Original Article

The Relationship Between Attitude, Belief, Experience, and Knowledge of Iranian Nurses Toward the Use of Personal Protective Equipment: A Cross-Sectional Study

Abstract

Background: Utilizing Personal Protective Equipment (PPE) is pivotal in averting infection transmission to both patients and nurses. The attitude of nurses is a critical determinant in their compliance with PPE usage. This study seeks to explore the correlation between the attitudes of Iranian nurses and their beliefs, experiences, and knowledge concerning the application of PPE. **Materials and Methods:** In this cross-sectional study, 303 nurses employed in hospitals affiliated with Kurdistan University of Medical Sciences (Iran) were chosen using a quota sampling technique. Between April and June 2022, they completed self-administered questionnaires, which consisted of a Demographic Information form and a four-part questionnaire on "Attitude, Belief, Experience, Knowledge" concerning the utilization of PPE. Data were analyzed utilizing descriptive and inferential statistical methods. The multiple linear regression model was applied to investigate the relationship between attitude scores and various examined variables. **Results:** The findings indicated that most participants held bachelor's degrees (93.07%), and their attitude scores toward using PPE exceeded 3.25 out of 6 for all 12 questions. Female gender, increased work experience, and higher organizational positions exhibited positive and significant associations with a favorable attitude toward PPE utilization. Conversely, the absence of training related to PPE, a lack of belief in infection control, and limited knowledge displayed negative correlations. **Conclusions:** Nurses have an ethical obligation to adhere to infection control guidelines, including consistently utilizing PPE, regardless of the level of infection risk or the visibility of the infection. Continuous training and regular monitoring of nurses in this context are indispensable.

Keywords: *Attitude, cross-sectional studies, Iran, nurses, personal protective equipment*

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Introduction

Effective prevention of pathogen transmission within healthcare center work environments requires strict adherence to standard precautions to mitigate risks. Standard precautions encompass infection prevention and control guidelines to safeguard healthcare personnel and patients from microorganism transmission.[1,2] These measures include infection control principles, such as proper hand hygiene, safe handling and disposal of sharp instruments, and using Personal Protective Equipment (PPE).[2] Among these standard precautions, PPE is a critical element in preventing infection transmission and is routinely employed by healthcare personnel to minimize risks arising from patient and environmental interactions.[3] Healthcare Workers (HCWs) face the risk of exposure to hazardous infectious diseases through contact with patients' bodily secretions, potentially leading to various complications and even fatalities.[4,5] Consequently, using PPE is imperative to reduce the risk of infection transmission.[6] Nurses who provide continuous patient care around the clock are particularly vulnerable to exposure to chemical and pharmaceutical residues and various infections.[7] Therefore, ensuring their maximum protection is paramount.[8] Safeguarding nurses not only preserves their health but also enhances the quality of nursing care and contributes to the overall efficiency of healthcare systems.[9,10] Moreover, this plays a pivotal role in epidemic control efforts.[11] A study in Japan revealed that the compliance rate for PPE usage among nurses stood at 28%, significantly lower than that of doctors and

How to cite this article: Banafshi Z, Valiee S, Moradi Y, Vatandost S. The relationship between attitude, belief, experience, and knowledge of Iranian nurses toward the use of personal protective equipment: A cross-sectional study. Iran J Nurs Midwifery Res 2024;29:466-72.

Submitted: 06-Aug-2022. **Revised:** 17-Mar-2024. **Accepted:** 18-Mar-2024. **Published:** 24-Jul-2024.

Access this article online

Website: https://journals.lww.com/jnmr

DOI: 10.4103/ijnmr.ijnmr_238_22

Quick Response Code:

janitors.[12] This low level of compliance among HCWs underscores the estimation that one in every four HCWs is at risk of contracting an infectious respiratory disease during their work.[13]

Previous research has consistently demonstrated that attitude is a crucial determinant influencing the utilization of PPE.[14,15] Nurses' attitudes play a pivotal role in shaping their behavior concerning PPE use while administering patient care.[15] Consequently, this influences their workplace safety and ensures the proper implementation of infection control guidelines.[16] Numerous factors are associated with nurses' attitudes toward PPE, including their level of education, clinical experience, gender, workload, managerial supervision, organizational support, beliefs, knowledge, individual skills, the availability of personal protective equipment, and the presence of training programs.[14,17,18] The influence of beliefs, experience, and knowledge on nurses' attitudes toward using PPE is substantial.[18] Nurses' confidence in the efficacy of PPE and their understanding of the significance of proper and appropriate usage can positively impact their attitudes, leading to increased adherence to PPE protocols.[16]

