

Burnout, stress and satisfaction among Australian and New Zealand radiation oncology trainees

John Leung¹ and Pilar Rioseco²

¹ Department of Radiation Oncology, Adelaide Radiotherapy Centre, Genesis Cancer Care, Adelaide, South Australia, Australia

² School of Demography, Australian National University, Canberra, Australian Capital Territory, Australia



J Leung FRANZCR; P Rioseco MSR.

Correspondence

Dr John Leung, Adelaide Radiotherapy Centre, Genesis Cancer Care, 352 South Terrace, Adelaide, SA 5000, Australia.

Email: john.leung@adradcentre.com.au

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Abstract

Introduction: To evaluate the incidence of burnout among radiation oncology trainees in Australia and New Zealand and the stress and satisfaction factors related to burnout.

Methods: A survey of trainees was conducted in mid-2015. There were 42 Likert scale questions on stress, 14 Likert scale questions on satisfaction and the Maslach Burnout Inventory-Human Services Survey assessed burnout. A principal component analysis identified specific stress and satisfaction areas. Categorical variables for the stress and satisfaction factors were computed. Associations between respondent's characteristics and stress and satisfaction subscales were examined by independent sample *t*-tests and analysis of variance. Effect sizes were calculated using Cohens's *d* when significant mean differences were observed. This was also done for respondent characteristics and the three burnout subscales. Multiple regression analyses were performed.

Results: The response rate was 81.5%. The principal component analysis for stress identified five areas: demands on time, professional development/training, delivery demands, interpersonal demands and administration/organizational issues. There were no significant differences by demographic group or area of interest after *P*-values were adjusted for the multiple tests conducted. The principal component analysis revealed two satisfaction areas: resources/professional activities and value/delivery of services. There were no significant differences by demographic characteristics or area of interest in the level of satisfaction after *P*-values were adjusted for the multiple tests conducted. The burnout results revealed 49.5% of respondents scored highly in emotional exhaustion and/or depersonalization and 13.1% had burnout in all three measures. Multiple regression analysis revealed the stress subscales 'demands on time' and 'interpersonal demands' were associated with emotional exhaustion. 'Interpersonal demands' was also associated with depersonalization and correlated negatively with personal accomplishment. The satisfaction of value/delivery of services subscale was associated with higher levels of personal accomplishment.

Conclusions: There is a significant level of burnout among radiation oncology trainees in Australia and New Zealand. Further work addressing intervention would be appropriate to reduce levels of burnout.

Key words: Australia; burnout; New Zealand; satisfaction; stress; trainee.

Introduction

Burnout is a syndrome described by three dimensions: emotional exhaustion, depersonalization and low personal accomplishment.^{1,2} Its prevalence is recognized

among oncology physicians with a recent survey of over 1000 oncologists in the United States revealing 44.7% suffering from burnout.³

There is little data in the Australian and New Zealand setting, but a recent study specifically focusing on the

entire radiation oncologist workforce in Australia and New Zealand revealed almost half (48.5%) were suffering from burnout.⁴

There is even less data on radiation oncology trainees.^{5,6} A French study examined radiation oncology residents, but also included medical oncology and haematology trainees.⁵ The percentage of respondents with burnout in this study was 44% and the authors found no differences between the three specialties.⁵ An Italian study revealed a third of the population suffering from burnout, but this study included young radiation oncologists as well as trainees.⁶

Burnout can have a negative impact on the physician's quality of life with it possibly causing anxiety, depression, insomnia, drug addiction and even increased risk of suicidal ideation.⁷⁻⁹ There are also professional ramifications of burnout with links to absenteeism, job withdrawal, poorer quality of care and even medical errors.^{7,8,10} Given the high levels of burnout identified in radiation oncologists in Australia and New Zealand⁴ and trainees in other medical disciplines,^{5,6} and the lack of research specifically on radiation oncology trainees, this study focuses on examining burnout in Australia and New Zealand radiation oncology trainees.

Apart from establishing the prevalence of burnout, identifying factors that might be associated with burnout can provide a better understanding of the context in which burnout occurs. The identification of these factors and relevant demographic characteristics could allow appropriate intervention and facilitate training for doctors still at an early stage of their careers. A previous study on Australian and New Zealand radiation oncologists established that certain stress and satisfaction factors are associated with emotional exhaustion, depersonalization and personal accomplishment.⁴ For example, demands on time (interruptions, disruption of home life, inability to pursue outside interests, etc.) had a significant effect on emotional exhaustion while stress from continuing professional development and interpersonal demands increased the feelings of depersonalization.⁴

Therefore, the aims of this study were to assess the prevalence of burnout as well as stress and satisfaction in Australian and New Zealand radiation oncology trainees. A secondary aim was to determine the association between stress and satisfaction with burnout.

