

Self-isolation during the COVID-19 pandemic is associated with increased risk of burnout among physician trainees: A cross sectional study

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Abstract

The COVID-19 pandemic emerged in late 2019. Previous research has shown a significant prevalence of burnout among physician trainees, with concern that the pandemic will increase burnout. We aimed to assess this risk among trainees at a large academic hospital. We performed a cross-sectional study during the pandemic using a survey that included the Maslach Burnout Inventory. The response rate was 94.7%. Among trainees, 58.5% changed their living arrangements to protect family. Psychological well-being was negatively affected in 81.7% and clinical performance in 64.3%; 13.8% were at high risk of burnout. Emotional exhaustion (EE) scores were high in 50% and depersonalization (DP) scores in 28.8%; a sense of personal accomplishment was low in 41.9%. Increased risk of burnout was associated with male gender and increased exposure to suspected COVID-19 cases. Risk of high EE correlated with an increased number of children and risk of high DP with male gender. High EE and DP

score correlated with increased exposure to suspected and confirmed COVID-19 patients. Trainees who self-isolated to protect family were more likely to experience high DP and burnout. Trainees in surgical specialties were more likely to feel their clinical performance was negatively affected. The results suggest that a significant percentage of trainees are at high risk of burnout during the pandemic especially those that attempted self-isolation. Training programs should incorporate methods to maintain well-being and coping, including adequate time off between shifts. Future research should evaluate other aspects of trainee well-being in relation to self-isolation and/or changed living arrangements.

Key words:

Burnout, Medical education, pandemic, coronavirus, psychological wellbeing, medical residents

Introduction

The coronavirus pandemic emerged late in 2019, initially being reported in Wuhan, China, and referred to as coronavirus disease 2019 (COVID-19) (1). On March 11, 2020, it was declared a global pandemic by the World Health Organization (WHO) (2). By early July 2020, over 11 million patients across the world were infected and over 500,000 mortalities reported. Over 200,000 cases and over 1,000 mortalities were reported in Saudi Arabia (3).

Healthcare workers (HCW), physicians and medical trainees can experience high levels of burnout, and there is reason to believe that these levels may increase during the pandemic. The term "burnout" was first used by psychologist Herbert Freudenberger in 1974 when he described job dissatisfaction induced by work stressors (4). Recently, burnout has been defined as a state of physical, emotional, and psychological exhaustion; depersonalization; and a decreased sense of accomplishment. As an entity, burnout has been gaining much attention in the last decade (5-7). Prior to the pandemic, reviews showed that its prevalence among medical trainees ranged between 27% and 75% (5). Medical trainees in Saudi Arabia are no exception, with several studies showing a high risk of burnout among local trainees (9-11). Its risk factors among trainees include first-year residency, being single, and having social stressors, with some medical specialties having a higher risk than others (12).

High burnout has been reported among HCW during previous endemics and pandemics (5-8). Similarly, several studies have demonstrated a high incidence of burnout during the COVID-19 crisis among physicians and trainees (13-15), with much of the academic literature

of late warning of the possible psychological impact of the COVID-19 pandemic on HCW (16-18). One study showed the prevalence of burnout among trainees during the COVID-19 crisis to be 76% (14). Because medical trainees are on the front line of healthcare, burnout among them can be attributed to the nature of their duties, work hours, the stress and frustration they face, time-management difficulties, high demands, and dealing with critical situations (8,19). In a pandemic, high burnout risk can be attributed to mental stress, physical exhaustion, safety concerns, prolonged wearing of personal protective equipment (PPE), and change in work routine (14). Burnout can lead to negative effects on the trainee's performance, psychological well-being, job satisfaction, and productivity (5,12,19).

In this study, we aimed to assess the degree of burnout and possible contributing factors among medical trainees from various specialties who work at a large tertiary academic center that was a COVID-19 referral center during the pandemic in Jeddah, Saudi Arabia.

Methods

1. Study design and setting

This cross-sectional survey was conducted during the month of May 2020. We obtained approval from the Biomedical Ethics Unit in the Faculty of Medicine at King Abdulaziz University. The principal investigator distributed the voluntary survey electronically to all trainees who were either affiliated with King Abdulaziz University Hospital or undergoing training there. Participants were licensed physicians pursuing specialist training in an accredited residency training program.

