



# Community-Based Assessment of Knowledge, Attitude, Practices and Risk Factors Regarding COVID-19 Among Pakistanis Residents During a Recent Outbreak: A Cross-Sectional Survey

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## Abstract

Exceptional precautionary measures have been adopted to stop the transmission and control of COVID-19 through the world and Pakistan is facing lockdown in this scenario. Public loyalty to precautionary measures is affected by their knowledge, attitude, risk factors and practices (KAP) towards COVID-19. The present study was conducted among the Pakistani residents to observe the knowledge, attitude, practices and risk factors towards COVID-19 outbreak in Pakistan. A questionnaire was designed, and a cross-sectional survey was conducted among participants of the study area. Participants were asked the questions regarding knowledge, attitude, practices and risk factors towards COVID-19. Data were analyzed by SPSS and *t/F* test and correlation was applied among the knowledge, attitude, risk factors and practices. A total of 1060 questionnaires were received. 1004 were included while 56 were excluded. The highest representation was from Punjab province (65.6%), female (63%) and age group of 21–30 years (62.1%). Most participants were single (85%), Muslim (99.4%), Urdu speaking (45.6%) and were graduates (51.5%). Most of the participants were students (52.9%) and were from economically middle-class families (40.8%). The knowledge was positively correlated with attitude and practices whereas negatively correlated with risk factors ( $P < 0.05$ ). The attitude was negatively correlated with risk factor and positively correlated with practices. The risk factors and practices were positively correlated with each other. Health education program to improve the COVID-19 knowledge, attitude, practices and risk factors should be initiated to combat current health challenge.

**Keywords** COVID-19 · Knowledge · Attitude · Practices · Correlation · Pakistan

## Introduction

Coronavirus is a pathogen that causes respiratory illness. The current COVID-19 (SARS-CoV-2) pandemic has been caused by the same pathogen. These coronaviruses have also

caused outbreaks previously including severe acute respiratory syndrome (SARS)-CoV and the Middle East respiratory syndrome (MERS)-CoV. Coronavirus (COVID-19) outbreak first emerged from the city of Wuhan, Hubei province, China in December 2019. Patients were admitted with acute

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pneumonia which later was identified as COVID-19 infection [1, 2]. Total of 1975 infected cases and 56 deaths were reported in China until 25 January 2020 [3]. In just next 5 days until 30 January, the number of positive cases rose to 7734. It showed how quickly the infection had spread. Overall, the disease mortality rate was reported to be 2.2% in China [4]. In the US, the first case of human–human transmission was reported on 22nd January 2020 [5].

As of now, 4,178,156 positive cases have been reported worldwide with 286,353 deaths while the USA, Spain, Italy, the UK and Russia have the highest of confirmed cases. In Pakistan, 32,673 confirmed cases have been reported with 618 deaths. In Islamabad capital territory 716, in Sindh province 12,610, Punjab 11,869, KPK province 4875, Baluchistan 2061, Gilgit Baltistan 457 and in AJK 86 cases have been reported [7].

COVID-19 infection has an incubation period of about 5.2 days after which symptoms starts to appear [8]. It takes around 6–41 days from onset of symptoms to death having a median of 14 days [3]. However, this period varies depending upon the immune system and age of the patient [3]. Some common symptoms of COVID-19 infection include dry cough, fever, fatigue, headache, diarrhoea, sputum production, haemoptysis, lymphopenia and dyspnea [3, 8–10].

China has taken some strict measures to control the outbreak. That includes a total shutdown of public places, public transport and isolation of suspected cases. Authorities had locked down the whole province of Hubei as of 27 January 2020. Residents inside and outside of Hubei province were asked to stay at home and practice self-isolation to avoid any physical contact with others. Fight against the pandemic continues in China as well as throughout the world [11]. The success of which largely depends upon the public's response towards the control measures which have been taken.

In South Korea, measures were taken as early as 3 January 2020 well before the first confirmed case. On 26 February, the government opened first drive-through testing facility. South Korea took a pro-active approach to mass testing and practicing self-isolation [12]. Whereas in the US, timely steps were not taken due to which the number of infected cases in the US rose drastically and became the country with the highest number of confirmed cases in the world. According to WHO, US has confirmed cases of 1,215,571 and 67,146 deaths [13].

