Burnout Among Saudi Radiological Sciences Undergraduate Students: A Cross-Sectional Study

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Abstract

Background

Burnout syndrome may adversely affect health care workers and health sciences students. The purpose of this study was to assess the prevalence of burnout among Saudi third- and fourth-year radiological sciences students across three campuses of King Saud bin Abdulaziz University for Health Sciences.

Methods

An exploratory, cross-sectional study was conducted among 176 Saudi radiological sciences students, using the Maslach Burnout Inventory-General Survey for Students. The 16-item questionnaire was administered electronically. The arithmetic means of individual items making up each scale of burnout were calculated, and statistical analyses were performed using Mann-Whitney U nonparametric test.

Results

From the 176 radiological sciences students approached, 96 (54.5%) completed the questionnaire. The percentage of students who were at moderate to high risk of burnout for emotional exhaustion, cynicism, and professional efficacy were 70.8%, 75% and 74%, respectively. Fourth-year students emotional exhaustion mean scale score was 19.3 ± 6.8 indicating significant higher burnout levels (P = 0.042), compared to third-year students mean scale score of 15.9 ± 7.2. Fourth-year female students cynicism mean scale score was 16.3 ± 7.6 indicating significant higher burnout levels (P = 0.035), compared to third-year female students mean scale score of 10.3 ± 7.1. Fourth-year female students showed significant lower professional efficacy mean score (21.1 ± 8.0), compared to males (26.1 ± 7.9, P = 0.007).

Conclusions

Our study shows 73.3% moderate to high burnout rates among Saudi radiological sciences students. A greater proportion of fourth year female students reported high levels of emotional exhaustion. Burnout increases as students advance to the fourth year. A block/modular curriculum structure for fourth-year courses may be necessary to reduce burnout among fourth-year students. The provision of academic counseling can relieve students' emotional stress and therefore reduce the risk of burnout.

Background

It was Herbert Freudenberger who introduced the term "burnout" into the research lexicon in 1974, describing the condition as "lack of motivation, emotional exhaustion, and cynicism." [1]. Burnout is characterized by three main elements including exhaustion, cynicism, and reduced professional efficacy in the workplace [2]. Medical-related research on burnout syndrome has increased greatly in recent years due to its adverse effect on health care workers as well as health sciences students. The symptoms of burnout may adversely affect the academic life of students through incompetence and unwillingness to exert effort [3]. Besides decreasing students' concentration and attention, burnout can also lead to absenteeism, negligence, cheating during exams, withdrawal from the program and an increase in medical errors during clinical rotations [4–6]. Burnout may also increase the risk of drug abuse and suicide among students [7, 8]. Additionally, the fear of examinations, insufficient leisure time, and high parental expectations can also contribute to a buildup of stress, resulting in burnout [9].

The curriculum of Radiological Sciences (RADS) program at the College of Applied Medical Sciences (CoAMS) in King Saud bin Abdulaziz University for Health Sciences (KSAU-HS), Kingdom of Saudi Arabia (KSA) is designed to provide high quality of undergraduate education and maximize the students' potential through intensive instructional and practical training. It is a four-year tracks-based program offered in three different cities / campuses within the KSA, in which three specialization pathways are incorporated including: a) Computed Tomography and Magnetic Resonance Imaging (CT & MRI) track; b) Vascular and Interventional Radiology (VIR) track, and c) Ultrasound (US) track. RADS' curriculum study plan offers preprofessional science and health courses to students during their first two years, after which students begin their professional studies in the third year (block/modular

curriculum structure) and fourth year of the program (traditional semester structure). RADS' curriculum incorporates a variety of instructional methods, such as interactive lectures, practical sessions, problem-based learning (PBL) and team-based learning (TBL), group discussions, and case studies. Additionally, RADS programs offer various field/clinical experiences during the third and fourth years of the program that provide students with hands-on training.

In the KSA, burnout has been reported in several studies among physicians, residents, nurses, radiographers and physiotherapists [10–15], and also among undergraduate students of various health specialties including medical and dental students, health and rehabilitation sciences, nursing, and pharmacy students [3, 16–20]. However, no study has been conducted to examine the prevalence of burnout among radiological sciences students in the KSA.

Thus, the aim of this study was to assess the prevalence of burnout among radiological sciences students using Maslach Burnout Inventory-General Survey for Students MBI-GS (S) within three campuses applied medical sciences college system in the KSA. The specific objective was to measure the levels of burnout among Saudi 3rd and 4th year male and female radiological sciences students

Methods

Participants and Procedure:

A cross-sectional study was conducted between November and December 2020 among RADS students enrolled in COAMS at the three campuses of KSAU-HS. All students (n = 176) from third and fourth year were approached via email invitation. The online questionnaire was administered using electronic survey tool (i.e., Google form).