Methods

The entire Australian and New Zealand radiation oncology trainee workforce was contacted by email. The stress, satisfaction and burnout survey among trainees is a voluntary instrument that included 87 questions. It was developed using Survey Monkey (<http://www.surveymonkey.com>) and included four sections; demographics, stress, satisfaction and burnout. The survey is included in Appendix S1.

The demographic questions included data that were not available in the Royal Australian and New Zealand College of Radiologists (RANZCR) membership database such as working hours, hours on direct patient care, marital status, number of children, personal before tax income and disabilities.

The stress and satisfaction sections used a 7-point Likert Scale with respondents identifying their levels of stress (42 items) and satisfaction (14 items) across a range from 'not at all' to 'very much'.

These questions were developed by the principal author and many were based on the previous study.⁴ They were discussed, reviewed and approved by the Economic Workforce Committee.

Burnout was assessed with the Maslach Burnout Inventory – Human Services Survey (MBI-HSS).¹ This validated inventory measures three aspects of burnout; emotional exhaustion, depersonalization and personal accomplishment. It has 22 questions with each question having an answer rated on a 7-point scale ranging from 'never' to 'everyday'. Scores ≥ 27 in the emotional exhaustion subscale, ≥ 10 in the depersonalization subscale or ≤ 33 in the personal accomplishment subscale are considered to have a high burnout for health workers.¹

The MBI-HSS is unable to be reproduced without permission from the publisher, MBI-HSS Mindgarden Inc.

The survey invitation was distributed on 17 July 2015 with weekly email reminders until 28 August 2015. Weekly email reminders were also sent out to those who had commenced, but not completed the survey. The decision was made to close the survey because very few responses were obtained in the last two email reminders.

There were 135 radiation oncology trainees, including five on a break-in-training who were sent an invitation to participate. They were sent a unique URL to the survey for identifying participants so reminders could be sent out and for obtaining additional demographic data.

Statistical analysis

The 42 stress and 14 satisfaction questions were subjected to a principal component analysis (PCA). A PCA converted these items into principal components. Stress and satisfaction subscales were obtained from taking the mean of the items grouped in each principal component. The subscales rather than the individual stress and satisfaction items were analysed.

The respondent characteristics and variables of interest were summarized in a descriptive analysis. Categorical variables (three categories) for the stress and satisfaction subscales were also computed. The association between respondent characteristics and the stress and satisfaction subscales were examined using independent sample *t*-tests which compared two independent groups. Analysis of variance (ANOVA) was used to compare three or more groups. This type of analysis was also conducted to examine the association between respondents'

Table 1. Demographic data

	n	%/mean (SD)
Sex		
Male	55	50.0
Female	55	50.0
Age		
<30 years	38	34.5
30–34 years	50	45.5
35 years	22	20.0
Generation		
Generation X (1965–1981)	32	29.1
Generation Y (1982–2000)	78	70.9
Marital status		
Married (registered or de facto)	67	60.9
Separated/Divorced	3	2.7
Never Married	40	36.4
Training network		
New South Wales Northern Alliance	22	20
Victoria Network (Victranet)	19	17.3
Queensland Network	19	17.3
New South Wales Southern Network	16	14.5
New Zealand Network	14	12.7
Western Australia/Singapore	12	10.9
South Australia Network	8	7.3
Branch network		
Queensland	19	17.3
New South Wales	34	30.9
Australian Capital Territory	4	3.6
Victoria	17	15.5
Tasmania	2	1.8
South Australia	8	7.3
Northern Territory	0	0.0
Western Australia	5	4.5
New Zealand	14	12.7
Overseas-Singapore	7	6.4
Year level		
Year 1	18	16.4
Year 2	23	20.9
Year 3	22	20
Year 4	17	15.5
Year 5	23	20.9
Year 6+	7	6.4
Highest academic qualification		
Bachelor/honours degree	88	80
Master degree	10	9.1
Postgraduate certificate/diploma	8	7.2
Doctoral degree	4	3.6
Spouse's work		
Works full time	62	70.5
Work part time	12	13.6
Not currently working	12	13.6
Work from home	2	2.3
Children		
No children	76	69.1
Has children	34	30.9
Working hours in a typical week	110	47.1 (9.5)
Time spent on direct patient care in a typical week	110	30.5 (9.8)
Income		
≤99,000	32	34.0
100,000–109,000	28	29.8

Table 1. (continued)

	n	%/mean (SD)
≥110,000	34	36.4
Areas of interest		
Brachytherapy	29	26.4
Breast	39	35.5
Gastrointestinal	37	33.6
Gynaecological	23	20.9
Head and neck	36	32.7
Lung	52	47.3
Neurology	30	27.3
Paediatrics	12	10.9
Palliative care	49	44.5
Sarcoma	12	10.9
Skin	30	27.3
Urology	36	32.7
Other	10	9.1

characteristics and the three burnout scales. Effect sizes were calculated using Cohen's *d* when significant mean differences were observed. The Holm Bonferroni correction was used to account for the multiple tests conducted. Correlations were used to identify bivariate associations between the stress and satisfaction subscales and the three burnout scales.