The case studies of China, South Korea and America showed that diseases surveillance pattern is linked with the behaviour of Governments and the response of the general public. Now, to contain the COVID-19 outbreak in Pakistan, public understanding of the disease must be evaluated so that an effective strategy could be made considering the public's awareness regarding COVID-19. In this current study, we have investigated the Knowledge, Attitude and Practices

(KAP) among Pakistan residents regarding COVID-19 during the outbreak.

## Methods

### Study Area

The current survey was conducted among the participants from Punjab, Sindh, Baluchistan, KP, Gilgit Baltistan and Azad Jammu Kashmir region of Pakistan.

### Geography

Pakistan has a total population of 208,518,662 and bordered by India (east), China (northeast), Iran (west) and Afghanistan (northwest). It has a total area of 881,913 square kilometres (340,509 square miles) and 33rd largest country by area. Pakistan geologically overlaps both with Indian and Eurasian tectonic plates where it's Sindh and Punjab provinces lie on the north-western corner of the Indian plate while Baluchistan and most of the Khyber Pakhtunkhwa (KPK) lie within the Eurasian plate which mainly comprises Iranian Plateau. Gilgit-Baltistan and Azad Kashmir (AJK) lie along the edge of the Indian plate (14).

### Permission from Institutional Review Board (IRB)

The study was approved by the IRB and Ethics Committee under project 'A community-based assessment of Knowledge, Attitude, Practices and risk factors regarding COVID-19 among Pakistanis residents during recent outbreak; A cross-sectional survey' and letter reference number Ref. # 2020-01-01/UMT.

### Study Design and Duration

The study design was a cross-sectional survey and conducted between March 01, 2020 to April 02, 2020. In this study during the lockdown (by using quick online Google form) for data collection concerning the awareness and knowledge of COVID-19 as well as the practices along with other hidden elements involved in the outbreak.

During COVID-19 pandemic to conduct a community based national survey was not possible during the study duration (1st March to 2nd April 2020), the data was collected online. Relying on the authors' networks with local people living in different areas of Pakistan, a questionnaire was posted/reposted to moments and groups of their WhatsApp, Facebook and emails accounts. This questionnaire comprises a brief introduction on the background, objective, procedures, voluntary nature of participation, declarations of anonymity

and confidentiality, and notes for filling in the questionnaire, as well as the link and quick response of the online questionnaire.

### **KAP and Socio-Demographic Characteristics Assessment**

To determine the validity and reliability of the research questionnaire, a pilot study of 20 participants was carried out and questionnaires were filled. Each questionnaire was divided into five sections which consisted of respective questions for the participants. The questionnaire comprised as (a) Socio-demographic characteristics (n=9) of the respondents, such as education, occupation, gender, age, marital status and ethnicity (b) Knowledge regarding COVID-19 (n=7), (c) Attitude (n=19), Risk factors (n=7) and (d) practices towards disease (n=11).

### **Inclusion/Exclusion Criteria**

Pakistani nationals aged 16 years or more who have access to the internet and can understand the content of the questionnaire were the target group of the study. After agreeing to participate, individuals were requested to complete the questionnaire via clicking the link.

### **Questionnaire Composition**

The questionnaire was developed according to guidelines for clinical and community management of COVID-19 by the National Institute of Health (NIH) of Pakistan (15), a COVID-19 knowledge questionnaire was developed by the authors. The questionnaire had 53 questions consisting of information related to clinical presentations, symptoms, transmission routes, preventive strategies and control of COVID-19. These questions were answered on a yes/no based responses.

### **Data Analysis**

Data were entered into MS Excel spreadsheet and a database was established. Knowledge, Attitude and Practices (KAP) scores were obtained by combining scores for their respective columns. Individual variables in each of KAP like symptoms, introduction to disease were scored based upon how many symptoms or sources one knows. To find the comparative performance of various groups in terms of their obtained scores for each of KAP, ANOVA or T/F Tests were performed.