Data collection:

The students were asked to complete the previously used and validated Maslach Burnout Inventory-General Survey for Students MBI-GS (S) [21]. The 16-item MBI–GS (S) is used to measure the levels of burnout in students and consists of three distinct burnout dimensions/subscales: a) emotional exhaustion (5-item), which assesses feelings of severe fatigue caused by study demands and represents the stress component of burnout; 2) cynicism (5-item), which assesses student's mental indifferent or distant attitude towards his/her studies or emotional detachment from other students at an academic setting, and represents the interpersonal component of the syndrome; and 3) professional efficacy (6-item), which assesses feelings of decline in one's competence and productivity and satisfaction with past and present accomplishments, and represents the self-evaluation component of burnout [18, 22].

Measurement of burnout:

All items are scored on a 7-point frequency rating scale ranging from 0 (never) to 6 (every day). For each respondent. the three subscale scores were calculated and interpreted separately. The subscale scoring was calculated using two methods (i.e., summation "SUM", and Average "AVE"), as described in Maslach et al. 2018 [22]. These two methods were used to comparing results to many recent publications. For both methods, higher scores in the exhaustion and cynicism scales indicate higher degrees of burnout, whereas lower scores in the professional efficacy scale indicate higher degrees of burnout. Scores of each dimension of burnout are then determined by calculating the arithmetic means of individual items making up each scale of burnout. The score for each burnout subscale is categorized into "low", "moderate", or "high", according to the lower (i.e., scoring in the 25th percentile or lower), medium (i.e., scoring between the 25th and 75th percentile), and upper quartile (i.e., scoring in the 75th percentile or higher) of the score-distribution [23, 24].

Ethical consideration:

This research was approved by the local institutional review board (IRB) authority. Participation was voluntary and written informed consent was obtained before filling the questionnaire. Anonymity and confidentiality were maintained throughout as the Microsoft Excel file exported from the electronic survey tool is a) password protected and b) does not reveal any subject identification attributes.

Statistical Analyses:

Statistical analysis consisted of four steps. First, descriptive statistics (mean “μ” and standard deviation “SD” or “σ”) of the scores were generated. Second, cronbach’s alpha test was used to examine the internal consistency for exhaustion, cynicism, and professional efficacy. Third, shapiro wilk test was used to examine data (i.e., scores) normality. Fourth, Mann-Whitney U nonparametric test was used to examine any difference between groups in score means (i.e., male vs. female and third year vs. fourth year students). All analysis were conducted using SPSS version 23 and at a statistical significance level of 0.05.

Results

Out of 176 RADs undergraduate students enrolled in CoAMS, 96 [3rd year = 38 (25 male; 13 female), 4th year = 58 (26 male; 32 female) students] of them agreed to participate, resulting in a 54.5% overall response rate. Of the 58 fourth-year students participating, 46 (77.3 %) were enrolled in the CT & MRI track, 9 (15.5 %) in the ultrasound track, and 3 (5.2 %) in the VIR track. There was also no statistically significant difference in the mean scores of fourth-year students between tracks on all items comprising the emotional exhaustion, cynicism, and professional efficacy dimensions. Descriptive and inferential statistics of the 96 RADS undergraduate students are shown in Table 1. Internal consistencies (Cronbach’s alpha) for the three subscales of MBI-GS (S) of the whole sample were good and acceptable ($\alpha > 0.70$) “exhaustion (3rd year $\alpha = 0.78$; 4th year $\alpha = 0.85$), cynicism (3rd year $\alpha = 0.73$; 4th year $\alpha = 0.76$), and professional efficacy (3rd year $\alpha = 0.825$; 4th year $\alpha = 0.83$).

Table 1
Descriptive and inferential statistics of MBI-General Survey for Students MBI-GS (S)

