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## Original article

# Knowledge, perception, and practices towards COVID-19 pandemic among general public of India: A cross-sectional online survey



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## ABSTRACT

**Background:** The success of battle against COVID-19 depends on public adherence towards infection control measures, which is greatly affected by their knowledge, perception, and practices towards this infection.

**Aim:** To assess the knowledge, perception, and practice towards COVID-19 among the general public of India.

**Materials and methods:** A cross-sectional, online survey was performed among Indian residents who were aged above 15 years. A pre-validated online questionnaire on COVID-19 was distributed through various messenger groups and social media in the author's network. The questionnaire comprised of four sections to collect data regarding demographics, knowledge, perception, and practices towards COVID-19 pandemic. Multiple linear regression analysis was used to correlate demographics with knowledge, perception and practice scores about COVID-19.

**Results:** A total of 2459 participants (Males = 1424; Females = 1035) completed the survey tool. The mean age of the study participants was  $24.5 \pm 7.2$ . The main sources for COVID-19 information were television (74.5%) and social media (71.0%). Majority of the respondents shown a correct rate of knowledge (74.7%), perception (57.6%), and practices (88.1%) towards COVID-19. Respondents aged more than 40 years; higher education level, living in urban areas, and pursuing healthcare profession were positively associated with high knowledge, perception, and practices scores towards COVID-19

**Conclusion:** The study concludes, majority of the respondents shown a good knowledge and right practices towards COVID-19 pandemic, still there was a gap in right perception towards underlying myths and facts about COVID-19. Providing educational programs and circulating WHO myth busters through media or social networks can resolve underlying misconceptions about COVID-19 and improves the knowledge, perception, and practices among public.

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## 1. Introduction

Coronavirus disease 2019 (COVID-19) is an emergent respiratory infection caused by the most recently discovered severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and it was first detected in December 2019 in Wuhan, China.<sup>1</sup> The World Health Organization (WHO) declared the SARS-CoV-2 outbreak as a pandemic on March 11, 2020, due to its alarming levels of spread

across the globe.<sup>2</sup> As of this time point (July 14, 2020, 09:44 a.m. CEST) of writing, SARS-CoV-2 had extended to 216 countries altogether, resulting in 12,929,306 confirmed cases and 569,738 deaths.<sup>3</sup>

India is under nation-wide lockdown since 25 March, 2020 to curb the spread of the novel coronavirus. To date (July 14, 2020, 08:00 IST), a total of 311,565 active cases, 571,459 cured/discharged, 23,727 deaths, were reported according to Ministry of Health and Family Welfare, Government of India.<sup>4</sup> Currently, there is no availability of any proven specific treatment or prevention strategy to fight against COVID-19.<sup>5</sup> Non-pharmaceutical interventions like; quarantine of exposed individuals, isolation of suspected/

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confirmed cases, and sensitization of the general public about control measures are the only available options to limit the spread of this new virus.<sup>6</sup>

The success of battle against COVID-19 depends on public adherence towards infection control measures, which is greatly affected by their knowledge, perception, and practices towards the COVID-19 pandemic.<sup>7</sup> To promote outbreak management in India, there is an urgent need to understand public awareness about the COVID-19 pandemic. This online survey aimed to assess the knowledge, perception, and practice towards COVID among the general public of India, during this rapid rise period.

## 2. Materials and methods

This is a cross-sectional survey that was conducted for 15 days from 1st to 15th May, 2020. Due to nationwide lockdown during this period, it is very difficult to have community sampling, so we adopted an online survey to collect the data. The study protocol, survey tool, and informed consent procedure was approved (RIPER/IRB/2020/019) by the institutional review board before the start of the survey.

### 2.1. Study criteria

Persons who belong to Indian nationality, aged more than 15 years, able to understand English and willing to participate by opting 'yes' for the first question (Are you interested in joining this online COVID-19 survey) after reading background information on the first page were eligible for this survey. Foreign nationals and people who already infected with COVID-19 were not eligible to participate in this study.

### 2.2. Sample size determination

To determine the number of participants to be included in this online survey, a single population proportion formula was used with an assumption of 50% of the people are aware of COVID-19, 2% margin of error, 1% design effect, and 80% power, which was calculated as 2395. A convenient sampling technique was used to catch the required sample for this survey.