Multiple regression analyses were performed using the different stress and satisfaction subscales to predict emotional exhaustion, depersonalization and personal accomplishment, while controlling for socio-demographic characteristics. Explanatory variables that showed bivariate associations ($p < 0.1$) with the outcome variables were included in the multiple regressions. The level of significance was set at 0.05 and Stata 12 (Stata Corp, College Station, TX, USA) was used.

Results

Demographic data

There was an 81.5% response rate ($n = 110$), but three respondents did not complete the whole survey leaving a 79.3% complete response rate ($n = 107$). The demographic data are presented in Table 1. Males accounted for 50% of respondents ($n = 55$) and the median age was 31.4 years with most trainees in the 31–34 age bracket. Respondents were reasonably divided into the five years of training, although 6.4% were in year six and beyond. Most respondents were from Australia (87.3%, $n = 96$) with the New South Wales Northern Alliance having the most respondents (20.0%, $n = 22$). The median hours worked per week was 45 hours (mean 47.1) with a median of 30.0 hours of direct patient care (mean = 30.5). Most respondents were married or de facto (60.9%, $n = 67$) and most were working full time (70.5%). Trainees in Australia and New Zealand reported an average income of around 103,000 dollars. Participants were

Table 2. Stress items and grouping into five categories

Demands on time (alpha = 0.90)	Lack of protected time
	Having conflicting demands on your time
	Having too great an overall volume of work
	Interruptions (phone calls, radiation therapists, administrative staff, medical staff)
	Feeling under pressure to meet deadlines
	Disruption of home life because of long work hours
	Inability to pursue outside interests
	Other meetings (practice, departmental, peer review)
	Demands from patient's relatives
	Being involved with the suffering of your patients
Professional development/training (alpha = 0.87)	Keeping up with the curriculum
	Doing assignments, doing critical evaluations and other tasks associated with training
	Keeping up to date with current critical research
	Verification imaging approval
	Attendance at multidisciplinary meetings
	Presenting at multidisciplinary meetings
	Participation in clinical audits
	Keeping up with new technologies (IMRT, stereotactic etc.)
	Keeping up with the literature
	Increasing specialization
Delivery demands (alpha = 0.79)	Contouring
	Clinical evaluation of new patients
	Clinical evaluation of follow ups
	Treatment reviews
	Planning referral and booking
	Ward consults
Interpersonal demands (alpha = 0.74)	Ward rounds
	Teaching of other staff
	Difficulties with radiation oncology trainee colleagues
	Difficulties with other trainee colleagues
	Difficulties with your consultant
	Difficulties with junior medical staff
	Difficulties with other staff
	Discrimination because of gender
	Discrimination because of race
	Feeling that you have insufficient input into management of your unit
Administration/organizational issue (alpha = 0.77)	Having inadequate facilities (e.g. equipment, space to do your job adequately)
	Feeling that your accumulated skills and experience are not being put to good use
	Documentation
	Thinking about your current remuneration level
	Non-clinical ward duties
	Documenting diagnosis in the oncology information system

asked to select their main areas of interest and were able to select multiple areas. The three most popular areas were lung, palliative and breast work in descending order.

Table 3. Distribution of responses in categories for stress subscales

Stress subscales		Not at all/not much	A bit/a reasonable amount	Quite a bit/a lot/very much
		(0–1)	(2–3)	(4–6)
Demands on time	n	28	66	14
	%	25.9	61.1	13.0
Professional development/training	n	39	66	3
	%	36.1	61.1	2.8
Delivery demands	n	81	27	0.0
	%	75.0	25.0	0.0
Interpersonal demands	n	103	5	0.0
	%	95.4	4.6	0.0
Administration/organizational issues	n	76	29	3
	%	70.4	26.9	2.8

Stress

Five stress subscales were identified through the PCA. These were demands on time, professional development/training, delivery demands, interpersonal demands and administration/organizational issues (Table 2). The five subscales showed good internal consistency (alphas of 0.90, 0.87, 0.79, 0.74 and 0.77 respectively). The distribution of responses for the stress subscale is outlined in Table 3. Results in Table 3 (percentages) and Table 4 (means) indicate that the largest source of stress for trainees was demands on time with 13.0% of respondents stressed by demands on time 'quite a bit', 'a lot' or 'very much' and 61.1% 'a bit' or 'a reasonable amount'. The second largest source of stress was professional development/training.