MBI-GS (S)		Third year RADs Students					Fourth year RADs Students				
Scale /Item		Burnout Level (Mean ± SD)			P-Value	Cronbach's Alpha	Burnout Level (Mean ± SD)			P-Value	Cronbach's Alpha
		Total (n = 38)	Male (n = 25)	Female (n = 13)	Male vs. Female		Total (n = 58)	Male (n = 26)	Female (n = 32)	Male vs. Female	
Exhaustion	**SUM method**	**15.9 ± 7.2**	**17.0 ± 6.3**	**13.7 ± 8.6**	**0.18**	-	**19.3 ± 6.8**	**18.0 ± 6.5**	**20.3 ± 7.0**	**0.16**	-
	AVE method	**3.2 ± 0.2**	**3.4 ± 0.2**	**2.7 ± 0.3**	**0.18**	-	**3.9 ± 0.2**	**3.6 ± 0.3**	**4.1 ± 0.2**	**0.16**	-
Item 1		3.0 ± 1.9	3.0 ± 1.9	3.1 ± 1.9	0.85	0.780	3.8 ± 1.6	3.5 ± 1.6	4.0 ± 1.6	0.3	0.853
Item 2		3.5 ± 1.8	3.7 ± 1.7	3.0 ± 1.8	0.26		4.0 ± 1.5	4.0 ± 1.6	3.8 ± 2.0	0.86	
Item 3		3.1 ± 2.1	3.2 ± 2.0	2.8 ± 2.4	0.62		3.6 ± 2.0	3.3 ± 2.0	3.8 ± 2.0	0.27	
Item 4		3.2 ± 2.0	3.6 ± 1.9	2.5 ± 2.0	0.09		4.2 ± 1.8	3.9 ± 1.9	4.4 ± 1.7	0.35	
Item 6		3.1 ± 2.1	3.5 ± 2.2	2.4 ± 1.9	0.1		3.8 ± 1.7	3.4 ± 1.6	4.1 ± 1.7	0.14	
Cynicism	**SUM method**	**12.6 ± 7.0**	**13.8 ± 6.8**	**10.3 ± 7.1**	**0.15**	-	**14.8 ± 7.1**	**13.0 ± 6.0**	**16.3 ± 7.6**	**0.07**	-
	AVE method	**2.5 ± 0.9**	**2.8 ± 1.0**	**2.1 ± 0.9**	**0.15**	-	**3.0 ± 0.9**	**2.6 ± 1.0**	**3.3 ± 0.8**	**0.07**	-
Item 8		2.0 ± 2.0	2.1 ± 2.2	1.9 ± 1.8	0.98	0.726	2.4 ± 2.1	1.9 ± 1.9	2.8 ± 2.1	0.1	0.756
Item 9		2.4 ± 2.1	2.2 ± 2.1	2.7 ± 2.2	0.52		2.8 ± 2.0	2.5 ± 2.0	3.1 ± 1.9	0.28	
Item 13		4.1 ± 1.9	4.5 ± 1.8	3.2 ± 2.0	0.045		4.5 ± 1.8	4.3 ± 1.9	4.7 ± 1.7	0.67	
Item 14		2.3 ± 2.1	2.9 ± 2.1	1.3 ± 2.1	0.044		2.7 ± 2.0	2.4 ± 2.0	3.0 ± 2.1	0.27	
Item 15		1.8 ± 2.0	2.2 ± 2.0	1.2 ± 1.7	0.15		2.4 ± 2.0	1.8 ± 1.7	2.8 ± 2.2	0.09	
Professional Efficacy	**SUM method**	**24.0 ± 8.2**	**24.8 ± 6.4**	**22.5 ± 10.9**	**0.97**	-	**23.3 ± 8.3**	**26.1 ± 7.9**	**21.1 ± 8.0**	**0.007**	-
	AVE	**4.0**	**4.1**	**3.7**	**0.97**	-	**3.9**	**4.3**	**3.5**	**0.007**	-

	method	± 0.4	± 0.3	± 0.6			± 0.3	± 0.4	± 0.3		
Item 5		4.1 ± 1.8	4.2 ± 1.5	3.7 ± 2.2	0.65	0.825	3.8 ± 1.7	3.9 ± 1.5	3.3 ± 2.2	0.27	0.831
Item 7		3.6 ± 1.9	3.9 ± 1.8	3.1 ± 1.8	0.2		3.6 ± 1.8	4.2 ± 1.6	3.1 ± 1.8	0.01	
Item 10		4.2 ± 1.9	4.2 ± 1.9	4.2 ± 2.0	0.92		4.1 ± 1.9	4.7 ± 1.8	3.7 ± 2.0	0.02	
Item 11		4.4 ± 1.8	4.5 ± 1.7	4.3 ± 2.1	0.76		4.3 ± 2.0	4.7 ± 1.6	3.9 ± 2.2	0.15	
Item 12		3.4 ± 2.0	3.7 ± 2.1	3.0 ± 1.9	0.31		3.6 ± 1.9	4.0 ± 1.9	3.3 ± 1.9	0.15	
Item 16		4.2 ± 1.9	4.3 ± 1.7	4.2 ± 2.2	0.84		4.2 ± 1.7	4.7 ± 1.7	3.8 ± 1.6	0.03	

Male vs. Female:

The mean scores of burnout dimensions among RADs male and female students are shown in Fig. 1, the supporting numerical data is listed in Table 1. Third-year male and female students' emotional exhaustion mean scale scores were (17.0 ± 6.3 and 13.7 ± 8.6, respectively), showing no statistically significant difference (P = 0.18) between groups (i.e., male vs. female). Fourth-year male and female students' emotional exhaustion mean scale score were (18.0 ± 6.5 and 20.3 ± 7.0, respectively), with no statistically significant difference (P = 0.16). Additionally, there was no statistically significant difference between the mean scores of male and female students (i.e., third year and fourth year) for each individual item making up the emotional exhaustion dimension.

