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Alexithymia and professional quality of life in radiation oncology: the mediator effect of the professional profile

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Abstract

Background and purpose.

Cancer care is taxing. Alexithymia, a personality construct characterized by difficulties in identifying and describing feeling and emotions, an externally-oriented thinking style and scarcity of imagination and fantasy, is significantly correlated with higher levels of both secondary traumatic stress (STS) and burnout and lower levels of compassion satisfaction in medical professionals in radiation oncology. In this study, we aimed to assess the difference in professional quality of life (QoL) and the association with alexithymia in this multidisciplinary field depending on the specific profession (radiation/ clinical oncologist RO, medical physicist MP, and radiation therapist RTT).

Material and Methods.

The study was conducted via an online questionnaire, receiving 1500 submissions between May and October 2018. Alexithymia was assessed via the Toronto Alexithymia Scale (TAS-20) and professional QoL was evaluated using the Professional Quality of Life Scale (ProQoL) version 5. Comparisons between the RO, RTT, and MP groups were performed by ANOVA or MANOVA, followed by Bonferroni corrected ANOVAs for continuous variables, and Pearson's chi-square test for categorical variables. The effect size was determined by calculating partial eta-squared (η^2).

Results.

Profession had a moderator role on the correlation between alexithymia and STS, with RO being at a higher risk than MP and RTT. Further, the results of this study demonstrate the consistent point prevalence of decreased well-being at work even for professional categories such as MP despite the more technical profile and reduced direct patient interaction.

Conclusions.

This study demonstrates the importance of alexithymia as a factor contributing to decreased professional quality of life amongst radiation oncology professionals. Alexithymic ROs are impacted to a higher extent by the indirect exposure to others' trauma. It is pertinent to address this in professional education, aiming to improve quality of life for medical personnel.

Introduction

Radiation oncology is a medical discipline based on the clinical use of ionizing radiation to treat cancer patients [1,2]. It consists of a multi-professional framework, comprising different occupational profiles such as radiation and/or clinical oncologists (ROs), medical physicists (MPs), radiation therapists (RTTs) and radiobiologists [1]. All professionals are involved, to various extent, in the specific steps of cancer treatment with radiotherapy, including delivery of multimodal personalized cancer treatments, safe utilisation of advanced technologies and optimisation of therapeutic processes [2]. Those with direct patient/caregiver contact are frequently confronted with death and suffering [3]. While, those having a more technically-oriented professional profile are confronted, on a daily basis, with the challenges of ensuring a safe and accurate delivery of treatments, dealing with technical issues and promoting a good communication amongst radiation oncology professionals [4]. On a general level, radiation oncology professionals are requested to face increasing productivity requirements, balancing patient caseload, demanding regulatory requirements and limited professional autonomy, potentially experiencing ‘administrative fatigue’ [5,6]. In this highly demanding, patient-centered working environment, a considerable proportion of radiation oncology professionals experience personal discomfort with different physiological manifestations, including personal fatigue and emotional distress, anxiety, depressive symptoms, and burnout, with substantial consequences on professional well-being and performance at work as shown by three recent studies [3-5]. There, we investigated the professional quality of life amongst radiation oncology professionals, evaluating the levels of ‘compassion fatigue’ and ‘compassion satisfaction’ for the three professional disciplines (ROs, MPs, RTTs) and assessing the potential correlation with the personality traits of alexithymia and empathy [3-5]. We previously demonstrated that alexithymia, a personality trait characterized by difficulties in identifying and describing feelings and emotions, an externally-oriented thinking style and reduced imagination and fantasy, was significantly correlated with higher levels of both secondary traumatic stress and burnout and lower levels of compassion satisfaction at work [3-5]. The level of professional well-being in radiation oncology may vary

amongst the three professional profiles, depending on the specific characteristics of the different disciplines, together with working duties and dynamics, organizational characteristics and different levels of interaction with the patient.

Therefore, the goal of this study is to assess the difference in professional quality of life in radiation oncology depending on the specific profession. In particular, to better understand the possible mechanisms underlying the association between professional quality of life and alexithymia, we conducted a moderation model to explore whether the professional profile serves as a moderator of the relationship between alexithymia and well-being at work amongst different radiation oncology professionals.

