Non-Adherence to Preventive Behaviors and the Risk of COVID-19: A Comparative Study

Farhad Abolnezhadian[1], Neamat Jaafarzadeh[2], Elham Maraghi[3], Morteza Abdullatif Khafaie[4], Ali Montazeri[5], Mahmood Karimy[6], Marzieh Araban[7]* ![ORCID]

Abstract

Background: Transmission routes of COVID-19 have been well identified and documented. Considering the high prevalence of the Covid-19 and its impacts on the population, this study aimed to assess the status of preventive behaviors against coronavirus infection and estimate the odds of its transmission routes among people.

Methods: A comparative study was conducted from March to April 2021. A total of 1256 participants were randomly selected, including 262 COVID-19 patients and 994 healthy people from 10 counties in Khuzestan, southwest Iran. A two-part questionnaire was used for data collection that included items on demographic and adherence to preventive behaviors. Statistical analysis was performed using the statistical software SPSS 18.0.0 applying logistic regression.

Results: The mean age of participants was 37.60 ± 11.48 years (female: 36.49 ± 11.15 years; male: 38.86 ± 11.74 years). The results showed that having contact with infected patient at home (OR = 4.90, 95%CI = 3.32-7.25), going to the hospital for not-necessary medical reasons (OR = 4.47, 95%CI = 3.05-6.55), leaving home for essential daily services (OR = 2.49, 95% CI = 1.63-3.81), and going to doctors' office (OR = 1.78, 95% CI = 1.20-2.63) could increase the odds of infection.

Conclusion: The findings suggest that different factors are responsible for the increased spread of the Covid-19. Indeed, since the intervention for every single factor will have a small contribution to reducing the prevalence of the disease, it seems essential to design comprehensive interventions while emphasizing isolation and contacts tracing. The study provides evidence for multi-level and multi-faceted policy and interventions for promoting adherence to COVID-19 preventive behaviors.

Keywords: COVID-19, Adherence, Behavior, Prevention, Iran

Introduction

COVID-19 is an infectious disease first identified in Wuhan, China, in late 2019. The disease was caused by a new, genetically modified virus from the coronavirus family called SARS-CoV-2. The disease has now become pandemic and is recogniz ed as a global threat to human health. COVID-19 causes severe respiratory infections in infected people and it is usually transmitted from person to person

_____
Corresponding author: Dr Marzieh Araban, arabanm@ajums.ac.ir

1. Division of Immunology and Allergy, Department of Pediatrics, Abuzar Children's Hospital, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
2. Environmental Technologies Research Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
3. Department of Biostatistics and Epidemiology, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
4. Social Determinants of Health Research Center, Ahvaz Jundishapur University Of Medical Sciences, Ahvaz, Iran
5. Iranian Institute for Health Sciences Research, ACECR, Tehran, Iran
6. Social Determinants of Health Research Center, Saveh University of Medical Sciences, Saveh, Iran
7. Department of Health Education and Promotion, School of public health, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

↑What is "already known" in this topic:
While we are confirming the fact that transmission routes of COVID-19 are known, the share of its transmission (non-adherence to preventive behavior) has not been reported in any scientific report.

→What this article adds:
The findings suggest that different factors are responsible for the increased spread of the Covid-19. Indeed, since the intervention for every single factor will have a small contribution to reducing the prevalence of the disease, it seems essential to design comprehensive interventions while emphasizing isolation and contacts tracing.

through hands, saliva, nasal secretions, and droplets. The average incubation period of the disease is estimated between 4 to 14 days (1-3). Clinical manifestations of COVID-19 include fever, cough, and dyspnea. However, loss of smelling, tasting, and in some cases diarrhea have also been reported (4). Like a pandemic, the number of people with COVID-19 is increasing worldwide. According to reports, 67,683,887 confirmed cases of this disease had been reported worldwide so far (4-6). In Iran, 3,467,765 confirmed cases have been reported, of which 92,628 led to death (6).