2. Covariates and outcomes

The first part of the questionnaire included demographic characteristics, residency training level, the training program they were enrolled in, and their current rotation. We asked whether they normally lived with family members and if they had changed their living arrangements or attempted self-isolation since the pandemic started in order to protect family members. We asked whether they felt that the COVID-19 pandemic had affected their psychological well-being or clinical performance. We asked how often they came in contact with suspected or confirmed COVID-19 patients. The second part of the questionnaire included the Maslach Burnout inventory – Human Services Survey for Medical Personnel (MBI-HSS (MP)) (20). This externally validated survey has 22 questions that assess three domains: emotional exhaustion (EE, nine questions), depersonalization (DP, five questions), and sense of personal accomplishment (PA, eight questions). Participants responded to the 22 questions by choosing one of the following according to the perceived intensity: everyday = 6, a few times a week = 5, once a week = 4, a few times a month = 3, once a month or less = 2, a few times a year or less = 1, and never = 0. High scores in the EE and DP domains are associated with a higher risk of burnout, whereas high scores in the PA domain are associated with a lower risk of burnout. High EE was defined as a score of 27 or over and high DP as a score of 13 or over. Low PA was defined as a score of 31 or under. A high risk of burnout was defined as co-existing high EE, high DP, and low PA.

3. Statistical analysis

Statistical analysis was performed with R studio version 3.6.2 (R Studio, Inc., Boston, MA, USA). Counts and percentages were used to summarize the participants' demographics. Continuous variables were summarized as means and standard deviations. Burnout dimensions and overall burnout were summarized as continuous and categorical (dichotomous) variables based on the previously mentioned criteria. Cronbach's alpha was used to assess the reliability of the tool used; a value of ≥ 0.7 was considered satisfactory. Univariate analysis was initially performed by using a chi-square test of independence or an unpaired t-test to assess the association of demographic and work-related variables with the risk of burnout. The dichotomized versions of burnout dimensions were used as dependent variables. Four models were constructed, one for each of the three dimensions of burnout, as well as one for overall burnout (three dimensional). Independent variables included in the analysis were age, gender, marital status, training program level, and exposure to COVID-19.

Results

Table 1 : Descriptive statistics of the study sample

Characteristic	n (%) (N = 328)	Valid N
Gender		328
Female	169 (51.5)	
Male	159 (48.5)	
Age, mean \pm SD	27.9 \pm 2.25	326
Marital status		328
Single	181 (55.2)	
Married	140 (42.7)	
Divorced	7 (2.13)	
Number of children, mean \pm SD	0.37 (0.71)	328
0	241 (73.5)	
1	60 (18.3)	
2	19 (5.79)	
3	8 (2.44)	
Normally live with family members		328
No	28 (8.54)	
Yes	300 (91.5)	
Training level		328
First year resident	81 (24.7)	
Second year resident	76 (23.2)	
Third year resident	76 (23.2)	
Fourth year resident	71 (21.6)	
Fifth year resident	24 (7.32)	
Hospital (current month)		328
KAUH (Base hospital)	306 (93.3)	
Outside KAUH	22 (6.71)	

Note. All values are n (%) except where otherwise indicated. KAUH = King Abdulaziz University Hospital.

The questionnaire was completed by 328 of the 346 trainees contacted to fill out the survey, a response rate of 94.8%. Demographic data can be found in Table 1. Males and females were almost equally represented. Approximately half of the included trainees were single (55.2%) and the great majority (91.5%) normally lived with family members.

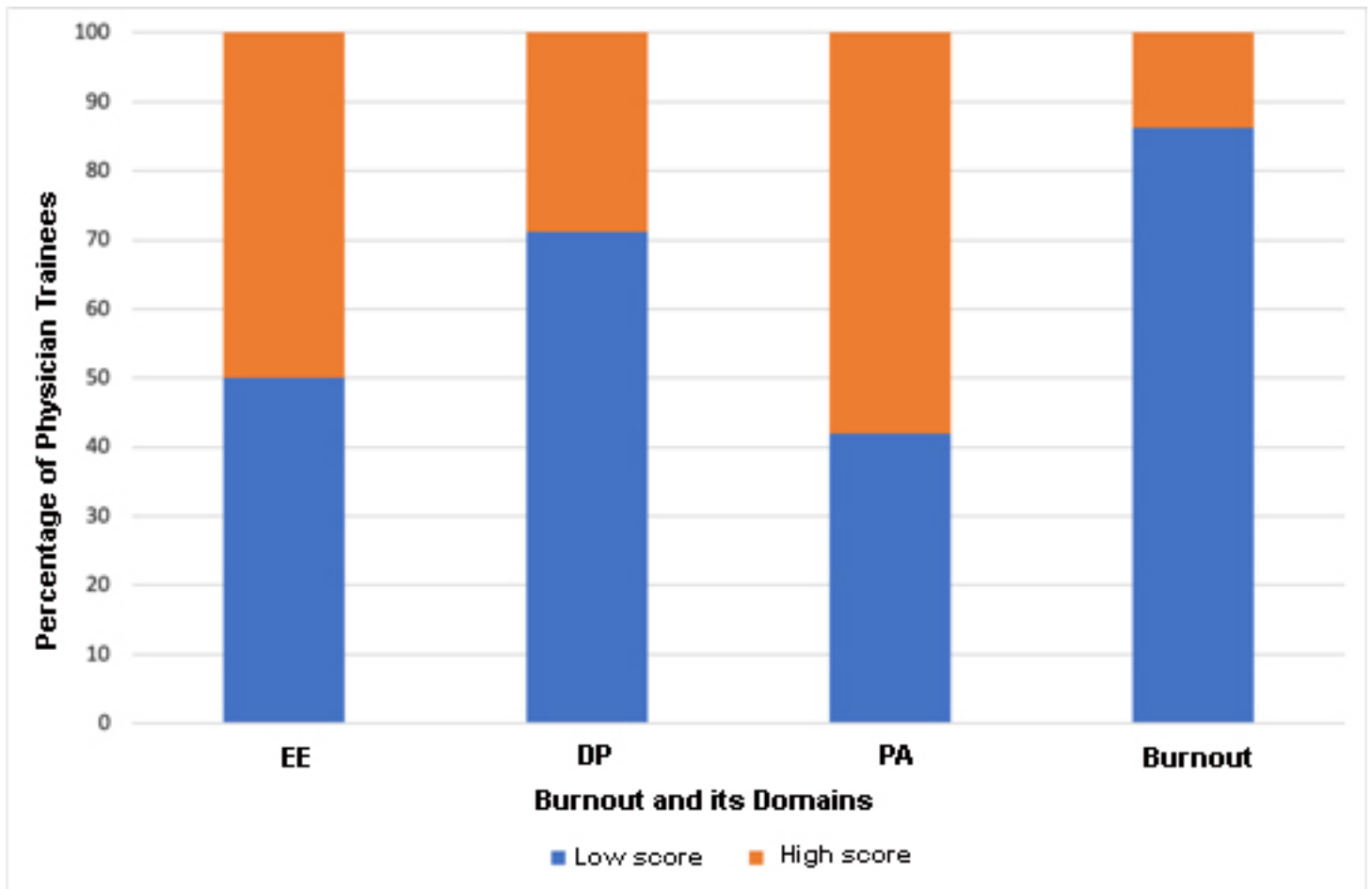
Table 2: Factors assessed in relation to the COVID-19 pandemic and burnout elements.

