JBACHS
Journal of Basic and Clinical Health Sciences

J Basic Clin Health Sci 2022; 6: 712-721
https://doi.org/10.30621/jbachs.992808
RESEARCH ARTICLE

THE RESPONSES OF RADIOLOGY PROFESSIONALS TO THE COVID-19 PANDEMIC

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Received: 10.09.2021; **Accepted:** 13.04.2022; **Available Online Date:** 29.09.2022

Cite this article as: Alkan T, Cilengiroglu OV. The Responses of Radiology Professionals to the COVID-19 Pandemic. J Basic Clin Health Sci 2022; 6: 712-721.

ABSTRACT

Purpose: This study aimed to investigate radiology professionals' response to the impact of COVID-19 on professional practice. In addition, the fear and anxiety levels experienced by this workforce during the pandemic process were investigated.
Material and Methods: A quantitative cross-sectional study was conducted. The questionnaire covered information on demographic characteristics, the Coronavirus Overviews and Impacts, the Coronavirus Anxiety Scale (CAS), and the Fear of COVID-19 Scale. Logistic regression was used to model the relationship between "CAS" and "Fear" scores and variables. Data collected was analysed using the Statistical Package for Social Sciences (v.24).
Results: A total of 290 responses were received, comprising 21.7% radiologists and 78.3% technicians. The key contributor factors to work-related stress were found to be the fear of COVID-19 infection, with 63.8%, the increase in workload, with 17.6% and inadequate personal protective equipment (PPE), with 11%. The percentages of anxiety were 75.6% for technician and 24.4% for radiologist. It was found that there was a significant association between "CAS" score and the gender variable ($p=0.030<0.05$), and similarly, between "Fear" score and gender (p-value=0.003) and age (p-value=0.080) variables. The women are 2.205 times more likely to be anxious than men (p=0.033) and 2.106 times more likely to be fear (p=0.003).
Conclusion: Almost half of the participants reported adequate PPE availability during the study period. Despite this, most feared being infected with COVID-19. Therefore, it is important to provide timely and adequate personnel training, adequate availability of PPE and regular psychosocial support for radiology professinals, during future pandemics.

Keywords: COVID-19, radiology professionals, anxiety, fear

INTRODUCTION

Novel coronavirus (2019-nCoV) was first detected in Wuhan, a Chinese city of 11 million in December 2019. In the last days of the year, China reported unexpected cases of pneumonia in the country to the World Health Organization (WHO) (1-3). 2019-nCoV was identified a distinct branch from SARS (human severe acute respiratory syndrome) and MERS (Middle East respiratory syndrome) (1). This outbreak in China has been identified as the largest pneumonia outbreak since the SARS in 2003. In the first weeks, the total number of cases and deaths surpassed SARS (4). Compared to SARS, the COVID-19 pandemic caused more widespread anxiety and panic in China; as of early February 2020, 35% of the

Chinese adult population were found to have psychological distress (5-7).

Following this, WHO officially declared the coronavirus disease 2019 (COVID-19) outbreak as a pandemic in March 2020. WHO (8) also reported that, as of the morning of 12 March, there were more than 20,000 confirmed cases and about 1,000 deaths in the European Region (9). By 30 December 2020, the confirmed cases of COVID-19 had climbed to over 79 million, with 1.7 million, confirmed deaths and over 200 countries or areas affected (10). Compared to SARS in 2003, the COVID-19 epidemic caused much more widespread anxiety and panic.

Previous research has revealed its psychosocial effects by showing that in infection outbreaks, people are likely to experience feelings of helplessness, fear of getting sick or dying, and stigma (11). Several studies investigating the psychological state revealed significant psychiatric morbidities, during the SARS outbreak (12,13).

During the COVID-19 pandemic, the pressure on healthcare professionals continues to increase due to the high number of patients, pressures on healthcare system capacity, adverse effects on healthcare services, the risk of infection on healthcare professionals and the prevalence of COVID-19 transmission for their family members. Evidence related to transmissibility and mortality highlight for the clinical community of the importance of preparation, active management, vigilance and protection (14,15).

Due to the ability to spread asymptomatically (16,17), for people with a clear history of exposure, regardless of clinical symptoms, or with suggestive clinical manifestations, infection should be confirmed or otherwise by chest computed tomography (CT), chest X-ray or COVID-19 test (PCR test or antibody test). Chest X-ray and chest CT, which are frequently used to support the diagnosis of COVID-19 infection, play an important role in timely detecting of lung abnormalities and allow early treatment (18,19).

