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Original Article

Knowledge, Attitudes, and Practices Towards COVID-19 in Iran: A Population-Based Study

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Abstract

Background and aims: The novel coronavirus (COVID-19) epidemic has far been the biggest global health threat of the 21st century. Protective measures are still one of the most effective methods for controlling COVID-19. Practicing hygiene and control measures are largely influenced by knowledge and attitude towards COVID-19. This study aimed to investigate the knowledge, attitude, and practice of Iranians towards COVID-19 as well as the demographic factors related to it in April and May, 2020.

Methods: The study population in this cross-sectional, descriptive-analytical, and web-based study included 3736 Iranian individuals who were collected via convenience sampling method. A validated Iranian knowledge, attitude, and practices (KAP) Questionnaire about COVID-19 was used for collecting the required data. Ordinal multivariate generalized estimating equations (GEEs) were applied to analyze data.

Results: The majority of participants (88.1%) had considerable knowledge, the right attitude (91%), and good practices (90.3%). In the multivariate models, factors related to greater knowledge were age>20 years ($P<0.001$), living in the urban area ($P=0.030$), holding a master's or doctoral degree ($P=0.044$), and a moderate financial status ($P=0.001$). Females displayed mor positive attitude ($P=0.035$). Variables related to more favorable practices were age>20 years ($P<0.001$), and having a good ($P=0.003$) or moderate ($P=0.038$) financial status.

Conclusion: It was concluded that the participants had good knowledge and a positive attitude, as well as adopted sound practices regarding COVID-19. However, this conclusion might not have been generalizable to entire Iranian community; therefore, it was recommended that preventive measures against COVID-19 should receive continued monitoring and emphasis.

Keywords: Attitudes, COVID-19, Knowledge, Practices

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Introduction

The novel coronavirus (COVID-19) epidemic has so far been the biggest global health threat of the 21st century.[1] In 2020, more than 68 million people became infected and more than 1.5 million died from the disease.[2] The most important route of transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is airborne transmission through droplets, droplet nuclei, and contaminated aerosols particles that enter the air by infected people during coughing, sneezing, and talking.[3] The COVID-19 virus is a heterogeneous virus, and the symptoms of the disease varies from asymptomatic and mild to severe and critical symptoms in 10%-20% of the cases.[4] There is a possibility of involvement of various organs such as the respiratory, gastrointestinal, musculoskeletal, and nervous systems. The symptoms vary depending on the organ involved.[5]

There is still insufficient information on how well the vaccines prevent people from spreading the virus, the duration that COVID-19 vaccines protect people, the number of the vaccinated people required to make the population immune, and the effectiveness of the vaccines against new variants of the virus.[6] For these reasons, even people who have been fully vaccinated against COVID-19 should continue implementing the protective measures in public places, such as wearing a mask, staying six feet away

from others, avoiding crowds and poorly ventilated spaces, and washing their hands.[6] Therefore, protective measures are still one of the most important methods for controlling COVID-19.[7]

Taking effective control measures necessarily entails the general awareness of the basic principles of health as well as the methods of disease transmission and prevention.[8,9] Implementing hygiene and control measures is largely influenced by knowledge about and attitude towards COVID-19.[10] Remarkable efforts have been made in Iran to control the disease.[11] It is now a common knowledge that inadequate understanding and wrong attitudes towards the disease can facilitate the spread of disease.[12] Therefore, it is necessary to monitor the knowledge, attitude, and practice of the community, as well to identify pitfalls and suggest strategies for improving them.[13] To this end, the present study aimed to investigate the knowledge, attitude, and practices (KAP) of the Iranian people regarding coronavirus disease during the rapid spread of the disease.

Materials and Methods

Study Design and Participants

The study population in this cross-sectional, descriptive-analytical, and web-based study performed in Iran included 3,736 individuals. The data were collected during April and May, 2020, when the COVID-19 epidemic swept the country. A COVID-19-KAP questionnaire was prepared to assess the KAP of the Iranian community regarding COVID-19. Participation in this study was completely voluntary.

The sample size was calculated based on the method adopted in a study by Zhong et al,[10] in which 90% of the participants were determined to have good knowledge. Assuming 1% acceptable error and a 95% confidence interval (CI), the minimum sample size required for this study was 3458 individuals. Inclusion criteria were age over 18 years, access to the web and social networks to complete the questionnaire, and literacy. This study had no exclusion criteria. The questionnaire was shared via a web link in social networks, including Telegram, WhatsApp, and Instagram. Convenience method was used for collecting data.