It has been recommended to observe health care measures such as home quarantine, wearing masks, and physical distance to reduce the transmission of the disease. The home quarantine is aimed at physical quarantine, preventing the patient from engaging in the community and preventing the occurrence of second and third-generation patients. It can be a solution to a problem that medical institutions cannot solve (7, 8). Although quarantine and public shutdown policies reduce the number of patients (9), they cannot last longer and cause irreparable economic losses (10, 11). Also, despite vaccination in many countries around the world, the progress of vaccine-preventable diseases sometimes increases owing to public support for vaccine use or increased skepticism about the vaccine, such as delaying or refusing immunization (12). Furthermore, vaccines are not yet available in some countries to the majority of the population, and other preventive actions are still emphasized (13).

As mentioned earlier, the growing trend of disease and death from COVID-19 shows that the introduced and published considerations and instructions regarding the prevention of COVID-19 are not performed as expected. This is contrary to the recognition of disease transmission methods, the importance of individual behaviors in controlling the epidemic, and the emphasis of governments, physicians, and the media on preventive behaviors (3, 14, 15). Moreover, the contribution of each mode of transmission (contact with an infected person, contact with carriers, and presence in crowded places, hospitals, and so on) to corona expansion is not clear. The prevalence of this disease is not specific to a definite age group, and its mortality occurs at different ages and population groups. Thus, awareness of the public and different groups through health education programs and providing health messages can be effective in preventing the disease and reducing its prevalence (16). To plan and provide targeted community interventions and training, as well as policy-making to control corona expansion, it is necessary to identify transmission routes in each region to break the transmission chain. No research has been conducted in Khuzestan, Iran on the extent of observing health behaviors for preventing the spread of COVID-19 infection. Considering the high prevalence of this disease in Iran and Khuzestan and its irreversible complications such as death, hospitalization, related costs, transmissibility (17), the aim of this study was to determine the status of preventive behaviors against the COVID-19 and estimate the odds of different transmission routes in Khuzestan, Iran.

Methods
Study design and participants
This cross-sectional comparative study was conducted from March to July 2021 in Khuzestan, southwest Iran. To estimate preventive behaviors and the risk of COVID-19 transmission, a sample was selected via a multi-stage sampling method. First, Khuzestan province was divided into 20 regions and 10 regions were randomly selected. Then, among health care centers located in each region, 2 health centers were selected randomly. Finally, the samples were randomly chosen from each selected area according to the existing population and the estimated proportion to sample size in that area. Dividing Khuzestan province into 20 regions, 10 regions were randomly selected. The samples were randomly chosen from each selected area according to the existing population under the coverage of the health care system and the sample size in that area. The individuals were selected with the help of health care providers in each area. Healthcare providers had a list of households referring to the healthcare center. After phone calls and obtaining informed consent, the link to the study questionnaires was sent for participants to be completed online. Inclusion criteria were: aged 18 years and above, giving informed consent, being able to read and write and having an internet connection, and being registered in the hospital/health centers' information system. For those who indicated they experienced the COVID-10, the positive PCR test and medical records should be available. The list of patients was confirmed by information obtained via the hospital information system using positive PCR tests and medical diagnosis records. Individuals living outside of Khuzestan were not included in the study.

Data collection
A two-part questionnaire was developed for data collection. The validity of the questionnaire was confirmed by the content validity ratio (CVR) and content validity index (CVI) of 1. The reliability of the entire questionnaire was confirmed with Cronbach's alpha = 0.9. The first part contained information on demographic characteristics, including age, gender, education, job, and comorbidity. The second part included items on the COVID-19 preventive measures which were prepared through the review of the text (14, 15). This part was completed as a self-report and under the supervision of a trained questioner. Behaviors of interest included: hand washing, covering mouth and nose when coughing or sneezing, wearing a mask in public places, cleaning high-touch surfaces regularly, social distancing (staying home and away from others as much as possible), Physical Distancing(complying to at least 1.5-meter distance from others), avoid presence in family and friend' gatherings, having contact with a patient at home, having contact with a patient in the workplace, Having contact with a patient in other places, going out only for essential daily services, going to doctor's office, going to the hospital for not-necessary medical reasons- for example visiting a friend or relatives-, being in crowded places. The response categories included 'Yes, and 'No' formats.

