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Knowledge, attitudes, risk perceptions, and practices of adults toward COVID-19: a population and field-based study from Iran

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Abstract

Objectives To determine peoples' knowledge, attitudes, risk perceptions, and practices to provide policymakers pieces of field-based evidence and help them in the management of the COVID-19 epidemic.

Methods This population-based survey was conducted using multi-stage stratified and cluster sampling in Shiraz, Iran. A total of 1331 persons were interviewed. The questionnaires were completed by face-to-face interviews. Univariable and multivariable (linear regression) data analyses were done using SPSS.

Results The participants answered 63% of questions regarding knowledge, and 78% of questions regarding practice correctly. Only, 4.8% knew about common symptoms of COVID-19 and 7.3% about warning signs that require referral to hospitals. Males, lower educated people, and elders had a lower level of knowledge and poorer practices. Knowledge was also lower in the marginalized (socially deprived) people. Knowledge and practices' correlation was 37%. Overall, 43.6% considered themselves at high risk of COVID-19, and 50% considered it as a severe disease. This disease had negative effects on most participants' routine activities (69.1%). The participants preferred to follow the news from the national TV/Radio, social networks, and foreign satellite channels, respectively.

Conclusions Encouragement of people to observe preventive measures and decreasing social stress, especially among males, lower educated people, elders, and marginalized groups, are highly recommended.

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Introduction

A recently detected novel coronavirus (nCoV), named as "SARS-CoV-2," causes "coronavirus disease 2019" (COVID-19) (WHO 2020b) with a clinical spectrum ranges from asymptomatic or mild respiratory symptoms to rapid death (Sahu et al. 2020; Tavakoli et al. 2020; WHO 2020b). COVID-19 was first reported in a hospital in Wuhan city, the capital of Hubei Province, China on 29th December 2019. Subsequently, the disease spread rapidly throughout the country. The first case of COVID-19 out of China was confirmed in Thailand on 13th January 2020. Iran reported the first confirmed case of COVID-19 in Qom, a city near Tehran; the capital city of Iran on 20th February 2020. World Health Organization (WHO) characterized this disease as a pandemic on 11th March 2020.

Up to now, it has been spread to all continents other than Antarctica (Cheng and Shan 2020; WHO 2020d). Until 23rd March 2020, the number of confirmed infected people and the number of deaths because of this disease reached 332,930 and 14,510 worldwide, respectively, that shows a 4.3% mortality rate (WHO 2020a). Until 23rd March 2020, Iran has been ranked as the fifth country in the world in terms of confirmed COVID-19 cases (21,638 cases) with about 7.7% mortality (1685 cases), which is around two times of the global level (WHO 2020a). In the Fars which is the fourth-most-populous province of Iran, 552 confirmed cases of COVID-19 and 17 dead cases were reported till 23rd March 2020 (SUMS 2020). A risk assessment by WHO declared that there is a very high level of risk regarding this pandemic, which shows a need for immediate action (WHO 2020a). On the other hand, previous pieces of evidence about severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS), and Ebola showed that public knowledge, attitudes, and perceived risks have a determining role in controlling the epidemics (Almutairi et al. 2015; Choi and Kim 2018; Madhav et al. 2017; WHO 2020c; Yap et al. 2010). It should be mentioned that several strategies have been established at both national and local levels in our country and in line with WHO guidelines to improve people's knowledge and practices regarding COVID-19. Among these strategies were the closure of unnecessary businesses, public transportation, schools, and universities, publishing some preventive protocols, and educating people through national and local TV programs and social media. Therefore, this study was conducted to determine the level of knowledge, attitudes, risk perceptions, and practices of adults about transmission, prevention, treatment, and following the news about COVID-19, providing policymakers pieces of field-based evidence to help them in the management of this epidemic.