Measurement Tool

The questionnaire included four sections, each of which posed questions on four different areas of demographic information, knowledge, attitude, and practice. Demographic questions asked about gender (male, female), age (≤20, 21-30, 31-40, 41-50, > 50), marital status (single, divorced or widow, married), place of residence (urban, rural), education (high school diploma or lower degrees, graduate diploma, bachelor, masters or doctoral degrees), occupation (unemployed, manual worker, student, employee, housewife), financial status based on self-report (good, moderate, poor), previously acquiring COVID-19 (yes, no), chronic pre-existing medical condition (yes, no), and ethnicity (Gilak, Arab, Tork, Kord, Bakhtiari, Azari, Fars, Lor or other).

Knowledge section consisted of 18 questions with 3 responses. As for the responses, scores 0 and 1 were assigned to wrong/"I don't know" and correct answers, respectively. The mean score ranged from 0 to18. We used overall average scores (i.e., sum of total questions values for each person/number of questions) to categorize the scale.[14] The overall average score was between 0 and 1. Individuals with an overall average score of 0-0.339 had limited knowledge, those with 0.340-0.669 had moderate knowledge, and those with 0.670-1 had great knowledge.

The attitude domain had 8 questions which were evaluated based on a 7-point Likert spectrum, from "Strongly disagree = 1" to " Strongly agree = 7". The mean score ranged from 8 to 56. The overall average score was between 1 and 7. The classification was based on the overall average score and the Likert score.[14] A score of 1-3.999 was indicative of a wrong attitude, and that of 4-7 was suggestive of a right attitude.

The practice questionnaire included 10 questions which were measured based on a 5-point Likert scale from "Almost Never = 1" to "Almost Always = 5". Some questions were scored in reverse. The mean score ranged from 10 to 50. The overall average score was between 1 and 5. Scores of 1 to 2.339, 2.340 to 3.669, and 3.670 to 5 were indicative of low practices, moderate practices, and high practices, respectively.[14]

Statistical Analysis

Descriptive and analytical analyzes were performed. In the descriptive part, frequency and percentage were calculated for qualitative variables whereas mean and standard deviations (SD) were evaluated for quantitative variables. In the analytical part, chi-square was used to compare the percentage of KAP variables in the population subgroups.

Generalized estimating equation (GEE) is a general statistical approach to fit a marginal model for performing longitudinal/clustered data analysis, and it has been popularly applied to clinical trials and biomedical studies.[15,16] In the current study, each province was considered as a cluster and, therefore, GEE was used. In this study, moreover, the dependent variable was three states and, as the result, ordinal GEE was adopted and the odds ratio (OR) index was reported after the confirmation of the proportional odds hypothesis. GEEs were applied to determine the relation between KAP and independent variables, since each province had been considered as a cluster. In this study, the dependent variable had three states and, therefore, ordinal univariable and multivariable GEE models were adopted to identify the independent variables related to KAP variables. OR, adjusted odds ratio (AOR), and 95% CIs were reported. All independent variables were entered into the univariable, and variables with a *P*

value of less than 0.2 were entered into the multivariable model. The final model was achieved using a backward selection approach. The response rate to each question is displayed in the graphs. The mean scores of KAP were compared for participants between low, medium, and high incidence provinces using forest plots. A report of the Iran Ministry of Health about the classification of provinces into low, medium, and high incidence was used.

All analyses were performed using SPSS 26 software, and *P* values < 0.05 were considered statistically significant.

Results

Characteristics of Participant

The study population of this study included 3,736 individuals. The majority of the participants were women (62.6%) aged 31-40 (35.1%) and married (74.6%), who were living in the urban area (94.8%) and holding a bachelor's degree (35.8%). The most common occupation group was the group of housewives (32.6%). Most participants had a moderate financial status (69.9%), had not acquired COVID-19 (97.2%), had no chronic pre-existing conditions (85.1%), and were Fars (56.6%). The demographics of the participants are shown in Table 1.

