

Non-radiation occupational hazards and health issues faced by radiologists - A cross-sectional study of Indian radiologists

Ameya S Kawthalkar, Rachel A Sequeira, Supreeta Arya, Akshay D Baheti

Department of Radiodiagnosis, Tata Memorial Hospital, Mumbai, Maharashtra, India

Correspondence: Dr. Ameya S Kawthalkar, F33, BMC Building, Agarwada Colony, GTB Nagar, Sion East, Mumbai - 400022, Maharashtra, India. E-mail: ameya005@gmail.com

Abstract

Context: Radiologists as a group face unique occupational health hazards among which musculoskeletal injuries, chronic eye strain, and others are yet to receive adequate attention. Constant mental strain due to demanding turnaround times and work pressures may lead to burnout and depression. These combine to decrease overall work satisfaction and productivity. **Aims:** To study the prevalence of various health issues faced by radiologists in India and to assess whether specific demographic and occupational factors are associated with an increased risk. **Settings and Design:** Cross-sectional observational study conducted as a voluntary anonymous electronic survey. **Methods and Materials:** A 36-item survey was sent to radiologists through email and social media. All respondents who completed survey were included in the study. Questions regarding workload, repetitive stress injuries, eye strain, burnout, and so on were asked. **Statistical Analysis Used:** Chi-square test was used to test significance of correlation ($P < 0.05$). **Results:** In all, 383 radiologists completed the survey. A high prevalence of repetitive stress injuries, chronic eye strain, depression, and burnout was found. Significant correlation was found between repetitive stress injuries and burnout. Pre-Conception and Pre-Natal Diagnostic Techniques Act (PCPNDT) related issues and work overload were the most common causes of high stress levels. Radiologists whose practices followed ergonomic design showed significantly less prevalence of neck pain. **Conclusion:** Radiologists in India have a high prevalence of repetitive stress injuries, chronic eye strain, and burnout, along with unique mental stressors such as PCPNDT-related issues.

Key words: Burnout; ergonomics; mental health; radiology; repetitive stress injuries

Introduction

Radiologists as a group face unique occupational health hazards. Radiology has a singular work environment not seen in other medical specialties. In addition to working long hours on a computer, many radiologists spend ample

time performing ultrasound (USG) requiring constant use of a single upper limb resulting in what is called as the Transducer user syndrome.^[1] Interventional radiologists working in angiography suites are also exposed to unique musculoskeletal problems.^[2] Besides physical issues, the

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

Cite this article as: Kawthalkar AS, Sequeira RA, Arya S, Baheti AD. Non-radiation occupational hazards and health issues faced by radiologists – A cross-sectional study of Indian radiologists. Indian J Radiol Imaging 2019;29:61-6.

Access this article online

Quick Response Code:



Website:
www.ijri.org

DOI:
10.4103/ijri.IJRI_403_18

constant mental strain due to the demanding turnaround times and constant work pressures takes its toll as well.^[3] These factors contribute to an increased incidence of repetitive musculoskeletal stress injuries, chronic eye strain, and mental health issues such as burnout, stress, depression, and lack of sleep.^[4]

Radiation as an occupational health hazard has received adequate attention with multiple national and international guidelines available. However, these nonradiation hazards have probably not yet received the attention they deserve. These can adversely impact the physical and mental health of the radiologist, decrease productivity, increase medical errors, and lead to early burnout. A few previous studies have been published regarding ergonomics and musculoskeletal problems in radiology as well as mental health issues faced by radiologists. However, no previously published study has looked at the overall physical and mental health of radiologists as a whole, as the two are related and often go hand in hand. Also, such a study has not been performed among the Indian radiology community to the best of our knowledge.

A recent editorial in this journal also highlighted the importance of safe ergonomic practices among radiologists to improve their health and productivity.^[5] In going with the same theme,^[6] we conducted a cross-sectional survey among practising radiologists and radiology residents in India to study the prevalence of various physical and mental health issues faced by them.

Materials and Methods

The study was designed according to the STROBE checklist for observational studies. A 36-item anonymous voluntary electronic survey was created online using Google Forms (Google Inc., Mountain View, California, USA), including four questions on demographics and practice patterns. This survey was sent to practising radiologists and radiology residents through email and using the social media platform of WhatsApp (2018; WhatsApp Inc., Menlo Park, California, USA). Responses were collected for a 10 day period starting from 4 April 2018 to 14 April 2018. All respondents who completed the survey were included within the study.