Methods

The PRO BONO study was developed within the Young European Society for Radiotherapy and Oncology (yESTRO) Committee, inviting participants, on a voluntary basis via email, social media and other ESTRO communication channels. Data was collected between May and October 2018. The questionnaire was administered through an online platform (SurveyMonkey Inc., San Mateo, California, USA; www.surveymonkey.com), collecting socio-demographic and professional information, while protecting anonymity of the respondents.

Measures

Alexithymia was assessed via the Toronto Alexithymia Scale (TAS-20) [7]. It comprises 20 items, each scored on a 5-point Likert scale. The results provide a TAS-20 total score and three subscale scores: Difficulty Identifying Feelings (DIF), which measures the inability to distinguish specific emotions or between emotions and the bodily sensations of emotional arousal; Difficulty Describing Feelings (DDF), which assesses the inability to verbalize one's emotions to other people; and Externally-Oriented Thinking (EOT), which evaluates the tendency of individuals to focus their attention externally and not on the inner emotional experience (Taylor et al., 2003).

The TAS-20 cut-off scores are as follows: ≤ 51 no alexithymia, 52–60 borderline alexithymia, ≥ 61 alexithymia. The scale has shown good internal consistency (Cronbach's α : ≥ 0.70) and test-retest reliability [8].

Professional QoL was assessed using the Professional Quality of Life Scale (ProQoL), version 5 [9]. It consists of 30 items rated on 5-point Likert scale, which assess two main aspects of professional QoL: compassion satisfaction (positive dimension) and compassion fatigue (negative dimension). Particularly, the Compassion Satisfaction Scale (CSS) evaluates the pleasure derived from being able to perform one's job well. Conversely, the compassion fatigue includes both the Burnout Scale (BS), which assesses feelings of hopelessness, exhaustion, frustration and difficulties in performing one's job effectively, and the Secondary Traumatic Stress Scale (STSS), which concerns negative feelings (e.g., fear, sleep difficulties, intrusive images) driven by work-related secondary exposure to excessive or traumatic stressful events.

Based on the corresponding percentile scores defined in the ProQoL Manual, participants can be classified into low (score below the 25th percentile), average (25th-75th percentile), and high (score above the 75th) groups for each scale [8].

The scale has shown good internal consistency (Cronbach's α ranging from 0.72 to 0.87) and test-retest reliability [10].

Statistical analyses

The statistical analyses were carried out with the Statistical Package for Social Science, version 25.0 (IBM SPSS Statistics for Macintosh, Armonk, NY, USA).

Indices of asymmetry and kurtosis were used to test for normality of the data. Values for asymmetry and kurtosis between -1 and $+1$ were considered acceptable in order to prove normal univariate distribution.

First, comparisons between the RO, RTT, and MP groups were performed by means of one-way analyses of variance (ANOVAs) or one-way multivariate analysis of variance (MANOVA),

followed by Bonferroni corrected ANOVAs, for continuous variables, and Pearson's chi-square test (χ^2) for categorical variables. The effect size was determined by calculating partial eta-squared (η^2).

Secondly, moderated models of regression analyses were used to test the moderation effect of profession in the relationship between alexithymia and professional QoL. Following a standard procedure, the measure of alexithymia was centred before performing the moderation analysis, in order to avoid potentially problematic multicollinearity with the interaction term [11]. Moreover, considering that our moderator variable (profession) was made up of three categories (RO, RTT, and MP), two dummy variables (ROs vs. RTTs and ROs vs. MPs) were preliminarily created, using the most represented group (RO) as a baseline sample against which the other two groups were compared. Moderation was examined by constructing three separate hierarchical regression models that included ProQoL subscales, as dependent variables, and profession and alexithymia, in the first step, and two multiplicative terms representing the interaction between profession and alexithymia, in the second step, as predictor variables. The level of significance for all statistical tests was set at $p < 0.05$.

