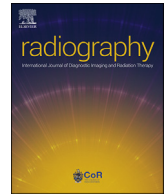




Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



Burnout among Portuguese radiographers during the COVID-19 pandemic

J.M. Pereira ^{a, b, c, *}, C. Silva ^d, D. Freitas ^{a, b}, A. Salgado ^{e, f}

^a Radiology Department, School of Health, Polytechnic Institute of Porto, Portugal

^b Department of Diagnostic Imaging, Centro Hospitalar Universitário do Porto (CHUP), Porto, Portugal

^c Department of Clinical Research, Centro Hospitalar Universitário do Porto (CHUP), Porto, Portugal

^d Department of Diagnostic Imaging, Hospital Lusíadas Porto, Porto, Portugal

^e School of Health, Polytechnic Institute of Porto, Portugal

^f Higher School of Education of Paula Frassinetti, Porto, Portugal

ARTICLE INFO

Article history:

Received 23 October 2020

Received in revised form

7 May 2021

Accepted 9 May 2021

Available online 18 May 2021

Keywords:

Burnout syndrome

COVID-19

Maslach burnout inventory-human services survey

Radiographers

ABSTRACT

Introduction: The COVID-19 pandemic has had a global impact, including in health services, placing health professionals under enormous tension, pressure, and stress. Professionals involved in the care, diagnosis, and treatment of COVID-19-infected patients have been subject to emotional and physical distress that can potentially enhance the development of occupational diseases. The aim of this study was to assess the impact of the COVID-19 pandemic on the incidence of burnout among Portuguese radiographers.

Methods: This was a cross-sectional, quantitative study. Burnout levels were estimated using the Maslach Burnout Inventory-Human Services Survey, composed of 22 questions. Specific questions were developed to characterize the socio-demographic situation and the impact of the pandemic on the radiographers. Data were descriptively analyzed and Mann–Whitney and Kruskal–Wallis tests were used for correlation analysis.

Results: The study sample comprised 386 radiographers, 68.7% of whom were female and 31.3% male. The mean sample age was 36.3 (± 9.1) years. A total of 43.5% and 45.5% of subjects had a high level of emotional exhaustion and depersonalization, respectively, and 59.8% experienced low personal accomplishment. Altogether, 23.3% of study participants were at high risk of burnout in the three dimensions assessed and 77.2% in at least one.

Conclusion: Study results showed that radiographers were at high risk of developing burnout in the COVID-19 pandemic setting. Health institutions should actively monitor these professional's mental health and develop restorative strategies that enable their emotional wellbeing, preventing absenteeism and increasing patients' quality of care.

Implications for practice: Burnout of health professionals has a strong impact on health services organization, resulting in increased absenteeism and error probability, frequent work delays, low productivity and job satisfaction, inter- and intra-professional conflicts, high job turnover, high job quit, and decreased quality of care perceived by users.

© 2021 The College of Radiographers. Published by Elsevier Ltd. All rights reserved.

* Corresponding author. Department of Radiology, School of Health of Porto/ Polytechnic Institute of Porto (ESS/IPP), Rua Dr. António Bernardino de Almeida 400, 4200-072, Porto, Portugal.

E-mail addresses: jro.pereira@gmail.com (J.M. Pereira), cristianaalexandravieirasilva@gmail.com (C. Silva), davidefreitas@gmail.com (D. Freitas), anasalgada@gmail.com (A. Salgado).

