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Awareness, Attitude, and Performance of Residents in Using Disinfectants to Prevent COVID-19 in 2022: a Case Study in Iran

Azam Tarfiei [1], Mohadeseh Zare Bidoki [2], Mohadeseh Motamed-Jahromi [3], Mahdieh Tarfiei [4], Elham Karimi [5], Ali Asghar Ebrahimi [6*]

[1] *Environmental Sciences and Technology Research Center, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.*
[2] *Department of Health Education and Promotion, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.*
[3] *Department of Public Health, School of Health, Fasa University of Medical Sciences, Fasa, Iran.*
[4] *Department of Environmental Health, Faculty of Health, Tabriz University Faculty of Health of Medical Sciences, Tabriz, Iran.*
[5] *Department of Safety and Environmental Management (HSE), School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.*
[6] *Environmental Sciences and Technology Research Center, Department of Environmental Health Engineering, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.*

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***Corresponding Author:**
Ali Asghar Ebrahimi

Email:
ebrahimi20007@gmail.com

Tel:
+98 35 31492273

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ABSTRACT

Introduction: It is essential to adopt preventive measures to reduce the prevalence and severity of COVID-19. Given the insufficient information about the use of disinfectants against the virus, which leads to various risks, this study aims to investigate awareness, performance, and attitudes of the residents of Yazd city regarding using disinfectants to prevent COVID-19.

Materials and Methods: In this descriptive study, the sample consisted of 271 people residing in Yazd using convenience sampling method. The tool used was a researcher-made questionnaire, which was reliable, valid, and was divided into two parts; after that the collected data was analyzed using descriptive and analytical statistical tests. SPSS software was used for data processing, and Amos software was used for model design.

Results: Most participants (51.3%) were female. The majority of participants (117 (43.2%)) aged between 30-40, and with an average age of 34.39 ± 9.6. The highest level of education attained by most participants was master's degree by 83 (30.6%) people. The mean and standard deviation for awareness (10.59 ± 2.7), attitude (40.74 ± 7.1), and performance (17.50 ± 5.1) were obtained. Structural Equation Modeling (SEM) analysis showed that the total effect had the greatest impact on the use of disinfectants, with performance (β = 0.032) and education (β = 0.068) having the strongest effects. Increase in disinfection and having a higher level of education increased the use of disinfectants as well.

Conclusion: As increasing people's awareness, attitude, and performance can help prevent the spread of COVID-19, implementing educational programs and timely comprehensive information dissemination about the use of disinfectants is recommended.

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Introduction

The outbreak of COVID-19 was first reported in the city of Wuhan, China, in December 2019, and it spread quickly across the world [1]. Due to the rapid spread of the virus, many countries faced large numbers of infected individuals [2, 3]. According to

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the World Health Organization (WHO), as of 29 January 2023, over 753 million people worldwide were infected with the virus, and 6.8 million died due to COVID-19 [4]. At the beginning, Iran had a high morbidity rate [5].

The COVID-19 pandemic prompted extensive research about its transmission and survival. The latest theories suggested that the virus primarily spread through respiratory droplets and aerosols, with some evidence supporting the possibility of airborne transmission [6]. The virus can survive on surfaces for varying lengths of time depending on the type of surface, with higher survival rates on smoother surfaces such as glass and stainless steel [7]. Environmental factors such as temperature and humidity may also play a role in the virus's survival and transmission [8]. Additionally, new variants of the virus have emerged, some of which may be more transmissible than the original strain. More research and observation are needed to better understand the virus and its transmission dynamics. Despite the successful administration of COVID-19 vaccines, it is crucial to implement preventive measures to reduce the spread and severity of the disease [9].

One of the preventive behaviors to reduce the transmission of Covid-19 is washing hands with soap or anti-microbial gels and sanitizing surfaces [10]. Using 70% ethyl alcohol, 50% hydrogen peroxide, 1% sodium hypochlorite, various anti-infective gels, moist towelettes containing anti-infective agents, etc., are among the recommended measures for sanitization [11]. According to the recommendations by the World Health Organization (WHO), frequently touched surfaces such as doorknobs, toilet handles, tables, keys, etc. should be regularly sanitized with household disinfectants. To ensure environmental sanitation, WHO recommends that disinfection methods be performed correctly and consistently [12]. Despite this, insufficient information about the use of disinfectant materials against the virus leads to various risks. A study by Biyabani et al. in the Saveh county showed that individuals lacked the awareness and desirable performance regarding the use of disinfection methods, as people used industrial alcohol or a mixture of vinegar and salt in the absence of access to medical alcohol, which itself could put their health at risk [13]. Similarly, the results of the study by Chang et al. showed that exposure to incorrect disinfectant materials could lead to undesirable outcomes such as respiratory distress, skin, equipment damage, and even death [14]. Therefore, by identifying the strengths and weaknesses in terms of awareness, attitude, and performance of the residents of Yazd in the use of disinfectants to control COvid-19, this study has provided solutions to improve the current situation.