Results

All variables included in the analyses were normally distributed according to the criteria employed. As a measure of internal consistency, in our sample, the Cronbach's alpha was good for the TAS-20 total score (α score = 0.76) and good/very good for the ProQoL subscales (α scores ranging from 0.75 to 0.87).

Sociodemographic and work-related characteristics

Sociodemographic and professional characteristics are presented in **Table 1** for the three professional categories. Significant differences between the three groups were found in terms of age, and marital

status. Similarly, the three groups differed significantly in certain work-related variables: the number of years in the field and in on call shifts.

Alexithymia and Professional Quality of Life

The comparisons between the three professions with respect to alexithymia and professional QoL scores are shown in **Table 2**.

As far as alexithymia is concerned, a one-way MANOVA revealed a significant difference between the three groups on the combined subscales scores of the TAS-20, Pillai's trace = 0.018, $F(6, 3062) = 4.687, p < 0.001$, partial $\eta^2 = 0.01$. Follow up post-HOC univariate ANOVAs showed that only the TAS-20 DDF factor score ($p = 0.004$; partial $\eta^2 = 0.01$) was statistically significant different between the three groups, using a Bonferroni adjusted α level of .017. In particular, Tukey HSD post-hoc tests revealed a statistically significant difference between the RO and MP groups (-0.73, 95% CI (-1.29 to -0.16), $p = 0.007$), and between the RTT and MP groups (-0.82, 95% CI (-1.46 to -0.18), $p = 0.008$).

Regarding the professional QoL, a one-way MANOVA showed a significant difference between the three groups on the subscale scores of the ProQoL, Pillai's trace = 0.052, $F(6, 3062) = 13.598, p < 0.001$, partial $\eta^2 = 0.03$. Follow-up univariate ANOVAs revealed that all the three subscales scores of the ProQoL (ProQoL CSS, $p = 0.001$, partial $\eta^2 = 0.01$; ProQoL BS, $p < 0.001$, partial $\eta^2 = 0.01$; ProQoL STSS, $p < 0.001$, partial $\eta^2 = 0.02$) were statistically significant different between the three groups, using a Bonferroni adjusted α level of .017. Particularly, regarding the ProQoL CSS, Tukey HSD post-hoc tests showed a statistically significant difference between the RO and MP groups (1.37, 95% CI (0.45 to 2.28), $p = .001$), and between the RTT and MP groups (1.57, 95% CI (0.52 to 2.61), $p = .001$). As far as the ProQoL BS is concerned, Tukey HSD post-hoc tests revealed a statistically significant difference between the RO and RTT groups (1.07, 95% CI (0.27 to 1.88), $p = .005$), and between the RTT and MP groups (-1.60, 95% CI (-2.59 to -0.60), $p = .001$). Finally, for the ProQoL STSS, Tukey HSD post-hoc tests showed a statistically significant difference between the RO and RTT groups (1.12, 95% CI (0.28 to 1.96), $p = .005$), between the

RO and MP groups (2.33, 95% CI (1.41 to 3.24), $p < .001$), and between the RTT and MP groups (1.21, 95% CI (0.16 to 2.25), $p = .019$).

Profession, alexithymia, and professional QoL: Moderation models

Three hierarchical multiple regression analyses were performed to examine whether adding the interaction terms (TAS-20 \times Profession) to the regression models may act as a moderator of the relationship between alexithymia and the different dimensions of professional QoL. The full results of the three regression analyses are reported in **Appendices A-C**; the final models for each regression analysis are shown in **Table 3**.

Regarding the ProQoL STSS, the final model explained a significant amount (22%) of the secondary traumatic stress variance, $F(5, 1529) = 84.130, p < .001$. Significant predictors were found to be both profession (ROs vs. RTTs, $\beta = -0.081, p = .001$; ROs vs. MPs, $\beta = -0.167, p < .001$) and TAS-20 total score ($\beta = 0.472, p < .001$), as well as the interaction term (TAS-20 \times ROs vs. MPs, $\beta = -0.063, p = .016$).

In order to examine better the moderation effect, the significant interaction was plotted, using the PROCESS macro 3.4 for SPSS (Hayes, 2017). As shown in **Fig. 1**, the slope of the correlation curve is more pronounced for the RO group, suggesting that the level of alexithymia has a significantly higher impact on the ProQoL STSS scores for ROs compared to MPs.