Questions regarding film-based versus workstation reporting, volume of work in USG and other modalities, musculoskeletal injuries, varicose veins, chronic eye strain, needle prick injuries, and contraction of tuberculosis were asked. Two questions were asked on ergonomics, whether the respondent was aware of ergonomics in radiology and whether any ergonomic steps had been taken in the respondent's practice to reduce physical injuries. Questions regarding depression, patient abuse, personal satisfaction, recreational activities, exercise, sleep, burnout,

and levels and the causes of stress were also included to assess various mental health issues. The responses were statistically analyzed to evaluate for correlation between patient demographics, the presence of various physical and mental health issues, and other issues. Chi-square test was performed to assess the level of significance of correlation. Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) software version 20 (IBM Inc., Armonk, New York, USA).

Results and Analysis

A total of 383 radiologists responded to the survey, of which 67% (258/383) were males and 32% (125/383) females. The radiologists surveyed included a broad mix of radiology trainees along with junior and senior practicing radiologists [Figure 1], with 50% having a work experience of 6 to 20 years. The majority of the respondents (96%; 369/383) practiced purely diagnostic radiology or predominantly diagnostic radiology with few interventional procedures. The working patterns of the radiologists surveyed (predominantly workstation-based vs. predominantly film-based vs. USG-only) are as summarized in Figure 2. Most radiologists (74%; 284/383) reported working for 40-70 hours/week [Figure 3]. 15% (59/383) respondents practised tele-radiology, with 81% (48 of 59) practising it for less than 3 hours per day.

As many as 301 of 383 (78%) radiologists reported symptoms consistent with repetitive stress injuries at some point in time after starting their radiology career with the most common being neck pain (52%). The other symptoms are as summarized in Table 1. More than one-third (37%; 143/383) of the radiologists did not take any treatment for their repetitive stress injuries [Figure 4]. Neck pain was observed to be significantly more common among female radiologists ($P = 0.02$). The rest of the repetitive stress injuries did not demonstrate any gender predilection. The prevalence of most repetitive stress injuries predictably increased with years of experience, workload, and number of hours of work per week.

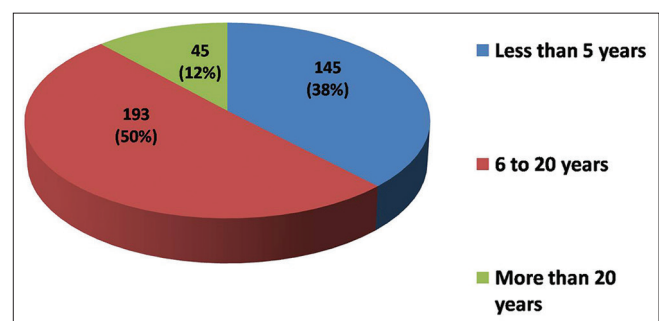


Figure 1: Years of experience of the study population of radiologists at the time of survey (numbers on pie chart indicate absolute number out of 383 with percentages)

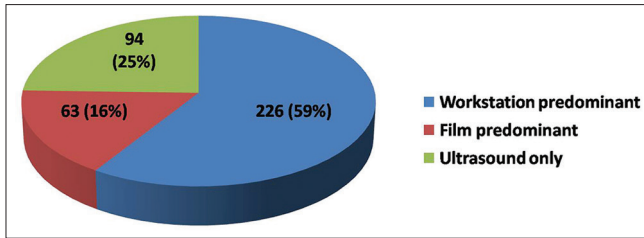


Figure 2: Work patterns of the studied population of radiologists at the time of survey (numbers on pie chart indicate absolute number out of 383 with percentages)

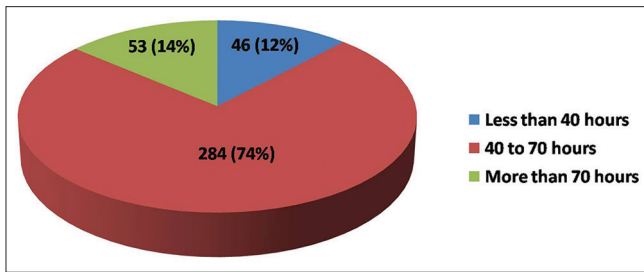


Figure 3: Number of hours per week worked by the respondents in their radiology department or practice (numbers on pie chart indicate absolute number out of 383 with percentages)

