NURSING SCIENCE

Nurses' Preparedness against the Middle East Respiratory Syndrome Coronavirus Outbreak: A Cross-Sectional Study in Iran

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ABSTRACT

Objective: **This study aimed to determine the preparedness of Iranian nurses against the Middle East Respiratory Syndrome coronavirus (MERS-CoV) outbreak and influencing factors.**

Design: **A cross-sectional study.**

Materials and methods: **One hundred and fifty five nurses in emergency and Intensive Care Units of two hospitals in the northwest of Iran were selected via stratified random sampling. Data was collected through a questionnaire with three dimensions of management and prevention, training for coronavirus and awareness of the center's policies for information transmission and infection control.**

Results: **The percentage of nurses' preparedness in total was 51.27%. The preparedness score of training for coronavirus was the least of the three (31.77%), but dimensions of management and prevention (55.13%) and awareness of the center's policies for information transmission and infection control (58.42%) needs planing to improvement too. The nurses preparedness significantly related with presence in a training program, educational level, age, nursing work experience, work experience in current department and the number of hours of training for coronavirus.**

Conclusions: **Iranian nurses showed moderate preparedness against MERS-CoV. They needed to be prepared for the outbreak of coronavirus, especially in terms of in-service training for dealing against diseases caused by coronavirus.**

KEY WORDS

coronavirus, middle East respiratory syndrome coronavirus, nurse, preparedness, sever acute respiratory syndrome

INTRODUCTION

Emerging and reemerging communicable diseases cause significant effect in our life and economies of countries[1)]. In the past years, fatal disease outbreaks caused by novel viruses with animal sources , such as several Influenza subtypes, SARS (severe acute respiratory syndrome) and MERS (Middle East respiratory syndrome) coronaviruses, became one of the significant topics for the health system[2)].

Human coronaviruses were first discovered in the 1960s as the causative agent of the common cold[3)] and in December 2019, a new strain of coronavirus (initially called 'Novel Coronavirus 2019-nCoV' and later renamed to SARS-CoV-2) causing severe acute respiratory syndrome (coronavirus disease COVID-19) emerged in Wuhan of China and spread across China and beyond[4)] strikingly faster compared to the SARS-CoV outbreak in 2002/2003 and the MERS-CoV outbreak in 2012-2014[5)]. Despite lower case fatality rate of COVID-19 than SARS

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Table 1: Personal and work-related characteristics of nurses participating in the study (N = 155) and its relationship with their preparedness against the MERS-CoV

Characteristics	n (%)	Mean (SD*)	Preparedness against the MERS-CoV Mean (SD*)	p-value+
Gender				0.557
Female	137 (88.4)		51.62 (20.64)	
Male	18 (11.6)		48.63 (17.07)	
Education				0.045
Bachelor	147 (94.8)		50.51 (20.01)	
Master	8 (5.2)		65.19 (20.35)	
Marital status				0.368
Single	63 (40.6)		49.49 (20.42)	
Married	92 (59.4)		52.49 (20.12)	
Position				0.067℗
Paramedic	3 (1.9)		71.79 (22.20)	
Nurse	144 (92.9)		50.44 (20.21)	
Head nurse	4 (2.6)		46.53 (13.49)	
Infection control supervisor	4 (2.6)		70.38 (7.36)	
In-service training for MERS-CoV			< 0.001	
No	95 (61.3)		45.44 (18.42	
Yes	60 (38.7)		60.51(19.64)	
Age		31.40 (6.57)	51.27 (20.23)	0.007

Abbreviation. *Standard Deviation

Note. + p-value of independent t-test was presented unless ℗ that ANOVA test was used.

and MERS, the statistics showed this has killed more people than the other two[6]. According to study of Shojaee *et al*., from 1/31/2020 to 3/15/2020, there are13938 confirmed cases with 724 death cases in Iran with mortality rate 5.19%[7].