The independent samples *t*-tests and ANOVAS revealed no significant differences by demographic group or area of interest after adjusting for the multiple tests conducted.

Satisfaction

Two satisfaction subscales were identified through the PCA: resources/professional activities and value/delivery of services (Table 5). The internal consistency was robust for the two subscales (alphas 0.91 and 0.89 respectively). As shown in Table 6 (percentages) and Table 7 (means), trainees were highly satisfied with resources/professional activities and value/delivery of services. The percentage of trainees classified in the 'quite a bit', 'a lot' or 'very much' categories for resources/professional activities was 34.6% and for value/delivery of services was 50.5%.

The independent samples *t*-tests and ANOVAS showed no significant differences by demographic characteristics or area of interest in the level of satisfaction after adjusting for the multiple tests conducted.

Burnout: univariate analysis

According to the cut-off points described in the materials and methods section, 13% (n = 14) of trainees had burnout in all three subscales. A total of 19% (n = 20) had burnout in two out of three subscales while another 25% (n = 27) had burnout in one category.

A total of 43% (n = 46) had no burnout in all three scales (Table 8). Nearly half of trainees (49.5%) scored

highly in emotional exhaustion or depersonalization (Table 8).

Similar to the results for stress and satisfaction, the independent samples *t*-tests revealed that trainees did not differ significantly in their levels of burnout by demographic group or area of interest.

That is to say, the results indicated that there was no one particular group that showed higher levels of burnout (Table 9).

Table 4. Trainees' stress results

Demographic variables	Stress factors									
	Demands on time		Professional development/training		Delivery demands		Interpersonal demands		Administration/organizational issues	
	(range 0.5–6.0)		(range 0.5–4.5)		(range 0.0–3.9)		(range 0.0–2.4)		(range 0.0–5.2)	
	Mean (SD)	p	Mean (SD)	p	Mean (SD)	p	Mean (SD)	p	Mean (SD)	p
All respondents	2.6 (1.1)	–	2.2 (0.8)	–	1.4 (0.7)	–	0.7 (0.5)	–	1.5 (0.9)	–
Sex										
Male	2.5 (1.0)	0.33	2.2 (0.9)	0.52	1.5 (0.6)	0.40	0.7 (0.6)	0.59	1.6 (1.0)	0.92
Female	2.7 (1.2)		2.3 (0.8)		1.4 (0.7)		0.8 (0.6)		1.5 (0.9)	
Age										
<30 years	2.6 (1.1)	0.89	2.4 (0.9)	0.49	1.6 (0.7)	0.11	0.6 (0.5)	0.08	1.5 (1.0)	0.92
30–34 years	2.5 (1.1)		2.2 (0.8)		1.4 (0.7)		0.9 (0.6)		1.5 (0.8)	
35+ years	2.7 (1.0)		2.2 (0.7)		1.2 (0.7)		0.6 (0.4)		1.6 (1.0)	
Generation										
Generation X (1965–1981)	2.7 (1.1)	0.30	2.3 (0.8)	0.72	1.3 (0.7)	0.37	0.8 (0.5)	0.85	1.7 (1.0)	0.27
Generation Y (1982–2000)	2.5 (1.0)		2.2 (0.8)		1.5 (0.7)		0.7 (0.5)		1.5 (1.0)	
Marital status										
Married (registered or de facto)	2.8 (1.1)	0.03	2.3 (0.9)	0.11	1.5 (0.6)	0.32	0.7 (0.6)	0.89	1.7 (0.9)	0.14
Not married (separated/divorced/never married)	2.3 (0.9)		2.1 (0.7)		1.4 (0.8)		0.8 (0.5)		1.4 (1.0)	
Spouse's work										
Works full time	2.8 (1.1)	0.82	3.0 (1.1)	0.24	1.3 (0.2)	0.74	1.1 (0.9)	0.32	2.3 (1.4)	0.26
Does not work full time	2.6 (1.1)		2.2 (0.8)		1.5 (0.7)		0.7 (0.6)		1.6 (0.9)	
Children										
No children	2.5 (1.1)	0.33	2.3 (0.8)	0.54	1.5 (0.7)	0.47	0.8 (0.6)	0.43	1.5 (1.0)	0.54
Has children	2.7 (1.0)		2.2 (0.9)		1.4 (0.6)		0.7 (0.5)		1.6 (1.0)	
Income										
≤99,000	2.8 (0.9)	0.76	2.3 (0.8)	0.98	1.6 (0.7)	0.52	0.7 (0.5)	0.73	1.7 (1.1)	0.54
100,000–109,000	2.6 (1.0)		2.3 (0.8)		1.5 (0.6)		0.8 (0.7)		1.5 (0.9)	
≥110,000	2.6 (1.3)		2.3 (0.9)		1.4 (0.7)		0.7 (0.5)		1.5 (0.8)	
Areas of interest										
Brachytherapy	2.8 (1.2)	0.29	2.4 (0.9)	0.25	1.5 (0.7)	0.39	0.6 (0.7)	0.28	1.7 (1.0)	0.31
Breast	2.6 (1.0)	0.66	2.3 (0.7)	0.87	1.4 (0.7)	0.85	0.7 (0.5)	1.00	1.4 (0.7)	0.40
Gastrointestinal	2.4 (0.8)	0.28	2.2 (0.9)	0.95	1.4 (0.5)	0.69	0.7 (0.6)	0.93	1.5 (0.7)	0.51
Gynaecological	2.6 (1.4)	0.89	2.4 (1.0)	0.44	1.3 (0.7)	0.39	0.6 (0.6)	0.24	1.6 (0.9)	0.61
Head and neck	2.4 (1.0)	0.16	2.2 (0.9)	0.65	1.3 (0.6)	0.18	0.7 (0.6)	0.34	1.5 (0.9)	0.51
Lung	2.6 (0.9)	0.92	2.2 (0.9)	0.51	1.4 (0.5)	0.39	0.7 (0.5)	0.95	1.6 (0.9)	0.46
Neurology	2.5 (0.9)	0.43	2.1 (0.8)	0.38	1.4 (0.7)	0.47	0.8 (0.6)	0.32	1.5 (0.9)	0.90
Palliative care	2.6 (0.9)	0.86	2.3 (0.8)	0.49	1.4 (0.5)	0.96	0.8 (0.6)	0.16	1.6 (0.8)	0.75
Skin	2.7 (0.9)	0.47	2.5 (0.9)	0.07	1.5 (0.7)	0.60	0.8 (0.6)	0.50	1.8 (1.1)	0.16
Urology	2.4 (0.9)	0.12	2.1 (0.7)	0.31	1.4 (0.6)	0.67	0.8 (0.6)	0.78	1.5 (0.9)	0.54
Other (including paediatrics and sarcoma)	2.8 (0.8)	0.35	2.3 (0.8)	0.64	1.7 (0.6)	0.03	0.7 (0.6)	0.87	1.8 (0.8)	0.73