Knowledge, Attitudes, and Practices Toward COVID-19

About 88.1% of the participants had great knowledge, 91% displayed the right attitude, and 90.3% adopted good practices. The situation of the KAP variables in demographic subgroups is presented in Table 1. The percentages of answers to the questions on KAP are shown in Supplementary file 1 (Figures S1-S3). In this study, the mean scores of KAP were 11.99 (±1.51), 48.99 (±11.60) and 43.96 (±5.49), respectively. There was no difference in the mean scores of knowledge (a), attitude (b), and practice (c) between the participants in low, moderate, and high incidence provinces (Figure 1).

Factors Related to KAP Variables

Predictors of knowledge, attitudes, and practices in univariable and multivariate analysis are presented in Tables 2 and 3, respectively. In the multivariable model, participants who were older than 20, including the age groups 21-30 (OR = 2.03, 95% CI: 1.38, 3.00), 31-40 (OR = 3.20, 95% CI: 2.24, 4.58), 41-50 (OR = 3.84, 95% CI: 2.60, 5.66) and over 50 years (OR = 3.67, 95% CI: 3.37, 5.66), as well as those living in the urban area (OR = 1.51, 95% CI: 1.04, 2.19), holding master's or doctoral degrees (OR = 1.89, 95% CI: 1.00, 1.96), and enjoying moderate financial status (OR = 1.52, 95% CI: 1.18, 1.95) showed greater knowledge about COVID-19.

In the multivariable model, moreover, females (OR = 1.29, 95% CI: 1.01, 1.64) displayed a significantly better attitude than males; and participants who were older than 20 including the age subgroups 21-30 (OR = 1.90, 95% CI: 1.26, 2.87), 31-40 (OR = 3.73, 95% CI: 2.53, 5.51), 41-50 (OR = 3.77, 95% CI: 2.48, 5.72), and over 50 years (OR = 5.84, 95% CI: 3.50, 9.73), as well as those having a moderate (OR = 1.34, 95% CI: 1.02, 1.74) or good (OR = 2.02, 95% CI: 1.27, 3.19) financial status adopted significantly more favorable practices toward COVID-19.

Discussion

In this study, majority of the participants had enough knowledge, displayed positive attitudes, and adopted good practices; and some demographic variables were related to the KAP variables.

Our study results were in line with the findings from a study conducted from January 27 to February 1, 2020 in Hubei, China, in which 90% of people were found to have correct knowledge about COVID-19.[10] In Malaysia, the percentages of high knowledge, right attitudes, and favorable practice regarding the control of COVID-19 were 80.5%, 83.1%, and 95.9%, respectively.[17] In another study conducted in Ecuador, about 88% of students had great knowledge about the COVID-19; however, majority (77%) of them displayed wrong attitudes towards the disease.[18] A community-based survey in India from March 10 to April 18, 2020, showed that majority of Indian population demonstrated good knowledge (80.64%), positive attitude (97.33%), and good practices (93.8%) regarding COVID-19.[19] Our study results were also in agreement with the findings from a study conducted in South Korea, showing that Korean females and individuals with higher levels of education had greater knowledge about COVID-19.[20]

Our study findings were also consistent with the results from another study exploring the health care workers of teaching hospitals affiliated to the university in Uganda, which revealed that the factor associated with high knowledge was age > 40 years, and the factors associated with good practice were age ≥40 years and holding a diploma.[21] Some studies have reported that age is an important factor related to the general perception of COVID-19, and the higher age is associated with increased social experience, knowledge and practices.[22] Kumbeni et al carried out a study in Northern Ghana and indicated that older age and living in an urban area were associated with good COVID-19 preventive practices. In this study, older age, gender (female), and good financial status were detected to have relationship with practices.[23] In addition, knowledge and practice were discovered to be more favorable among older individuals. Given the fact that the old age is a risk factor causing severe complications and mortality for older people afflicted with COVID-19,[24] they were more likely to take good COVID-19 preventive measures against the infection.[23]

According to our study findings, married people had a more positive attitude than single ones. By way of explanation, married individuals – in addition to protecting themselves – are also responsible for caring for

Table 1. The Mean (±SD) of the KAP Variables in Demographic Subgroups (N = 3736)

