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Research article

The role of alexithymia and empathy on radiation therapists' professional quality of life

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ABSTRACT

Background and purpose: Physical and mental well-being are crucial for oncology professionals as they affect performance at work. Personality traits, as alexithymia and empathy, may influence professional quality of life. Alexithymia involves diminished skills in emotion processing and awareness. Empathy is pertinent to the ability to understand another's 'state of mind/emotion'. The PROject on Burn-Out in RadiatioN Oncology (PRO BONO) investigates professional quality of life amongst radiation oncology professionals, exploring the role of alexithymia and empathy. The present study reports on data pertinent to radiation therapists (RTTs).

Material and methods: An online survey targeted ESTRO members. Participants were asked to fill out 3 questionnaires for alexithymia, empathy and professional quality of life: (a) Toronto Alexithymia Scale (TAS-20); (b) Interpersonal Reactivity Index (IRI); (c) Professional Quality of Life Scale (ProQoL). The present analysis focuses on RTTS to evaluate compassion satisfaction (CS), secondary traumatic stress (STS) and Burnout and their correlation with alexithymia and empathy, using generalized linear modeling. Covariates found significant at univariate linear regression analysis were included in the multivariate linear regression model.

Results: A total of 399 RTTs completed all questionnaires. The final model for the burnout scale of ProQoL found, as significal predictors, the TAS-20 total score ($\beta = 0.46$, $p < 0$ 0.001), and the individual's perception of being valued by supervisor ($\beta = -0.29$, $p < 0.001$). With respect to CS, the final model included TAS-20 total score ($\beta = -0.33$, $p < 0.001$), the Empatic Concern domain ($\beta = 0.23$, $p < 0.001$) of the IRI questionnaire and the individual's perception of being valued by colleagues ($\beta = 0.22$, $p < 0.001$).

Conclusions: Alexithymia increased the likelyhood to experience burnout and negatively affected the professional quality of life amongst RTTs working in oncology. Empathy resulted in higher professional fulfillment together with collegaues' appreciation. These results may be used to

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benchmark preventing strategies and implement organization-direct and/or individual-directed interventions.

Introduction

Radiation oncology is a clinical discipline employing ionizing radiation to treat cancer [1,2]. It is characterized by a multi-professional framework, involving different occupational profiles such as radiation and/or clinical oncologists, medical physicists, radiobiologists and radiation therapists (RTTs) [3]. RTTs have a crucial role in the planning and delivery of targeted radiation treatment to cancer patients, with high-profile technical and procedural requirements demanding great responsibility [4]. At the same time, they need to interact with patients on a daily basis, monitoring side effects and providing patients with meaningful information, comfort and support [5]. Moreover, similar to other healthcare professionals, they face increasing productivity requirements. They have to balance between patient caseload, demanding regulatory requirments and limited professional autonomy, which can result in 'administrative fatigue' [6].

Long-term exposure to stressors, particularly if combined with ineffective coping strategies, may significantly affect the professional quality of life, leading to cognitive and emotional distress, anxiety, mood disorders and, finally, burnout [7]. The definition of burnout refers to an occupational syndrome correlated to stress. It is characterized by three principal domains: (a) emotional exhaustion (i.e. being overextended and exhausted in emotions, with a perception of diminished enthusiasm for professional life), (b) depersonalization (i.e. propensity to cynism, with cold and impersonal relationships) and (c) low personal accomplishment (i.e. feelings of inadequacy, with loss of perspective for the meaningfulness of work) [6]. Burnout is frequent amongst human service workers who may experience chronic emotional drain due to the demanding and prolonged exposure to psychological, social and physical issues of individuals. Hence, it is a common observation amongst healthcare providers, leading to negative implications for professionals, patients and organizations [8,9].

Different inherent factors may have an impact on the professional well-being and the likelihood to develop burnout, including personality traits such as alexithymia and empathy. Alexithymia refers to a psychological construct characterizing individuals with a deficit in emotional expression and processing, leading to an intrinsic difficulty in discriminating emotions from bodily sensations, cognition from emotion, and in communicating emotions to other individuals [10]. Empathy is the ability to share and understand another's 'state of mind' or emotion. It has been defined by Zinn as the process of understanding a person's subjective experience by vicariously sharing it while maintaining an observant distance [11]. Both alexithymia and empathy may influence the interaction between the healthcare professionals and the patients, particularly in the demanding field of radiation oncology, with an ultimate impact on one's professional well-being.

