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Original Article

Healthcare workers' knowledge and practices in managing COVID-19: A cross-sectional study

Morteza Atayi[1*], Donya Mohammadi[2], Nasim Mahdavi[1], Ehsan Aliasghari[3], Fatemeh Hamzepour[2]

[1]Research Center for Evidence-Based Medicine, Iranian EBM Center: A Joanna Briggs Institute Center of Excellence, Tabriz University of Medical Sciences, Tabriz, Iran
[2]Faculty of Nursing and Midwifery, Maragheh University of Medical Sciences, Maragheh, Iran
[3]Department of Surgery, Shahid Madani Hospital, Tabriz University of Medical Sciences, Tabriz, Iran

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***Corresponding Author:**
Morteza Atayi,
Email: m.atayi6722@gmail.com

Abstract

Background: The COVID-19 pandemic has placed a significant burden on healthcare workers (HCWs), particularly those involved in respiratory care. This study aimed to assess the knowledge and practices of anesthesia staff regarding COVID-19 patient care and prevention measures.

Methods: A cross-sectional study was conducted among anesthesia staff in Iran from July 1 to December 25, 2021. Participants completed a questionnaire assessing demographic characteristics, knowledge, and preventive practices. The obtained data were analyzed using descriptive statistics, t-tests, analysis of variance, correlation analysis, and multiple linear regression.

Results: While most participants demonstrated sufficient knowledge, significant gaps were identified in specific areas, such as hand hygiene and personal protective equipment (PPE) use. Factors associated with higher knowledge scores included being single, being a nurse, and having fewer daily work hours. Anesthesia staff generally adhered to preventive measures, with stronger adherence observed among anesthesia nurses and those with less experience.

Conclusion: Despite sufficient knowledge, targeted training is needed to address knowledge gaps and improve adherence to preventive measures among anesthesia staff. This will contribute to a more resilient healthcare workforce and better preparedness for future pandemics.

Keywords: COVID-19, Anesthesia, Knowledge and practices, Preventive measures, Personal protective equipment, Respiratory care

Introduction

The COVID-19 pandemic, caused by the severe acute respiratory syndrome coronavirus 2, emerged as a global health crisis in late 2019.[1] Starting in Wuhan, China, the virus rapidly spread worldwide, prompting the World Health Organization (WHO) to declare a public health emergency of international concern and, subsequently, a pandemic.[2]

COVID-19 is a highly contagious respiratory illness that can be spread through close contact with an infected person or by touching contaminated surfaces.[3] Symptoms typically appear within 2–14 days and range from mild to severe. While most people fully recover, a small percentage of them experience severe complications, including respiratory failure and death. The most common symptoms are fever, cough, fatigue, anorexia, shortness of breath, and myalgia.[4] COVID-19 currently has no definitive cure, and while vaccines have been effective in preventing severe illness, they may have some side effects, as observed with the Sinopharm vaccine.[5,6] According to previous studies, antibiotics have no significant effect on viral diseases, including COVID-19.[7]

Iran's initial COVID-19 case was reported in Qom on February 20, 2020. Based on subsequent data from the WHO, the country experienced over 141 000 COVID-19-related fatalities.[8]

Healthcare workers (HCWs) in Iran, positioned at the forefront of the pandemic response, faced significant challenges. Frequent exposure to infected patients increases their risk of contracting COVID-19. Additionally, the psychological strain, fatigue, occupational stigma, and fear associated with the pandemic had a profound impact on their well-being.[9]

The WHO recommends that HCWs implement stringent protection measures during close patient interactions to prevent COVID-19 transmission. These measures typically include washing hands regularly, maintaining social distancing, and practicing respiratory hygiene (covering the mouth and nose when coughing or sneezing).[10]

Respiratory care is a core responsibility of anesthesia personnel, including anesthesiologists, nurse anesthetists, certified anesthesia assistants, and trainees. This encompasses monitoring patient breathing, circulation, consciousness,

muscle strength, and blood oxygen saturation, preventing common complications, and managing respiratory emergencies such as endotracheal intubation, non-invasive and manual ventilation, tracheostomy, cardiopulmonary resuscitation, bronchoscopy, and the like.[11-13] During these procedures, anesthesia staff are exposed to infectious droplets and airborne particles, the primary mode of COVID-19 transmission.[10-12] To ensure patient and personnel safety, anesthesia staff must possess adequate knowledge of managing patients post-surgery and in the intensive care unit (ICU).[11]

