




Evaluation of the Effect of Educational Interventions on Knowledge, Attitude, and Practice Against COVID-19 in a Residential Complex in Tehran: A Prospective Cross-sectional Study

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Abstract

Background: The coronavirus disease 2019 (COVID-19) pandemic at the end of 2019 posed a global health concern. It has been found that health education is one of the best methods for health promotion, changing inappropriate personal behaviors, and increasing people's awareness and attitude through major health concerns, including the COVID-19 pandemic. This study aimed to investigate the effect of educational interventions with environmental health approach on the knowledge, attitude, and practice of people in the COVID-19 epidemic era in one residential complex in Tehran.

Methods: This cross-sectional study was conducted in Tehran in 2021. The study population was households of a residential complex in Tehran, which was selected by a random sampling method. A researcher-made checklist was used to gather data for this study, and its validity and reliability in the domains of environmental health and knowledge, attitude, and practice in the COVID-19 setting were evaluated before it was used. An intervention was made through social media and the checklist was reevaluated after the intervention.

Results: A total number of 306 participants were enrolled in this study. In the assessment of the knowledge, attitude, and practice after the intervention, the mean score of the mentioned values increased significantly ($P < 0.001$). However, the influence of intervention was more prominent in the improvement of knowledge and attitude than practice.

Conclusion: Public health intervention with an environmental health approach can increase people's knowledge, attitude, and practice against chronic diseases and epidemics such as COVID-19.

Keywords: Health Interventions, Environmental Health, Health Education, Health Promotion

Conflicts of Interest: None declared

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Introduction

Coronavirus disease 2019 (COVID-19) has been spread globally since December 2019 and caused a global pandemic (1, 2). COVID-19 caused infection in more than 550

million people and caused almost 6.3 million mortalities until July 8, 2022 (3). Also, it has caused almost 7.2 million infections among the Iranian population, with more than

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↑What is “already known” in this topic:

Improving people awareness against coronavirus disease 2019 (COVID-19) require educational health intervention to increase knowledge, attitude, and practice against this disease. Environmental health interventions are useful in this regard. Environmental health-based measures play a vital role in the management and prevention of SARS-CoV-2 infection through educating people about the transmission route and prevention of COVID-19.

→What this article adds:

Educational intervention based on environmental health can increase knowledge, attitude, and practice against COVID-19 infection. Developing educational intervention in different residential areas is effective in controlling COVID-19 transmission and results in public health promotion.

141,000 mortalities until July 9, 2022 (4). Due to high transmission rate of the disease, it has caused global phobia, which emerged needs for interventions in regard to prevention (5). Prevention of COVID-19 requires public health measures to improve people awareness against this disease, which can result in increasing knowledge, attitude, and practice against this disease (6).

Improving knowledge, attitude, and practice against COVID-19 can be done through public health interventions (7). According to studies, environmental health measures including enhancing sanitation and modifying hygiene practices may be helpful in illness prevention (8). In addition, considering the high rates of social network administration in the general population, public health interventions such as environmental health interventions are being conducted through social networks during recent years (9). It has been found that environmental health interventions have a great effect on knowledge, attitude, and practice of people about health issues (10). In fact, environmental health-based measures play a vital role in the managing and preventing SARS-CoV-2 infection through educating people about the transmission of the SARS-CoV-2 in different environmental conditions, disinfection measures such as hand washing, and protection measures such as facial mask (11).

Due to the high rates of COVID-19 infection in the Iranian population and the significance of knowledge, attitude, and practice against COVID-19, we designed this study to determine the impact of an environmental health intervention on enhancing knowledge, attitude, and practice against COVID-19 in one of the residential complexes in Tehran, the capital of Iran.

Methods

Study Design

This cross-sectional study was conducted in 2021 to assess environmental health interventions for improving knowledge, attitude, and practice among the general population during the COVID-19 era in one of residential complexes of Tehran, Iran. We performed this study in a residential complex, which can represent the general population. Without regard to age or gender, the study included anyone who had a smartphone and was a householder, with the assumption that the only exclusion factor was lack of social network experience. Based on the Cochran sample size formula (12) and the population of the residential complex ($N = 3000$), 340 people were used as the sample size, with a 5% margin of error and a 95% confidence interval. The sampling process was conducted by simple random sampling.