Variables	No. (%)	Knowledge				Attitude			Practices			
		Low	Moderate	High	*P* Value	Wrong	Right	*P* Value	Weak	Moderate	Strong	*P* Value
Overall	3736	22 (0.6)	422 (11.3)	3292 (88.1)	-	336 (9.0)	3400 (91.0)	-	30 (0.8)	331 (8.9)	3375 (90.3)	-
Gender												
Male	1396 (37.4)	13 (0.9)	168 (12.0)	1215 (87.0)	0.053	106 (7.6)	1290 (92.4)	0.021	18 (1.3)	204 (14.6)	1174 (84.1)	<0.001
Female	2340 (62.6)	9 (0.4)	254 (10.9)	2077 (88.8)		230 (9.8)	2110 (90.2)		12 (0.5)	127 (5.4)	2201 (94.1)	
Age (y)												
20 and under	257 (6.9)	7 (2.7)	66 (25.7)	184 (71.6)		29 (11.3)	228 (88.7)		9 (3.5)	48 (18.7)	200 (77.8)	
21-30	772 (20.7)	8 (1.0)	110 (14.2)	654 (84.7)		61 (7.9)	711 (92.1)		10 (1.3)	100 (13.0)	662 (85.8)	
31-40	1310 (35.1)	2 (0.2)	130 (9.9)	1178 (89.9)	<0.001	124 (9.5)	1186 (90.5)	0.850	5 (0.4)	97 (7.4)	1208 (92.2)	<0.001
41-50	799 (21.4)	2 (0.3)	66 (8.3)	731 (91.5)		65 (8.1)	734 (91.9)		3 (0.4)	58 (7.3)	738 (92.4)	
Over 50	598 (16.0)	3 (0.5)	50 (8.4)	545 (91.1)		57 (9.5)	541 (90.5)		3 (0.5)	28 (4.7)	567 (94.8)	
Marital status												
Single	843 (22.6)	11 (1.3)	141 (16.7)	169 (82.0)		75 (8.9)	768 (91.1)		18 (2.1)	117 (13.9)	708 (84.0)	
Divorced/ Widow	105 (2.8)	0 (0)	12 (11.4)	93 (88.6)	<0.001	16 (15.2)	89 (84.8)	0.737	3 (2.9)	6 (5.7)	96 (91.4)	<0.001
Married	2788 (74.6)	11 (0.4)	269 (9.6)	2508 (90.0)		245 (8.8)	2543 (91.2)		9 (0.3)	208 (7.5)	2571 (92.2)	
Residence												
Urban	3543 (94.8)	20 (0.6)	384 (10.8)	3139 (88.6)	<0.001	322 (9.1)	3221 (90.9)	0.386	27 (0.8)	296 (8.4)	3220 (90.9)	<0.001
Village	193 (5.2)	2 (1.0)	38 (19.7)	153 (79.3)		14 (7.3)	179 (92.7)		3 (1.6)	35 (18.1)	155 (80.3)	
Education												
High School Diploma or less	1270 (34.0)	10 (0.8)	183 (14.4)	1077 (84.8)		125 (9.8)	1145 (90.2)		16 (1.3)	126 (9.9)	1128 (88.8)	
Graduate Diploma	482 (12.9)	4 (0.8)	61 (12.7)	417 (86.5)	<0.001	44 (9.1)	438 (90.2)	0.553	4 (0.8)	37 (7.7)	441 (91.5)	0.022
Bachelor	1300 (35.8)	5 (0.4)	122 (9.4)	1173 (90.2)		95 (7.3)	1205 (92.7)		6 (0.5)	112 (8.6)	1182 (90.9)	
Masters/ Doctorate	684 (18.3)	3 (0.4)	56 (8.2)	625 (91.4)		72 (10.5)	612 (89.5)		4 (0.6)	56 (8.2)	624 (91.2)	
Job												
Unemployed	198 (5.3)	1 (0.5)	30 (15.2)	167 (84.3)		19 (9.6)	179 (90.4)		5 (2.5)	25 (12.6)	168 (84.8)	
Manual worker	186 (5.0)	2 (1.1)	23 (12.4)	161 (86.6)		14 (7.5)	172 (92.5)		3 (1.6)	24 (12.9)	159 (85.5)	
Student	438 (11.7)	9 (2.1)	82 (18.7)	347 (79.2)	<0.001	47 (10.7)	391 (89.3)	0.870	8 (1.8)	66 (15.1)	364 (83.1)	<0.001
Freelance	492 (13.2)	3 (0.6)	65 (13.2)	424 (86.2)		40 (8.1)	452 (91.9)		8 (1.6)	62 (12.6)	422 (85.8)	
Employee	1204 (32.2)	4 (0.3)	97 (8.1)	1103 (91.6)		103 (8.6)	1101 (91.4)		5 (0.4)	95 (7.9)	1104 (91.7)	
Housewife	1218 (32.6)	3 (0.2)	125 (10.3)	1090 (89.5)		113 (9.3)	1105 (90.7)		1 (0.1)	59 (4.8)	1158 (95.1)	
Financial status												
Good	462 (12.4)	4 (0.9)	54 (11.7)	404 (87.4)		50 (10.8)	412 (89.2)		2 (0.4)	29 (6.3)	431 (93.3)	
Moderate	2611 (69.9)	14 (0.5)	264 (10.1)	2333 (89.4)	0.032	219 (8.4)	2392 (91.6)	0.910	17 (0.7)	220 (8.4)	2374 (90.9)	<0.001
Poor	663 (17.7)	4 (0.6)	104 (15.7)	555 (83.7)		67 (10.1)	596 (89.9)		11 (1.7)	82 (12.4)	570 (86.0)	
Having COVID-19 disease												
Yes	106 (2.8)	5 (4.7)	11 (10.4)	90 (84.9)	0.028	13 (12.3)	93 (87.7)	0.233	6 (5.7)	10 (9.4)	90 (84.9)	0.001
No	3630 (97.2)	17 (0.5)	411 (11.3)	3202 (88.2)		323 (8.9)	3307 (91.1)		24 (0.7)	321 (8.8)	3285 (90.5)	
Chronic pre-existing conditions												
Yes	557 (14.9)	5 (0.9)	59 (10.6)	493 (88.5)	0.950	49 (8.8)	508 (91.2)	0.861	4 (0.7)	55 (9.9)	498 (89.4)	0.514
No	3179 (85.1)	17 (0.5)	363 (11.4)	2799 (88.0)		287 (9.0)	2892 (91.0)		26 (0.8)	276 (8.7)	2877 (90.5)	
Ethnicity												