Materials and Methods

The current study was of the applied type and was conducted with a descriptive-analytical approach among in the residents of the city of Yazd, Iran. The city is located in the central region of Iran and has a population of 586,276 with an altitude of 1216 meters above sea level. The climate in the Yazd province is characterized by cold, relatively humid winters and hot, long, and dry summers due to its location on world's dry belt (Figure 1) [15].

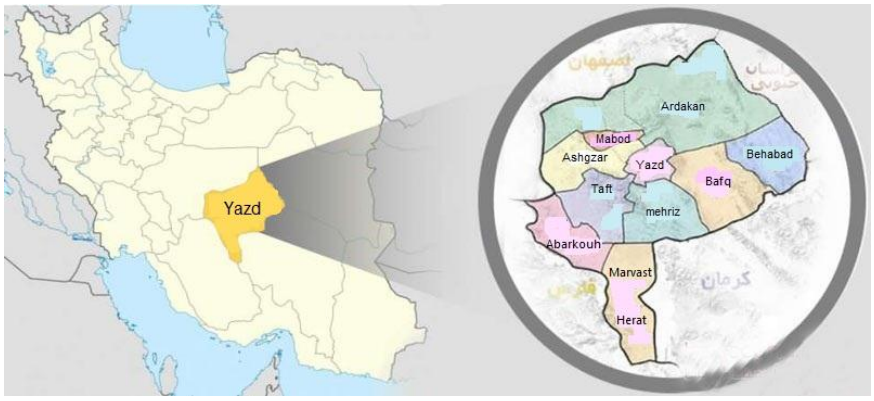

Figure 1: Geographical location of the study area in Yazd province

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The sampling method was available and a link to the electronic questionnaire was provided through WhatsApp and Telegram to the residents, and then a snowball method was used to request that the questionnaire link be made available to the participants whose consent was obtained. The objectives of the study and the confidentiality of the information were clearly explained at the beginning of the questionnaire.

The data collection tool in the present study was a self-administered questionnaire, which consisted of two sections. The first section contained demographic information, and the second section included questions on awareness, attitudes, and behaviors of the residents of Yazd city. This questionnaire was designed based on the information obtained from WHO regarding the use of anti-infective materials during the COVID-19 pandemic [16, 17].

This questionnaire consisted of 4 sections and 35 questions, including demographic information (11 questions), awareness (7 questions), attitudes (11 questions), and performance (6 questions). Then, the questionnaire was subjected to a pilot test. The reliability and validity of the questionnaire were confirmed by a panel of experts (regarding environmental health and health education and promotion) consisting of members of the academic faculty in Health Faculty of the Medical Sciences University of Yazd. The minimum acceptable content validity index CVI was 70% (22), and the content validity ratio (CVR) and (CVI) were respectively 0.877 and 0.855. To determine the validity of the questionnaire, 30 residents of Yazd were recruited and no items were deleted to increase alpha amount. The validity assessment was carried out with Cronbach's alpha test, which was 0.88. To reduce the risk of exposure to Covid-19, the questionnaire was designed and completed online.

The demographic section of the questionnaire included age, gender, education level, marital status, employment status, and the type of residency. The awareness section of the questionnaire consisted of questions about people's general awareness in the use of disinfectant materials. For example, it was asked whether it was better to let the surface dry naturally after using a disinfectant solution. The response options were "correct," "incorrect," and "I don't know." A five-point Likert scale (from completely disagree to completely agree) was used to answer the questions. For example, it was asked whether it was necessary to frequently disinfect the touched surfaces during the pandemic. With sufficient awareness about disinfection methods, COVID-19 infection can be prevented.