Methods

Study setting

This cross-sectional and population-based study was performed from February 2020 to March 2020, in Shiraz, in the southwest of Iran. Shiraz with a population of about 2 million is the capital city of Fars; the fourth widest and the fourth-most-populated province in Iran. The statistical population in this study was people aged at least 15 years. The sample size was calculated as 1200, according to the frequency of correct knowledge of 50% in the pilot test that was conducted on 20 citizens, confidence interval of 95%, error of 5%, and design effect of 1.5. We used a multi-stage stratified and cluster sampling to conduct this study. At first, we divided Shiraz into five geographical regions (North, South, Center, East, and West) and allocated an equal sample size for each region. For generalization of the results to the population of this city, sampling protocol was set in accordance with the Shiraz population's distribution in gender and age group based on the last National Population Census in 2016. Then, according to time-location sampling, we defined three main streets in each region. The questionnaires were completed in the morning, evening, and night in the selected streets. Only, residents of the defined regions were recruited, and if there were more than one person walking together on the street, only one of them was requested for an interview. There were not any other exclusion criteria, except non-willingness to participate in this study. Nineteen trained interviewers filled the questionnaires by face-to-face and in-personal interviews with selected persons.

Data collection and quality assurance

Initially, interviewers introduced themselves to the selected persons verbally and by showing their identification cards. Then, the aims of this study were explained to all participants while keeping at least 1–1.5 m physical distance from interviewees. After accepting to participate in this study, an interview was done with them. The questionnaire consisted of 52 questions: 6 demographic items, 17 knowledge-based, and 18 practice-based questions about transmission, prevention, and treatment of COVID-19, 10 questions regarding attitudes and risk perceptions, and 1 question about the source of COVID-19 news. There are several conceptual frameworks in health behavior research such as the health belief model (HBM) and the behavior change wheel (Ajzen and Fishbein 2005; Glanz et al. 2008; Michie et al. 2011). We selected the HBM as the main conceptual framework of this study and tried to design the questionnaire based on HBM asking some questions in different fields including knowledge, practice, risk perception, cues to action, facilitators, and barriers. For scoring of knowledge, we divided the questions into two subgroups; 8 questions included three options: completely correct, incompletely correct, and incorrect/not knowing the answer, while 9 questions included two options: correct and incorrect/not knowing the answer. The total score of knowledge was up to 25. For scoring of practices, 13 questions were scored on a 5-point Likert scale and 5 questions were scored on a 2-point scale (yes/no answers) with the maximum score of 70. We considered if the achieved score was less than 40%, 40% to 70%, and more than 70% of total achievable scores in both knowledge and practice sections as "inappropriate," "roughly appropriate," and "appropriate," respectively. The face and content validity of the questionnaire, which had been designed in

Persian, was confirmed by an expert panel consisted of experienced epidemiologists, virologists, and regional health policymakers in three sessions. The reliability of the questionnaire was calculated based on the pilot test. The Cronbach's alpha was 64.1% for the knowledge, 78.1% for the attitudes, 82.3% for the practices, and 65.5% for the whole questionnaire. Quality assurance was accomplished by supervision on the data collection process, data extraction, data entry to the software, and data analysis.

Data analysis

The data were entered into IBM SPSS 20 software. Univariable analysis was done using a *t*-test and analysis of variance (ANOVA). The correlation between knowledge and practices was evaluated by the Pearson correlation coefficient test. Multivariable analysis was done using linear regression after checking collinearity and VIF factors. In this study, $p < 0.05$ was considered as the significant level.

Results

A total of 1331 persons participated in this study. Their mean of age was 36 ± 13.9 years, the female-to-male ratio was 1.1, and 52.4% were married. Out of all participants, 45.7% were educated up to 12 years and the same percentage had a kind of job. About half of the responders were residents of the north and south of Shiraz (Table 1). The mean score of knowledge was 15.9 ± 3.5, while the mean score of practices was 55.1 ± 8.1, showing 63% and 78% of total achievable scores, respectively. Knowledge and practices had a correlation of 0.37 ($p < 0.001$). The most frequent correct responses to the knowledge questions were about properly wearing the face mask (74%) and the least frequent ones were about common symptoms of COVID-19 (4.8%) and warning signs that require referral to the hospitals (7.3%) (Table 2). In terms of attitudes, 53.1% believed that preventive measures are highly observed in the community, while 68.6% believed that they themselves highly applied preventive measures. Moreover, 43.6% considered themselves at high risk of COVID-19, and 50% considered it as a severe and lethal disease. According to the answers by 69.1% of participants, this epidemic had highly negative effects on their routine activities (Table 3). The most frequent appropriate practice was the reduction of unnecessary out-of-home commuting (72.1%), and the least frequent one was keeping a 1-m distance from others (17.1%). Furthermore, 63.5% of the participants had increased their drinking water, 17.7% traveled outside the city, and 19.1% were in contact with patients with at least one of the three symptoms of fever,