Radiology professionals are healthcare professionals who are exposed to patients affected by COVID-19. Most radiology department employees come into direct physical contact with patients while performing radiological examinations. Therefore, the imaging team should be aware that they are in the high-risk field and must strictly adhere to the rules to avoid the risk of contracting coronavirus. In addition, they should receive mandatory training in the use of personal protective equipment, infection control and prevention, sterilization and disinfection.

The case of COVID-19 first appeared on March 10, 2020 in Turkey. Since then, the spread of the illness has remained a matter of major concern in Turkey. When the regions with the most cases are examined from the official website of the Ministry of Health of the Republic of Turkey, it is seen that the Aegean region, which also includes Izmir, is in the third place (20). Many healthcare workers around the world have died as a result of infection (21). Regarding the risk of contracting coronavirus, and changes in work patterns, for patient-facing radiology workers there are likely to be additional workplace-related stress factors. Therefore, it is essential for medical imaging healthcare providers to be mentally and psychologically healthy, as well as adhere to control measures, to ensure ultimate success. Currently, little is known about the psychological impact and mental health of radiology workers during the peak of the COVID-19 outbreak. The purpose of this study is as follows: to determine the general information (GI) of radiology professionals about COVID-19, to assess their perceptions of the impact of the COVID-19 outbreak, gather data using the COVID-19 Anxiety Scales (CAS), and understand the fears of radiology workers with different experiences of the COVID-19 pandemic in Izmir.

MATERIAL AND METHODS

Study Design and Participants

A cross-sectional study was carried out among individual workers in İzmir, the most developed area of western Turkey, using an anonymous online questionnaire from 28th December 2020 to 11th January 2021. The online survey was considered an efficient method for gathering information during the pandemic of COVID-19. We adopted questionnaire design to assess the general information (GI) of radiology professionals about COVID-19, to understand the effects of COVID-19, gather data through COVID-19 Anxiety Scales (CAS), and understand fears about COVID-19 (FC-19S) during the epidemic of COVID-19.

Participants included those working in hospital during the pandemic, such as radiologists and technicians. The population size (n=287) was calculated for proportion (95% confidence level, 10%, margin of error, 33% the known proportion for population and infinite population size).

Table 1. Demographic information of participants

Variables	n (%)	Variables	n (%)
Gender		**Title**	
Female	177(61.0)	Radiologist	63(21.7)
Male	113(39.0)	Technician	227(78.3)
Age Group		**Workplace**	
x≤25	72(24.8)	Government Hospital	47(16.3)
26≤x<36	81(27.9)	University Hospital/Training and research Hospital	157(54.1)
36≤x<46	82(28.3)	Private Hospital	59(20.3)
x≥46	55(19.0)	Private Clinic	27(9.3)
Experiences		**Medical Device**	
x≤4	75(25.9)	X ray (Absent)	123(42.4)
5≤x<10	38(13.1)	X ray (Present)	167(57.6)
10≤x<15	43(14.8)	CT (Absent)	118(40.7)
15≤x<20	45(15.5)	CT (Present)	172(59.3)
20≤x<25	44(15.2)	IMR (Absent)	170(58.6)
x≥25	45(15.5)	IMR (Present)	120(41.4)
Variables	**Min-Max**	**Mean ± SD**	
Age	20-69	35.48±10.78	
Experiences	1-42	13.61±10.02	

Data Collection

Social media research is a method that has been used frequently recently. This research can present difficulties as well as opportunities in terms of research reliability and validity; however, it is a convenient way easy to access major data when it is difficult to collect face-to-face data, such as during the COVID-19 outbreak. Although social media users do not represent the entire population, it presents an opportunity to reach a specialist group such as radiologists and technicians (22, 23). Questionnaire data were collected online, using Google Forms (https://docs.google.com/ forms/) with social media research. The online questionnaire was piloted by the research team before it was distributed to the participants, and some questions were modified for clarity. Then, the questionnaire was sent to the graduates of the medical imaging techniques program in Izmir and to radiologists working in state and private hospitals, private imaging centers, university/education and research hospitals and municipal hospitals in İzmir. Data (n=290) were collected by random sampling method.

Instruments

The survey consisted of five sections: (i) demographic characteristics, (ii) the Coronavirus Overviews, (iii) the Coronavirus Impacts, (iv) CAS, and (v) Fear Scale. The demographic characteristics included general participant information (age, gender, years of experience and used medical imaging device).

The CAS consisted of 5 questions was used to measure anxiety with a 5-point frequency scale (0: "not at all" to 4:"nearly every day") (24). The scale measures the physiological and psychological symptoms of fear or anxiety experienced when exposed to thoughts or information about COVID-19. The total score was calculated by adding up each item's score (ranging from 0 to 20). Scores of 9 or greater indicates at risk or anxious groups (25).