Table 1. Cotinued

Variables	No. (%)	Knowledge				Attitude			Practices			
		Low	Moderate	High	*P* Value	Wrong	Right	*P* Value	Weak	Moderate	Strong	*P* Value
Gilak	55 (1.5)	1 (1.8)	7 (12.7)	47 (85.5)		6 (10.9)	49 (89.1)		1 (1.8)	6 (10.9)	48 (87.3)	
Arab	91 (2.4)	0 (0)	12 (13.2)	79 (86.8)		7 (7.7)	84 (92.3)		1 (1.1)	15 (16.5)	75 (82.4)	
Tork	162 (4.3)	2 (1.2)	22 (13.6)	138 (85.2)		9 (5.6)	153 (94.4)		1 (0.6)	16 (9.9)	145 (89.5)	
Kord	179 (4.8)	1 (0.6)	15 (8.4)	163 (91.1)		14 (7.8)	165 (92.2)		3 (1.7)	19 (10.6)	157 (87.7)	
Bakhtiari	217 (5.8)	5 (2.3)	29 (13.4)	183 (84.3)	0.007	18 (8.3)	199 (91.7)	0.412	5 (2.3)	23 (10.6)	189 (87.1)	<0.001
Azari	267 (7.1)	1 (0.41)	23 (8.6)	243 (91.0)		25 (9.4)	242 (90.6)		2 (0.7)	10 (3.7)	255 (95.5)	
Other	320 (8.6)	5 (1.6)	45 (14.1)	270 (84.4)		40 (12.5)	280 (87.5)		4 (0.7)	55 (9.9)	498 (89.4)	
Lor	331 (8.9)	0 (0)	41 (12.4)	290 (87.6)		27 (8.2)	304 (91.8)		2 (0.6)	36 (10.9)	293 (88.5)	
Fars	2114 (56.6)	7 (0.3)	228 (10.8)	1879 (88.9)		190 (9.0)	1924 (91.0)		9 (0.4)	167 (7.9)	1938 (91.7)	

