Perception and knowledge of Pakistanis on COVID-19 and its vaccination: implications for public health

Moath Refat[1*]   ORCID: https://orcid.org/0000-0003-4017-9052
Sundus Shukar[2,3]   ORCID: https://orcid.org/0000-0001-8078-165X
Iltaf Hussain[2,3,4]   ORCID: https://orcid.org/0000-0003-0556-0181
Ahmed Ibrahim Mohamed[5,6] ORCID: https://orcid.org/0009-0003-3654-9433

[1] Department of Biochemistry and Molecular Biology, The Key Laboratory of Environment and Genes Related to Disease of Ministry of Education, Health Science Center, Xi'an Jiaotong University. Xi'an, China.
[2] Department of Pharmacy Administration and Clinical Pharmacy, School of Pharmacy Xi'an Jiaotong University. Xi'an, Shaanxi, China.
[3] Center for Drug Safety and Policy Research, Xian Jiaotong University. Xi'an, Shaanxi, China.
[4] Department of Pharmacy Practice, Faculty of Pharmacy, Bahauddin Zakariya University. Multan, Pakistan.
[5] Health Science Center, Xi'an Jiaotong University. Xi'an, Shaanxi, China.
[6] Internal Medicine Department, First Affiliated Hospital of Xi'an Jiaotong University. Xi'an, Shaanxi, China.

Corresponding author: moath.refat@hotmail.com

Since the beginning, COVID-19 caused deaths and social and economic devastation worldwide. Effective prophylactic strategies such as personal protection measures, social distancing, and vaccination were key players in limiting disease transmission. The present study aimed to investigate the perception and knowledge of the Pakistani public regarding various aspects of COVID-19 after more than 3 years of the pandemic initiation. The study also aimed to investigate the association between educational level and knowledge about COVID-19. An online cross-sectional survey was conducted using a convenience sample of 1,043 individuals from different cities in Pakistan. The survey consisted of various sets of questions covering the aspects of the study objectives. Most of the participants reported a solid understanding of COVID-19; however, there were some misconceptions and knowledge gaps concerning certain pandemic elements. The study also highlighted a link between educational level and awareness of COVID-19, with a higher education level related to a better understanding of the pandemic and effective preventive strategies. This study provides valuable insight into the perception and education level of the Pakistani public regarding COVID-19. The findings highlight the need of continued public health efforts to promote and ensure access to effective prevention measures, particularly in vulnerable populations who may face barriers to obtaining protective equipment.

Keywords: COVID-19; perception; health knowledge, attitudes, practice; educational level; Pakistan.

Introduction

COVID-19, which originated in Wuhan, China, on December 31, 2019, quickly spread globally due to international travel and migration. Regions with limited healthcare infrastructure and fewer medical professionals experienced higher case burdens and poorer outcomes. Socioeconomic disparities within cities further contributed to varying infection rates, with marginalized communities being particularly affected. The disease's spread highlighted significant global and local disparities in healthcare access and outcomes.[1]

COVID-19 had a severe global impact,[2] causing 3.29 million fatalities among 15 million infected individuals as of May 7, 2021.[3] Mortality rate varied widely, with

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* MSc. in Pharmacy. Researcher at the Health Science Center at Xi'an Jiaotong University. Xi'an, China.

some countries experiencing a 50% mortality, while those with strict lockdown measures decreased by 5%. In many countries, deaths were found 1.6 times greater than the reported number. Additionally, the pandemic caused the loss of priceless time.[3] As reported by 81 countries from January 2021, the pandemic stole 20.5 million years of life, nine times higher than seasonal influenza.[4]

Public awareness about any outbreak is crucial in mitigating the impact of such events, as increased awareness leads to quick adaptation of public health measures, fewer fatalities, and timely control of the spread. Previous outbreak experiences witnessed that the success of outbreak control depends upon attitude, knowledge, and public perception about it.[5,6] Numerous studies revealed a direct correlation between public awareness of the disease and adherence to governmental regulations, resulting in the containment of COVID-19 spread and development.[5,6,7,8] Public perception can also impact how government and health organizations respond to the disease, including developing and implementing public health policies and communication strategies.