Given the critical role of nurses' attitudes in compliance with PPE, the significance of PPE usage, and the associated risks when neglected, it is imperative to address this issue meticulously. Furthermore, the ongoing COVID-19 pandemic has heightened the importance of PPE usage in healthcare settings. Therefore, conducting a comprehensive study to investigate the relationship between attitudes, beliefs, experience, and knowledge toward using PPE is essential. This research will provide fundamental insights to inform future actions to enhance healthcare protocols and guidelines in this critical domain.

Materials and Methods

This article constitutes a section of a master's thesis endorsed by the School of Nursing and Midwifery at Kurdistan University of Medical Sciences. In this cross-sectional study, 303 nurses employed in hospitals affiliated with the Kurdistan University of Medical Sciences (Iran) were selected through quota sampling. From April to June 2022, they completed self-administered questionnaires. The sample size calculation was based on the findings of Oladele's study (2021), which estimated the attitude related to PPE among nurses and all HCWs at 53.10%.[19] Assuming a 53.10% attitude related to PPE among nurses, with a 95% confidence level and a 0.01 margin of error, the sample size was determined as 303 participants. Inclusion criteria comprised an individual's willingness to participate in the study and hold at least a bachelor's degree in nursing, while exclusion criteria included incomplete questionnaire submissions. Data were collected using a "Demographic Information" form and a four-part questionnaire assessing "Attitude, Belief, Experience, Knowledge" concerning PPE utilization.

The four-part questionnaire, "Attitude, Beliefs, Experience, and Knowledge toward the use of personal protective equipment," was designed by Morioka *et al*. (2020).[20] This questionnaire demonstrated a content validity of 0.75 and a Cronbach's alpha coefficient of 0.89. The "attitude" section (n = 12) and "beliefs" section (n = 14) featured responses on a six-point Likert scale, ranging from one (completely disagree) to six (completely agree). Average scores were reported for each question. The "Experience" section (n = 3) contained binary "yes or no" responses, and the results were presented as percentages indicating the presence or absence of experience for each question. In the "Knowledge" section (n = 6), respondents provided "true or false" answers, with results displayed as percentages of correct responses to each question. Following permission from the questionnaire's designer, the questionnaire was translated into Persian using the forward-backward translation method. The scale's face validity was assessed by ten members of the academic staff at the Faculty of Nursing and Midwifery, incorporating quantitative and qualitative methods. Comments were incorporated, and quantitative results indicated an impact score exceeding 1.5 for each question. The questionnaire's reliability, as assessed by Cronbach's alpha, was deemed acceptable at 0.79. After data collection, descriptive statistics were reported, including frequency and percentage for qualitative variables and mean and standard deviation for quantitative variables. The normality assumption for quantitative variables was assessed using the Kolmogorov–Smirnov test. For nominal qualitative variables such as gender, the Mann–Whitney U test was applied, while ordinal qualitative variables like education level and quantitative variables such as age were analyzed using the Kruskal–Wallis H test. The multiple linear regression model examined the relationship between attitude scores and tested variables. Data analysis was conducted using IBM SPSS Statistics version 26 software, with a significance level set at 0.05.

Ethical considerations

The University's study was approved by the Ethics Committee, bearing the code IR.MUK.REC.1400.269. The study's objectives were explicitly communicated to the participants, who received written informed consent. Regarding preserving the confidentiality of personal information and responses, participants were assured of their privacy.

Results

Demographic findings revealed that most participants held bachelor's degrees (93.07%). More than half (51.16%) of the participants had not undergone any infection control courses. 81.52% of the nurses had received such instruction concerning training in PPE usage. Furthermore, 83.50% of the nurses had previous experience working in COVID-19 wards [refer to Table 1].