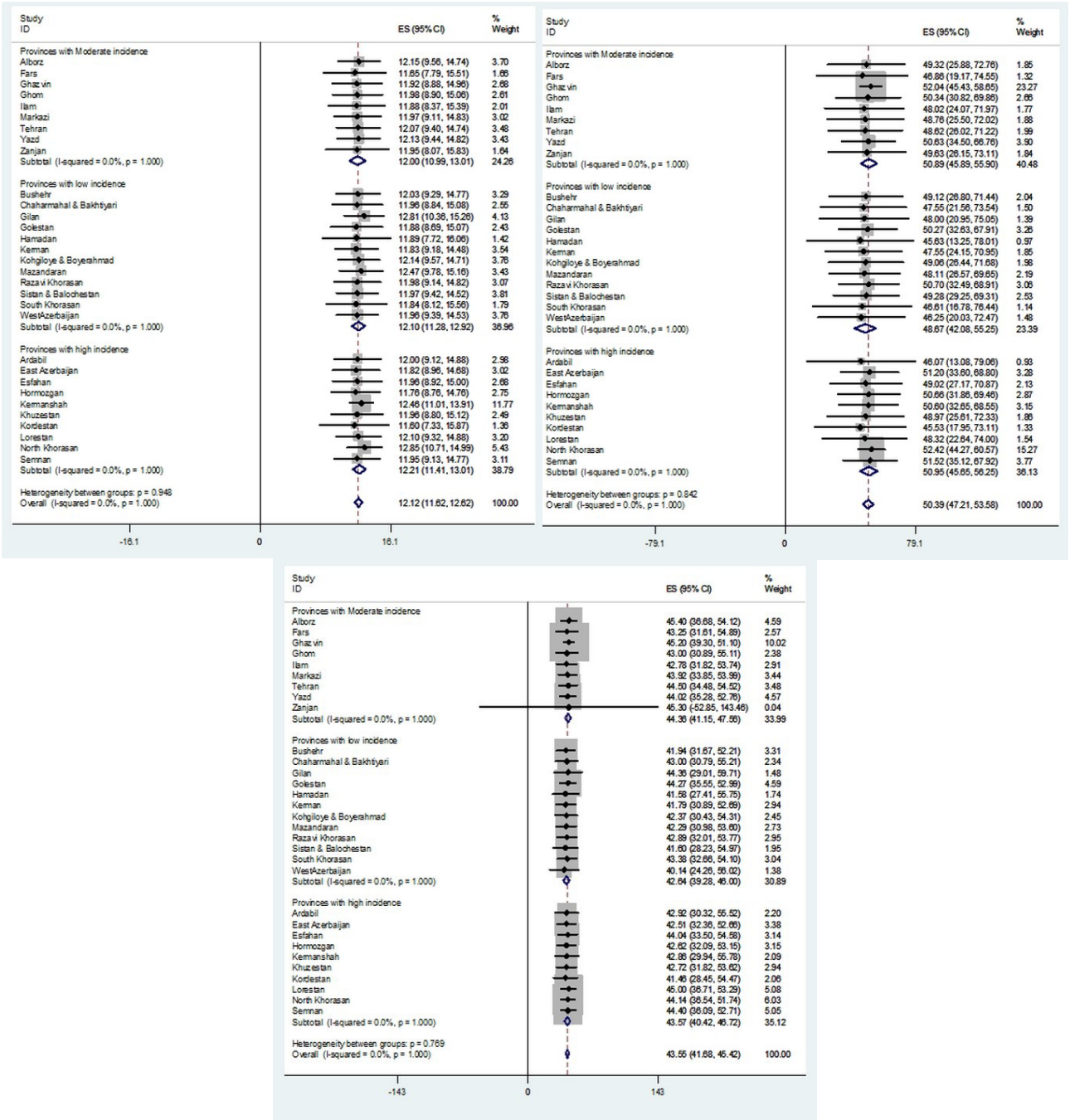

Figure 1. Comparing the Mean Scores of Knowledge (a), Attitude (b) and Practices (c) of the Provinces

Table 2. Univariable Ordinal Generalized Estimating Equation Models to Determine Factors Significantly Associated With KAP Toward COVID-19 in Iran (N = 3736)

