Published Online: 2024 October 28

Research Article

The Effect of the COVID-19 Pandemic on the Working Conditions and Efficiency of Radiographers at Ahvaz Jundishapur University of Medical Sciences' Radiology and CT Scan Imaging Centers

Marzieh Reshadatian [1,*], Mohammad Najafi [2], Maryam Moradi [3], Sara Zahmatkesh [2]

[1] Department of Medical Physics, School of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[2] Department of Medical Imaging and Radiation Sciences, Faculty of Paramedicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[3] Department of Biostatistics and Epidemiology, School of Health, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

[*] ***Corresponding Author:*** Department of Medical Physics, School of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran. Email: m.reshadatian@gmail.com

Received: 13 July, 2024; **Revised:** 29 September, 2024; **Accepted:** 1 October, 2024

Abstract

Background: Radiographers are highly skilled imaging technology users who work directly with COVID-19 cases.

Objectives: This study aims to assess the impact of COVID-19 on the working conditions and efficiency of radiographers and their level of satisfaction with personal protective equipment (PPE), cleaning supplies, and facilities during the COVID-19 epidemic.

Methods: A prospective observational study was conducted among radiographers registered in the radiology and CT scan imaging centers of Ahvaz Jundishapur University of Medical Sciences and some private centers between June and October 2022. A questionnaire with 28 multiple-choice questions was used to collect information. The questionnaire consisted of two sections; the first part contained demographic information. In the second part, participants answered questions about changes in working conditions, such as changes in stress level, work efficiency, the need for more rest, imaging time, use of equipment, and personal protective equipment at work, based on their experiences and observations during the COVID-19 pandemic. The data analysis was performed using Statistical Product Service Solutions (SPSS) software, version 26.0, with statistical significance assumed at a P-value < 0.05.

Results: One hundred and fifty radiographers completed the questionnaire. The mean age and mean work experience of participants were 33.2 ± 8.3 years and 9 ± 7.2 years, respectively. The results showed that most participants of both sexes agreed that they needed more rest (P-value < 0.05); their work efficiency had not decreased significantly during the COVID-19 epidemic. The stress level of participants had significantly increased compared to before the epidemic. There were significant differences between government-owned hospitals and private radiology centers regarding the presence of a COVID-19-related protocol, the compulsory use of masks, the existence of decontamination instructions, the type of air decontamination, the contact with imaging equipment manufacturers, the timing of decontamination, and the type of decontamination applied to the imaging equipment (P-value < 0.05).

Conclusions: This study demonstrated that the reduction in work efficiency among radiographers was not significant compared to before the COVID-19 pandemic. According to the study's results, radiographers' working conditions underwent numerous adjustments over the course of the COVID-19 epidemic.

Keywords: COVID-19, Radiology, Working Efficiency, Ahvaz, Radiographer, CT-Scan

1. Background

Since the first signs of COVID-19 appeared in February 2020 in Iran, the epidemic has placed an increasing burden on healthcare institutions (1). Radiological examinations are crucial in diagnosing and managing COVID-19 patients (2). Radiographers, as highly skilled imaging technology specialists, work directly with COVID-19 cases (3) and are at heightened risk of infection

due to their essential role in managing the outbreak. They face emotional strain, physical exhaustion, family isolation, shame, and the distress of losing patients or colleagues (4). The pandemic's enduring nature underscores the need to prioritize support for healthcare providers dealing with workplace stress. Previous pandemics, including SARS and A/H1N1, have negatively affected healthcare providers' mental health (5, 6). Workplace stress can lead to emotional exhaustion, which is associated with poor performance and burnout (7, 8). Several studies have documented heightened stress levels among nurses and physicians due to the COVID-19 pandemic, which has become a major stressor (9). One objective of this study was to assess the stress levels experienced by radiographers during the COVID-19 pandemic. Research has extensively documented the effects of COVID-19 on radiographers across Europe, Africa, the Middle East, and Asia. However, the majority of information from the United Kingdom (UK) has focused on student radiographers and the impact on education (10). Due to the high transmission rate of COVID-19, radiographers must exercise extra caution with personal protective equipment (PPE) and decontaminating themselves and their equipment after contact with suspected or confirmed cases (10). A significant global concern has been the lack of infection control procedures and PPE in hospitals and community settings. Effective functional and procedural strategies included isolation procedures, establishing outpatient clinics outside hospitals to treat symptomatic patients, and implementing infection control measures (11).