Table 1: Demographic characteristics of participants (*n*=303)

Variable	Status	Number (%)
Age range	≤26 years	75 (24.75)
	27–34 years	153 (50.50)
	≥ 35 years	75 (24.75)
Gender	Male	125 (41.25)
	Female	178 (58.75)
Education	Bachelor	282 (93.07)
	M.Sc.	21 (6.93)
Marital status	Single	196 (64.69)
	Married	107 (35.31)
Years of clinical experience	≤5 years	137 (45.21)
	6 – 15 years	125 (41.25)
	≥ 16 years	41 (13.53)
Work shift	Morning	50 (16.50)
	Circulation	253 (83.50)
Type of organizational post	Nurse	264 (87.13)
	Staff	15 (4.95)
	Head nurse	16 (5.28)
	Supervisor	8 (2.64)
Participating in infection control courses	Yes	148 (48.84)
	No	155 (51.16)
Trained on personal protective equipment	Yes	247 (81.52)
	No	56 (18.48)
COVID-19 infection	Yes	215 (70.96)
	No	88 (29.04)
Vaccine dose	Nothing	12 (3.96)
	One	16 (5.28)
	Two	122 (40.26)
	Three	153 (50.50)
Work in COVID-19 ward	No	50 (16.50)
	<6 months	106 (34.99)
	6–12 months	68 (22.44)
	> 12 months	79 (26.07)

The average scores concerning nurses' attitudes toward the utilization of PPE, as indicated by their responses to 12 questions, all surpassed the threshold of 3.25 out of 6. The highest score, 5.03 (0.726), was recorded for the question: "When infection is spreading within a ward, I always wear PPE." In contrast, the lowest score, 3.25 (0.994), was associated with the question: "I consistently employ PPE, regardless of the type of detected bacteria." In the realm of beliefs, the highest score, 5.36 (0.661), was linked to the question: "I must never be the source of infection transmission." The results from the knowledge section revealed that out of the six questions, at least 65.01% of participants answered four correctly, indicating commendable performance. However, knowledge regarding the remaining two questions was notably deficient, with only 17.82% and 29.04% responding accurately to "For patients subject to infection transmission-based precautions, there is no need to implement standard preventive measures" and "If you are tending to the same patient, there is no requirement to change your gloves," respectively [refer to Table 2].

Multiple linear regression analysis revealed a significant positive correlation between attitude and the following variables: female gender ($t_{291} = 4.88$, $p < 0.001$, $R^2 = 0.51$), extensive work experience ($t_{291} = 4.20$, $p < 0.001$, $R^2 = 0.51$), higher organizational position ($t_{291} = 2.61$, $p = 0.010$, $R^2 = 0.51$), absence of COVID-19 infection ($t_{291} = 2.36$, $p = 0.016$, $R^2 = 0.51$), and receiving three doses of the COVID-19 vaccine ($t_{291} = 2.85$, $p < 0.005$, $R^2 = 0.51$). Conversely, other factors, such as a lack of training related to PPE ($t_{291} = -2.37$, $p = 0.019$, $R^2 = 0.51$), disbelief in specific infection control scenarios ($t_{291} = 3.06$, $p = 0.002$, $R^2 = 0.51$), and inadequate knowledge in questions 4 and 6 ($t_{291} = -2.14$, $p = 0.033$, $r^2 = 0.51$), ($t_{291} = -2.79$, $p = 0.006$, $R^2 = 0.51$), exhibited a significant negative association with the attitude score [Table 3].

Discussion

The present study has demonstrated that nurses generally maintain a favorable attitude toward using PPE, with a significant association between attitude and nurses' beliefs, knowledge, and experience in PPE utilization. Overall, the results regarding attitude scores indicate that nurses scored above average on all questions, albeit with varying scores. The highest attitude score in this study was linked to the statement, "I always wear PPE when the infection is spreading within a ward," followed by "I always wear PPE when there is a chance of coming in contact with bodily fluids." The observed heightened situational awareness and risk perception may explain the improved adherence to PPE[21] usage, as noted by Lizar *et al*.[13] (2019), who highlighted that the COVID-19 pandemic significantly heightened nurses' awareness of the importance of wearing PPE. Conversely, the lower attitude score for the question "I always wear PPE regardless of the type of bacteria detected" suggests that nurses tend to base their PPE usage on their understanding of the pathogenicity of each microorganism. This finding aligns with Harrod *et al*.'s[22] (2020) studies, which revealed that HCWs typically employ PPE only when exposed to known infected patients. The current and past studies consistently indicate that nurses exhibit a positive attitude toward PPE utilization when the source of infection and contact are evident. Nonetheless, healthcare personnel should maintain vigilance in PPE use during all patient interactions, given that most infections are transmissible during incubation. Therefore, nurses should exercise caution in employing PPE across all clinical and caregiving scenarios.