The PROject on Burn-Out in RadiatioN Oncology (PRO BONO) was set up to explore the professional quality of life amongst radiation oncology professionals and to explore the potential correlation with alexithymia and empathy [12]. The present study reports on the data obtained from the population of RTTs.

Materials and methods

PRO BONO was developed within the Young European Society for Radiotherapy and Oncology (yESTRO) Committee, to answer the research questions whether personality traits, such as alexithymia and empathy, may have an influence on the perceived professional well-being in the field of radiation oncology. Participants were invited to participate on voluntary basis via email, social media and other ESTRO communication channels. Data were collected between May and October 2018. The questionnaire was administered to the participants through an online survey software (SurveyMonkey Inc., San Mateo, California, USA; www.surveymonkey.com), intrinsically protecting anonymity of the respondents. Socio-demographic and professional information were also collected.

In order to assess alexithymia, empathy and burnout, we used the following validated instruments:

Alexithymia. The 20-Item Toronto Alexithymia Scale (TAS-20) [13] was used. The TAS-20 comprises 20 items rated from "strongly disagree" to "strongly agree" on a 5-point Likert scale. The TAS-20 provides 3 subscale scores: "Difficulty Identifying Feelings" (DIF); "Difficulty Describing Feelings" (DDF) and "Externally Oriented Thinking" (EOT). The total score (TAS_Tot) is used to stratify participants into non-alexithymic (score ≤ 51), borderline (score between 52 and 61), and alexithymic (score ≥ 61) [13]. The scale has shown good internal consistency (Cronbach's alpha: $\geq$0.70) and test-retest reliability [14].

Empathy. The Interpersonal Reactivity Index (IRI) was used to assess empathy. It is based on 28 items on a 5-point Likert scale, which range from "Does not describe me well" to "Describes me very well" [15]. The IRI evaluates two affective components pertinent to the emotional reaction elicited by an agent focusing on the other- and self-oriented set of feelings, respectively: Empathic Concern (EC, i.e. the tendency to share the experience of others, with feelings of warmth and compassion); and Personal Distress (PD, i.e. the tendency to focus on one's own feelings of anxiety and discomfort in reaction to the emotions of other individuals). In addition, the IRI assesses two cognitive aspects of empathy: the Perspective Taking (PT, i.e. the ability to adopt the point of view of other persons) and Fantasy (FS, i.e the tendency to imagine oneself with the feelings and into the actions in fictitious situations). The final score of each scale ranges from 0 to 4. The scale has shown good internal consistency (Cronbach's α range: 0.70–0.78) and test-retest reliability [15].

Professional quality of life. The Professional Quality of Life scale (ProQoL) version 5 [16], comprising of 30 items rated on a 1 (never) to 5 (very often) scale, was used. The ProQoL assesses both the positive (Compassion Satisfaction) and negative (Compassion Fatigue) aspects influencing the professional quality of life. The Compassion Satisfaction Subscale (CSS) measures the pleasure derived from being able to perform one's job well. Compassion Fatigue (CF) is divided into 2 scales: the Burnout Scale (BS), concerning feelings of hopelessness, exhaustion, frustration and difficulties in dealing with work or in performing one's job effectively; and the Secondary Traumatic Stress Scale (STSS), concerning negative feeling and issues (like fear, sleep difficulties, intrusive images) driven by work-related secondary exposure to excessive or traumatic stressful events. Based on the correspondent percentile scores established in the original ProQoL [16], participants are classified into low (score below the 25th percentile), average, and high (score above the 75th) groups for each scale. The cut-off scores at the 25th percentile are 44 for the CSS, 43 for the BS and 42 for the STSS. The cut-off scores

at the 75th percentile are 57 for the CSS, 56 for the BS and the STSS.

The scale has shown good internal consistency (Cronbach's α range: 0.75–0.88) and test-retest reliability [16].

