

Protection Behaviors and Related Factors Against COVID-19 in the Healthcare Workers of the Hospitals in Iran: A Cross-Sectional Study

Abstract

Background: Protective behaviors play a key role in reducing the incidence of COVID-19 in HealthCare Workers (HCWs), and these behaviors are related to other factors. These related factors have not been comprehensively evaluated and determined in the literature. This study aimed to determine protection behaviors against COVID-19 and their related factors using the Protection Motivation Theory (PMT) among HCWs of hospitals in Tehran, Iran, in 2021. **Materials and Methods:** For this cross-sectional study, 270 HCWs of different wards in 3 hospitals in Tehran, Iran, were selected through multistage sampling (April to July 2021). The participants completed a self-reporting questionnaire which consisted of a demographic characteristics form and questions about protective behaviors against COVID-19 and other constructs of the PMT (60 items). Data analysis was performed using descriptive and inferential methods. **Results:** The mean score of the protective behaviors of the HCWs was 4.20 (SD = 0.56) and was significantly higher in the nurses, women, married individuals, and those with a BSc degree compared with others ($p < 0.05$). Furthermore, the results of multiple regression analysis showed that protection behavior among HCWs could be strongly predicted by the type of profession, protection motivation/intention, and self-efficacy constructs ($F_{14, 255} = 16.34, p < 0.001$). **Conclusions:** The protection behaviors of HCWs against COVID-19 were relatively desirable and these behaviors were related to and predicted by various factors. These results could apply to developing plans for protective behaviors against COVID-19 and possibly other infectious diseases among HCWs. Further research in this regard is recommended.

Keywords: COVID-19, cross-sectional studies, health behavior, health personnel, motivation

Introduction

COVID-19 disease was first observed in Wuhan, China, and became a pandemic after spreading to various regions and infecting numerous people across the world.^[1] By November 8, 2021, there were 249,507,923 confirmed cases of COVID-19 and 5,044,654 deaths around the world,^[2] and 5,987,814 confirmed cases and 127,299 deaths in Iran.^[3] The results of a study showed that the prevalence of COVID-19 infection was almost ten times higher in HealthCare Workers (HCWs) and COVID-19 outcomes (e.g., hospitalization, ICU admission, fatality) were significantly lower in HCW Patients (HCWPs) compared with non-HCWPs.^[4] During the period of another study in 2020 in Iran, COVID-19 was detected in 23% of hospital HCWs.^[5] Front-line HCWs may have up to a 12-fold increased risk of reporting a positive COVID-19 test compared to the general

community.^[6] Moreover, the level of infection incidence varies for different HCWs, and factors such as the type of profession, type of work environment, and protective behaviors may be effective in this regard.^[6-8] In a study, the type of health professionals and care environment were reported to be influential factors in the risk of COVID-19 in HCWs, and the hazard ratio of this disease for HCWs has been estimated at 6.94-24.3 in various care environments.^[6] Moreover, the COVID-19 infection rate among HCWs in Qatar has been reported to be 10.6%, and only 5% of them were acquired in the COVID-19 ward and 95% were acquired in other hospital wards through accidental exposure to a colleague (45%) or a patient (29%). Nurses, midwives, and non-clinical support service staff had the highest number of infections. Ultimately, protecting HCWs against infectious diseases, especially during a pandemic such as COVID-19 is vital.^[7]

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Toghanian R, Ghasemi S, Hosseini M, Nasiri M. Protection behaviors and related factors against COVID-19 in the healthcare workers of the hospitals in Iran: A cross-sectional study. Iran J Nurs Midwifery Res 2022;27:587-92.

Submitted: 19-Dec-2021. **Revised:** 23-Jan-2022.

Accepted: 11-Oct-2022. **Published:** 18-Nov-2022.

Reyhaneh Toghanian¹, Saeed Ghasemi¹, Meimanat Hosseini¹, Malihe Nasiri²

¹Department of Community Health Nursing, School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, Iran, ²Department of Basic Sciences, Faculty of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, Iran

Address for correspondence:

Dr. Saeed Ghasemi,
Vali Asr Ave., Niayesh Cross
Road, Niayesh Educational
Complex, Department of
Community Health Nursing,
School of Nursing and Midwifery,
Shahid Beheshti University of
Medical Sciences, Tehran, Iran.
E-mail: saeedghasemi20@sbmu.
ac.ir

Access this article online

Website: www.ijnmrjournal.net

DOI: 10.4103/ijnmr.ijnmr_430_21

Quick Response Code:



Some of the protective behaviors against COVID-19 include early vaccination, keeping a social distance of at least one meter from others, avoiding mass gatherings and crowded places, only going to well-ventilated indoor spaces, wearing a face mask, regular and correct hand washing and disinfection, covering the mouth and nose with a cloth or the inner part of the elbow while coughing/sneezing, rapid disposal of used napkins, and self-quarantining until recovery in cases that show symptoms or have a positive COVID-19 test result.^[9] Improper protective behaviors such as lack of use/inefficient use of Personal Protective Equipment (PPE) will increase the risk of COVID-19 infection in HCWs. Protective behaviors play a key role in the reduction of COVID-19 infection rates in HCWs.^[6] Notably, the staff of various healthcare centers has different behaviors toward the use of PPE.^[6,7] In a study in this regard, the observance rate of protective behaviors in HCWs was estimated at 68–82% in non-COVID and COVID wards.^[7] Moreover, HCWs had different types of protective behaviors, which were related to factors such as demographic characteristics and type of profession. For instance, women gained higher scores compared to men, and paramedics and technicians, respectively, received the highest and lowest scores in this regard.^[10] However, no difference was observed between men and women regarding the COVID-19 infection rate in another study.^[6] Findings in the literature concerning related factors of protective behaviors of HCWs against COVID-19 are scattered and different, and thus, the identification of these related factors is essential. Social cognition models provide an appropriate approach to understanding and studying health behavior and its related factors. Protection Motivation Theory (PMT) is one of the most used social cognition models. This model has been used for the prediction of health behavior and its related factors. PMT describes adaptive and maladaptive responses to a health threat.^[11] The main constructs of the PMT include protection behavior, protection motivation/intention, self-efficacy, response efficacy, vulnerability, severity, response costs, fear, and rewards of maladaptive response.^[11,12]

Since findings presented in the literature on protective behaviors against COVID-19 and their related factors are scattered, different, and sometimes inconsistent with each other in different groups of HCWs,^[6,7,10,13] and one of the best models for determining protective behaviors against health-related risks such as COVID-19 and their related factors is PMT,^[10,12-14] the present study was conducted to determine the protective behaviors against COVID-19 and their related factors using PMT in HCWs in the hospitals of Tehran, Iran, in 2021.

Materials and Methods

The present study was conducted (April to July 2021) as part of a master's degree thesis in community health nursing approved and funded by Shahid Beheshti University of

Medical Sciences, Tehran, Iran. This cross-sectional study was performed through a multistage sampling procedure. Based on an approximately similar previous study^[10] and using the sample size formula ($Z = 1.96$; Standard deviation = 4; $d = 0.5$), the total sample size was calculated to be 245 individuals. To guarantee sufficient power for statistical analysis in subgroups and considering attrition, the sample size was increased by approximately 10%. Thus, the sample size was determined to be 270 HCWs (nurses, physicians, laboratory staff, physiotherapy and radiology personnel, administrative staff such as receptionists, and discharge and medical records). In the first stage of sampling, 3 out of 12 educational hospitals affiliated with Shahid Beheshti University of Medical Sciences were randomly selected using the lottery method. In the second stage, 270 HCWs (90 HCWs from each hospital) were selected through convenience sampling and completed self-reporting questionnaires. The inclusion criteria were informed consent and a minimum work experience of 6 months. The exclusion criterion was incomplete or distorted questionnaires. Figure 1 presents the flow chart of the multistage sampling procedure.

The study questionnaire consisted of 2 sections. The first section was a demographic characteristics form (10 items) and the second section included questions about constructs of the PMT (60 items). The demographic characteristics form included questions about age, gender, number of children, marital status, education level, type of profession, years of work experience, history of underlying diseases, a history of underlying diseases in first-degree relatives, and history of COVID-19 disease. The second section of the questionnaire consisted of 9 constructs and 60 items, including protection behavior (items 1–11; scoring: 11–55) (e.g., How many times have you used a face mask in your workplace in the past month?), protection motivation/intention (items 12–24; scoring: 13–91) (e.g., I intend to use a face mask at my workplace until the end of the COVID-19 pandemic), perceived severity (items 25–28; scoring: 4–28) (e.g.,