In response to the COVID-19 outbreak, the WHO initiated online training sessions to bolster strategies such as raising awareness and training HCWs in preventive measures.[10,14]

Inadequate scientific knowledge and misconceptions among the personnel can contribute to delayed diagnosis, poor infection control, and disease spread. Assessing the anesthesia staff's knowledge level and preventive practices can identify knowledge gaps and inform targeted training initiatives.[10,14]

The existing studies have primarily assessed HCWs' knowledge of COVID-19, with a limited focus on specific measures to prevent infection. This study aims to evaluate the extent of anesthesia staff's scientific knowledge regarding providing respiratory care to COVID-19 patients while minimizing the risk of infection.

Methods

Setting and Participants

This cross-sectional study was performed in Maragheh, Iran, from July 1 to December 25, 2021. Anesthesia staff involved in respiratory care for COVID-19 patients, including anesthesiologists, nurse anesthetists, certified anesthesia assistants, and trainees, at Sina and Amir hospitals were eligible to participate in this study. Due to the small sample size, all 69 eligible staff members received the questionnaire. Ultimately, 30 completed questionnaires were returned.

Data Collection Tool

The questionnaire comprised three sections, namely, demographic characteristics, knowledge, and preventive measures related to COVID-19. The first section collected general information, including gender, marital status, education level, job category, workplace, work experience, exposure to COVID-19 patients, and daily work hours.

The second section consisted of 18 questions (6 multiple-choice and 12 true or false) to assess the anesthesia staff's knowledge of medical and respiratory care for confirmed COVID-19 patients.

The knowledge questions were developed based on the WHO's 'Clinical Management of COVID-19 Patients: Living Guidance, 25 January 2021.'[10] This section focused on the anesthesia staff's knowledge of hand hygiene, personal protective equipment (PPE) use, and COVID-19 patient care.

Multiple-choice questions awarded 2 and 0 points for correct and incorrect answers, respectively. For the remaining 12 questions, correct answers received 2 points, 'I don't know' received 1 point, and incorrect answers received 0 points. The overall knowledge score ranged from 0 to 36.

The third section evaluated practice toward COVID-19 using a 5-point Likert-type scale (ranging from 1 to 5, representing never to always). This section included 4 items with scores ranging from 4 to 20.

To assess questionnaire validity, the questionnaire was sent to 6 experts in various fields for review. Experts rated each item on a 3-point scale (necessary, useful but not necessary, and not necessary). Additionally, they evaluated the relevance, simplicity, and clarity of each phrase using a 4-point Likert-type scale based on the Waltz and Bausell content validity index (CVI). Phrases with a CVI below 0.79 were removed or revised. The validity of the variables was confirmed after addressing defects and ambiguities.[15]

Cronbach's alpha was used to evaluate questionnaire reliability, with a measure of 0.86 for practice. Social media platforms (Telegram, WhatsApp, and Instagram) were utilized to distribute the questionnaire to the target population.

Ethical Considerations

The study protocol was approved (IR.MARAGHEHPHC.REC.1400.008) by the Ethics Committee of Maragheh University of Medical Sciences. Voluntary participation through an online questionnaire eliminated the need for a consent statement. The study adhered to the Declaration of Helsinki (1964).[16] Participant confidentiality was ensured as the questionnaire required no identifiable information. The study followed the Strengthening the Reporting of Observational Studies in Epidemiology and Checklist for Reporting Results of Internet E-Surveys guidelines.[17,18]

Statistical Analysis

Completed questionnaires were analyzed using SPSS version 26 (IBM). Descriptive and categorical data were presented as means and standard deviations, as well as frequencies and percentages, respectively.

Beyond descriptive analysis, independent sample t-tests and one-way analysis of variance were employed to compare outcomes between groups. Pearson correlation was used to examine relationships between variables, and multiple linear regression identified factors associated with favorable preventive measures. A P value less than 0.05 was considered statistically significant.

