Research Article

Occupational burnout among radiation therapy technologists in Italy before and during COVID-19 pandemic

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ABSTRACT

Introduction: Radiation therapy technologists (RTTs) are exposed to high stress levels which may lead to burnout, which could be further increased by the current pandemic. The aim of our study was to assess burnout and stress among Italian RTTs before and during the pandemic.

Methods: The Italian Association of Radiation Therapy and Medical Physics Technologists (AITRO) and the Italian Federation of Scientific Radiographers Societies (FASTeR) proposed a national online survey, including the Maslach Burnout Inventory assessing emotional exhaustion (EE), depersonalisation (DP), and personal accomplishment (PA) to RTTs before and during the pandemic. Multivariate regression analyses and χ^2 tests were used for data analysis.

Results: We obtained 367 answers, 246 before and 121 during the pandemic. RTTs before and during the pandemic showed high EE and DP, intermediate PA. Median EE was 37 (interquartile range [IQR] 31–46] before and 37 (IQR 30–43) during the pandemic, median DP was 16 (IQR 13–21) and 15 (IQR 12–20), respectively. PA was 31 (IQR 28–34) and 32 (IQR 28–34), respectively. Through multivariate analysis, being female and having children led to higher EE scores before and during the pandemic ($p \leq 0.026$). Only the presence of workplace stress management courses was related to lower DP before and being female was related to higher DP during the pandemic ($p < 0.001$). Being female, having children, and working with paediatric patients were related to lower PA before and during the pandemic ($p \leq 0.015$).

Conclusion: Our study highlighted high burnout levels for RTTs regardless of the pandemic. Future interventions aimed at preventing burnout should be implemented in their work environment, independently of the impact of exceptional events.

RÉSUMÉ

Introduction : Les technologues en radiothérapie (RTT) sont exposés à des niveaux de stress élevés qui peuvent conduire à l'épuisement professionnel, lequel pourrait être encore accru par la pandémie actuelle. L'objectif de notre étude était d'évaluer l'épuisement professionnel et le stress chez les RTT italiens avant et pendant la pandémie.

Méthodologie : L'Association italienne des technologues en radiothérapie et en physique médicale (AITRO) et la Fédération italienne des sociétés de radiographes scientifiques (FASTeR) ont proposé une enquête nationale en ligne, comprenant l'Inventaire d'épuisement professionnel de Maslach évaluant l'épuisement émotionnel (EE), la dépersonnalisation (DP) et l'accomplissement personnel (AP) des RTT avant et pendant la pandémie. Des analyses de régression multivariées et des tests χ^2 ont été utilisés.

Résultats : Nous avons obtenu 367 réponses, 246 avant et 121 pendant la pandémie. Les RTT avant et pendant la pandémie ont montré un EE et une DP élevés, un AP intermédiaire. L'EE médian était 37 (intervalle interquartile [IQR] 31-46) avant et 37 (IQR 30-43) pendant la pandémie, la DP médian était 16 (IQR 13-21) et 15 (IQR 12-20), respectivement. L'AP était 31 (IQR 28-34) et 32 (IQR 28-34), respectivement. En analyse multivariée, être une femme, et avoir des enfants, conduisaient à des scores d'EE plus élevés avant et pendant la pandémie ($p \leq 0,026$). Seule la présence de cours de gestion du stress au travail était liée à une DP plus faible avant et être une femme était lié à une DP plus élevé pendant la pandémie ($p < 0,001$). être une femme, avoir des enfants ou travailler avec des patients pédiatriques était lié à une DP plus faible avant et pendant la pandémie ($p \leq 0,015$).

Conclusion : Notre étude a mis en évidence des niveaux élevés d'épuisement professionnel pour les RTT, indépendamment de la pandémie. Les futures interventions visant à prévenir l'épuisement professionnel devraient être mises en œuvre dans leur environnement de travail, indépendamment de l'impact des événements exceptionnels.