Introduction

On March 2, 2020, with confirmation of the first COVID-19 case in Portugal, the country had to quickly adjust to the pandemic contingencies.¹ Due to its high transmissibility and mortality in certain risk groups,² severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the etiological agent of COVID-19, posed new challenges to health services: a) danger of service overload, limiting their response capacity; and b) detrimental effects on health

professionals' wellbeing due to work overload and increased infection risk.³

Health professionals are in contact with COVID-19-infected patients, which adds tension and pressure at work. Some studies point out stress as an important psychological exhaustion indicator.^{3,4}

Literature review

According to the World Health Organization (WHO), 8096 individuals had SARS between November 8, 2002 and July 21, 2003,⁵ 774 of whom died, resulting in a 9.6% mortality rate.⁶ A high level of psychological stress was identified in health professionals caring for patients during that outbreak, related to feelings of vulnerability, concern for one's health and for the health of relatives and friends, fear of being part of the virus chain of transmission, fear of changes in the workplace, and feelings of isolation.⁷

The impact of the current COVID-19 pandemic is aggravated by its global reach. Health professionals face a high risk of infection, enhanced by other factors, such as lack of personal protective equipment (PPE), work overload, and frustration due to inability to reverse patients' clinical condition. Additionally, health professionals face some degree of stigma from the general population, which regards them as a potential COVID-19 infection source.^{4,8}

A recent study by the National School of Public Health, with the participation of approximately 5300 health professionals, including around 1000 Health and Care Professionals (HCP), revealed high levels of anxiety as well as depression and emotional exhaustion scores.⁹

The psychological impact on health professionals when dealing with COVID-19 patients may lead to pathological conditions,⁸ including burnout.^{3,9} Radiographers are one of the professional groups actively participating in these patients' management.⁹

Burnout is a syndrome characterized by high emotional exhaustion (EE), depersonalization (DP), and low personal accomplishment (PA) resulting from professional activity.¹⁰ It generally starts with emotional overload caused by everyday events occurring in the workplace, which induce feelings of wear off and energy loss. To cope with the emotional distress, health professionals tend to adopt a set of attitudes that promote emotional distance from patients, treating them with indifference and depersonalization.^{10,11} This emotional turmoil is perceived by the individual as failure in professional competence, leading to reduced PA.^{10,11}

The aim of this study was to evaluate the impact of the COVID-19 pandemic on the incidence of burnout among Portuguese radiographers.

Methods

This was a cross-sectional, quantitative study of the incidence of burnout among radiographers during the COVID-19 pandemic. Data was collected through an online questionnaire that was disseminated to radiographers working in Portugal through professional associations and social and digital platforms between April 16 and 26, starting 45 days after confirmation of the first COVID-19 case in Portugal.

The questionnaire was drawn up using Google Forms and the data collected was anonymized. The cover page included information about the study and ethical procedures, including informed consent, assurance of participants' anonymity, and voluntary nature of participation. The questionnaire was structured in three parts. The first part retrieved sociodemographic data. The second part retrieved data on the impact of the pandemic on radiographers: (1) changes in the workplace, (2) adaptation difficulties, (3) conditions and strategies developed by institutions to facilitate

adaptation, and (4) impact on subjects' personal life. The third part of the questionnaire consisted of the Portuguese version of the Maslach Burnout Inventory-Human Services Survey (MBI-HSS),¹² consisting of 22 items divided into three-dimensional subscales. Participants were instructed to rate items using a 7-point Likert scale (with zero meaning "never" and six meaning "every day").¹¹ Each dimension was classified as high, moderate, or low, according to the final score and cut-off-values¹³ presented in Table 1.

Data were analyzed using SPSS-26 (IBM, USA). Quantitative variables were described using measures of central tendency and dispersion and qualitative variables through their absolute and relative frequencies. An association analysis was performed between scores obtained in each dimension and the remaining variables, through the application of the non-parametric Mann–Whitney and Kruskal–Wallis tests, whenever appropriate, and using an $\alpha = 0.05$ significance level.

Results

A total of 386 participants answered the questionnaire, 265 (68.7%) of whom were female and 121 (31.3%) male. The mean sample age was 36.3 (± 9.1) years. Subjects' sociodemographic characteristics are depicted in Table 2.

Participants were asked to rate how well they adapted to changes imposed by the pandemic on a 10-point Likert-type scale, in which 1 was 'very easy' and 10 'very difficult' to adapt. Difficulty levels were rated an average of 6.45 and a median of 7. The institution played an important role in the implementation of new working conditions, both regarding communication and complementary training. Participants were asked to rate some aspects related to this using a 10-point scale, in which 1 corresponded to 'weak' and 10 to 'excellent' (Table 3).