Table 1 Demographic characteristics of participants in a survey about COVID-19 from Iran, 2020 (*n* = 1331)

Characteristics	
Age (year)	
Mean ± SD	36 ± 13.9
Median(min–max)	33 (14–82)
15–19 n (%)	133 (10)
20–29	391 (29.4)
30–39	341 (25.6)
40–49	214 (16.1)
50–59	156 (11.7)
60≤	96 (7.2)
Gender n (%)	
Male	629 (47.3)
Female	702 (52.7)
Marital status n (%)	
Single	554 (41.6)
Married	697 (52.4)
Education n (%)	
Illiterate	28 (2.1)
Lower than diploma	217 (16.3)
Diploma	364 (27.3)
Associate degree	174 (13.1)
Bachelors	355 (26.7)
Masters	127 (9.5)
Doctorate	23 (1.7)
Job status n (%)	
Unemployed	468 (35.2)
Public sector's employee	191 (14.4)
Private sector's employee	418 (31.4)
Retired	81 (6.1)
Geographical region of living in the city	
North	357 (26.8)
South	302 (22.7)
Central	208 (15.6)
East	202 (15.2)
West	262 (19.7)

dry cough, or dyspnea during 2 weeks before this study (Table 4). Nearly half of the interviewees (46%) declared that their first action was to refer to the medical doctors' clinics upon the occurrence of any suspected symptom of COVID-19, while 22.5% stated that their action was to refer to the public hospitals, the choice of 5.3% was to refer to the private hospitals, and 13.9% announced that they stayed at home for self-treatment. The univariable analysis in Table 5 shows that males had a lower level of correct knowledge and had more inappropriate practices about different aspects of COVID-19 than females. Elders also had a lower level of knowledge compared to other age

Table 2 Knowledge of participants about COVID-19 in a survey from Iran, 2020

No	Item	Completely correct n (%)	Incompletely correct n (%)	Completely incorrect n (%)	Don't know n (%)
K1	Is it possible that someone gets COVID-19, while being asymptomatic?	815 (61.2)	–	290 (21.8)	208 (15.6)
K2	After being infected with COVID-19, how many days does it take to show its symptoms?	834 (62.7)	4 (0.3)	172 (12.9)	289 (21.7)
K3	What are the transmission routes of COVID-19?	767 (57.6)	536 (40.3)	3 (0.2)	14 (1.1)
K4	What are the preventive routes of infection by COVID-19?	663 (49.8)	650 (48.8)	1 (0.1)	3 (0.2)
K5	Which symptoms of COVID-19 are more frequent?	64 (4.8)	1170 (87.9)	60 (4.5)	16 (1.2)
K6	In terms of COVID-19, what are the warning signs for going to the hospital?	97 (7.3)	945 (71)	236 (17.7)	33 (2.5)
K7	What phone number you call, if you have any questions about COVID-19?	362 (27.2)	0 (0)	377 (28.3)	443 (33.3)
K8	Which groups of people are at higher risk for mortality following getting COVID-19?	917 (68.9)	383 (28.8)	5 (0.4)	13 (1.0)
K9	How the hands should be washed properly?	985 (74)	0 (0)	294 (22.1)	23 (1.7)
K10	What is the minimum time for proper hand washing?	802 (60.3)	0 (0)	418 (31.4)	66 (5.0)
K11	Do you know the different types of face masks and their uses?	209 (15.7)	687 (51.6)	–	355 (26.7)
K12	How long can you leave a mask on your face?	948 (71.2)	136 (10.2)	145 (10.9)	72 (5.4)
K13	How a face mask should be worn properly?	996 (74.8)	–	–	287 (21.6)
K14	How a used face mask should be disposed properly?	849 (63.8)	–	–	453 (34)
K15	How a used glove should be disposed properly?	837 (62.9)	–	–	463 (34.8)
K16	How COVID-19 patients should be cared at home?	817 (61.4)	–	–	479 (36)
K17	Is the flu vaccine protective against COVID-19?	576 (43.3)	–	96 (7.2)	494 (37.1)

