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KNOWLEDGE, ATTITUDES AND PRACTICES TOWARDS COVID-19: A CROSS-SECTIONAL STUDY IN INDIA

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ABSTRACT

Background: India has adopted an array of various preventive measures to control the rapid spread of the COVID-19 epidemic outbreak. Population knowledge, attitude, and practice towards COVID-19 significantly influence these control measures. Immediately after the lockdown measures were implemented, this study of KAP was conducted during the rapid rise of the outbreak. A web-based cross-sectional survey was conducted from 1st June 2020 to 30th June 2020. The general population of India aged more than 18 years was recruited online, and consent was taken. Various sociodemographic variables were assessed for knowledge, attitude, and practice, and overall KAP scores were calculated based on the questionnaire method. A total of 2086 individuals participated, with 1038 males and 1048 females. Of these, 1766 people were between 18 and 30 years of age. A total of 1660 subjects were unmarried, 961 had a bachelor's degree, and 1367 were residents of Uttar Pradesh. The survey revealed that the average knowledge score was 10.07 (total score 13), the average attitude score was 1.43 (total score 2), and the average practice score was 0.93 (total score 1). The total average KAP score was 12.43 (total score 16). In multiple logistic regression analyses, age, marital status, education, and occupation indicated a higher correlation with the KAP score and were statistically significant ($p < 0.05$). Also, for the assessment of the knowledge score, educational qualification and occupation were the significant independent variables, with $p = 0.06$ and $p < 0.001$, respectively. During the rapid rise of the COVID-19 pandemic outbreak, it is crucial to determine the KAP of the general population in order to develop effective and tailored health education programs for COVID-19. India has taken stringent preventive measures to safeguard its citizens from the COVID-19 pandemic, prevent its spread, and ensure their well-being. Knowledge and attitude towards the disease ensure public adherence to various preventive measures. This study investigated the knowledge, attitude, and practice of the Indian population towards COVID-19 during the pandemic. The aim of the study was to predict the outcomes of knowledge, attitude, and practice regarding COVID-19 among the Indian population based on input demographic characteristics such as age, sex, education, profession, current place of residence, etc. Knowledge regarding clinical presentations, transmission routes, and prevention and control was assessed through different questionnaires in an online survey. Attitudes towards COVID-19 regarding agreement on its eventual control and management were analysed by assessing participants' responses, and practices regarding the isolation of patients were determined. This study will help policymakers and authorities develop effective health education programmes aimed at improving knowledge, thus leading to more favourable attitudes and the incorporation of safe practice strategies. Settings and Design was a cross-sectional, web-based study conducted among the general population of India from June 1, 2020 to June 30, 2020. Due to the nature of the disease and the ongoing COVID-19 pandemic, community-based sampling was not feasible. Therefore, data

collection was conducted online using a non-probability convenience sampling method. The survey was distributed through the authors' networks. A total of 2,086 individuals aged >18 years participated in the study. A series of questions were asked regarding the knowledge, attitude, and practice (KAP) of the population towards COVID-19. The participants' demographic characteristics and sources of information regarding COVID-19 were also analysed.