### 2.3. Validation of a survey tool

A suitably designed, self-administered questionnaire on COVID-19 was prepared and subjected to the face validity and reliability assessment. Face validation (content) was made by a panel of experts comprising; clinical microbiologist (1), physician specialized in infectious diseases (1), epidemiologist (1), and community health officer (1). A total of 30 questions (knowledge = 10; perception = 10; practice = 10) are present in the survey tool. Expert opinion towards the inclusion of each question/statement in the survey tool was placed on four point likert scale ranges strongly agree 4, agree 3, disagree 2, and strongly disagree 1. Finally, scale level content validity index (S-CVI) indicators like S-CVI/Average number and S-CVI/Utility agreement were calculated for knowledge (0.9, 1), attitude (0.9, 1), and practice domains (0.85, 1) of the survey tool. The S-CVI more than or equal to 0.8 is the threshold point for acceptance of the content in the survey tool/questionnaire.<sup>8</sup> The reliability test findings in a pilot sample survey revealed, a Cronbach's alpha coefficient of 0.78 for the knowledge domain, 0.8 for perception domain, and 0.76 for practice domain, indicating acceptable internal consistency.<sup>9</sup>

### 2.4. Survey tool

The survey tool/questionnaire comprises four sections to collect data regarding demographic variables, knowledge, perception, and practices towards COVID-19 pandemic. The demographic variables like age, gender, state, area of residence, educational qualification, and profession are included in the tool.

The knowledge section had 10 questions (Table 2): 1 regarding the name of virus (K1), 1 regarding incubation period (K2), 3 regarding symptoms (K3–K5), 1 regarding people at high risk in developing serious illness (K6), 2 regarding mode of transmission (K7 & K9), and 2 regarding prevention and control (K8 & K10) of COVID-19. These question had three choices (True/False/Don't know) to answer. A correct answer was scored 1 point and incorrect/unknown answer was 0 point. The total points scored by each individual ranged between 0 and 10, high score indicated good knowledge towards COVID-19.

The perception domain had 10 questions regarding myths and facts about COVID-19 (Table 2): 3 regarding myths about transmission of virus (PE1-PE3), 2 regarding myths about control of COVID-19 (PE4-PE5), 2 regarding myths about preventive measures of SARS-CoV-2 (PE6-PE7), 1 regarding myth about a diagnostic test (PE9), and 2 regarding myths about treatment availability for COVID-19 (PE8 & PE10). These question were also having three choices (True/False/Don't know) to answer. A correct answer was scored 1 point and incorrect/unknown answer was 0 point. The total points scored by each individual ranged between 0 and 10; high score indicated right perception towards COVID-19.

The practice section comprised 10 questions (Table 2): 1 regarding staying at home (P1), 1 regarding practice of respiratory hygiene (P2), 1 regarding social distance (P3), 1 regarding regular hand wash (P4), 1 regarding use of mask (P5), 1 regarding avoiding travel (P6), 1 regarding sanitizing suspected areas of infection (P7), 1 regarding use of Arogya setu app recommended by government of India (P8), 1 regarding avoiding shake hand (P9), and 1 regarding avoid touching mouth, nose, and eyes (P10). These questions have two choices (Yes/No) to answer. A correct answer was scored 1 point and incorrect/unknown answer was 0 point. The total points scored by each individual ranged between 0 and 10; high score indicated good practice towards COVID-19.

### 2.5. Data collection

The data was collected through online survey by providing a link to fill the questionnaire/survey tool. The link was presented in various messenger groups (Whatsapp, We Chat, and IMO) and social media networks (Facebook, Twitter, and LinkedIn). First page of the form describes background, core objectives, and expected outcomes of this KAP survey. The participant need to opt 'yes' for the first question (Are you interested in joining of this online KAP survey), to enter into survey.

### 2.6. Data analysis

Descriptive statistics are used to represent the demographics and KPP levels towards COVID-19 among study participants. Knowledge, perception, and practices scores of different persons according to demographic characteristics were compared with unpaired *t*-test, and one-way analysis of variance (ANOVA) based on the number of categories present in each variable. Multiple linear regression analysis was performed by using demographic characteristics as independent variables and knowledge, perception, and practices scores as outcome variables. Data analysis was performed by using Epi-Info for Dos version 3.5.1 software (Centers for Disease Control and Prevention, Atlanta, USA). The statistical significance

level was fixed at  $P < 0.05$  (two-sided).