The increased viral contagion introduced an additional concern to health professionals, both due to the risk of acquiring the disease and to the possibility of being a vehicle of virus spread. Using the same 10-point scale, in which 1 meant 'no fear' and 10 'extreme fear', participants were asked about their fear of becoming infected [$x = 7.4 (\pm 2.0)$] and transmitting the disease [$x = 8.9 (\pm 1.7)$], with 50.8% acknowledging an extreme fear of the latter. Additionally, 149 (38.6%) professionals claimed to have at least one infected coworker.

More than half of participants acknowledged always practicing the recommended social distancing, with 10.4% being displaced from their residence. Access to mental health support services was residual (2.1%) among study participants. On average, subjects dedicated 45.3 (± 40.9) minutes per day looking for information related to COVID-19.

Professional practice during the pandemic had no impact on the self-esteem of 50.5% ($n = 195$) of individuals and negatively affected the self-esteem of 39.9% ($n = 154$). Only 9.6% ($n = 37$) of participants had their self-esteem positively affected. For the

Table 1
Cut-off values and categories of burnout subscales.¹³

Burnout dimension	Category	Cut-off score
Emotional Exhaustion Score (0–54)	High	≥ 27
	Moderate	19–26
	Low	0–18
Depersonalization Score (0–30)	High	≥ 10
	Moderate	6–9
	Low	0–5
Personal accomplishment Score (0–48)	High	≥ 40
	Moderate	34–39
	Low	0–33

Table 2
Sample characterization.

Gender	Age (years)	Marital status	Children	Profession time (years)	Team size (Radiographers)	Literary abilities	Weekly working hours	Labor status	Works with infected COVID-19 patients
Female 265 (68.7%)	\bar{x} 36.3 \pm 9.1 (22–59)	Single n = 148 (38.3%)	Without n = 212 (54.9%)	\leq 5 n = 97 (25.1%) >5 \leq 10 n = 65 (16.8%)	\leq 10 n = 92 (23.8%) >10 \leq 20 n = 95 (24.6%)	Bachelor n = 14 (3.6%)	Before COVID-19 \bar{x} 40 h \pm 9.1	In site n = 341 (88.3%)	No n = 61 (15.8%)
Male 121 (31.3%)	\leq 30 n = 120 (31.1%) >30 \leq 40 n = 153 (39.6%) >40 \leq 50 n = 78 (20.2%) >50 n = 35 (9.1%)	Married n = 215 (55.7%) Divorced n = 22 (5.7%) Widower n = 1 (0.3%)	With n = 174 (45.1%)	>10 \leq 20 n = 128 (33.2%) >20 \leq 30 n = 68 (17.6%) >30 n = 28 (7.3%)	>20 \leq 40 n = 98 (25.4%) >40 n = 101 (26.2%)	Graduation n = 322 (83.4%) Master's degree n = 49 (12.7%) Doctorate n = 1 (0.3%)	After COVID-19 \bar{x} 36.1 h \pm 13.5	Telework n = 4 (1.0%) Job loss n = 2 (0.5%) Furlough = 28 (7.3%) COVID-19 Infected n = 2 (0.5%) Family assistance n = 9 (2.4%)	Yes n = 325 (84.2%)

majority, the pandemic had a detrimental impact on family (81.1%) and social (87.3%) life. Following the recommended protective measures, such as using a mask and complete PPE, affected the professional–patient relationship in 80.8% (n = 312) of cases. A total of 87.6% (n = 338) of subjects felt they had an active role in the diagnosis/follow-up of COVID-19 patients, and 68.9% (n = 266) felt that their contribution was not more valued than before the pandemic.