Results

Of the 30 participants, over half (53.3%) were female, a majority were single (86.7%), and most had an undergraduate degree or lower (96.7%). Anesthesia nurses and operating room participants were the predominant groups in our study, comprising 90% and

83.3%, respectively. Most participants had less than 5 years of experience (63.3%). The average daily work hours were 7.95 ± 1.46 hours, and the majority of participants (76.7%) had fewer than 5 daily exposures to COVID-19 patients (Table 1).

Our study evaluated anesthesia staff's knowledge of self-protection, PPE use, and management of COVID-19 patients while minimizing the risk of infection. The mean knowledge score was 24.3 ± 4.3, ranging from 0 to 36. Independent sample *t* tests revealed significant differences in knowledge scores based on marital status and profession. Singles and nurses demonstrated higher knowledge levels compared to married individuals and anesthesia nurses, respectively ($P = 0.014$, $P = 0.013$, Table 2).

Spearman's correlation analysis indicated a significant negative correlation between knowledge scores and daily work hours. Longer work hours were associated with lower knowledge scores ($r = -0.40$, $P = 0.027$). However, no significant differences in knowledge were observed based on gender, education, workplace, experience, or exposure (Table 2).

The average correct answer rate for knowledge questions was 65%. Most knowledge items were correctly answered by the majority of participants. The lowest correct answer rates (Table 3) were found for 'How should you perform hand hygiene when removing (doffing) your PPE?' (13.3%), 'When should you use a so-called half-face mask when present in an ICU only for COVID-19 patients?' (43.3%), and 'The maximum possible oxygen flow is used in the respiratory care of the COVID-19 patient.' (43.3%).

The lack of sufficient knowledge regarding hand hygiene during PPE removal (13.3% correct answers) is particularly concerning. Many anesthesia staff revealed misconceptions about this critical step. Significant differences in knowledge about hand hygiene while doffing PPE were observed among gender, profession, and exposure groups. Males, nurses, and staff with more than 10 daily exposures exhibited higher knowledge levels ($P = 0.037$, $P = 0.039$, and $P = 0.031$, respectively; Table 3).

Additionally, significant differences in knowledge about 'When should you use a so-called half-face mask when present in an ICU only for COVID-19 patients?' and 'In the face of children with COVID-19, we perform a tracheotomy to prevent the production of more aerosols.' were observed based on work hours. Staff who correctly answered these questions had significantly fewer work hours than those who answered incorrectly ($P = 0.039$ and $P = 0.012$, respectively; Table 3).

Based on the data (Table 4), profession is the only factor significantly influencing preventive measures scores (14.81 ± 1.41 versus 11 ± 1.73, $P = 0.01$). Anesthesiologists and anesthesia nurses demonstrated higher practice scores compared to nurses (Table 4).

Table 1. Demographic Characteristics of the Study Group (N = 30)

Characteristics	N	%
Gender		
Female	16	53.3
Male	14	46.7
Marriage status		
Single	26	86.7
Married	4	13.3
Education		
Undergraduate and lower level	29	96.7
Postgraduate and upper level	1	3.3
Profession		
Nurse	3	10
Anesthesiologist and anesthesia nurse	27	90
Workplace		
1-ICU, COVID-19 ward, emergency ward	5	16.67
2-Operating room	25	83.33
Experience		
Less than 5 years	19	63.33
More than 5 years	11	36.67
Exposure		
Less than 5 cases	23	76.7
Between 5 and 10 cases	0	0
More than 10 cases	7	23.3

Note. ICU: Intensive care unit.