### 3. Results

#### 3.1. Demographics

A total of 2459 participants (Males = 1424; Females = 1035) completed the survey tool. The average age of the study participants was  $24.5 \pm 7.2$ , and majority (1837; 74.7%) were in 18–25 years age group. Majority of the participants were, from Andhra Pradesh state (2107; 85.7%), qualified as graduates or above (2112; 85.9%), rural residency (1149; 46.7%), and non-healthcare profession (1338; 54.4%). The main sources for COVID-19 information were television (1832; 74.5%) and social media (1746; 71.0%). The complete demographic details of study participants were represented in [Table 1](#).

#### 3.2. Knowledge about COVID-19

The mean COVID-19 knowledge score of the respondents was 7.47, suggesting overall 74.7% correct rate of knowledge. More than 90% of the study participants were aware about; name & origin of the virus (K1), incubation period (K2), symptoms (K3), people at high risk for serious COVID-19 illness (K6), mode of transmission (K7), prevention and control (K8 & K10). However, only half of the participants are aware about COVID-19 cannot be transmitted

through air (K9). Very few participants are aware about that all infected persons not develop the symptoms and serious illness (K4 & K5) as shown in [Table 2](#).

#### 3.3. Perception about COVID-19

The mean COVID-19 perception score of the respondents was 5.76, suggesting overall 57.6% correct rate of perception. More than three-fourth of the participants had a right perception regarding medication unavailability in global market (1853; 75.4%), and COVID-19 is not transmitted by the mosquito bite (2011; 81.8%). More than half of the participants are in a right perception about the real facts like; virus can transmit in hot and humid climate areas (1421; 57.8%), hot bath cannot protect the person from COVID-19 (1598; 64.9%), hand dryers are not effective in killing virus (1610; 65.5%), pneumonia vaccine cannot protect COVID-19 (1241; 50.4%), and antibiotics are not effective against COVID-19 (1499; 60.9%). Less than half of the participants are in a right perception regarding, spraying alcohol or chlorine all over the body can harm the skin and mucous membranes (1179; 47.9%), eating garlic cannot prevent COVID-19 (835; 33.9%), and breath holding test is not a right test to diagnose COVID-19 (932; 37.9%) as shown in [Table 2](#).

#### 3.4. Practices towards COVID-19

The mean COVID-19 practice score of the respondents was 8.81, suggesting overall 88.1% correct rate of practice. More than 90% of the participants had rational practices towards COVID-19 like; staying at home (2407; 97.9%), elbow sneezing (2410; 98.0%), maintenance of physical distance (2383; 96.9%), hand hygiene (2414; 98.2%), wearing mask (2388; 97.1%), avoiding travel to COVID-19 affected areas (2222; 90.4%), sanitization of surrounding areas (2213; 90.0%), and avoiding shake hand (2222; 90.4%). More than half of the participants were using Arogya Setu application recommended by government of India (1294; 52.6%), and avoiding touch over eyes, nose, and mouth (1721; 69.9%). The complete results are depicted in [Table 2](#).

#### 3.5. Factors associated with knowledge, perception, and practice towards COVID-19

Knowledge, perception, and practice scores are significantly different across age, educational levels, and location of residence ( $P < 0.0001$ ). There was a significant difference in practice score between females and males ( $P = 0.0014$ ). Respondents belong to the health care profession have high knowledge and perception scores than non-healthcare profession. The complete results are depicted in [Table 3](#).

Multiple linear regression analysis showed that age-group more than 40 years (vs. less than 18, 18–25, 26–30, 31–35, and 36–40 years), location semi-urban (vs. rural), location urban (vs. rural) were significantly associated with high knowledge score ( $P < 0.05$ ). Age group less than 18 years (vs. 31–35 years), education primary school (vs. high school, intermediate or post high school diploma, and graduate or above), education high school (vs. graduate or above), education or post high school diploma (vs. graduate or above) were significantly associated with low knowledge score ( $P < 0.05$ ). Factors associated with high or low perception and practice scores among study respondents were represented in [Table 4](#).