Materials and Methods: For the purpose of this study, questionnaires were developed to collect information about the subjects' knowledge, practice, and attitude towards COVID-19, along with demographic details. The questionnaires were designed by the authors following the guidelines used in Zhong et al. (2020). The knowledge questionnaire consisted of 13 questions, as detailed in Table 1: K1–K4 concerning clinical presentations, K5–K7 concerning transmission routes, and K8–K13 concerning prevention and control. Attitudes towards COVID-19 were assessed through two questions (A1–A2, Table 1) about agreement on the final control and confidence in winning the battle against COVID-19. The subjects' behaviour was assessed through one question (P1, Table 1): an infected person should be isolated immediately. These questionnaires had "True," "False," or "I do not know" as response options. Table 1 also details the correct response to each question. Following the data cleaning process and exclusion of subjects younger than 18 years of age, the final dataset consisted of 2,086 samples. Data collection was conducted through various social media platforms using a web-based survey. Through the link, participants could view the questions simply by clicking on it and marking their answers according to the options provided. The cover page of the questionnaire included a short introduction regarding the objectives, voluntary nature of participation, and declarations of confidentiality and anonymity. The inclusion criteria were Indian residents aged 18 years or older who could understand the content of the survey and were willing to participate. The questionnaires were answered by 2,086 participants from June 1, 2020 to June 30, 2020. Demographic details were recorded along with other factors during the survey. Statistical analysis used the data obtained from the study described in this paper were used to build a computational model that could predict knowledge, attitude, and practice based on demographic features. Using a prediction model, we aimed to determine the accuracy of predicting knowledge, attitude, and practice based on input demographic features such as age, education, profession, location, etc. The collected data formed the input for training a computational model that could analyse the input features and determine knowledge, attitude, and practice accuracy as the output class. The work described by Chaurasia et al. (2016)[1] states that if each feature typically has a large number of categories, the resulting models are quite complex, with a high possibility of lower accuracy. Additionally, categorising each of the features into fewer subcategories makes the models simpler and more appropriate for healthcare professionals to understand. Therefore, for building the models, we used the re-categorised demographic features described in Table 5. For modelling purposes, k-Nearest Neighbour (kNN) was used to build the prediction model for each case. The kNN classifier finds a group of k objects in the training set that are closest to the test object, and the assignment of a label is based on the predominance of a particular class in this neighbourhood (Wu et al., 2007). kNN is based on finding the nearest neighbours for an unknown case by calculating the similarity measure between its neighbours and the unknown case. This characteristic is useful to healthcare professionals.[2] Based on the given values of the features for an unknown case, the outcome of the model can be interpreted by healthcare professionals based on their experience with similar observations. In contrast, the outputs from NN- and SVM-based models are complex and difficult to interpret (Chaurasia et al., 2016). Therefore, we used kNN for modelling purposes. The models were built using Weka Experimenter (University of Waikat). To investigate the relationship between kNN classifier accuracy and the input features, a cross-validation test was performed. The goal of cross-validation is to define datasets to evaluate the model during the training phase (i.e., validation datasets), in order to limit problems such as overfitting and provide insight into how the model will generalise to an independent dataset (Wu et al., 2007). Table 13 shows the kNN modelling results for each question

on knowledge, attitude, and practice. The results were calculated by fitting multinomial logistic regression models for COVID-19 KAP, knowledge, attitude, and practice scores.

Results: Among the 2,086 participants, the average knowledge score achieved was 10.07 (total score of 13) regarding COVID-19 characteristics. Regarding attitude and practice, the overall average scores were 1.43 (total score of 2) and 0.93 (total score of 1), respectively. The total average KAP score among the study population was 12.43 (total score of 16). Among the various demographic parameters studied, age, marital status, education, and occupation showed statistically significant associations with the KAP score ($p < 0.005$). Also, educational qualification and occupation were independent variables associated with the knowledge score, with $p = 0.06$ and $p < 0.001$, respectively. However, only occupation showed a statistically significant association with the knowledge score at the conventional significance level of $p < 0.05$.

Conclusion: Our findings suggest that the Indian population demonstrated decent knowledge, appropriate practices, and a positive attitude towards the COVID-19 outbreak. Targeted populations, such as less-educated individuals, females, unskilled workers, and unmarried individuals, can be educated by organising various health programmes to encourage positive attitudes and maintain safe practices. By increasing public knowledge, more effective control of the disease by health policymakers and authorities can be anticipated.

Keywords: Knowledge, Attitude, Practice, COVID-19.

INTRODUCTION

Coronavirus disease (COVID-19) is caused by a novel coronavirus, also called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The first cases were reported in December 2019 in Wuhan, Hubei Province, China, where a cluster of acute respiratory illness cases was reported. Beginning as an epidemic there, it was declared a global pandemic by the WHO on 11 March 2020.5 The first case in India was reported in Kerala on 30 January 2020, where a 20-year-old female presented to the emergency department in Thrissur with a one-day history of dry cough and sore throat.[1-3]

It is of vital importance to have knowledge regarding the routes of transmission and basic hygiene principles in order to introduce and implement effective control measures in India. To achieve ultimate success in the battle against COVID-19, it is of paramount importance that people remain committed to these precautions by practising appropriate behaviour. According to KAP theory, this is affected by their knowledge, attitudes, and practices regarding COVID-19.[6, 7] One of the most important measures to control the disease is public education.[4-9]

The main goal of this study was to measure the levels of knowledge, attitude, and practice concerning COVID-19, identify demographic variables associated with them, and explore awareness and behaviours related to disease prevention.[6]

The knowledge questionnaire had 13 questions concerning clinical presentations, transmission routes, and prevention and control. Attitudes towards COVID-19 were assessed through two questions about agreement on the final control of the disease and confidence in winning the battle against COVID-19. The subjects' behaviour was assessed through one question regarding the immediate isolation of an infected person.

MATERIALS AND METHODS

Methodology

This study was conducted between June 1, 2020 and June 30, 2020. Due to the nature of the disease and the ongoing lockdown, community-based sampling was not possible, so it was decided to conduct data collection online. The survey was conducted online in India and distributed through the authors' networks.[13]

The study was approved by the Institutional Ethics Committee of the Institute of Medical Sciences, Banaras Hindu University, Varanasi, India. The study was registered with the Clinical Trials Registry–India (CTRI), registration number CTRI/2020/05/025497, on May 31, 2020, prior to the commencement of data collection on June 1, 2020. Informed consent was obtained electronically from all participants before participation in the online survey. Participation was voluntary, and the confidentiality and anonymity of respondents were maintained throughout the study.