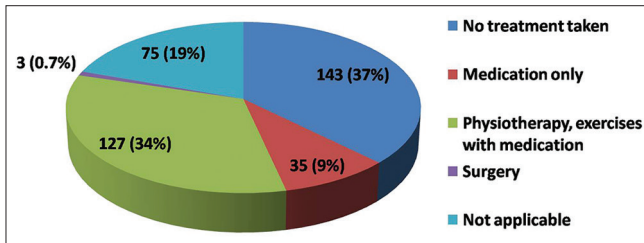


Figure 4: Treatment taken by the respondents for various musculoskeletal repetitive stress injuries (numbers on pie chart indicate absolute number out of 383 with percentages)

Significant correlation was found between increasing number of USG examinations performed per day and the prevalence of neck pain, low back pain, and shoulder pain ($P < 0.05$). No significant correlation was found between the number of USG examinations performed and elbow pain, wrist pain, tenosynovitis, and carpal tunnel syndrome.

About 6% of radiologists (23/383) developed varicose veins after joining radiology. 57% of the radiologists (219/383) surveyed said they suffered from symptoms of chronic eye strain and computer vision syndrome (CVS), with the incidence of chronic eye strain significantly increasing with increasing years of experience in radiology ($P < 0.05$) [Table 2].

32% (124/383) of the respondents had suffered needle prick injuries during their careers in radiology, while one-fourth of all radiologists surveyed (99/383) were not vaccinated against hepatitis B. 9% (35/383) of the respondents had developed tuberculosis after starting their careers in radiology. A majority (57%; 217/383) of radiologists felt their

Table 1: Prevalence of musculoskeletal repetitive stress injuries or their symptoms within the studied population of radiologists

Musculoskeletal repetitive stress injury symptom/condition	Percentage of radiologists suffering from the symptom/condition after joining radiology
Neck pain	52%
Low back pain	45%
Shoulder pain	38%
Wrist pain	27%
Elbow pain	12%
Tenosynovitis	5%
Carpal tunnel syndrome	3%

Table 2: Prevalence of various conditions among the studied population of radiologists

Condition	Percentage of radiologists suffering/have suffered in the past from the condition after joining radiology
Chronic eye strain (computer vision syndrome)	57%
Needle prick injury	32%
Tuberculosis	9%
Varicose veins	6%

reporting rooms were not adequately aerated or ventilated. However, no significant correlation was found between radiologists acquiring tuberculosis and lack of adequate room ventilation.

45% (173/383) radiologists were not aware of the science of ergonomics, and a majority of respondents (57%; 213/383) either did not know whether ergonomic steps had been taken in their department or reported that no ergonomic steps had been taken. Radiologists in whose practices or departments ergonomic steps had been taken reported a statistically significant lower prevalence of neck pain ($P = 0.014$).

35% (134/383) of radiologists surveyed reported having an excess workload, and 37% (141/383) reported feeling depressed or having suffered from symptoms of depression at some point in their careers in radiology. The proportion was slightly higher among residents, with 40% saying they suffered from depression; however, the difference was not statistically significant. 46% (178/383) of radiologists reported having faced either physical or verbal abuse from patients in the past. A majority (66%; 255/383) of radiologists reported obtaining either excellent or good personal satisfaction from their work [Figure 5]. However, a high number (40%; 153/383) also felt they were not achieving personal growth in radiology in their current workplace. Only 42% (163/383) of the radiologists said they get adequate time to pursue their hobbies and for recreational activities, and 15% (58/383) reported getting less than 6 hours of sleep every day [Table 3].

Table 3: Prevalence of various mental health conditions and the associated risk factors for developing the same among the studied population of radiologists

Mental health condition/associated risk factor	Percentage of radiologists suffering/have suffered in the past from the condition after joining radiology, or have been exposed to risk factor
Depression	37%
Abuse from patients (verbal or physical)	46%
Poor work environment	4%
Below average or poor sense of personal satisfaction	4%
Unable to achieve personal growth in current career	40%
Inadequate time for recreational activities and hobbies	57%
Less than 6 h of sleep per day	15%
Not indulging in any exercise/meditation/sport	58%
Lack of proficiency in communication skills	27%
Lack of proficiency in management skills	41%
Burn out	54%
Excessive workload	35%