Vaccination has played an important role in the reduction of the disease burden, disability, and fatality saving around 5 million people from deadly ailments per year, evidenced in a history of tackling polio, tetanus, hepatitis B, influenza, diphtheria, MMR (measles, mumps, and rubella) and pertussis. Despite this, vaccine hesitancy remains a significant global health threat, identified by the World Health Organization (WHO) in 2019.[9] Nonetheless, various countries such as Thailand, Vietnam, and Mongolia have been identified as having high levels of vaccine reluctance, often due to religious beliefs.[9,10] Currently, vaccination against COVID-19 is one of the most effective ways to protect people from the virus and its potentially severe consequences.[11]

Some people worldwide also mistaken COVID-19 for seasonal influenza, despite of key differences between the two diseases. COVID-19 caused by a novel coronavirus, is more contagious and can cause more severe illness and death compared to seasonal influenza which is caused by various influenza viruses. However, both are transmissible via respiratory droplets and share symptoms such as fever, cough, and body aches.

Therefore, it is essential for people to understand these differences, as well as the potential benefits and hazards of vaccination against both diseases.[11]

Pakistan, a developing South Asian country, has a hybrid healthcare system with minimum budget for medicines and medical products. With a population estimated over 225 million in 2023 and a median age of 22.8 years,[12] the literacy rate stood at 58.0% in 2019.[13] In Pakistan, COVID-19 presented significant challenges, particularly due to the country's dense population and limited healthcare infrastructure. On April 10, 2020, Pakistan disclosed 4,601 confirmed cases and 66 fatalities within 45 days of initial outbreak. As of mid-2021, Pakistan reported over 1.2 million confirmed cases and more than 27,000 deaths. As of April 13, 2024, the total cases were 1,581,936 and total deaths were 30,664.[14]

The WHO praised Pakistan for appropriate measures to curb the pandemic[15] including immediate response, border control, quarantine houses, country-wide lockdown, area cordons, testing and contact tracing, field epidemiology laboratory training program, implementation of standard operating procedures (masks, sanitization, and social distancing), awareness campaigns, economic measures, and production of ventilators.[15] Six months after first reported case, these efforts resulted in a steady decline in active cases, with daily death rates frequently falling into the single digits. By October 1, 2020, Pakistan had reported 312,263 confirmed cases, and 6,479 deaths.[15]

Despite the Pakistani government efforts to combat COVID-19 and raised awareness through social and electronic media, however, the country's status as the 5th most populous nation with a poverty rate of 21.89% at national poverty lines[16] in 2018 poses significant challenges.[17] Therefore, understanding the public perception of COVID-19 and vaccination is crucial, as it can influence behavior and decision-making related to the pandemic.

Previous studies suggest that understanding of the pandemic and adherence to public health guidelines may be influenced by the education level of individuals.[18] Therefore, this study aims to evaluate how education shapes public perception of the COVID-19 pandemic and to assess the evolution of these perceptions over

time, considering that the study was conducted more than two years after the pandemic's initial outbreak. By incorporating multiple aspects of the pandemic, this study provides a comprehensive understanding of the Pakistani public's perception of COVID-19 and the potential role of education in shaping these views.

Materials and Methods

Study design

A cross-sectional study design was adopted to evaluate the perception of the Pakistani public about the COVID-19 pandemic regarding its nature, cause, symptoms, and vaccination through an internet-based survey. The study duration was from December 2022 to March 2023.

Study ethics

The study procedures were approved by the Department of Pharmacy Practice, Bahauddin Zakariya University (Acad/PRAC/EXT/23/02). Participant confidentiality was maintained throughout the study. The current study did not collect the participant's personal or identifying information. Informed consent was obtained from the participants before recruiting for the study.