The performance section was designed based on the health protocols provided by WHO, which included five options of "always, most of the time, sometimes, rarely, and never". For example, some of the questions were as follows: "Do you disinfect your home or workplace daily? Do you disinfect your belongings immediately after returning home? Do you disinfect your food and other materials before purchasing? Do you disinfect the doorknob periodically after opening it?"

The number of samples was calculated based on the following formula (Cochran's formula):

$$n = \frac{\frac{z^2 pq}{d^2}}{1 + \frac{1}{N}(\frac{z^2 pq}{z^2} - 1)}$$

Z = Z score is the value of the standard normal distribution.
P = Population proportion
q= 1-p
d = Precision
N = Population size

This was cross-sectional research which used descriptive statistics, i.e., count, percentage, mean, and standard deviation to describe data. Independent samples t-test was used to analyze the difference in means between the groups in terms of gender and marital status. One-way ANOVA was used to analyze the difference in means among the ordinal and categorical variables (such as educational level). To perform inferential statistics, the normality of the study's continuous variable (age of the participants) was first tested through

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Kolmogorov–Smirnov test.

In structural equation modeling analysis, RAMSA-GFI-IFI-CFI-X2-X2/DF was used to develop the theoretical model. The total effects of awareness, attitude, behavior and performance of the residents of Yazd regarding the use of disinfectant materials to prevent the spread of COVID-19 were studied, taking into account the effects of age and education. A model of the relationships between the predictors (awareness, attitude, behavior, age and education) and the use of disinfectant materials was developed by showing the path in the form of a structural equation model to examine the factors affecting the use of disinfectant (SEM) (Figure 2).

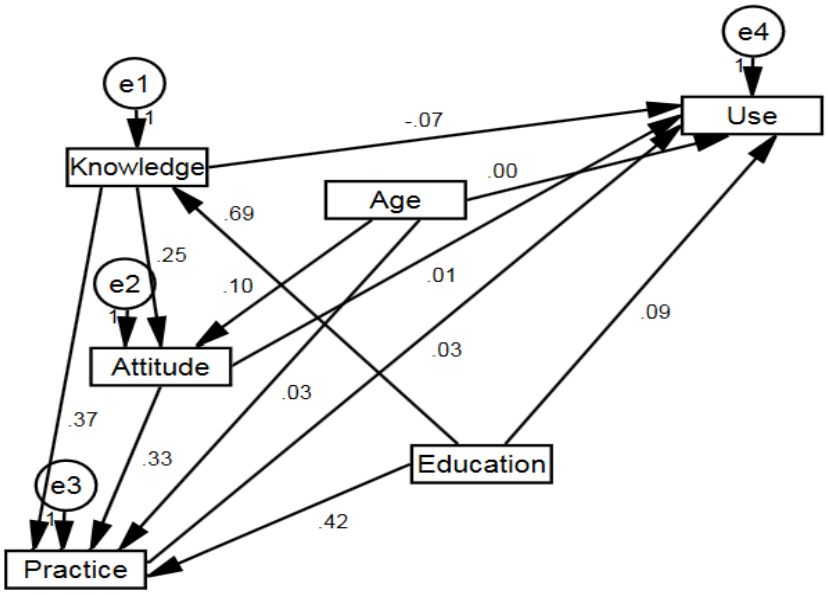

Figure 2: Structural equation model to investigate relationships among variables

After model refinement, its convergence was determined using convergence indices. SPSS software was used for data processing and survey analysis, and Amos software was used for structural equation modeling design. A significance level of 0.05 was considered.

Result

139 (51.3%) of the participants were women. The largest group of people was between 30-40 years old, 117 (43.2%) of whom had an average age of 34.39 ± 9.6. 144 (53.1%) of the participants were single, and 83 (30.6%) had the highest level of education. Most of the participants, 140 (51.7%), were unemployed, and 186 (68.6%), used an antiseptic once a day. 169 (62.4%) stated that the high cost of antiseptic products was a barrier to using them (antiseptic levels) in controlling the virus. Additionally, 147 (54.2%) reported that they disinfected their internal surfaces and handles once a day (Table1).