Designing the Checklist

Before starting the study, a researcher-based checklist was designed to assess knowledge, attitude, and practice among participants. The checklist had 60 items, designed based on a 5-point Likert scale, with 26 items related to knowledge, 10 related to attitude, and 24 related to practice. The designed checklist is presented in Table 1. The checklist was assessed for validity based on the Content Validity Ratio (CVR) and the Content Validity Index (CVI) (12) by 12 experts in the field of environmental health and public health before administration in this study. In addition, the reliability of the checklist was assessed based on the Cronbach alpha (13). The minimum CVR value for 12 experts is assumed as 0.56 (14), and CVR values were >0.65 for all of our checklist items. Furthermore, the minimum CVI value is assumed as 0.79 (15), and CVI values were >0.83 in this study. Moreover, the Cronbach alpha was

Table 1. Designed checklist for assessing knowledge, attitude, and practice

Questions for knowledge assessment
1. Are fever and shivering symptoms of COVID-19?
2. Are loss of smell and taste symptoms of COVID-19?
3. Is earache a symptom of COVID-19?
4. Is fatigue a symptom of COVID-19?
5. Are rhinorrhea or nasal congestion symptoms of COVID-19?
6. Is excessive sputum a symptom of COVID-19?
7. Is depression a symptom of COVID-19?
8. Is dyspnea a symptom of COVID-19?
9. Is seizure a symptom of COVID-19?
10. Is diarrhea a symptom of COVID-19?
11. Is sore throat a symptom of COVID-19?
12. Is cough a symptom of COVID-19?
13. Are pediatrics aged under five at risk for COVID-19?
14. Are adults aged more than 65 at risk for COVID-19?
15. Are young adults at risk for COVID-19?
16. Are pregnant females at risk for COVID-19?
17. Are patients with underlying disease at risk for COVID-19?
18. Are females at risk for COVID-19?
19. Are males at risk for COVID-19?
20. Is COVID-19 transmitted through contaminated foods?
21. Is COVID-19 transmitted through direct contact of contaminated hand with face?
22. Is COVID-19 transmitted through fly bite?
23. Is COVID-19 prevented through consuming spicy foods?
24. Is it true that there are no vaccinations against COVID-19?
25. Is COVID-19 transmitted through animals?
26. Is COVID-19 transmitted through sneeze and cough of infected individuals?

Table 1. Continued

Questions for attitude assessment
1. I do observe my 1-to-2-meter distance with the others
2. COVID-19 is a dangerous disease
3. I and my family are susceptible for COVID-19
4. I have to infected with COVID-19 and I do not want to prevent this
5. If I will be infected with COVID-19, my family will be also at risk
6. Being infected with COVID-19 is associated with adverse outcomes on my job or education
7. Being infected with COVID-19 may be associated with mortality
8. Being infected with COVID-19 is associated with a rapid recovery
9. If I will be infected with COVID-19, my relatives will be also at risk
10. Using personal hygiene equipment is not mandatory for COVID-19 prevention
Questions for practice assessment
1. I usually do not participate in people aggregation such as ceremonies or festivals
2. I usually do my prayers at public masques
3. I usually have outside town trips
4. I usually use public transportation for my daily routines
5. I usually use my personal vehicle for my daily routines
6. I usually use facial mask when I am going out of house
7. I usually use hand gloves when I am going out of house
8. I usually observe hygiene precautions and distancing in the house
9. I usually see my parents, children or friends as a weekly routine
10. I usually observe social distancing in personal conversation and going out
11. I usually do most of my shopping in person
12. I usually go to restaurant for eating food and not order it online
13. I usually have hand sanitizer when I go out
14. I try to not contact my hand with my face when I am outside of the house
15. I usually sanitize my hand when it has a contact with a possible contamination
16. I usually wash my hand just after I come in the house
17. I usually sanitize my shopping bags
18. I usually sanitize contact surfaces in the house
19. I usually go out as a necessity and I try to stay home
20. I usually follow COVID-19 news and I am sensitive in this regard
21. I try to daily improve my knowledge about COVID-19 prevention and treatment
22. I use our residential gym for my work out
23. I observe hygiene precautions almost always in everywhere
24. I warn those who do not observe hygiene precautions