## **Results**

### **Socio-Demography**

A total of 1060 participants completed the survey questionnaire. After excluding 56 respondents who provided

inadequate information required for study, the final sample consisted of 1004 participants. A total of 9 questions covered the demographic section of survey. The highest number of participants belongs to Punjab province (65.6%; n = 659) followed by Islamabad Capital Territory (ICT) (10.3%; n = 103), Khyber Pakhtunkhwa (KPK) (8.8%; n = 88), Sindh (8.3%; n = 83), Azad Jammu & Kashmir (AJK) (3.5%; n = 35), Gilgit Baltistan (2.2%; n = 22), and Baluchistan (1.4%; n = 14), respectively. Number of female respondents (63%; n = 633) were greater than male respondents (37.0%; n = 371). Among the age groups, 62.1% (n = 623) participants were between 21–30 age group, 29.9% (n = 300) were up to 20 years of age, and 8.1% (n = 81) were greater than 30 years of age. More of the participants were single (85.1%; n = 854), whereas 13.9% (n = 140) were married. Nearly all the participants were Muslim (99.4%; n = 998). Among the sample, major native languages included Urdu (45.6%; n = 458), Punjabi (27.0%; n = 271), and Pushto (9.4%; n = 94) respectively. 23.8% respondents had intermediate level education, 51.5% had graduation level and 24.7% had master and above level education. Most of the participants (52.9%; n = 531) were students, other professions among the sample include teachers (12.5%; n = 126), health care professionals (11.2%; n = 112), unskilled job (11.0%; n = 110), unemployed (6.0%; n = 60) and others (6.5%; n = 65) respectively. Majority of respondents belonged to middle class economic status (40.8%; n = 410) followed by poor class (20.1%; n = 202), and high class (10.6%; n = 106) while 28.5% (n = 286) participants did not respond on their economic status. The association of demographic characteristics were presented in Table 1.

### **Knowledge**

A total of 7 questions were solicited to check the knowledge of subjects towards COVID-19 pandemic. Of the study population, 866 (86.3%) of subjects were familiar with the viral outbreak, whereas, 44.4% (n = 445) were aware of COVID-19 pandemic. Among the respondents, 50.1% (n = 503) had knowledge of human–human transmission and 46.6% (n = 468) has seen COVID-19 patient. Only 2.9% (n = 29) of participants went to public swimming pools in last 15 days. 6.3% (n = 63) subjects' acquaintances had recent (last 15 days) international travel history. 54.7% (n = 549) of the respondents were not knowing that physical contact is the main cause of infection spread while 45.3% (n = 455) were aware (Table 2).

### **Attitude**

To inquire about the attitude of participants towards COVID-19 pandemic, response on a total of 19 questions were collected in the survey. 44% of respondents were agreed that

**Table 1** Socio-demographic characteristics of the participants (n = 1004)

Variables	Characteristics	n	Frequency (%)
Provinces/territories	Punjab	659	65.6
	Sindh	83	8.3
	Khyber Pakhtunkhwa	88	8.8
	Baluchistan	14	1.4
	Islamabad Capital Territory	103	10.3
	Azad Jammu and Kashmir	35	3.5
Gender	Gilgit-Baltistan	22	2.2
	Male	371	37.0
Age	Female	633	63.0
	0–20	300	29.9
	21–30	623	62.1
Marital status	30 <	81	8.1
	Married	140	13.9
	Single	854	85.1
Religion	Other	10	1.0
	Muslim	998	99.4
Mother-tongue	Non-Muslim	6	0.6
	Urdu	458	45.6
	Punjabi	271	27.0
	Pushto	94	9.4
	Siraiki	53	5.3
	Sindhi	33	3.3
	Pothari	31	3.1
Education level	Other	64	6.4
	Up to intermediate	239	23.8
	Graduation	517	51.5
Occupation	Master and above	248	24.7
	Student	531	52.9
	Teacher	126	12.5
	Health care professional	112	11.2
	Unskilled job	110	11.0
	Unemployed	60	6.0
Economic status	Others	65	6.5
	Poor (upto 40 K)	202	20.1
	Middle class (40 K-100 K)	410	40.8
	High class (> 100 K)	106	10.6
	Unwilling/no response	286	28.5

infected patients should be separated. Most participants were willing to receive disease inspection, free treatment, and to undergo quarantine if infected (80.7%, 87.6%, and 94.5% respectively). 61.6% of subjects (n = 619) considered going to the mosque as a factor for the spread of infection. Likewise, most of the respondents were of the view that health of other people around them is linked to their health, public events should be banned, and economic stability can

improve health conditions (94.5%, 95.8% and 93.3% respectively). Moreover, 93.0%, 57.1% and 42.9% of participants showed a positive attitude for the requirement of masks and hand sanitizers, treatment facilities, and vaccination campaigns respectively. A considerable number of respondents showed positive attitude for suspension of an international flight, closure of shops, offices, schools, etc., and only to allow takeaways on restaurants and fast food points (77.9%, 56.6% and 92.9%, respectively). The results of the questionnaire relating to attitude were summarized in Table 3.