Data collecting tool

The research team developed the initial draft of the study questionnaire based on previously available literature. For clarity and comprehensiveness, face validity was done by an expert of the same background for the initial questionnaire draft. For the reliability assessment, a pilot study was conducted on 37 participants. A Cronbach alpha value of 0.71 was obtained to show a valid internal consistency. For the convenience of the study population, an Urdu translation was added alongside the English questions.

The questionnaire was comprised of six sections with a total of 37 questions. The first section consisted of participants' demographic data (seven questions) regarding age, gender, educational level, and current working profile. The second section asked participants about their perception of the nature of the COVID-19 pandemic (eight questions). The three-point Likert scale (agree, neutral, disagree) was adopted with the perception questions items in this section. The third

section was on the participants' perceived susceptibility to the severe COVID-19 pandemic (single question). The fourth section was on the perception of participants about the symptoms of COVID-19 and the way they protect themselves (eleven questions). The fifth section was about the participants' perception regarding the symptoms of the COVID-19 pandemic compared to seasonal influenza (three questions). The sixth section contained questions regarding participants' perceptions of the COVID-19 vaccine (seven questions). Only close-ended questions were used in the questionnaire.

Participants

The final pre-tested questionnaire was utilized to create a Google survey form and published as a cross-sectional survey on December 1st, 2022. The link of the Google survey form was designed in such a way that only one response can be generated using one device. The inclusion criteria were Pakistani citizens of both sexes and residing within the country. The recruitment was accomplished online (Facebook, LinkedIn, WhatsApp, Instagram, and Twitter) and offline methods (data collectors took responses conveniently). In order to avoid selection biases, the data collectors were hired from different regions of Pakistan to have a representative sample (four provinces: Punjab, Sindh, Khyber Pakhtunkhwa (KPK), and Balochistan; the Islamabad Capital Territory; and the administrative territories of Azad Jammu and Kashmir and Gilgit–Baltistan). Moreover, the data collectors included participants from different age groups. Participants declared their consent to voluntarily participate in this study prior to filling out the survey.

Initially, the sample size was calculated using a 0.6% prevalence of COVID-19 as of December 2022, with a margin of error of 5%; the sample size was 377. After accounting for a 20% non-response rate, the sample size was 452. The sample size was increased to 1,043 to address potential fluctuations in prevalence rates over time, and variation in the demographic characteristics in order to ensure robust and reliable results using a conservative approach. The participants were conveniently selected for the current study.

Data analysis

The data collection was done using Google Forms and cleaned using Microsoft Excel. The final datasets were integrated and analyzed using the Statistical Package for the Social Sciences (SPSS version 21). To summarize the results, we used descriptive statistics. The continuous variables were tabulated as mean and standard deviation, whereas the categorical variables were presented as frequency and percentage. A Pearson correlation analysis was conducted to determine the relationship between medication recommendation, vaccination status, and vaccination willingness and demographic characteristics. All statistical tests were deemed significant with a p-value < 0.05 and a 95% confidence interval.

Results

Demographic characteristics

A total of 1,043 individuals participated in this current study, most of which were males (51. 05 %) compared to females (48.85 %). Most participants were aged between 18-30 years (80. 08%), with a smaller portion over 30 years old (19.83 %). Additionally, most of the participants were students who have undergraduate education level (59.48 %) or have attained graduate-level education (33.81 %), and a considerable number were professional workers (33.43 %). Finally, most indicated residing in urban areas (74.14%). The details regarding demographic characteristics can be seen in Table 1.

Public's knowledge of COVID-19 virus nature and origin

Most participants (56.6%) believed that COVID-19 is a naturally occurring human virus, while others (38.0%) believed it has a bacterial origin. A considerable number (43.2%) believed it to be a laboratory-created virus or a punishment from God (48.9%). The details can be seen in Table 2.