Table 2. Relationship Between Sociodemographic Characteristics and Knowledge Scores of Study Participants

Characteristics	Knowledge	*P* Value
Gender		
Female	23.88 ± 3.55	0.559
Male	24.79 ± 5.1	
Marital status		
Single	24.69 ± 4.47	0.014*
Married	21.75 ± 1.26	
Education		
Undergraduate and lower level	24.34 ± 4.36	0.764
Postgraduate and upper level	23	
Profession		
Nurse	30 ± 7.21	0.013*
Anesthesiologist and anesthesia nurse	23.67 ± 3.52	
Workplace		
1-ICU, COVID-19 ward, emergency ward	24.4 ± 4.34	0.956
2-Operating room	24.28 ± 4.37	
Experience		
Less than 5 years	25.11 ± 4.78	0.181
More than 5 years	22.91 ± 2.98	
Exposure		
Less than 5 cases	24.13 ± 3.89	
Between 5 and 10 cases	-	0.702
More than 10 cases	24.86 ± 6.82	
Work hours (hours/day)	24.3 ± 4.3	0.027*

Note. ICU: Intensive care unit.
*Significance; Maximum score = 36.

Table 3. Relations Between Knowledge About Airway Management of COVID-19 Patients and Sociodemographic Caractristics of Participants

No.	Knowledge	Total Correct Answers N (%)	*P* Value							
			Gender[a]	Marriage[a]	Education[a]	Profession[a]	Work Place[a]	Experience (Years)[a]	Exposure (Case/Day)[a]	Work Hours (Hours/Day)[b]
K1	How should you perform hand hygiene when removing (doffing) your PPE?	4 (13.3%)	**0.037***	0.454	0.133	**0.039***	1.000	0.611	**0.031***	0.751
K2	In which order should you remove PPE?	23 (76.7%)	1.000	0.225	0.233	1.000	0.565	0.068	0.306	0.263
K3	Why should you apply positive end-expiratory pressure to a mechanically ventilated patient?	25 (83.3%)	0.642	0.119	0.167	0.064	1.000	0.327	0.068	0.623
K4	By default, the ventilation I:E ratio is set to 1:1.5 for COVID-19 patients as opposed to the normal 1:2 default. What is its risk?	18 (60%)	0.296	1.000	0.400	1.000	0.128	0.266	0.084	0.141
K5	When should you use a so-called half-face mask when present in an ICU only for COVID-19 patients?	13 (43.3%)	0.491	0.113	1.000	0.565	0.628	0.259	1.000	0.039*
K6	How many staff can be in a room during tracheostomy or intubation?	19 (63.3%)	0.389	1.000	1.000	0.279	0.626	0.466	0.215	0.823
K7	Closed suction systems should not be used for suctioning a patient with COVID-19.	23 (76.6%)	0.204	1.000	0.233	1.000	1.000	0.372	1.000	0.140
K8	Patients with COVID-19 should not be encouraged to cough before and after extubation.	18 (60%)	0.654	0.274	0.400	1.000	1.000	0.712	0.669	0.068
K9	The maximum possible oxygen flow is used in the respiratory care of the COVID-19 patient.	13 (43.3%)	0.961	0.613	1.000	0.070	0.138	0.708	0.666	0.258
K10	After the extubation of the patient with COVID-19, there is no need to change the respiratory circuit.	26 (86.7%)	1.000	0.454	1.000	1.000	1.000	1.000	0.548	0.081
K11	In the face of a person with an unknown COVID-19 status, we assume that the patient is infected.	28 (93.3%)	0.209	1.000	1.000	1.000	1.000	1.000	0.418	0.142
K12	In the face of a person with an unknown COVID-19 status, complete neuromuscular relaxation is not required for procedures such as intubation and tracheotomy.	22 (73.3%)	0.226	0.284	1.000	0.545	0.589	0.417	0.638	0.846
K13	In the face of a person with an unknown COVID-19 status, using the N95 mask alone is sufficient.	16 (53.3%)	0.696	1.000	1.000	0.586	0.642	0.257	1.000	0.376
K14	In the face of a person with an unknown COVID-19 status, procedures such as intubation and tracheotomy should preferably be performed in an isolated location with negative air pressure.	21 (70%)	0.440	0.563	1.000	1.000	0.622	0.225	0.640	0.398
K15	Cuffed endotracheal tubes should be used in the intubation of children with COVID-19.	23 (76.7%)	1.000	0.548	1.000	1.000	1.000	0.029*	1.000	0.133
K16	In the face of children with COVID-19, tracheotomy is performed to prevent the production of more aerosols.	21 (70%)	0.236	1.000	1.000	0.534	0.622	1.000	0.153	0.012*
K17	In children with COVID-19 who develop hypoxemia, oxygen therapy with minimal flow through the nasal cannula is performed first.	16 (53.3%)	0.696	1.000	1.000	1.000	0.642	0.707	0.399	0.880
K18	In children with COVID-19, large volumes of sedatives should be prescribed to prevent coughing.	22 (73.3%)	0.101	1.000	0.267	0.545	1.000	1.000	1.000	0.284