### Risk Factors

Data was collected through seven questions regarding risk factors of respondents towards COVID-19 pandemic. Out of subject sample, 62.3% subjects, considered public gathering as a risk factor while, according to 78.4% subjects, lack of awareness is also a risk factor. Majority of the participants (80.3%, and 87.2%, respectively) considered asymptomatic onset and social, political and economic stability as a major risk factor. Moreover, for 64.4% and 68.7% respondents, exposure to people with a recent travel history and infected patients is a major risk factor respectively, while only 45.3% subjects enlisted physical/close contact as a risk factor for the spread of infection. The results relating to risk factors were summarized in Table 4.

### Practices

55.9%, 43.4% and 68.6% of respondents had exposure to unknown people, met people with an international travel history and their work include public dealing, respectively. On personal hygiene, 85.5% subjects wash hands frequently, 59.8% wash hands before eating and 92.6% wash hands after coming home and 50.5% covers face when sneezing or coughing. Among the subjects, only 7.5% were smokers, 59.3% were used to go to the mosque for prayers and now 77.2% has stopped going to the mosque for prayers. 92.8% of respondents practised maintaining safe physical distance Data of practices of participants regarding COVID-19 is depicted in Table 5.

### T/F-Test Statistics for Comparisons of All Factors (Knowledge, Attitude, Risk Factors and Practices) Among Provinces and Other Socio-Demographic Variables

The F-test used for comparisons of all factors (Knowledge, Attitude, Risk, Practices) among provinces and according to F-test for all factors are statistically significant and showed that knowledge, attitude, risk factors and practices all are not same in all the provinces. The highest knowledge score was 3.06 which is in Sindh and KPK, whereas the second-highest

**Table 2** Knowledge about COVID-19 pandemic among participants in different study areas (n = 1004)

Knowledge parameter	Response	N	Frequency (%)
Know about viral outbreak	Yes	866	86.3
	No	138	13.7
Know about COVID-19 pandemic	Yes	445	44.4
	No	559	55.6
Knowledge of human–human transmission	Yes	503	50.1
	No	501	49.9
Seen any COVID-19 patient	Yes	468	46.6
	No	536	53.4
Went to public swimming pool in last 15 days?	Yes	29	2.9
	No	975	97.1
Have your family relative or friend whom you have met recently has travelled abroad in last 15 days?	Yes	63	6.3
	No	941	93.7
Do you know physical contact is the main source of infection spread?	Yes	455	45.3
	No	549	54.7

knowledge score 2.90 was in Gilgit-Baltistan, followed by 2.74 and 2.72 scores in AJK and Punjab respectively. The lowest knowledge scores were in ICT and Baluchistan with 2.41 and 2.42, respectively. The highest attitude score was 15.36 which was in Gilgit-Baltistan, whereas the second-highest attitude score 15.22 was in KPK, third-highest score 14.05 was in AJK and Punjab. The lowest attitude scores were in ICT, Baluchistan and Sindh with scores as 13.28, 13.78 and 12.27, respectively. The high score of risk factors was in Gilgit-Baltistan (5.45), ICT (5.11) and AJK (5) whereas all other provinces have almost the same risk factor score (about 4.7). The higher practices were in Baluchistan, KPK and ICT with score 8.28, 8.13 and 8.02 respectively. All other provinces have a lower score as 7.85, 7.54, 7.57 and 7.42 of AJK, Gilgit-Baltistan, Sindh and Punjab respectively (Table 6).

According to the current survey, knowledge score was statistically significant across provinces/territories, Age groups, marital status, occupation and economic status. The attitude was statistically significant across provinces/territories, age groups, marital status, mother-tongue, education, occupation and economic status. Risk factors were significant across provinces/territories, mother-tongue, education and economic status while practices were significantly differed across all demographic variables i.e. provinces/territories, gender, age groups, marital status, mother-tongue, education, occupation and economic status (Table 6).

### Correlation of Knowledge, Attitude, Risk Factors and Practices

The correlation matrix for knowledge, attitude, risk factors and practices scores were analyzed. The average score of knowledge is about 3 out of 6 which is exactly the centre of the score, and which suggested that 50% of people know

COVID-19. The attitude average score was 14 out of 18 and showed that about 3 out of 4 respondents showed good attitude towards disease and similarly the average score of risk factors is 5 out of 7 and the average score of practices is 8 out of 12.