Third-year male and female students' cynicism mean scale scores were (13.8 ± 6.8 and 10.3 ± 7.1, respectively), whereas fourth-year male and female students' mean scale scores were (13.0 ± 6.0 and 16.3 ± 7.6, respectively) showing no statistically significant difference between groups (i.e., male vs. female) with p-values of 0.15 for third-year students and 0.07 for fourth-year students. Third-year male students' cynicism means scores for items 13 and 14 were significantly higher compared to female students (P = 0.045, and 0.044, respectively), indicating that male students were more cynical than females. There was no statistically significant difference between the mean scores of third year male and female students on the other items making up the cynicism dimension. Additionally, there was no statistically significant difference between the mean scores of fourth year male and female students on all items making up the cynicism dimension.

Third-year male and female students' professional efficacy mean scale scores were (24.8 ± 6.4 and 22.5 ± 10.9, respectively), showing no statistically significant difference between groups (i.e., male vs. female) (P = 0.97). In contrast, fourth-year male and female students' professional efficacy mean scale score were (26.1 ± 7.9 and 21.1 ± 8.0, respectively), showing statistically significant difference between groups (P = 0.007), and indicating higher burnout levels for females. Fourth-year female students' professional efficacy means scores for items 7, 10 and 16 were significantly lower compared to male students (P = 0.01, 0.01, and 0.02, respectively). There was no statistically significant difference between the mean scores of fourth year male and female students on the other items making up the professional efficacy dimension. Additionally, there was no statistically significant difference between the mean scores of third year male and female students on all items making up the professional efficacy dimension.

Third year vs. Fourth-year students:

Fourth-year students emotional exhaustion mean scale score was 19.3 ± 6.8 indicating significant higher burnout levels (P = 0.042), compared to third-year students mean scale score of 15.9 ± 7.2 Table 1. Furthermore, the fourth-year students emotional exhaustion mean scores for items 1, and 4 were significantly different compared to third-year students (P = 0.049, and 0.022, respectively). Fourth-year female students' emotional exhaustion means scores for items 1, 4, and 6 were significantly higher compared to third-year female students (P = 0.05, 0.005, and 0.014, respectively). There was no statistically significant difference between the mean

scores of third year and fourth-year female students on the other items making up the emotional exhaustion dimension. Additionally, there was no statistically significant difference between the mean scores of third year and fourth-year male students on all items making up the emotional exhaustion dimension.

Fourth-year female students cynicism mean scale score was 16.3 ± 7.6 indicating significant higher burnout levels (P = 0.035), compared to third-year female students mean scale score of 10.3 ± 7.1.

Fourth-year female students' cynicism means scores for items 13, 14, and 15 were significantly higher compared to third-year female students (P = 0.006, 0.014, and 0.016, respectively). There was no statistically significant difference between the mean scores of third year and fourth-year female students on the other items making up the cynicism dimension. Additionally, there was no statistically significant difference between the mean scores of third year and fourth-year male students on all items making up the cynicism dimension.

There was also no statistically significant difference between the mean scores of third year and fourth year (male and female) students on all items making up the professional efficacy dimension.

Interpretation of MBI-GS (S) scores:

Table 2 summarizes the classification cut-off values of MBI–GS (S) scales' scores for all radiological sciences' undergraduate students into low, moderate, or high risk of burnout; the interpretation of MBI–GS (S) scales' scores for all students is listed in Table 3 and illustrated in Fig. 2a-c. For the whole sample (Fig. 2a), the percentage of students who were at moderate to high risk of burnout for emotional exhaustion, cynicism, and professional efficacy were 70.8%, 75% and 74% respectively; the percentage of male students who were at moderate to high risk of burnout for emotional exhaustion, cynicism, and professional efficacy were 70.6%, 78.4% and 62.8% respectively; and the percentage of female students who were at moderate to high risk of burnout for emotional exhaustion, cynicism, and professional efficacy were 71%, 71.1% and 86.7% respectively.

Table 2
Categorization of MBI-GS scores for radiological sciences undergraduate students