Burnout levels were determined for each MBI-HSS subscale. In EE subscale, an average global score of 24.3 (\pm 10.4) was obtained, with 43.5% (n = 168) of subjects displaying a high level of EE. In DP subscale, an average global score of 8.9 (\pm 5.1) was obtained, with 45.5% (n = 175) of subjects presenting a high level of DP. In PA subscale, an average global score of 31.5 (\pm 6.7) was obtained, with 59.8% (n = 231) of subjects showing a low level of PA (Table 4). Noteworthy, 23.3% (n = 90) of study participants showed a maximum risk of burnout in all three evaluated dimensions.

Of the 386 study participants, 25.1% (n = 97) displayed a high risk of burnout in two of the three dimensions and 28.8% (n = 111) in only one dimension. Thus, 77.2% (n = 298) of individuals scored in at least one of the high-risk-of-burnout categories.

A significant difference was observed between genders regarding EE (P = 0.035) and PA (P = 0.014), with females having higher EE and lower PA scores. Participants under the age of 30 had lower EE scores (P = 0.047) and individuals over the age of 50 had lower DP scores (P = 0.003). Being divorced (P = 0.037), having children (P = 0.016), and having 20–30 years of professional activity (P = 0.012) were conditions favoring higher EE scores. Subjects with more than 30 years of professional experience had higher PA scores (P = 0.008).

EE (P = 0.029) and DP (P < 0.001) scores were significantly higher and PA levels were significantly lower in subjects directly working with infected patients compared to those who did not.

Individuals experiencing more difficulties in dealing with work changes were found to have higher EE (P < 0.001) and DP (P = 0.001) scores.

Significantly lower EE and DP levels were observed in subjects working in institutions promoting training excellence (P = 0.039 and P = 0.0039, respectively) and communication (P < 0.001 and P = 0.001, respectively) during this period. Lower EE and higher PA scores were observed among individuals who considered that their health institution had technical (P = 0.003 and P = 0.013, respectively) and human (P = 0.001 and P = 0.002, respectively) resources to meet the existing needs. Lower risk of burnout was reported in the three dimensions in cases that the institution favored employee's safety, ensuring good radiological protection conditions (P = 0.040, P = 0.031, and P = 0.005 for EE, DP, and PA dimensions, respectively) and providing PPE in quantity (P < 0.001, P = 0.001, and P = 0.011 for EE, DP, and PA) and quality (P < 0.001, P = 0.003, and P = 0.003 for EE, DP, and PA).

Individuals with greater fear of becoming infected had higher EE (P < 0.001) and DP (P = 0.002) scores. Individuals with greater fear of transmitting the disease to family members or colleagues also exhibited higher EE scores (P < 0.001).

Significantly higher EE/DP and lower PA scores were observed among individuals who considered that work negatively affected their self-esteem (P < 0.001, P < 0.001, and P = 0.004 for EE, DP, and PA), family life (P < 0.001, P < 0.001, and P = 0.038 for EE, DP, and PA), or social life (P = 0.002 and P = 0.014 for EE and DP; PA not statistically significant).

The perception that using the recommended protective measures impaired the relationship between radiographer and patient aggravated EE (P = 0.039) and DP (P = 0.014) scores. Participants who considered having an active role in the management of COVID-19 patients had higher DP scores (P = 0.031), while participants

Table 3 Characterization of adaptation to changes, institution conditions, and fear of becoming infected by radiographers.