The correlation matrix showed that all the relationship is statistically significant. The knowledge was positively correlated with attitude and practices whereas negatively correlated with risk factors. With the increase of knowledge increases attitude and practices increases whereas risk factor decreases. The attitude is negatively correlated with risk factor and positively correlated with practices and as attitude increases risk factors decreases and practices increases. The risk factor and practices were positively correlated with each other (Table 7).

### Discussion

COVID-19 is a respiratory disease which is caused by a novel coronavirus (SARS-CoV-2) and outbreak was started from Wuhan, China in December, 2019. The disease causing virus is highly contagious and declared pandemic by WHO. The main clinical symptoms of the disease include fever, dry cough, fatigue, myalgia, and dyspnea. In China, 18.5% of the patients with COVID-19 developed the severe stage, similarly global clinical data have shown that the overall case fatality rate of COVID-19 is 17% across the globe [6]. The mortality rate due to COVID-19 (2.3%) is much lower than those of SARS (9.5%), MERS (34.4%), and H7N9 (39.0%) in China [11].

Pakistan, a developing country with limited resources and being a neighboring country to China and Iran, two hard-hit countries puts Pakistan at high risk [16]. In Pakistan, the COVID-19 fatality rate for closed cases is 16% which is

**Table 3** Attitude of respondents towards COVID-19 pandemic (n = 1004)

Attitude parameter	Response	n	Frequency (%)
Separate infected patient from others	Yes	442	44
	No	562	56
Would like to receive disease inspection	Yes	810	80.7
	No	194	19.3
In case of treatment would like to receive free treatment	Yes	880	87.6
	No	124	12.4
Would like to go under quarantine if infected	Yes	949	94.5
	No	55	5.5
Going to mosque can spread the infection	Yes	619	61.6
	No	385	38.0
Health of other people around you is linked to your health	Yes	949	94.5
	No	55	5.5
Public events should be banned	Yes	962	95.8
	No	42	4.2
Economic stability can improve health	Yes	937	93.3
	No	67	6.7
Treatment facilities required	Yes	466	46.4
	No	538	53.6
Vaccination campaigns required	Yes	573	57.1
	No	431	42.9
International flights should be suspended	Yes	782	77.9
	No	222	22.1
Shops, offices, schools, etc. should be closed	Yes	568	56.6
	No	436	43.4
Closing all restaurants, fast food joints, only allowing takeaways?	Yes	933	92.9
	No	71	7.1
Should travelers coming from abroad be quarantined	Yes	540	53.8
	No	464	46.2
Positive patients should be quarantined	Yes	898	89.4
	No	106	10.6
Social distancing should be done	Yes	623	62
	No	381	38
Prevention should be done	Yes	720	71.7
	No	284	28.3
Should we stop going out	Yes	952	94.8
	No	52	5.2
Closing all restaurants, fast food joints, only allowing takeaways?	Yes	933	92.9
	No	71	7.1

quite alarming [6]. So, in Pakistan, researchers had earlier warned before the arrival of the first case that travellers coming from abroad specifically from hard-hit pandemic countries could pose a threat to spread of infection in Pakistan [17]. The SARS-Cov-2 virus has a zoonotic origin, bats are the natural hosts of the virus which transmitted to humans through intermediate host which is still not known [18]. This pandemic will have a very daunting impact on the world economy, in the year 2020; this pandemic will cause an economic loss of 1 trillion USD globally and might result in limiting the economic aid to internally displaced people

(IDP's), refugees and asylum seekers [19]. It is well established that diseases spread are directly linked with population knowledge, attitude and practices towards disease. The current mortality rate is alarming and if disease spread is going to high in coming weeks in Pakistan it might go higher.