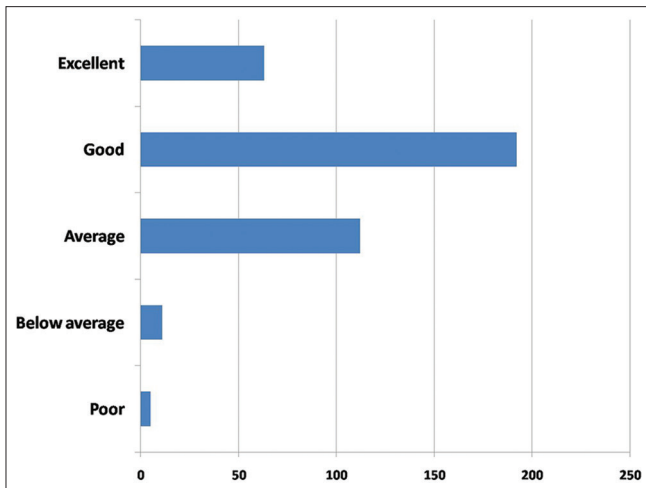


Figure 5: Rate of personal satisfaction reported by radiologists in the studied population. X-axis: absolute number of responding population. Y-axis: rating of personal satisfaction

The prevalence of burnout among radiologists was 54% (208/383) in our study. A significant correlation was found between the presence of physical repetitive stress injuries and prevalence of burnout ($P < 0.05$). Significant correlation was also found between radiologist burnout and past patient abuse, depression, lack of time for hobbies and recreation, less than 6 hours of sleep, and lack of personal work satisfaction ($P < 0.05$). A significant correlation was also found between the prevalence of burnout and radiologists who reported lack of proficiency in management skills ($P < 0.05$).

On a scale of 1 to 10 to measure levels of stress with 1 being the least and 10 being the maximum possible level of stress, 53% (205/383) of the radiologists reported a stress level of 7 to 10 [Figure 6]. Generally, those radiologists reporting burnout, depression, patient abuse, lack of personal work satisfaction, and improper workplace relationships had higher levels of stress. Among the

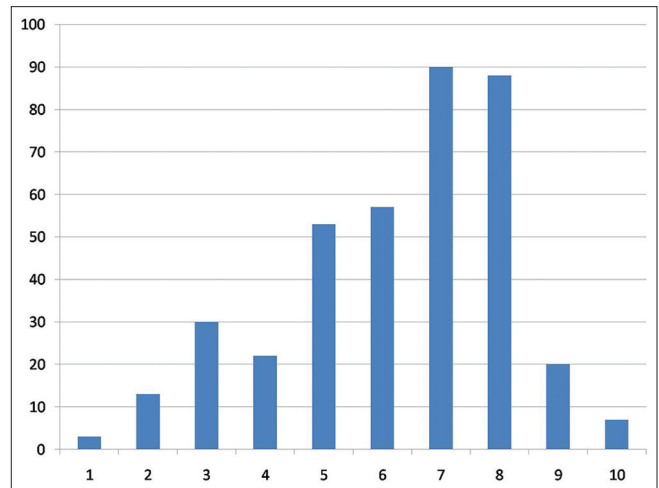


Figure 6: On a scale of 1–10, own stress levels as rated by the radiologists in the studied population, from 1 being none to minimal stress, up to 10 being the maximum possible level of stress. X-axis: stress levels. Y-axis: absolute number of the responding population

causes of stress mentioned, the most common cause of stress among radiologists was Pre-Conception and Pre-natal Diagnostic Techniques Act (PCPNDT) related issues (53%; 203/383) and work overload (50%; 193/383). Inadequate income was also cited as a source of stress by 36% (139/383) respondents, with other causes of stress being administrative responsibilities (29%; 110/383) and improper workplace atmosphere and interpersonal relationships (27%; 103/383) [Table 4].

27% (105/383) of the radiologists surveyed felt lack of proficiency in their communication skills, and 41% (159/383) radiologists did not feel proficient in their management skills.

