnesses are at greater risk of severe COVID-19 complications. However, in this study, only individuals with a combination of hypertension and lung disease showed a significant association with vaccine acceptance, while those with other chronic conditions exhibited no such trend. This finding is unexpected, as individuals with conditions such as diabetes, cardiovascular disease, and respiratory illnesses are more vulnerable to severe COVID-19 outcomes. The lack of association between comorbid conditions and vaccine acceptance may be attributed to limited awareness regarding the increased risks posed by COVID-19 to individuals with pre-existing health conditions (36,37).

Knowledge and awareness of COVID-19 and vaccination played a crucial role in influencing vaccine acceptance. Significant differences were observed between individuals who had knowledge about COVID-19 vaccines and those who lacked information. Previous studies have demonstrated that individuals with higher awareness of infectious diseases and their preventive measures are more likely to accept vaccination. The role of media as a primary source of information was evident in this study, with a considerable proportion of participants relying on television, social media, and family for vaccine-related knowledge. While media exposure can facilitate public awareness, it can also contribute to misinformation and vaccine hesitancy. The spread of misleading information, particularly through social media, has been a major barrier to vaccination efforts, fueling doubts about vaccine safety, effectiveness, and necessity (29,38). A significant proportion of participants believed that vaccinated individuals could still transmit COVID-19, which influenced their decision to get vaccinated. Misconceptions about vaccine efficacy and the belief that natural immunity is superior to vaccine-induced immunity were also observed. The perception that vaccines provide lifelong immunity was significantly associated with vaccine acceptance, although scientific evidence suggests that COVID-19 vaccine-induced immunity may wane over time, necessitating booster doses (18,39).

The impact of myths and conspiracy theories on vaccine hesitancy was apparent in this study. Misinformation regarding vaccine ingredients, alleged side effects, and government motives contributed to vaccine refusal among some individuals. Notably, beliefs that vaccines could alter DNA, contain microchips, or cause death within two years were prevalent among vaccine-hesitant individuals. These findings underscore the urgent need for targeted public health campaigns to counteract vaccine misinformation and enhance public trust in immunization programs (12,40). This study has several strengths, including its diverse sample representation and comprehensive analysis of demographic, social, and behavioral factors influencing vaccine acceptance. The use of a validated questionnaire ensured reliability in data collection. However, there are limitations that should be acknowledged. The study relied on self-reported data, which may be subject to recall bias and social desirability bias. Additionally, the cross-sectional design limits the ability to establish causality between variables. Future research should explore longitudinal trends in vaccine acceptance, particularly in the context of emerging variants and booster dose recommendations (11,21).

Public health strategies should prioritize addressing vaccine hesitancy through targeted educational interventions, particularly among women, older adults, and individuals with chronic conditions. Strengthening trust in healthcare institutions, combating misinformation, and leveraging trusted sources of information can enhance vaccine acceptance. Given the evolving nature of the pandemic, ongoing assessment of public perceptions and attitudes toward vaccination is essential for optimizing immunization coverage and controlling the spread of COVID-19 (9).

CONCLUSION

This study highlights the key factors influencing COVID-19 vaccine acceptance, emphasizing the role of demographic characteristics, knowledge, and societal perceptions in shaping vaccination decisions. Findings suggest that vaccine acceptance is influenced by factors such as gender, age, education, profession, and exposure to urban environments, with media and family playing a crucial role in disseminating information. Misinformation and vaccine-related myths continue to be significant barriers, underscoring the need for targeted public health interventions to address misconceptions and enhance trust in vaccination programs. Strengthening awareness through credible information sources and policy-driven incentives can improve vaccine uptake, ultimately contributing to better public health outcomes. The insights gained from this research provide a foundation for designing effective strategies to mitigate vaccine hesitancy and support global immunization efforts.

Author Contributions

Author	Contribution
Asmat Wahab	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Saira Saira	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Aisha Imtiaz	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Muhammad Altaf Khan	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Muhammad Tariq Hamayun Khan	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Asmat Ullah Khan	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Muhammad Younas	Contributed to study concept and Data collection Has given Final Approval of the version to be published
Rehman Mehmood Khattak*	Writing - Review & Editing, Assistance with Data Curation Has given Final Approval of the version to be published
Abdus Salam	Writing - Review & Editing, Assistance with Data Curation
Fawad Khan	Writing - Review & Editing, Assistance with Data Curation