Factor	n (%)
Changed living arrangements and/or practiced self-isolation to protect family member from possible infection	
No	136 (41.5)
Yes	192 (58.5)
Exposure to <i>suspected</i> COVID-19 cases	
Less than once a week	115 (35.1)
A few times a week	134 (40.9)
Daily	79 (24.1)
Exposure to <i>confirmed</i> COVID-19 cases	
Less than once a week	220 (67.1)
A few times a week	66 (20.1)
Daily	42 (12.8)
Psychological well-being affected by the COVID-19 pandemic	
No	60 (18.3)
Yes	268 (81.7)
Clinical performance affected by the COVID-19 pandemic	
No	117 (35.7)
Yes	211 (64.3)
Burnout, mean \pm SD	
EE score ($\alpha=0.89$)	27.8 (12.2)
DP score ($\alpha=0.7$)	9.50 (6.23)
PA score ($\alpha=0.72$)	33.5 (7.52)

Note. All values are n (%) except where otherwise indicated. EE = emotional exhaustion, DP = depersonalization, PA = personal accomplishment.

More than half of the trainees (58.5%) changed their living arrangements or practiced some form of self-isolation in order to protect family members from infection. COVID-19 negatively affected the psychological well-being of 81.7% of the trainees and the clinical performance of 64.3%. The average EE score was 27.8, the average DP score 9.5, and the average PA score 33.5. Cronbach's alpha was ≥ 0.7 , which was considered satisfactory. These data can be found in Table 2.

Figure 1. Prevalence of burnout and its domains among physician trainees. EE = emotional exhaustion, DP = depersonalization, PA = personal accomplishment.



Fifty percent of the trainees had a high EE score, 28.8% had a high DP score, and 41.9% had a low PA score; these scores indicated a high risk of burnout, which was present in 13.8% of the trainees (Figure 1).

Factors associated with burnout dimensions and overall burnout

Table 3 Factors that affected burnout domain scores (EE, DP, and PA) in physician trainees.