The questionnaires collected information about the subjects' knowledge, practice, and attitude towards COVID-19, along with demographic details. The questionnaires were designed by the authors following the guidelines used by Zhong et al. (2020).[3] The knowledge questionnaire consisted of 13 questions, as detailed in [Table 1] K1–K4 concerning clinical presentations, K5–K7 concerning transmission routes, and K8–K13 concerning prevention and control.

Attitudes towards COVID-19 were assessed through two questions (A1–A2, [Table 1]) about agreement on the final control of the disease and confidence in winning the battle against COVID-19. The subjects'

behaviour was assessed through one question (P1, [Table 1] an infected person should be isolated immediately.

These questionnaires had "True," "False," or "I do not know" as response options. [Table 1] also details the correct response to each question. Following the data cleaning process and exclusion of subjects younger than 18 years of age, the final dataset consisted of 2,086 samples.

Table 1: Questionnaire on Knowledge, Attitudes, and Practices Towards COVID-19

Item	Questionnaire	Response options	Reported response	Percentage (%)
K1	The main clinical symptoms of COVID-19 are fever, fatigue, dry cough, and myalgia.	True / False / I do not know	True	94.12
K2	Unlike the common cold, a stuffy nose, runny nose, and sneezing are less common in persons infected with the COVID-19 virus.	True / False / I do not know	True	57.14
K3	There is currently no effective cure for COVID-19, but early symptomatic and supportive treatment can help most patients.	True / False / I do not know	True	94.77
K4	Not all persons with COVID-19 will develop severe disease. Elderly individuals, those with chronic illnesses, and those with obesity are more likely to develop severe disease.	True / False / I do not know	True	72.87
K5	Eating or coming into contact with wild animals would result in COVID-19 infection.	True / False / I do not know	I do not know	7.24
K6	Persons with COVID-19 cannot infect others when fever is absent.	True / False / I do not know	False	84.08
K7	The COVID-19 virus spreads via respiratory droplets from infected individuals.	True / False / I do not know	True	90.36
K8	The general public can wear masks to prevent COVID-19 infection.	True / False / I do not know	True	96.40
K9	It is not necessary for children and young adults to take measures to prevent infection with the COVID-19 virus.	True / False / I do not know	False	81.30
K10	The general public should wear N95 masks.	True / False / I do not know	False	37.25
K11	To prevent COVID-19 infection, individuals should avoid crowded places, such as train stations, and avoid using public transportation.	True / False / I do not know	True	96.93
K12	Isolation and treatment of people infected with the COVID-19 virus are effective ways to reduce the spread of the virus.	True / False / I do not know	True	96.02
K13	People who have contact with someone infected with the COVID-19 virus should be immediately isolated in an appropriate place. In general, the observation period is 14 days.	True / False / I do not know	True	98.42
A1	Do you agree that COVID-19 will eventually be successfully controlled?	True / False / I do not know	True	59.16
A2	Do you agree that India can win the battle against the COVID-19 virus?	True / False / I do not know	True	83.89
P1	In recent days, have you visited any crowded place?	True / False / I do not know	True	93.38

K1–K13: Knowledge; A1–A2: Attitude; P1: Practice. Percentages and reported response keys are retained from the original dataset. K5 and P1 require verification of their response coding before the table is submitted as final. Attitude responses represent favourable responses rather than objectively correct answers.

We also calculated the knowledge score based on the response given, a correct response was assigned 1 point and an unknown/incorrect answer was assigned 0 points. Based on the response noted for the knowledge, attitude, and practice questionnaires detailed in Table 1, Table 2 shows the total knowledge, attitude, and practice (KAP) scores.

Table 2: Mean knowledge, attitude, and practice (KAP) scores among 2,086 participants.

KAP Scores	Mean Score	Maximum Possible Score
Knowledge score (K1–K13)	10.07	13
Attitude score (A1–A2)	1.43	2
Practice score (P1)	0.93	1
Total KAP score (K1–K13 + A1–A2 + P1)	12.43	16

Note: KAP = Knowledge, Attitude, and Practice. The total mean KAP score was calculated as the sum of the mean knowledge, attitude, and practice scores.

Data analysis: Frequencies of correct knowledge, attitudes, and practices are described. Knowledge scores, attitudes, and practices of different persons according to demographic characteristics were compared [Table 3 - 6].