more than 75% for knowledge, attitude, and practice in this study, which is a desirable value (16). The validity and reliability of our created checklist were therefore applicable.

Data Collection

All participants fill the checklist at the baseline of the study. Each item in the checklist had a 5-point Likert scale, which was classified as follows: 1 = strongly disagree; 2 = disagree; 3 = neither agree nor disagree; 4 = agree; 5 = strongly agree. After filling the questionnaire at the baseline and assessing needs and challenges with respect to knowledge, attitude, and practice toward COVID-19 among participants, educational contents were prepared by short movie clips and educational pamphlets to educate participants about COVID-19. The intervention was conducted through social network for 2 weeks and 3 months after completing the intervention, participants were reevaluated about COVID-19 to assess the effect of intervention in improving knowledge, attitude, and practice.

Statistical Analysis

Data were entered into Version 26 of SPSS software for statistical analysis. The normality of variables was assessed by the Kolmogorov-Smirnov test and because of the normal distribution of the data, parametric tests were used for statistical analysis. The quantitative variables were reported as mean \pm standard deviation and nominal values reported as

number (percentage). The mean score of each item was used for the statistical analysis and a paired t test was used to assess items before and after the intervention. $P < 0.05$ was considered as significant.

Results

Baseline Characteristics

Among 340 householders, 306 participants were included in the final analysis. The mean age of participants was 63.65 ± 6.74 years (range, 22-61 years) and 165 of them (53.9%) were men. In the assessment of marital status, 99.3% of participants were married and in the evaluation of educational status, 184 participants (60.1%) had academic educations. In addition, 1.2% of participants had a history of underlying disease, and 14.7% had a history of COVID-19 infection.

Knowledge Assessment

The mean point of knowledge for each item is presented in Table 2. The item number 19 (Are men at risk for COVID-19?) had the lowest mean and the item number 21 (Is COVID-19 transmitted through direct contact of contaminated hand with face?) had the highest mean before the intervention. Our analysis demonstrated that all items, except for item 21, improved significantly after our intervention. In fact, the overall point for knowledge increased significantly from 2.24 ± 0.28 to 2.81 ± 0.12 ($P < 0.001$).