Sample size

We used the following formula to estimate the sample size: n=Z²P(1−P)/d2

Considering that Z for 95% confidence interval is 1.96, P = 0.5 (assuming that 50% of people would perform preventive behaviors), and d = 0.03 (precision = 3%), we estimated at least 1071 participants would be necessary for the study to have a power of 80% at 5% significant level. However, in practice, 1256 individuals participated in the study.

Statistical analysis

Results were presented as absolute frequencies and percentages for qualitative variables. Quantitative variables were presented as means and standard deviations. Univariate logistic regression analyses were used to examine the relationships between independent variables and the risk of being infected. The odds ratio (OR) was calculated and presented with a 95% confidence interval (CI). Any variable with a p-value less than 0.25 was selected as a candidate for the multiple logistic regression analysis. Backward stepwise logistic regression modeling was then used to obtain a subset of factors associated with being diseased. We used likelihood ratio tests to judge by removing the factors. Statistical analysis was performed using the statistical software SPSS 18.0.0. (SPSS Inc. Chicago, IL, USA). P-values less than 0.05 were assumed significant.

Results

In total, 1256 (54.2% female and 45.8% male) individuals fulfilling the inclusion criteria were included in the study. The subjects were divided into the COVID-19 patient (n = 262, 20.9%) and healthy group (n = 994,79.1%) groups. The mean age of participants was 37.60±11.48
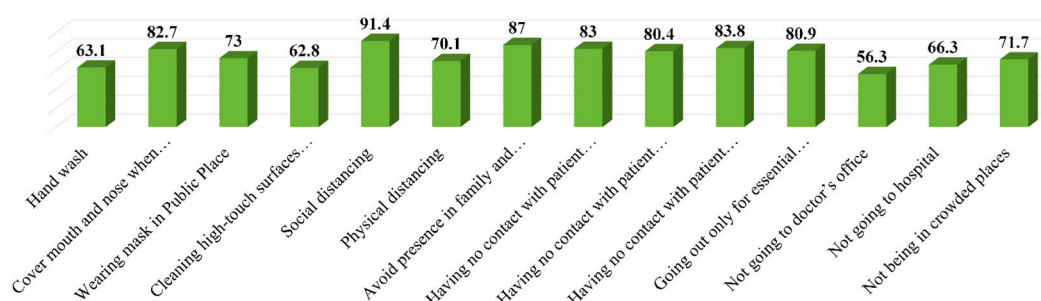

Fig. 1. Bar chart for percent of participants' adherence to preventive behaviors

Table 1. The characteristics of the study groups and the risk of being infected

Variable	Healthy No (%)	Diseased No. (%)	Crude OR (95% CI)	P-value
Age; years				
Mean±Std	35.68±9.63	44.92±14.65	1.07 (1.05, 1.08)	<0.0001
Gender				
Female	546 (55.2)	131 (50.6)	1.0 (ref.)	
Male	443 (44.8)	128 (49.4)	1.20 (0.91, 1.58)	0.184
Residency				
Rural	124 (12.5)	13 (5.1)	1.0 (ref.)	
Urban	867 (87.5)	244 (94.9)	2.68 (1.49, 4.83)	0.001
Education				<0.0001
University degree	695 (69.9)	138 (53.3)	1.0 (ref.)	
≤Secondary	295 (29.7)	104 (40.2)	1.77 (1.33, 2.37)	<0.0001
Illiterate	4 (0.4)	17 (6.6)	21.40 (7.09, 64.58)	<0.0001
Marriage				
Single/ Divorced	260 (26.3)	45 (17.4)	1.0 (ref.)	
Married	727 (73.7)	213 (82.6)	1.69 (1.19, 2.40)	0.003
Job				<0.0001
Unemployed	75 (7.6)	15 (5.8)	1.0 (ref.)	
Self-employed	100 (10.1)	43 (16.7)	2.15 (1.3-3.24)	0.023
Retired	30 (3.0)	30 (11.6)	5.00(2.22-5.87)	<0.0001
Housewife	196 (19.8)	63 (24.4)	1.60(0.2-1.96)	0.135
Worker	63 (6.4)	17 (6.6)	1.34(033-1.22)	0.446
Employed	440 (44.4)	82 (31.8)	0.93(0.54-1.89)	0.818
Student	88 (8.9)	8 (3.1)	0.45 (0.2-1.14)	0.090
Economic status				0.799
Poor	184 (18.5)	52 (20.4)	1.0 (ref.)	
Fair	466 (47.0)	117 (45.9)	0.88 (0.61, 1.28)	0.529
Good	342 (34.5)	86 (33.7)	0.89 (0.60, 1.31)	0.555
Comorbidity				
No	821 (82.6)	157 (59.9)	1.0 (ref.)	
Yes	173 (17.4)	105 (40.1)	3.17 (2.35, 4.26)	<0.0001