For the other subscales of the ProQoL, no moderating effect of profession in the relationship between alexithymia and professional QoL was detected (**Table 3**).

Discussion

With the PRO BONO project, we investigated the professional quality of life, including burnout, amongst radiation oncology professionals, focusing on its correlation with the personality constructs of alexithymia and empathy [3-5]. On a cross-sectional design, we provided data on more than 1500 professionals working in 94 countries as ROs, MPs and RTTs. In the present study, we cross-compared the three dimensions of the professional well-being (compassion satisfaction, secondary traumatic stress and burnout), as assessed by the PROQoL scale, among the three professional profiles working in the field of radiation oncology.

For compassion satisfaction, a measure of the pleasure one derives from being able to exploit his/her own work, the rates of professionals scoring high ranged from 20.1% (for MPs) to 30.6% (for RTT), while those scoring low ranged from 26.3% (ROs and RTTs) to 30.2% (MPs). Conversely, the rates of professionals scoring high on burnout ranged from 25.6% (for RTTs) to 30.9% (for ROs). The point-prevalences for burnout found in our study compare consistently with the literature data. A recent meta-analysis investigating burnout in oncology care providers reported average rates of emotional exhaustion around 32% [12]. Signs of personal distress and burnout were reported in 20 to 36% of professionals working in the oncology unit, in the meta-analysis by Trufelli et al [13]. Interestingly, this finding seems to be consistent in radiation oncology, with comparable estimates for professionals at different stages of their career.

Nevertheless, a few differences were found, with respect to professional quality of life, among the 3 professional profiles investigated. With respect to compassion satisfaction, MPs had a significantly lower average score compared to ROs and RTTs, together with a significantly higher proportion of respondents scoring below the 25th percentile (low level of satisfaction) and a lower proportion scoring above the 75th (high level of satisfaction). This is paralleled by the rates observed for burnout in the three professions, with MPs having a significantly higher average score compared to ROs, and

RTTs, together with a lower proportion of respondents scoring below the 25th percentile (low level of burnout) and a higher proportion scoring above the 75th (high level of burnout).

In general, most of the professional distress experienced by healthcare providers involved in oncology is related to the ‘compassion fatigue’ derived from the management of cancer patients, including being confronted with death on a daily basis, taking critical decisions, delivering treatment having potential severe side effects and communicating proficiently with patients and caregivers [3]. This also applies to radiation oncology professionals, particularly those heavily involved in patient care (ROs and RTTs). However, compassion fatigue is likely not the main cause of professional distress for MPs, since they are to a far lesser extent involved in the direct face-to-face management of patients compared to ROs or RTTs.

Given the crucial role of MPs in the generation of treatment plans for patients, together with careful control of delivery safety and global quality assurance of the radiotherapy processes, these professionals can often be exposed to consistent pressure from colleagues and supervisors with a consequent effect on professional well-being. This pressure and workload may have been increased in the last decades due to the increasing complexity of radiotherapy treatment techniques and multimodal cancer care that introduced new challenges for radiation oncology professionals/MPs [4,15]. A recent study of Jasperse *et al*, who assessed job satisfaction in New Zealand radiation oncology departments, described a lower level of personal accomplishment for MPs, compared to other professionals having a higher level of patient contact [16]. Excessive workload, lack of recognition and lack of professional development opportunities were found to be significant risk factors for decreased professional quality of life, together with organizational stressors, structural and environmental conditions (time and efficiency pressure, participation in decision-making, professional autonomy, role conflicts) [17,18]. This provides evidence on the importance of this type of stressors in radiation oncology.

Another interesting finding was the significantly higher average score observed for MPs with respect to the subscale ‘Difficulty Describing Feelings’ (DDF), within the alexithymia assessment as per TAS-20 questionnaire.