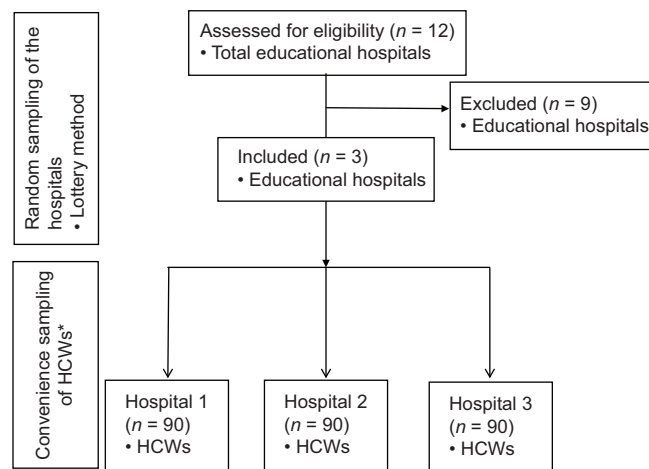


Figure 1: Flow chart of the multistage sampling procedure. *HCWs: HealthCare Workers

COVID-19 morbidity may lead to serious physical complications for me), perceived vulnerability (items 29–31; scoring: 3–21) (e.g., I may be infected with COVID-19 in the future), fear (items 32–35; scoring: 4–28) (e.g., The thought of having COVID-19 scares me), perceived response costs (items 36–41; scoring: 6–42) (e.g., Using PPE is hard and boring for me), rewards of maladaptive response (items 42–44; scoring: 3–21) (e.g., During the COVID-19 pandemic, leaving the house or going on a trip makes me happy), perceived self-efficacy (items 45–52; scoring: 8–56) (e.g., I can receive sufficient information about the prevention of COVID-19), and perceived response efficacy (items 53–60; scoring: 8–56) (e.g., Accurate and standard use of face masks at the workplace reduces the possibility of COVID-19).

The items of protection behavior constructs were scored based on a 5-point Likert scale (Never-Always), and higher scores indicated higher compliance with protection behaviors against COVID-19. Furthermore, the items related to the other constructs of PMT were scored based on a 7-point Likert scale (completely agree-completely disagree). In this regard, achieving higher scores in all the constructs of the items showed the higher propensity of the participants to comply with the protection behaviors against COVID-19, except for the rewards of the maladaptive response construct. All the items were scored positively, except for item 31, which was scored reversely. The validity of the tool was evaluated before use, and all the items of the instrument achieved an impact score of higher than 1.5. Moreover, the Content Validity Index (CVI) and Content Validity Ratio (CVR) of the entire tool was estimated at 0.95 and 0.70, respectively. The Cronbach's alpha and Intraclass Correlation Coefficient (ICC) of the scale were 0.86 and 0.77, respectively.

After obtaining the necessary permissions and coordinating with the hospital authorities, one of the researchers referred to different wards of the 3 selected hospitals for data collection. Informed written/online consent forms and study questionnaires were distributed among the nurses and other HCWs. The participants completed the written/online consent form and study questionnaire at a time suitable to them so that their work time and rest would not be affected by the research process. Questionnaires were collected after completion. Data were analyzed using descriptive (such as mean, standard deviation, frequency, and frequency percentage) and inferential methods (such as Pearson's correlation coefficient, Analysis of variance, independent t-test, and regression analysis) in SPSS software (version 22; IBM Corp., Armonk, NY, USA).

Ethical considerations

This study was approved by the Research Ethics Committee of the School of Pharmacy and Nursing & Midwifery of Shahid Beheshti University of Medical Sciences (Approval

ID: IR.SBMU.PHARMACY.REC.1399.361, Approval Date: 2021-03-07). Consent forms were obtained from all participants, and the principles of voluntary participation, anonymity, and confidentiality for the participants, and accuracy and bailment for the texts were respected throughout the study. The necessary permissions for sampling were obtained from the authorities.

Results

The mean age of the participants was 32.65 (SD = 8.75) years and their mean work experience was 8.82 (SD = 7.89) years. Moreover, 47% of the participants were nurses, and 53% were other HCWs. All the HCWs worked in hospitals that had several COVID-19 units and HCWs had direct or indirect contact with COVID-19 patients. Most of the participants were nurses and women and had a BSc degree and no children. Other demographic characteristics of the HCWs are presented in Table 1.