Statistical analyses

For each of the questionnaire employed, Cronbach's alpha was calculated as a measure of internal consistency and scale reliability. Normal distribution was assessed throught the values of skewness (Sk) and kurtosis (K). The assumption of normality was met for all the variables (all the absolute values were lower than 1, excepted for age (kurtosis = 1.48) in the drop-out group). To compare socio-demographical and work-related variables between completers and drop-out participants, planned independent *t*-test and Fisher exact tests were used. To investigate if alexithymia, empathy and work-related variables were significant contributing factors for the explanation of each domain of the professional QoL, three hierarchical multiple regression analyses were planned, using the three subscales of the ProQoL as outcome variables (i.e. CSS, BS, and STSS). First, Pearson bivariate (r) or point-biserial (r_{pb}) correlations were computed to analyze the relationship between variables. Then, when significantly correlated with the outcome variables (p-value <0.05), age, gender, and marital status were inserted into the first regression block of the multiple regression analyses, alexithymia (i.e. TAS-20) into the second block, empathy (i.e. IRI_EC, IRI_PD, IRI_PT, and IRI_FS subscales) into the third. Lastly, professional variables were inserted into the fourth block, using a stepwise method for variable inclusion. Collinearity was assessed using the statistical factors of tolerance and Variance Inflation Factor (VIF).

All the statistical analyses were carried out with the software "Statistical Package for Social Sciences – version 25" (IBM SPSS Statistics for Macintosh, Armonk, NY, USA: IBM Corp.).

Results

Sociodemographic and work-related characteristics are shown in Table 1 and Appendix A. Amongst the 522 RTTs involved in the survey, 399 (76%) fully aswered all 3 questionnaires (TAS.20, IRI, ProQoL), while 123 (24%) did not complete the whole survey. Only those who fully completed all 3 instruments were considered in the analysis. Direct comparison between respondents who did or did not complete the survey showed a statistically significant difference with respect to sociodemographic and professional characteristics, in terms of age (dropout participants were younger than completers, $p = 0.002$) and years of experience in the field (dropout participants had less experience than completers, $p < 0.001$) (Appendix A). Participants who fully completed the survey were 39 years old on average, had a predominance of female gender (71.2%), had more than 10 years expecience in the field (59.2%) and stated they felt valued by patients (93%), patient's caregiver (89%) colleagues (84%) and supervisor (68.9%) in the workplace (Table 1).

As a measure of internal consistency, in our sample, the Cronbach's alpha was very good for the TAS-20 total score (α score = 0.84), acceptable for the IRI subscales (α scores ranging

Table 1
Socio-demographical and work-related variables of the 399 radiation therapists who completed the on-line survey.

	Complete (399)
Age (M (SD))	38.95 (9.9)
Gender (N (%))	
M	115 (28.8%)
F	284 (71.2%)
Marital Status (N (%))	
Single	110 (27.6%)
Married/Cohabiting	269 (67.4%)
Divorced	15 (3.8%)
Widowed	5 (1.2%)
Year in the field (N (%))	
<=10	163 (40.8%)
>10	236 (59.2%)
N_Shift (N (%))	
No	235 (58.9%)
Yes	164 (41.1%)
V_Patients (N (%))	
No	28 (7%)
Yes	371 (93%)
V_Caregivers (N (%))	
No	44 (11%)
Yes	355 (89%)
V_Supervisor (N (%))	
No	124 (31.1%)
Yes	275 (68.9%)
V_Colleagues (N (%))	
No	64 (16%)
Yes	335 (84%)

N_Shift: "On call" shift; V_Patients/Caregivers/Colleagues/Supervisor: perception of being valued by patients, patients' caregivers/colleagues/supervisor.

Table 2
Alexithymia, Empathy and Professional QoL among the 399 radiation therapists who completed the on-line survey.