Difficulty with work changes	Quality of training provided by the institution to deal with changes	Quality of institution's communication regarding information about changes	Number of technical equipment in the department to meet COVID-19 requirements	Number of radiographers in the department to meet COVID-19 requirements	Quality of radioprotection conditions to meet COVID-19 requirements	Number of PPE in the institution in relation to needs	Quality of PPE in the institution in relation to needs	Fear of getting infected	Fear of transmitting the infection to family members and colleagues
\bar{x} 6.45	\bar{x} 4.83	\bar{x} 5.63	\bar{x} 5.65	\bar{x} 6.45	\bar{x} 6.15	\bar{x} 5.55	\bar{x} 5.7	\bar{x} 7.39	\bar{x} 8.89
\pm 2.0	\pm 2.5	\pm 2.5	\pm 2.4	\pm 2.4	\pm 2.4	\pm 2.3	\pm 2.2	\pm 2.0	\pm 1.7
P ₂₅ = 5	P ₂₅ = 3	P ₂₅ = 4	P ₂₅ = 4	P ₂₅ = 5	P ₂₅ = 4	P ₂₅ = 4	P ₂₅ = 4	P ₂₅ = 6	P ₂₅ = 8
P ₅₀ = 7	P ₅₀ = 5	P ₅₀ = 6	P ₅₀ = 6	P ₅₀ = 7	P ₅₀ = 6	P ₅₀ = 5	P ₅₀ = 6	P ₅₀ = 8	P ₅₀ = 10
P ₇₅ = 8	P ₇₅ = 7	P ₇₅ = 8	P ₇₅ = 8	P ₇₅ = 8	P ₇₅ = 8	P ₇₅ = 7	P ₇₅ = 7	P ₇₅ = 9	P ₇₅ = 10

PPE, personal protective.

who considered that their role is currently more valued decreased EE (P = 0.041) and increased PA (P = 0.002) scores.

Discussion

According to the Health Ministry,¹⁴ in 2018 the Portuguese National Health System comprised 1537 radiographers, accounting for 19% of the total HCP group. Of these, 79% were female and 65% had higher educational qualification (first degree).¹⁴ No data was available regarding radiographers working in the private sector. A total of 386 radiographers participated in the present study, including professionals from the public and private sectors, 69% of whom were female and approximately 84% had first-degree qualification.

Although almost 85% of subjects directly worked with COVID-19-infected patients, only two reported having been infected with COVID-19. On June 19, the Portuguese national press reported that a total of 3681 health professionals were infected with COVID-19.¹⁵ Of these, 113 belonged to the HCP group, representing around 3% of health professionals infected. The fact that only two radiographers participating in this study were infected suggests that these professionals use the appropriate protective equipment and adopt the recommended standards for controlling the pandemic while being exposed to the virus, resulting in a low rate of contagion within this group.

Adopting rules to contain virus spread seems to be a factor enhancing health professionals' EE. The relationship between patients and health professionals is built on personal and emotional contact.¹⁶ Rules of social exclusion, use of full PPE, and need to minimize contacts to those strictly necessary were perceived by more than 80% of participants as obstacles for establishing a positive relationship with patients and associated with increased EE and DP experienced by radiographers. DP consists of a set of attitudes developed by health professionals to acquire physical and emotional distance from patients.^{10–12,16}

Study results showed that 23.3% of radiographers are at high risk of burnout in all dimensions considered and 78.8% in at least one. In a previous study conducted by our group in 2019 which included 122 radiographers,¹⁷ approximately 14% were at high risk of burnout in all dimensions and 68% in at least one. The present study discloses a higher risk of burnout among these professionals, possibly due to the particular pandemic situation.

Previous studies have shown that HCP represent a high-risk group, with traditionally high burnout scores due to high stress levels associated with their professional activity.^{16–20} In Portugal, only a few studies have addressed burnout among radiographers. The study by Videira and Ventura,¹⁸ involving radiographers working in a tertiary hospital, found that around 55% of the 38 study participants reported increased work-related stress throughout their professional life. The study by Melo¹⁹ showed that approximately 51% of 72 radiographers perceived their work-related stress levels as high. It also showed that 66.2% and 58% had moderate-to-high EE and DP scores, respectively. In the PA dimension, 33.8% of subjects displayed values classified as low.¹⁹ The study by Silva and Pereira¹⁷ found that 39.3% and 29.5% of individuals had high EE and DP, respectively. Low PA was also experienced by 48.4% of participants.¹⁷

Most subjects in the present study experienced difficulty in adapting to changes and this had a positive association with increased EE and DP. Difficulties in adapting to change lead to feelings of lack of control, with studies showing a clear link between lack of control and burnout.^{7,16}

The data collected showed that the risk of burnout decreases when the institution provides quality training to professionals and implements effective communication channels between medical

Table 4
Characterization of burnout dimensions.