2. Objectives

This study aims to assess the impact of COVID-19 on the working conditions and efficiency of radiographers, as well as their level of satisfaction with personal protective equipment (PPE), COVID-19 testing availability, cleaning supplies, and facilities designed to reduce the spread of the virus in the radiology and CT scan imaging centers of Ahvaz Jundishapur University of Medical Sciences, and to compare these aspects with those in select private centers.

3. Methods

3.1. Study Design and Setting

A descriptive cross-sectional study was conducted among radiographers working in hospitals and radiology and CT scan centers to evaluate the effects of the COVID-19 period on working conditions and radiographer efficiency at the imaging centers of Ahvaz Jundishapur University of Medical Sciences and select private radiology and CT scan imaging centers in Ahvaz between June and October 2022.

3.2. Questionnaire

The questionnaire was developed based on recent research (12-14) and a relevant online survey conducted by the British Institute of Radiology among imaging and cancer specialists (15). The purpose of the questionnaire was to gather radiographers' opinions regarding the effects of the COVID-19 pandemic on their daily tasks and assess their perception of the adequacy of workplace safety measures. To ensure validity and accuracy, the questionnaire was created using Google Forms, with specific questions selected based on input from subject-matter experts. The questionnaire consisted of two sections, with a total of twenty-eight questions. The first section included seven multiple-choice questions related to participants' demographic characteristics, covering age, gender, education level, workplace during the COVID-19 pandemic, and clinical experience. The second section consisted of twenty-one questions regarding participants' views and experiences during the COVID-19 pandemic, assessing three main areas: (1) the impact of COVID-19 on radiographers' work; (2) the implementation of specific protocols and the COVID-19 PPE used; and (3) training and disinfection methods adopted to control the spread of COVID-19.

3.3. Participants

A total of 180 radiographers working in radiology and CT scan imaging centers under the authority of Ahvaz Jundishapur University of Medical Sciences, as well as in some private radiology and CT scan imaging centers, were invited to participate. Inclusion criteria required a bachelor's degree or higher and at least one year of clinical work experience in radiology or CT scan imaging centers during the COVID-19 pandemic. Finally,

150 participants who met the eligibility criteria were included in the study.

3.4. Statistical Analysis

Once the data were loaded into the statistical program (Statistical Product Service Solutions (SPSS) software, version 26.0), comparative and statistical analyses were performed. The normality of quantitative data was assessed using the Kolmogorov-Smirnov test. For research hypotheses, parametric tests, including analysis of variance and *t*-tests, and non-parametric tests, such as Mann-Whitney and Kruskal-Wallis, were applied. The significance level for the tests was set at less than 0.05.

4. Results

A total of 150 radiographers who met the eligibility criteria participated in the study and completed the questionnaire. Of these, 53 were male and 97 were female. In terms of age distribution, 46% of participants were in the 20 - 30 age group, 31% in the 31 - 40 age group, 17% in the 41 - 50 age group, and 5% in the 51 - 60 age group. Regarding clinical work experience, 66% had less than ten years, 22% had between ten and twenty years, and 12% had over twenty years of experience. Educational qualifications showed that 92% of participants held an undergraduate degree, 5% held a master's degree, and 3% held a PhD. Furthermore, 60% of the radiographers were employed by government hospitals, while 40% worked at private CT and radiography centers (Table 1).