Variables	Knowledge		Attitude		Practices	
	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
Gender						
Female	0.84 (0.69, 1.03)	0.104	1.32 (1.04, 1.68)	0.021	0.33 (0.26, 0.41)	<0.001
Male	1	1	1	1	1	1
Age (y)						
21-30	2.22 (1.58, 3.12)	<0.001	1.19 (0.80, 1.75)	0.377	1.74 (1.22, 2.48)	0.002
31-40	3.60 (2.58, 5.03)	<0.001	1.00 (0.73, 1.39)	0.963	3.44 (2.45, 4.85)	<0.001
41-50	4.33 (3.00, 6.26)	<0.001	1.22 (0.84, 1.78)	0.284	3.52 (2.42, 5.11)	<0.001
Over 50	4.13 (2.74, 6.22)	<0.001	0.82 (0.52, 1.31)	0.424	5.30 (3.33, 8.43)	<0.001
20 and under	1	1	1	1	1	1
Marital status						
Single	0.50 (0.40, 0.62)	<0.001	0.98 (0.76, 1.27)	0.918	0.43 (0.34, 0.54)	<0.001
Divorced/ Widow	0.87 (0.49, 1.54)	0.634	0.53 (0.31, 0.91)	0.021	0.87 (0.44, 1.73)	0.703
Married	1	1	1	1	1	1
Residence						
Urban	2.02 (1.42, 2.88)	<0.001	0.78 (0.43, 1.41)	0.416	2.43 (1.70, 3.48)	<0.001
Rural	1	1	1	1	1	1
Education						
Graduate diploma	1.14 (0.85, 1.53)	0.357	0.92 (0.69, 1.24)	0.615	1.35 (0.92, 1.99)	0.118
Bachelor	1.65 (1.31, 2.08)	<0.001	1.38 (1.05, 1.82)	0.021	1.27 (0.98, 1.63)	0.061
Masters/Doctorate	1.89 (1.38, 2.59)	<0.001	1.08 (0.76, 1.54)	0.645	1.31 (0.97, 1.77)	0.072
High school diploma or less	1	1	1	1	1	1
Job						
Unemployed	0.63 (0.40, 0.98)	0.042	0.96 (0.56, 1.65)	0.893	0.28 (0.17, 0.46)	<0.001
Manual worker	0.75 (1.48, 1.17)	0.207	1.25 (0.71, 2.21)	0.430	0.30 (0.19, 0.48)	<0.001
Student	0.44 (0.33, 0.59)	<0.001	0.85 (0.59, 1.21)	0.378	0.25 (0.17, 0.36)	<0.001
Freelance	0.73 (0.53, 1.00)	0.053	1.15 (0.80, 1.66)	0.439	0.31 (0.21, 0.45)	<0.001
Employee	1.28 (0.97, 1.68)	0.081	1.09 (0.82, 1.45)	0.540	0.57 (0.40, 0.80)	0.001
Housewife	1	1	1	1	1	1
Financial status						
Good	1.34 (0.94, 1.19)	0.098	0.92 (0.64, 1.34)	0.685	2.28 (1.52, 3.42)	<0.001
Moderate	1.62 (1.28, 2.07)	<0.001	1.22 (0.92, 1.63)	0.159	1.64 (1.28, 2.10)	<0.001
Poor	1	1	1	1	1	1
Having COVID-19 disease						
Yes	0.71 (0.38, 1.33)	0.293	0.69 (0.38, 1.25)	0.233	0.56 (0.31, 0.98)	0.044
No	1	1	1	1	1	1
Chronic pre-existing conditions						
Yes	1.04 (0.76, 1.41)	0.796	1.02 (0.74, 1.43)	0.866	0.88 (0.65, 1.20)	0.442
No	1	1	1	1	1	1
Ethnicity						
Gilak	0.72 (0.35, 1.48)	0.377	0.80 (0.30, 2.11)	0.663	0.61 (0.25, 1.46)	0.273
Arab	0.82 (0.44, 1.54)	0.553	1.18 (0.53, 2.60)	0.673	0.42 (0.24, 0.74)	0.003
Tork	0.71 (0.46, 1.10)	0.132	1.67 (0.84, 3.33)	0.139	0.77 (0.47, 1.26)	0.308
Kord	1.26 (0.75, 2.14)	0.373	1.16 (0.66, 2.02)	0.593	0.64 (0.39, 1.05)	0.081
Bakhtiari	0.66 (0.44, 0.97)	0.037	1.09 (0.65, 1.80)	0.733	0.60 (0.39, 0.92)	0.021
Azari	1.26 (0.80, 1.97)	0.303	0.95 (0.60, 1.49)	0.844	1.91 (1.06, 3.46)	0.031
Other	0.66 (0.48, 0.91)	0.013	0.69 (0.47, 1.01)	0.056	0.54 (0.37, 0.79)	0.002
Lor	0.88 (0.62, 1.26)	0.512	1.11 (0.71, 1.72)	0.635	0.70 (0.48, 1.02)	0.063
Fars	1	1	1	1	1	1