Abbreviations

AITRO	Italian Association of Radiation Therapy and Medical Physics Technologists
DP	depersonalization
EE	emotional exhaustion
FASTeR	Italian Federation of Scientific Radiographers Societies
IQR	interquartile range
MBI	Maslach Burnout Inventory
PA	personal accomplishment
PPE	personal protective equipment
PSS	Perceived Stress Scale
RTT	Radiation Therapy Technologist

Introduction

Burnout, first described by Freudenberger in 1974, is defined as a syndrome characterized by emotional exhaustion, depersonalization, and reduced personal accomplishment" [1]. Burnout is included in the 11th Revision of the International Classification of Diseases (ICD-11) as an occupational phenomenon [2]. It is described in the chapter: "Factors influencing health status or contact with health services", which includes reasons why people contact health services that are not classified as diseases or health conditions. Burnout is the consequence of working circumstances perceived as stressful, which can lead workers to become apathetic, cynical, indifferent and detached from their environment. In certain critical cases, burnout can lead to serious psychopathological damage which can result in insomnia, marital or family problems, increase in the use of alcohol or drugs, and absenteeism, thus possibly deteriorating the quality of care or service provided by the operators [3].

Cancer burden involves not only patients and caregivers but also all professionals involved in their care [4]. Job stress and burnout have therefore often been investigated in healthcare workers in oncology settings. Among healthcare professionals, it is not uncommon to discover that radiation therapy technologists (RTTs) experience high levels of stress and burnout [5–7]. Such healthcare personnel always work in contact with oncologic patients and their caregivers, and while this can lead to professional satisfaction, it may also contribute to occupational stress and burnout [8]. Patient characteristics, frequent deaths, and other stressors related to workloads and work organization frequently lead oncology staff to physical and psychological stress [9].

Moreover, this appears even more evident during the novel coronavirus disease (COVID-19) pandemic [10], which has created new and unpredictable challenges for the whole healthcare system, heightening the prevalence of depression, anxiety, and burnout in clinicians and other healthcare professionals [11,12]. In this context, limitations in resources, equipment, space, and staffing may increase the critical issues that already exist in a radiation therapy department [13]. In addition, to minimize the risk of exposure of cancer patients to SARS-CoV-2 during radiotherapy, the number of visits by relatives or acquaintances has been reduced and this has inevitably affected their supportive role [14].

Thus, the aims of our study were to assess: the prevalence of burnout among RTTs across Italy before and during the pandemic outbreak and whether demographic variables and work-related factors had any influence on burnout and perceived stress among Italian RTTs.

Methods

Ethics committee approval was waived for this survey. Informed consent was obtained prior to accessing the survey. Participation was completely voluntary, and all answers and preferences remained anonymous. No incentive was offered for participating in this survey.

The survey was initially conceived in 2019 to assess the prevalence of burnout among RTTs across Italy, however during the COVID-19 pandemic we opted to utilise the same survey to appraise the impact of the pandemic on RTTs mental wellbeing. The survey was developed using Google Forms (https://docs.google.com/forms) and it was proposed to RTTs at two different time points, before (June 2019) and during the COVID-19 pandemic (June 2020). The Italian Association of Radiation Therapy and Medical Physics Technologists (AITRO) and the Italian Federation of Scientific Radiographers Societies (FASTeR) proposed the previously mentioned national online survey to all Italian RTTs, who are estimated to count around 2,000 individuals (data retrievable on https://albo.alboweb.net/registry/search).

The first part of the survey comprised demographic and work-related questions, addressing gender, age range, working place, marital status, offspring, extent of experience in a radiotherapy department, work commitment (full time, part time/casual), presence of paediatric patients, workload, presence of courses on managing emotional factors or psychological support. Moreover, a survey identifier (also known as unique responder identifier) was collected and it was composed by a short string of characters assigned to each questionnaire recipient. All the questions from the first part of the survey are listed in **Table 1**. The second part of the survey was based on the Maslach Burnout Inventory (MBI) questionnaire [15], reported in **Supplementary Table 1**. The MBI is the most widely used tool to evaluate burnout in healthcare workers. It assesses three different dimensions: emotional exhaustion (EE), depersonalization (DP) and personal accomplishment (PA). The MBI survey is composed by 22 items and it is divided in 3 sub-scales: EE (9 items), DP (5 items) and PA (8 items). For each item the MBI uses a 7-point response scale, whose extremes are "never" and "every day". Scores within individual burnout domains can either be used as continuous variables or categorized into indicators of low, medium or high risk of burnout using established cut-offs (**Table 2**). It is important to note that high levels in EE and DP subscales are associated to high burnout, while high levels in PA subscale are associated to low burnout.