Table 2. The impact of intervention in the knowledge of individuals

Items	Before	After	P-value
1. Are fever and shivering symptoms of COVID-19?	2.81 ± 0.57	2.98 ± 0.11	< 0.001
2. Are loss of smell and taste symptoms of COVID-19?	2.83 ± 0.54	2.99 ± 0.05	< 0.001
3. Is earache a symptom of COVID-19?	1.75 ± 0.83	2.69 ± 0.57	< 0.001
4. Is fatigue a symptom of COVID-19?	2.58 ± 0.79	2.97 ± 0.19	< 0.001
5. Are rhinorrhea or nasal congestion symptoms of COVID-19?	2.11 ± 0.89	2.51 ± 0.53	< 0.001
6. Is excessive sputum a symptom of COVID-19?	1.76 ± 0.81	2.74 ± 0.49	< 0.001
7. Is depression a symptom of COVID-19?	1.79 ± 0.91	2.94 ± 0.25	< 0.001
8. Is dyspnea a symptom of COVID-19?	2.8 ± 0.59	2.77 ± 0	< 0.001
9. Is seizure a symptom of COVID-19?	1.67 ± 0.88	2.91 ± 0.4	< 0.001
10. Is diarrhea a symptom of COVID-19?	2.19 ± 0.91	2.44 ± 0.63	< 0.001
11. Is sore throat a symptom of COVID-19?	2.42 ± 0.83	2.8 ± 0.41	< 0.001
12. Is cough a symptom of COVID-19?	2.79 ± 0.59	2.97 ± 0.16	< 0.001
13. Are pediatrics aged under five at risk for COVID-19?	1.77 ± 0.81	2.77 ± 0.52	< 0.001
14. Are adults aged more than 65 at risk for COVID-19?	2.81 ± 0.57	2.99 ± 0.11	< 0.001
15. Are young adults at risk for COVID-19?	1.71 ± 0.8	2.91 ± 0.34	< 0.001
16. Are pregnant females at risk for COVID-19?	2.49 ± 0.84	2.86 ± 0.36	< 0.001
17. Are patients with underlying disease at risk for COVID-19?	2.78 ± 0.61	2.99 ± 0.05	< 0.001
18. Are females at risk for COVID-19?	1.64 ± 0.75	2.52 ± 0.59	< 0.001
19. Are males at risk for COVID-19?	1.61 ± 0.72	2.57 ± 0.56	< 0.001
20. Is COVID-19 transmitted through contaminated foods?	1.86 ± 0.48	2.44 ± 0.65	< 0.001
21. Is COVID-19 transmitted through direct contact of contaminated hand with face?	2.94 ± 0.32	2.97 ± 0.16	0.123
22. Is COVID-19 transmitted through fly bite?	2.23 ± 0.96	2.91 ± 0.37	< 0.001
23. Is COVID-19 prevented through consuming spicy foods?	2.03 ± 0.9	2.84 ± 0.49	< 0.001
24. Is it true that there are no vaccinations against COVID-19?	2.08 ± 0.78	2.96 ± 0.17	< 0.001
25. Is COVID-19 transmitted through animals?	1.92 ± 0.87	2.24 ± 0.8	< 0.001
26. Is COVID-19 transmitted through sneeze and cough of infected individuals?	2.83 ± 0.53	3 ± 0	< 0.001
Overall	2.24 ± 0.28	2.81 ± 0.12	< 0.001

Attitude Assessment

The mean point of attitude for each item is presented in Table 3. The item number 8 (Is a quick recovery linked to COVID-19 infection?) had the lowest mean and the item number 1 (I keep my distance of 1 to 2 meters from the others.) had the highest mean before the intervention. Our analysis demonstrated that all items, except for the items number 1, 4, and 21, improved significantly after our intervention. In fact, the overall point for attitude increased significantly from 3.97 ± 0.46 to 4.39 ± 0.46 ($P < 0.001$).

Practice Assessment

The mean point of practice for each item is presented in Table 4. The item number 17 (I usually sanitize my shopping bags.) had the lowest mean and the item number 16 (I usually wash my hand just after I come home) had the highest mean before the intervention. Our analysis demonstrated that all items, except for items number 2, 6, 8, 10, 11, 13, 14, 15, 20, and 21 improved significantly after our intervention. In fact, the overall point for practice increased

significantly from 3.20 ± 0.16 to 3.30 ± 0.15 ($P < 0.001$).

Discussion

In this study, the attitude, knowledge, and practice of householders in a selected residential area were examined during COVID-19 epidemic in Iran. The findings indicated that the level of knowledge, attitude, and practice regarding COVID-19 are lacking, necessitating an intervention. We evaluated the level of awareness at the baseline, and then educational contents were prepared and an intervention was made to improve awareness through social network. Our study revealed that an intervention based on the environmental health status can successfully increase the level of knowledge, attitude, and practice in the COVID-19 era. To the best of our knowledge, this is the first study to use environmental health intervention in residential complex in Iran.