## 4. Discussion

To the best of our knowledge, this is the first study conducted in India to evaluate the knowledge, perception, and practices towards

**Table 1**  
Demographic profile of the study participants (n = 2459).

Variable	Frequency (%)
Age in years (Mean $\pm$ SD)	24.5 $\pm$ 7.2
<18	33 (1.3)
18–25	1837 (74.7)
26–30	263 (10.7)
31–35	122 (4.9)
36–40	79 (3.2)
>40	125 (5.1)
Gender	
Male	1424 (57.9)
Female	1035 (42.1)
State	
Andhra Pradesh	2107 (85.7)
Assam	3 (0.1)
Delhi	7 (0.2)
Karnataka	86 (3.5)
Kerala	9 (0.4)
Madhya Pradesh	12 (0.5)
Maharashtra	30 (1.2)
Tamilnadu	120 (4.9)
Telangana	80 (3.2)
Uttar Pradesh	5 (0.2)
Education	
Primary school	10 (0.4)
High school	40 (1.6)
Intermediate/post high school diploma	297 (12.1)
Graduate/Post graduate	2112 (85.9)
Profession	
Healthcare	1121 (45.6)
Non-healthcare	1338 (54.4)
Area of location	
Rural	1149 (46.7)
Semi-urban	320 (13.0)
Urban	990 (40.3)
Sources of COVID-19 information	
Television	1832 (74.5)
Social media	1746 (71.0)
MOHFW/WHO website	945 (38.4)
Friends or relatives	602 (24.5)
Others	720 (29.3)

SD=Standard deviation; WHO=World Health Organization; MOHFW = Ministry of Health and Family Welfare.

**Table 2**  
Knowledge, perception, and practice towards COVID-19 (n = 2459).

Question/Statement	Correct No. (%)
<b>Knowledge</b>	
K1. COVID-19 is an infectious disease caused by the most recently discovered novel coronavirus in Wuhan, China (Ans. True)	2370 (96.4)
K2. The time between catching the novel coronavirus and beginning to have symptoms will be 14 days (Ans. True)	2374 (96.5)
K3. Fever, dry cough, tiredness, and body pains are the most common symptoms in COVID 19 (Ans. True)	2325 (94.5)
K4. The person infected with novel coronavirus definitely develops symptoms (Ans. False)	592 (24.1)
K5. The majority of people (about 80%) who get COVID-19 becomes seriously ill and develops breathing problem. (Ans. False)	431 (17.5)
K6. Old age people, and those with underlying medical problems like high BP, heart problems or diabetes, are more likely to develop serious illness. (Ans. True)	2264 (92.1)
K7. People can also catch COVID-19 if they breathe in droplets from a person with COVID-19 who coughs out or exhales droplets (Ans. True)	2232 (90.8)
K8. Social distance means stay more than 1 m (3 feet) away from a person who is sick. (Ans. True)	2241 (91.1)
K9. COVID-19 can be transmitted through the air. (Ans. False)	1186 (50.2)
K10. Regular hand wash, social distancing, avoiding crowd, wearing a mask, and stay at home can protect the person from getting COVID-19 (Ans. True)	2372 (96.5)
<b>Perception</b>	
PE1. COVID-19 virus CANNOT be transmitted in areas with hot and humid climates. (Ans. False)	1421 (57.8)
PE2. Taking a hot bath CANNOT prevent the novel Coronavirus disease (Ans. True)	1598 (64.9)
PE3. The novel Coronavirus CAN be transmitted through mosquito bites (Ans. False)	2011 (81.8)
PE4. Hand dryers are NOT effective in killing the novel Coronavirus (Ans. True)	1610 (65.5)
PE5. Spraying alcohol or chlorine all over your body cannot harm skin and mucous membranes (Ans. False)	1177 (47.9)
PE6. Vaccines against pneumonia can protect you against the novel Coronavirus (Ans. False)	1241 (50.47)
PE7. Eating garlic helps in the prevention of infection with novel Coronavirus (Ans. False)	835 (33.9)
PE8. Antibiotics are NOT effective in preventing and treating the novel Coronavirus (Ans. True)	1499 (60.9)
PE9. Holding breath for more than 10 s is a test for COVID-19 (Ans. False)	932 (37.9)
PE10. Medicines are available in the global market to prevent or treat the novel Coronavirus. (Ans. False)	1853 (75.4)
<b>Practice</b>	
P1. Do you stay at home during this COVID-19 pandemic (Ans. Yes)	2407 (97.9)
P2. Do you cover your mouth and nose with a tissue or elbow when sneezing (Ans. Yes)	2410 (98.0)
P3. Do you follow social distancing (>1 m) when you go and meet other people. (Ans. Yes)	2383 (96.9)
P4. Do you perform regular hand wash in your daily routine activities? (Ans. Yes)	2414 (98.2)
P5. Do you wear a mask when you visit a hospital or infected person. (Ans. Yes)	2388 (97.1)
P6. Have you traveled to any area affected with COVID-19? (Ans. No)	2222 (90.4)
P7. Do you sanitize the surfaces which are suspected of infection exposure? (Ans. Yes)	2213 (90.0)
P8. Do you use Arogya sethu application given by government of India (Ans. Yes)	1294 (52.6)
P9. Do you give shake hand upon meeting of friends/family members/others? (Ans. No)	2222 (90.4)
P10. Do you touch routinely your mouth, nose, and eyes? (Ans. No)	1721 (69.9)