SD, standard deviation. Means and SD reported for groups with n ≥ 25, except for age group 35+ (n = 22) and areas of interest gynaecological (n = 23). Results for groups with n < 30 should be interpreted with caution. Significant tests for areas of interest were performed comparing those interested in each area with those not interested. The adjusted significance criterion according to the Holm-Bonferroni method is 0.0006.

Burnout: regression analysis

Regression analyses were conducted in order to identify to what extent the stress and satisfaction subscales explained each of the burnout outcome variables, controlling, for relevant covariates. Results indicated that higher scores in the stress subscales demands on time and interpersonal demands were associated with higher levels of emotional exhaustion among radiation oncology trainees. In addition a higher score in the interpersonal demands subscale was associated with higher levels of depersonalization. Higher scores in the stress subscales, delivery demands ($p = 0.057$) and interpersonal demands were associated with lower levels of personal accomplishment, and a higher score in the satisfaction subscale value/delivery of services was associated with higher levels of personal accomplishment.

Discussion

To the best of our knowledge, this is the first study examining burnout among radiation oncology trainees in Australia and New Zealand. Almost half (49.5%) of trainees had emotional exhaustion or depersonalization which are the criteria for burnout in a number of studies.^{3,5,6}

There are two other studies in the literature dealing with burnout among radiation oncology trainees.^{5,6} A French study, which defined burnout as having high scores in emotional exhaustion or depersonalization, had a similar percentage of respondents with burnout to our study (44%).⁵ However, this study also dealt with medical oncology and haematology trainees with a

lower response at 60%.⁵ In France, it would appear one may become a radiation oncology trainee immediately after basic medical education training and the median age at 29 was younger than our study.⁵ It is unknown whether this factor influences the prevalence of burnout but certainly age did not seem to be a factor in our study.

An Italian study had similar definition of burnout with 35% meeting the criteria, but included young specialists as well as trainees (there were only 45 trainees in that study).⁶ There is no United States study specifically focusing on radiation trainees, but there is literature on trainees from other specialties which have revealed similar levels of burnout.¹¹ Both the French and Italian studies found between 11 to 13% of respondents wanted to change their specialty.^{5,6} This highlights the importance of addressing burnout levels in trainees early in their training.