According to the current survey, knowledge score was statistically significant across provinces/territories, Age groups, marital status, occupation and economic status. Results of knowledge score of our study are concordant with another study conducted in China where residence place, age groups,

**Table 4** Risk factors of respondents towards COVID-19 pandemic (n = 1004)

Practices parameter	Response	n	Frequency (%)
Public gathering is a risk factor	Yes	626	62.3
	No	378	37.7
Lack of awareness is risk factor	Yes	787	78.4
	No	217	21.6
Asymptomatic onset of disease is a risk factor	Yes	807	80.3
	No	197	19.7
Social, political, economic instability is a risk factor?	Yes	875	87.2
	No	129	12.8
Exposure to people with recent travel history is a risk factor	Yes	647	64.4
	No	357	35.6
Exposure to infected patient is a risk factor?	Yes	690	68.7
	No	314	31.3
Do you know physical/close contact is the risk factor of infection spread?	Yes	455	45.3
	No	549	54.7

**Table 5** Practices of different participants regarding COVID-19 (n = 1004)

Practices parameter	Response	n	Frequency (%)
Exposure with unknown people on daily basis	Yes	561	55.9
	No	443	44.1
Met people with recent international travel history	Yes	436	43.4
	No	568	56.6
Work includes public dealing	Yes	689	68.6
	No	315	31.4
Wash hands frequently	Yes	859	85.5
	No	145	14.5
Wash hands before eating	Yes	660	59.8
	No	344	34.2
Wash hands after coming home	Yes	930	92.6
	No	74	7.4
Cover face when cough or sneeze	Yes	507	50.5
	No	497	49.5
Smoking	Yes	75	7.5
	No	800	79.7
	Sometimes	129	12.8
Go to mosque for prayers	Yes	595	59.3
	No	409	40.7
Stop going to mosque for prayers	No	229	22.8
	Yes	775	77.2
Maintain safe physical distance	Yes	932	92.8
	No	72	7.2

marital status, education and occupation significantly differed.<sup>11</sup> Similar results were also reported among physicians, nurses, lab staff and academic individuals including faculty and students in Pakistan [20]. Our knowledge results are contrary to Zhong et al. [11], regarding gender and educational variables. This indicates that in Pakistan, gender does not influence knowledge while education variable difference is due to the reason that data was electronically gathered

hence most of the subjects were literate, and illiterate community cannot be incorporated in this study as they are handicapped to use such technology.

The attitude was statistically significant across provinces/territories, age groups, marital status, mother-tongue, education, occupation and economic status. Our results of attitude score are similar in educational level and provinces/territories with Zhong et al. [11], while in case of occupation it is

**Table 6** Socio-demographic characteristics and mean score of Knowledge, attitude, risk factors and practices of COVID-19