COVID-19 = Coronavirus disease 2019.

**Table 3**  
Association of demographic variables towards knowledge, perception and perception score towards COVID-19.

Variable	Knowledge (Mean ± SD)	t/F	P value	Perception (Mean ± SD)	t/F	P value	Practice (Mean ± SD)	t/F	P value
<b>Gender</b>									
Male	7.44 (1.38)	1.494	0.1351	5.72 (2.42)	0.914	0.3607	8.75 (1.26)	3.2051	0.0014
Female	7.52 (1.20)			5.82 (2.27)			8.89 (0.89)		
<b>Age in years</b>									
<18	7.12 (1.74)	13.783	<0.0001	5.48 (2.68)	8.844	<0.0001	7.61 (1.80)	10.176	<0.0001
18–25	7.39 (1.32)			2.63 (2.34)			8.82 (1.16)		
26–30	7.51 (1.12)			5.99 (2.54)			8.68 (0.88)		
31–35	7.92 (1.24)			6.45 (2.39)			9.06 (0.78)		
36–40	7.61 (1.52)			5.59 (2.12)			8.87 (1.16)		
>40	8.23 (0.92)			6.80 (1.86)			8.97 (0.91)		
<b>Education</b>									
Primary school	5.30 (2.83)	40.451	<0.0001	3.00 (1.63)	23.706	<0.0001	6.40 (2.59)	46.925	<0.0001
High school	6.97 (1.27)			4.27 (1.66)			7.37 (1.67)		
Intermediate/PHSD	6.85 (1.57)			5.00 (2.28)			8.57 (1.32)		
Graduate or above	7.58 (1.22)			5.91 (2.35)			8.89 (1.04)		
<b>Location</b>									
Urban	7.66 (1.24)	22.118	<0.0001	6.17 (2.35)	41.631	<0.0001	9.00 (0.98)	26.453	<0.0001
Semi-urban	7.54 (1.29)			6.13 (2.32)			8.81 (1.09)		
Rural	7.29 (1.34)			5.31 (2.30)			8.65 (1.22)		
<b>Profession</b>									
Healthcare	7.58 (1.31)	3.592	0.0003	5.99 (2.28)	4.4051	<0.0001	8.84 (1.14)	11.1607	0.2458
Non-healthcare	7.39 (1.30)			5.57 (2.41)			8.79 (1.12)		

PHSD=Post High School Diploma; COVID-19 = Coronavirus disease 2019.

COVID-19 amongst general public of India. The major sources for COVID-19 information were television and social media. Similar findings were also observed in the study conducted by Zhong et al. in China.<sup>7</sup>

Based on knowledge scores of the respondents, an overall correct rate of knowledge towards COVID-19 is 74.7%. The high rate of knowledge about COVID-19 among respondents is due to wide initiatives (country wide lockdown, public exposure to the



**Table 4**

Multiple linear regressions on factors associated with knowledge, perception, and practices towards COVID-19.