Table 3. Multivariable Ordinal Generalized Estimating Equation Models to Determine Factors Significantly Associated With KAP Toward COVID-19 in Iran (N = 3736)

Variables	Knowledge		Attitude		Practices	
	OR (95% CI)	*P* value	OR (95% CI)	*P* value	OR (95% CI)	*P* value
Gender						
Female	-	-	1.29 (1.01, 1.64)	0.035	0.32 (0.25, 0.40)	<0.001
Male	-	-	1	1	1	1
Age (y)						
21-30	2.03 (1.38, 3.00)	<0.001	-	-	1.90 (1.26, 2.87)	0.002
31-40	3.20 (2.24, 4.58)	<0.001	-	-	3.73 (2.53, 5.51)	<0.001
41-50	3.84 (2.60, 5.66)	<0.001	-	-	3.77 (2.48, 5.72)	<0.001
Over 50	3.67 (2.37, 5.66)	<0.001	-	-	5.84 (3.50, 9.73)	0.001
20 and under	1	1	-	-	1	1
Marital status						
Single	-	-	0.98 (0.76, 1.27)	0.889	-	-
Divorced/ Widow	-	-	0.57 (0.34, 0.97)	0.042	-	-
Married	-	-	1	1	-	-
Residence						
Urban	1.51 (1.04, 2.19)	0.030	-	-	-	-
Village	1	1	-	-	-	-
Education						
Graduate Diploma	0.96 (0.70, 1.30)	0.795	-	-	-	-
Bachelor	1.28 (0.99, 1.67)	0.055	-	-	-	-
Masters/ Doctorate	1.89 (1.00, 1.96)	0.044	-	-	-	-
High school diploma or less	1	1	-	-	-	-
Financial status						
Good	1.39 (0.95, 1.02)	0.088	-	-	2.02 (1.27, 3.19)	0.003
Moderate	1.52 (1.18, 1.95)	0.001	-	-	1.34 (1.02, 1.74)	0.038
Poor	1	1	-	-	1	1

their families. Therefore, they tend to learn more about preventive behaviors, have a more positive attitude, and take preventive measures more seriously.[25]

Great knowledge, right attitude, and good practices of people may be due to their continuous pursuit of COVID-19 information on the news. Usually, people hear the news about COVID-19 from social media, internet, news media (TV/video, magazines, newspapers), family, friends, school, and health-care providers (e.g., the doctors).[26] The knowledge, attitudes, and practices that people show regarding a disease play an vital role in determining society's readiness to control the disease.[17] As long as the treatment of COVID-19 and approved effective vaccines against new variants of the virus are not developed, it is necessary to follow the hygienic instructions.[27]

This study faced some limitations. First, the web-based sampling method was adopted in this study. Second, only volunteers participated in this study, which may not have been a good representative of the entire population. However, the limitations may have been justified considering the fact that face to face data collection was not possible due to the risky situation existed during the studied period.

Conclusion

It was concluded the majority of participants had great knowledge and right attitude, as well as adopted proper practices. However, some population subgroups were found to face unfavorable situation and need more information and support. It was recommended that that preventive measures against COVID-19 should receive continued monitoring and emphasis.

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Authors' Contribution

ST and AA conceived of the presented idea. ZJ and VK developed the theory and performed the proposal. ST and RE performed the analyses. ST, NK, and MM took the lead in writing the manuscript. All authors discussed the results and contributed to the final manuscript.

Conflict of Interest Disclosures

The authors declare that they have no conflict of interests.

Ethical Approval

Ethics approval was obtained from the Shahrekord University of

Medical Sciences with the ethical code IR.SKUMS.REC.1399.026.

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Supplementary files
Supplementary file 1 contains Figures S1- S3.

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