The FC-19S consisted of 7 questions was used to assess fears caused by COVID-19 (26). The participants indicated their level of agreement with the statements using a five-item Likert-type scale (1: "strongly disagree", 2: "disagree", 3:"neither agree nor disagree", 4: "agree", and 5:"strongly agree"). The total score was calculated by totalling the scores of all items (ranging from 7 to 35). The higher the score, the greater the fear of COVID-19.

Statistical Analyses

The data were collected, categorized and processed using the SPSS (version 24®). The descriptive statistics (mean, standard deviation) and percentages were used for the quantitative variables. The comparisons were made using Mann-Whitney U test (MWU) and Kruskal Wallis test (KW). The frequencies, percentages and chi-square test were used for the qualitative variables. Cronbach alfa was used to determine the reliability of questionnaire. Cut-off point 9 was used to assess the level of CAS among participants. A score of >19 was considered to indicate fear. Logistic regression model was used

Table 2. Understanding of COVID-19 transmission, infection control and availability of PPE

	Response, n (%)				
Question	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
GI1	224(77.2)	49(16.9)	4(1.4)	1(0.3)	12(4.1)
GI2	83(28.6)	83(28.6)	60(20.7)	45(15.5)	19(6.6)
GI3	134(46.2)	110(37.9)	36(12.4)	4(1.4)	6(2.1)
GI4	54(18.6)	96(33.1)	76(26.2)	47(16.2)	17(5.9)
G15	48(16.5)	86(29.7)	77(26.5)	44(15.2)	35(12.1)
GI1: Radiology professionals are a part of the major frontline healthcare management team in response to COVID-19.					
G12: My personal radiation exposure has changed as imaging protocols changed after the COVID-19 outbreak.					
G13: I have a clear understanding of how the COVID-19 virus is transmitted.					
G14:G My understanding of the principles of infection prevention and control is adequate to deal with the COVID-19 outbreak.					
GI5: My facility has made available adequate personal protective equipment (PPE) for work during the COVID-19 outbreak.					

to estimate adjusted odds ratios (ORs) and their 95% confidence intervals (CIs) for “CAS” and “Fear” scores associated with risk factors. p-value of <0.05 were considered statistically significant.

Ethical Considerations

This study was approved by the Izmir University of Economics Health Sciences Research Ethics Committee (No: 52, Date: 18.07.2022). Radiologists and technicians who voluntarily agreed to participate in the study were accepted. At the beginning of the questionnaire form, there was a short text explaining the purpose of the study. There was no request for contact details or private information. Ethical permission was not obtained from any institution because the research was not interventional, as the data was collected using social media tools.

RESULTS

Demographics

Two hundred and ninety responses were received from radiology professionals. Of these participants, 61% percent were females. The “age” and “experience” variables were considered both continuous and categorical. They were aged from 20 to 69 years, with an average of 35.48 ± 10.78 years. The age group 36 to 46 years, was the largest, with 28.3% of the participants while 25.9% of the sample had less than four years of experience. 21.7% of the participants were radiologists and 78.3% were technicians. The largest workplace group, with 54.1% of the participants was the group from University Hospital/Training and research Hospital. The percentages using various medical devices is as follows: 57.6% used X ray, 59.3% used CT, and 41.4% used MRI (Table 1).

Then "CAS" and "Fear" scales were statistically analyzed. Reliability analysis of “CAS” and “Fear” scales was performed for the questions in the questionnaire. Cronbach's alpha coefficients of these scales were high 0.911 and 0.900, respectively, showing the reliability of the questionnaire. In addition, according to the Tukey test, which was used to determine whether the questions in the scale were on an additive scale, the p values were found as 0.007, 0.017, respectively (p values<0.05, H1: It is appropriate to collect the total score of the scale). This showed the additivity of the scales. It enabled us to express these scales as scores.

Descriptive statistics (mean and standard deviation) of "CAS" and "Fear" scores were found after obtaining the additivity properties. It was found by Anderson Darling test that "CAS" and "Fear" scores were not normally distributed (p values <0.05, H1: It is not normal distribution). Therefore, “CAS” and “Fear” scores can be used categorically.

General Information (GI) About COVID-19

The frequency and percentage values for understanding COVID-19 transmission, infection control and availability of PPE were found. 77.2% of participants stated that radiology professionals are part of the healthcare team at the forefront of the fight against COVID-19 (GI1). In addition, 84.1% (46.2+37.9) stated that they had a very good understanding of the transmission routes of the COVID-19 virus (GI3) (Table 2).