For preventing a large epidemic in a country and global dissemination, all healthcare facilities must ensure that their personnel is correctly trained and capable of implementing infection control procedures and adhere to infection control requirements[8]. Failure to prepare medical personnel in a timely manner, might lead to more stress and anxiety and can prevent effective action. Finally, medical facilities shortages and prolonged disease outbreak, can increase the mortality risk and more physical and mental exhaustion among health care workers[9]. The WHO considers infection prevention and control measures necessary to control the disease, which includes observation of standard precautions, droplets and airborne precautions[10]. The Centers for Diseases Control and Prevention (CDC) recommends the use of a negative-pressure isolation room, wearing personal protective equipment to prepare clinics for the prevention of MERS-CoV, infection control measures, correct patient triage and disease screening[11]. In addition to the recommendations of the WHO, the Iranian CDC, announced that limitation of patients' visitors, non-attendance of students in isolated rooms, wearing surgical masks by patient, and decontamination of the surrounding environment and patient's equipment are necessary[12].

In the study of Jeon and Kim in Korea, factors of misdiagnosis, delay in patient admission, misinformation in hospital transmission and ignoring new guidelines for the prevention of infectious diseases were found be effective in the spread of disease[13]. Global spread of coronavirus was quick by dint of air travel and tourism[14] and a global coordinated effort is needed to enhance preparedness in all regions of the world for preventing coronavirus spread[15].

A review of Iranian research databases demonstrates that there has been no study on the level of preparedness of health care workers (HCWs) for dealing with MERS-CoV outbreaks. Considering the major role of nurses in the prevention and control of emerging infectious diseases, the purpose of this study, which was conducted from October 2017 to April 2018, when the COVID-19 was not yet emerged, was to determine the level of preparedness of nurses in Tabriz city in the northwest of Iran against the MERS-CoV outbreak. Findings of this study can show to what extent nurses in Tabriz have been prepared to deal with the possible outbreak of the disease in future.

MATERIAL AND METHODS

Sample

In a cross-sectional study, 155 nurses working in the Emergency Department (ED) and ICUs of internal, general, pulmonary, emergency, infectious of Imam Reza and Sina Hospitals, which are referral centers of respiratory and infectious diseases in the northwest of Iran, were selected via stratified random sampling. Inclusion criteria were having at least six months of experience in nursing, and having a bachelor's degree or higher in nursing; and exclusion criteria were the reluctance of nurses to participate in research on the beginning and during the study.

To determine the sample size, findings of the similar study on the institutional preparedness to prevent MERS-CoV[13] was used. Considering a confidence interval of 95%, power 80%, two-tailed test and using G-Power software, the minimum sample size was obtained equal to 128 (with 20% attrition rate, 155 nurses was selected).

Data collection tool

Self-reporting data for nurses' preparedness against MERS-CoV was collected from October 2017 to April 2018 through a 65-items questionnaire. Three dimensions of "management and prevention of MERS-CoV" (44 items with responses of "I do" and "I don't" , "training for MERS-CoV" (12 items with responses of "there was", "there was not" and "don't remember") and "awareness of the center's policies for information transmission and infection control" (9 items with responses of "correct", "false" and "don't know") were considered in this questionnaire. Participants who chose the answer "I do", there was, and correct, scored 1 point for each item, and who chose "I don't", "there was", "false", "don't know", and "don't remember" scored 0 point for that item. The minimum and maximum raw possible scores was zero and 65, respectively.

Considering the different score range in the three dimensions, we used a normalized score utilizing the following formulae which lead in the scores range over 0-100 percent:

Table 2: Frequency (%) of the actions taken by participants to identify suspected patients with MERS-CoV disease and their awareness on policies of infection control and information transmission (N = 155)