REFERENCES

1. Di Gennaro F, Pizzol D, Marotta C, Antunes M, Racalbuto V, Veronese N, et al. Coronavirus diseases (COVID-19) current status and future perspectives: a narrative review. Int J Environ Res Public Health. 2020;17(8):2690.
2. Sethi BA, Sethi A, Ali S, Aamir HS. Impact of coronavirus disease (COVID-19) pandemic on health professionals. Pak J Med Sci. 2020;36(COVID19-S4):S6–S11.
3. Lazarus JV, Ratzan SC, Palayew A, Gostin LO, Larson HJ, Rabin K, et al. A global survey of potential acceptance of a COVID-19 vaccine. Nat Med. 2021;27(2):225–8.
4. Dodd RH, Cvejic E, Bonner C, Pickles K, McCaffery KJ; Sydney Health Literacy Lab COVID-19 Group. Willingness to vaccinate against COVID-19 in Australia. Lancet Infect Dis. 2020;20(3):318–9.
5. Fisher KA, Bloomstone SJ, Walder J, Crawford S, Fouayzi H, Mazor KM. Attitudes toward a potential SARS-CoV-2 vaccine: a survey of US adults. Ann Intern Med. 2020;173(12):964–73.
6. Reiter PL, Pennell ML, Katz ML. Acceptability of a COVID-19 vaccine among adults in the United States: how many people would get vaccinated? Vaccine. 2020;38(42):6500–7.
7. Malik AA, McFadden SM, Elharake J, Omer SB. Determinants of COVID-19 vaccine acceptance in the US. EClinicalMedicine. 2020;26:100495.
8. Ahmed S, Ahmad QM, Akhtar T, Usman M, Al Rehman S, Ayub MR. Incidence of Rifampicin-Resistant Strains in Pediatric Cases Newly Identified with Pulmonary Tuberculosis. Annals of Punjab Medical College. 2023 Dec 31;17(4):440-5. https://doi.org/10.29054/apmc/2023.1306
9. El-Elimat T, AbuAlSamen MM, Almomani BA, Al-Sawalha NA, Alali FQ. Acceptance and attitudes toward COVID-19 vaccines: a cross-sectional study from Jordan. PLoS One. 2021;16(4):e0250555.
10. Frank K, Arim R. Canadians' willingness to get a COVID-19 vaccine: group differences and reasons for vaccine hesitancy. Statistics Canada; 2020.
11. Barello S, Nania T, Dellafiore F, Graffigna G, Caruso R. 'Vaccine hesitancy' among university students in Italy during the COVID-19 pandemic. Eur J Epidemiol. 2020;35(8):781–3.