Factor	EE (N = 161)		P-value	DP (N = 92)		P-value	PA (N = 134)		P-value
	Low n (%)	High n (%)		Low n (%)	High n (%)		Low n (%)	High n (%)	
Gender			1.000			0.005*			0.722
Female	83 (49.7)	84 (50.3)		130 (78.3)	36 (21.7)		95 (56.9)	72 (43.1)	
Male	78 (50.3)	77 (49.7)		97 (63.4)	56 (36.6)		91 (59.5)	62 (40.5)	
Age, mean (SD)	27.8 (2.13)	28.1 (2.37)	0.215	27.9 (2.15)	28.1 (2.52)	0.424	28.0 (2.36)	27.9 (2.14)	0.987
Marital status			0.317			0.613			0.497
Single	94 (53.4)	82 (46.6)		124 (70.9)	51 (29.1)		97 (55.4)	78 (44.6)	
Married	63 (45.3)	76 (54.7)		99 (72.3)	38 (27.7)		84 (60.9)	54 (39.1)	
Divorced	4 (57.1)	3 (42.9)		4 (57.1)	3 (42.9)		5 (71.4)	2 (28.6)	
Number of children			0.029*			0.607			0.967
0	125 (53.0)	111 (47.0)		167 (71.7)	66 (28.3)		135 (57.7)	99 (42.3)	
1	29 (49.2)	30 (50.8)		43 (72.9)	16 (27.1)		35 (59.3)	24 (40.7)	
2+	7 (25.9)	20 (74.1)		17 (63.0)	10 (37.0)		16 (59.3)	11 (40.7)	
Normally live with family members			0.323			0.447			0.623
No	11 (39.3)	17 (60.7)		17 (63.0)	10 (37.0)		18 (64.3)	10 (35.7)	
Yes	150 (51.0)	144 (49.0)		210 (71.9)	82 (28.1)		168 (57.5)	124 (42.5)	
Training level			0.114			0.315			0.212
First year resident	46 (58.2)	33 (41.8)		59 (75.6)	19 (24.4)		47 (59.5)	32 (40.5)	
Second year resident	30 (40.5)	44 (59.5)		48 (65.8)	25 (34.2)		41 (56.2)	32 (43.8)	
Third year resident	33 (43.4)	43 (56.6)		49 (65.3)	26 (34.7)		43 (58.1)	31 (41.9)	
Fourth year resident	39 (56.5)	30 (43.5)		54 (78.3)	15 (21.7)		36 (51.4)	34 (48.6)	
Fifth year resident	13 (54.2)	11 (45.8)		17 (70.8)	7 (29.2)		19 (79.2)	5 (20.8)	
Exposure to suspected COVID-19 cases			0.005*			<0.001*			0.840
Less than once a week	67 (60.4)	44 (39.6)		84 (76.4)	26 (23.6)		61 (56.0)	48 (44.0)	
A few times a week	66 (49.3)	68 (50.7)		104 (78.2)	29 (21.8)		80 (59.7)	54 (40.3)	
Daily	28 (36.4)	49 (63.6)		39 (51.3)	37 (48.7)		45 (58.4)	32 (41.6)	
Exposure to confirmed COVID-19 cases			0.003*			<0.001*			0.401
Less than once a week	122 (56.5)	94 (43.5)		162 (76.1)	51 (23.9)		123 (57.5)	91 (42.5)	
A few times a week	26 (40.0)	39 (60.0)		47 (71.2)	19 (28.8)		36 (54.5)	30 (45.5)	
Daily	13 (31.7)	28 (68.3)		18 (45.0)	22 (55.0)		27 (67.5)	13 (32.5)	
Hospital (current month)			0.825			0.940			0.898
KAUH (base hospital)	149 (49.7)	151 (50.3)		212 (71.4)	85 (28.6)		174 (58.4)	124 (41.6)	
Other (please specify)	12 (54.5)	10 (45.5)		15 (68.2)	7 (31.8)		12 (54.5)	10 (45.5)	

Table 3

Note. All values are n (%) except where otherwise indicated. Statistical analysis was performed by using a chi-square test of independence or an unpaired t-test. EE = emotional exhaustion, DP = depersonalization, PA = personal accomplishment, KAUH = King Abdulaziz University Hospital.

* P value < 0.05.

Statistical analysis showed trainees with a higher number of children had an increased risk of EE ($P < 0.05$), the percentage at high risk rising with an increase in the number of children. Higher frequency of exposure to suspected or confirmed COVID-19 cases was associated with a higher risk of EE ($P = 0.005$ and $P = 0.003$, respectively). Males were at higher risk of DP than females were (36.6% vs. 21.7%, respectively, $P = 0.005$). Higher frequency of exposure to suspected or confirmed COVID-19 cases was associated with a higher risk of DP ($P < 0.001$ for both comparisons). None of the included factors was significantly associated with a low sense of PA. These data are shown in Table 3.