Variables	Characteristics	n (%)	Knowledge score ± SD	Attitude score ± SD	Risk Factors score ± SD	Practices score ± SD
Provinces/territories	Punjab	659 (65.6)	2.72 ± 0.93	14.04 ± 2.44	4.59 ± 1.53	7.41 ± 1.40
	Sindh	83 (8.3)	3.06 ± 1.39	12.27 ± 2.93	4.86 ± 1.36	7.57 ± 2.15
	Khyber Pakh- tunkhwa	88 (8.8)	3.06 ± 0.90	15.22 ± 2.17	4.75 ± 1.38	8.13 ± 1.22
	Baluchistan	14 (1.4)	2.42 ± 1.01	13.78 ± 1.80	4.81 ± 1.40	8.28 ± 1.85
	Islamabad Capital Territory	103 (10.3)	2.41 ± 1.02	13.28 ± 1.93	5.11 ± 1.31	8.01 ± 1.32
	Azad Jammu and Kashmir	35 (3.5)	2.74 ± 0.85	14.05 ± 2.14	5 ± 1.28	7.85 ± 1.47
	Gilgit-Baltistan	22 (2.2)	2.90 ± 0.68	15.36 ± 2.42	5.45 ± 0.94	7.54 ± 1.18
Statistics			<i>F</i> test = 5.28; p = 0.000	<i>F</i> test = 13.61; p = 0.000	<i>F</i> test = 5.626; p = 0.000	<i>F</i> test = 5.78; p = 0.000
Gender	Male	371 (37)	2.80 ± 1.07	13.90 ± 2.57	4.93 ± 1.33	7.86 ± 1.65
	Female	633 (63)	2.72 ± 0.94	13.97 ± 2.45	4.82 ± 1.38	7.41 ± 1.35
Statistics			<i>t</i> test = 1.13; p = 0.266	<i>t</i> test = 0.459; p = 0.646	<i>t</i> test = 1.02; p = 0.230	<i>t</i> test = 4.167; p = 0.000
Age	0–20	300 (29.9)	2.65 ± 1.00	13.60 ± 2.43	4.74 ± 1.40	7.29 ± 1.45
	21–30	623 (62.1)	2.75 ± 0.95	14.09 ± 2.49	4.89 ± 1.34	7.62 ± 1.38
	30 <	81 (8.1)	3.09 ± 1.13	14.08 ± 2.64	5.11 ± 1.41	8.33 ± 1.96
Statistics			<i>F</i> test = 6.49; p = 0.002	<i>F</i> test = 4.164; p = 0.016	<i>F</i> test = 2.744; p = 0.065	<i>F</i> test = 16.81; p = 0.000
Marital status	Married	140 (13.9)	3.02 ± 1.12	13.94 ± 2.71	4.93 ± 1.38	7.99 ± 1.75
	Single	854 (85.1)	2.72 ± 0.95	13.98 ± 2.43	4.86 ± 1.35	7.52 ± 1.39
	Other	10 (1)	1.9 ± 1.44	10.7 ± 2.66	4.5 ± 1.95	6.6 ± 3.02
Statistics			<i>F</i> test = 9.38; p = 0.000	<i>F</i> test = 8.730; p = 0.000	<i>F</i> test = 0.545; p = 0.580	<i>F</i> test = 8.18; p = 0.000
Mother-tongue	Urdu	458 (45.6)	2.67 ± 0.97	13.85 ± 2.51	4.82 ± 1.35	7.41 ± 1.47
	Punjabi	271 (27)	2.80 ± 0.96	13.88 ± 2.23	5.01 ± 1.29	7.73 ± 1.41
	Pushto	94 (9.4)	2.91 ± 1.08	14.90 ± 2.14	5.10 ± 1.20	8.27 ± 1.40
	Siraiki	53 (5.3)	2.69 ± 0.82	14.15 ± 3.02	4.41 ± 1.54	7 ± 1.61
	Sindhi	33 (3.3)	3.15 ± 1.60	12.15 ± 3.21	4.09 ± 1.68	7.48 ± 2.13
	Pothari	31 (3.1)	2.58 ± 0.84	13.29 ± 1.86	5.29 ± 1.13	7.96 ± 1.22
	Other	64 (6.4)	2.81 ± 0.88	14.57 ± 2.59	4.79 ± 1.52	7.53 ± 1.09
Statistics			<i>F</i> test = 2.08; p = 0.052	<i>F</i> test = 6.60; p = 0.000	<i>F</i> test = 4.439; p = 0.000	<i>F</i> test = 6.88; p = 0.000
Education level	Up to Intermediate	239 (23.8)	2.75 ± 1.13	13.56 ± 2.34	4.79 ± 1.40	7.41 ± 1.53
	Graduation	517 (51.5)	2.72 ± 0.97	13.97 ± 2.50	4.79 ± 1.37	7.53 ± 1.45
	Master and above	248 (24.7)	2.82 ± 0.87	14.26 ± 2.56	5.08 ± 1.31	7.86 ± 1.47
Statistics			<i>F</i> test = 0.869; p = 0.420	<i>F</i> test = 4.97; p = 0.007	<i>F</i> test = 4.33; p = 0.013	<i>F</i> test = 6.38; p = 0.002
Occupation	Student	531 (52.9)	2.67 ± 0.93	13.84 ± 2.33	4.86 ± 1.32	7.38 ± 1.34
	Teacher	126 (12.5)	2.73 ± 0.84	14.20 ± 2.76	4.82 ± 1.38	7.78 ± 1.55
	Health care Profes- sional	112 (11.2)	3.13 ± 0.99	15.02 ± 2.29	4.88 ± 1.33	8.40 ± 1.63
	Unskilled job	110 (11)	2.95 ± 1.26	13.32 ± 2.77	4.77 ± 1.48	7.83 ± 1.70
	Unemployed	60 (6)	2.58 ± 0.97	13.78 ± 2.17	5.11 ± 1.46	7.28 ± 1.22
	Others	65 (6.5)	2.6 ± 1.05	13.69 ± 2.76	4.89 ± 1.43	7.26 ± 1.43
Statistics			<i>F</i> test = 5.60; p = 0.000	<i>F</i> test = 6.37; p = 0.000	<i>F</i> test = 0.535; p = 0.750	<i>F</i> test = 11.43; p = 0.000