The actions to identify suspected patients	I do	I don't	Missed
Determining a specific triage location for febrile patients	52 (33.55)	99 (63.87)	4 (2.58)
Measuring the temperature of each patient	82 (52.90)	69 (44.52)	4 (2.58)
Observing of the patients about fever	63 (40.65)	88 (56.77)	4 (2.58)
Observing of the patients about a set of symptoms (fever, diarrhea, vomiting, sore throat and shortness of breath)	94 (60.65)	57 (36.77)	4 (2.58)
Observing of the patients about exposure to a patient with MERS-CoV	62 (40)	89 (57.42)	4 (2.58)
Observing of the patients about the history of traveling to Saudi Arabia, Yemen, the UAE, Qatar and Iraq.	97 (62.58)	54 (34.84)	4 (2.58)
Performing a physical examination and taking a medical history	93 (60)	58 (37.42)	4 (2.58)
Obtaining a history from the patient about recent consumption of milk and camel products	70 (45.16)	81 (52.26)	4 (2.58)
Obtaining a history from the patient about the presence of a similar respiratory illness in the family and colleagues who needed to be admitted.	64 (41.29)	87 (56.13)	4 (2.58)
Sending a laboratory sample of bronchial secretions or throat or nose swab of patients with respiratory problems	67 (43.23)	84 (54.19)	4 (2.58)
Performing standard precautions in asymptomatic patients or irrelative symptoms with MERS-CoV infections.	40 (25.81)	111 (71.61)	4 (2.58)
The actions done after identifying suspicious cases			
Isolating of the patient in a negative-pressure isolation room	119 (76.77)	35 (22.58)	1 (0.65)
Hospitalization of patients in a special room with the similar diagnosis and maintaining a distance of one meter between patients, in cases of lack of the negative-pressure isolation room	80 (51.66)	74 (47.74)	1 (0.65)
Carrying out standard precautions	103 (66.45)	51 (32.90)	1 (0.65)
Informing the doctor	108 (69.68)	46(29.68)	1 (0.65)
Obtaining a history of exposure to the MERS disease	87(56.13)	67(43.23)	1 (0.65)
Controlling the temperature of the patient	98(63.23)	56(36.13)	1 (0.65)
Performing a physical examination and taking a medical history	81(52.26)	72(46.45)	2 (1.29)
Wearing masks and gloves	111(71.61)	43(27.74)	1 (0.65)
Wearing full personal protective equipment (gown, gloves, and mask).	88(56.77)	65(41.94)	2 (1.29)
Informing the Center of Disease Management	101 (65.16)	53(34.19)	1 (0.65)
Reducing of entering and exiting to isolation rooms	98(63.23)	55(35.48)	2 (1.29)
Applying limitations for visiting patients	91(58.71)	63(40.65)	1 (0.65)
Registering healthcare providers list in an isolation room	76(49.03)	78(50.32)	1 (0.65)
Closing the door of isolation room	92(59.35)	62(40)	1 (0.65)
Performing standard precautions in asymptomatic patients or irrelative symptoms with MERS-CoV infections.	63(40.65)	91(58.71)	1 (0.65)
The participants' awareness on policies of infection control and information transmission	Correct	False	Don't know
The CDC's policies and MERS-CoV prevention guidelines are properly communicated by the hospital's managers to the center staff and a copy has been sent to my department.	65 (41.93)	72 (46.45)	18 (11.62)
Some specific individuals at the hospital that I work are responsible for communicating with health center officials and transferring information to the health care workers.	93 (60)	20 (12.90)	42 (27.10)
The hospital managers carry out periodic tests for identifying immune deficiencies and underlying illnesses in their health care workers.	83 (53.55)	71 (45.81)	1 (0.65)
If we get sick, the hospital policy for health care workers allows us to stay in our home.	102 (65.81)	47 (30.32)	6 (3.87)
The effectiveness of cleaning and disinfection methods in the hospital environment is evaluated by the hospital's services officials	104 (67.10)	39 (25.16)	12 (7.74)
Training program on the infection control compliance in this hospital is carried out for hospital cleaning staff.	93 (60)	24 (15.48)	38 (24.52)

Normalized Score = (raw score- possible minimum)/ (possible range)*100

The questionnaire was designed and validated in the master thesis of the first author[16]. The guideline of the Iranian CDC for the MERS-CoV management, the standards of HCWs preparedness to prevent spread of MERS-CoV prepared by WHO and the CDC were used to design questionnaire. Content and face validity methods were used to validate the questionnaire. In addition, reliability of questionnaire was confirmed by a stability test (test-retest). The face validity of the questionnaire was investigated with the participation of 10 nurses and questions with an item impact score greater than 1.5 were retained. The content validity ratio (CVR) and the content validity index (CVI) were determined with the proposed methods of Lawshe[17] and Waltz and Basel[18] respectively. The questionnaire was sent to 11 experts in field of emerging diseases and according to the Table of Lawshe, the items with a CVR higher than 0.59 remained and the rest were removed, and the questionnaire's CVI with the average method (S-CVI/Ave) was obtained 0.93. To assess the reliability of the questionnaire, 25 nurses completed questionnaire twice in two weeks interval, with an intra-class correlation coefficient (ICC) of 0.87. Demographic and professional information of nurses were also collected.