	M (SD)	*N(%)*
Alexithymia		
TAS_20	47.3 (9.6)	
Non alexithymic		278 (69.7%)
Borderline		79 (19.8%)
Alexithymic		42 (10.5%)
TAS_DIF	15.7 (5)	
TAS_DDF	12 (3.5)	
TAS_EOT	19.6 (3.6)	
Empathy (IRI)		
IRI_PT	2.59 (0.67)	
IRI_FS	2.2 (0.74)	
IRI_EC	2.77 (0.62)	
IRI_PD	1.46 (0.64)	
Professional QoL (ProQoL)		
PQ_CSS	38.2 (5.9)	
Low		105 (26.3%)
Average		172 (43.1%)
High		122 (30.6%)
PQ_BS	24.5 (5.7)	
Low		135 (33.8%)
Average		162 (40.6%)
High		102 (25.6%)
PQ_STSS	23 (5.7)	
Low		91 (22.8%)
Average		212 (53.1%)
High		96 (24.1%)

TAS-20: Toronto Alexithymia Scale-20 total score; TAS-20_DIF: Difficulty identifying feelings subscale; TAS-20_DDF: Difficulty describing feeling subscale; TAS-20_EOT: Externally oriented thinking subscale; IRI: Interpersonal Reactivity Index; IRI_PT: Perspective Taking; IRI_FS: Fantasy; IRI-EC: Empathic Concern; IRI-PD: Personal Distress; PQ_CSS: Compassion Satisfaction Scale; PQ_BS: Burnout Scale; PQ_STSS: Secondary Traumatic Stress Scale. Low and High refer to a score below the 25th percentile or above the 75th percentile, respectively, whereas Average include the intermediate scores.

from 0.68 to 0.75) and good/very good for the ProQoL subscales (α scores ranging from 0.77 to 0.87).

Alexithymia, empathy, and professional quality of life

Table 2 shows a descriptive analysis of the overall scores on alexithymia, empathy, and professional QoL for those that fully completed the survey. In 10.5% of participants the presence of alexithymia was observed, while almost 20% were shown to have borderline alexithymic traits. With respect to empathy, respondents showed the highest scores (2.77 ± 0.62) on the 'Empathic Concern' subscale of the IRI, while the lowest were observed on the 'Personal Distress' subscale (1.46 ± 0.64). Based on the professional QoL scale, 30.6% of RTTs reported high scores on the 'Compassion Satisfaction' Scale of the ProQoL, while 24% scored high on the 'Secondary Traumatic Stress' and 27% scored high for 'Burnout'.

Multivariate regressions and correlations

Table 3 reports on the preliminary correlation analysis, based on a hierarchical multiple linear regression model, between alexithymia, empathy, professional variables and the reported professional QoL. Appendixes B–D show the full results of the three regression analyses, while Table 4 shows the final models for each of the regression analysis.

With respect to ProQoL_CSS (Table 4), the full model of alexithymia, empathy, and work-related variables as predictors of compassion satisfaction was statistically significant ($R^2 = 0.27$, $F(3,395) = 48.65$, $p < 0.001$; adjusted $R^2 = 0.26$). Particularly, TAS-20 total score ($\beta = -0.33$, $p < 0$ 0.001), 'Empathic Concern' ($\beta = 0.23$, $p = 0$ 0.001) and the individual's perception of being valued by colleagues ($\beta = 0.22$, $p < 0.001$) were found to significantly contribute to the final model.

For ProQoL_BS (Table 4), the final model explained a significant amount (35%) of the burnout variance ($F(2,396) = 106.80$, $p < 0.001$). Significant predictors in the final model were found to be the TAS-20 total score ($\beta = 0.46$, $p < 0.001$), and the individual's perception of being valued by the supervisor ($\beta = -0.29$, $p < 0.001$).

Table 3
Correlations with the Professional Quality of Life (ProQoL).

	PQ_CSS	PQ_BS	PQ_STSS
Age (r)	−0.029	0.017	0.060
Gender (r_{pb})	0.07	−0.021	0.102*
Marital Status# (r_{pb})	0.059	−0.064	0.041
Years in the Field (r_{pb})	−0.04	0.04	0.03
Do you do "on call" shifts? (r_{pb})	0.072	−0.016	0.165**
Do you feel valued by your patients? (r_{pb})	0.069	−0.126*	−0.094
Do you feel valued by your patients' caregivers? (r_{pb})	0.145*	−0.172**	−0.111*
Do you feel valued by your supervisors? (r_{pb})	0.291**	−0.371**	−0.230**
Do you feel valued by your colleagues? (r_{pb})	0.200**	−0.197**	−0.149*
TAS-20 (r)	−0.413**	0.518**	0.413**
IRI_PT (r)	0.231**	−0.175**	0.027
IRI_FS (r)	0.144*	−0.082	0.172**
IRI_EC (r)	0.301**	−0.147*	0.136*
IRI_PD (r)	−0.192**	0.267**	0.353**