Despite the high prevalence of repetitive stress injuries, depression, and burnout among radiologists in India, a majority (58%; 223/383) did not actively exercise, meditate,

Table 4: Prevalence of the various causative factors of stress reported by radiologists in the studied population

Causative factor of stress	Percentage of radiologists reporting increased stress due to the causative factor
PCPNDT issues	53%
Work overload	50%
Inadequate income	36%
Administrative responsibilities	29%
Improper workplace atmosphere and workplace relationships	27%

or play sports [Table 3]. Radiologists who regularly either exercised or meditated or played sports had a statistically significant low prevalence of burnout as compared to those who did not ($P = 0.01$).

Discussion

The incidence of musculoskeletal injuries among Indian radiologists reported in our study was much higher than those reported in western literature, with some injuries having almost double the incidence. The prevalence of musculoskeletal injuries among radiologists in our study versus another 2018 study from the United States in *JACR* is as follows – neck pain: 52% in our study versus 25% in the *JACR* study, low back pain: 45% in our study versus 32% in the *JACR* study, and 78% prevalence of at least one upper limb joint repetitive stress injury in our study versus 16% with an upper limb stress injury in the *JACR* study.^[7]

A significant correlation was found in our study between increasing USG workload and prevalence of neck pain, low back pain, and shoulder pain – a condition known as Transducer user syndrome.^[8] The incidence matched with those of studies on sonologists published elsewhere (65%–78%).^[11] Radiologists perform a lot of visual (convergence and accommodation) exercise during work, leading to ciliary muscle fatigue and sometimes ciliary muscle spasm. This leads to digital eye strain and CVS. Symptoms of CVS include headache, blurred vision, either dry eyes or excessive watering from eyes, eye strain, and diplopia.

Various studies indicate a prevalence of CVS ranging from 68% to 76% among computer professionals in India and other South Asian countries.^[9,10] Our study also showed a prevalence of 57% for eye strain among radiologists.

Ergonomics (from *ergo*: work and *nomos*: natural law) is the science of designing workplaces, products and systems so that they fit the people who use them. Use of ergonomic chairs, ergonomic workstations, and imparting ergonomic training have been reported to cause up to a 70%–80% of improvement in repetitive stress symptoms.^[11] In our study, radiologists in whose practices or departments ergonomic

steps had been taken reported a statistically significant lower prevalence of neck pain ($P = 0.014$).

As per World Health Organization estimates, the lifetime prevalence of mental illnesses in the general population is an astonishingly high number of 18%–36%.^[12,13] Approximately 13%–20% of physicians are known to suffer from depression.^[14,15] In our study, 37% of radiologists reported feeling depressed at some point in their careers.

Burnout is increasingly being recognized as a serious mental health condition. It has been defined as a triad of emotional exhaustion, depersonalization, and reduced personal accomplishment.^[13,16] Residency in particular is known to be a period of one's career where one is prone to develop a psychiatric illness.^[17] As per previous studies, one-third of residents suffer from depression and up to 75% residents experience burnout.^[17,18] In our study, 40% of residents reported feeling depressed at some point in their radiology career, and 55% reported burnout. Importantly, a 1996 report in *Lancet* found burnout to be significantly higher in radiologists as compared to nonradiologists (which included surgeons, oncologists, and gastroenterologists), indicating the need to focus more on this issue within the radiology community.^[19]

A unique stressor among Indian radiologists, which is also the most common cause of stress among them, is PCPNDT-related issues [Table 4]. Our study showed 66% of radiologists reporting either excellent or good sense of personal satisfaction from their work [Figure 5]. This number is much less when compared with previous studies from the United States and Europe which have reported more than 90% of radiologists with very high or somewhat high levels of personal satisfaction.^[20-23]

Limitations of our study include the use of a voluntary subjective electronic survey to collect responses, with its inherent biases. Standardized questionnaires to test for burnout are available, the most commonly used being the Maslach Burnout Inventory.^[24] Our study does not test for burnout using Maslach Inventory questionnaire, and a subjective question regarding whether the responder has experienced burnout at any time during his or her career in radiology had been asked instead. Further more detailed studies on radiologists in India should be carried out using standardized psychological questionnaires to investigate this serious issue further.