Emotional Exhaustion (EE)	Depersonalization (DP)	Personal accomplishment (PA)	Burnout risk
\bar{x} 24.3 \pm 10.4 Low level n = 118 (30.6%)	\bar{x} 8.9 \pm 5.1 Low level n = 115 (29.8%)	\bar{x} 31.5 \pm 6.7 Low level n = 231 (59.8%)	Individuals with high EE and DP and low PA n = 90 (23.3%)
Moderate level n = 100 (25.9%)	Moderate level n = 96 (24.9%)	Moderate level n = 114 (29.5%)	Individuals with two elevated dimensions n = 97 (25.1%)
High level n = 168 (43.5%)	High level n = 175 (45.3%)	High level n = 41 (10.6%)	Individuals with one elevated dimension n = 111 (28.8%)
			Individuals with no elevated dimension n = 88 (22.8%)

team members. Vulnerability and lack of control often result from a lack of information. Preparing teams and promoting support between colleagues and managers and accurate communication of procedures to face challenges are proven measures to reduce mental health problems.²⁰ Team leaders play a crucial role in this matter, by providing encouragement, identifying difficulties, fostering dialogue and good practices regarding the situation, and supporting team members.^{3,20}

Trusting that their institution has enough equipment and human resources to fight the pandemic contributes to EE reduction by health professionals. Scarcity of equipment leads to less efficient work organization. Shortage of professionals implies an increased workload for the whole team, which in the literature is directly related to increased psychological stress and burnout.^{3,10,16,20}

Directly working with COVID-19 patients was shown to be associated with an increased risk of burnout in the three dimensions considered. This is a new disease, with epidemic potential and fast transmission, for which health authorities were not fully prepared.²¹ Only disease symptoms are currently treatable.^{4,8,22} In a study involving Canadian doctors during the SARS outbreak, Grace and colleagues showed that individuals involved in the direct care of infected patients reported greater psychological distress compared to those not directly involved.²³ The same study indicated feelings of stigma due to professionals' occupational exposure to the virus.²³ In a study involving Chinese health professionals during the COVID-19 pandemic, Lai and collaborators⁸ reported high levels of depression, anxiety, insomnia, and psychological stress among health professionals directly involved in these patients' care.⁸

Health professionals fear not only for their health but also for potentially being a vehicle of virus transmission to family and friends.^{3,5,21,24} In the present study, fear of becoming infected and transmitting the virus to family members was a factor positively associated with EE.

In China, many health professionals became infected at the beginning of the pandemic because there was not enough information about the transmission process and hence appropriate PPE was not used.^{4,25} Study participants who believed that their institution provided good-quality and sufficient PPE displayed lower EE and DP and higher PA scores.

The need to keep COVID-19 patients isolated requires conducting radiological examinations in places not originally prepared for that. This is yet another source of concern for radiographers, as shown in this study by a lower risk of burnout in all dimensions among individuals who believed having good radioprotection conditions in their institution.

Hospitalized patients require periodic imaging assessment to monitor disease progression, with radiographers having a key role in this setting. This is reflected in this study's results, as almost 88% of subjects considered having an active role in the management of COVID-19 patients. However, only 31% felt that their role within the community was currently more valued.

Professional activities with significant occupational exposure have an impact on individuals' professional and personal life. In many cases, professionals feel stigmatized²³ and discriminated against by others.^{4,23,24} They often have to spend long periods away from family and friends due to voluntary confinement.^{3,4,24} This study shows that professional practice during the COVID-19 pandemic negatively affected family and social life for more than 80% of subjects, with associated EE and DP increase. Social support is a preventive factor of burnout, with interaction with family and friends playing a restorative role and contributing to emotional balance.²⁶ During the pandemic, radiographers were deprived of this type of support, strongly associated with mental health.²⁴