years (female: 36.49±11.15 years; male: 38.86±11.74 years). Most participants (66.5%) had a university degree. Figure 1 shows the percentage of adherence to 14 preventive behaviors in the whole sample. Table 1 compares the demographic characteristics of the participants. Some demographic characteristics, including age, residency, education, being married or single, job, and having comorbidity, were significant regarding the development of COVID-19 in univariate regression.

Table 2 shows the univariate analysis of each of the preventive behaviors. In univariate analysis, the effect of some behaviors was significant for the development of COVID-19, including the absence of physical distance, having a positive COVID-19 patient at home, going out shopping, and referring to the hospitals and doctors offices. The highest and lowest effects were related to contacting patients at home with odds of 6.36 and being in crowded places with odds of 1.01, respectively. To determine the adjusted odds of each significant variable in univariate regression, multiple logistic regression was performed, for which the results

are shown in Table 3. The odds of getting COVID-19 increase by 4.9, 4.47, 1.78, and 2.49, respectively by the existence of a COVID-19 patient at home, going to the hospital and doctor's office and leaving home for essential services.

Discussion

The current research aimed to compare the demographic characteristics and estimate the COVID-19 transmission routes in two groups of "COVID-19 patients and healthy people" in the population of Khuzestan province, Iran. A descriptive study of preventive behaviors showed that adherence to the whole preventive behaviors in any of the population groups is not 100%, which is in line with previous studies (18). COVID-19 is currently a public health concern for which there is no known cure. Hence, preventing it through preventative behaviors regularly should be at the forefront of health plans (19). This finding may indicate the need for education and awareness or conducting risk informing mobilizations at the population level.

Some demographic characteristics increase a person's

Table 2. Adherence to preventive behaviors among the study participants and risk of being infected