Table 3: Demographic characteristics of participants and KAP score of COVID-19 by demographic variables.

Characteristics		Number of participants	KAP score (mean ± standard deviation)	p-value
Gender	Male	1038	12.50 ± 1.809	
	Female	1048	12.37 ± 1.703	0.338
Age-group (years)	18 to 30	1766	12.36 ± 1.741	
	30+	320	12.83 ± 1.797	<0.001
Marital status	Married	377	12.74 ± 1.967	
	Never married	1660	12.38 ± 1.690	
	Others (re-married, co-habiting, separated, divorced, and widowed)	49	11.82 ± 1.954	< 0.001
Education	School	267	12.33 ± 1.851	
	Bachelor's degree	961	12.36 ± 1.686	
	Master's degree and above	858	12.55 ± 1.800	< 0.001
Occupation	Non-skilled/Physical work	86	11.50 ± 2.028	
	Skilled	401	12.37 ± 1.939	
	Others	1599	12.50 ± 1.678	< 0.001
Place of current residence	Uttar Pradesh	1367	12.45 ± 1.702	
	Rest of India	719	12.41 ± 1.858	0.327

The p-values obtained for age, marital status, education, and occupation are less than 0.005 indication a higher correlation between these variables and the KAP score.

Table 4: Demographic characteristics of participants and Knowledge score of COVID-19 by demographic variables.

Characteristics		Number of participants	Knowledge score (mean ± standard deviation)	p-value
Gender	Male	1038	10.13 ± 1.503	
	Female	1048	10.01 ± 1.452	0.190
Age-group (years)	18 to 30	1766	10.00 ± 1.475	
	30+	320	10.45 ± 1.440	< 0.001
Marital status	Married	377	10.36 ± 1.607	
	Never married	1660	10.02 ± 1.438	
	Others (re-married, co-habiting, separated, divorced, and widowed)	49	9.61 ± 1.483	< 0.001
Education	School	267	9.92 ± 1.566	
	Bachelor's degree	961	9.98 ± 1.451	
	Master's degree and above	858	10.21 ± 1.469	0.004
Occupation	Non-skilled/Physical work	86	9.41 ± 1.662	
	Skilled	401	10.04 ±1.722	
	Others	1599	10.11 ± 1.391	< 0.001
Place of current residence	Uttar Pradesh	1367	10.06 ± 1.440	
	Rest of India	719	10.08 ± 1.548	0.421

Table 5: Demographic characteristics of participants and Attitude score of COVID-19 by demographic variables.

Characteristics		Number of participants	Attitude score (mean ± standard deviation)	p-value
Gender	Male	1038	1.45 ± 0.716	
	Female	1048	1.41 ± 0.735	0.344
Age-group (years)	18 to 30	1766	1.43 ± 0.721	
	30+	320	1.43 ± 0.752	0.166
Marital status	Married	377	1.45 ± 0.725	
	Never married	1660	1.43 ± 0.724	
	Others (re-married, co-habiting, separated, divorced, and widowed)	49	1.31 ± 0.769	0.689
Education	School	267	1.45 ± 0.683	
	Bachelor's degree	961	1.45 ± 0.708	
	Master's degree and above	858	1.41 ± 0.757	0.028
Occupation	Non-skilled/Physical work	86	1.30 ± 0.783	
	Skilled	401	1.43 ± 0.742	
	Others	1599	1.44 ± 0.718	0.370
Place of current residence	Uttar Pradesh	1367	1.45 ± 0.710	
	Rest of India	719	1.39 ± 0.753	0.728

Table 6: Demographic characteristics of participants and Practice score of COVID-19 by demographic variables.