Table 4: Factors associated with high risk of burnout among physician trainees

Factor	Burnout (three dimensional)		P-value
	Low n (%) (N = 276)	High n (%) (N = 44)	
Gender			0.017*
Female	151 (91.0)	15 (9.04)	
Male	125 (81.2)	29 (18.8)	
Age, mean (SD)	27.9 (2.26)	28.1 (2.24)	0.604
Marital status			1.000
Single	150 (86.2)	24 (13.8)	
Married	120 (86.3)	19 (13.7)	
Divorced	6 (85.7)	1 (14.3)	
Number of children			0.823
0	203 (86.8)	31 (13.2)	
1	50 (84.7)	9 (15.3)	
2+	23 (85.2)	4 (14.8)	
Normally live with family members			0.556
No	25 (92.6)	2 (7.41)	
Yes	251 (85.7)	42 (14.3)	
Training level			0.832
First year resident	69 (88.5)	9 (11.5)	
Second year resident	61 (83.6)	12 (16.4)	
Third year resident	66 (86.8)	10 (13.2)	
Fourth year resident	58 (84.1)	11 (15.9)	
Fifth year resident	22 (91.7)	2 (8.33)	
Exposure to suspected COVID-19 cases			0.05*
Less than once a week	97 (89.0)	12 (11.0)	
A few times a week	118 (88.7)	15 (11.3)	
Daily	61 (78.2)	17 (21.8)	
Exposure to confirmed COVID-19 cases			0.142
Less than once a week	189 (88.7)	24 (11.3)	
A few times a week	55 (83.3)	11 (16.7)	
Daily	32 (78.0)	9 (22.0)	
Hospital (current month)			0.521
KAUH (Base hospital)	258 (86.6)	40 (13.4)	
Outside KAUH	18 (81.8)	4 (18.2)	

Table 4

Note. All values are n (%) except where otherwise indicated. Statistical analysis was performed by using a chi-square test of independence or an unpaired t-test. KAUH = King Abdulaziz University Hospital.

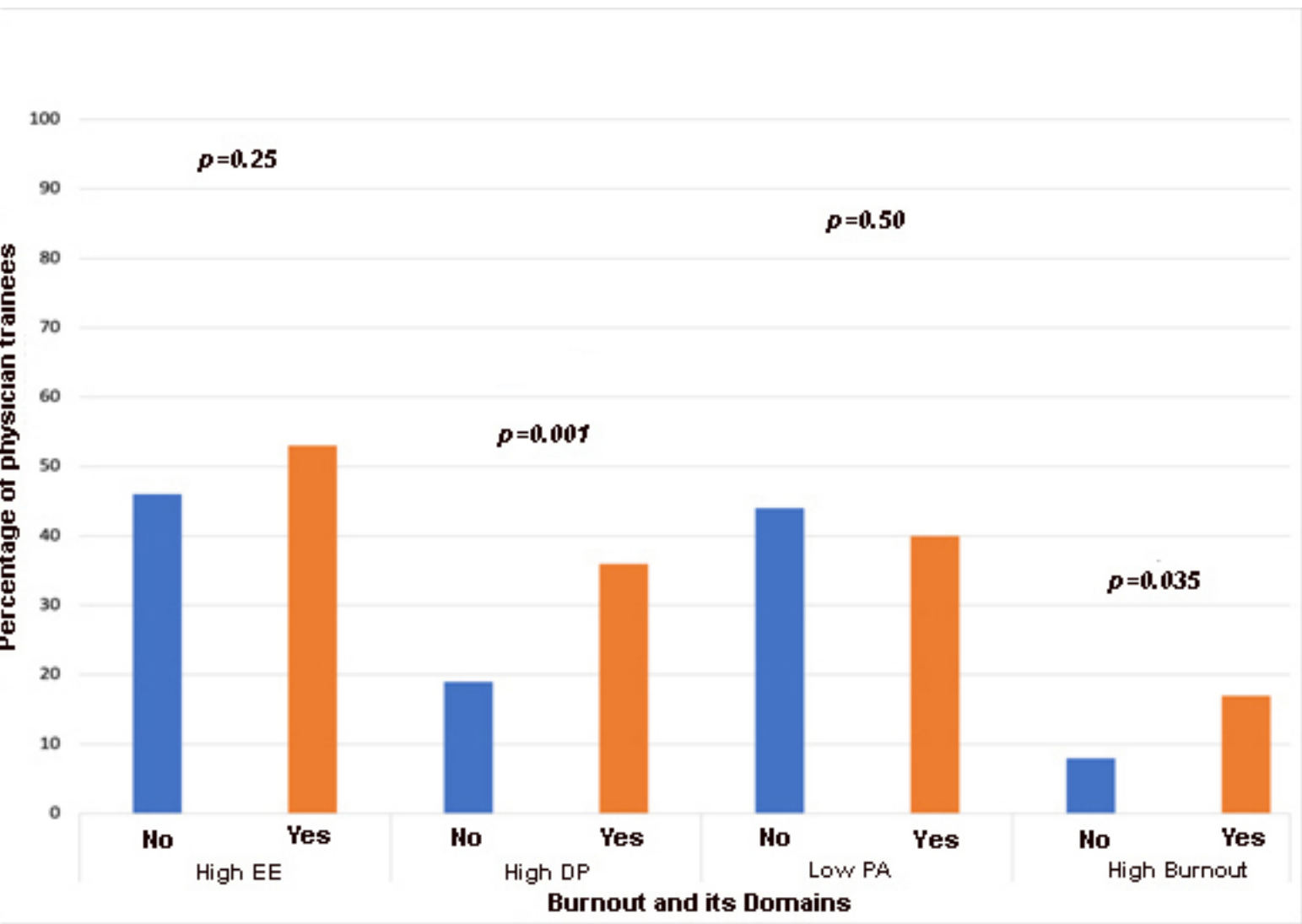
* P value < 0.05.