Pearson (r) or point-biserial (r_{pb}) correlation has been used as appropriate.
TAS-20: Toronto Alexithymia Scale-20; IRI_PT: Perspective Taking subscale; IRI_FS: Fantasy; IRI-EC: Empathic Concern; IRI-PD: Personal Distress subscale of the Interpersonal Reactivity Index; PQ_CSS: Compassion Satisfaction Scale; PQ_BS: Burnout Scale; PQ_STSS: Secondary Traumatic Stress Scale of the Professional QoL.
Marital status has been dichotomized in Married/Cohabiting or Single/Divorced/Widowed.
* p < 0.05.
** p < 0.001.

Finally, regarding the ProQoL_STSS (Table 4), the full model of gender, alexithymia, empathy, and work-related variables to predict secondary traumatic stress was found to be statistically significant ($R^2 = 0.30$, $F(6, 302) = 28.50$, $p < 0.001$; adjusted $R^2 = 0.29$). Particularly, TAS-20 total score ($\beta = 0.34$, $p < 0.001$), 'Empathic Concern' ($\beta = 0.18$, $p < 0.001$) and 'Personal Distress' ($\beta = 0.19$, $p < 0.001$) subscales of the IRI, perception of being valued by supervisor ($\beta = -0.16$, $p < 0.001$), and being 'on call' ($\beta = 0.16$, $p < 0.001$) were found to be significant predictors.

In all regression analyses, the statistical factor of tolerance and variance inflation factor showed that there were no interfering interactions amongst the variables.

Discussion

The Project on Burn-Out in Radiation Oncology (PRO BONO) is a cross-sectional study investigating professional quality of life and burnout amongst radiation oncology professionals and exploring the potential correlation with personality traits, such as alexythymia and empathy. This report provides data on 399 RTTs practicing worldwide.

The results show that 1 out of 4 (25.6%) RTT participating in the survey had high scores in the burnout scale of the ProQoL, reported on feeling of distress and gaps in the professional well-being, similarly to the population of radiation oncologist previously reported on [12].The findings for RTT, even though reporting significant rates of burnout in the cohort, highlight lower levels compared to those available in the literature. As an example, the US RT workforce survey identified up to 53% of the particpants with high levels of burnout in the emotional exhaustion domain [8]. Moreover, a study on RTTs in the United Kingdom showed high levels of emotional exhaustion in up to 38% of participants, similarly to a survey performed amongst Canadian RTTs (43%) [9,17].

This variation in point prevalence could be a result of the different instrument used to assess burnout as in the aforementioned studies the Maslach Burnout Inventory was used. Another point is the burnout definition, which leads to a different estimation of occurrence rate whenever using high score in at least one of the three Maslach Burnout Inventory domains to define burnout, as it was done in the aforcited studies. Detailed cross-comparison with this study cannot be easily undertaken, as the ProQoL version 5 questionnaire was used, which relies on Compassion Satisfaction and Compassion Fatigue theory, including both positive and negative aspects of the profession for individuals working in sevice delivery or healthcare provision [16]. The ProQoL provides a comprehensive assessement of the professional well-being, evaluating the interaction between personal, professional and emotional aspects of the worker and the professional quality of life. In this sense, it must be noted that 30.6% of participants reported high scores on the Compassion Satisfaction scale of the ProQoL, which explores the pleasure and reward an RTT may derive from being able to perform his/her own job well. This can indirectly reflect the rewarding nature of radiation therapy as a profession.

Nevertheless, it is important to highlight that RTTs working in radiation oncology are compelled to deal with an intensely patient-centered working environment, requiring different abilities suh as technical competence, supportive patient-care, an interdisciplinary attitude, collaboration, effective comunication, management and administrative skills [4]. Hence, individual and environmental stressors can influence the degree of professional satisfaction and contribute to the likelihood to experience burnout. Among them, high workload, staff shortage, organizational stress, conflict and personal distress have been demontsrated to be correlated to burnout amongst RTTs [5,8]. These results demonstate that personality trait of alexithymia and empathy, together

Table 4
Final models of the hierarchical multiple linear regression on the Compassion Satisfaction (PQ_CSS), Burnout (PQ_BS) and Secondary Traumatic Stress (PQ_STSS) Scales of the ProQoL.