4.1. Analysis of Gender vs. Changes in Working Conditions

The results were analyzed to determine if there was a relationship between gender and changes in working conditions to assess how each gender managed the COVID-19 pandemic. All findings were statistically significant. Most participants, regardless of gender, agreed on the need for more rest (P-value < 0.05), and the increase in stress levels was also significant (P-value < 0.05) (Table 2). Figure 1 illustrates the percentage of decreased efficiency between male and female radiographers, while Figure 2 displays the percentage of stress-related emotions reported by male and female radiographers.

4.2. Participants' Workplaces vs. Changes in Working Conditions

The data were analyzed to explore the relationship between participants' workplace locations during the COVID-19 pandemic and changes in their working conditions (Table 3). A statistically significant result was observed when comparing workplace location with the need for more rest (P-value < 0.05). This indicates that participants working in government hospitals felt a greater need for additional rest during the COVID-19 pandemic.

4.3. Participants' Workplace vs. Safety Precautions and Disinfection Methods

The results were analyzed to identify correlations between workplace location and specific safety precautions and disinfection methods, such as the presence of a COVID-19 protocol, mandatory mask use for all patients, provision of decontamination training, consultation with equipment manufacturers or resellers for decontamination guidance, and the decontamination methods used. Further analysis also explored workplace practices regarding decontamination protocols, types of air purification, and ground-level precautions (Table 4). When comparing work location with the presence of a COVID-19 protocol, there were no statistically significant results for mandatory mask usage, contact with imaging equipment manufacturers, or the type of decontamination applied to imaging equipment. However, significant differences were found between government-owned hospitals and private radiology centers in terms of the presence of decontamination instructions, the type of air decontamination (P-value < 0.05), and the timing of decontamination (P-value < 0.05).

4.4. Participants' Responses to Other 19-Related Questions

The participants were asked to evaluate how well their workplace currently provided adequate support for various issues and to express their confidence in the workplace's ability to provide sufficient support in addressing the situation as they anticipated it developing over the next three months. Tables 5 and 6

Table 1. Demographic Information About the Study's Participants

Variables	Number of Participants (n = 150); No. (%)
Gender	
Male	53 (35)
Female	97 (64)
Age	
20 - 30	69 (46)
30 - 40	47 (31.3)
40 - 50	28 (17.3)
≥ 51	8 (5.3)
Clinical work experience (y)	
1 - 10	99 (66)
11 - 20	33 (22)
≥ 21	18 (12)
Type of workplace	
Governmental	90 (60)
Private	60 (40)
Education	
Undergraduate degree	139 (92.6)
Master's degree	10 (6.7)
PhD	1 (0.7)

Table 2. Analysis of Gender vs. Changes in Working Conditions

Variables	Males (%)	Females (%)	P-Value
Breaks must be increased			0.005
Yes	30.7	69.3	
No	60.9	39.1	
Stressful emotions			< 0.05
Extremely stressed	16.9	80.4	
Significantly stressed	32.4	67.6	
Little stressed	57.7	42.3	
Not stressed	85.7	14.3	
decreased efficiency			0.786
Yes	34.2	65.8	
No	36.4	63.6	
Increased average examination time			0.684
Significant	30.8	69.2	
Average	37.3	62.7	
Small	35.7	64.3	
No	45	55	

present the participants' opinions on these matters, respectively.

5. Discussion

The world has not experienced such a severe health threat in many years. On January 30, 2020, the World Health Organization (WHO) convened an emergency committee and declared that the novel coronavirus outbreak constituted a public health emergency of international concern (1). COVID-19 predominantly targets the respiratory system and frequently leads to pneumonia. Radiology departments are crucial in diagnosing, managing, and monitoring both suspected and confirmed cases of COVID-19 using imaging