It was revealed that the prevention and control measures are necessary for the limitation of COVID-19 transmission (17). Educating people in this regard can successfully help to prevent and control the disease (18). This issue shows

Table 3. The impact of intervention in the attitude of participants

Item	Before	After	P-value
1. I do observe my 1–2-meter distance with the others	4.77 ± 0.44	4.81 ± 0.38	0.216
2. COVID-19 is a dangerous disease	3.94 ± 0.69	4.83 ± 0.39	< 0.001
3. I and my family are susceptible for COVID-19	3.83 ± 1.25	4.29 ± 0.72	< 0.001
4. I have to infected with COVID-19 and I do not want to prevent this	3.68 ± 1.05	3.76 ± 0.89	< 0.001
5. If I will be infected with COVID-19, my family will be also at risk	4.33 ± 0.89	4.71 ± 0.53	< 0.001
6. Being infected with COVID-19 is associated with adverse outcomes on my job or education	3.58 ± 1.23	4.13 ± 0.59	< 0.001
7. Being infected with COVID-19 may be associated with mortality	4.15 ± 1.01	4.65 ± 0.61	< 0.001
8. Being infected with COVID-19 is associated with a rapid recovery	2.86 ± 1.02	3.62 ± 0.96	< 0.001
9. If I will be infected with COVID-19, my relatives will be also at risk	4.35 ± 0.71	4.62 ± 0.59	< 0.001
10. Using personal hygiene equipment is not mandatory for COVID-19 prevention	3.74 ± 1.33	4.53 ± 0.88	< 0.001
Overall	3.97 ± 0.46	4.39 ± 0.31	< 0.001

Table 4. The impact of intervention in the practice of participants

Items	Before	After	P-value
1. I usually do not participate in people aggregation such as ceremonies or festivals	3.58 ± 0.51	3.70 ± 0.53	0.002
2. I usually do my prayers at public masques	3.60 ± 0.52	3.63 ± 0.55	0.456
3. I usually have outside town trips	3.64 ± 0.51	3.51 ± 0.54	< 0.001
4. I usually use public transportation for my daily routines	3.55 ± 0.66	3.66 ± 0.59	0.013
5. I usually use my personal vehicle for my daily routines	3.22 ± 1.01	3.61 ± 0.68	< 0.001
6. I usually use facial mask when I am going out of house	3.9 ± 0.34	3.91 ± 0.31	0.803
7. I usually use hand gloves when I am going out of house	2.25 ± 1.05	2.62 ± 0.85	< 0.001
8. I usually observe hygiene precautions and distancing in the house	2.79 ± 1.11	2.75 ± 0.92	0.571
9. I usually see my parents, children or friends as a weekly routine	2.82 ± 0.79	3.03 ± 0.63	< 0.001
10. I usually observe social distancing in personal conversation and going out	3.64 ± 0.67	3.70 ± 0.64	0.270
11. I usually do most of my shopping in person	2.06 ± 0.88	1.96 ± 0.85	0.121
12. I usually go to restaurant for eating food and not order it online	3.62 ± 0.67	3.71 ± 0.53	0.06
13. I usually have hand sanitizer when I go out	3.63 ± 0.46	3.79 ± 0.49	0.418
14. I try to not contact my hand with my face when I am outside of the house	3.71 ± 0.52	3.78 ± 0.41	0.05
15. I usually sanitize my hand when it has a contact with a possible contamination	3.76 ± 0.46	3.79 ± 0.49	0.418
16. I usually wash my hand just after I come in the house	3.93 ± 0.27	3.97 ± 0.17	0.023
17. I usually sanitize my shopping bags	1.49 ± 0.79	1.95 ± 0.69	< 0.001
18. I usually sanitize contact surfaces in the house	1.72 ± 0.91	2.15 ± 0.78	< 0.001
19. I usually go out as a necessity and I try to stay home	3.35 ± 0.6	3.56 ± 0.62	< 0.001
20. I usually follow COVID-19 news and I am sensitive in this regard	3.23 ± 0.82	3.18 ± 0.72	0.462
21. I try to daily improve my knowledge about COVID-19 prevention and treatment	3.24 ± 0.75	3.18 ± 0.68	0.274
22. I use our residential gym for my work out	3.42 ± 0.82	3.73 ± 0.66	< 0.001
23. I observe hygiene precautions almost always in everywhere	3.69 ± 0.64	3.79 ± 0.45	0.013
24. I warn those who do not observe hygiene precautions	2.98 ± 0.81	2.75 ± 0.76	< 0.001
Overall	3.20 ± 0.16	3.30 ± 0.15	< 0.001