Variable	Healthy No. (%)	Diseased No. (%)	Crude OR (95% CI)	P-value
Hand wash				
No	373 (38.3)	82 (31.7)	1.0 (ref.)	
Yes	601 (61.7)	177 (68.3)	1.34 (1.00, 1.79)	0.051
Cover mouth and nose when coughing or sneezing				
Yes	939 (95.6)	244 (93.8)	1.0 (ref.)	
No	43 (4.4)	16 (6.2)	1.43 (0.79, 2.58)	0.234
Wearing Mask in Public Place				
Yes	712 (74.1)	180 (69.0)	1.0 (ref.)	
No	249 (25.9)	81 (31.0)	1.28 (0.95, 1.73)	0.099
Cleaning high-touch surfaces regularly				
Yes	625 (64.1)	152 (58.0)	1.0 (ref.)	
No	350 (35.9)	110 (42.0)	1.29 (0.97, 1.70)	0.071
Social Distancing				
Yes	908 (91.8)	233 (89.6)	1.0 (ref.)	
No	81 (8.2)	27 (10.4)	1.29 (0.82, 2.05)	0.264
Physical Distancing				
Yes	700 (71.6)	169 (64.5)	1.0 (ref.)	
No	278 (28.4)	93 (35.5)	1.38 (1.03, 1.84)	0.027
Avoid presence in family and friend' gatherings				
Yes	123 (12.4)	40 (15.3)	1.0 (ref.)	
No	868 (87.6)	221 (84.7)	1.27 (0.86, 1.87)	0.214
Having contact with patient in home; No (%)				
No	873 (89.7)	151 (57.9)	1.0 (ref.)	
Yes	100 (10.3)	110 (42.1)	6.36 (4.61, 8.76)	<0.0001
Having contact with patient in workplace				
No	782 (80.5)	209 (80.4)	1.0 (ref.)	
Yes	190 (19.5)	51 (19.6)	1.004 (0.71, 1.41)	0.980
Having contact with patient in other places				
No	820 (84.8)	207 (79.9)	1.0 (ref.)	
Yes	147 (15.2)	52 (20.1)	1.40 (0.98, 1.99)	0.060
Going out only for essential services				
Yes	815 (83.7)	183 (70.4)	1.0 (ref.)	
No	159 (16.3)	77 (29.6)	2.15 (1.57, 2.95)	<0.0001
Going to doctor's office				
No	607 (62.2)	90 (34.5)	1.0 (ref.)	
Yes	369 (37.8)	171 (65.5)	3.12 (2.34, 4.16)	<0.0001
Going to hospital				
No	730 (74.9)	89 (34.1)	1.0 (ref.)	
Yes	245 (25.1)	172 (65.9)	5.75 (4.29, 7.72)	<0.0001
Being in crowded places				
No	519 (52.2)	136 (51.9)	1.0 (ref.)	
Yes	475 (47.8)	126 (48.1)	1.01 (0.77, 1.32)	0.930

Table 3. The results obtained from multiple logistic regression indicate the odds ratio of being infected

Variable	Adjusted OR (95% CI)	*P*-value
Age; years	1.05 (1.03, 1.07)	<0.0001
Residency		
Rural	1.0 (ref.)	
Urban	2.16 (1.04, 4.46)	0.037
Education		0.005
University degree	1.0 (ref.)	-
≤Secondary	1.36 (0.93, 1.98)	0.111
Illiterate/primary	13.37 (2.43, 73.38)	0.003
Comorbidity		
No	1.0 (ref.)	
Yes	1.48 (0.97, 2.24)	0.064
Hand wash		
Yes	1.0 (ref.)	
No	1.38 (0.94, 2.03)	0.049
Having contact with a patient at home		
No	1.0 (ref.)	
Yes	4.90 (3.32, 7.25)	<0.0001
Going out only for essential services		
No	1.0 (ref.)	
Yes	2.49 (1.63, 3.81)	<0.0001
Going to doctor's office		
No	1.0 (ref.)	
Yes	1.78 (1.20, 2.63)	0.004
Going to hospital		
No	1.0 (ref.)	
Yes	4.47 (3.05, 6.55)	<0.0001

odds of developing COVID-19 disease, including older age, lower education, residency (urban), being married, being self-employed and retired and having comorbidities. Previous studies have also highlighted some of the demographic characteristics associated with COVID-19 (20). In univariate regression for analyzing any preventive behaviors, the odds of getting this disease are increased by not observing physical distance, presence in friendly and family gatherings, contacting the patient at home, going out for essential services, and going to the doctor's office and hospital. Numerous studies emphasize the observance of all preventive behaviors to prevent COVID-19 (21, 22). The lack of significance of all preventive behaviors can also be due to the sample selection bias or information recall.

To determine the effect of each of the above variables, multiple regression was performed, and the results showed that the effect of age (there is a 4% increase in the odds of COVID-19 disease per year) is in line with the previous study. A university education degree reduces the odds of being diseased compared to less education level. Higher education increases the odds of getting a better job and higher knowledge of obtaining health-related information (23). Thus, it can be effective in reducing the odds of getting the disease.