Note: PPE: personal protective equipment; ICU: Intensive care unit; COVID-19: Coronavirus disease 19.
* Significance.
[a] Chi-square test (Fisher's exact).
[b] Mann-Whitney test.

The majority of anesthesia staff represented sufficient adherence to preventive measures, with an average score of 14.43 ± 1.83 out of 16. The data analysis revealed that PPE use in-patient beds was significantly associated with profession. Anesthesia staff exhibited better performance in this area ($P = 0.020$). Regarding PPE removal, experience groups significantly differed in their adherence to guidelines. Staff with less than five years of experience were more likely to follow correct doffing procedures than those with more than five years of experience ($P = 0.012$). Social distancing was influenced by both profession and exposure. Anesthesia staff and individuals with fewer than five daily exposures were more likely to maintain the required distance from patients ($P = 0.007$ and $P = 0.048$, respectively; Table 5).

Table 4. Predictors of Preventive Measures Toward COVID-19

Predictors[a]	Unstandardized Coefficients		Standardized Coefficients	t	*P* Value
	B	SE	Beta		
(Constant)	23.228	3.922		5.922	0.000*
Gender: (female versus male)	-0.241	0.683	-0.067	-0.352	0.728
Marriage status: (single versus married)	-1.146	1.090	-0.216	-1.051	0.306
Education: (undergraduate and lower level versus postgraduate and upper level)	-1.413	1.911	-0.141	-0.739	0.468
Profession: (nurse versus anesthesia nurse)	-4.736	1.673	-0.789	-2.831	0.010*
Workplace: (ICU, COVID-19 ward, and emergency ward versus operating room)	1.522	0.898	0.315	1.695	0.106
Experience: (less than 5 years versus more than 5 years)	-1.104	0.653	-0.295	-1.690	0.107
Exposure: (less than 5 cases versus more than 10 cases)	-0.022	0.603	-0.010	-0.036	0.972
Work time (hours/day)	-0.214	0.247	-0.171	-0.865	0.397
Knowledge score	0.018	0.085	0.043	0.217	0.830

Note. ICU, Intensive care unit; SE, Standard error.
* Significance.
[a] Multiple linear regression analysis

Table 5. Relations Between Preventive Measures During Airway Management of COVID-19 Patients With Sociodemographic Caractristics of Participants

No.	Preventive Measures	Total "Always" and "Usually" Answers n (%)	*P* Value							
			Gender[a]	Marriage[a]	Education[a]	Profession[a]	Workplace[a]	Experience (Years)[a]	Exposure (Case/Day)[a]	Work Hours (Hours/Day)[b]
P1	When working on the bed of a person with COVID-19, I use PPE according to the instructions.	27 (90%)	0.586	1.000	1.000	0.020*	1.000	0.279	0.128	0.050
P2	I remove the PPE in the order by touching the inside of surgical gown while removing the gloves (H), then the shield and finally the mask (H).	26 (86.7%)	0.315	0.075	0.133	0.360	0.538	0.012*	0.225	0.536
P3	According to WHO instructions, I disinfect my hands before touching the patient or performing a clean (or sterile) procedure, and after contact with the patient's body or body fluids, as well as after touching the patient's surroundings.	29 (96.7%)	0.467	1.000	1.000	1.000	1.000	0.367	0.233	0.067
P4	I keep my social distance with the COVID-19 patient.	28 (93.3%)	0.209	1.000	1.000	0.007*	1.000	0.520	0.048*	0.092

Note. PPE, personal protective equipment; WHO, World Health Organization.
* Significance.
[a] Chi-square test (Fisher's exact).
[b] Mann-Whitney test.