Table1: Demographic characteristics of the study participants

Demographic characteristics		N (%)
Sex	Female	139 (51.3%)
	Male	132 (48.7%)
Age	20-30	93 (34.3%)
	30-40	117(43.2%)
	40-50	37 (13.7%)
	50^{+}	24 (8.9%)
Marital status	Single	144 (53.1%)
	Married	127 (46.9%)

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Demographic characteristics		N (%)
Education	Primary school	15 (5.5%)
	High school	35 (12.9%)
	Associate degree	19 (7.0%)
	Bachelors' degree	61 (22.5%)
	Master of science degree	83 (30.6%)
	PhD	58 (21.4%)
Occupational status	Unemployed	140 (51.7%)
	Working in health sector	84 (31.0%)
	Working in the other parts of the sector	47 (17.3%)
Use of disinfected material	One time	186 (68.6%)
	Two times	39 (14.4%)
	Three times	13 (4.8%)
	More than three times	33 (12.2%)
Cost	Yes	169 (62.4%)
	No	84(31.0%)
Family members infected with Covid-19	Yes	147 (54.2%)
	No	124(45.8%)

The mean and standard deviation for awareness (10.59 ± 2.7), attitude (40.74 ± 7.1), and performance (17.50 ± 5.1) were obtained. There were 7 questions for awareness, and the total score for the questions ranged from 0 to 14. There were 11 questions for attitude, and the total score for the questions ranged from 11 to 55. Regarding performance, there were 6 questions, and the total score for the questions ranged from 0 to 24.

Analysis

After refining SEM, its fitness was determined using fitness indices. As shown in Table 2, fitness indices indicated a good fit for the model.

Table 2: Fitting the modified model (Fit model) with the data based on the fit indices

Index	RMSEA	GFI	IFI	CFI	X^2	DF	X^2/DF
	0.034	0.99	0.99	0.99	3.919	3	1.306

RMSEA: The Root Mean Square Error of Approximation, GFI= Goodness of Fit Index, IFI: Incremental Fit Index, CFI: Comparative Fit Index. DF: Degrees of freedom. X^2:Chi-Square.

Table 3 shows direct, indirect, and total path coefficients. The total effects from the SEM analysis show that the highest total effect on the use of disinfectant materials was related to performance (β = 0.032) and education (β=0.068), with increased use of disinfectant materials when performance and education level was at higher level. The total effect of attitude on the use of disinfectant materials (β = 0.019) was also direct, meaning that an increase in attitude could predict an increase in the use of disinfectant materials.

Regarding the relationships between the predictor variables, the largest impact was total training on performance (β = 0.731) and awareness (β = 0.731), which indicated that with an increase in training, both awareness and performance increased as well. The largest impact of total training was also observed on performance (β = 0.463) due to age, which suggested that with age, the performance of infection prevention improved. Attitude also had the largest impact on performance, and with an increase in attitude, performance increased as well.

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Table 3: SEM showing total effects of some variables

	Age	Education	Awareness	Attitude	Performance
Awareness	0.000	0.691	0.000	0.000	0.000
Attitude	0.104	0.175	0.253	0.000	0.000
Performance	0.064	0.731	0.455	0.333	0.000
Use	-0.002	0.068	-0.058	0.019	0.032

Table 4 determines the relationship between mean awareness, attitude, performance and demographic characteristics. The results showed that the mean awareness of 30–40-year-old participants was higher than the rest of the age groups, and the mean awareness of individuals over 50 was the lowest, and this difference in mean awareness based on age was statistically significant (p = 0.000). The results also indicated that the mean attitude of 30–40-year-old subjects was also higher than the rest of the age groups, and the mean attitude of individuals between 20-30 was the lowest, and this difference in mean attitude based on age was statistically significant (p = 0.000). Furthermore, the mean performance of 40-50-year-old participants was higher than the rest of the age groups, and the mean performance of individuals over 50 years old it was the lowest; this difference in mean performance based on age was statistically significant (p = 0.000).

The difference in mean awareness, attitude, and performance between men and single versus married individuals was not significant. According to the results, the mean awareness regarding the individuals who did not spend much money was higher than those who spent a lot, and this difference was significant (p = 0.006). Conversely, the mean attitude regarding those with high expenses was higher than those who little expenses, and the difference was significant (p = 0.001). Based on the results, the mean attitude of individuals who did not have a sick family member was better than those with a sick family member, and this difference was significant (p = 0.001). In addition, the results showed that the mean performance of individuals who did not have a sick family member was better than those who had a sick family member, and the difference was significant (p = 0.000).