Variable	Coefficient	SE	t	P
<b>Knowledge</b>				
Age group (<18 vs. 31–35 years)	–0.2366	0.267	3.0122	0.0030
Age group (>40 vs. <18 years)	0.3710	0.223	4.9903	<0.0001
Age group (31–35 vs. 18–25 years)	0.0978	0.123	4.3457	<0.0001
Age group (>40 vs. 18–25 years)	0.1562	0.120	7.0017	<0.0001
Age group (31–35 vs. 26–30 years)	0.1640	0.127	3.2538	0.0012
Age group (>40 vs. 26–30 years)	0.3033	0.115	6.2535	<0.0001
Age group (>40 vs. 31–35 years)	0.1396	0.139	2.2060	0.0283
Age group (>40 vs. 36–40 years)	0.2492	0.171	3.6567	0.0003
Education (Primary school vs. High school)	–0.3775	0.593	2.8242	0.0069
Education (Primary school vs. Intermediate/PHSD)	–0.1677	0.523	2.9700	0.0032
Education (Primary school vs. Graduate or above)	–0.1261	0.390	5.8546	<0.0001
Education (High school vs. Graduate or above)	–0.0674	0.195	3.1312	0.0017
Education (Intermediate/PHSD vs. Graduate or above)	–0.1867	0.079	9.3255	<0.0001
Location (Semi-urban vs. Rural)	0.0776	0.084	2.9820	0.0029
Location (Urban vs. Rural)	0.1407	0.056	6.5679	<0.0001
Profession (Non-healthcare vs. Healthcare)	–0.0723	0.053	3.5916	0.0003
<b>Perception</b>				
Age group (<18 vs. 31–35 years)	–0.1602	0.481	2.0072	0.0465
Age group (>40 vs. <18 years)	0.2534	0.402	3.2714	0.0013
Age group (26–30 vs. 18–25 years)	0.0501	0.156	2.2967	0.0216
Age group (31–35 vs. 18–25 years)	0.0843	0.219	3.7417	0.0002
Age group (>40 vs. 18–25 years)	0.1225	0.214	5.4652	<0.0001
Age group (>40 vs. 26–30 years)	0.1602	0.254	3.1893	0.0015
Age group (36–40 vs. 31–35 years)	–0.1810	0.330	2.5959	0.0101
Age group (>40 vs. 36–40 years)	0.2884	0.282	4.2803	<0.0001
Education (Primary school vs. High school)	–0.2995	0.586	2.1749	0.0346
Education (Primary school vs. Intermediate/PHSD)	–0.1555	0.728	2.7488	0.0063
Education (Primary school vs. Graduate or above)	–0.0848	0.744	3.9164	<0.0001
Education (High school vs. Graduate or above)	–0.0943	0.373	4.3903	<0.0001
Education (Intermediate/PHSD vs. Graduate or above)	–0.1274	0.145	6.3007	<0.0001
Location (Semi-urban vs. rural)	0.1457	0.146	5.6404	<0.0001
Location (Urban vs. Rural)	0.1831	0.101	8.6090	<0.0001
Profession (Non-healthcare vs. Healthcare)	–0.0885	0.095	4.4051	<0.0001
<b>Practices</b>				
Gender (Male vs. Female)	–0.0645	0.046	3.2051	0.0014
Age group (<18 vs. 18–25 years)	–0.1354	0.206	5.9070	<0.0001
Age group (<18 vs. 26–30 years)	–0.3154	0.189	5.6986	<0.0001
Age group (<18 vs. 31–35 years)	–0.4844	0.212	6.8484	<0.0001
Age group (<18 vs. 36–40 years)	–0.3898	0.285	4.4400	<0.0001
Age group (<18 vs. >40 years)	0.4377	0.225	6.0795	<0.0001
Age group (31–35 vs. 18–25 years)	0.0492	0.107	2.1809	0.0292
Age group (31–35 vs. 26–30 years)	0.1996	0.094	3.9864	<0.0001
Age group (>40 vs. 26–30 years)	0.1512	0.097	3.0060	0.0028
Education (Primary school vs. Intermediate/PHSD)	–0.2712	0.441	4.9207	<0.0001
Education (Primary school vs. Graduate or above)	–0.1603	0.333	7.4766	<0.0001
Education (Intermediate/PHSD vs. High school)	0.2737	0.230	5.2088	<0.0001
Education (High school vs. Graduate or above)	–0.1905	0.168	8.9968	<0.0001
Education (Intermediate/PHSD vs. Graduate or above)	–0.0956	0.067	4.7141	<0.0001
Location (Semi-urban vs. rural)	0.0543	0.076	2.0846	0.0371
Location (Urban vs. Rural)	0.1548	0.049	7.2456	<0.0001
Location (Urban vs. Semi-urban)	0.0823	0.065	2.9871	0.0028