**Table 6** (continued)

Variables	Characteristics	n (%)	Knowledge score ± SD	Attitude score ± SD	Risk Factors score ± SD	Practices score ± SD
Economic status	Poor (upto 40 K)	202 (20.1)	2.56 ± 1.09	13.92 ± 2.72	4.64 ± 1.40	7.37 ± 1.58
	Middle class (40 K-100 K)	410 (40.8)	2.77 ± 0.96	14.13 ± 2.53	4.84 ± 1.33	7.60 ± 1.39
	High class (> 100 K)	106 (10.6)	3.07 ± 0.89	14.36 ± 2.27	4.89 ± 1.54	8.15 ± 1.64
	Unwilling/no response	286 (28.5)	2.73 ± 0.96	13.55 ± 2.29	5.05 ± 1.30	7.48 ± 1.43
Statistics			<i>F</i> test = 6.36; p = 0.000	<i>F</i> test 4.185; p = 0.006	<i>F</i> test = 3.640; p = 0.012	<i>F</i> test = 7.070; p = 0.000

**Table 7** Correlation of knowledge, attitude, risk factors and practices showing mean, median, SD, min, max and correlation matrix

Correlations	Mean	Median	SD <sup>&amp;</sup>	Min	Max	KNW <sup>@</sup> score	ATT <sup>#</sup> score	RF <sup>§</sup> score	PR <sup>+</sup> score
Knowledge score	2.755	3	0.99336	0	6	1			
Attitude score	13.9502	14	2.49416	0	18	0.280**	1		
Risk factors score	4.8675	5	1.36813	0	7	- 0.063*	- 0.151**	1	
Practices score	7.5847	8	1.48633	0	12	0.158**	0.160**	0.351**	1

\*Significant at the 0.05

\*\*Significant at the 0.01

&Standard deviation

@ Knowledge score

#Attitude score

§Risk factors score

+Practices score

concordant with Giao et al. [21] and Zhong et al. [11]. Risk factors were significant across provinces/territories, mother-tongue, education and economic status while practices were significantly differenced across all demographic variables i.e. provinces/territories, gender, age groups, marital status, mother-tongue, education, occupation and economic status.

Correlation analysis revealed that knowledge is positively correlated with attitude and practices and negatively with risk factors indicating that if knowledge would increase, attitude and practices will also increase, and risk factors would be decreased. The attitude is positively correlated with practices and negatively with risk factors indicating that attitude and practices would increase or decrease simultaneously. While attitude with risk factors explains that if attitude would be higher the risk would be less and vice versa. Practices and risk factors are positively correlated indicating that maintaining practices to visit crowded places, smoking and will meet the unknown persons on daily basis it would increase risk while wash hands properly, maintain a safe distance and use masks reduces the risk factor.

In the present study, there is no significant relationship among gender, age and risk factors, while it is

contradictory to the previous studies where the male has shown risky behavior as compared to females and different age groups were engaged in risk-taking behaviors variably [11, 22, 23].

Findings of the present study suggested that the demographic factors are associated with KAP towards COVID-19 as were previously found for SARS studies in 2003 [11, 24, 25]. The current data was obviously over-representative of women, well-educated people, students, and the findings can only be generalized to literate Pakistani populations and is in accordance with Zhong et al. [11].

There are a few limitations to the study. Due to limited access to the internet and online health information resources, vulnerable groups such as illiterate and rural people were missed. It is most likely that these groups may have poor knowledge, negative attitudes, and inappropriate preventive practices towards disease. These high-risk populations are very important to include in the study but due to lockdown in the country, it was not possible. The study was electronically conducted, so there is a limitation of participants representation regarding socio-demographic variables especially gender and education variables.

Findings of this study suggest that Pakistani literate society in particularly women had good knowledge, optimistic attitudes, and appropriate practices towards COVID-19 during the rapid rise period of the COVID-19 outbreak. Besides, good COVID-19 knowledge is associated with optimistic attitudes and appropriate practices towards COVID-19, suggesting that health education programs aimed at improving COVID-19 knowledge help encourage an optimistic attitude and maintain safe practices. Due to the limitation in the representativeness of the sample, more studies are warranted to investigate the KAP towards COVID-19 among Pakistani residents of low socioeconomic status and education.

## Conclusion

COVID-19 is pandemic needs extraordinary steps for its control. This study explains the perceptions of Pakistani population regarding COVID-19. Although people are aware of COVID-19 health education program should start to improve the COVID-19 knowledge, attitude, practices and risk factors among the illiterate or less educated community. More work or surveys should be done to impose the perceptions about general population across the country.

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## Compliance with Ethical Standards

**Conflict of interest** The authors declare that have no conflict of interest.

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