	Predictor	R^2	Adj R^2	F	B	SE B	β	P
PQ_CSS		0.270	0.264	48.65*				
	TAS-20				−0.201	0.027	−0.327	<0.001
	IRI_EC				2.227	0.422	0.231	<0.001
	V_Colleagues				2.843	0.561	0.222	<0.001
PQ_BS		0.350	0.347	106.80*				
	TAS-20				0.275	0.025	0.463	<0.001
	V_Supervisor				−3.601	0.510	−0.291	<0.001
PQ_STSS		0.304	0.293	28.50*				
	Gender				0.784	0.555	0.063	0.158
	TAS-20				0.202	0.028	0.343	<0.001
	IRI_PD				1.655	0.413	0.188	<0.001
	IRI_EC				1.651	0.414	0.180	<0.001
	N_Shifts				1.819	0.485	0.158	<0.001
	V_Supervisor				−1.957	0.527	−0.160	<0.001

TAS-20: Toronto Alexithymia Scale-20; IRI_PT: Perspective Taking subscale; IRI_FS: Fantasy; IRI-EC: Empathic Concern; IRI-PD: Personal Distress subscale of the Interpersonal Reactivity Index; V_ Colleagues/Supervisor: perception of being valued by colleagues/supervisor; N_Shift: "On call" shift.
* $p < 0.001$.

with professional variables, were significantly correlated with burnout and all the other components of professional QoL. In this study, with respect to the compassion satisfaction dimension, the TAS-20 total score, the 'Empathic Concern' subscale of the IRI, and the perception of being valued by colleagues were found to be significant predictors for the ProQoL_CSS. Particularly, the presence of alexithymia was found to be negatively associated to the levels of compassion satisfaction, while both empathy and colleague's appreciation were observed to be positive contributors. Consistent results were observed for the other ProQoL domains. Coherently, high levels of alexithymia were found to be positively associated to higher levels of burnout as assessed via the ProQoL_BS, whereas the 'perception of being valued by supervisor' were found to be a negative predictor of this dimension. Finally, with respect to the secondary traumatic stress dimension, alexithymia, empathy (empathic concern and personal distress, specifically) and being required to cover 'on call' shifts were observed to be significantly correlated to a higher score in the ProQoL_STSS.

As a whole, these results suggest a negative impact of alexithymia on the professional quality of life of RTTs, with increased likelihood for distress and burnout in case of high levels of alexithymia. To our knowledge, the present study is the first exploring the correlation between alexithymia and burnout in RTTs. Similar results were found for other healthcare professionals. For example, Mattila et al found that alexithymia (in particular the DIF factor of the TAS-20), was a significant predictor for both the emotional exhaustion and the professional inefficacy components of burnout in a group of healthcare professionals working in emergency departments, even when controlled for confounding factors (sociodemographic and health-related variables, and depressive symptoms) [18]. In another study, Popa-Velea et al observed a positive correlation between alexithymia and emotional exhaustion and low personal accomplishment in female medical students [19]. Alexithymia was also positively correlated to depersonalization in male students [19].

The mechanisms through which alexithymia may increase the likelihood to develop burnout include various aspects related to the management of relationships in the working environment. The inability to identify and describe emotions may lead to impaired coping with emotional and occupational stress, and the impaired capacity of alexithymic individuals to build intimate relationships may decrease social support, predisposing to potential interpersonal issues, socially avoidant behaviour and depression. All these aspects may render individuals more vulnerable to interpersonal difficulties at work, with an overall impact on the professional quality of life and an increased risk of experiencing burnout. It is interesting to note that employees working in human service work, where contact with other people make up most of the tasks and could be an important stressor, have been demonstrated to be particularly prone to a client-centered form of burnout [20]. This context can be considered comparable to the one experienced by RTTs working in radiation oncology, which is a typical patient-centered professional environment [20].