PHSD=Post High School Diploma; COVID-19 = Coronavirus disease 2019; SE=Standard Error; P &lt; 0.05 = statistically significant value.

information) taken by the government of India and media for bringing public awareness about COVID-19 from the start of outbreak. Another reason could be the fact that 85.9% of the respondents were graduate or above graduation level of education. Even the study also found a positive correlation between higher education level and high knowledge scores. However, knowledge rate of our study is low compared to the previous studies conducted in China and Iran.<sup>7,10</sup> In these studies the overall correct rate of knowledge towards COVID-19 is 90%. The underlying reason for high knowledge score in China and Iran may be due to the differences in the time and the area in which the two studies were conducted. These studies were conducted in main phase of COVID-19 outbreak where people got exposed to the lot information about the disease.

In our study, a poor knowledge was reported about virus transmission (not transmitted through air), and risk of getting

serious COVID-19 illness (Very rare). It builds a panic situation among public and abrupt the implementation of safety measures to control COVID-19. So, there is a need to bring confidence among the public about transmission mode (droplet infection & fomites in the immediate environment of the infected person) and seriousness of COVID-19. The public need to avoid redundant fear about seriousness of COVID-19 and adhere to the safety measures to control COVID-19 pandemic.

The recent evidence suggest that, airborne transmission may be possible in specific circumstances and settings in which procedures or support treatments that generate aerosols are performed; i.e., endotracheal intubation, bronchoscopy, open suctioning, administration of nebulized treatment, manual ventilation before intubation, turning the patient to the prone position, disconnecting the patient from the ventilator, non-invasive positive-pressure ventilation, tracheostomy, and cardiopulmonary resuscitation.<sup>11</sup> Our

study is focused towards general public so all these concerns are not addressed in our study.

The current study explored the public perception towards myths and facts about COVID-19. A right perception towards myths and facts about COVID-19 can encourage good practices among the public. Till date, there was no study aimed to assess the misconceptions surrounding COVID-19 among the general public. In our study, more than half (57.6%) of the respondents had shown a right perception towards COVID-19. But, this is not an acceptable margin to promote better practices among the public of India. There was a drastic need to sensitize the public about, COVID-19 myth busters, which were recommended by the World Health Organization.<sup>12</sup> The study findings suggest that, television and social media are the right source to communicate the COVID-19 myth busters.

The up to date evidence (July 14, 2020) on facts and myths about COVID-19 revealed various new things which were not discussed in this study. These facts are; 1. People should not wear masks while exercise as it may reduce the ability to breathe comfortably; 2. The likelihood of COVID-19 being spread on shoes and infecting individuals is very low; 3. The prolonged use of medical masks can be uncomfortable. However, it does not lead to CO<sub>2</sub> intoxication nor oxygen deficiency; 4. Most people who get COVID-19 have mild or moderate symptoms and can recover thanks to supportive care; 5. Thermal scanner cannot detect people who are infected with COVID-19; 6. COVID-19 is not transmitted through houseflies; 7. 5G mobile network do not spread COVID-19. 8. People with all ages can be infected by the COVID-19 virus; 9. Rinsing nose with saline does not prevent COVID-19; 10. UV radiation can cause skin irritation and damage your eyes; 11. Cold weather and snow cannot kill the COVID-19 virus; and 12. Drinking methanol, ethanol, and bleach cannot cure COVID-19 and can be more dangerous.<sup>11</sup>

In our study, majority (88.1%) of the participants had show right practices to avoid spread of COVID-19. This may be due to vast broadcasting about COVID-19 by the government of India and good knowledge of the respondents. The current study practice findings are nearly similar with the study conducted in Iran (89%).<sup>10</sup> However, the practice scores were lower compared to practice scores of Chinese residents.<sup>7</sup> Aarogya Setu is a mobile application developed by government of India to connect health services with the people of India to fight against COVID-19. In our study, only half (52.6%) of the respondents are getting COVID-19 information and services from this application. Still, there is a need to promote awareness on use of Aarogya Setu application among general public of India.