Although there may be cultural differences, the incidence of burnout is globally comparative and ranges from 35 to 50% among all professionals in the oncologic specialty.^{4-6,12-14}

In our study, there were certain factors that were associated with burnout. Demands on time and interpersonal demands were associated with emotional exhaustion, and interpersonal demands were also associated with depersonalization. Both the French and Italian studies had similar findings, although the terminology was different.^{5,6} The French study classified emotional load, demands of patients and relatives and total workload as their stress categories.⁵ The Italian study found working with unwell patients, negative relationships with colleagues and superiors and lack of free time to be associated with burnout.⁶ There are other studies which have emphasized that interpersonal demands and conflicts in the clinical encounter are an overlooked source of burnout and more attention should be given to them.^{15,16}

It is interesting to note that although there was an association between interpersonal demands and emotional exhaustion and depersonalization in our study, the actual scores in interpersonal demands were low (mean = 0.7 on a scale of 0–6). This seems to be in contrast to the French and Italian studies where up to 40%

Table 5. Satisfaction items and grouping into two categories

Resources/professional activities (alpha = 0.91)	Deriving intellectual stimulation from research
	Being involved in activities which contribute to the development of your profession
	Having adequate equipment facilities to do your job
	Feeling that you are adequately remunerated
	Enjoyment of learning
	Having opportunities for personal learning
	Being able to make a positive contribution to your unit
	Feeling that you deal well with patients
	Feeling that you deal well with relatives
	Being perceived to do a good job by boss
Value/delivery of services (alpha = 0.89)	Feeling that your clinical experience is being used appropriately
	Having high level of responsibilities
	Having variety in your job
	Feeling that you deal well with technical aspects of radiation oncology, e.g. contouring, evaluating and approving plans, port film approval
	Feeling that your clinical experience is being used appropriately
	Having high level of responsibilities
	Having variety in your job
	Feeling that you deal well with technical aspects of radiation oncology, e.g. contouring, evaluating and approving plans, port film approval

Table 6. Distribution of responses in categories for satisfaction subscales

Satisfaction subscales		Not at all/ not much (0–1)	A bit/a reasonable amount (2–3)	Quite a bit/a lot/very much (4–6)
Resources/professional activities	n	8	62	37
	%	7.5	57.9	34.6
Value/delivery of services	n	3	50	54
	%	2.8	46.7	50.5

Table 7. Trainees' satisfaction results

Demographic variable	Satisfaction factors				
	Resources/ professional activities (range 0.0–6.0)		Value/delivery of services (range 0.6–6.0)		
	Mean (SD)	p	Mean (SD)	p	
All respondents	3.4 (1.0)	–	3.8 (0.9)	–	
Sex					
Male	3.4 (1.2)	0.88	3.8 (1.1)	0.96	
Female	3.5 (0.9)		3.8 (0.8)		
Age					
<30 years	3.5 (1.0)	0.17	3.9 (0.9)	0.46	
30–34 years	3.2 (1.1)		3.7 (1.0)		
35+ years	3.7 (0.9)		4.0 (1.0)		
Generation					
Generation X (1965–1981)	3.6 (1.0)	0.45	4.1 (1.0)	0.51	
Generation Y (1982–2000)	3.4 (1.1)		3.8 (1.0)		
Marital status					
Married (registered or de facto)	3.6 (1.0)	0.36	3.8 (1.0)	0.66	
Not married (separated/ divorced/ never married)	1.1 (3.4)		3.9 (1.0)		
Spouse's work					
Works full time	3.5 (0.1)	0.92	4.2 (0.3)	0.53	
Does not work full time	3.4 (1.1)		3.8 (1.0)		
Children					
No children	3.4 (1.0)	0.92	3.9 (1.0)	0.85	
Has children	3.5 (1.2)		3.9 (1.0)		
Income					
≤99,000	3.6 (1.2)	0.40	3.9 (1.1)	0.16	
100,000–109,000	3.2 (1.2)		3.8 (0.9)		
≥110,000	3.6 (0.8)		4.2 (0.8)		
Areas of interest					
Brachytherapy	3.2 (1.2)	0.28	3.8 (1.2)	0.88	
Breast	3.6 (0.9)	0.38	3.9 (0.7)	0.22	
Gastrointestinal	3.4 (1.2)	0.75	3.9 (1.1)	0.82	
Gynaecological	3.7 (0.9)	0.27	4.2 (0.9)	0.03	
Head and neck	3.5 (1.2)	0.89	3.9 (1.2)	0.30	
Lung	3.5 (1.2)	0.51	3.9 (1.1)	0.64	
Neurology	3.6 (1.0)	0.23	4.1 (0.9)	0.07	
Palliative care	3.6 (0.9)	0.21	4.1 (0.8)	0.02	
Skin	3.5 (1.0)	0.57	3.9 (1.0)	0.73	
Urology	3.6 (1.2)	0.36	4.0 (1.0)	0.11	
Other (including paediatrics and sarcoma)	3.3 (1.1)	0.43	3.8 (1.0)	0.66	

SD, standard deviation. Means and SD reported for groups with $n \geq 25$, except for age group 35+ ($n = 22$) and areas of interest gynaecological ($n = 23$). Results for groups with $n < 30$ should be interpreted with caution. Significant tests for areas of interest were performed comparing those interested in each area with those not interested. The adjusted significance criterion according to the Holm-Boneferroni method is 0.0014.