Having contact with the patient at home increases the odds 4.9 times. The possible reason is that living in a shared space increases the likelihood of exposure to respiratory droplets and increases the odds of being affected (24). Therefore, a special program for isolating and tracking contact COVID-19 patients must be executed exactly. Going out for essential services increases the odds to 2.49. In other words, even if a person observes other behaviors, he/she is prone to the disease only by one exposure because not getting COVID-19 requires constant adherence to all preventative behaviors. Going to the doctor's office and the hospital also increases the odds by 1.78 and 4.47, respectively.

In one study, about 20% of infections in inpatients and 73% of infections in healthcare workers (HCWs) were caused by nosocomial transmission (25). In another study, the COVID-19 patients (6.8%) were likely to have acquired COVID-19 in hospital (26). The ventilation status of hospitals has also been suggested as a factor for getting COVID-19 (26). Therefore, it is necessary to study and improve the status of adherence to health protocols and ventilation in offices and hospitals. Also, turning to telemedicine and educating people to reduce unnecessary appointments may be helpful during the pandemic. In this study, not washing hands and wearing masks in multivariate regression had no effect on the disease. The possible reason is that these are important behaviors and people have responded according to social desirability. Furthermore, considering the output of the multivariate model, it may be stated that personal hygiene has a minor role in relation to environmental risk factors and environmental risk factors are more important than personal hygiene; These should be assessed in the future studies on COVID-19.

Limitations of the study
Due to the nature of the study, the results might be affected by recall bias. A cohort study is necessary to determine and accurately attribute the contribution of each of the transmission routes. In this study, the incidence of COVID-19 was assessed in general while not assessing the severity of the disease. Additionally, since some people in the healthy group may have had the infection but had no symptoms or got tested for COVID-19, the results should be interpreted with caution.

Conclusion
The findings suggest that different factors are responsible for the increased spread of COVID-19. Indeed, since the

intervention of every single factor will have a small contribution to reduce the prevalence of the disease, it seems essential to design comprehensive interventions while emphasizing isolation and contact tracing. The findings provided evidence for infection prevention percussions programs. Additionally, the study provides evidence for multi-level and multi-faceted policy and interventions for promoting adherence to COVID-19 preventive behaviors.

Ethics approval and consent to participate

The study was approved by the Ethics Committee of Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran (Registration No: IR.AJUMS.REC.1399.875). Written Informed Consent was obtained from participants.

Acknowledgments

Conflict of Interests

The authors declare that they have no competing interests.