Table 3 Attitudes and risk perceptions about COVID-19 in a survey from Iran, 2020

No	Item	Very high n (%)	High n (%)	Moderate n (%)	Low n (%)	Very low n (%)	None n (%)
A1	To what extent preventive measures against COVID-19 are observed in the community?	292 (21.9)	415 (31.2)	413 (31)	116 (8.7)	48 (3.6)	19 (1.4)
A2	To what extent do you observe the preventive measures against COVID-19?	344 (25.8)	570 (42.8)	303 (22.8)	51 (3.8)	11 (0.8)	22 (1.7)
A3	To what extent, do you consider yourself at risk of getting COVID-19?	197 (14.8)	383 (28.8)	352 (26.4)	204 (15.3)	96 (7.2)	65 (4.9)
A4	How much do you afraid of getting COVID-19?	208 (15.6)	422 (31.7)	317 (23.8)	175 (13.1)	78 (5.9)	99 (7.4)
A5	How much do you afraid of getting COVID-19 by your family?	415 (31.2)	417 (31.3)	265 (19.9)	120 (9.0)	43 (3.2)	37 (2.8)
A6	How much do your family members are concerned about getting COVID-19?	362 (27.2)	442 (33.2)	314 (23.6)	109 (8.2)	36 (2.7)	29 (2.2)
A7	To what extent do you think COVID-19 is a dangerous and deadly disease?	258 (19.4)	407 (30.6)	418 (31.4)	150 (11.3)	43 (3.2)	19 (1.4)
A8	If you are suspected to have COVID-19, how prepared are you to do the related test?	624 (46.9)	384 (28.9)	171 (12.8)	60 (4.5)	32 (2.4)	15 (1.1)
A9	If you are suspected to have COVID-19, to what extent do you hold yourself responsible for the health of others and follow the preventive measures more precisely?	841 (63.2)	278 (20.9)	114 (8.6)	37 (2.8)	16 (1.2)	12 (0.9)
A10	To what extent has COVID-19 had a negative influence on your routine life?	469 (35.2)	451 (33.9)	229 (17.2)	74 (5.6)	36 (2.7)	33 (2.5)

Table 4 Practices of participants about COVID-19 in a survey from Iran, 2020

No	Item	Always n (%)	Often n (%)	Sometimes n (%)	Rarely n (%)	Never n (%)
P1	How often do you wash or disinfect your hands?	676 (50.8)	437 (32.8)	158 (11.9)	24 (1.8)	13 (1.0)
P2	How often do you avoid touching your face and eyes with unwashed hands?	555 (41.7)	466 (35.0)	225 (16.9)	30 (2.3)	27 (2.0)
P3	How often do you use a face mask?	397 (29.8)	407 (30.6)	300 (22.5)	90 (6.8)	109 (8.2)
P4	How often do you use a face mask, paper tissue, or elbow when sneezing, coughing, or having runny nose?	470 (35.3)	517 (38.8)	224 (16.8)	60 (4.5)	31 (2.3)
P5	How often do you throw your used face masks and tissue papers in separate bags and then in a bin?	393 (29.5)	443 (33.3)	260 (19.5)	100 (7.5)	104 (7.8)
P6	How often do you regularly disinfect surfaces of personal objects and places?	335 (25.2)	461 (34.6)	315 (23.7)	111(8.3)	70 (5.3)
P7	How often do you shake hands with others?	37 (2.8)	77 (5.8)	252 (18.9)	346 (26)	583 (43.8)
P8	How often do you kiss others?	20 (1.5)	62 (4.7)	164 (12.3)	314 (23.6)	745 (56.0)
P9	How often do you hug others?	23 (1.7)	61 (4.6)	162 (12.2)	312 (23.4)	744 (55.9)
P10	How often do you keep at least 1–1.5 m distance from others?	227 (17.1)	313 (23.5)	367 (27.6)	256 (19.2)	126 (9.5)
P11	How often do you follow the news about COVID-19?	416 (31.3)	478 (35.9)	239 (18.0)	104 (7.8)	52 (3.9)
P12	How often do you try to teach other people about the prevention of getting COVID-19?	343 (25.8)	460 (34.6)	301 (22.6)	122 (9.2)	69 (5.2)
P13	How often do you or your family cook eggs or meat properly before consumption?	902 (67.8)	309 (23.2)	48 (3.6)	30 (2.3)	7 (0.5)