Table 8. Trainees with burnout and no burnout for subscales. (a) Categorical variable number of subscales with burnout (exclusive categories). (b) Trainees with burnout in the emotional exhaustion and depersonalization subscales.

Categories	n	%
(a)		
No burnout	46	43.0
Burnout in one subscale	27	25.2
Burnout in two subscales	20	18.7
Burnout in three subscales	14	13.1
Total	107	100
(b)		
Burnout in emotional exhaustion or depersonalization	53	49.5
Burnout in emotional exhaustion and depersonalization	25	23.4

of respondents reported negative relationships with colleagues, superiors and absence of communication. Whether this is due to cultural or other differences might be a factor worth exploring in the future.

There are multiple definitions of burnout in the literature. Some authors do not include personal accomplishment in their definition of burnout, but focus only on emotional exhaustion or depersonalization,^{3,5,6} while the original Maslach Burnout Inventory stipulates that high scores in emotional exhaustion and depersonalization with low scores in personal accomplishment constitutes burnout. In contrast, 13% of trainees would fit the original definition of burnout. Regardless of the definition used, there is a significant proportion of trainees undergoing burnout in Australia and New Zealand.

This study is also unique in that it has investigated the association of demographic characteristics with stress and satisfaction subscales and burnout. After adjusting for the multiple tests conducted in this study, no differences in stress, satisfaction or burnout were found between demographic groups or by area of interest. Results suggest that the levels of stress, satisfaction and burnout are independent from trainees' background, interest and personal circumstances, and no particular group is at higher risk of experiencing burnout.

Radiation oncology trainees in Australia and New Zealand were particularly interested in palliative care. Our analysis revealed that those interested in palliative care did not show higher levels of stress than other groups. This is in contrast to the French and Italian studies which revealed dealing with the terminally ill patients was a significant stress.^{5,6} It would be interesting to ascertain whether cultural differences are a factor in explaining these different results.

Trainees are our future radiation oncologists. Therefore, it is important to take into account their needs and problems. Burnout has been associated with a desire to quit medicine, leave the specialty and job absenteeism.^{5,6} It is important to intervene, so we can prevent this in the future radiation oncology workforce.

Table 9. Trainees' burnout results

Demographic variables	Burnout					
	Emotional exhaustion		Depersonalization		Personal accomplishment	
	Mean (SD)	p	Mean (SD)	p	Mean (SD)	p
All respondents	23.6 (9.1)	–	7.8 (5.8)	–	35.2 (7.1)	–
Sex						
Male	22.8 (9.5)	0.35	8.7 (6.2)	0.13	34.4 (7.6)	0.22
Female	24.5 (8.7)		6.9 (5.3)		36.0 (6.7)	
Age						
<30 years	25.3 (9.1)	0.28	9.0 (5.3)	0.12	35.8 (6.2)	0.77
30–34 years	23.4 (9.5)		7.9 (6.5)		35.1 (7.8)	
35+ years	21.45 (7.7)		5.7 (4.7)		34.4 (7.2)	
Generation						
Generation X (1965–1981)	23.7 (9.2)	0.94	6.5 (5.9)	0.13	34.3 (7.1)	0.39
Generation Y (1982–2000)	23.6 (9.0)		8.4 (5.8)		35.6 (7.2)	
Marital status						
Married (registered or de facto)	24.0 (9.7)	0.59	7.3 (6.0)	0.23	35.1 (7.3)	0.93
Not Married (separated/divorced/never married)	23.0 (8.0)		8.6 (5.5)		35.3 (7.1)	
Spouse's work						
Work full time	27.5 (0.7)	0.54	7.5 (6.4)	0.97	32.0 (7.1)	0.56
Does not work full time	23.3 (9.6)		7.7 (6.0)		35.1 (7.5)	
Children						
No children	23.8 (8.9)	0.81	8.4 (6.0)	0.09	35.2 (7.5)	0.89
Has children	23.3 (9.5)		6.4 (5.3)		35.0 (6.5)	
Income						
≤99,000	23.9 (9.4)	0.98	8.1 (6.4)	0.25	37.4 (5.8)	0.25
100,000–109,000	23.5 (10.0)		8.5 (5.2)		35.4 (6.4)	
≥110,000	23.8 (9.5)		6.2 (5.7)		34.6 (6.8)	
Areas of interest						
Brachytherapy	24.1 (10.5)	0.74	6.9 (6.5)	0.36	36.9 (5.8)	0.15
Breast	24.3 (7.9)	0.56	7.5 (5.6)	0.68	35.97 (6.9)	0.40
Gastrointestinal	20.5 (7.9)	0.12	6.8 (4.9)	0.12	35.5 (7.3)	0.72
Gynaecological	23.7 (10.2)	0.96	7.5 (6.5)	0.76	38 (6.1)	0.03
Head and neck	22.0 (9.8)	0.19	7.9 (5.9)	0.88	35.7 (6.6)	0.56
Lung	22.4 (9.0)	0.17	7.7 (5.2)	0.81	35.3 (6.9)	0.90
Neurology	22.1 (8.1)	0.27	7.9 (5.1)	0.96	36.2 (6.2)	0.35
Palliative care	23.7 (8.0)	0.99	7.8 (5.4)	0.97	37.4 (7.1)	0.01
Skin	23.7 (8.6)	0.99	7.9 (4.9)	0.87	35.4 (5.9)	0.86
Urology	21.0 (8.7)	0.04	7.3 (5.7)	0.52	36.1 (7.6)	0.35
Other (including paediatrics and sarcoma)	22.8 (7.8)	0.58	7.1 (5.8)	0.47	36.6 (6.1)	0.23