The results from the belief section suggest that most participants strongly believe in using PPE for infection control as an integral aspect of their professional responsibilities. Most nurses believed in statements such as "I should never be the cause of the spread of infection" and "The spread of resistant bacteria affects

Table 2: Nurses' attitudes, beliefs, experiences, and knowledge of nurses toward appropriate Personal Protective Equipment (PPE) use

Q.	Attitudes	Mean score a* (SD)*
1	I always wear PPE when there is a chance of contact with bodily fluids (urine, sputum, stools).	5.00 (0.73)
2	I always wear PPE regardless of the patient's activities of daily living and bodily conditions.	4.52 (0.75)
3	Even in emergency situations, I always wear PPE.	3.72 (0.91)
4	Even when conducting treatment or care on parts of the body other than where the pathogen was detected, I always wear PPE.	4.09 (0.95)
5	Even when I don't expect to contact the patient or any surface environment, I always wear PPE.	3.25 (0.99)
6	Even when I'm only handing drugs to a patient, I always wear PPE	3.46 (1.03)
7	When infection is spreading within a ward, I always wear PPE	5.03 (0.73)
8	When entering patient rooms along with another employee, I always wear PPE.	4.38 (0.79)
9	Even when handling patients other than those I am in charge of, I always wear PPE.	4.54 (1.22)
10	When Middle East Respiratory is detected in the patient sputum, I always wear PPE.	4.78 (0.76)
11	When clostridium (Clostridioides) difficile or norovirus are detected in patient stools, I always wear PPE.	4.74 (0.76)
12	I always wear PPE regardless of the type of bacteria detected.	3.94 (0.88)
Q.	**Beliefs**	**Mean score (SD)*** **
1	Aprons with sleeves are hot, so I hate wearing them.	3.95 (1.25)
2	If there are increasing numbers of patients for whom contact prevention measures are required due to spreading infection, this requires PPE to be worn more often, and I think this, in turn, increases our workload.	3.95 (1.12)
3	I must never be the cause of spreading infection.	5.36 (0.66)
4	Spreading resistant bacteria to patients affects your prospects as a nurse.	5.12 (0.65)
5	PPE is used for protecting yourself.	5.02 (0.68)
6	When I don't know what kind of infection a patient has, I find that frightening.	3.65 (1.17)
7	Compared to other work, wearing PPE is a low priority.	2.77 (0.98)
8	When I'm busy, putting on PPE is a hassle.	3.95 (1.59)
9	From the perspective of medical material costs, I'm resistant to the idea of using large quantities of PPE.	2.22 (1.10)
10	Whenever a supervisor is watching, I think I should make sure I'm wearing the proper PPE.	3.47 (1.39)
11	Whenever I'm entering a room along with someone else, I think I should make sure I'm wearing the proper PPE.	3.60 (1.31)
12	I feel guilty about not wearing PPE in a situation in which I should have.	3.86 (1.16)
13	Infections will spread unless staff wear PPE properly.	4.88 (2.73)
14	Even if you're only touching environmental surfaces within the ward, you should still wear PPE.	3.46 (1.15)
Q.	**Experiences**	**Number (percent)**
1	I have experienced having a patient hospitalized long-term due to drug-resistant bacteria in my career up until this point.	113 (37.29%)
2	I have experienced an outbreak of drug-resistant bacteria or a ward shut down for this reason in my career up until this point.	136 (44.88%)
3	I have experienced having my boss or an infection control supervisor warn me that I need to wear PPE in my career up until this point.	98 (32.34%)
Q.	**Knowledge**	**Correct answers**
1	Standard preventive measures are the fundamental infection countermeasures applied when individuals have warning signs of infections, and these countermeasures can be terminated if there is no infection found.	207 (68.31%)
2	Even if you wear gloves, the prescribed hand hygiene is required after removing them.	280 (92.40%)
3	If you are handling the same patient, there is no need to change your gloves.	88 (29.04%)
4	PPE such as gloves and gowns should be removed and disposed of before leaving patient rooms (areas).	236 (77.88%)
5	For patients subject to infection transmission-based precautions, there is no need to carry out standard preventive measures.	54 (17.82%)
6	When performing care for a patient for whom contact countermeasures are in place, even if you do not come into contact with blood or sputum, you should still use gloves for contact with the patient and their surroundings.	197 (65.01%)