Table 3. Stress profile associated with COVID-19

	Response, n (%)				
Question	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
S1	42(14.5)	88(30.3)	82(28.3)	50(17.2)	28(9.7)
S2	148(51.0)	96(33.1)	22(7.6)	16(5.5)	8(2.8)
S3	17(5.9)	27(9.3)	81(27.9)	68(23.4)	97(33.4)
S1: I feel I may be in need of professional help to deal with stress during the COVID-19 outbreak.					
S2: My family/partner/ friends are being significantly affected by this recent work-related stress.					
S3: There are adequate social and psychological support structures at work for dealing with stress.					

Table 4. Coronavirus anxiety scale (CAS)

CAS Score Descriptive Statistics, Frequencies and Percentages					
	Mean	**S.D.**		**<9: n(%)**	**≥9: n(%)**
CAS Score	**4.01**	**4.59**		**245(84.5)**	**45 (15.5)**
	Response, n (%)				
Question	**Never**	**Rare**	**Several days**	**Most of the time**	**Everyday**
CAS1	164(56.6)	63(21.7)	46(14.8)	16(5.5)	4(1.4)
CAS2	120(41.4)	87(30.0)	47(16.2)	23(7.9)	13(4.5)
CAS3	186(64.1)	53(18.3)	33(11.4)	12(4.1)	6(2.1)
CAS4	159(54.8)	60(20.7)	39(13.5)	21(7.2)	11(3.8)
CAS5	164(56.5)	64(22.1)	35(12.1)	18(6.2)	9(3.1)
CAS1: I felt dizzy, lightheaded, or faint when I read or listened to news about the coronavirus.					
CAS2: I had trouble falling and staying asleep because I was thinking about coronavirus.					
CAS3: I felt paralysed/frozen when I thought about or was exposed to information about the coronavirus.					
CAS4: I lost interest in eating when I thought about or was exposed to information about the coronavirus.					
CAS5: I felt nauseous or had stomach problems when I thought about or was exposed to information about the coronavirus.					

Stress About COVID-19

The most significant percentage is that families believe that they are affected by work-related stress in this process (S2, 51.0%). 56.8% of the participants stated that they lacked a social and psychological support unit to support them in coping with workplace stress (S3, 56.8=23.4+33.4) (Table 3). In addition, the participants were asked whether they experienced stress at work and what was the source of this stress. 88.3% of the participants stated that they experienced workplace stress due to the COVID-19 outbreak. It was determined that the biggest source of stress in the workplaces since the COVID-19 outbreak was fear of infection with 63.8%, increase in workload with 17.6% and inadequate personal protective equipment with 11% (Figure 1).

To measure how stressed participants felt while working during the COVID-19 outbreak, a Likert scale was used (from 1 to 10 points), entitled "stress rating", with low (1-3 points), medium (4-7 points) and high (8-0 points) categories (Figure 2).

According to the chi-square test conducted to determine whether there was a relationship between "stress rating" and "title", no relationship was found with 95% confidence interval ($p = 0.918 > 0.05$).

CAS (Anxiety) Score

The mean and standard deviation value of the “CAS” score was obtained as 4.01 ± 4.59 out of 20 points. The “CAS” score was used categorically as it did not come from a normal distribution. Considering the studies in the literature, the cut-off point for the score of the "CAS" was taken as 9. The analysis of the “CAS” revealed that only 15.5% (n=45) of respondents were anxious, and 84.5% (n=245) were not anxious. Considering the questions in the scale in general, it was determined that the percentage weights were mainly in the "never" category. This showed that most participants were not affected by COVID-19 anxiety states (Table 4). The percentages of technicians and radiologists reporting anxiety were 75.6% and 24.4%, respectively.

Fear Score

The mean and standard deviation value of the “Fear” score was obtained as 21.11 ± 7.43 out of 35 points.