The mean score of the protection behavior of HCWs against COVID-19 was 4.20 (SD = 0.56) and 83.80% of the mean from the maximum obtainable score was at a relatively desirable level. The results of the independent t-test demonstrated significant statistical differences in the mean scores of protection behavior

Table 1: Demographic characteristics of HealthCare Workers (HCWs)

Characteristics	HCWs n (%)
Gender	
Female	213 (78.90)
Male	57 (21.10)
Marital status	
Single	106 (39.30)
Married	164 (60.70)
Having children	
Yes	93 (34.40)
No	177 (65.60)
Education level	
Diploma	27 (10.00)
BSc*	199 (73.70)
MSc**	24 (8.90)
Ph.D.***/physician	20 (7.40)
History of underlying diseases	
Yes	24 (8.90)
No	246 (91.10)
History of underlying diseases in first-degree relatives	
Yes	95 (35.20)
No	175 (64.80)
History of COVID-19 diagnosis	
Yes	83 (30.70)
No	187 (69.30)
Total	270 (100)

*BSc: Bachelor of science; **MSc: Master of science;

***Ph.D.: Doctor of Philosophy

construct among subjects classified by type of profession (Nurse/other HCWs), gender (female/male), and marital status (single/married) ($p < 0.05$); nurses, women, and married HCWs had higher scores. The results of the comparison of protection behavior construct among different demographical groups are presented in Table 2.

For a more accurate assessment of the relationship between the protective behaviors of HCWs and the type of profession and constructs of the PMT, multiple regression analysis was used (method: enter), (adjusted variables: education level, age, gender, marital status, having/not having children; dependent variables: type of profession and constructs of PMT). The results of multiple regression analysis showed that type of profession, protection motivation/intention and self-efficacy constructs of PMT were statistically significant and had predictable power for protective behaviors of HCWs against COVID-19 ($R^2 = 0.473$; $F_{14,255} = 16.34$; $p < 0.001$). Other results in this regard showed that the mean score of protection behavior was 0.14 times higher in the nurses compared to the other HCWs. In addition, protection behavior increased by 0.58 and 0.23 points per unit increase of protection motivation/intention and self-efficacy constructs, respectively [Table 3].

Discussion

The present study was conducted to determine the protection behaviors against COVID-19 and their related factors using PMT in HCWs. The results of the study showed that protection behavior was relatively desirable in these participants and was significantly higher in nurses, women, married individuals, and those with a BSc degree compared to others. Other results also showed that protection behavior could be strongly predicted by profession, protection motivation/intention, and self-efficacy constructs.

The results of the study showed that protection behavior was significantly higher in women, married individuals, and those with a BSc degree compared to others. In a study on protective behavior against COVID-19 among the public in Kuwait, results showed no statistically significant difference between male and female participants and subjects with different occupational statuses (student, private business, retired, employees, and unemployed) with regards to protective behavior intention,^[14] which is inconsistent with our findings. The results of another study conducted on the general population in Iran showed a higher level of protective behaviors in individuals aged

Table 2: Comparison of protective behaviors against COVID-19 among different demographical groups of HealthCare Workers (HCWs)

Demographic Characteristics	F/t/r***	df	p
Age	r=0.11	-	0.07
Profession (nurses/other HCWs)	t=3.46	259.91	0.001**
Gender (Female/Male)	t=-3.45	70.53	0.001**
Marital status (Single/Married)	t=-2.31	268	0.02*
Having children (Yes/No)	t=1.43	268	0.15
History of underlying diseases (Yes/No)	t=-0.25	268	0.80
History of underlying diseases in first-degree relatives (Yes/No)	t=-0.90	268	0.37
History of COVID-19 diagnosis (Yes/No)	t=0.82	268	0.41
Education level (Diploma, BSc, MSc, Ph.D./physicians)	F****=11.81	3	<0.001**

*Significant at 0.05 level. **Significant at 0.01 level. ***F (Analysis of variance), t (independent t-test), r (Pearson's correlation coefficient). ****(Tukey's Post Hoc Test showed a significant difference in the mean score of protection behavior construct between those with a BSc and diploma, and Ph.D./physicians. Moreover, there was a statistically significant difference between those with an MSc and Ph.D./physicians in this regard. The scores of those with a BSc were higher than those with an MSc, diploma, and Ph.D./physicians, respectively

Table 3: The results of multiple regression analysis for predicting the related factors of protection behavior among Healthcare Workers (HCWs)

Entered variables	Statistical indices				
	B	Standard error	Beta	t	p
Profession type	-0.14	0.05	-0.12	-2.54	0.01*
Protection motivation/intention construct	0.58	0.07	0.50	8.41	<0.001**
Perceived severity	-0.01	0.03	-0.01	-0.22	0.82
Perceived vulnerability	-0.02	0.03	-0.03	-0.65	0.51
Fear	0.03	0.02	0.07	1.26	0.20
Perceived response costs	-0.02	0.02	-0.06	-1.05	0.29
Rewards of maladaptive response	-0.01	0.02	-0.02	-0.41	0.68
Self-efficacy	0.23	0.05	0.24	4.26	<0.001**
Perceived response efficacy	-0.10	0.06	-0.10	1.62	0.10