*SD: Standard deviation. **Average score on score on a six-point Likert-type scale from 1 (never compliant) to 6 (always compliant). ***Average score on a six-point Likert-type scale from 1 (strongly disagree) to 6 (strongly agree)

your future as a nurse," both play a pivotal role in influencing PPE compliance. This underscores nurses' faith in their professional obligations, including patient and self-protection, while maintaining safety standards. However, Jackson *et al*.[23] (2014) reported that nurses may be inclined to adhere to correct guidelines and present

Table 3: The results of multiple regression analysis

Variable	Unstandardized coefficients		Standardized coefficients	*t*	*p*	95.0% CI for B	
	B	Standard Error (SE)	B			Lower	Upper
Gender (female)	0.29	0.06	0.23	4.88	0.001	0.18	0.41
History work (≥ 16 y)	0.37	0.09	0.20	4.20	0.001	0.20	0.54
Type of organizational post (head nurse)	0.34	0.13	0.12	2.61	0.010	0.08	0.60
Type of organizational post (supervisor)	0.49	0.20	0.13	2.43	0.016	0.09	0.89
COVID-19 infection (no)	0.17	0.07	0.13	2.36	0.019	0.03	0.32
Vaccine dose=3	0.18	0.06	0.14	2.85	0.005	0.05	0.30
Trained on personal protective equipment (no)	- 0.21	0.09	-0.13	-2.37	0.019	-0.39	-0.04
Beliefs	0.21	0.07	0.14	3.06	0.002	0.07	0.34
Experience question 3 (no)	0.59	0.07	0.44	8.49	0.000	0.45	0.72
Knowledge question 4 (false)	-0.19	0.09	-0.13	-2.14	0.033	-0.36	-0.02
Knowledge question 6 (false)	-0.21	0.07	-0.16	-2.79	0.006	-0.35	-0.06

themselves as knowledgeable professionals who comply with nursing standards and policies, even if not explicitly stated. Hence, it is plausible that nurses strive to exhibit logical and compliant behavior, which could elucidate the high scores in these belief-related components. On the other hand, many nurses believe using PPE can sometimes be burdensome due to increased workload and discomfort, including heat and sweating. Prolonged use of PPE can lead to fatigue, reduced performance, and diminished willingness to wear PPE.[24] These findings align with Schoberer *et al.* (2022) research, underscoring a significant relationship between PPE use and its associated side effects.[25] These results emphasize the potential necessity for human factors and ergonomic research to enhance the functional design of PPE.

The current study indicates that nurses generally possess favorable knowledge of infection control, as most questions received correct responses. However, the question "For patients subject to infection transmission-based precautions, there is no need to carry out standard preventive measures" garnered a low frequency of correct answers. It is imperative to utilize PPE for all patients based on their clinical conditions, as these precautions aim to prevent infection transmission from nurses to patients with weakened immune systems and vice versa. Furthermore, the lowest level of nurses' knowledge was associated with the question, "If you are handling the same patient, there is no need to change your gloves." Improper usage of clinical gloves and failure to change them elevate the risk of cross-transmission. Not changing gloves during the same patient's care can transmit the infection to other areas of the patient's body.[26] This was highlighted by Gaikwad *et al*.[27] (2022), who emphasized that the most common breach of PPE is related to glove use. Enhancing knowledge among HCWs may positively impact their attitudes and practices.[28] These results underscore the importance of comprehensive attention to various facets of infection control. While nurses may receive an overall satisfactory score in infection control, it is essential to scrutinize their knowledge to identify areas requiring correction, ensuring that an overall positive result does not conceal weaknesses in some dimensions.