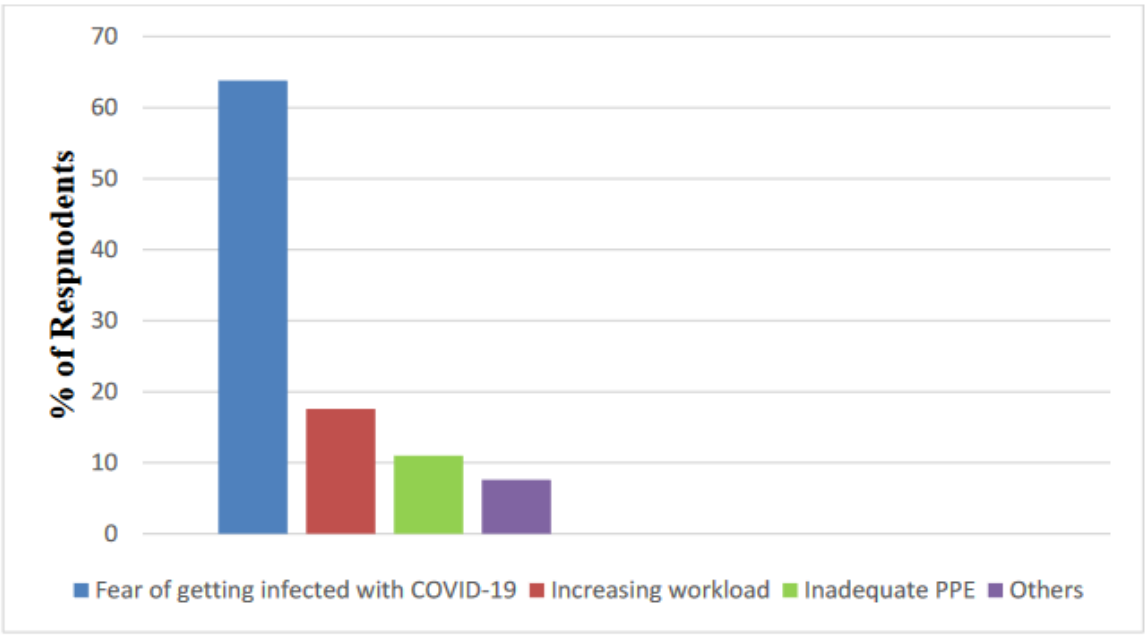

Figure 1. Distribution of the major workplace stressors

The “Fear” score was used categorically as it was not from a normal distribution. In line with studies in the literature, 19 was determined as the cut-off point for the "Fear" score. The analysis revealed that only 64.5% (n=187) of participants had fear, and 35.5% (n=103) did not. The responses to items about being afraid of COVID-19, thinking about COVID-19, losing life due to COVID-19, and watching news and stories about COVID-19 were mainly in the "agree" and "strongly agree" categories, i.e., most participants had fear of COVID-19 (Table 5). The percentages of Fear were 76.5% (n=143) and 23.5% (n=44) for technicians and radiologists, respectively.

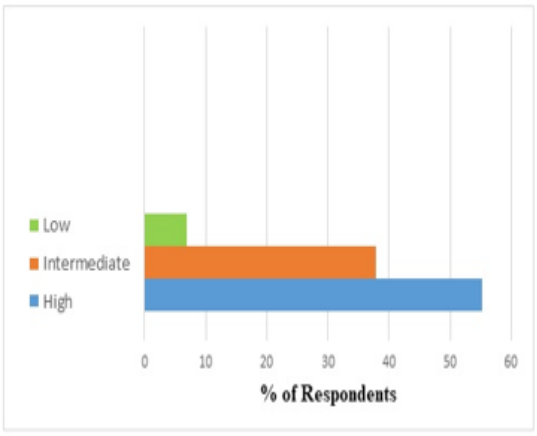

Figure 2. Perceived stress level among the radiology professionals during the COVID-19 outbreak

Statistical Tests for CAS and Fear Scores

The chi-square p-values showed the relationship between these scale scores and other variables. The chi-square test only found significant association between "CAS" score and the gender variable (p=0.030<0.05). There was no significant relationship between the "Fear" score and other variables (p-values>0.05). A relationship was found only with gender (p-value=0.003) and age (p-value=0.080) variables.

In order to reveal any difference between the medians of the "CAS" and "Fear" total scores of the variables, MWU test of two non-parametric independent samples, and KW test of more than k non-parametric independent samples were performed (H1: Medians are different). According to the MWU test, a significant difference was found for "CAS" and "Fear" scores, with 95% confidence level, according to gender (p-value for gender of CAS = 0.001, p-value for gender of Fear = 0.001). According to KW test, a statistical difference was found for "Fear" score according to age and experience (p-value for age= 0.034 and p-value for experience=0.023).