groups, while practices were nearly inappropriate in teenagers. Illiterate people had both a lower level of knowledge and practice. The married participants had lower knowledge but they had the same practices as singles. The retired persons had both a lower level of knowledge and poorer practices compared to the other types of occupations. The residents of the northern region had higher knowledge, and the residents of central and northern regions had more appropriate practices compared to the other regions of Shiraz. According to the multivariable analysis, knowledge about COVID-19 was lower in those with up to 12 years of education, people older than 60 years, in males, as well as in the residents of western and southern parts of Shiraz (Table 6). The practices were also poorer in the males, in the people with up to 12 years of education, and in the retired ones (Table 6). The participants preferred to follow the news about COVID-19 from different sources: mostly national TV/Radio (72.4%), social networks (49.3%), and foreign satellite channels (41%).

Discussion

Key findings

Overall, knowledge and practices about COVID-19 in adults were roughly appropriate; however, the practices were not related to knowledge in two-third of the participants. Sheeran and Webb represented that there is a large gap between people's intention and behavior, including health behavior, in their study. They concluded that about half of people's intentions get translated into action which is similar to the results of the current study (Sheeran and Webb 2016). Most of the people did not know the common symptoms of COVID-19 and also did not know when they should refer to the hospitals. Therefore, unnecessary referrals to the limited hospitals in the current pandemic may cause burn out of the hospital staff, decreases the quality of healthcare services provided to the patients, and increases the carrier rate of COVID-19 in the community. The lower level of knowledge and observance toward COVID-19 were remarkable in the lower educated ones, elders, and males. Furthermore, nearly half of the population was worried about getting this disease. National media were the main sources selected by most participants to follow the news about COVID-19.

Interpretation of the findings

About two-thirds of people had correct knowledge regarding transmission routes of COVID-19, the technique of hand washing, and the correct use of protective equipment. However, their overall knowledge about preventive routes, common symptoms of COVID-19, indicative symptoms that require referral to hospitals, and phone numbers about COVID-19-related information was not

Table 5 Univariable analysis of demographic determinants of knowledge and practices about COVID-19; concluded from a survey from Iran, 2020