Public's knowledge of COVID-19 disease susceptibility, self-protection measures, and antibiotics and antimalarial use

The majority of the participants opined that COVID-19 virus could infect any population group. However, the elder (20.4%) and co-morbidities population (13.3%) were more susceptible to COVID-19. Most of the participants (94.4%) confirmed the importance of having self-protection measures against the COVID-19 pandemic, and most (66.3%) believed that antibiotics and antimalarials (chloroquine) are effective in protection against the COVID-19 pandemic, as shown in Table 3.

Public's drug recommendation for COVID-19 disease

Regarding antibiotic recommendations, (34.4%) of the participants recommended antibiotics for people in their circle; the medications included antibiotics (4.9%), steroids (0.8%), and antiviral (0.5%). On the other hand, a majority of participants were well knowledge about the COVID-19 symptoms (94.3%), as shown in Table 4.

Public knowledge regarding influenza and COVID-19 viruses and their vaccination

Most participants reported that the symptoms and vaccines for influenza and COVID-19 are very similar. However, most participants were not vaccinated against influenza (51.7%). On the other side, the participants vaccinated against COVID-19 were (73.8%) and (26.2%) were still not vaccinated. The reported reasons for not-vaccinated were the believe of vaccine's ineffectiveness (6.5%), dependency on innate immunity (8.7%), and safety concerns regarding the COVID-19 vaccine (5.9%). The majority of the participants showed a willingness to recommend vaccination to others (76.3%). Most participants decided by themselves to vaccinate and opined that healthcare professionals should prioritize vaccination against COVID-19. The details can be seen in Table 5.

Correlation of demographics with medication recommendation, influenza and COVID-19 vaccination

Table 6 displays the correlation between demographic factors (gender, age, education, occupation, and residence) and various vaccination-related variables, including the recommendation of medication as COVID-19 prophylaxis, seasonal influenza vaccination, COVID-19 vaccination status, and willingness to receive the COVID-19 vaccine.

Table 1. Demographic characteristics of the participants.

Variables		N (%)
Gender	Male	533 (51.05)
	Female	510 (48.85)
Age (year)	18-30	836 (80.08)
	>30	207 (19.83)
Education	Illiterate	17 (0.67)
	Secondary education	48 (4.60)
	Higher secondary education	4 (0.19)
	Undergraduate	621 (59.48)
	Graduate	353 (33.81)
Occupation	Professional worker	349 (33.43)
	Worker	576 (55.17)
	Other	118 (11.30)
Residence	Urban	774 (74.14)
	Rural	269 (25.77)

Table 2. Perception of the participants regarding the COVID-19 virus.

Variables		N (%)
A naturally occurring human virus	Agree	590 (56.6)
	Neutral	212 (20.3)
	Disagree	241 (23.1)
A lab-altered virus (man-made virus)	Agree	451 (43.2)
	Neutral	297 (28.5)
	Disagree	295 (28.3)
An animal disease transmitted to human (from animal to human)	Agree	517 (49.6)
	Neutral	233 (22.3)
	Disagree	293 (28.1)
A bacterial origin	Agree	396 (38.0)
	Neutral	218 (20.9)
	Disagree	429 (41.1)
A punishment from the God	Agree	510 (48.9)
	Neutral	270 (25.9)
	Disagree	263 (25.2)
A serious and fatal (critical) virus	Agree	785 (75.3)
	Neutral	190 (18.2)
	Disagree	68 (6.5)
A serious but not fatal	Agree	354 (33.9)
	Neutral	276 (26.5)
	Disagree	413 (39.6)
A toxic gas effect on the respiratory system (breathing system)	Agree	583 (55.9)
	Neutral	194 (18.6)
	Disagree	266 (25.5)

Table 3. Participants' perceptions regarding COVID-19 susceptibility, self-protection, and use of antibiotics and antimalarial in the COVID-19 pandemic.