Alexithymia implies deficit in emotional word processing and cognitive interpretations of emotions, alteration in emotional arousal, deficits in emotional perception and embodiment, which can alter a proficient interaction within the working environment [20]. The diminished ability to accurately describe and express emotions of alexithymic subjects or for those with an alexithymic trait is thought to impair the regulation of emotion by interpersonal communication, hindering empathic abilities and potentially being a source of distress in the working environment. This may partially explain the results in terms of professional well-being observed for the MP population.

Alexithymia was found to have a point prevalence ranging from 10.5% (for RTTs) to 13.6% (for ROs) in the cohort we analysed. This is in line with two large population-based studies performed in Finland and Germany, where the prevalence of high alexithymia was observed to be 10% in the general population [21,22]. Alexithymia is a dimensional trait that is normally distributed in the population and is slightly more prevalent in men [21]. This seems to explain the slightly lower prevalence in the RTT group compared to ROs and MPs, since RTTs had a higher proportion of female professionals (71.2% for RTTs vs 52.5% and 49.7% for ROs and MPs, respectively). The relatively higher prevalence of alexithymia within the MP population may be partially responsible for the lower level of professional quality of life in this group. The significant correlation between alexithymia and all three domains of professional quality of life (compassion satisfaction, burnout and secondary traumatic stress) was confirmed within the whole cohort for the three professions (RO, MP and RTT) in the hierarchical multiple regression models, highlighting its important role in the modulation of well-being at work in the field of radiation oncology.

Since radiation oncology professionals are a heterogeneous group in terms of educational background, working duties, responsibility and exposure to patient’s needs, we hypothesized a different contribution of the professional category on the relationship between alexithymia and

professional quality of life. We hence proposed a moderation model to investigate the role of the profession as a moderator of the correlation between alexithymia and professional well-being. Profession had no role in moderating burnout or compassion satisfaction with respect to the level of alexithymia. This means that, even though the presence of alexithymia has a negative effect on both professional satisfaction and burnout, these effects are comparable between the 3 professional profiles, and therefore additional differences between the groups lies outside the mere presence of alexithymia. This further highlights the fact that professional satisfaction and burnout are multifactorial sets of instances pertinent to environmental and psychological aspects of an individual at work and therefore deserve multifaceted considerations [23].

Conversely, the correlation between alexithymia and secondary traumatic stress was significantly moderated by the profession, with ROs exposed to a higher level of STS, the level of alexithymia being equal. STS is defined as the post-traumatic stress from which professionals dedicated to care may suffer due to the indirect exposure to others' trauma and is directly correlated to intensity and duration of exposure to working stressors [24,25]. It is made up of different dimensions including compassion fatigue, shattered assumptions and psychological symptoms [24]. Compassion fatigue, the emotional part of STS, is a state of emotional exhaustion resulting from continued exposure to compassion stress, which is highly prevalent in patient-centred environments such as those of radiation oncology. Shattered assumptions, the cognitive part of STS, refer to the way continuous exposure to traumatic events may shatter a person's assumptions, beliefs or values about the inner self and the external world [25]. Symptoms include those related to post-traumatic stress disorder, including intrusion (being disturbed by images, thoughts, memories related to the trauma), avoidance (behaviours aimed at escaping suffering and the trauma object) and arousal (excess energy caused by the anxiety response displayed towards the trauma object).

STS is correlated with physical and mental health and found to have a profound impact on job's performance [26]. ROs were found to be more prone to STS in case of alexithymia. This can be explained by the specific characteristics of the profession, which requires direct contact with both

patients and caregivers and to be confronted with death and suffering on a daily basis. This specific profile applies to a higher extent to ROs compared to MPs and RTTs. Moreover, STS has been specifically correlated to the years of working experience in healthcare providers, with workers having less professional experience reporting higher compassion fatigue compared to more experienced staff [26]. This is relevant since the category of RO had a higher percentage of participants having ≤ 10 -year working experience.

To conclude, our results demonstrate the important contribution of alexithymia to decreased professional quality of life amongst radiation oncology professionals. Profession had a moderator role on the correlation between alexithymia and STS, with RO being at a higher risk than MP and RTT. Further, we demonstrate the relevant point prevalence of decreased well-being at work even for professional categories such as MP with a supposedly lower chance to interact with patients and a more technical professional profile.