Moreover, the survey presented in 2020 added the Perceived Stress Scale (PSS) with the 10 questions proposed by Cohen et al. [16] in 1983, which can be scored from 0 to 4 as reported in **Supplementary Table 2**. This scale is used to assess everyone's perception of situations of daily life, and their reaction in response to such events. It was chosen because it is widely used to determine how unpredictable, uncontrollable, and overloaded respondents find their lives; consistent with other studies we found it ideal for this current situation [17].

Both times, the link to the survey was also published on the AITRO (https://www.aitro.it/) and FASTeR websites (https://www.associazionefaster.org/) and on the AITRO and FASTeR social media channels.

Statistical analysis

Descriptive analyses were conducted to provide an overview of the participant characteristics and to compare EE, DP and PA scores, as well as the perceived stress scale. Multivariate regression was conducted to assess which variables influenced the different components of burnout, namely EE, DP and PA. The Wilcoxon signed-rank test, Mann–Whitney U and Chi-square tests were used to assess differences between groups and at different time points. Data analyses were performed using Python 3.7.6 and the threshold for significance was set at $p < 0.05$ [18].

Results

Participant characteristics

We obtained 367 answers, 246 in the first administration in June 2019, accounting for 12.3% of the estimated total Italian RTTs, and 121 in June 2020 accounting for 6.1% of the estimated total Italian RTTs. Of those, 140 (57%) respondents were women in 2019 and 62 (51%) in 2020. Respondents'

Table 1
Questionnaire demographic and work-related questions.

1. **Gender**: Male; Female
2. **Age range**: 18–29 years; 30–39 years; 40–49 years; 50–59 years; 60–69 years; ≥ 70 years
3. **Working place**: University/Teaching hospital; Hospital; Private practice; Private research centre; Private company; Other
4. **Marital status**: Married/defacto, Single
5. **Do you have children?** Yes; No
6. **Number of years' (y) experience in profession in a radiotherapy department?** 0–5 y, 6–10 y, 10–15 y, >15 y
7. **Work commitment in a radiotherapy department?** Full time, part time/casual
8. **In your department, are radiotherapy treatments performed on pediatric patients, too?** Yes; No
9. **Number of hours (h) worked overtime per week**: 0–5 h; 6–10 h; > 10 h
10. **In your institute, are training courses on understanding and managing emotional factors carried out?** Yes; No; I don't know
11. **In your institute, is psychological support provided for radiation therapy technologist - RTT?** Yes; No; I don't know

Table 2
Reference value of Maslach burnout inventory questionnaire.

Burnout Risk			
MBI Subscale	**Low**	**Medium**	**High**
EE	≤16	17-26	≥27
DP	≤6	7-12	≥13
PA	≥39	38-32	≤31

MBI: Maslach Burnout Inventory; EE: Emotional Exhaustion; DP: Depersonalisation; PA: Personal Accomplishment. Reference: Maslach et al. (2012).

Table 3
Participant demographics.

	2019	**2020**	***p*-value**
Population	246	121	
Females	140 (57%)	62 (51%)	0.305
Age			
<30 years old	44 (18%)	27 (21%)	0.153
31–40 years old	73 (30%)	43 (36%)	
41–50 years old	63 (25%)	19 (16%)	
>50 years old	66 (27%)	32 (27%)	
Children	112 (46%)	52 (43%)	0.644
Work years			
0–5 years	58 (24%)	39 (32%)	0.269
6–10 years	40 (16%)	19 (16%)	
11–15 years	61 (25%)	22 (18%)	
>15 years	87 (35%)	41 (34%)	
Paediatric patients treated	111 (45%)	60 (50%)	0.420
Stress management courses available	67 (27%)	51 (42%)	0.004*
Psychological support available	60 (24%)	48 (40%)	0.003*

* Significant *p*-value.

information are reported in **Table 3**. During the pandemic outbreak, 3 (2%) respondents declared they had contracted COVID-19 with a positive reverse transcriptase polymerase chain reaction test.