Sub-scale		Number of items	Calculation methods	Max. Score	High	Moderate	Low
Exhaustion	All students	5	Summation (SUM)	30	≥ 24	12.1–23.9	≤ 12
			Average (AVE)	6	≥ 4.8	2.5–4.7	≤ 2.4
Cynicism		5	Summation (SUM)	30	≥ 18	8.76–17.9	≤ 8.75
			Average (AVE)	6	≥ 3.6	1.76–3.5	≤ 1.75
Professional Efficacy		6	Summation (SUM)	36	≤ 19	19.1–29.9	≥ 30
			Average (AVE)	6	≤ 3.2	3.3–4.9	≥ 5
Exhaustion	Fourth year students	5	Summation (SUM)	30	≥ 24	13.25–23.9	≤ 13.25
			Average (AVE)	6	≥ 4.8	2.7–4.9	≤ 2.6
Cynicism		5	Summation (SUM)	30	≥ 19	10.1–18.9	≤ 10
			Average (AVE)	6	≥ 3.8	2.1–3.7	≤ 2
Professional Efficacy		6	Summation (SUM)	36	≤ 17.25	17.26–28.8	≥ 29
			Average (AVE)	6	≤ 2.8	2.9–4.7	≥ 4.8
Exhaustion	Third year students	5	Summation (SUM)	30	≥ 22.75	12.1–22.74	≤ 11
			Average (AVE)	6	≥ 4.6	2.3–4.5	≤ 2.2
Cynicism		5	Summation (SUM)	30	≥ 16	8–15	≤ 7.25
			Average (AVE)	6	≥ 3.2	1.6–3.1	≤ 1.4
Professional Efficacy		6	Summation (SUM)	36	≤ 21.25	22–29	≥ 30
			Summation (SUM)	30	≥ 22.75	12.1–22.74	≤ 11

Table 3
Interpretation of MBI-GS subscale scores for radiological sciences undergraduate students

Sub-scale			n (%)		
			High	**Moderate**	**Low**
Exhaustion	All students	Total (N = 96)	25 (26)	43 (44.8)	28 (29.2)
		Male (N = 51)	9 (17.6)	27 (53)	15 (29.4)
		Female (N = 45)	16 (35.5)	16 (35.5)	13 (29)
Cynicism		Total (N = 96)	28 (29.2)	44 (45.8)	24 (25)
		Male (N = 51)	13 (25.5)	27 (52.9)	11 (21.6)
		Female (N = 45)	15 (33.3)	17 (37.8)	13 (28.9)
Professional Efficacy		Total (N = 96)	24 (25)	47 (49)	25 (26)
		Male (N = 51)	11 (21.6)	21 (41.2)	19 (37.2)
		Female (N = 45)	13 (28.9)	26 (57.8)	6 (13.3)
Exhaustion	Fourth year students	Total (N = 58)	17 (29.3)	26 (44.8)	15 (25.9)
		Male (N = 26)	4 (15.4)	14 (53.8)	8 (30.8)
		Female (N = 32)	13 (40.6)	12 (37.5)	7 (21.9)
Cynicism		Total (N = 58)	16 (27.6)	21 (36.2)	21 (36.2)
		Male (N = 26)	4 (15.4)	11 (42.3)	11 (42.3)
		Female (N = 32)	12 (37.5)	10 (31.25)	10 (31.25)
Professional Efficacy		Total (N = 58)	15 (25.9)	27 (46.5)	16 (27.6)
		Male (N = 26)	5 (19.2)	10 (38.5)	11 (42.3)
		Female (N = 32)	10 (31.3)	17 (53.1)	5 (15.6)
Exhaustion	Third year students	Total (N = 38)	10 (26.3)	16 (42.1)	12 (31.6)
		Male (N = 25)	7 (28)	14 (56)	4 (16)
		Female (N = 13)	3 (23.1)	2 (15.4)	8 (61.5)
Cynicism		Total (N = 38)	14 (36.8)	14 (36.8)	10 (26.4)
		Male (N = 25)	8 (32)	13 (52)	4 (16)
		Female (N = 13)	6 (46.1)	1 (7.8)	6 (46.1)
Professional Efficacy		Total (N = 38)	10 (26.3)	17 (44.7)	11 (29)
		Male (N = 25)	7 (28)	10 (40)	8 (32)
		Female (N = 13)	3 (23.1)	7 (53.8)	3 (23.1)

For fourth year RADS students (Fig. 2b), the percentage of students who were at moderate to high risk of burnout for emotional exhaustion, cynicism, and professional efficacy were 74.1%, 63.8% and 72.4% respectively; the percentage of male students who were at moderate to high risk of burnout for emotional exhaustion, cynicism, and professional efficacy were 69.2%, 57.7% and 57.7% respectively; and the percentage of female students who were at moderate to high risk of burnout for emotional exhaustion, cynicism, and professional efficacy were 78.1%, 68.75% and 84.4% respectively.

For third year RADS students (Fig. 2c), the percentage of students who were at moderate to high risk of burnout for emotional exhaustion, cynicism, and professional efficacy were 68.4%, 73.6% and 71% respectively; the percentage of male students who were at moderate to high risk of burnout for emotional exhaustion, cynicism, and professional efficacy were 84%, 84% and 68%

respectively; and the percentage of female students who were at moderate to high risk of burnout for emotional exhaustion, cynicism, and professional efficacy were 38.5%, 53.9% and 76.9%, respectively.