Statistical Analysis:

Statistical analysis was done by IBM SPSS Statistics software [ver.21] (IBM SPSS Statistics, Armonk, USA). Normality of the numeric variables was checked by Kolmogorov- Smirnov test. Data were pre-

Table 3: The viewpoint of study participants that had participated in a training program on the MERS-CoV about the content of the program (N = 60)

Content of training program on the MERS-CoV	There was	There was not	Don't remember
How to identify a case of suspected to MERS-COV	46 (76.67)	10 (16.67)	4 (6.67)
Triage of patients with acute respiratory infection	39 (65)	17 (28.33)	4 (6.67)
Who do we contact at hospital in the case of dealing with patients of suspected coronavirus?	43 (71.67)	12 (20)	5 (8.33)
Wearing personal protective equipment for healthcare personnel	48 (80)	8 (13.33)	4 (6.67)
Removing personal protective equipment	46 (76.67)	10 (16.67)	4 (6.67)
Safe disposal of medical waste	(40 (66.67)	16 (26.67)	4 (6.67)
Managing of visitors (coming and going)	36 (60)	20 (33.33)	4 (6.67)
Controlling of resource for patients (wearing mask by suspected patients)	41 (68.33)	15 (25)	4 (6.67)
Requiring the use of personal protective equipment for aerosol generating procedures (such as endotracheal intubation, airway suction, tracheostomy, chest physiotherapy, nebulizer treatment, and sputum induction)	47 (78.33)	9 (15)	4 (6.67)
Using of N95 respirator	49 (81.67)	7 (11.67)	4 (6.67)

Table 4: Influencing factors on the nurses' preparedness against the MERS-CoV outbreak *

Characteristics	Preparedness total	Dimension1†	Dimension2‡	Dimension3§
Age	0.22 (0.007)	0.12 (0.141)	0.25 (0.002)	0.18 (0.023)
Work experience in nursing	0.27 (0.001)	0.17 (0.034)	0.26 (0.001)	0.15 (0.048)
Work experience in current position	0.16 (0.041)	0.09 (0.247)	0.21 (0.008)	0.05 (0.481)
The number of hours of training for coronavirus	0.24 (0.005)	0.08 (0.318)	0.51 (< 0.001)	0.12 (0.135)

*Data was presented as Pearson correlation coefficient (p-value).

†anagement and prevention of MERS-CoV, ‡Iraining for MERS-CoV and §Awareness of the center's policies for information transmission and infection control.

sented using mean (SD) and range (min-max) for the continious variables and frequency (percent) for categorical variables. The comparisons between group were done with independent t-test and analysis of variance (ANOVA). For assessing the relationship among continious variables, the Pearson correlation coefficient was utilized. In all analyses, *p-value* less than 0.05 were considered significant.

Ethical considerations

This study has been approved by the Ethics Committee of Tabriz University of Medical Sciences(IR.TBZMED.REC.1395.1065). The first author initially provide explanations about the research goals and the confidentiality of the information to the participants and then, the informed consent was signed and the questionnaire was completed by participants.

RESULTS

Participants' Characteristics

The majority of participants were female (88.4%) with an average age of 31.40 (SD = ± 6.57). Only 38.7% of the participants attended the MERS-CoV training course. Table 1 also shows the mean score (SD) of preparedness against the MERS-CoV outbreak and its relation with personal and work-related characteristics, which indicates that nurses with a master's degree (p = 0.045) and being train for MERS-CoV (p < 0.001) were significantly better prepared against MERS-CoV outbreak (Table 1).

Preparedness of participants against the MERS-CoV outbreak

The mean score of nurses' preparedness against the MERS-CoV outbreak was 51.27 (SD = 20.23). The lowest percentage of nurses' preparedness was in dimension of "training for MERS-CoV" with a mean of 31.77% (SD = ± 19.87) and dimensions of management and prevention of MERS-CoV (55.13% ± 25.07) and awareness of the center's policies for information transmission and infection control (58.42% ± 21.51) were in the next ranks.