Variables		N (%)
In your opinion, who is the most susceptible to severe COVID-19 pandemic?	Children only	70 (6.5)
	Elders people only	220 (20.4)
	People with chronic illnesses such as heart disease and diabetes	143 (13.3)
	Pregnant women only	9 (0.8)
	All of the above	582 (57.2)
	Non	19 (1.8)
Do you know anyone infected with COVID-19?	Yes	855 (82.0)
	No	188 (18.0)
Are you afraid to get infected with the COVID-19 pandemic?	Yes	604 (57.9)
	No	369 (35.4)
	I don't care	70 (6.7)
Do you think you have come in contact with COVID-19?	Yes	414 (39.7)
	No	450 (43.1)
	I am not sure	179 (17.2)
Do you think it is important to have protection measures (such as masks, hand sanitizers, etc.)?	Yes	985 (94.4)
	No	58 (5.6)
Do you have protection measures (such as masks, hand sanitizers) in your place?	Yes	952 (91.3)
	No	91 (8.7)
Do you believe medications such as antibiotics, chloroquine, and/or herbal remedies can protect you against the COVID-19 pandemic?	Yes	691 (66.3)
	No	352 (33.7)

Table 4. Participants' recommendation of medication and knowledge about the COVID-19 pandemic.

Variables		N (%)
Do you recommend any medications for people in your circle (area) as protection against the COVID-19 pandemic?	Yes	371 (34.4)
	No	672 (65.6)
Class of medication recommended by the participants	Antibiotics	18 (4.9)
	Antiviral	2 (0.5)
	Antibiotics and Antimalarial	1 (0.3)
	Antibiotics and symptomatic treatment	11 (3.0)
	Antibiotics and antiviral	1 (0.3)
	Anticoagulant	1 (0.3)
	Antibiotics, steroids, and symptomatic treatment	2 (0.5)
	Herbal remedies	9 (2.4)
	Symptomatic and herbal remedies	5 (1.3)
	Symptomatic treatment	60 (16.2)
	Steroids	3 (0.8)
	Vaccination	12 (3.2)
	Vaccination and antibiotics	1 (0.3)
	Vaccination and symptomatic treatment	1 (0.3)
	Self-Protection	244 (65.8)
Do you know the symptoms of the COVID-19 pandemic include fever, fatigue, dry cough, loss of smell and/or taste, and muscle pain?	Yes	985 (94.4)
	No	58 (5.6)
Do you know any other symptoms of the COVID-19 pandemic other than the above symptoms?	Yes	338 (32.4)
	No	705 (67.6)
Other symptoms reported by the participants	Respiratory symptoms	94 (44.8)
	Psychological symptoms	6 (2.9)
	Multiple organ symptoms	12 (5.7)
	General symptoms	98 (46.7)

Table 5. Participants' perception regarding influenza and COVID-19 viruses and their vaccination.

Variables		N (%)
To which extent do you think symptoms of COVID-19 are similar to seasonal influenza?	No similarity	68 (6.5)
	Small similarity	229 (22.9)
	Similar, but I am not sure how much	328 (31.4)
	Large extent	1 (0.1)
	There is a big similarity	417 (40.0)
Have you ever been vaccinated against seasonal influenza?	Yes	346 (33.2)
	No	539 (51.7)
	I don't remember	158 (15.1)
To what extent do you think there is a similarity between the COVID-19 vaccine and the seasonal influenza vaccine?	No similarity	225 (21.6)
	Small similarity	193 (18.5)
	Similar, but I am not sure how much	377 (36.1)
	There is a big similarity	248 (23.8)
Have you ever been vaccinated against COVID-19?	Yes	769 (73.8)
	No	274 (26.2)
Reason for non-vaccination against COVID-19	The vaccine is safe and effective, but I would prefer to depend on my innate immunity	91 (8.7)
	Due to the cost of the vaccine	14 (1.3)
	Fear of vaccination due to weakened immune system, it is not safe and could be lethal	62 (5.9)
	I believe the vaccine is not effective	68 (6.5)
	I believe there is no such thing called COVID-19, so I don't need to take any vaccines	28 (2.7)
	The vaccine is not available in my area	11 (1.1)
Do you know people who are not willing to get vaccinated?	Yes	641(61.5)
	No	402 (38.5)
Do you recommend for those who are not willing the vaccination to get vaccinated?	Yes	796 (76.3)
	No	247 (23.7)
Who recommends you get the COVID-19 vaccine?	I decided myself to get vaccinated	641 (59.5)
	Family member or friend	174 (16.2)
	Govt. policy to get vaccinated	40 (3.7)
	A physician or other medical professional	85 (7.9)
	Social media or TV	137 (12.7)
In your opinion, which of the following has the priority to receive the COVID-19 vaccine?	18 years old or younger	25 (2.3)
	People older than 65 years	145 (13.5)
	Healthcare providers in direct contact with patients	391 (36.3)
	All of the above	484 (44.9)
	None	32 (3.0)