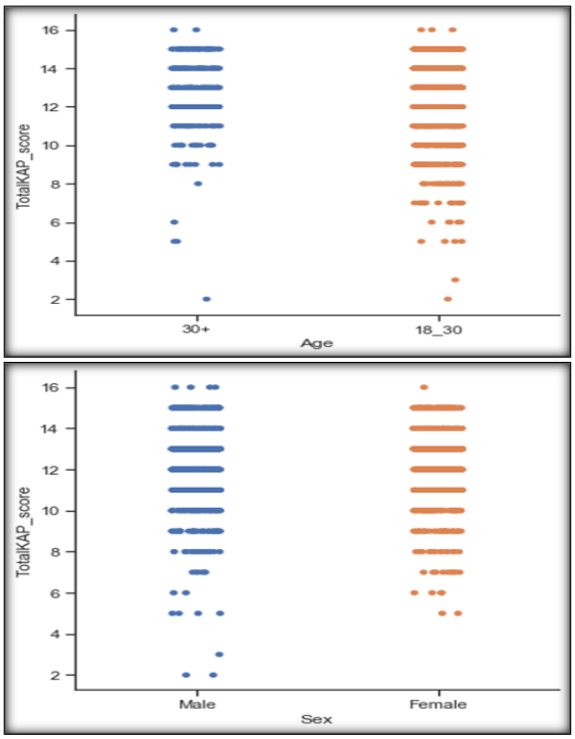
Characteristics		Number of participants	Practice score (mean ± standard deviation)	p-value
Gender	Male	1038	0.95 ± 0.213	
	Female	1048	0.91 ± 0.280	0.418
Age-group (years)	18 to 30	1766	0.93 ± 0.253	
	30+	320	0.94 ± 0.231	< 0.001
Marital status	Married	377	0.92 ± 0.267	
	Never married	1660	0.94 ± 0.243	
	Others (re-married, co-habiting, separated, divorced, and widowed)	49	0.90 ± 0.306	0.380
Education	School	267	0.96 ± 0.199	
	Bachelor's degree	961	0.93 ± 0.251	
	Master's degree and above	858	0.93 ± 0.261	0.180
Occupation	Non-skilled/Physical work	86	0.79 ± 0.409	

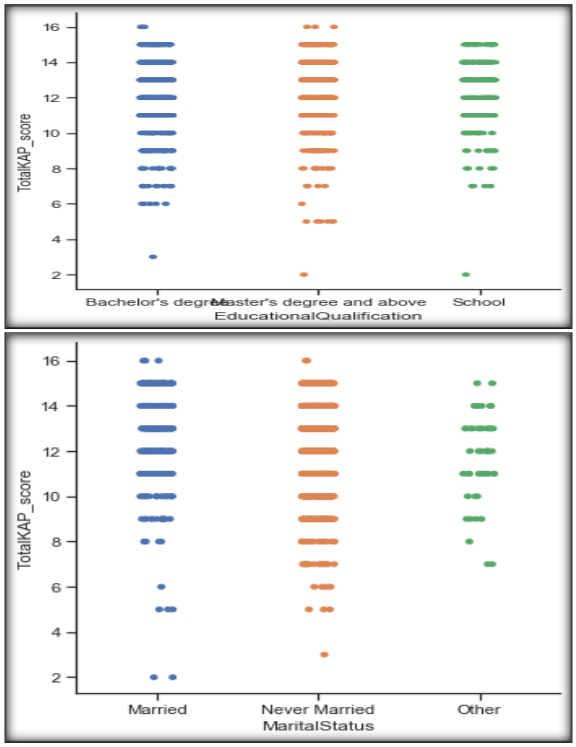
Table 7: Demographic feature set labelled with fewer categories.

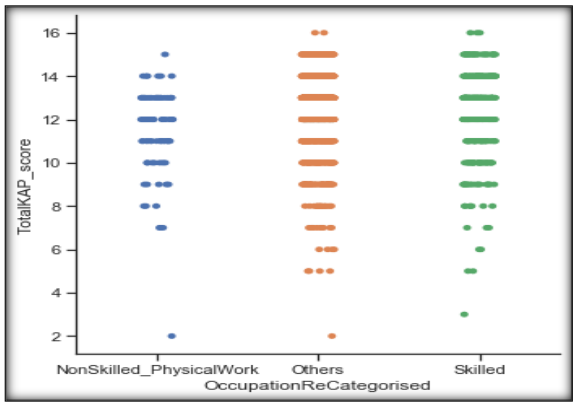
KAP Score	Between 1 and 16
Knowledge score	Between 1 and 13
Attitude score	Between 1 and 2
Practice score	1
Age	{18 to 30, 30+}
Sex	{Male, Female}
Marital status	{Married, never married, Others (re-married, co-habiting, separated, divorced, and widowed)}
Educational qualification	{Master's degree and above, School, Bachelor's degree}
Occupation Re Categorised	{Non-skilled/Physical work, Skilled, Others}
UP, Rest India	{Rest Of India, Uttar Pradesh}

RESULTS

Based on the recategorised demographic features, an analysis of the correlation between the KAP score and each of these features was performed (Figure 2). Figure 3 shows box plots of the scores across demographic features.