Discussion

In this study, burnout was described by its main three elements: feelings of exhaustion due to study demands, mental detachment toward one's study, and feeling incompetent as a radiological sciences student. Burnout is considered when students report high emotional exhaustion and cynicism values, but low professional efficacy values. To the best of our knowledge, this is the first study to measure burnout among RADS students in Saudi Arabia. This study revealed the following main findings: a) the percentage of students who were at moderate to high risk of burnout for emotional exhaustion, cynicism, and professional efficacy were 70.8%, 75% and 74%, respectively, b) the mean scores for emotional exhaustion and cynicism were higher than the MBI-GS norms, and the mean scores for professional efficacy were lower [22], c) third year male students were more cynical than females, d) fourth year female students showed higher feelings of incompetence compared to males, e) fourth year students showed higher feelings of exhaustion compared to third year students, and f) fourth year female students were more cynical than third year females.

Although the overall response rate is considered excellent, the majority (77.3%) of responses were from students enrolled in the CT & MRI track, followed by 15.5 % and 5.2 % from students enrolled in the ultrasound and VIR tracks, respectively. The reason for this is because the CT & MRI track is available across all campuses, while the ultrasound and VIR tracks are available only at one campus. We were unable to compare our findings with other local studies within the context of radiological sciences since no such study has ever been carried out in Saudi Arabia prior to our work. Rather, we compared our findings with local studies that examined burnout among medical, dental, pharmacy, health sciences, and nursing Saudi students.

The results showed similar burnouts' subscales proportionality and prevalence for RADS students within the high risk group; 25 (26%) of RADS students had high levels of emotional exhaustion, 28 (29%) had high levels of cynicism, and 24 (25%) had low levels of professional efficacy. In comparison, these levels were lower than those reported for 249 Saudi medical students admitted in the same institution [25], and 632 Saudi medical students admitted in different institutions [17, 18].

Previous studies have reported a larger proportion of Saudi female medical students exhibiting higher emotional exhaustion than their male counterparts; these studies further reported comparable prevalence within the high-risk group between Saudi female and male medical students for the cynicism and professional efficacy domains [17, 18]. Similarly, our findings revealed a larger proportion (35.5%) of the RADS female students were suffering from high emotional exhaustion, compared to 18% for males; our findings also revealed comparable proportionality between RADS female and male students within the high-risk group for the cynicism and professional efficacy domains (Table 3).

In our study, we found that third year RADS male students were more cynical than female students. Furthermore, fourth year female students showed higher feelings of incompetence compared to males. In contrast, gender was not a predictor of cynicism and was not associated with academic efficiency among Saudi medical students [18].

The findings of this study revealed that fourth-year students (i.e., specifically females), showed higher levels of burnout than third-year students. In addition to feeling emotionally drained by their study load, and stressed from being in classes all day, fourth-year students have more cynical attitudes and doubts about the significance of university work. These findings support previous studies suggesting that student burnout increases as students advance in classes [26–28], and contradict a study reporting that the level of burnout diminishes as the Saudi medical students advance from pre-clinical to clinical years [17]. This study findings may be attributed to the nature of the traditional fourth-year curriculum delivery, which involves students enrolled in four different theoretical and practical courses over the course of a semester, which are typically delivered under tight time constraints, where students are likely to experience high stress and burnout. The third-year curriculum, on the other hand, incorporates a block system (i.e., block curriculum delivery) where students take only two courses at a time to fully understand the content area before advancing to the next module, which may enhance students' motivation and interest. Despite the benefits of both types of curriculum delivery, the block/modular format allows better student focus, helps students to understand the amount of material to be learned, unburdens students and allows them to devote more time to their studies, and is more appropriate for clinical courses.[29] The degree of burnout among Saudi students enrolled in the colleges of pharmacy, dentistry, health and rehabilitation sciences, and nursing has been attributed to differences in the curriculum structure, which affects stress levels and increases burnout [3].

The limitations of this study stems from not investigating the etiological factors associated with burnout. Additionally, the lower sample size of RADs 4th year students enrolled in the ultrasound and VIR tracks may have limited “between tracks” comparison. Further studies should be carried out to explore and determine the factors linked with burnout among RADS students.

Conclusions

Our study shows 73.3% moderate to high burnout rates among RADS students. A greater proportion of RADS fourth year female students reported high levels of emotional exhaustion as compared to their male and third year counterparts. The burnout rate increases as RADS students advance from the third to the fourth year. Considering these findings, medical educators and health care professionals should pay greater attention to the mental health of students. A variety of preventative measures, including improving coping skills, providing targeted support, and increasing mental health awareness, are necessary. Academic counseling programs can greatly reduce students' emotional stress and therefore alleviate burnout symptoms. The higher burnout levels experienced by fourth year students than those of the third year may necessitate a curriculum transition from the traditional semester-based structure to block/modular structure for RADS fourth-year courses, without making any other significant changes to the curriculum design or content. This topic requires further investigation in light of the findings of this study.