Statistical analysis showed that males were at higher risk of burnout than females were (18% vs. 9%, P < 0.05). High risk of burnout was more prevalent in those who were exposed to suspected cases daily (21.8%) than in those who were exposed to suspected cases weekly or less than weekly (P = 0.05). The risk of burnout increased with increased exposure to confirmed COVID-19 cases, but this did not reach statistical significance. None of the remaining factors were significantly associated with a high risk of burnout. Table 4 shows the full details.

Living arrangements and burnout

Results showed trainees who changed their living arrangements and/or self-isolated to protect family members during the pandemic were more likely to have a high risk of both DP and burnout than were those who did not, and this was statistically significant (Figure 2).

Figure 2. Association between changed living arrangements and/or self-isolation and burnout. EE = emotional exhaustion, DP = depersonalization, PA = personal accomplishment.



Clinical specialty and burnout

Table 5 shows that the highest proportions of burnt-out trainees were neurosurgeons (37.5%), followed by psychiatrists (33.3%) and urologists (33.3%). Among critical care trainees, 72.2% had a high EE score, whereas 50% of neurosurgeons, 44.4% of urologists, and 37.9% of internal medicine trainees had a high DP score.

Table 5: Percentage of physician trainees with significant scores in overall burnout and its domains by clinical specialty.

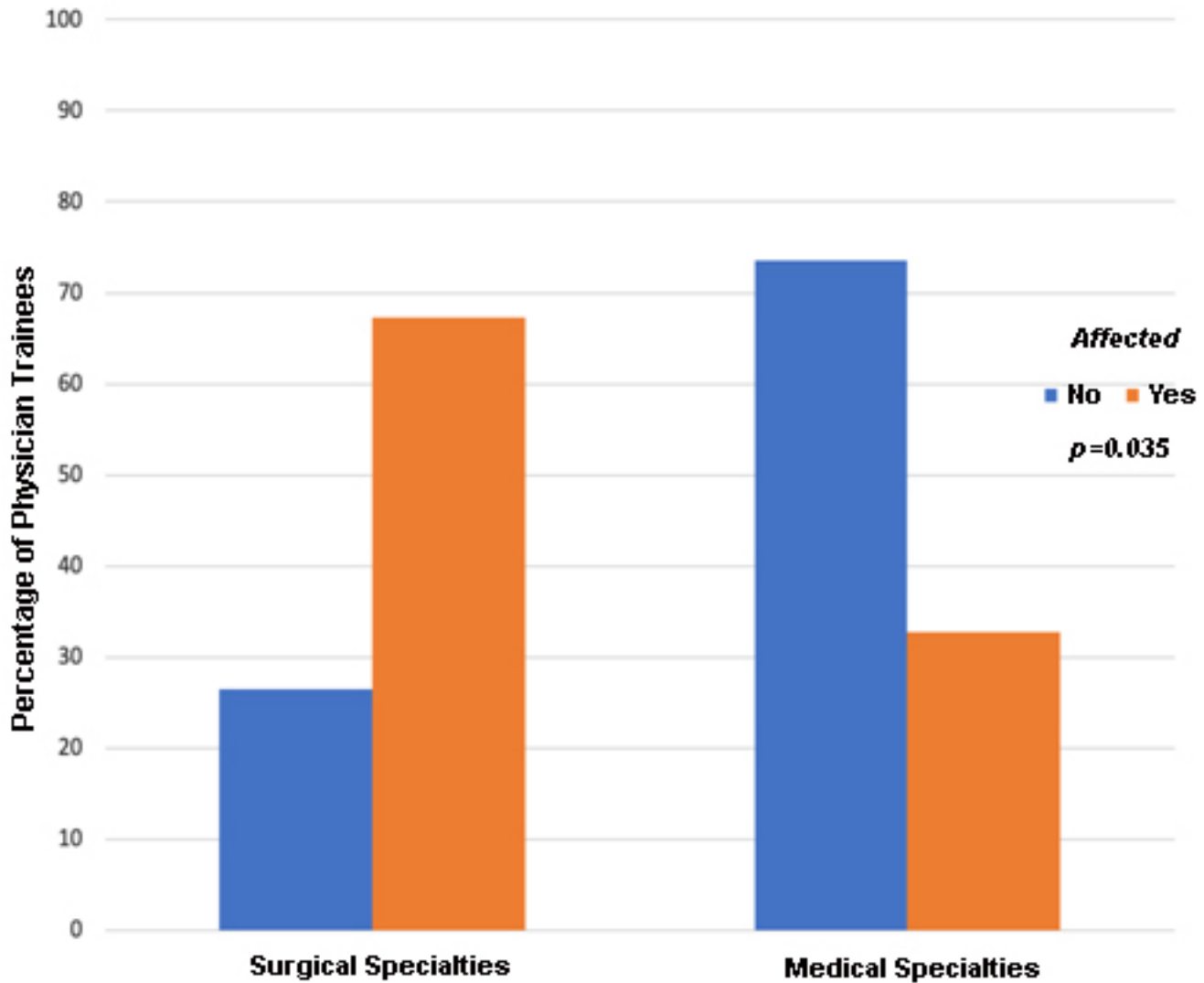
Clinical Specialty	N	EE High n (%) (N = 161)	DP High n (%) (N = 92)	PA Low n (%) (N = 134)	Burnout High n (%) (N = 44)
Anesthesia	16	7 (43.8)	2 (12.5)	6 (37.5)	0 (0.00)
Critical Care	18	13 (72.2)	6 (33.3)	7 (38.9)	2 (11.1)
Emergency Medicine	26	10 (38.5)	5 (20.0)	8 (30.8)	3 (11.5)
Otorhinolaryngology	13	7 (50.0)	5 (35.7)	6 (46.2)	3 (23.1)
Family Medicine	6	6 (85.7)	3 (50.0)	3 (42.9)	1 (16.7)
General Surgery	20	9 (45.0)	4 (20.0)	9 (45.0)	2 (10.0)
Internal Medicine	58	32 (56.1)	22 (37.9)	26 (44.8)	12 (20.7)
Neurology	6	3 (50.0)	1 (16.7)	3 (50.0)	0 (0.00)
Neurosurgery	8	4 (50.0)	4 (50.0)	4 (50.0)	3 (37.5)
Obstetrics and Gynecology	25	17 (65.4)	10 (40.0)	6 (23.1)	4 (16.0)
Orthopedics	17	6 (35.3)	4 (23.5)	7 (41.2)	1 (5.88)
Other	22	14 (63.6)	9 (40.9)	5 (23.8)	3 (13.6)
Pediatrics	48	18 (37.5)	6 (12.8)	20 (41.7)	2 (4.17)
Plastic Surgery	5	1 (20.0)	0 (0.00)	3 (60.0)	0 (0.00)
Psychiatry	3	1 (33.3)	1 (33.3)	1 (33.3)	1 (33.3)
Radiology	20	8 (40.0)	6 (30.0)	15 (78.9)	4 (20.0)
Urology	9	5 (55.6)	4 (44.4)	5 (55.6)	3 (33.3)

