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

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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.

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

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**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 recognized 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.

↑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 the 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-19, 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:
\[ n = \frac{Z^2 \cdot P(1-P)}{d^2} \]
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 step-wise 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](http://mjiri.iums.ac.ir)

| 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      | 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(2.22-8.7)   | <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(0.33-1.22)  | 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 |                 |                 |                 |             |
| 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     |
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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 | No. (%) | Diseased | Crude OR (95% CI) | P-value |
| Handwash | 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 | No | 43 (4.4) | 16 (6.2) | 1.43 (0.79, 2.58) | 0.234 |
| | | Yes | 939 (95.6) | 244 (93.8) | 1.0 (ref.) |
| 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 | No | 350 (35.9) | 110 (42.0) | 1.29 (0.97, 1.70) | 0.071 |
| | Yes | 625 (64.1) | 152 (58.0) | 1.0 (ref.) |
| 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 | No | 123 (12.4) | 40 (15.3) | 1.0 (ref.) |
| | Yes | 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 |

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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.

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**Conflict of Interests**

The authors declare that they have no competing interests.

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