*Significant at 0.05 level, **Significant at 0.01 level

higher than 15 years, women, married subjects, HCWs, and subjects with a BSc degree (or higher).^[12] In another research performed in the United States, the correlations of income status, gender, occupation status, and different living environments with protective behaviors against COVID-19 were evaluated and were found to be higher in women and those with a higher income,^[15] which is in line with the results of the present study. The results of studies on the effect of demographic characteristics on protection behaviors may differ, and factors such as type of population and the scales used to assess protective behaviors may be the cause of this difference, but it is important to note that some demographic characteristics certainly have a relationship with the protection behaviors of humans. For example, being married creates a kind of responsibility in human beings to perform protection behaviors because of their families; the results of another study showed that family healthy lifestyle and family health resources were significantly related to increases COVID-19 protection motivation^[16] and to COVID-19 protection behaviors.

In the current study, one of the factors that predicted protection behaviors against COVID-19 in HCWs was a type of profession; nurses had a higher score in protection behaviors compared to the other HCWs. In a study conducted in Pakistan, physicians had a more efficient protective performance regarding COVID-19 compared to nurses; however, this difference was not statistically significant.^[17] Another study indicated a difference between nurses and other HCWs in terms of accurate responses to the questions of protective behaviors, and nurses scored higher compared to general practitioners and specialists.^[18] Similarly, the results of another study showed a higher score of protective behaviors in nurses compared to doctors.^[19] Notably, the results of the present study are in line with the aforementioned studies, which might be due to the nature of the nursing profession, the direct contact of nurses with patients, and the need for attention to protective behaviors against communicable diseases among nurses.

Ultimately, the results of this study showed that protection motivation/intention and self-efficacy constructs were other predictive factors for protection behavior against COVID-19 among HCWs. Bashirian *et al.*^[10] reported that self-efficacy, vulnerability, severity, response costs, and response efficacy were predictive factors for the protection intention construct, and protection intention was a predictive factor for the protection behaviors of HCWs against COVID-19. Ezati *et al.*^[12] found that protection motivation, maladaptive behavior rewards, response efficacy, self-efficacy, and fear predicted protective behaviors against COVID-19. The results of the present study regarding self-efficacy and intention are consistent with the two mentioned articles, but their findings regarding the other constructs of PMT are inconsistent with that of our study, which may be related to factors such as normalization and lack of fear of COVID-19 among HCWs because of constant contact with

COVID-19. This issue could also be due to factors such as organizational or national laws and supervision for the performance of the protection behaviors against COVID-19 among HCWs. Some related factors with protection behaviors against COVID-19 may exist that were not evaluated in this study and this is one of the limitations of the study. Another limitation was possible carelessness in completing the self-reporting questionnaires by HCWs.

Conclusion

In the present study, the protective behaviors of HCWs against COVID-19 and their related factors were evaluated and determined. Protection behaviors of HCWs against COVID-19 were relatively desirable. Demographic characteristics (such as gender, marital status, education level, and type of profession), and the constructs of the PMT (protection motivation/intention and self-efficacy) were the most related and predictable factors for the protective behaviors of HCWs against COVID-19. These results could be useful and applicable in developing and designing plans for protective behaviors against COVID-19 and possibly other infectious diseases among HCWs, and greater emphasis should be placed on these predictors of protective behaviors in plans. Further research in these areas is recommended.

Acknowledgements

We appreciate the cooperation of Shahid Beheshti University of Medical Sciences and the authorities of the educational hospitals. We would also like to thank all participants who took part in the study.

Financial support and sponsorship

Shahid Beheshti University of Medical Sciences (SBMU), Tehran, Iran

Conflicts of interest

Nothing to declare.