Note. EE = emotional exhaustion, DP = depersonalization, PA = personal accomplishment.

Clinical performance during the COVID-19 pandemic

Of the 328 physician trainees, 211 (64.3%) thought that their clinical performance had been compromised during the COVID-19 pandemic. The clinical performance of trainees in surgical specialties (otorhinolaryngology, general surgery, neurosurgery, obstetrics and gynecology, orthopedics, plastic surgery, and urology) was more likely to be affected than their fellow non-surgical trainees ($p = 0.035$), as depicted in Figure 3.

Figure 3. Impact of COVID-19 pandemic on the clinical performance of surgical and medical trainees.



Discussion

With the COVID-19 pandemic straining worldwide healthcare resources and creating an unprecedented burden on HCW, we set out to assess the prevalence of burnout among physician trainees at a tertiary academic hospital that was a referral center for COVID-19 patients in the region. We chose to focus on trainees because previous research had shown this period in their career to carry the highest risk of burnout, with high EE and high DP (21).

We found 13.8% of trainees were at a high risk of burnout. At first, this rate would seem to compare favorably with the results described in previous studies. In a systematic review of burnout among medical trainees by specialty, the authors reported its prevalence to vary between 9.9% and 73.4%. However, not all of the studies agreed on the definition of burnout, with burnout risk in some articles defined as high DP and/or EE (low PA was not an obligatory criterion) (22). Indeed, there is considerable disagreement within the literature as to the definition of burnout even when using a single instrument such as the MBI-HSS (MP). In a systematic review of burnout among consultant physicians (i.e., non-trainees), Rotenstein et al. (2018) found that there were 47 unique implementations of MBI versions, cutoff combinations, or both. This variation will inevitably lead to potential under- or overdiagnosis of burnout. Among studies that defined burnout as high levels of EE, high DP, and low PA, as we did, the prevalence of burnout among consultant physicians varied between 2.6% and 11.8% (23).

Another factor that could explain our seemingly low rate of burnout may be that during the time of our survey, the hospital had implemented a week-on, week-off system for clinicians in order to decrease the risk of cross-infection and burnout. The benefit of this may have been a lower rate of burnout, as time off work is one recognized way of decreasing the risk of circumstantial burnout (burnout resulting from self-limited circumstances and environmental triggers) (24-26). Thus, only 13.8% of trainees were found to be at high risk of burnout, but the trainees themselves identified changes in their well-being due to the pandemic, with 81.7% feeling that their psychological well-being had been affected by the COVID-19 pandemic and 64.3% indicating that their clinical performance had been affected. In addition, although medical specialties saw an increase in patient volume, there was a slowdown in many other specialties, as nonurgent clinic visits and elective surgeries were canceled. This change decreased some trainees' exposure to their own specialty, which was confirmed when we found that trainees in surgical programs were more likely to feel that their clinical performance had been affected by the pandemic than were those in nonsurgical programs.