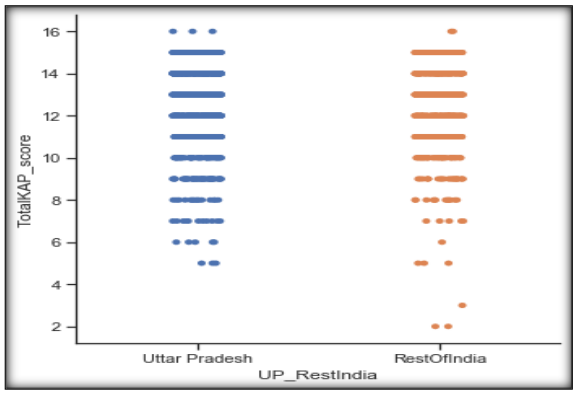
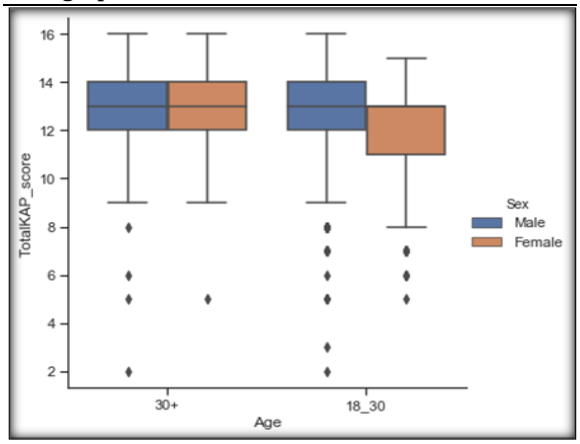
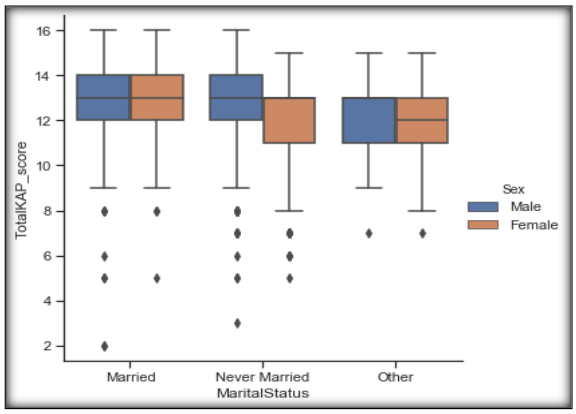
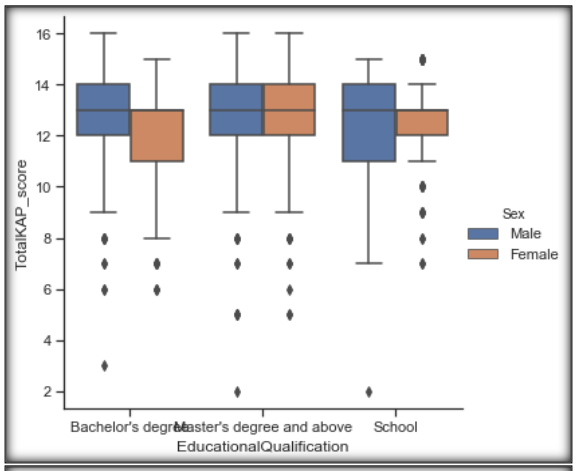
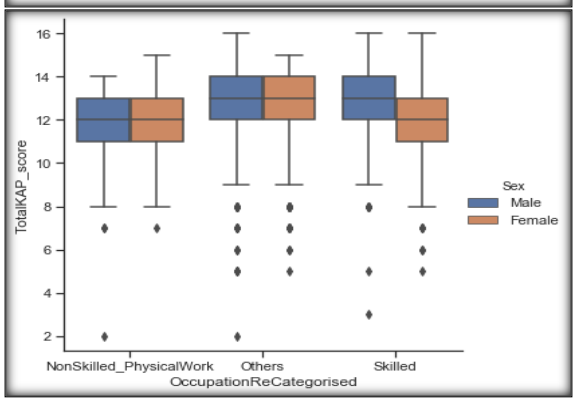


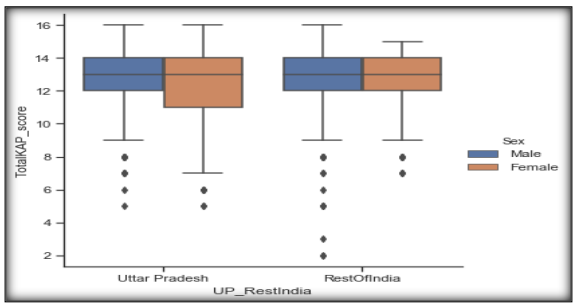
Figure 1: Correlation between KAP score and different demographic features.