Table 6. Correlation of demographics with medication recommendation and influenza and COVID-19 vaccination.

Variables		Gender	Age	Education	Occupation	Residence
Recommendation of medication as prophylaxis to COVID -19 to other	Pearson Correlation	0.063*	-0.004	0.045	0.050	0.012
	Sig. (2-tailed)	0.043	0.902	0.143	0.110	0.700
	N	1043	1043	1043	1043	1043
Have you ever been vaccinated against seasonal influenza?	Pearson Correlation	0.011	-0.017	0.020	0.051	0.011
	Sig. (2-tailed)	0.717	0.588	0.515	0.103	0.713
	N	1043	1043	1043	1043	1043
Have you ever been vaccinated against COVID-19 pandemic?	Pearson Correlation	-0.038	0.003	-0.026	0.069*	0.000
	Sig. (2-tailed)	0.221	0.926	0.394	0.026	0.991
	N	1043	1043	1043	1043	1043
If not, are you willing to get COVID-19 vaccine?	Pearson Correlation	0.055	-0.034	-0.032	0.047	-0.064
	Sig. (2-tailed)	0.184	0.418	0.436	0.256	0.122
	N	581	581	581	581	581

**Correlation is significant at the 0.01 level (2-tailed)
*Correlation is significant at the 0.05 level (2-tailed)

Although some correlations are statistically significant, the small magnitude of the correlation coefficients (close to zero) suggests that these associations are weak and may not be practically meaningful.

Discussion

Understanding the public perception of COVID-19 is crucial for effective public health management, policymaking, communication, and addressing the social and economic impacts of the pandemic. It can influence public health outcomes by affecting peoples' adherence to preventive measures, such as wearing masks, social distancing, and vaccination. It can also impact policymaking decisions and help policymakers develop appropriate responses to address the social and economic impacts of the pandemic.

Since the beginning of the COVID-19 pandemic, several studies have examined the public's perception of the outbreak in Pakistan from various perspectives. For instance, Khyzar Hayat et al. conducted a rapid online survey within 2 weeks of the outbreak to assess the public's general knowledge about it in different areas of Pakistan;[2] in addition to studies conducted by other authors.[3,4,5,6] Muhammad Junaid Tahir et al.[7] have investigated the attitudes of the Pakistani population toward COVID-19 vaccination. This research aimed to provide a comprehensive understanding of the Pakistani public's perception of COVID-19 and the impact of education on their perception of the pandemic.