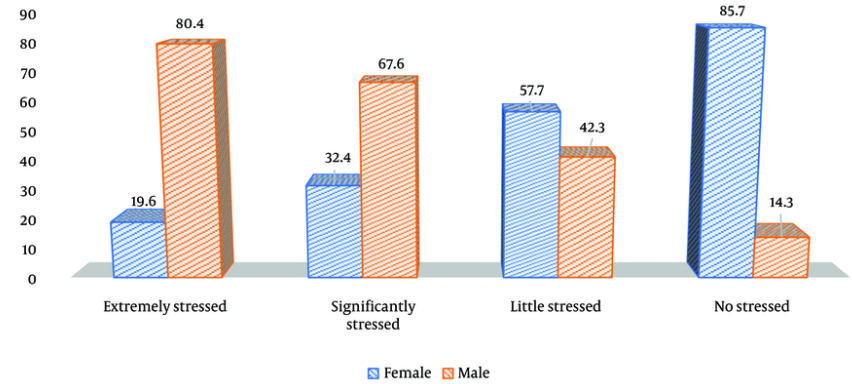

Figure 1. Bar chart showing the percentage of stressful emotions among male and female radiographers.

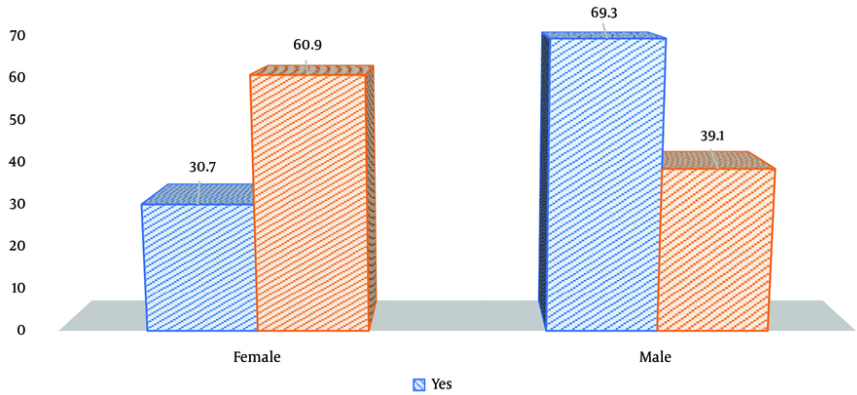

Figure 2. Bar chart showing participants' opinions about the need to increase the rest hours during the COVID-19 pandemic between male and female radiographers.

techniques like CT scans and X-rays (2-4). Furthermore, the risk of hospital cross-infection in the radiology department is increased when nonstandard preventative procedures are employed during radiological investigations (5). Radiology departments must evaluate and update their emergency plans to address the particular challenges posed by this viral outbreak (6, 7). Establishing a specific protocol for the COVID-19 outbreak and appointing an administrator will result in a more efficient and organized procedure for handling challenging and emergency situations. According to the findings of this investigation, most radiology departments in private and public hospitals have created COVID-19 pandemic protocols (88% and 93%, respectively). Equally crucial is the prompt education and training of all radiology department staff members. Surveys have pointed out a gap in knowledge concerning infection control practices. This study reveals that, irrespective of their workplace (private or government-owned center), participants have not received adequate training on decontamination methods. A straightforward method for guiding the radiology department through the necessary measures is to follow the recommendations of the European Centre for Disease Prevention and Control (8). In addition, it is essential for all members of the radiology

Table 3. Participants' Workplaces vs. Changes in Working Conditions

Variables	Government-Owned Hospital	Private-Owned Hospital and Private Center	P-Value
Breaks must be increased			0.007
Yes	64.4	35.4	
No	34.8	65.2	
Stressful emotions			0.804
Extremely stressed	63	37	
Significantly stressed	59.2	40.8	
Little stressed	53.80	46.2	
Not stressed	71.4	28.6	
decreased efficiency			0.205
Yes	54.8	45.2	
No	64.9	35.1	
Increased average examination time			0.071
Significant	70.8	29.2	
Average	41.7	52.9	
Small	64.3	35.7	
No	55	45	