Burnout problems evidenced by professionals have a strong impact on health services organization. Evidence shows that they result in increased absenteeism, frequent delays, low productivity and job satisfaction, inter- and intra-professional conflicts, and decreased quality of care perceived by users, among others.^{27,28}

In the present study, only 2.1% of radiographers resorted to psychological support. However, experts recommend regular follow-up and monitoring of those who are in direct contact with infected patients, monitoring anxiety, depression, and even suicidal tendencies.^{4,21}

Adoption of a set of strategies has the potential to decrease the level of EE related to SARS-CoV-2 exposure and prevent harmful effects that extend over time. One of the main stressors identified in this study was the fear of becoming infected. On May 14, 2020, the press reported that at least 100,000 health professionals were infected with SARS-CoV-2 worldwide, 10% of which in Europe.²⁹ This fear can be mitigated by identifying the main reasons why health professionals get the disease and adopting measures to minimize them. Wang and colleagues²⁵ identified the scarcity and inappropriate use of PPE, high exposure time to the virus, high work intensity, and insufficient infection prevention and control training as the main contagion causes among health professionals.

Recommendations

Infection prevention and control committees can play a key role, by providing clear, accurate, and timely information on how health professionals should proceed to be able to return to their families and on social strategies they can adopt at home to minimize contagion risk.³

Having periodic meetings with team leaders to discuss the problems that most concern radiographers and develop joint solutions to tackle them represents an important inter-peer support strategy.²⁰

Defining multidisciplinary teams which include mental health professionals responsible for accompanying professionals and developing restorative strategies is key for prevention of mental health issues.^{21,24,30}

Limitations

The main limitation of this study is its sample size. Even so, its results can serve as an indicator of the current national situation and should be analyzed jointly with data retrieved from other health professionals.

Conclusions

This study's results point to a high risk of burnout among radiographers, with almost 80% presenting a high score in at least one of the dimensions assessed.

Results from this study highlight that the conditions provided by health institutions are decisive in defining risk. Thus, a lower risk of burnout among radiographers is associated with a higher investment in providing training on all aspects related to the pandemic, developing channels and forms of effective communication, having appropriate human resources and sufficient PPE quantity and quality, and privileging radiological protection even in adverse situations.

It is crucial that accountable entities monitor aspects related to professionals' mental health of radiographers and develop emotional restorative strategies so that the risk of burnout does not turn into long-term pathological processes.

Funding

This research received no specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of interest

None.

Acknowledgements

The authors thank the National Associations that represent the Portuguese Radiographers and participated in the dissemination of the questionnaire for this study, NUCLIRAD, ATARP and APIMR.