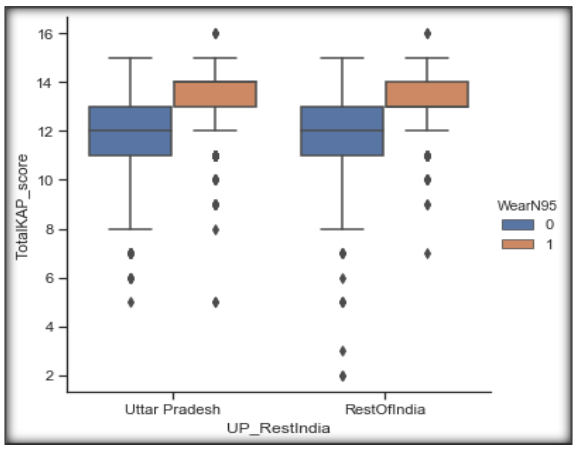


Figure 2: Box plot distribution of KAP score and demographic features.

[Table 8] shows state wise average KAP score and number of participants per state.

Table 8: Average KAP score and number of participants per state.

State	Number of participants	Average Score
Andhra Pradesh	2	13.00
Arunachal Pradesh	3	11.00
Assam	10	10.8
Bihar	165	12.67
Chandigarh	1	12.00
Chhattisgarh	8	12.62
Dadra and Nagar Haveli & Daman and Diu	1	11.00
Gujarat	14	11.93
Haryana	32	11.87
Himachal Pradesh	4	11.50
Jammu and Kashmir	7	12.00
Jharkhand	104	12.28
Karnataka	13	12.54
Kerala	4	13.00
Madhya Pradesh	135	12.49
Maharashtra	32	12.16
Mizoram	1	12.00
National Capital Territory of Delhi	31	12.64
Odisha	4	11.00
Punjab	7	11.71
Rajasthan	31	12.06
Sikkim	2	11.50
Tamil Nadu	5	11.80
Telangana	6	12.00
Tripura	2	15.00
Uttar Pradesh	1367	12.45
Uttarakhand	6	12.50
West Bengal	89	12.81

[Table 9-12] show the results of fitting multinomial logistic regression models for COVID-19 KAP, knowledge, attitude, and practice scores. As shown in Table 9 (the "Sig." column), educational qualification and occupation were independent variables associated with the knowledge score, with $p = 0.06$ and $p < 0.001$, respectively. However, only occupation showed a statistically significant association with the knowledge score at the conventional significance level of $p < 0.05$.

Table 9: Results of multinomial logistic regression on factors associated with COVID-19 KAP score.

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	1552.757	.000	0	.
Age	1569.495	16.738	13	.212
Sex	1564.425	11.668	13	.555
Marital Status	1592.962	40.205	26	.037
Educational Qualification	1604.124	51.367	26	.002
Occupation Re Categorised	1608.844	56.088	26	.001
UP, Rest India	1566.069	13.313	13	.424

Table 10: Results of multinomial logistic regression on factors associated with COVID-19 Knowledge score.

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	1385.874	.000	0	.
Age	1402.875	17.002	12	.150
Sex	1397.922	12.048	12	.442
Marital Status	1415.033	29.159	24	.214
Educational Qualification	1419.268	33.395	24	.096
Occupation Re Categorised	1456.189	70.315	24	.000
UP, RestIndia	1397.372	11.498	12	.487

Table 11: Results of multinomial logistic regression on factors associated with COVID-19 Attitude score.

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	576.650	.000	0	.
Age	579.242	2.592	2	.274
Sex	579.193	2.543	2	.280
Marital Status	581.088	4.438	4	.350

Educational Qualification	584.982	8.332	4	.080
Occupation Re Categorised	580.108	3.458	4	.484
UP, Rest India	579.920	3.270	2	.195

Table 12: Results of multinomial logistic regression on factors associated with COVID-19 Practice score.

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	215.283	.000	0	.
Age	221.028	5.746	1	.017
Sex	225.893	10.611	1	.001
Marital Status	216.878	1.595	2	.450
Educational Qualification	219.452	4.170	2	.124
Occupation Re Categorised	240.232	24.950	2	.000
UP, Rest India	216.608	1.326	1	.250

[Table 13] shows kNN modelling results for each of the questionnaire on knowledge, attitude, and practice.

Table 13: Averaged prediction accuracy of the kNN model learnt for each of the questionnaire.