Other than alexithymia, empathic characteristics seems to have an overall beneficial effect on the satisfaction an individual derives from work. Higher scores in the 'Empathic Concern' subdomain of the IRI scale were significantly correlated to higher scores in the ProQoL_CSS, with a better professional quality of life. This is interesting since 'Empathic Concern' was also significantly correlated to higher scores in the ProQoL_STSS, but not in the ProQoL_BS. An interpretation of these findings could be that empathy makes the RTT professional more prone to endure patient's suffering which may increase the level of acute stress. Neverthelss, with effective coping and appropriate stress management, this does not lead to chronic stress and consequent burnout, but enhances the professional satisfaction derived from taking care of others.

Another interesting finding, in the RTT population, is the association between higher scores in both ProQoL_STSS, and ProQoL_BS and a low perception of being valued by one's supervisor. In line with the literature, our data suggests a positive association between lack of supervisor support and burnout symptoms. As an example, the study of Weigl et al. reported that the relationship between emotional exhaustion and depressive state was more prominent for nurses having low supervisor support [21]. Conversely, feeling valued by the supervisor increases the chance to be satisfied at work and decreases the chance to experience acute stress and burnout. This observation represents a confirmation of the Compassion Fatigue/Compassion Satisfaction theoretical model which outlines the influence of working environment on the quality of professional life [16]. It also stresses the importance of effective leadership style for those having managerial positions within the hospital, calling for initiatives to engage in developing self-awareness, enhancing effective communication, sharing vision and strategies, supporting team members, contributing in negotiation and problem-solving approaches [22].

The data we presented on the population of RTTs are in line with those observed for other radiation oncology professionals such as radiation oncologists and medical physicists, with comparable rates for burnout (25–30%), alexithymia (10–13%) and a similar distribution of the measures of empathy [12,23]. A negative correlation of alexithymia with professional well-being and a positive influence of empathy and supervisor's appreciation on compassion satisfaction were observed in all three categories. This is an interesting finding, transversal to professions with a different exposure to patients and a different set of skills and responsabilities. We are planning to perform a detailed analysis exploring the mediator role of professionalism on well-being at work amongst radiation oncology professionals to better understand this type of dynamic.

Nevertheless, the study has some biases, including its cross-sectional nature which does not allow to establish a causal relationship between professional quality of life and alexithymia and empathy. Moreover, as in most studies reporting on burnout, the standardized questionnaires we used rely on self-reporting, which is known to be potentially milsaligned with reality. This might have led to the underestimation of the presence of frank alexithymic traits in individuals falling into borderline cut-off scores. Performance-based instruments or structured interviews, less dependent on the individuals' awareness, would be useful in addition to traditional self-reported measures.

Despite these limitations, the present study represents the first attempt to assess professional QoL and the correlation with both individual characteristics (i.e. alexithymia and empathy) and professional variables in RTTs working in the field of radiation oncology. The results stress the importance of fostering emotional competencies in RTTs, to promote the positive dimensions of professional QoL and reduce the levels of distress and burnout experienced within the working environment [24]. They also show the importance of supervisor's recognition and, on a larger scale, professional community acknowledgement. This makes the recognition of the RTT profession crucial.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Comparison between radiation therapists who completed and those who drop-out the survey in terms of socio-demographical and work-related variables.

	Complete (399)	Drop-out (123)	
Age (M (SD))[a]	38.95 (9.9)	35.86 (9.1)	T = -3.09 (520); 0.002
Gender (N (%))[b]			0.035
M	115 (28.8%)	48 (39%)	
F	284 (71.2%)	75 (61%)	
Marital Status (N (%))[b]			0.083
Other	130 (32.6%)	51 (41.5%)	
Married/Cohabiting	269 (67.4%)	72 (58.5%)	
Year in the field (N (%))[b]			<0.001
<=10	163 (40.8%)	73 (59.3%)	
>10	236 (59.2%)	50 (40.7%)	
N_shift (N (%))[b]			0.834
No	235 (58.9%)	74 (60.2%)	
Yes	164 (41.1%)	49 (39.8%)	
V_Patients (N (%))[b]			0.556
No	28 (7%)	11 (8.9%)	
Yes	371 (93%)	112 (91.1%)	
V_Caregivers (N (%))[b]			0.206
No	44 (11%)	19 (15.4%)	
Yes	355 (89%)	104 (84.6%)	
V_Supervisor (N (%))[b]			1
No	124 (31.1%)	38 (30.9%)	
Yes	275 (68.9%)	85 (69.1%)	
V_Colleagues (N (%))[b]			0.060
No	64 (16%)	29 (23.6%)	
Yes	335 (84%)	94 (76.4%)	

N_Shift: "On call" shift; V_Patients/Caregivers/Colleagues/Supervisor: perception of being valued by patients, patients' caregivers/colleagues/supervisor.
[a]t-test.
[b]Fisher exact test.