Dimension 1. Participants' preparedness on the management and prevention of MERS-CoV

The finding of this study in the first dimension of preparedness for the management and control of MERS revealed that the participants considered "using of gloves" (86.45%) more in compliance with standard precautions and they observed less the "using protective glasses" (43.23%). The findings also indicated that 28.39% of the participants performed all 8 standard precautions measures.

Nurses mentioned the greatest reason for considering standard precautions was to protect of themselves against disease (85.81%) and the less important reason to use standard precaution measures was to protect their patients' companions and visitors (42.58%). From the viewpoint of 58.39% of participants, their center had a plan for possible situation of exposure to a suspected case of MERS-CoV.

The most and the least common actions to identify patients suspected of MERS-CoV were asking patients about the history of traveling to Saudi Arabia, Yemen, United Arab Emirates (UAE), Qatar and Iraq (62.58%), and performing standard precaution measures in asymptomatic patients or irrelative symptoms with MERS-CoV infections (25.81%) respectively. According to the participants self-reporting, after identifying suspicious cases to MERS-CoV according to their hospital policies, the most and the least common actions were isolating of the patient in a negative-pressure isolation room (76.77%), and performing standard precautions in asymptomatic patients or irrelative symptoms with MERS-CoV infections (40.65%) respectively (Table 2).

According to the participants self-reporting, decontamination of the equipment using appropriate disinfection agents, after referral or transferring suspected patients of MERS-CoV, was performed by 78.9% of participants.

Dimension 2. Training for MERS-CoV

The findings of this study showed that 60 (38.7%) of the nurses had passed training course on MERS-CoV, and 18.54% passed this course more than one year ago (Table 1). From the viewpoint of the participants who completed the course, the training content for MERS-CoV was more about the use of N95 respirator (81.67%) and less about visitors management (60%). (Table 3).

Dimension 3. Awareness of the center's policies for information transmission and infection control

The most nurses participated in this study (86.62%) had reported suspicious cases to infection control supervisor and 9.55% cases to the health centers. In addition, 3.82% of participants were unaware of the center to be reported. The suspicious cases were reported through a specific form (54.44%), the telephone (42.22%) and the internet (3.33%) by participants.

The results showed that 41.93% of nurses were aware of the The CDC's policies and MERS-CoV prevention guidelines. Also, 60% of participants were aware of the existence of intermediary officials with health center officials and information transmission to HCWs and 53.55% of nurses were aware to carry out periodic tests to identify their underlying illnesses (Table 2).

Influencing factors on the nurses' preparedness against the MERS-CoV outbreak

According to the results of study, the age of the participants ($r = 0.22$, $p = 0.007$), work experience in nursing ($r = 0.27$, $p = 0.001$), work experience in the current position ($r = 0.16$, $p = 0.041$), and the number of hours for training on the MERS-CoV ($r = 0.24$, $p = 0.005$) had a significant relationship with the preparedness against the MERS-CoV outbreak (Table 4).

DISCUSSION

The results of this study that was carry out to determine the preparedness of Iranian nurses against the MERS-CoV outbreak and influencing factors, showed that the nurses participating in this study had almost half the criteria for dealing with MERS-CoV. The highest percentage of preparedness was related to the awareness of center policies for information transmission and infection control and the lowest percentage was related to the training programs for MERS-CoV in their centers. In a study by Mohammad Nour and *et al*. in Saudi Arabia, nurses' performance in control of infection and using personal protective equipment in caring for a suspicious or confirmed MERS-CoV patient was reported well and about 88% which is better than the preparedness of participants of this study[19]. Perhaps this difference is due to the difference in instruments for measuring nurses' preparedness. While the instrument of this study have been designed with the principles of design and psychometrics of research instruments and evidence of its validity and reliability have been reported[16], this evidence is not available for the instrument used in their study.

Nurses took more "use of gloves" in the context of observing precautionary measures and followed the “use of protective glasses” less than other measures. In the study of Haile *et al*., wearing gloves was good, but wearing protective eye glasses was weak[20], that is consistent with our study.