Discussion

This study was conducted approximately 16 months after Iran's initial COVID-19 case, during a period when numerous guidelines for managing COVID-19 patients had been published. As HCWs bear the primary responsibility for treating the disease, prioritizing their health is crucial.

Ventilator use has become a standard procedure in treating respiratory issues among COVID-19 patients.[11] This study evaluated anesthesia staff's knowledge and practices regarding respiratory care for COVID-19 patients, with a focus on personnel safety. While studies on the severe acute respiratory syndrome coronavirus 2, Middle East respiratory syndrome, and Ebola indicated that anesthesia staff's familiarity with PPE due to their work in the operating room and post-anesthesia care unit might be advantageous, COVID-19's higher contagiousness necessitates strict adherence to PPE use and procedural guidelines.[11,13]

In our study, the mean knowledge score among anesthesia staff was 24.3 ± 4.3 out of 36. Using Bloom's cut-off points, overall knowledge was categorized as good (8-10 points), moderate (6-7.9 points), or poor (<6 points). Approximately 76.7% of participants demonstrated sufficient knowledge (moderate or good), closely aligning with the findings of studies conducted in Italy and Ethiopia.[19-21] A study performed in Pakistan reported that 93.2% of participants had sufficient knowledge of COVID-19.[22] However, a study in Libya revealed an extremely lower level of knowledge, with only 26.5% of participants representing sufficient understanding.[23] Significant differences in knowledge were observed between marital status and profession subgroups. Additionally, a significant relationship was found between participants' overall knowledge scores and daily work hours. Singles, nurses, and individuals with

fewer daily work hours tended to have higher knowledge scores.

Daily work hours were negatively correlated with face mask use. Staff with heavier workloads tended to have less interest in using face masks.

Many participants represented misconceptions about hand hygiene during PPE removal. However, males, nurses, and individuals with greater exposure to COVID-19 patients exhibited relatively higher knowledge levels, which conforms to the findings of studies conducted in Egypt and China.[24,25]

Anesthesia staff demonstrated sufficient knowledge regarding proper PPE removal, respiratory care, and precautions during patient care, which corroborates the results of a study performed in China.[11]

Despite the participants' predominantly moderate knowledge level, they showed strong adherence to preventive measures. Correctly removing contaminated PPE is crucial to prevent further contamination.[10] Anesthesia nurses confirmed superior adherence to guidelines compared to nurses. Personnel with less than five years of experience performed PPE removal more accurately than those with more than five years of experience. This finding contradicts that of a study conducted in China, suggesting that greater experience leads to better adherence to preventive measures.[25] In our study, profession and exposure were associated with social distancing. Anesthesia nurses exhibited stronger adherence to maintaining social distance, and individuals with fewer than five daily exposures were more likely to adhere to this guideline.

Conclusion

A healthy and well-informed healthcare workforce is essential for providing quality patient care. Additionally, HCWs must stay updated on emerging and advanced diseases.

Empowering HCWs in various aspects that influence their experiences can contribute to building a sustainable workforce and strengthening health systems for future pandemics. Despite nearly 70% of staff achieving a satisfactory knowledge score in our study, further training in this area is necessary.

Authors' Contribution

Conceptualization: Morteza Atayi, Ehsan Aliasghari
Data curation: Donya Mohammadi
Formal analysis: Morteza Atayi
Funding acquisition: Donya Mohammadi
Investigation: Nasim Mahdavi, Fatemeh Hamzepour
Methodology: Morteza Atayi, Fatemeh Hamzepour
Project administration: Morteza Atayi
Resources: Donya Mohammadi
Software: Not-Applicable
Supervision: Morteza Atayi, Ehsan Aliasghari
Validation: Nasim Mahdavi
Visualization: Fatemeh Hamzepour
Writing–original draft: Nasim Mahdavi, Donya Mohammadi
Writing–review & editing: Morteza Atayi, Ehsan Aliasghari

Competing Interests

The authors declare that they have no conflict of interests.

Ethical Approval

The study protocol was approved (IR.MARAGHEHPHC.REC.1400.008) by the Ethics Committee of Maragheh University of Medical Sciences.

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