Males and those who encountered suspected COVID-19 cases daily were at the highest risk of burnout, but not those who encountered confirmed COVID-19 cases daily. This unexpected result is similar to what Wu et al.

(27) described when they found that frontline COVID-19 HCW had a lower burnout score than did those working on the usual wards. They attributed this finding to frontline workers having a potentially greater sense of control of the situation and being more involved in the new policies and procedures being implemented to protect physicians and patients. We would add that this finding may also be due to trainees who encountered confirmed COVID-19 cases daily having more training, as well as greater access to and stricter adherence to full PPE protocols when treating patients, which may have contributed to a greater sense of ease and less stress (14). Another possibility is that uncertainty about the patients' COVID-19 status could increase trainee anxiety. Although our study showed that the percentage of trainees reporting high burnout scores increased as their exposure to confirmed cases increased, this did not reach statistical significance. The finding that men were more likely to experience burnout is consistent with the results of a previous meta-analysis of burnout among physician trainees (28). This observation is concerning, as it has been shown that men are more likely than women to develop persistent burnout (29).

We found that 50% of trainees were at high risk of EE, with those with a higher number of children at greatest risk. The closures of schools and daycares creates a unique plight for parents. They face additional demands at work because of the crisis and at home because they have to take on the role of teacher or sitter during daytime hours. This situation creates an additional emotional burden, highlighting the importance of providing childcare services for HCW during the pandemic. We also found that increased exposure to suspected or confirmed COVID-19 cases was associated with a higher risk of EE.

Males and those with increased exposure to suspected or confirmed COVID-19 cases were at the highest risk of DP. In general, it has been suggested that with the increased use of masks and full PPE during the COVID-19 pandemic, physicians may be at increased risk of DP. The loss of the ability to read the facial expressions of both colleagues and patients, as well as the limitations on interactions imposed by physical distancing, could contribute to higher DP among HCW during the pandemic (14). This change in normal social interactions is not limited to work but extends to the home, as 58.5% of our study population stated they had changed their living arrangements and/or were practicing self-isolation to avoid infecting family. An important new finding is the association between this and the risk of DP and burnout among physician trainees. We hypothesize that attempts to physically self-isolate may contribute to psychological self-isolation, with trainees anxious about transmitting the infection to family and losing their normal support network around them in a time of increased need. Such drastic changes at both work and home gives some indication of the huge challenges facing trainees (and other HCW) during the pandemic. Previous research on premedical students showed they rank family as their most important source of support and coping (30). The average PA score in our cohort was 33.5, but none of the factors that we included were associated with it.

Our study has several limitations. As the COVID-19 pandemic was an unforeseen event, we did not have an opportunity to assess trainees' pre-pandemic responses to the MBI-HSS (MP); comparing their current responses to a "baseline". We had a high response rate, but it is unclear whether the results from our large academic institute are generalizable to trainees in other healthcare institutes. We also did not assess the degree to which trainees had changed their living arrangements or for how long.

Our study strengths are that we included all three domains in our definition of burnout in order to obtain a more global assessment of trainees' well-being and to avoid overestimated measures of diagnosing burnout while at the same time analyzing the three domains individually. We had a good response rate from a reasonably large population of trainees. We included all specialties that would be expected to have significant risk of exposure to COVID-19 patients. Ours is also the first study in the Middle East to examine the risk of burnout among medical practitioners during the COVID-19 outbreak and the first we know of to document the association of self-isolation and/or changed living arrangements in the increased risk of burnout.

In conclusion, we have shown that a significant percentage of trainees are at high risk of burnout during the COVID-19 pandemic. Changing living arrangements and/or self-isolation was associated with an increased risk of burnout. It is important that program directors and institutions work on preventing and treating symptoms of burnout by instituting support groups, hotlines, a specialized clinic, and work regulations. Program directors and institutional administrators should meet regularly with trainees to answer questions, provide reassurance, and update them with any changes in their training program. Attending physicians must remain vigilant for early signs of burnout and provide support proactively, as trainees may be reluctant to seek help for stress-related issues. It is important to reduce stigma by normalizing the feelings of EE and encouraging open discussions (31,32). Residency training programs should incorporate methods on maintaining psychological well-being and coping into their curricula, including adequate time off between shifts. The focus of future research should be on assessing the effectiveness of these steps, identifying coping mechanisms for trainees, and evaluating other aspects of trainee psychological well-being (such as depression, anxiety, and insomnia), especially in relation to changing living arrangements and/or self-isolation.

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