Conclusion

Radiologists in India show a higher prevalence of repetitive stress injuries, chronic eye strain, and burnout as compared to their western counterparts. Indian radiologists are also faced with unique mental stressors with the most common being PCPNDT-related issues, and overall report less work

satisfaction when compared with the West. Significant correlation exists between the presence of repetitive stress injuries and burnout among radiologists.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

- Schoenfeld A, Goverman J, Weiss DM, Meizner I. Transducer user syndrome: an occupational hazard of the ultrasonographer. *Eur J Ultrasound* 1999;10:41-5.
- Benjamin JL, Meisinger QC. Ergonomics in the development and prevention of musculoskeletal injury in interventional radiologists. *Tech Vasc Interv Radiol* 2018;21:16-20.
- Setness PA. Is it real or is it memorex? Discerning whether job-related stress or mental illness is causing physician impairment. *Postgrad Med* 2003;113:7-9.
- Halpenny D, O'Driscoll D, Torreggiani WC. Ocular health among radiologists in the age of PACS: Is it time for our profession to open its eyes to this issue in light of existing European legislation? *Br J Radiol* 2012;85:e1309-11.
- Mohan C. Ergonomics in radiology-Time to revisit. *IJRI* 2018;28:271-2.
- Atwal SS, Prasad A, Deepak D, Agarwal K. Health issues among radiologists: Toll they pay to their profession. *J Clin Diagn Res* 2017;11:TM01-2.
- Parikh JR, Bender C, Bluth E. Musculoskeletal injuries affecting radiologists according to the 2017 ACR human resources commission workforce survey. *J Am Coll Radiol* 2018;15:803-8.
- Murphey S. Work related musculoskeletal disorders in sonography. *J Diagnostic Med Sonogr* 2017;33:354-69.
- Ranasinghe P, Wathurapatha WS, Perera YS, Lamabadusuriya DA, Kulatunga S, Jayawardana N, *et al.* Computer vision syndrome among computer office workers in a developing country: An evaluation of prevalence and risk factors. *BMC Res Notes* 2016;9:150.
- Thomas J, K V, Sankar N, Jacob GP. Prevalence of ocular symptoms among computer professionals in a university setting in South India. *J Evol Med Dent Sci* 2014;3:14777-86.
- Boiselle PM, Levine D, Horwich PJ, Barbaras L, Siegal D, Shillue K, *et al.* Repetitive stress symptoms in radiology: Prevalence and response to ergonomic interventions. *J Am Coll Radiol* 2008;5:919-23.
- Kessler RC, Aguilar-Gaxiola S, Alonso J, Chatterji S, Lee S, Ormel J, *et al.* The global burden of mental disorders: An update from the WHO World Mental Health (WMH) Surveys. *Epidemiol Psychiatr Soc* 2009;18:23-33.
- Brown SD, Goske MJ, Johnson CM. Beyond substance abuse: Stress, burnout, and depression as causes of physician impairment and disruptive behavior. *J Am Coll Radiol* 2009;6:479-85.
- Bender A, Farvolden P. Depression and the workplace: A progress report. *Curr Psychiatry Rep* 2008;10:73-9.
- Center C, Davis M, Detre T, Ford DE, Hansbrough W, Hendin H, *et al.* Confronting depression and suicide in physicians: A consensus statement. *JAMA* 2003;289:3161-6.
- Bianchi R, Schonfeld IS, Laurent E. Is it time to consider the "Burnout Syndrome" a distinct illness? *Front Public Heal* 2015;3:158.
- Levey RE. Sources of stress for residents and recommendations for programs to assist them. *Acad Med J Assoc Am Med Coll* 2001;76:142-50.
- Thomas NK. Resident burnout. *JAMA* 2004;292:2880-9.
- Ramirez AJ, Graham J, Richards MA, Cull A, Gregory WM. Mental health of hospital consultants: The effects of stress and satisfaction at work. *Lancet* 1996;347:724-8.
- Guenette JP, Smith SE. Burnout: Prevalence and associated factors among radiology residents in New England with comparison against United States resident physicians in other specialties. *Am J Roentgenol* 2017;209:136-41.
- Graham J, Ramirez AJ, Field S, Richards MA. Job stress and satisfaction among clinical radiologists. *Clin Radiol* 2000;55:182-5.
- Lim RCH, Pinto C. Work stress, satisfaction and burnout in New Zealand radiologists: Comparison of public hospital and private practice in New Zealand. *J Med Imaging Radiat Oncol* 2009;53:194-9.
- Zafar HM, Lewis RS, Sunshine JH. Satisfaction of radiologists in the United States: A comparison between 2003 and 1995. *Radiology* 2007;244:223-31.
- Maslach C, Jackson SE. The measurement of experienced burnout. *J Organ Behav* 1981;2:99-113.