Most of the nurses participating in the study to identify suspected cases of respiratory syndrome in the Middle East conducted a patient survey in Saudi Arabia, Yemen, UAE and Qatar. However, observation of standard precautions in asymptomatic patients was poor, while standard precautions in all patients should be observed according to the CDC's guidelines[21].

Nurses in their actions after identifying a patient suspected of MERS-CoV, had used the isolation room for these patients more than the rest of the actions. The results of this study are contradictory with the results of study by Mohammad Suliman *et al*., in Jordan, where the use of an isolated room was poor among HCWs[22], and the reason can be due to the lack of resources or organizational structure or lack of guidelines in this country. Most of the nurses participating in the study disinfected the equipment and the environment after the release of the patient suspected of MERS-CoV. According to study of Bin *et al*. in Korea, the MERS-CoV can survive in the environment and equipment around the patient for several days. As a result, disinfection of the equipment and the environment around the patient is necessary to prevent the transmission of infection[23].

A small number of participants had passed a training program on MERS-CoV, and the results of this study are consistent with the results of study by Alsahafi and Cheng, which on the nurses believed that quality of the training provided by their centers on emerging infectious diseases and MERS-CoV was moderate and only 7% of nurses rated these training at high levels[24]. From the viewpoint of our nurses, training on "management of visitors" was less than the rest of the topics in the content of course, while experience of South Korea outbreak has shown that one of the measures to prevent the outbreak of respiratory infectious diseases in the hospital and community is to limit visitors and to force HCWs of the patient to use the isolation room[25]. As a result, it is necessary to provide training to nurses in order to change their care behaviors. Alkot *et al*. in Saudi Arabia, showed that the performance of primary HCWs in the care of patients with MERS-CoV has improved after education[27].

The most of the nurses participating in the study reported cases of the suspected disease to an infection control supervisor, and their reporting was mostly by telephone or special forms. Correct and prompt notification of cluster-type infections to health systems regarding emerging infectious diseases is one of the measures that can be important in preventing the epidemic property of infectious diseases[26]. In accordance with the guidelines of the Iranian CDC, all HCWs are obliged to report urgently (less than an hour) suspicious cases which were reported to the intermediaries (infection control specialists) in hospital and primary information was reported to the health department of universities based on completing the form[12].

Based on the viewpoint of more than half of the nurses participating in the study, the policies of the CDC and the prevention of MERS-CoV were not properly informed. Awareness and timely response of health officials from cases of infection can prevent the disease outbreaks and transmission of virus may be stopped with implementation of appropriate infection control measures[27]. More than half of the participating nurses were aware that the hospital infection control supervisor was in charge of communicating with the health authorities and was responsible for providing the necessary training in infection control. Therefore, it is possible to use these human resources in the individual and periodic training of nurses and to incorporate these training in their job descriptions more accurately.

According to our findings, there was a significant relationship between participants' preparedness against the MERS-CoV outbreak with their work experience in nursing, their work experience in the current work situation, training hours on the MERS-CoV and their degree. In the study of Muhammad Umar Khan and colleagues, there was a significant relationship between the experience of nurses with their knowledge and attitudes towards MERS-CoV[28].

CONCLUSION

Although the better preparedness of health-care workers against emerging infectious diseases can reduce the spread of infection and themselves infection, they are often equipped after the disease outbreak. The findings of this study suggest, in addition to performing standard precautions, in order to better prepare nurses for preventing from the spread of emerging infectious diseases such as MERS-CoV, it is necessary to have a proper triage for patients in the ED, to conduct continuing education program about these diseases and training regarding the management of patients and visitors in these situations. Hospital managers need to be able to use trained and experienced nursing staff in the ICU and the ED. In this study, collecting data with self-reporting method and investigating in two hospitals of Tabriz can be considered as limitations of the study. It is suggested that other studies be conducted in other provinces and countries. The instrument designed in this study can provide a reliable way to measure the preparedness of nurses in other areas with high infection risk in the region. Another limitation of this study was the assessment of nurses preparedness for a time when there was no crisis in the outbreak of MERS-CoV. It is recommended that another study be conducted at current situation, when countries such as Iran, struggle with COVID-19 outbreak.

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