Logistic regression was used to model the relationship between "CAS" and "Fear" scores and variables. According to the backward logistic regression model, only the gender variable was found to be statistically significant for "CAS" and "Fear" scores. According to the logistic regression model established for the “CAS” score, women are 2.205

Table 5. Fear of COVID-19

Fear Score Descriptive Statistics, Frequencies and Percentages					
	Mean	**SD**		**<19: n(%)**	**≥19: n(%)**
Fear Score	**21.11**	**7.43**		**103(35.5)**	**187(64.5)**
	Response, n (%)				
Question	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
F1	60(20.7)	84(29.0)	64(22.1)	46(15.9)	36(12.4)
F2	91(31.4)	100(34.5)	35(12.1)	33(11.4)	31(10.7)
F3	23(7.9)	31(10.7)	42(14.5)	94(32.4)	100(34.5)
F4	75(25.9)	78(26.9)	42(14.5)	39(13.4)	56(19.3)
F5	83(28.6)	99(34.1)	48(16.6)	21(7.2)	39(13.4)
F6	29(10.0)	52(17.9)	48(16.6)	71(24.5)	90(31.0)
F7	33(11.4)	51(17.6)	47(16.2)	74(25.5)	85(29.3)
F1: I am most afraid of coronavirus-19.					
F2: It makes me uncomfortable to think about coronavirus-19.					
F3: My hands become clammy when I think about coronavirus-19.					
F4: I am afraid of losing my life because of coronavirus-19.					
F5: When watching news and stories about coronavirus-19 on social media, I become nervous or anxious					
F6: I cannot sleep for worry about getting coronavirus-19.					
F7: My heart races or palpitates when I think about catching coronavirus-19.					

times more likely to be anxious than men (p=0.033). According to the logistic regression model established for the “Fear” score, women are 2.106 times more likely to experience fear than men (p=0.003). As a result, women experience more anxiety and more fear in relation to COVID-19 than men. In addition, since the confidence interval of the OR value does not contain value of 1, the coefficient interpretation was made statistically (Table 6).

Table 6. Logistic regression results for "CAS" and "Fear" scores and variables

		β	p-value	OR	CI for OR
CAS	Gender	0.791	0.033	2.205	1.067-4.556
	Constant	-2.227	0.000	0.108	
Fear	Gender	0.745	0.003	2.106	1.287-3.447
	Constant	0.160	0.398	1.173	

DISCUSSION

We conducted an online survey involving 290 radiology professionals to investigate their levels of awareness, anxiety and fear regarding COVID-19. To the best of our knowledge, this is the first study that comprehensively investigates the effect of COVID-19 on radiology professionals and wellbeing of theirs in İzmir, Turkey.

This study gives an idea about the views of radiology technicians and radiologists regarding the impact of the COVID-19 pandemic on clinical radiology practices in Izmir. X-ray and CT continue to be a basic diagnostic tool for COVID-19 in Turkey. Therefore, it is likely that almost all COVID-19 patients have had at least one chest X-ray (27). Coronavirus-specific recommendations have been consistently issued by health authorities and professional organizations for the management of radiology departments and safe clinical imaging, during the COVID-19 pandemic (28). With the awareness that radiology professionals are key frontline personnel in the pre-clinical evaluation of COVID-19, it is important that they strictly adhere to transmission prevention principles. Our findings indicate that most respondents (94.1%) considered themselves a part of the major frontline healthcare team in the management of COVID-19 patients.

Radiology technicians, in particular, are often close to the patient during imaging and therefore need extensive knowledge of infection control (29, 30). The results of our study also showed that 84.1% of the participants stated that they clearly understood the transmission routes of the COVID-19 virus, and 51.7% confirmed an adequate level of infection prevention and control knowledge. This finding is broadly consistent with studies reporting similarly high understandings of infection control, prevention and compliance among radiology professionals (31, 32). This high level of understanding by radiologists and technicians in the current study may be attributed to the active dissemination of COVID-19 information by public health agencies via media outlets.

Stress and anxiety are linked to fear (33). The current study also showed that 49% of the participants were most afraid of coronavirus-19; 65.9% are uncomfortable when thinking about it, 52.8% were afraid of losing their lives, and 62.7% reported feeling nervous or anxious while watching the related news. The main workplace-related stressors identified in the study included fear of COVID-19 infection (63.8%) and perceived inadequacy of PPEs (17.6%). A significant proportion of participants (44.8%) felt they needed professional help in dealing with stress during the outbreak. However, 56.8% reported lacking adequate social and psychological support structures to deal with stress in the workplace during their employment. A high rate of fear was also reported in a study conducted in China; 85% of healthcare workers feared infection at work (34). Xiang et al. advocated that the general well-being and mental health of all frontline healthcare personnel should be regularly assessed, especially during the pandemic. Furthermore, 84.1% of respondents agreed that their work-related stress significantly affected their family/partner/ friends. This is consistent to the findings of another study that reported changes to the pandemic on diagnostic radiology professionals' family relations, and negative impact of their well-being (35). Thus, in order to mitigate the burden of workplace-related stress on radiology professionals, institutional support structures are necessary.