Concerning sample distribution in this study, age is a critical factor, as it may influence participant's level of knowledge and cognitive abilities; therefore, our findings confirmed the intimate link between age and knowledge, corroborating the findings of previous studies.[4,8,9]

Furthermore, the large proportion of educated participants in this study suggests a potential correlation between higher levels of education, and improved perception and knowledge of COVID-19. Educated individuals are likely to have higher critical thinking and access to information resources, resulting in greater awareness, comprehension of health hazards and preventive measures.[10] Additionally, the fact that the overwhelming majority of the participants resided in urban areas suggests that their experience and perception may differ from those living in rural areas. Moreover, individuals with a higher socioeconomic status were found to possess greater knowledge about the diseases, display optimistic attitudes, and engage in reasonable practices to prevent their spread.[19] Interestingly, no significant association was observed between gender and perception, susceptibility to complications, and relationship with influenza, which is opposite to what was mentioned by Hayat et al.[2] These findings suggest that gender may not significantly determine an individual's knowledge and attitudes about COVID-19. However, further research is needed to explore other potential factors that may influence individuals' perceptions and behaviors related to the

disease, especially in cities where females have no right to pursue their high education unless under special circumstances.

Since the onset of the COVID-19 pandemic, numerous hypotheses have emerged regarding its origin. Of particular interest is the contention that SARS-CoV-2 virus was laboratory engineered as part of an effort to produce an acquired immunodeficiency syndrome (AIDS) vaccine. In contrast, the belief that COVID-19 has a bacterial origin, despite its acronym indicating a viral origin, suggests that a substantial portion of the population still lacks awareness about the COVID-19 acronym and its corresponding meaning. The COVID-19 pandemic has also been approached through a religious lens.[12] Since Pakistan has a predominantly Muslim population, participants were queried about their perspective on whether COVID-19 represents a divine punishment. Half of the participants (48.9%) affirmed that they believed COVID-19 to be a punishment from God. This outcome highlights the importance of spirituality in Pakistan.

Furthermore, almost half of the participants (49.6%) believed the virus may have been transmitted to humans from an animal host. This perspective is supported by scientific evidence indicating that bats serve as the primary reservoir hosts of SARS-CoV-2.[13] However, it does not necessarily suggest that COVID-19 can directly transmit to humans from animals, particularly bats. Similarly, a significant proportion (55.9%) believed that COVID-19 is nothing more than a toxic gas that solely affects the respiratory system rather than a microbial organism. These findings imply that a lack of adequate medical knowledge may impair the public's capacity to comprehend scientific news or that the scientific reports presented on social media may not be sufficiently comprehensible for general publicity.

Despite the global prevalence of the COVID-19 globally, a significant majority of the participants (75.3%) believed COVID-19 could be fatal. Nevertheless, a minority (33.9%) believed it was not an excessively severe life-threatening affliction. These outcomes suggest that despite the high global mortality rate, many individuals may lack awareness of the fatal effect of COVID-19 or express skepticism regarding the reliability of global health authorities and statistical data.

All together suggests that knowledge promotion could contribute to the relative success of future public health measures enforced in Pakistan.

This research also assessed participants' knowledge of COVID-19 disease susceptibility. Based on the results, it is suggested that participants have linked the severity and life-threatening consequences of COVID-19 with elderly individuals, possibly due to their perception of the higher vulnerability of this population group. This perception is consistent with previous studies that have reported higher susceptibility to COVID-19 in older adults,[15] pregnant women,[16] or those with chronic co-morbidities,[20] including cancer and transplantation patients.[17] However, it is important to note that COVID-19 can affect individuals of all ages,[21] and younger individuals can also experience severe symptoms and complications, in particular, mentally and financially.[22] This highlights the need for continued public health efforts to promote accurate information about COVID-19 susceptibility, effective prevention measures, and treatments, particularly among those who may be less informed or have limited access to information. By raising awareness about the potential risks of COVID-19 for all age groups and providing accurate information about prevention and treatment, public health officials can help to mitigate the spread of the disease and reduce the incidence of severe complications.