Prevalence of burnout before the pandemic outbreak

RTTs had an overall high median EE score (37, interquartile range - IQR 31–46), and high DP (16, IQR 13–21) compared to occupational burnout references (≥27 and ≥13, respectively). The median score of PA (31, IQR 28–34) was comparable to the reference for high risk (≤31). Levels of EE, DP and PA over their respective thresholds were present in 235

(96%), 193 (78%) and 130 (53%) participants, respectively. Data information are reported in **Table 4**.

At multivariate analysis, being female (p<0.001), having children (p=0.026), number of years working as RTT (p=0.006), were related to higher EE scores, while presence of workplace stress management courses (p<0.001), and psychological support (p=0.022) were related to lower EE scores. Only the presence of workplace stress management courses (p<0.001) was related to lower DP scores. Being female (p<0.001), having children (p<0.001), working with paediatric patients (p<0.001) were related to lower PA scores, while the presence of workplace stress management courses (p=0.003) was related to higher PA scores.

Prevalence of burnout during the pandemic outbreak

RTTs had an overall high median EE score (37, IQR 30–43), and high DP (15, IQR 12–20) compared to occupational burnout references (≥27 and ≥13, respectively). The median score of PA (32, IQR 28–34) was over the reference for high risk (≤31). Levels of EE, DP and PA over their respective thresholds were present in 115 (95%), 79 (65%) and 57 (47%) participants, respectively.

At multivariate analysis, being female (p<0.001) and having children (p=0.019) were related to higher EE scores. Only being female (p<0.001) was related to higher DP. Being female (p<0.001), having children (p=0.001), and working with paediatric patients (p=0.015) were related to lower PA scores.

Perceived stress scale

RTTs had an overall high median PSS scale scores with a median of 16 [11–21] and 73 (60%) had scores ≥ 14. The total PSS score showed significant positive correlation with EE ($\rho = 0.552$, p<0.001), DP ($\rho = 0.435$, p<0.001), and PA ($\rho = 0.221$, p=0.015). At multivariate analysis, being female (p=0.012) and having children (p=0.011) were related to higher PSS scores.

Subgroup analysis: comparison 2019 – 2020

Considering the survey identifier, we analysed the 34 subjects who answered the survey both in 2019 and in 2020. No

Table 4
Maslach burnout inventory and perceived stress scale.

	2019 (246 participants)	2020 (121 participants)	*p*-value
Maslach Burnout Inventory			
EE	37 [31–46]	37 [30–43]	0.179
DP	16 [13–21]	15 [12–20]	0.022*
PA	31 [28–34]	32 [28–34]	0.440
Perceived Stress Scale	NA	16 [11–21]	–

NA: Not available; EE: Emotional Exhaustion; DP: Depersonalisation; PA: Personal Accomplishment. * Significant *p*-value.

significant differences were found in terms of EE (EE median score in 2019 was 35 [29–42], while in 2020 39 [31–43], p=0.244), and DP (DP median score in 2019 was 15 [12–18], while in 2020 15 [12–20], p=0.625). PA was significantly higher in 2019 than 2020 (the median PA for this subgroup in 2019 was 32 [27–33], while in 2020 it was 29 [27–32], p=0.040).

Discussion

This study explored Italian RTTs, occupational burnout before and during the COVID-19 pandemic using an anonymous survey to collect sociodemographic, burnout (MBI), and, during the pandemic, perceived stress (PSS) information from RTTs working in radiation therapy departments. The results from this study indicate that, as a professional group, RTTs exhibit high levels of the first two stages of burnout (EE and DP) at both time points, namely before and during the pandemic outbreak.

In literature, several studies evaluated the burnout levels of oncology workers, nurses and doctors [19–24], RTTs with other healthcare workers [25–28], and exclusively RTTs [5–7,29–34]. In many studies, the MBI was used to assess RTTs burnout levels. Previous research showed how that high levels of burnout also yield negative effects on individual well-being and on daily work [34–36].