department to use personal protective equipment (PPE) correctly and prioritize their safety. The necessary equipment should include at least face shields, goggles, fluid-resistant surgical masks, surgical caps, disposable fluid-resistant isolation gowns, disposable gloves that extend over the gown cuffs, and shoe covers, among other items (1). According to the survey, most participants reported wearing surgical masks and disposable protective gloves. However, fewer than half of the respondents indicated that they use disposable surgical caps, face shields, and disposable shoe covers. In the same vein, staff members in the radiology department are advised to reduce unnecessary interactions and maintain safe distances from others. A practical and straightforward example is for radiographers to avoid helping patients onto the machine's gantry, instead letting the accompanying person manage this task. Based on the results of Table 4, a high level of disinfectant is used to decontaminate imaging equipment in most centers. In private centers, equipment is disinfected after imaging each patient, but in government centers, the equipment is usually disinfected after imaging each COVID-19-confirmed patient. In most radiology and CT centers, whether public or private, no special methods are used to decontaminate the air in the imaging room. However, the ground is well decontaminated in most centers. Many hospitals followed a comprehensive cleaning approach after imaging a patient with a known COVID-19 infection (9, 10). In this study, a considerable number of radiographers in Ahvaz believe that their workplace is adequately stocked with PPE for both staff and patients, along with cleaning supplies, equipment, and cleaning personnel. They also appear confident that these resources will continue to be sufficient over the next three months. Nevertheless, they argued that there is, and will continue to be, a lack of adequate availability of COVID-19 antibody testing. In contrast, a similar online survey conducted by the British Institute of Radiology and published on May 4, 2020, found that most British radiographers felt they were not adequately supplied with the necessary equipment. Moreover, they were neither satisfied nor assured that they would be adequately equipped in the near future (11). Moreover, every radiology department is strongly advised to consult with equipment manufacturers for guidance on the proper disinfection techniques for each type of equipment. In this study, the majority of participants from both private and government-owned hospitals reported that they had not reached out to equipment representatives for guidance on proper decontamination procedures. Moreover, it is essential to guarantee thorough cleaning of all surfaces in the radiology department, effective decontamination of floors, air disinfection, and the incorporation of more robust disinfection methods into the daily cleaning

Table 4. Participants' Workplace vs. Safety Precautions and Disinfection Methods

Variables	Government-Owned Hospital	Private-Owned Hospital and Private Center	P-Value
The existence of a protocol			0.286
Yes	61.3	38.7	
No	46.2	53.8	
All patients must wear face masks at all times			0.701
Yes	60.4	39.6	
No	54.5	45.5	
Existence of decontamination instructions			0.038
Yes	65.7	34.3	
No	47.9	52.1	
contacting imaging equipment manufacturers for advice on proper disinfection of this equipment			0.385
Yes	56.3	43.7	
No	63.3	36.7	
Decontamination method used on imaging equipment			0.750
High-level disinfectant	57.1	42.9	
Low-level disinfectant	62.7	37.3	
Water& soap	66.7	33.3	
When is decontamination done?			0.006
After each patient	40	60	
After COVID-19 confirmed patient	70	30	
After COVID-19 suspected patient	71.4	28.6	
No need	66.7	33.3	
Air decontamination methods			0.510
Air specific disinfectant	54.3	45.7	
Aired the place every 4h for30min	55.6	44.4	
Uv air disinfectant	100	0	
No method	62.8	37.2	
Decontamination of the ground			0.061
Yes	65.6	34.4	
No	50	50	

Table 5. Assessment of the Adequacy of Support Provided by the Workplace in Various Categories to Address the Current Situation

Variables	Adequate (%)	Almost Adequate (%)	Not Adequate (%)	Do Not Know/NA (%)
COVID-19 PPE for radiographers	44	46.7	8	1.3
COVID-19 PPE for patients	32	46	18	4
COVID-19 testing for radiographers	40	26	22	12
Antibody testing for radiographers	22	25.3	19.3	33.3
Cleaning supplies & equipment	42.7	43.3	14	0
Cleaning staff	20.7	36.7	37.3	5.3

procedures. The survey found that high-level disinfectants are utilized to decontaminate equipment, especially following each patient's examination, regardless of the participants' workplace. However, workplaces employ a range of techniques for air decontamination, with the most common approaches being turning off the air-conditioning system and ensuring proper ventilation. Additionally, ground decontamination is not carried out in almost half of the workplaces. A limitation of our research was the low response rate, which could have been caused by COVID-19-related staff illness, shielding, or departmental time