According to Table 4, the average awareness of individuals who were employed in health and medical environments was higher than others, and unemployed individuals had the lowest average awareness, and this difference was significant (p = 0.000). The average attitude of individuals who were employed in organizations other than health and medicine was higher than others, the difference of which was significant (p = 0.000). In addition, the average performance of such participants was higher than others, and the unemployed ones had the lowest average performance, and this difference was significant (0.000). The results also indicated that the average awareness of the subjects with a master's degree was higher than others, and those with below a high school degree had the lowest average awareness, and this difference (p = 0.000) was significant. There was no significant difference in the average attitude between individuals with different levels of education (p = 0.174). In addition, individuals with PhD or higher education had better performance, and individuals with a high school diploma or lower education level had the lowest average performance (p = 0.002).

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Table 4: Determining the relationship between average awareness, attitude and performance with demographic characteristics

Variable			Awareness		Attitude		Performance	
		N (%)	Mean ± SD	P-value	Mean± SD	P-value	Mean ± SD	P-value
Age	20-30	93 (34.3)	9.89 ± 2.8	0.000	38.17 ± 6.1	0.000	15.28 ± 5.5	0.000
	30-40	116 (42.8)	11.56 ± 1.9		42.44 ± 7.9		19.12 ± 4.3	
	40-50	37 (13.7)	10.97 ± 2.1		41.05 ± 4.8		19.41 ± 3.4	
	Over 50	24 (8.9)	7.83 ± 3.8		41.38 ± 7.1		15.21 ± 5.2	
Sex	Female	139 (51.3)	10.78 ± 2.5	0.243	40.55 ± 7.2	0.665	17.63 ± 5.4	0.685
	Male	132 (48.7)	10.39 ± 2.8		40.93 ± 7.14		17.37 ± 4.8	
Marriage	Single	144 (53.1)	10.58 ± 2.4	0.948	39.99 ± 6.5	0.066	17.72 ± 4.8	0.454
	Married	127 (46.9)	10.60 ± 3.1		41.59 ± 7.7		17.25 ± 5.4	
Cost	Yes	169 (62.4)	10.22 ± 3.1	0.006	41.89 ± 6.6	0.001	17.27 ± 5.4	0.988
	No	84 (31.0)	11.25 ± 2.1		38.80 ± 7.4		17.25 ± 4.5	
Having a sick family member	Yes	147 (54.2)	10.35 ± 2.9	0.118	39.44 ± 6.9	0.001	16.04 ± 5.3	0.000
	No	124 (45.8)	10.87 ± 2.4		42.28 ± 7.1		19.11 ± 4.3	
Job	Unemployed	140 (51.7)	9.99 ± 2.8	0.000	40.56 ± 6.2	0.000	16.85 ± 5.1	0.001
	Working in health sector	47 (17.3)	11.46 ± 1.8		39.10 ± 6.1		17.17 ± 5.1	
	Working in other parts of the sector	84 (31.0)	10.81 ± 3.2		44.19 ± 10.1		20.01 ± 4.2	
Education	Below high school	15 (5.5)	7.07 ± 3.9	0.000	43.73 ± 7.0	0.147	16.33 ± 4.2	0.002
	diploma	35 (12.9)	9.46 ± 2.6		38.31 ± 3.9		15.34 ± 4.6	
	High school diploma	19 (7.0)	10.21 ± 2.3		41.16 ± 6.9		19.21 ± 3.1	
	Associate degree	61 (22.5)	9.93 ± 3.1		41.26 ± 7.4		16.82 ± 6.5	
	Bachlor's degree	83 (30.6)	11.95 ± 1.9		41.28 ± 7.8		17.35 ± 5.2	
	Master of Science	58 (21.4)	11.03 ± 1.7		39.97 ± 7.2		19.48 ± 3.5	
	PhD and higher							
Use	One time		10.64 ± 2.7	0.042	40.29 ± 7.2	0.136	17.09 ± 5.2	0.049
	Two times		11.36 ± 2.3		41.31 ± 7.6		17.67 ± 5.6	
	Three times		9.31 ± 2.8		39.15 ± 9.3		17.08 ± 4.9	
	More than three times		9.88 ± 2.9		43.21 ± 4.6		19.79 ± 3.1	

Discussion

The present study aimed to identify the strengths and weaknesses in terms of awareness, attitude, and performance of the residents of Yazd in using disinfectants to control COVID-19. Preventive beliefs and positive attitudes should be created, and positive behaviors should be improved to effectively respond to the disease [18]. Moreover, preventive behaviors are needed to reduce the spread and severity of the COVID-19 disease. Previous research showed that little attention had been paid to the appropriate use of disinfectants for controlling the virus. However, improper use of disinfectants may have adverse effects [19].