12. Sallam M. COVID-19 vaccine hesitancy worldwide: a systematic review of vaccine acceptance rates. Int J Infect Dis. 2021;105:338–46.
13. Liu L, Xie J, Li K, Ji S. Exploring how media influence preventive behavior and excessive preventive intention during the COVID-19 pandemic in China. Int J Environ Res Public Health. 2020;17(21):7980.
14. Detoc M, Bruel S, Frappe P, Tardy B, Botelho-Nevers E, Gagneux-Brunon A. Intention to participate in a COVID-19 vaccine clinical trial and to get vaccinated against COVID-19 in France during the pandemic. Vaccine. 2020;38(45):7002–6.
15. Cascini F, Pantovic A, Al-Ajlouni Y, Failla G, Ricciardi W. Attitudes, acceptance and hesitancy among the general population worldwide to receive the COVID-19 vaccines and their contributing factors: a systematic review. EClinicalMedicine. 2021;40:101113.
16. Lin C, Tu P, Beitsch LM. Confidence and receptivity for COVID-19 vaccines: a rapid systematic review. Vaccines. 2020;9(1):16.
17. Afifi TO, Salmon S, Taillieu T, Stewart-Tufescu A, Fortier J, Driedger SM. Older adolescents and young adults' willingness to receive the COVID-19 vaccine: implications for informing public health strategies. Vaccine. 2021;39(26):3473–9.
18. Ward JK, Alleaume C, Peretti-Watel P; COCONEL Group. The French public's attitudes to a future COVID-19 vaccine: the politicization of a public health issue. Soc Sci Med. 2020;265:113414.
19. Williams L, Gallant AJ, Rasmussen S, Nicholls LAB, Cogan N, Deakin K, et al. Towards intervention development to increase the uptake of COVID-19 vaccination among those at high risk: outlining evidence-based and theoretically informed future intervention content. Br J Health Psychol. 2020;25(4):1039–54.
20. AlKetbi LMB, Elharake JA, Al Memari S, Al Mazrouei S, Al Shehhi B, Malik AA, et al. COVID-19 vaccine acceptance among healthcare workers in the United Arab Emirates. IJID Reg. 2021;1:20–6.
21. Troiano G, Nardi A. Vaccine hesitancy in the era of COVID-19. Public Health. 2021;194:245–51.
22. Wang K, Wong EL, Ho KF, Cheung AW, Yau PS, Dong D, et al. Change of willingness to accept COVID-19 vaccine and reasons of vaccine hesitancy of working people at different waves of local epidemic in Hong Kong, China: repeated cross-sectional surveys. Vaccines. 2021;9(1):62.
23. Kreps S, Prasad S, Brownstein JS, Hswen Y, Garibaldi BT, Zhang B, et al. Factors associated with US adults' likelihood of accepting COVID-19 vaccination. JAMA Netw Open. 2020;3(10):e2025594.
24. Qunaibi E, Basheti I, Soudy M, Sultan I. Hesitancy of Arab healthcare workers towards COVID-19 vaccination: a large-scale multinational study. Vaccines. 2021;9(5):446.
25. Rosso A, Massimi A, Pitini E, Nardi A, De Vito C, Marzuillo C, et al. Factors affecting the vaccination choices of pregnant women for their children: a systematic review of the literature. Hum Vaccin Immunother. 2020;16(8):1969–83.
26. Manitoba Department of Health. COVID-19 vaccines: confidence, hesitancy and access. [Accessed 2022].
27. Biswas R. Are men more vulnerable to COVID-19 as compared to women? Biomed J Sci Tech Res. 2020;27(2).
28. Pogue K, Jensen JL, Stancil CK, Ferguson DG, Hughes SJ, Mello EJ, et al. Influences on attitudes regarding potential COVID-19 vaccination in the United States. Vaccines. 2020;8(4):582.
29. Islam MS, Siddique AB, Akter R, Tasnim R, Sujan MS, Ward PR, et al. Knowledge, attitudes and perceptions towards COVID-19 vaccinations: a cross-sectional community survey in Bangladesh. medRxiv. 2021.
30. Paul E, Steptoe A, Fancourt D. Attitudes towards vaccines and intention to vaccinate against COVID-19: implications for public health communications. Lancet Reg Health Eur. 2021;1:100012.
31. Ali SH, Foreman J, Tozan Y, Capasso A, Jones AM, DiClemente RJ. Trends and predictors of COVID-19 information sources and their relationship with knowledge and beliefs related to the pandemic: nationwide cross-sectional study. JMIR Public Health Surveill. 2020;6(4):e21071.
32. Mohamad E, Tham JS, Ayub SH, Hamzah MR, Hashim H, Azlan AA. Relationship between COVID-19 information sources and attitudes in battling the pandemic among the Malaysian public: cross-sectional survey study. J Med Internet Res. 2020;22(11):e23329.
33. Basheti IA, El-Hajji F, Nassar R, Qunaibi E, Abufarha R, Mukattash T, et al. Pharmacists' awareness of COVID-19 and perceptions of their roles, barriers, and roles of policymakers: exploring the Middle East and North Africa (MENA). Int J Clin Pract. 2021;75(6):e14074.
34. Chadwick A, Kaiser J, Vaccari C, Freeman D, Lambe S, Loe BS, et al. Online social endorsement and COVID-19 vaccine hesitancy in the United Kingdom. Soc Media Soc. 2021;7(2):20563051211008817.
35. Elgendy MO, Abdelrahim MEA. Public awareness about coronavirus vaccine, vaccine acceptance and hesitancy. J Med Virol. 2021;93(12):6535–43.

36. Omeish H, Najadat A, Al-Azzam S, Tarabin N, Abu Hameed A, AlGallab N, et al. Reported COVID-19 vaccines side effects among Jordanian population: a cross-sectional study. Hum Vaccin Immunother. 2021;17(10):4048–56.
37. Saeed BQ, Al-Shahrabi R, Alhaj SS, Alkokhardi ZM, Adrees AO. Side effects and perceptions following Sinopharm COVID-19 vaccination. Int J Infect Dis. 2021;111:219–26.
38. Callaghan T, Moghtaderi A, Lueck JA, Hotez PJ, Strych U, Dor A, et al. Correlates and disparities of COVID-19 vaccine hesitancy. SSRN. 2020.
39. Marco-Franco JE, Pita-Barros P, Vivas-Orts D, González-de-Julián S, Vivas-Consuelo D. COVID-19, fake news, and vaccines: should regulation be implemented? Int J Environ Res Public Health. 2021;18(2):744.
40. Branswell H. The world needs COVID-19 vaccines. It may also be overestimating their power. STAT News. Published May 22, 2020. Accessed September 22, 2020.