References

1. Guan WJ, Ni ZY, Hu Y, Liang WH, Ou CQ, He JX, et al. Clinical characteristics of coronavirus disease 2019 in China N Engl J Med. 2020;382(18):1708-20.
2. Ali M, Shah STH, Imran M, Khan A. The role of asymptomatic class, quarantine and isolation in the transmission of COVID-19. J Biol Dyn. 2020;14(1):389-408.
3. Docherty AB, Harrison EM, Green CA, Hardwick HE, Pius R, Norman L, et al. Features of 20 133 UK patients in hospital with covid-19 using the ISARIC WHO Clinical Characterisation Protocol: prospective observational cohort study. BMJ. 2020;369:m1985.
4. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020;395(10223):497-506.
5. Organization WH. WHO coronavirus disease (COVID-19) dashboard: Situation by country, territory & area. https://covid19.who.int/table. 2022;4.25.
6. Coronavirus Cases. 2020 16.11.2020 [cited 2020 11.16.2020].
7. Alsahafi AJ, Cheng AC. Knowledge, attitudes and behaviours of healthcare workers in the Kingdom of Saudi Arabia to MERS coronavirus and other emerging infectious diseases Int J Environ Res Public Health. 2016;13(12):1214.
8. Bates BR, Moncayo AL, Costales JA, Herrera-Cespedes CA, Grijalva MJ. Knowledge, attitudes, and practices towards COVID-19 among Ecuadorians during the outbreak: an online cross-sectional survey. J Community Health. 2020;45(6):1158-67.
9. Badr HS, Du H, Marshall M, Dong E, Squire MM, Gardner LM. Association between mobility patterns and COVID-19 transmission in the USA: a mathematical modelling study. *Lancet Infect Dis*. 2020;20(11):1247-54.
10. Haleem A, Javaid M, Vaishya R. Effects of COVID-19 pandemic in daily life. Curr Med Res. 2020;10(2):78.
11. Atalan A. Is the lockdown important to prevent the COVID-19 pandemic? Effects on psychology, environment and economy-perspective. Ann Med Surg. 2020;56:38-42.
12. Biswas N, Mustapha T, Khubchandani J, Price JH. The Nature and Extent of COVID-19 Vaccination Hesitancy in Healthcare Workers. J Community Health. 2021:1-8.
13. Detoc M, Bruel S, Frappe P, Tardy B, Botelho-Nevers E, Gagneux-Brunon A. Intention to participate in a COVID-19 vaccine clinical trial and to get vaccinated against COVID-19 in France during the pandemic. Vaccine. 2020;38(45):7002-6.
14. Jahangiry L, Bakhtari F, Sohrabi Z, Reihani P, Samei S, Ponnet K, et al. Risk perception related to COVID-19 among the Iranian general population: an application of the extended parallel process model. BMC Public Health. 2020;20(1):1-8.
15. McCloskey B, Zumla A, Ippolito G, Blumberg L, Arbon P, Cicero A, et al. Mass gathering events and reducing further global spread of COVID-19: a political and public health dilemma. Lancet. 2020;395(10230):1096-9.
16. Zhong BL, Luo W, Li HM, Zhang QQ, Liu XG, Li WT, et al. Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey. Int J Biol Sci. 2020;16(10):1745.
17. Moghadas SM, Fitzpatrick MC, Sah P, Pandey A, Shoukat A, Singer BH, et al. The implications of silent transmission for the control of COVID-19 outbreaks. Proc Natl Acad Sci. 2020;117(30):17513-5.
18. Shahnazi H, Ahmadi-Livani M, Pahlavanzadeh B, Rajabi A, Hamrah MS, Charkazi A. Assessing preventive health behaviors from COVID-19: a cross sectional study with health belief model in Golestan Province, Northern of Iran. Infect Dis Poverty. 2020;9(1):1-9.
19. Bante A, Mersha A, Tesfaye A, Tsegaye B, Shibiru S, Ayele G, et al. Adherence with COVID-19 Preventive Measures and Associated Factors Among Residents of Dirashe District, Southern Ethiopia. Patient Prefer Adherence. 2021 Feb 3;15:237-249.
20. Hager E, Odetokun IA, Bolarinwa O, Zainab A, Okechukwu O, Al-Mustapha AI. Knowledge, attitude, and perceptions towards the 2019 Coronavirus Pandemic: A bi-national survey in Africa. PloS One. 2020;15(7):e0236918.
21. Hussain A, Garima T, Singh BM, Ram R, Tripti RP. Knowledge, attitudes, and practices towards COVID-19 among Nepalese Residents: A quick online cross-sectional survey. Sian J Med Sci. 2020;11(3):6-11.
22. Association WM. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. Jama. 2013;310(20):2191-4.
23. Araban M, Karimy M, Mesri M, Rouhani M, Armoon B, Koohestani HR, et al. The COVID-19 Pandemic: Public Knowledge, Attitudes and Practices in a central of Iran. J. Educ. Community. Health. 2021.
24. COVID-19: How to Protect Yourself & Others. 2021.
25. Evans S, Agnew E, Vynnycky E, Stimson J, Bhattacharya A, Rooney C, et al. The impact of testing and infection prevention and control strategies on within-hospital transmission dynamics of COVID-19 in English hospitals. Philos Trans R Soc. 2021;376(1829):20200268.
26. Chen C, Zhao B. Makeshift hospitals for COVID-19 patients: where health-care workers and patients need sufficient ventilation for more protection. J Hosp Infect. 2020;105(1):98.