the importance of knowledge among the general population that was explored by previous studies. In a study by Chen et al, it was suggested that the knowledge of individuals about COVID-19 was significantly lower than the attitude and practice (19). This study showed that our intervention significantly improved the knowledge of the population against COVID-19, observed by several indicators. In fact, lack of proper knowledge existed among the participants and only the score of 1 item, which was related to COVID-19 transmission through hands, did not have a significant difference. Indeed, improving the knowledge through social network is one of the best ways for COVID-19 prevention in the general population. In the study of Abuhashesh et al, the knowledge of the studied population against COVID-19 increased significantly after social network based interventions, which was associated with the current study (20). The results of this study and other studies showed that educational interventions through social networks can be effective in increasing knowledge about COVID-19.

Assessing the attitude toward COVID-19 was another aim of this study. Improving attitude can decrease adverse outcomes of COVID-19 on the lifestyle (21). In a study by Padmanaban, it was suggested that the attitude of 25% of the studied population was low in regard to COVID-19 (22). According to Prapaso et al study, it was also stated that COVID-19 attitudes may be worse than knowledge and practice, which highlights the need for intervention to improve them (23). In addition, in a study by Araban et al in Iran in 2021, only 64% of participants had a valuable attitude toward COVID-19, which expresses the need for intervention for improving attitude in our society (24). In the evaluation of the participants' attitudes in this study, the results showed a significant increase in 8 items (out of 10) and only 2 items, including social distance and lack of pre-

ventive measures for COVID-19, did not improve significantly that had high scores at the baseline of the study. Similar previous studies were associated with our results. In a study by Maude et al, educational intervention based on video clip was effective in improving the attitude about COVID-19 (25). In addition, Rossi et al suggested that educational interventions can be effective in the attitude improvement for COVID-19 (26). Thus, educational interventions are necessary for improving attitude during the COVID-19 era.

Evaluation of preventative practices against COVID-19 was another goal of this study. Similar to attitude and knowledge, effective COVID-19 preventative practices are helpful; however, this element may not be as important as knowledge and attitude (27). This study demonstrated similar results. Our study suggested an improvement in preventative practices against COVID-19; however, this improvement was lower than knowledge and attitude improvements. Also, among 24 items that assessed the preventative practice, we observed a decrease in 3 items. This issue can be justified by some reasons. The first concern relates to potential research population burnout brought on by COVID-19 extension. In fact, the community performance may decline due to mental burnout and routine hygiene precautions (28). The second problem relates to a reduced risk of COVID-19 reinfection. Many people in the community have been infected with COVID-19 at least once, which is associated with higher immunity and reduces the risk of reinfection, but may be accompanied by lack of hygiene observation. Returning to the immunization is the next difficulty. In fact, when vaccination rates rise among the general public, a normalization of COVID-19 would start to emerge and impact people's practices. For overcoming this issue, studies suggested to have local health departments in different parts of a community (29). During conducting this study, we have established a local health department in the

mentioned residential area, which was a positive point in this study and can be helpful for further health interventions in this area.

The Islamic Republic of Iran is under several economic and political sanctions during recent years (30). Our study reflects the importance of environmental health intervention, which is effective in COVID-19 prevention and can properly help to interfere with COVID-19, considering all the sanctions (31). This study had some limitations. Lack of proper funding resource was one of the limitations of this study. In addition, some personal concerns might have prevented participants to answer the questions truthfully. Due to long period of the study, some participants failed to complete the study and some others did not fill the informed consent form because of fear and stress due to COVID-19 issues. Besides, choosing a residential complex as the study population may be associated with selection bias, but we tried to overcome this limitation by including a random sample of the residential complex population. To have the most impact, it would be preferable for future studies to use a larger sample size and a variety of educational methods. In order to reduce the impact of confounding factors and evaluate the effectiveness of environmental health interventions in raising population awareness of COVID-19, it would be preferable to perform future investigations as quasi-experimental studies.