Knowledge	kNN modelling results		
The main clinical symptoms of COVID-19 are fever, fatigue, dry cough, and myalgia- True	Correctly Classified Instances Incorrectly Classified Instances	1962 124	94.06% 5.94 %
Unlike the common cold, stuffy nose, runny nose, and sneezing are less common in persons infected with the COVID-19 virus- True	Correctly Classified Instances Incorrectly Classified Instances	1174 912	56.28% 43.72%
There currently is no effective cure for COVID-2019, but early symptomatic and supportive treatment can help most- True	Correctly Classified Instances Incorrectly Classified Instances	1976 110	94.73% 5.27%
Not all persons with COVID-19 will develop into severe cases. Only those who are elderly, have chronic illnesses and are obese are more likely to be severe cases- True	Correctly Classified Instances Incorrectly Classified Instances	1508 578	72.29% 27.71%
Eating or coming in contact with wild animals would result in COVID-19 infection- False	Correctly Classified Instances Incorrectly Classified Instances	1933 153	92.66% 7.33%
Persons with COVID-19 cannot infect others when fever is not present- False	Correctly Classified Instances Incorrectly Classified Instances	1742 344	83.51% 16.49%
The COVID-19 virus spreads via respiratory droplets of infected individuals- True	Correctly Classified Instances Incorrectly Classified Instances	1880 206	90.12% 9.87%
General public can wear masks to prevent COVID-19 infection	Correctly Classified Instances Incorrectly Classified Instances	2052 34	98.37% 1.63%
It is not necessary for children and young adults to take measures to prevent the infection by the COVID-19 virus- False	Correctly Classified Instances Incorrectly Classified Instances	1670 416	80.06% 19.94%
General public should wear N95 mask- False	Correctly Classified Instances Incorrectly Classified Instances	1328 758	63.66% 36.34%
To prevent the infection by COVID-19, individuals should avoid going to crowded places such as train stations and avoid taking public transportations- True	Correctly Classified Instances Incorrectly Classified Instances	2019 67	96.79% 3.21%
Isolation and treatment of people who are infected with the COVID-19 virus are effective ways to reduce the spread of the virus- True	Correctly Classified Instances Incorrectly Classified Instances	2001 85	95.92% 4.075%
People who have contact with someone infected with the COVID-19 virus should be immediately isolated in a proper place. In general, the observation period is 14 days- True	Correctly Classified Instances Incorrectly Classified Instances	2001 85	95.92% 4.075%
Attitude			
Do you agree that COVID-19 will finally be successfully controlled? - True	Correctly Classified Instances Incorrectly Classified Instances	1178 908	56.47% 43.53%
Do you agree that India can win the battle against the COVID-19 virus? - True	Correctly Classified Instances Incorrectly Classified Instances	1736 350	83.22% 16.78%
Practice			
In recent days, have you gone to any crowded place? - True	Correctly Classified Instances Incorrectly Classified Instances	1938 148	92.90% 7.095%

From the results obtained for prediction, it can be concluded that most of the questionnaire's outcome was quite well predicted using the kNN classification algorithm.

DISCUSSION

Since its first detection in December 2019, COVID-19 has resulted in an unprecedented crisis in a short period of time. Owing to the uncertainties associated with the pathogenesis of the disease, it is of utmost importance to educate the general population about preventing the spread of the disease. This highlights the importance of understanding the KAP patterns among the general population regarding this pandemic.

Based on our findings, KAP towards COVID-19 was higher among more educated, married, female, and more skilled populations. Based on the knowledge scores of the participants, the majority were educated about COVID-19 symptomatology. Our results are similar to those of a study conducted in China, which also showed an overall correct response rate for knowledge of around 90%.[3] These results can be attributed to the high exposure of the population to information provided by the Government of India through various social platforms. Another reason could be that a larger proportion of the population

held a master's degree and responded actively by collecting information from reliable sources. A positive correlation was observed between the level of education and knowledge regarding COVID-19, similar to previous studies supporting this finding.[3,9] Furthermore, our study showed that participants with higher knowledge scores were more likely to have positive attitudes and good practices regarding the COVID-19 pandemic. These results also signify the importance of educating the general population to enhance their attitudes and practices, particularly among targeted populations such as young, unmarried individuals, females, and unskilled workers.

During the early phase of the COVID-19 outbreak, various KAP studies were conducted by Tomar et al. (2020), Prasad Singh et al. (2020) in India, Maheshwari et al. (2020), Al-Hanawi et al. (2020), Haque et al. (2020) in Bangladesh, Erfani et al. (2020) in Iran, and Azlan et al. (2020) in Malaysia, which supported similar findings.[10,11]

The study is unique as it included populations from various states of the country. The maximum number of participants was from Uttar Pradesh (1,367), followed by Bihar, where the average KAP scores were 12.45 and 12.67, respectively. The highest average score was however, only two participants were enrolled in the study from that state.[12,13]

CONCLUSION

In summary, although a comprehensive analysis of COVID-19 KAP was conducted despite the restrictions during the lockdown, the present study had limited participation from a few states.[13] Therefore, future studies should aim for more uniform representation from all states. The findings suggest acceptable levels of knowledge about the disease and a positive outlook towards overcoming the pandemic. Considering the possibility of a prolonged pandemic and a second wave of COVID-19, innovative measures to increase awareness about prevention and control are urgently needed.

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