SD, standard deviation. Means and SD reported for groups with $n \geq 25$, except for age group 35+ ($n = 22$) and areas of interest gynaecological ($n = 23$). Results for groups with $n < 30$ should be interpreted with caution. Significant tests for areas of interest were performed comparing those interested in each area with those not interested. The adjusted significance criterion according to the Holm-Bonferroni method is 0.0009.

Interestingly, although there may be a perceived association between burnout and medical errors, this is not always the case.^{17,18}

A number of strategies and interventions have been suggested in the literature to address burnout. A multi-step process has been proposed by Shanefelt to limit the incidence of stress and burnout and to maximize personal satisfaction.¹⁹ This involves the identification of personal goals, the choice of the most fitting type of practice and the management of stressors specific to that practice type.¹⁹ On the other hand, there are a number of burnout-recovery strategies that have been evaluated, but it is not clear which are the most helpful. A

recent Italian study used art therapy (psychodrama and relaxation) and found an increase in collaboration and improved relationships among colleagues.²⁰ Other interventions that have been evaluated include support groups, training programmes, teaching of stress management skills and intensive coaching by senior physicians.^{21,22} In Australia, a recent study showed that a one day workshop improved recovery skills, satisfaction with self-care practices and perceived sleep quality among radiation therapists and oncology nurses. In this study, the face to face workshop was more effective than reading educational material.^{22,23} This type of intervention could be explored in the trainee population.

Support groups not just from trainee colleagues but from senior clinicians and management could be explored. In the United States, there are formal mentorship programmes for trainees, but in Australia, this is underdeveloped with only the research mentor being recently recognized.^{24,25} Several studies of physician burnout have demonstrated a possible benefit of mentorship while a study on academic chairs of radiation oncology discussed the benefit of mentors for the reduction of burnout.^{26–30}

A New Zealand study found that the organizational stressors were the most important and support from management, recognition and realistic expectations and demands would help reduce emotional exhaustion and depersonalization.³⁰ On an individual level, an emphasis on recreation, hobbies, exercise and personal relationships has been suggested.³¹ However, others believe although this might improve life satisfaction, these measures do not necessarily prevent burnout.³² Further research is needed to establish the effectiveness of these different strategies, particularly in the context of radiation oncology.

This study has a number of limitations. The cross-sectional design of the study does not allow the ability to make causal assumptions. Also, as with all survey-based studies, response bias may have an impact on the results. These types of studies also rely on self-reported measures which could overestimate burnout prevalence and its association with stress and satisfaction factors (independent and dependent variables have the same source, the participant). The population size is small and we did not compare our findings with other specialties within Australia and New Zealand.

However, this is the first study to analyse burnout, stress and satisfaction among radiation oncology trainees in Australia and New Zealand. A strength of this study is that it has covered the entire trainee population with a high response rate compared to other studies. It also has a homogenous population group unlike other Australian and New Zealand studies which had mixed population groups such as radiation therapists, nurses and radiation oncologists. This study has examined in detail the association between demographic characteristics, stress, satisfaction and burnout.

In conclusion, a significant proportion of Australian and New Zealand radiation oncology trainees experience burnout with a number of stress and satisfaction factors being associated with burnout. Further work would include comparing radiation oncology trainees with trainees from other specialties in Australia and New Zealand, other radiation oncology trainees from other countries and appropriate interventions to reduce burnout.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Appendix S1 2015 RO trainee stress, satisfaction and burnout survey.