Conclusion

Educational intervention during the COVID-19 era has an effective role in increasing knowledge, attitude, and practice against this disease. Increasing and expanding educational programs based on environmental health in residential areas can be effective in controlling the epidemic and lead to the public health promotion.

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Authors contribution

Designing the study: H.M., G.G., R.Y.A., M.S. Statistical analysis: M.R., A.M., M.A.S. Preparing the manuscript: M.A.S. Editing the manuscript: H.M., G.G., M.S.

Ethical Considerations

This study was conducted under the permission of medical ethics committee of Baqiyatallah University of Medical Sciences with the registration number of IR.BMSU.REC.1400.035. The researchers also guarantee that they will keep the data confidential.

Conflict of Interests

The authors declare that they have no competing interests.

References

- Shahrbaf MA, Tabary M, Khareshi I. The right ventricle in COVID-19 patients. *Eur Heart J*. 2021;42(6):559-60.

- Shahrbaf MA, Hassan M, Vosough M. COVID-19 and hygiene hypothesis: increment of the inflammatory bowel diseases in next generation? *Expert Rev Gastroenterol Hepatol*. 2021:1-3.
- WHO Coronavirus (COVID-19) Dashboard 8 July 2022 [Available from: <https://covid19.who.int/>].
- Worldometer 9 July 2022 [Available from: <https://www.worldometers.info/coronavirus/country/iran/>].
- Lipsitch M, Swerdlow DL, Finelli L. Defining the Epidemiology of Covid-19 - Studies Needed. *N Engl J Med*. 2020;382(13):1194-6.
- Kakemam E, Ghoddoosi-Nejad D, Chegini Z, Momeni K, Salehimiya H, Hassanipour S, et al. Knowledge, Attitudes, and Practices Among the General Population During COVID-19 Outbreak in Iran: A National Cross-Sectional Online Survey. *Front Public Health*. 2020;8:585302.
- Reuben RC, Danladi MMA, Saleh DA, Ejembi PE. Knowledge, Attitudes and Practices Towards COVID-19: An Epidemiological Survey in North-Central Nigeria. *J Community Health*. 2021;46(3):457-70.
- Eisenberg JNS, Scott JC, Porco T. Integrating disease control strategies: balancing water sanitation and hygiene interventions to reduce diarrheal disease burden. *Am J Public Health*. 2007;97(5):846-52.
- Hunter RF, de la Haye K, Murray JM, Badham J, Valente TW, Clarke M, et al. Social network interventions for health behaviours and outcomes: A systematic review and meta-analysis. *PLoS Med*. 2019;16(9):e1002890.
- Albouy-Llaty M, Rouillon S, El Ouazzani H, DisPro SG, Rabouan S, Migeot V. Environmental Health Knowledge, Attitudes, and Practices of French Prenatal Professionals Working with a Socially Underprivileged Population: A Qualitative Study. *Int J Environ Res Public Health*. 2019;16(14).
- Mousazadeh M, Naghdali Z, Rahimian N, Hashemi M, Paital B, Al-Qodah Z, et al. Management of environmental health to prevent an outbreak of COVID-19: a review. *Environmental and Health Management of Novel Coronavirus Disease (COVID-19)*. 2021:235-67.
- Almanasreh E, Moles R, Chen TF. Evaluation of methods used for estimating content validity. *Research in social and administrative pharmacy*. 2019;15(2):214-21.
- Ekolu SO, Quainoo H. Reliability of assessments in engineering education using Cronbach's alpha, KR and split-half methods. *Global journal of engineering education*. 2019;21(1):24-9.
- Zeraati M, Alavi NM. Designing and validity evaluation of quality of nursing care scale in Intensive Care Units. *Journal of Nursing Measurement*. 2014;22(3):461-71.
- Vakili MM, Jahangiri N. Content validity and reliability of the measurement tools in educational, behavioral, and health sciences research. *Journal of Medical Education Development*. 2018;10(28):106-18.
- Taber KS. The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in science education*. 2018;48(6):1273-96.
- Feyisa ZT. Factors limiting youths' practice of preventive measures toward the outbreak of COVID-19 in Oromia special zone surrounding Finfinnee, Ethiopia. *PLoS One*. 2021;16(3):e0248495.
- Gray DJ, Kurscheid J, Mationg ML, Williams GM, Gordon C, Kelly M, et al. Health-education to prevent COVID-19 in schoolchildren: a call to action. *Infectious Diseases of Poverty*. 2020;9(1):81.
- Chen H, Zhang M, Su L, Cao H, Zhou X, Gu Z, et al. Knowledge, Attitudes, and Practices Toward COVID-19 Among Chinese Teachers, Shenzhen: An Online Cross-sectional Study During the Global Outbreak of COVID-19. *Frontiers in Public Health*. 2021;9.
- Abuhashesh MY, Al-Dmour H, Masa'deh Re, Salman A, Al-Dmour R, Boguszewicz-Kreft M, et al. The Role of Social Media in Raising Public Health Awareness during the Pandemic COVID-19: An International Comparative Study. *Informatics*. 2021;8(4):80.
- Islam MS, Ullah MA, Islam US, Hossain S, Araf Y, Das A, et al. Influence on attitudes and lifestyle due to lockdown amidst COVID-19 pandemic: a perception-based analysis among Bangladeshi residents. *BMC Public Health*. 2021;21(1):1974.
- Padmanaban S, Rajendran P, Davis P, Velayutham P. Knowledge, attitude and practices towards COVID-19 among higher education students in India: a cross sectional study. *Z Gesundh Wiss*. 2021:1-13.
- Prapaso S, Luvira V, Lawpoolsri S, Songthap A, Piyaphanee W, Chanchaoentana W, et al. Knowledge, attitude, and practices toward COVID-19 among the international travelers in Thailand. *Tropical Diseases, Travel Medicine and Vaccines*. 2021;7(1):29.