The result of the current study found that there was no evidence of significant association between anxiety level and experience, title and workplace, or between the fear of COVID-19 and experience, title and workplace. Nevertheless, in the current study, CAS and Fear Score were associated with gender. According to the logistic regression model established for “CAS” score, women are 2.205 times more likely to be anxious than men, and according to the model established for “Fear” score, women are 2.106 times more likely to be anxious. Related to this, a previous study found that COVID-19 can be an independent risk factor for stress among health care professionals (36).

We acknowledge a number of strengths and limitations associated with this study. Our response rate (the required minimum sample size of valid responses was achieved) is considered satisfactory. Limitations associated with the current study include use of a non-standardised stress rating (simple Likert) scale, and lack of a baseline assessment. Future studies would benefit from the use of standardised stress assessment tools to facilitate comparison across studies. Furthermore, the study was limited by our study scope, which did not include capturing the underlying reasons for participants’ responses, or their expectations and recommendations for service improvement during future pandemics.

CONCLUSION

In conclusion, this study has highlighted the important patient-facing role of the radiology professionals during the COVID-19 pandemic, and revealed their conditions in terms of fear, stress and anxiety. Despite reporting adequate PPE, radiology workers were nevertheless concerned about becoming infected with COVID-19. Therefore, radiology departments should try to reduce the impact on the workforce by not only providing adequate PPE, but also establishing clear directives, infection prevention and control protocols and adequate training in handling infected patients in future pandemics.

The findings from our study could help alleviate or prevent anxiety and fear in frontline healthcare professionals in possible future pandemics. This would also strengthen the infection control measures taken healthcare workers in the face of a future pandemic and could contribute to an improved overall strategy of preparedness.

Acknowledgement: Authors thank to all the radiologists and technicians who participated in the study and worked devotedly during the COVID-19 pandemic in Izmir, Turkey. The authors also thank Simon MUMFORD for proofreading the article.

Author contribution: TA: Concept, design supervision, materials, data collection and/or processing, analysis, literature review, writing, critical review. OVC: Design, data collection and/or processing, analysis, literature review, writing, critical review.

Conflict of interests: The authors have no conflicts of interest to declare.

Ethical approval: This study was approved by the Izmir University of Economics Health Sciences Research Ethics Committee (No: 52, Date: 18.07.2022).

Funding: None.

Peer-review: Externally peer-reviewed.

REFERENCES

1. Zhu N, Zhang D, Wang W, et al. A novel coronavirus from patients with pneumonia in China, 2019. N Engl J Med. 2020; 382 (8): 727-733.
2. Jiang S, Du L, Shi Z. An emerging coronavirus causing pneumonia outbreak in Wuhan, China: calling for developing therapeutic and prophylactic strategies. Emerg Microbes Infect. 2020; 9: 275–277.