Table 6. Participants' Confidence in the Adequacy of Provisions at Their Workplace to Address the Situation Over the Next Three Months

Variables	Adequate (%)	Almost Adequate (%)	Not Adequate (%)	Do Not Know/NA (%)
COVID-19 PPE for radiographers	33.3	50	13.3	3.3
COVID-19 PPE for patients	26	40.7	26.7	6.7
COVID-19 testing for radiographers	36	29.3	19.3	15.3
Antibody testing for radiographers	25.3	24	17.3	33.3
Cleaning supplies & equipment	33.3	44.7	20.7	1.3
Cleaning staff	23.3	36.7	35.3	4.7

constraints. This study demonstrated that the reduction in the work efficiency of radiographers was not significant compared to before the COVID-19 pandemic. According to the results of the study, radiographers' working conditions had undergone numerous adjustments over the COVID-19 epidemic. The current study highlights the impact of the COVID-19 pandemic on the changes in the working conditions and efficiency of radiographers, including the amount of change in their efficiency, the need for more rest, changes in their stress level at work, and the increase in imaging time for each patient. In addition, this research investigated the presence of protective protocols against the spread of COVID-19, including radiology imaging and CT scanning, protective equipment used by radiographers and patients, and the type of equipment and disinfectants used for the equipment and imaging room in these centers. Finally, the variables mentioned above were compared between radiographers of government centers affiliated with Ahvaz Jundishapur University of Medical Sciences and radiographers of private radiography centers in Ahvaz. This survey indicates that radiographers in Ahvaz adhere to specified standards for protecting against a similar situation. It also shows that there are significant differences in the disinfection methods used among the different workplaces of the participants. Radiology departments are required to continue developing equipment and implementing ways that, while being successful, improve patient and staff safety, manage workloads, and prepare for possible future outbreaks. All radiology departments needed to implement rapid training.

Acknowledgements

We would like to thank all the radiographers who participated in this study.

Footnotes

Authors' Contribution: Study concept and design, M. R.; acquisition of data, M. N. and S. Z.; analysis and interpretation of data, M. M. and M. R.; drafting of the manuscript, M. R.; critical revision of the manuscript for important intellectual content, M. R.; statistical analysis, M. M.

Conflict of Interests Statement: The authors declare no conflict of interest.

Data Availability: The dataset presented in the study is available on request from the corresponding author during submission or after its publication. Due to the extension of the data, the data is not publicly available.

Ethical Approval: This study is approved under the ethical approval code of IR.AJUMS.REC.1402.462 .

Funding/Support: This research is supported by Ahvaz Jundishapur University of Medical sciences, Ahvaz, Iran (Grant No: U-01049).

Informed Consent: Written informed consent was obtained from study participants.

References

1. Heydarian M, Behzadifar M, Chalitsios CV, Keshvari M, Omidifar R, Ghanbari MK, et al. Effect of COVID-19 on the Number of CT-scans and MRI Services of Public Hospitals in Iran: An Interrupted Time Series Analysis. *Ethiop J Health Sci*. 2021;**31**(6):1109-14. [PubMed ID: 35392347]. [PubMed Central ID: PMC8968382]. https://doi.org/10.4314/ejhs.v31i6.5.
2. Abuzaid MM, Elshami W, Tekin HO. Infection control and radiation safety practices in the radiology department during the COVID-19

outbreak. *PLoS One*. 2022;**17**(12). e0279607. [PubMed ID: 36574426]. [PubMed Central ID: PMC9794035]. https://doi.org/10.1371/journal.pone.0279607.