The present study reveals a significant positive correlation between the female gender and a favorable attitude toward using PPE. In support of this finding, Huang *et al*.[29] (2021) demonstrated that female healthcare personnel exhibits more significant concern for disease outbreaks and infectious microorganisms compared to their male counterparts. This heightened awareness among females may stem from their increased sensitivity to health matters and tendency to adhere to organizational standards. Consequently, it is imperative to place additional emphasis on male healthcare workers regarding PPE compliance. Furthermore, the study highlights a direct correlation between the organizational position of nurses and their attitude toward PPE, with supervisors exhibiting the highest attitude scores. A higher organizational position tends to enhance individual skills, knowledge, and experience, subsequently fostering a positive attitude toward ensuring the safety of both healthcare professionals and patients. Conversely, individuals in higher job positions may also perceive themselves as role models for their colleagues, thereby justifying these results. Our research further underscores that nurses who have not contracted COVID-19 and have received three doses of the COVID-19 vaccine demonstrate a more positive attitude toward using PPE. Ciardi *et al*.[17] (2021) observed that healthcare workers who have faith in the effectiveness of PPE methods and continue to use them even after vaccination display a positive attitude toward the COVID-19 vaccine. These findings underscore the significance of employing PPE and receiving the complete COVID-19 vaccine regimen as primary measures supported by scientific consensus to curb the spread of COVID-19. In contrast, the results indicate that despite 81.52% of participants receiving training on correct PPE usage, they answered only 58.34% of the knowledge section questions correctly. Nurses typically receive PPE training only once during their initial department orientation.

Therefore, the lower knowledge scores may be attributed to the lack of recurrent training courses and in-service education programs related to infection control and PPE usage.[11] While several studies have indicated that training alone may not significantly enhance PPE adherence,[12,20] the mode of training, participant evaluation, and training intervals can all influence nurses' knowledge levels in infection control, including PPE usage. Consequently, it is recommended that these aspects be considered to improve educational outcomes.

One of the study's key findings is the direct link between belief and attitude, with a lack of belief associated with a negative attitude toward PPE utilization. Individual beliefs substantially influence attitudes and satisfaction with PPE usage.[30] In alignment with this observation, Alao *et al*.[31] (2020) emphasized the importance of healthcare personnel's attitudes and beliefs in preventing workplace hazards and increasing compliance with PPE usage. Furthermore, the study reveals a direct relationship between not receiving supervisor reminders and a positive attitude toward PPE. This contrasts with the findings of Lizar *et al*.[13] (2019), who reported no significant relationship between monitoring and PPE compliance. It may be postulated that nurses who do not receive reminders from their supervisors regarding PPE usage are typically more conscientious about PPE compliance. However, the results also reveal that attitude scores remain low even among nurses who receive reminders. This underscores the challenge of altering nurses' attitudes and emphasizes the need to reconsider reminder methods and identify noncompliant nurses for additional training and monitoring.

Given that this study was conducted during the COVID-19 pandemic, there is a possibility that this unique context may have influenced the results. Therefore, to acquire additional corroborative data, it is advisable to replicate this study during nonpandemic periods. Furthermore, it is worth noting that the data collection method employed in this study relied on self-reporting, potentially affecting the accuracy of the results. However, to address this limitation, the researcher implemented measures to ensure participants of the confidentiality of their responses.

Conclusion

The results indicate that nurses generally exhibited a favorable attitude toward utilizing PPE, with higher scores associated with situations presenting a heightened risk of infection. Conversely, attitude scores were lower when addressing clinical scenarios considered routine. These findings emphasize the necessity for reevaluating and enhancing nurses' attitudes concerning PPE utilization. This is crucial because even in ostensibly noninfectious clinical settings, there exists potential for contamination and transmission of infections due to incubation periods of diseases or unforeseen sources of contamination.

Moreover, the study identified several factors significantly influencing nurses' attitudes toward PPE use. These factors encompassed female gender, increased work experience, higher organizational positions, absence of COVID-19 infection, and receipt of three doses of the COVID-19 vaccine, all of which exhibited a positive correlation with a favorable attitude toward PPE utilization. Conversely, factors such as lack of PPE-related training, skepticism in specific infection control scenarios, and insufficient knowledge displayed a negative and significant correlation with nurses' attitudes toward PPE use. Consequently, there is an urgent necessity for nationwide reform programs and practical PPE training to mitigate the spread of infections among healthcare workers and patients.

Acknowledgments

We thank the Vice-Chancellor of Research and Technology members at Kurdistan University of Medical Sciences [grant numbers: 27373] and all the study participants who contributed to this research.

Financial support and sponsorship

Kurdistan University of Medical Sciences, Iran

Conflicts of interest

Nothing to declare.

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