Abbreviations

RADS: Radiological Sciences; MBI-GS: Maslach Burnout Inventory-General Survey for Students; KSA: Kingdom of Saudi Arabia; CT & MRI: Computed Tomography and Magnetic Resonance Imaging; VIR: Vascular and Interventional Radiology.

Declarations

- ### Ethics approval and consent to participate:

Ethical approval was obtained from the institutional review board at King Abdullah International Medical Research Center (KAIMRC). Participation was voluntary and written informed consent was obtained before filling the questionnaire. All methods were performed in accordance with the relevant guidelines and regulations.

- ### Consent for publication:

Not applicable

- ### Availability of data and materials:

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

- ### Competing interests:

The authors declare that they have no competing interests.

- ### Funding:

Not applicable

- ### Authors' contributions:

The first and second author had an equal contribution. K. A. (1st author): Idea generation, Literature review, Survey design, Data collection, Data analysis, manuscript writing. A. A. (2nd author): Data analysis, manuscript writing. The third, fourth and fifth authors had an equal contribution. A. M. (3rd author): proposal writing, data collection & data entry. W. M. (4th author): proposal writing, data collection & data entry. A. A. (5th author): proposal writing, data collection & data entry. The sixth, seventh, and eighth authors had an equal contribution. M. A. (6th author): Data analysis, manuscript writing. A. Q. (7th author): Data analysis, manuscript writing. R. K. (8th author): Data analysis, major contribution in manuscript writing. All authors read and approved the final manuscript.