Variable	Knowledge (of 25)			Practice (of 70)		
	Mean ± SD	Statistic	P value	Mean ± SD	Statistic	P value
Gender						
Male	15.5 ± 3.7	t = 2.4	0.014	53.4 ± 8.3	t = 6.7	< 0.001
Female	16.1 ± 3.3			56.5 ± 7.7		
Age (year)						
14–19	15.4 ± 3.7	F = 23.2	<0.001	51.7 ± 9.3	F = 6.5	< 0.001
20–29	16.6 ± 3.3			55.4 ± 8.6		
30–39	16.7 ± 2.8			56.5 ± 7.3		
40–49	15.9 ± 3.2			55.0 ± 7.5		
50–59	14.6 ± 3.9			54.9 ± 7.3		
60≤	12.3 ± 3.2			53.4 ± 7.9		
Level of education						
Illiterate	10.7 ± 3.7	F = 33.1	< 0.001	50.2 ± 10.7	F = 11.6	< 0.001
Under Diploma	13.4 ± 3.6			51.6 ± 8.3		
Diploma	15.4 ± 3.5			54.5 ± 8.1		
Associate Degree	16.4 ± 2.8			56.9 ± 8.0		
Bachelors	17.2 ± 2.6			55.9 ± 7.2		
Master	17.2 ± 2.7			57.6 ± 7.3		
Doctorate	19.1 ± 3.0			60 ± 7.5		
Marital status						
Single	16.1 ± 3.6	t = 2.03	0.042	54.7 ± 8.4	t = − 1.9	0.055
Married	15.6 ± 3.4			55.6 ± 7.6		
Job Status						
Jobless	15.4 ± 3.6	F = 6.0	< 0.001	55.2 ± 8.3	F = 12.9	< 0.001
Public sector's employee	17.0 ± 3.0			57.5 ± 6.4		
Private sector's employee	16.0 ± 13.2			55.3 ± 7.8		
Retired	14.4 ± 3.5			53.1 ± 7.7		
Region of living						
North	16.5 ± 3.3	F = 5.01	0.001	56.1 ± 7.8	F = 4.4	0.001
South	15.4 ± 3.6			54.2 ± 7.7		
Central	15.8 ± 3.4			56.3 ± 9.0		
East	16.1 ± 3.4			54.3 ± 8.4		
West	15.2 ± 3.6			54.1 ± 7.4		

appropriate. Chen et al. conducted a study in Anhui province of China and showed that people had a high awareness of the main symptoms, transmission routes, using masks, hand washing, and treatment of COVID-19, while they had low awareness of atypical symptoms (Chen et al. 2020). Li et al. in their study in 31 Chinese provinces demonstrated that Chinese people had a moderate level of knowledge about COVID-19 (Li et al. 2020), while Thai people in the provinces close to China had poor knowledge about this disease (Srichan et al. 2020). Zhong et al. assessed the level of Chinese residents' knowledge in the early stages of the epidemic in China and concluded that they did not have a high level of knowledge (Zhong et al. 2020). According to our findings, more effective education should be provided to the males, elders, and lower educated ones, especially in the deprived regions. It is worth noting that COVID-19 causes more mortality among some of these groups such as elders. (Tavakoli et al. 2020).

In terms of the source of information, most of the people had followed COVID-19-related news via national TV/ Radios, social media, and foreign satellite channels, respectively. In the Anhui province of China, about 98% of participants declared that they received their information about COVID-19 from social media (Chen et al. 2020). It should be mentioned that tendency of people to use social media has been increased in the recent years due to easy access and appeal (Chitra and Senjith 2020); however, non-evidence-based information that is occasionally provided to people may mislead them and transfer some incorrect information to them.

Table 6 Linear regression analysis of demographic determinants of knowledge and practices about COVID-19; concluded from a survey from Iran, 2020

Variable	Knowledge					Practice				
	Unstandardized B	Standardized B	95% Confidence interval for B	t	Sig.	Unstandardized B	Standardized B	95% Confidence interval for B	t	Sig.
Contrast	14.43	–	13.2,15.6	23.3	<0.001	53.8	–	51.2,56.4	40.3	<0.001
Level of education	0.95	0.38	0.8, 1.11	12.1	<0.001	1.38	0.24	1.05,1.71	8.19	<0.001
Age	−0.61	−0.23	−0.79, −0.43	−6.6	<0.001	0.27	0.048	−0.11,0.67	1.3	0.16
Gender	−0.46	−0.06	−0.92,−0.003	−1.9	0.049	−2.2	−0.13	−3.1, −1.2	−4.4	<0.001
Region of living	−0.15	−0.06	−0.29,−0.007	−2.06	0.039	−0.19	−0.03	−0.51,0.12	−1.18	0.236
Marital status	0.42	0.06	−0.04,0.9	1.7	0.077	0.76	0.048	−0.29,1.8	1.41	0.157
Job status	0.018	0.007	−0.14,0.18	0.21	0.834	−0.93	−0.16	−1.2, −0.58	−5.2	<0.001