Appendix B. Hierarchical multiple linear regression on the Compassion Satisfaction Scale of the ProQoL (PQ_CSS).

	Predictor	R^2	Adj R^2	F	B	SE B	β	P
Model 1		0.171	0.169	81.87*				
	TAS-20				−0.255	0.028	−0.413	<0.001
Model 2		0.222	0.218	56.58*				
	TAS-20				−0.228	0.028	−0.369	<0.001
	IRI_EC				2.22	0.434	0.231	<0.001
Model 3		0.27	0.264	48.65*				
	TAS-20				−0.201	0.027	−0.327	<0.001
	IRI_EC				2.227	0.422	0.231	<0.001
	V_Colleagues				2.843	0.561	0.222	<0.001

*p < 0.001.
TAS-20: Toronto Alexithymia Scale-20; IRI-EC: Empathic Concern subscale of the Interpersonal Reactivity Index; V_Colleagues: perception of being valued by colleagues.

Appendix C. Hierarchical multiple linear regression on the Burnout Scale of the ProQoL (PQ_BS).

	Predictor	R^2	Adj R^2	F	B	SE B	β	P
Model 1		0.269	0.267	145.7*				
	TAS-20				0.308	0.026	0.518	<0.001
Model 2		0.350	0.347	106.8*				
	TAS-20				0.275	0.025	0.463	<0.001
	V_Supervisor				−3.601	0.510	−0.291	<0.001

*p < 0.001.
TAS-20: Toronto Alexithymia Scale-20; V_Supervisor: perception of being valued by supervisor.

Appendix D. Hierarchical multiple linear regression on the Secondary Traumatic Stress Scale of the ProQoL (PQ_STSS).

	Predictor	R^2	Adj R^2	F	B	SE B	β	P
Model 1		0.011	0.009	4.46*				
	Gender				1.313	0.623	0.105	0.036
Model 2		0.191	0.187	46.79**				
	Gender				1.815	0.566	0.146	0.001
	TAS-20				0.251	0.027	0.426	<0.001
Model 3		0.226	0.220	38.51**				
	Gender				1.478	0.560	0.119	0.009
	TAS-20				0.201	0.029	0.342	<0.001
	IRI_PD				1.818	0.429	0.206	<0.001
Model 4		0.253	0.245	33.30**				
	Gender				0.935	0.570	0.075	0.102
	TAS-20				0.224	0.029	0.381	<0.001
	IRI_PD				1.596	0.427	0.181	<0.001
	IRI_EC				1.594	0.428	0.174	<0.001
Model 5		0.279	0.270	30.45**				
	Gender				0.983	0.561	0.079	0.080
	TAS-20				0.222	0.028	0.378	<0.001
	IRI_PD				1.573	0.419	0.178	<0.001
	IRI_EC				1.629	0.421	0.178	<0.001
	N_Shifts				1.875	0.492	0.163	<0.001

(*continued on next page*)

Appendix D (*continued*)

Predictor	R^2	Adj R^2	F	B	SE B	β	P
Model 6	0.304	0.293	28.5**				
Gender				0.784	0.555	0.063	0.158
TAS-20				0.202	0.028	0.343	<0.001
IRI_PD				1.655	0.413	0.188	<0.001
IRI_EC				1.651	0.414	0.180	<0.001
N_Shifts				1.819	0.485	0.158	<0.001
V_Supervisor				−1.957	0.527	−0.160	<0.001

* $p < 0.05$.
** $p < 0.001$.
TAS-20: Toronto Alexithymia Scale-20; IRI-EC: Empathic Concern; IRI-PD: Personal Distress subscale of the Interpersonal Reactivity Index; N_Shift: "On call" shift; V_Supervisor: perception of being valued by supervisor.

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