References

1. Geral de Saúde Direção. SARS-CoV-2/COVID-19:Relatório da Situação n.º1. Sítio da Direção Geral da Saúde: Direção Geral da Saúde; 2020.
2. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet* 2020; **395**(10229):1054–62.
3. Adams JG, Walls RM. Supporting the health care workforce during the COVID-19 Global epidemic. *J Am Med Assoc* 2020; **323**(15):1439–40.
4. Kang L, Li Y, Hu S, Chen M, Yang C, Yang BX, et al. The mental health of medical workers in Wuhan, China dealing with the 2019 novel coronavirus. *Lancet Psychiatr* 2020; **7**(3):e14.
5. Lee AM, Wong JG, McAlonan GM, Cheung V, Cheung C, Sham PC, et al. Stress and psychological distress among SARS survivors 1 year after the outbreak. *Can J Psychiatr* 2007; **52**(4):233–40.
6. World Health Organization. *Summary of probable SARS cases with onset of illness from 1 November 2002 to 31 July 2003*. WHO: World Health Organization; 2015.
7. Wong T, Yau J, Chan C, Kwong R, Ho SMY, Lau CC, et al. The psychological impact of severe acute respiratory syndrome outbreak on healthcare workers in emergency departments and how they cope. *Eur J Emerg Med : Off J Eur Soc Emerg Med* 2005; **12**(1):13–8.
8. Lai J, Ma S, Wang Y, Cai Z, Hu J, Wei N, et al. Factors associated with mental health outcomes among health care workers exposed to Coronavirus disease 2019. *JAMA Netw Open* 2020; **3**(3):e203976.
9. Serranheira F. Proteger os profissionais de saúde é garantir a saúde pública. *Roentgen* 2020; **1**(1):9–10.
10. Maslach C, Jackson S. The measurement of experienced burnout. *J Organ Behav* 1981; **2**(2):99–113.
11. Maslach C, Goldberg J. Prevention of burnout: new perspectives. *Appl Prev Psychol* 1998; **7**(1):63–74.
12. Benevides-Pereira A. *Burnout: quando o trabalho ameaça o bem-estar do trabalhador*. 1ª ed. S. Paulo: Casa do Psicólogo; 2002.
13. Thorsen V, Tharp A, Meguid T. High rates of burnout among maternal health staff at a referral hospital in Malawi: a cross-sectional study 2011; **10**(1):9.
14. da Saúde Ministério. *Relatório Social do Ministério da Saúde e do Serviço Nacional de Saúde 2018*. Ministério da Saúde; 2018.
15. LUSA. *Registados 3.681 profissionais de saúde infetados com Covid-19. País ao Minuto: 2020-06-19*. 2020.
16. Maslach C, Leiter MP. Understanding the burnout experience: recent research and its implications for psychiatry. *World Psychiatr* 2016; **15**(2):103–11.
17. Silva C, Pereira J. Risco de burnout nos técnicos de radiologia das unidades de saúde do Porto. *Saúde & Tecnologia* 2020; **2020**(23):38–50.
18. Videira S, Ventura S. Estudo do stress nos técnicos de radiologia. *TDI Online Mag* 2008; **2008**(jan/fev):1–14.
19. Melo S. *Stress relacionado com o trabalho e burnout em técnicos de radiologia*. Lisboa: Universidade Nova de Lisboa; 2012.
20. Greenberg N, Docherty M, Gnanapragasam S, Wessely S. Managing mental health challenges faced by healthcare workers during covid-19 pandemic. *BMJ* 2020; **368**:m1211.
21. 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 Psychiatr* 2020; **7**(3):228–9.
22. Lu H. Drug treatment options for the 2019-new coronavirus (2019-nCoV). *Biosci Trends* 2020; **14**(1):69–71.
23. Grace SL, Hershenfield K, Robertson E, Stewart DE. The occupational and psychosocial impact of SARS on academic physicians in three affected hospitals. *Psychosomatics* 2005; **46**(5):385–91.
24. Zheng W. Mental health and a novel coronavirus (2019-nCoV) in China. *J Affect Disord* 2020; **269**:201–2.
25. Wang J, Zhou M, Liu F. Reasons for healthcare workers becoming infected with novel coronavirus disease 2019 (COVID-19) in China. *J Hosp Infect* 2020; **105**(1):100–1.
26. Akroyd D, Caison A, Adams R. Patterns of burnout among U.S. radiographers. *Radiol Technol* 2002; **73**(3):215–23.
27. Salyers MP, Bonfils KA, Luther L, Firmin RL, White DA, Adams EL, et al. The relationship between professional burnout and quality and safety in health-care: a meta-analysis. *J Gen Intern Med* 2017; **32**(4):475–82.
28. Nicola R, McNeeley MF, Bhargava P. Burnout in radiology. *Curr Probl Diagn Radiol* 2015; **44**(5):389–90.
29. LUSA. Covid-19: pelo menos 100 mil trabalhadores da saúde infectados em todo o mundo. *J Publico* 2020. 2020-05-14. <https://www.publico.pt/2020/05/14/mundo/noticia/covid19-menos-100-mil-trabalhadores-saude-infectados-mundo-1916633>.
30. Barelli S, Palamenghi L, Graffigna G. Burnout and somatic symptoms among frontline healthcare professionals at the peak of the Italian COVID-19 pandemic. *Psychiatr Res* 2020; **290**:113129.