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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 ± 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. 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. 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.

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. Currently, there is no availability of any proven specific treatment or prevention strategy to fight against COVID-19. Non-pharmaceutical interventions like: quarantine of exposed individuals, isolation of suspected/
confirmed cases, and sensitization of the general public about control measures are the only available options to limit the spread of this new virus.\(^6\)

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.\(^7\) 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 ranging from 0 to 4, agree 1, disagree 2, and strongly disagree 3. 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.\(^3\) 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.\(^9\)

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 section comprised 10 questions (Table 2): 1 regarding the idea 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 (PE8), and 2 regarding myths about a 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 analysis

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 un-paired 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 ± 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 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; 37.5%) 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...
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.7

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
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.\(^{2,16}\) 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 & fomities in the immediate environment of the infected person) and seriousness of COVID-19. The public need to avoid redundant fear about serious COVID-19 illness (Very rare). It builds a panic situation among public and abrupt the implementation of safety measures to control COVID-19.

### Table 4

| Variable                                                                 | Coefficient | SE   | t     | P     |
|--------------------------------------------------------------------------|-------------|------|-------|-------|
| Knowledge                                                                |             |      |       |       |
| Age group (<18 vs. 31–35 years)                                          | -0.2366     | 0.267| 3.012 | 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| 2.0260| 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| 0.0009 |
| 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 |
| Perception                                                               |             |      |       |       |
| 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|
| Practices                                                                |             |      |       |       |
| Gender (Male vs. Female)                                                 | -0.0645     | 0.046| 2.0521| 0.0014 |
| Age group (<18 vs. 18–25 years)                                          | -0.1354     | 0.206| 5.9070| <0.0001|
| Age group (>40 vs. 26–30 years)                                          | -0.3154     | 0.189| 5.6896| <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)                                        | 0.0996      | 0.094| 3.9864| <0.0001|
| Age group (>40 vs. 26–30 years)                                          | 0.1512      | 0.097| 3.0660| 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| 6.5208| <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| 0.0272 |
| 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 < 0.05 — statistically significant value.
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 sensitise the public about COVID-19 myth busters, which were recommended by the World Health Organization. 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 CO2 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 in 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.11

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%). However, the practice scores were lower compared to practice scores of Chinese residents.7 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. The current study practice scores were lower compared to practice scores of Iran.10 How- ever, the practice scores were lower compared to practice scores of Chinese residents.7 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 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 limitations 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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