According to the results, there was a significant relationship between the age of individuals and their level of awareness, attitude, and performance; older individuals had more information and awareness and better preventive behaviors, including the proper use of antiseptics. It seems that this increase

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was due to people's increasing sensitivity towards their health as they aged; Nesirzadeh and Aligol stated that there was a direct and meaningful relationship between preventive behaviors and awareness and attitudes, and that attitudes were the strongest predictor of behaviors. A direct and meaningful correlation was also seen between the average score of preventive behaviors and age. In this study, the lack of sufficient awareness was a major issue for individuals who had poor hygiene performance and did not properly care for their sick family member at home [20].

The results of the study showed that there was no significant difference in the mean awareness, attitude, and performance between men and women, and also between single and married individuals. Different results were obtained from other studies. The study by Hosseinkhani et al. revealed that the level of awareness and performance of men was lower than that of women, indicating that despite the fact that men were more likely to be exposed to occupational hazards and had higher mortality rates, they had lower levels of awareness and preventive behaviors, which could make the epidemiological conditions worse. Therefore, it is necessary to focus more on educational and preventive programs for men as the target group [21].

Among occupations, healthcare personnel had the most awareness and self-employed individuals had the least awareness. This was due to the fact that the staff had a direct contact with COVID-19 patients and were more aware of the disease than others. Alikhani's study found that the awareness of personnel in other sectors about preventing the spread of COVID-19 was average [22]. The results of Rahmanian's study were also consistent with the results of this study, which showed that the level of awareness in administrative personnel was significantly lower compared to healthcare personnel, but administrative personnel had a better performance in dealing with COVID-19 [18]. The results of Moradi et al. also suggested that education had a significant impact on increasing awareness and motivating employees to observe health measures and take the disease seriously [23].

The performance of employed individuals was better than that of unemployed, which indicated a better economic status. Therefore, they spent more time on preventive measures. This was similar to the results of a study conducted in China, which showed that participants with a better economic-social status had better performance in this field. It was also found that the higher the education level of individuals, the more their awareness score was, but there was not much difference in their attitudes. Similarly, individuals with higher education, such as postgraduates, had better performance in using sanitizers. These results were similar to a study in China, where participants with higher education and better economic-social status had better awareness and followed appropriate preventive measures to avoid the spread of COVID-19 [24]. However, other similar studies had shown a weak correlation between education and people's attitudes, indicating that higher education did not necessarily lead to a better attitude and in this study, education did not have a significant relationship with performance [25].

Strengths and weaknesses

A positive feature of this study was its relevance. To this day, no studies had been conducted to examine awareness, attitudes, and behaviors towards the use of disinfectants among the residents of Yazd.

The sample was obtained through convenience sampling through social networks, which limited the generalizability of the results of the study. There was also a possibility of selection bias, as those with low economic status and low literacy levels might not have been able to participate in the study.

Conclusion

The results of the present study show that despite the fact that the level of awareness and attitude of the people is acceptable, due to the spread of COVID-19 information and disinfection methods, it is necessary to design different educational programs according to the needs of the community with the aim of enhancing their level of awareness, attitude and performance regarding disinfection methods. Furthermore, the high cost of

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buying disinfectant materials is a barrier for using those (disinfecting surfaces) in controlling COVID-19. Education, age, and occupation are the most influential variables affecting the level of awareness of the residents of Yazd city. People aged 30-40 have a high level of awareness about disinfection in preventing COVID-19, but the average awareness of people over 50 is the lowest. Therefore, to improve the behavior of this age group, comprehensive information dissemination and training is recommended.

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Conflict of Interest

The authors declared no conflict of interest.

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Code of Ethics

This study was registered with the Ethics Committee of Shahid Sadoughi University of Medical Sciences in Yazd, under the code IR.SSU.SPH.REC.1401.006

Author's contributions

Azam Tarfiei was involved with methodology; Ali Asghar Ebrahimi and Azam Tarfiei carried out project administration, and supervision, Azam Tarfiei and Mohadeseh Zare Bidoki wrote the original draft, and; Mohadeseh Motamed-Jahromi analyze data; Mahdieh Tarfiei and Elham Karimi wrote the paper; Ali Asghar Ebrahimi was involved with reviewing and editing, all the authors read and agreed to the final manuscript.

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