Attitudes of people as a mediator between their knowledge and practices have an important role for better controlling of epidemics of infectious diseases; they facilitate the process of changing people's behavior (Ajzen and Fishbein 2005). Also, risk perceptions can influence health-related behaviors and change risky behaviors (Glanz et al. 2008). Our study showed that only half of the participants perceived COVID-19 as a deadly disease, while in Thailand, about 70% considered it as a serious and dangerous disease (Srichan et al. 2020). Similarly, two other studies in China showed that the majority of people thought that COVID-19 outbreak was very severe and scary (Chen et al. 2020; Li et al. 2020). In our study, less than half of the people considered themselves at risk of COVID-19 and were worried about it, while a higher proportion were concerned about their family's health. According to Chen et al., more than 91% of people in Anhui province, China were scared of this disease (Chen et al. 2020), while 75% of Thai people thought that there was a high risk to get COVID-19 and two-third of them were worried about it (Srichan et al. 2020). Three-quarters of our respondents stated that the epidemic of COVID-19 had negative effects on their routine life, that was also mentioned by another study (Sadati et al. 2020). However, Li et al. had a different view and concluded that the frequency of sleep problems, aggression, and substance use became slightly lower after this outbreak (Li et al. 2020). We also found that two-thirds of participants observed the preventive measures against COVID-19, while three-quarters of them showed a good self-efficacy in their testing for COVID-19. Most interviewees felt a sense of responsibility and commitment to follow the preventive measures, more precisely, aiming to keep others healthy. Sirchan et al. showed that less than 15% of Thai people had strong attitudes toward COVID-19 prevention and its controlling (Srichan et al. 2020).

We found that nearly 70% of the people did the preventive measures to prevent the COVID-19, more than 80% of people washed their hands, and more than 60% used a face mask and removed it properly. However, nearly three-fourth of them had travel out of the city during two weeks before this study and more than half of them did not keep 1-m distance from others. These results were weaker than findings by Chen et al. in China, as over 91% of their studied people did the main ways of prevention including low gathering, less going out, and wearing masks (Chen et al. 2020). We also found that the practices to prevent COVID-19 were associated with gender and occupations, which is in line with the findings of Zhong et al. (2020).

Strengths, limitations, and recommendations

Until now, population-based studies that have been conducted about public awareness, risk perceptions, and behavior toward COVID-19 are scarce; while most of them were mobile application-based, as a strength point, our research was a field-based study. As a limitation of this study, we could not extend its domain to the villages; however, this pandemic has influenced mostly the cities around the world. We also could not apply a completely random sampling due to administrative and ethical challenges; however, the time-location design of this study, its gender-age distribution protocol, and considering the design effect of 1.5 in the sample size calculation could to some extent overcome this weakness. We recommend to conduct similar studies in different countries to provide more pieces of evidence about public educational needs, to detect people with more needs for education and care, needs for controlling people's commuting within and out of cities, needs for equipment, hospitals' workloads, appropriate using of news and information's sources, and decreasing anxiety and stress at the family and community levels. Moreover, high-risk groups of communities, such as pregnant women, patients with chronic diseases, elders in nursing homes, prisoners, barracks staff, people with cognitive disabilities, disabled people, citizens of minorities, refugees and marginalized people including those who live in slums, socially deprived people, and those who do not have equal access to health and some other social facilities in comparison to other citizens, should not be overlooked in this pandemic as some of these groups were more regarded in the previous outbreaks (Lee et al. 2006).

Conclusion

Overall, knowledge and practices about COVID-19 in adults are roughly appropriate; however, in two-third of participants, practices were not related to their knowledge. Most of the people do not know about common symptoms of this disease and also do not know when they should refer to the hospitals. Therefore, unnecessary referrals to the limited hospitals in the current pandemic may cause burn out of the hospital staff, decreases the quality of healthcare services provided to the patients, and increases the carrier rate of COVID-19. Furthermore, continuous encouragement of people about the observance of preventive measures, especially in lower educated people, elders, and males is recommended, while high priority should be given to the residents of the deprived regions of the city.

Compliance with ethical standards

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