In our study population, RTTs had an overall high median EE score (37, IQR 31–46), and high DP (16, IQR 13–21), while the median PA (31, IQR 28–34) was comparable to the reference for high risk, with 96%, 78%, and 53% of respondents being over the respective thresholds for EE, DP and PA.

These data showed a higher burnout burden than that found by other research groups that investigated occupational burnout [5–7,29–34], except for Australian RTTs as described by Singh et al. [37] in 2017 (i.e., before the pandemic) who showed burnout levels similar to those reported in our work. Our subgroup analysis results showed that a high proportion of RTTs respondents were suffering from very high levels of EE and DP and relatively low levels of PA, both before and during pandemic outbreak. Further multi-country studies are warranted to assess this issue and to investigate the potential differences in workplace conditions and therefore the causes behind the higher burnout levels of Italian and Australian RTTs compared to other settings.

Through our multivariate analyses, we noticed that many different variables may have an impact on EE, DP and PA scores. In particular, being female and having children were related to higher EE scores and lower PA scores. This is in line with the evidence of a significant association between female gender and critical EE and PA scores [38,39]. Results show that presence of psychological support significantly reduces EE, while the presence of workplace stress management courses is associated with lower EE and DP and higher PA. Literature supports the usefulness of these tools in counteracting burnout [40]. Unfortunately, although the efficacy of stress management courses and psychological support is widely documented, these practices are not uniformly widespread in Italy. In our sample, only 27% (2019) and 42% (2020) indicated having access to workplace stress management courses, and 24% (2019) and 40% (2020) to psychological support. The notable increase in access to psychological support between 2019 and 2020 might be due to the COVID-19 pandemic, which caused a considerable emotional burden on healthcare workers and students [51]. Hence, we believe that even those who did not feel the need for support before the pandemic might have resorted to such services for stress relief.

While the pandemic is considered to have taken an important toll on health workers' mental health, often leading to burnout, results from our subgroup analysis only highlighted a significant impact on PA, but not on EE or DP. This might be due to the fact that RTTs already present with high levels of burnout, and thus they remained over the thresholds for EE and DP regardless of the pandemic, while in radiotherapy patients were the same but risk of contagion, work organization, and timelines have definitely changed. Moreover, RTTs were not among the frontline emergency workers during the first waves of the pandemic, albeit their relationship with patients suffered from a drastic shift [41]. In particular, the use of personal protective equipment (PPE) and the need to maintain social distances may cause increased emotional distress, compassion fatigue or low levels of satisfaction [42,43], this aspects can be crucial in the interaction with paediatric patients [44–46].

Recent research, conducted during the COVID-19 pandemic among emergency workers, shows that high stress levels correlate positively with EE and DP, and negatively with PA [47]. In contrast to these findings, in our sample, PSS scores correlated positively with all scales of the Maslach Burnout Inventory, including PA. This finding, consistent with other studies investigating stress in healthcare [48], underscores the need to accurately identify different needs and consequently different types of psychological interventions based on the type of professional and the areas in which they work [49].

This study has some limitations to be taken into account. First, the limited sample equal to only 12.3% in 2019 and 6.1% in 2020 of the estimated total Italian RTTs not sufficiently representative of Italian RTTs population, and the inability to compare stress perceptions level with previous measurements. It should be noted that the low response rate may underestimate or overestimate the risk of burnout in the sample. Furthermore, low response rates to the survey might have been due to low access to the website and social media channels where it was posted. However, Guerra et al. [50] appraised 11 studies in a systematic review, with study samples ranging from 12 to 502 participants, with a global low response rate, as also confirmed by further surveys [5–7,29–34]. Similarly, the low number of RTTs who performed both surveys before and during the pandemic (n = 34) makes intra-individual comparison only viable for outlining some trends. In particular, the lack of significance for EE could be due to the small sample size.

In conclusion, our study highlighted high burnout levels for RTTs regardless of the pandemic. Future interventions aimed at preventing burnout should be implemented in their work environment, independently of the impact of exceptional events.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jmir.2021.12.004.

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