These findings call for action. Different mitigation strategies have already been proposed [27]. Some of them include organization-directed interventions and involve initiative for task restructuring, work evaluation and supervision, management support, communication training and counselling. Others are individual-directed interventions and comprises programs to enhance job competencies, improve coping skills and resilience and training in managing negative emotions [3].

Alexithymia is a personality trait that can be screened for in the student or early career population; this would facilitate the precocious identification of individuals at risk. Early detections should be accompanied with precocious emotional education and training. At present, few components in formal medical training focus on the emotional sphere of students, in terms of both curricular instructions or physician role model indications. This is a mirror of the tendency of medical education to ignore, detach from and distance from emotions. Efforts should be made to teach individuals in training and young professionals in the field of radiation oncology to work skilfully with emotions. One option could be to incorporate emotional awareness into medical student training, MP/RTT/RO residency programs and core curricula, focusing on emotional regulation, emotional intelligence and

tools to better deal with emotions including psychological training, mindfulness meditation and narrative medicine [23].

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Table 1. Sociodemographic and professional characteristics of the 3 professional groups for those who fully completed the online survey ($N = 1535$). Mean (SD) or percentage, ANOVA (F) or chi-squared (χ^2) test are listed.

	RO Group (N = 828)	RTT Group (N = 399)	MP Group (N = 308)	Test (df)	p
Age (years)	41.82 (10.64)	38.95 (9.88)	39.97 (9.63)	F(2, 746.73) = 11.695	< .001*
Gender				$\chi^2(2) = 46.123$	< .001
M	393 (47.5%)	115 (28.8%)	155 (50.3%)		
F	435 (52.5%)	284 (71.2%)	153 (49.7%)		
Marital Status				$\chi^2(6) = 19.691$.003
Single	153 (18.5%)	110 (27.6%)	74 (24%)		
Married/Cohabitant	639 (77.2%)	269 (67.4%)	219 (71.1%)		
Divorced	31 (3.7%)	15 (3.8%)	15 (4.9%)		
Widowed	5 (0.6%)	5 (1.3%)	0 (0%)		
Years in the field				$\chi^2(2) = 23.639$	< .001
≤10	456 (55.1%)	163 (40.9%)	142 (46.1%)		
>10	372 (44.9%)	236 (59.1%)	166 (53.9%)		
'On call' shifts				$\chi^2(2) = 32.696$	< .001
No	366 (44.2%)	235 (58.9%)	181 (58.8%)		
Yes	462 (55.8%)	164 (41.1%)	127 (41.2%)		
Valued by Supervisor				$\chi^2(2) = 4.803$.091
No	238 (28.7%)	124 (31.1%)	73 (23.7%)		
Yes	590 (71.3%)	275 (68.9%)	235 (76.3%)		
Valued by Colleagues				$\chi^2(2) = 2.298$.317
No	119 (14.4%)	64 (16.0%)	37 (12%)		
Yes	709 (85.6%)	335 (84.0%)	271 (88%)		

RO: Radiation Oncologists; RTT: Radiotherapy Technologists; MP: Medical Physicists.

* Significant difference: ROs vs. RTTs, $p < 0.01$; ROs vs. MPs, $p < 0.05$.

Table 2. Alexithymia and Professional QoL scores for the RO, RTT, and MP professionals who fully completed the online survey ($N = 1535$). Mean (SD) or percentage, ANOVA (F) or chi-squared (χ^2) test are listed.