The study findings revealed that knowledge, perception, and practice scores towards COVID-19 were high among population aged more than 40 years, higher education level, living in urban areas, and pursuing healthcare profession. Similar findings are also observed in the population survey conducted in China and Iran.<sup>7,10</sup> The findings of multiple linear regression analysis shown various factors associated with high and low scores of knowledge, perception, and practices towards COVID-19 among public. These findings help public health policy makers and health workers to identify the target population for COVID-19 education and prevention programs.

#### 4.1. Strengths and limitations

The major strength of this study is lies in its large sample size recruited in critical phase of COVID-19 in India. The survey tool used in this study also helps in improving the existing knowledge and to resolves any misconception laid among the public regarding COVID-19. There are certain limitations which need to be

considered before interpreting the findings of this study. Firstly, as this is an online survey, it might not capture the responses from the areas with the restricted access to the social media and internet facilities. Even, economically weaker sections of society who don't have android mobile phone with social media applications are not captured in the sample, this results in coverage bias. Secondly, respondents may give false information in the self-administered questionnaire used in this online survey. Finally, illiterates, and respondents unable to understand English are not covered in this online survey.

## 5. Conclusion

The study concludes that, respondents aged more than 40 years; higher education level, living in urban areas, and pursuing healthcare profession were positively associated with high knowledge, perception, and practices scores towards COVID-19. Even though majority of the respondents shown a good knowledge and right practices towards COVID-19 pandemic, still there was a gap in right perception towards underlying myths and facts about COVID-19. Providing educational programs and circulating WHO myth busters through media or social networks can resolve underlying misconceptions about COVID-19 and improves the knowledge, perception, and practice among public. Due to the limitation in representativeness of the sample, interview based studies are warranted in Indian residents to investigate knowledge, perception, and practice levels among illiterates.

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## Declaration of competing interest

All authors declare that there was no conflict of interest.

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## References

- World Health Organization Novel Coronavirus (2019-nCoV) Situation Report-1. [https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200121-sitrep-1-2019-ncov.pdf?sfvrsn=20a99c10\\_4](https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200121-sitrep-1-2019-ncov.pdf?sfvrsn=20a99c10_4). Accessed 14 July 2020.
- WHO announces COVID-19 outbreak a pandemic. <https://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/news/news/2020/3/who-announces-covid-19-outbreak-a-pandemic>. Accessed 14 July 2020.
- Coronavirus disease (COVID-19) pandemic. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>. Accessed 14 July 2020.
- COVID-19 India. <https://www.mohfw.gov.in/>. Accessed 14 July 2020.
- Cunningham AC, Goh HP, Koh D. Treatment of COVID-19: old tricks for new challenges. *Crit Care*. 2020 Dec;24(1):91. <https://doi.org/10.1186/s13054-020-2818-6>.
- Lai S, Ruktanonchai NW, Zhou L, et al. Effect of non-pharmaceutical interventions to contain COVID-19 in China. *Nature [Internet]*. 2020 May 4. <https://doi.org/10.1038/s41586-020-2293-x>.
- Zhong B-L, Luo W, Li H-M, et al. Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey. *Int J Biol Sci*. 2020;16(10):1745–1752. <https://doi.org/10.7150/ijbs.45221>.
- Zamanzadeh V, Ghahramanian A, Rassouli M, Abbaszadeh A, Alavi-Majd H, Nikanfar A-R. Design and implementation content validity study: development of an instrument for measuring patient-centered communication. *J Caring Sci*. 2015 Jun 1;4(2):165–178. <https://doi.org/10.15171/jcs.2015.017>.
- Taber KS. The use of cronbach's alpha when developing and reporting Research instruments in science education. *Res Sci Educ*. 2018 Dec;48(6):1273–1296.

- <https://doi.org/10.1007/s11165-016-9602-2>.
10. Erfani A, Shahriarirad R, Ranjbar K, Mirahmadizadeh A, Moghadami M. Knowledge, Attitude and Practice toward the Novel Coronavirus (COVID-19) Outbreak: A Population-Based Survey in Iran [Internet]. nCoV; [http://www.who.int/bulletin/online\\_first/20-256651.pdf](http://www.who.int/bulletin/online_first/20-256651.pdf). Accessed 14 July 2020.
  11. Modes of transmission of virus causing COVID-19: implications for IPC precaution recommendations. <https://www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations>. Accessed 14 July 2020.
  12. Coronavirus disease (COVID-19) advice for the public: Mythbusters. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/myth-busters>. Accessed 14 July 2020.