3. Wang C, Horby PW, Hayden FG, Gao GF. A novel coronavirus outbreak of global health concern. Lancet 2020; 395: 470–473.
4. Hawryluck L, Gold WL, Robinson S, Pogorski S, Galea S et al. SARS control and psychological effects of quarantine, Toronto, Canada. Emerg Infect Dis. 2004; 10 (7): 1206–1212.
5. Wu KK, Chan SK, Ma TM. Posttraumatic stress, anxiety, and depression in survivors of severe acute respiratory syndrome (SARS). J Trauma Stress 2005; 18: 39–42.
6. Wu P, Fang Y, Guan Z, et al. The psychological impact of the SARS epidemic on hospital employees in China: exposure, risk perception, and altruistic acceptance of risk. Can J Psychiatry 2009; 54: 302–311.
7. Xiang YT, Yang Y, Li W, et al. Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. Lancet Psychiatry 2020; 7: 228–229.
8. World Health Organization, WHO Director-General's opening remarks at the media briefing on COVID-19 [online, 2020]. Website https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020 (accessed 20/01/2021).
9. Wang, C. A novel coronavirus outbreak of global health concern. Lancet 2020; 395: 470-473.
10. World Health Organization, WHO Coronavirus disease 2019 (COVID-19) Situation Report [online, 2020]. Website https://www.who.int/publications/m/item/weekly-epidemiological-update---29-december-2020 (accessed 20/01/2021).
11. Hall RCW, Chapman MJ. The 1995 Kikwit Ebola outbreak: Lessons hospitals and physicians can apply to future viral epidemics. Gen Hosp Psychiatry 2008; 30: 446–452.
12. Sim K, Chan YH, Chong PN, Chua HC, Soon SW. Psychosocial and coping responses within the community health care setting towards a national outbreak of an infectious disease. J Psychosom Res. 2010; 68: 195–202.
13. Sim K, Chua HC. The psychological impact of SARS: a matter of heart and mind. CMAJ 2004; 170: 811-812.
14. Bai Y, Yao L, Wei T, et al. Presumed asymptomatic carrier transmission of COVID-19. JAMA 2020; 323 (14): 1406-1407.
15. Adams JG, Walls RM. Supporting the health care workforce during the COVID-19 global epidemic. J Am Med Assoc. 2020; 323 (15): 1439-1440.
16. Rothe C, Schunk M, Sothmann P, et al. Transmission of 2019-nCoV Infection from an Asymptomatic Contact in Germany. N Eng J Med. 2020; 382 (10): 970-971.
17. Ryu S, Chun BC. An interim review of the epidemiological characteristics of 2019 novel coronavirus. Epidemiol Health. 2020; 42.
18. Xu X, Yu C, Qu J, et al. Imaging and clinical features of patients with 2019 novel coronavirus SARS-CoV-2. Eur J Nucl Med Mol Imag, 2020; 47 (5): 1275-1280.
19. Yu J, Ding N, Chen H, et al. Infection control against COVID-19 in departments of radiology. Acad Radiol. 2020; 27 (5): 614-617.
20. Republic of Turkey Ministry of Health. Current situation in Turkey [online, 2020]. Website https://covid19.saglik.gov.tr/TR-76676/covid-19-durum-raporu-tr.html (accessed 20/01/2021).
21. Choi KR, Skrine Jeffers K, Cynthia Logsdon M. Nursing and the novel coronavirus: Risks and responsibilities in a global outbreak. J Adv Nurs. 2020; 76 (7): 1486-1487.
22. Ruths D, Pfeffer J. Social media for large studies of behavior. Soc Sci. 2014; 346 (6213): 1063-1064.
23. Social Media Research Group. Using social media for social research: An introduction [online, 2016]. Website https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/524750/GSR_Social_Media_Research_Guidance__Using_social_media_for_social_research.pdf. (accessed 20/01/2021).
24. Lee SA. Coronavirus Anxiety Scale: a brief mental health screener for COVID-19 related anxiety. Death Stud. 2020; 44 (7): 393-401.
25. Mauldin WP. The population of India. In: Population growth, (Freedman R, ed.), 1st ed. New York: Routledge. pp. 191-205; 2017.
26. Ahorsu DK, Lin C-Y, Imani V, et al. The fear of COVID-19 scale: development and initial validation. Int J Ment Health Addict, 2020; 1-9.
27. Nair A, Rodrigues JC, Hare S, et al. A British Society of Thoracic Imaging statement: considerations in designing local imaging diagnostic algorithms for the COVID-19 pandemic. Clin Radiol. 2020; 75 (5): 329-334.
28. Mendel JB. COVID-19 pandemic and radiology: facts, resources, and suggestions for near-term

protocols. J Glob Radiol. 2020; 6 (1): 1100.
29. Kotian R, Faujdar D, Kotian S, D'souza B. Knowledge and understanding among medical imaging professionals in India during the rapid rise of the COVID-19 pandemic. Health Technol, 2020; 1-6.
30. Cieszanowski A, Czekajska E, Gizycka B, et al. Management of patients with COVID-19 in radiology departments, and indications regarding imaging studies recommendations of the Polish Medical Society of Radiology. Pol J Radiol. 2020; 85: e209-e214.
31. Ishami W, Akudjedu TN, Abuzaid M, et al. Theradiology workforce's response to the COVID-19 pandemic in the Middle East, North Africa and India. Radiography 2020 [in press]. https://doi.org/10.1016/j.radi.2020.09.016. S1078-8174(20)30205-4.
32. Akudjedu TN, Lawal O, Sharma M, et al. Impact of the COVID-19 pandemic on radiography practice: findings from a UK radiography workforce survey. Brit J Radiol. 2020; 2 (1): 20200023.
33. Fink G. Stress, definitions, mechanisms, and effects outlined: lessons from anxiety. In: Stress: concepts, cognition, emotion, and behavior, (Fink G, ed.), San Diego: Elsevier, pp. 3-11; 2016.
34. Zhou M, Tang F, Wang Y, et al. Knowledge, attitude and practice regarding COVID-19 among health care workers in Henan, China. J Hosp Infect. 2020; 105 (2): 183-187.
35. Lewis S, Mulla F. Diagnostic radiographers' experience of COVID-19, Gauteng South Africa. Radiography 2020 [in press]. https://doi.org/10.1016/j.radi.2020.09.009
36. Ornell F, Schuch JB, Sordi AO, Kessler FH. “Pandemic fear” and COVID-19: mental health burden and strategies. Braz J Psychiatry 2020; 42 (3): 232-235.