	RO Group (N = 828)	RTT Group (N = 399)	MP Group (N = 308)	Test (df)	<i>p</i>
Alexithymia					
TAS-20 DIF	15.51 (5.61)	15.72 (5.02)	16.04 (5.78)	F(2, 1532) = 1.037	.355
TAS-20 DDF	12.08 (3.60)	11.98 (3.47)	12.81 (3.76) ^a	F(2, 1532) = 5.454	.004*
TAS-20 EOT	19.82 (3.89)	19.63 (3.58)	19.29 (3.56)	F(2, 1532) = 2.324	.098
TAS- 20 Total	47.42 (10.93)	47.33 (9.63)	48.13 (10.21)	F(2, 745.35) = 0.669	.513
<i>Non alexithymic</i>	561 (67.8%)	278 (69.7%)	202 (65.6%)	$\chi^2(4) = 2.355$.671
<i>Borderline</i>	160 (19.3%)	79 (19.8%)	64 (20.8%)		
<i>Alexithymic</i>	107 (12.9%)	42 (10.5%)	42 (13.6%)		
Professional QoL					
ProQoL CSS	37.96 (5.90)	38.16 (5.93)	36.59 (5.69) ^a	F(2, 1532) = 7.498	.001*
<i>Low</i>	218 (26.3%)	105 (26.3%)	93 (30.2%)	$\chi^2(4) = 10.627$.031
<i>Average</i>	377 (45.5%)	172 (43.1%)	153 (49.7%)		
<i>High</i>	233 (28.1%)	122 (30.6%)	62 (20.1%)		
ProQoL BS	25.58 (5.61)	24.51 (5.73) ^b	26.10 (5.49)	F(2, 1532) = 7.886	<.001*
<i>Low</i>	208 (25.1%)	135 (33.8%)	64 (20.8%)	$\chi^2(4) = 18.010$.001
<i>Average</i>	364 (44.0%)	162 (40.6%)	151 (49.0%)		
<i>High</i>	256 (30.9%)	102 (25.6%)	93 (30.2%)		
ProQoL STSS	24.13 (6.00) ^c	23.01 (5.66)	21.81 (5.79)	F(2, 1532) = 18.632	<.001*
<i>Low</i>	151 (18.2%)	91 (22.8%)	98 (31.8%)	$\chi^2(4) = 31.145$	<.001
<i>Average</i>	410 (49.5)	212 (53.1%)	139 (45.1%)		
<i>High</i>	267 (32.2%)	96 (24.1%)	71 (23.1%)		

^a Significant difference: RO vs. MP, $p < 0.01$; RTT vs. MP, $p < 0.01$. ^b Significant difference: RO vs.

RTT, $p < 0.01$; RTT vs. MP, $p < 0.01$. ^c Significant difference: RO vs. RTT, $p < 0.01$; RO vs. MP, $p < 0.01$; RTT vs. MP, $p < 0.05$.

* Significant difference according to Bonferroni correction ($0.05/3 = 0.017$) for follow-up univariate ANOVAs.

RO: Radiation Oncologists; RTT: Radiotherapy Technologists; MP: Medical Physicists; TAS-20:

Twenty-item Toronto Alexithymia Scale; TAS-20 DIF: Difficulty identifying feelings subscale of the

Toronto Alexithymia Scale; TAS-20 DDF: Difficulty describing feeling subscale of the Toronto

Alexithymia Scale; TAS-20 EOT: Externally oriented thinking subscale of the Toronto Alexithymia Scale; ProQoL CSS: Compassion Satisfaction Scale of the Professional Quality of Life Scale; ProQoL BS: Burnout Scale of the Professional Quality of Life Scale; ProQoL STSS: Secondary Traumatic Stress Scale of the Professional Quality of Life Scale. 'Low' and 'High' refer to a score below the 25th percentile or above the 75th percentile, respectively, whereas 'Average' includes the intermediate scores.

Table 3. Final models of the hierarchical multiple regressions with Compassion Satisfaction (ProQoL CSS), Burnout (ProQoL BS), and Secondary Traumatic Stress (ProQoL STSS) as dependent variables and alexithymia as predictor variable, moderated by profession ($N = 1535$).