24. 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. *Journal of Education and Community Health*. 2021;8(1):35-40.
25. Maude RR, Jongdeepaisal M, Skuntaniyom S, Muntajit T, Blacksell SD, Khuenpetch W, et al. Improving knowledge, attitudes and practice to prevent COVID-19 transmission in healthcare workers and the public in Thailand. *BMC Public Health*. 2021;21(1):749.
26. Rossi IV, de Lima JD, Sabatke B, Nunes MAF, Ramirez GE, Ramirez MI. Active learning tools improve the learning outcomes, scientific attitude, and critical thinking in higher education: Experiences in an online course during the COVID-19 pandemic. *Biochem Mol Biol Educ*. 2021;49(6):888-903.
27. Yesuf M, Abdu M. Knowledge, attitude, prevention practice, and associated factors toward COVID-19 among preparatory school students in Southwest Ethiopia, 2021. *PLoS One*. 2022;17(1):e0262907.
28. Morón M, Yildirim M, Jach L, Nowakowska J, Atlas K. Exhausted due to the pandemic: Validation of Coronavirus Stress Measure and COVID-19 Burnout Scale in a Polish sample. *Current Psychology*. 2021.
29. Juan L, Yongchun L. Intervention Effect of the Video Health Education Model Based on Solution-Focused Theory on Adolescents' Mental Health during the COVID-19 Pandemic. *Iranian Journal of Public Health*. 2021;50(11).
30. Ahmadi ZH, Mousavizadeh M, Nikpajouh A, Bahsir M, Hosseini S. COVID-19: A perspective from Iran. *Journal of Cardiac Surgery*. 2021;36(5):1672-6.
31. Nikpajouh A, Ahadi MS. Adverse impact of sanctions on control of COVID-19 epidemic in Iran. *Archives of Iranian medicine*. 2020;23(9):649-50.