References

- Centers for Disease Control and Prevention. COVID-19. Identifying the source of the outbreak (Content source: National Center for Immunization and Respiratory Diseases (NCIRD), Division of Viral Diseases). Available from: <https://www.cdc.gov/coronavirus/2019-ncov/science/about-epidemiology/identifying-source-outbreak.html>. [Last accessed on 2021 Oct 28].
- World Health Organization WHOCoronavirus (COVID-19) Dashboard. Available from: <https://covid19.who.int>. [Last accessed on 2021 Nov 08].
- World Health Organization Global, Iran (Islamic Republic of). available From: <https://covid19.who.int/region/emro/country/ir>. [Last accessed 2021 Nov 08].
- Alshamrani MM, El-Saed A, Al Zunitan M, Almulhem R, Almohrij S. Risk of COVID-19 morbidity and mortality among healthcare workers working in a Large Tertiary Care Hospital. *Int J Infect Dis* 2021;109:238-43.
- Kalantar SH, Mortazavi SJ, Bagheri N, Dehghan Manshadi SA,

- Moharrami A, Ariamloo P, *et al.* Prevalence of coronavirus disease-2019 among healthcare workers in imam Khomeini hospital complex in Tehran, Iran. *J Orthop Spine Trauma* 2021;6:30-2.
6. Nguyen LH, Drew DA, Joshi AD, Guo CG, Ma W, Mehta RS, *et al.* Risk of COVID-19 among frontline healthcare workers and the general community: A prospective cohort study. *medRxiv* 2020:2020.04.29.20084111. doi: 10.1101/2020.04.29.20084111.
 7. Alajmi J, Jeremijenko AM, Abraham JC, Alishaq M, Concepcion EG, Butt AA, *et al.* COVID-19 infection among healthcare workers in a national healthcare system: The Qatar experience. *Int J Infect Dis* 2020;100:386-9.
 8. Wei JT, Liu ZD, Fan ZW, Zhao L, Cao WC. Epidemiology of and risk factors for covid-19 infection among health care workers: A multi-centre comparative study. *Int J Environ Res Public Health* 2020;17:7149.
 9. World Health Organization Home/Diseases/Coronavirus disease (COVID-19)/Advice for the public: Coronavirus disease (COVID-19). Available from: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public>. [Last accessed on 2021 Oct 28].
 10. Bashirian S, Jenabi E, Khazaei S, Barati M, Karimi-Shahanjarini A, Zareian S, *et al.* Factors associated with preventive behaviours of COVID-19 among hospital staff in Iran in 2020: An application of the protection motivation theory. *J Hosp Infect* 2020;105:430-3.
 11. Conner M, Norman P. Predicting and Changing Health Behavior, Research and Practice with Social Cognition Models. 3rd ed. McGraw-Hill Global Education Holdings, LLC; 2015.
 12. Ezati Rad R, Mohseni S, Kamalzadeh Takhti H, Hassani Azad M, Shahabi N, Aghamolaei T, *et al.* Application of the protection motivation theory for predicting COVID-19 preventive behaviors in Hormozgan, Iran: A cross-sectional study. *BMC Public Health* 2021;21:466.
 13. Mortada E, Abdel-Azeem A, Al Showair A, Zalat MM. Preventive behaviors towards Covid-19 pandemic among healthcare providers in Saudi Arabia using the protection motivation theory. *Risk Manag Healthc Policy* 2021;14:685-94.
 14. Al-Rasheed M. Protective behavior against COVID-19 among the public in Kuwait: An examination of the protection motivation theory, trust in Government, and sociodemographic factors. *Soc Work Public Health* 2020;35:546-56.
 15. Papageorge NW, Zahn MV, Belot M, van den Broek-Altenburg E, Choi S, Jamison JC, *et al.* Socio-demographic factors associated with self-protecting behavior during the Covid-19 pandemic. *J Popul Econ* 2021;34:691–738.
 16. Hanson CL, Crandall A, Barnes MD, Novilla ML. Protection motivation during COVID-19: A cross-sectional study of family health, media, and economic influences. *Health Educ Behav* 2021;48:434-45.
 17. Saqlain M, Munir MM, Rehman SU, Gulzar A, Naz S, Ahmed Z, *et al.* Knowledge, attitude, practice and perceived barriers among healthcare workers regarding COVID-19: A cross-sectional survey from Pakistan. *J Hosp Infect* 2020;105:419-23.
 18. Arslanca T, Fidan C, Daggez M, Dursun P. Knowledge, preventive behaviors and risk perception of the COVID-19 pandemic: A cross-sectional study in Turkish health care workers. *PLoS One* 2021;16:e0250017. doi: 10.1371/journal.pone.0250017.
 19. Lai X, Wang X, Yang Q, Xu X, Tang Y, Liu C, *et al.* Will healthcare workers improve infection prevention and control behaviors as COVID-19 risk emerges and increases, in China?. *Antimicrob Resist Infect Control* 2020;9:83.