Predictor variables	B	β	t	R ²	F	ΔR^2	ΔF
ProQoL CSS				.17	62.746**	.001	0.744
ROs vs. RTTs	0.173	0.013	0.529				
ROs vs. MPs	-1.215	-0.083	-3.384**				
TAS 20 (Centred)	-0.219	-0.388	-12.793**				
TAS-20 (Centred) X ROs vs. RTTs	-0.036	-0.030	-1.100				
TAS-20 (Centred) X ROs vs. MPs	0.008	0.006	0.226				
ProQoL BS				.29	125.174**	.01	1.389
ROs vs. RTTs	-1.042	-0.081	-3.594**				
ROs vs. MPs	0.305	0.022	0.958				
TAS 20 (Centred)	0.269	0.498	17.752**				
TAS-20 (Centred) X ROs vs. RTTs	0.040	0.034	1.360				
TAS-20 (Centred) X ROs vs. MPs	0.039	0.032	1.281				
ProQoL STSS				.22	84.130**	.003	2.923
ROs vs. RTTs	-1.100	-0.081	-3.426**				
ROs vs. MPs	-2.469	-0.167	-7.016**				
TAS 20 (Centred)	0.268	0.472	16.003**				
TAS-20 (Centred) X ROs vs. RTTs	-0.026	-0.021	-0.801				
TAS-20 (Centred) X ROs vs. MPs	-0.082	-0.063	-2.411*				

* $p < .05$; ** $p < .01$

ProQoL CSS: Compassion Satisfaction Scale of the Professional Quality of Life Scale; ProQoL BS:

Burnout Scale of the Professional Quality of Life Scale; ProQoL STSS: Secondary Traumatic Stress

Scale of the Professional Quality of Life Scale; RO: Radiation Oncologists; RTT: Radiotherapy

Technologists; MP: Medical Physicists; TAS-20: Twenty-item Toronto Alexithymia Scale.

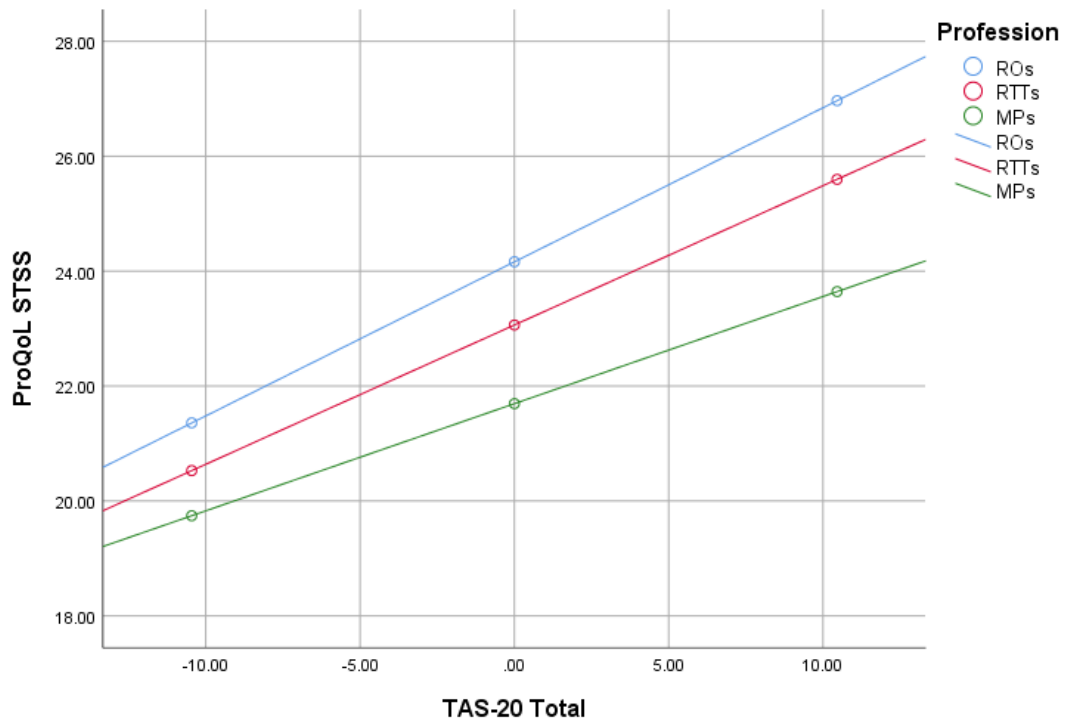


Fig. 1. Illustration for the moderation effect of group (Profession) in the relationship between alexithymia (TAS-20) and professional quality of life (ProQoL STSS).