3. Khandaker MU, Abuzaid MM, Mohamed IA, Yousef M, Jastaniah S, Alshammari QT, et al. Investigation of the Radiographer's adherence and compliance with radiation protection and infection control practices during COVID-19 mobile radiography. *Radiat Phys Chem Oxf Engl 1993*. 2023;**210**:111023. [PubMed ID: 37206369]. [PubMed Central ID: PMC10174468]. https://doi.org/10.1016/j.radphyschem.2023.111023.
4. AlMulla M. Measurement of Radiographers' Pandemic Experiences and Perceptions During COVID-19. *Archives of Clinical and Biomedical Research*. 2022;**6**(2). https://doi.org/10.26502/acbr.50170247.
5. Blake H, Bermingham F, Johnson G, Tabner A. Mitigating the Psychological Impact of COVID-19 on Healthcare Workers: A Digital Learning Package. *Int J Environ Res Public Health*. 2020;**17**(9). [PubMed ID: 32357424]. [PubMed Central ID: PMC7246821]. https://doi.org/10.3390/ijerph17092997.
6. Maben J, Bridges J. Covid-19: Supporting nurses' psychological and mental health. *J Clin Nurs*. 2020;**29**(15-16):2742-50. [PubMed ID: 32320509]. [PubMed Central ID: PMC7264545]. https://doi.org/10.1111/jocn.15307.
7. Leiter MP, Harvie PL. Burnout among mental health workers: a review and a research agenda. *Int J Soc Psychiatry*. 1996;**42**(2):90-101. [PubMed ID: 8811393]. https://doi.org/10.1177/002076409604200203.
8. Maslach C, Schaufeli WB, Leiter MP. Job burnout. *Annu Rev Psychol*. 2001;**52**:397-422. [PubMed ID: 11148311]. https://doi.org/10.1146/annurev.psych.52.1.397.
9. Xiang YT, Yang Y, Li W, Zhang L, Zhang Q, Cheung T, et al. Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. *Lancet Psychiatry*. 2020;**7**(3):228-9. [PubMed ID: 32032543]. [PubMed Central ID: PMC7128153]. https://doi.org/10.1016/S2215-0366(20)30046-8.
10. Yasin B, Barlow N, Milner R. The impact of the Covid-19 pandemic on the mental health and work morale of radiographers within a conventional X-ray department. *Radiography (Lond)*. 2021;**27**(4):1064-72. [PubMed ID: 34023228]. https://doi.org/10.1016/j.radi.2021.04.008.
11. Ness MM, Saylor J, Di Fusco LA, Evans K. Healthcare providers' challenges during the coronavirus disease (COVID-19) pandemic: A qualitative approach. *Nurs Health Sci*. 2021;**23**(2):389-97. [PubMed ID: 33580590]. [PubMed Central ID: PMC8012981]. https://doi.org/10.1111/nhs.12820.
12. Kooraki S, Hosseiny M, Myers L, Gholamrezanezhad A. Coronavirus (COVID-19) Outbreak: What the Department of Radiology Should Know. *J Am Coll Radiol*. 2020;**17**(4):447-51. [PubMed ID: 32092296]. [PubMed Central ID: PMC7102595]. https://doi.org/10.1016/j.jacr.2020.02.008.
13. Huang Z, Zhao S, Li Z, Chen W, Zhao L, Deng L, et al. The Battle Against Coronavirus Disease 2019 (COVID-19): Emergency Management and Infection Control in a Radiology Department. *J Am Coll Radiol*. 2020;**17**(6):710-6. [PubMed ID: 32208140]. [PubMed Central ID: PMC7118524]. https://doi.org/10.1016/j.jacr.2020.03.011.
14. Myers L, Balakrishnan S, Reddy S, Gholamrezanezhad A. Coronavirus Outbreak: Is Radiology Ready? Mass Casualty Incident Planning. *J Am Coll Radiol*. 2020;**17**(6):724-9. [PubMed ID: 32304643]. [PubMed Central ID: PMC7128279]. https://doi.org/10.1016/j.jacr.2020.03.025.
15. British Institute of Radiology. *New poll: radiographers concerned about COVID PPE, testing & supplies [press release]*. 2019. Available from: https://bir.org.uk/media-centre/press-releases/2020/may/new-poll-radiographers-concerned-about-covid-ppe,-testing-supplies.aspx.