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Figures

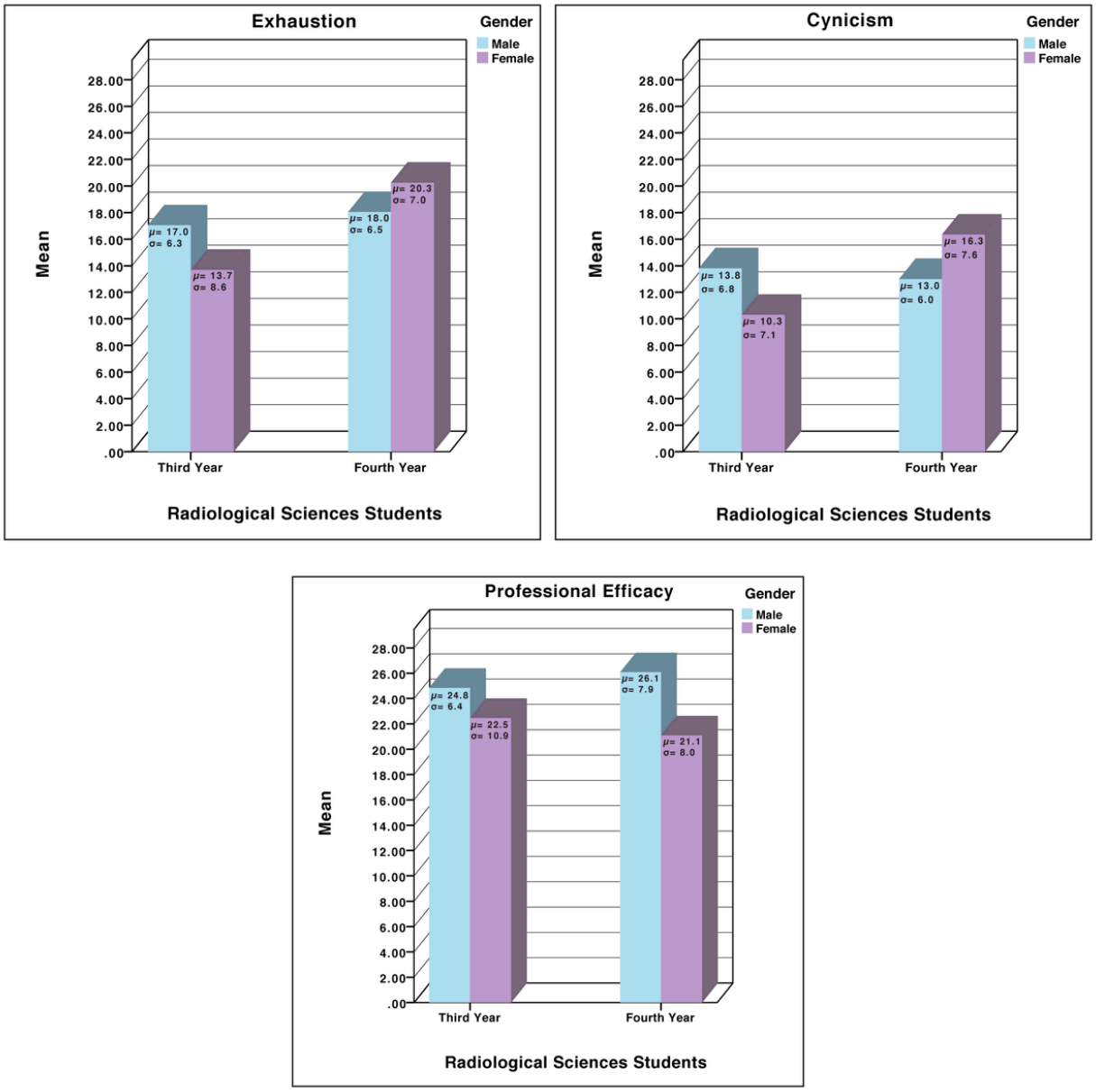

Figure 1

Mean scores of burnout dimensions among radiological sciences undergraduate male and female Students

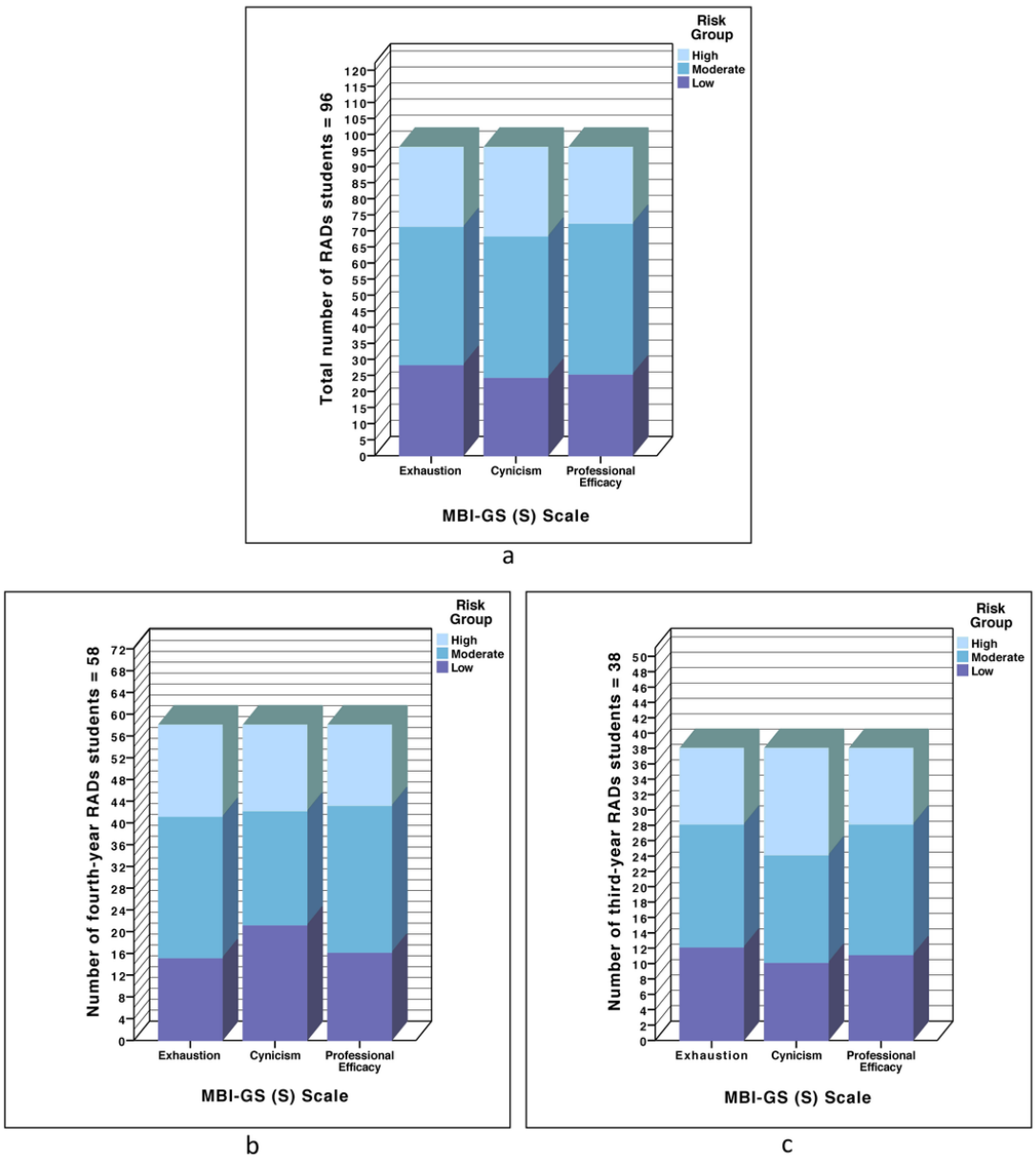

Figure 2

Interpretation of MBI-GS subscale scores for radiological sciences undergraduate students