Regarding prophylaxis and preventive measures against COVID-19, most participants showed an acceptable understanding with high adherence to preventive measures, including using masks and hand sanitizers to minimize the risk of infection. In contrast, exceeding half of the participants have used or recommended specific medications such as antibiotics and chloroquine or suggested self-protection, despite the lack of evidence to support these claims, indicating a potential lack of awareness about the risk and benefits of medications. The findings obviously indicated the participants have mixed up the use of drugs for prophylaxis or treatment purposes. This delusion led the participants to recommend some prescription-required medications, such as antibiotics, antiviral, anticoagulants, and steroids. Such drugs are intended for prophylactic use and require specialized medical supervision. The misuse of such medications can result in severe or even lethal

consequences that could be more harmful than the pandemic itself. These findings emphasize the critical need to increase participants' health education and improve their health knowledge, especially regarding over-the-counter (OTC) medications and their appropriate use. People must be educated that non-specialized individuals should not recommend specific medications to others, and the general public should be aware of the potential risks and benefits of medications and consult medical professionals for guidance.

The results suggest that people have a good understanding of the similarities between COVID-19 and seasonal influenza. They also showed acceptable knowledge regarding the vaccine priorities. These findings underscore the importance of targeted health education campaigns to address vaccine hesitancy and improve public knowledge about the benefits of COVID-19 vaccination.

Conclusions

The present study provides valuable insights into the perception of the Pakistani public regarding various aspects of COVID-19; the findings highlight the importance of continued public health efforts to promote and ensure access to effective prevention measures, particularly in vulnerable populations who may face barriers to obtaining protective equipment. The study also highlights the critical demand for sustained public education initiatives that advocate accurate knowledge about COVID-19 susceptibility, effective prevention measures, and treatments, especially for less informed people or those with limited information access. These outcomes will significantly implicate policy development and health interventions that aim to improve the efficiency of COVID-19 prevention measures in public.

Conflict of interest

The authors declare that there is no conflict of interest.

Author's contributions

Moath Refat: conceptualization, investigation, original drafting, drafting-revising, editing.

Sundus Shukar: conceptualization, methodology, investigation, original drafting, drafting-revising.

Iltaf Hussain: conceptualization, methodology, formal analysis, data curation, original drafting, drafting-revising.

Ahmed Ibrahim Mohamed: conceptualization and methodology.

All authors have revised and approved the final manuscript before submission. Moath Refat, Sundus Shukar, Iltaf Hussain contributed equally to this work.

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Percepción y conocimientos de los pakistaníes sobre COVID-19 y su vacunación: implicaciones para la salud pública

Resumen

Desde el principio, la COVID-19 causó muertes y devastación social y económica en todo el mundo. Las estrategias profilácticas eficaces, como las medidas de protección personal, el distanciamiento social y la vacunación fueron fundamentales para limitar la transmisión de la enfermedad. El presente estudio tuvo como objetivo investigar la percepción y los conocimientos del público pakistaní en relación con diversos aspectos de la COVID-19 después de más de 3 años del inicio de la pandemia. El estudio también pretendió investigar la asociación entre el nivel educativo y el conocimiento sobre COVID-19. Se realizó una encuesta transversal en línea utilizando una muestra de conveniencia de 1.043 individuos de diferentes ciudades de Pakistán. La encuesta constaba de varios conjuntos de preguntas que cubrían los aspectos de los objetivos del estudio. La mayoría de los participantes declararon tener un conocimiento sólido sobre COVID-19; sin embargo, tenían algunas ideas erróneas y lagunas de conocimiento en relación con determinados elementos de la pandemia. El estudio también puso de relieve una relación entre el nivel educativo y el conocimiento sobre COVID-19, relacionándose un mayor nivel educativo con una mejor comprensión de la pandemia y de las estrategias preventivas eficaces. Este estudio proporciona una valiosa información sobre la percepción y el nivel de educación del público pakistaní en relación con COVID-19. Los resultados ponen de relieve la necesidad de continuar los esfuerzos de salud pública para promover y garantizar el acceso a medidas de prevención eficaces, en particular en las poblaciones vulnerables que pueden enfrentarse a barreras para obtener equipos de protección.