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ORIGINAL ARTICLE

Depression and fatigue among Egyptian health care workers: cross-sectional survey

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Abstract

Aim In recent years, the mental health requirements of healthcare professionals have drawn attention as a significant public health issue and a danger to the provision of high-quality care. Healthcare workers are subjected to multiple stressors at work, which may negatively affect their physical, mental, and emotional health. This study aims to assess the prevalence of depression and fatigue among Egyptian healthcare workers (HCWs) and to assess factors associated with depression and fatigue.

Subject and methods This cross-sectional survey used Google Form to build online questionnaires, including sociodemographic data, a 10-question fatigue assessment scale, and a depression assessment scale (PHQ-9 questionnaire). The study was conducted post-COVID-19 from November 28, 2022, to January 28, 2023.

Results The study involved 1511 Egyptian HCWs with a mean age of 37.4±7.7 years (range 26-71 years); 73% were female. Physicians constituted 77.8% of the participants. Mild depression was found in 26.1% of the participants, 26.8% reported moderate, and 43.1% had severe depressive symptoms. Fatigue symptoms were encountered in 88.7%. The independent factors affecting depression were female gender, single, living in a rural area, having a chronic disease, working > 8 h/day, being a public hospital worker, and studying for postgraduate degrees. Age of 35 years or younger, female gender, and studying for postgraduates were found to independently affect fatigue.

Conclusion Depression and fatigue are highly prevalent among Egyptian healthcare workers. Many factors related to the prevalence of depression and fatigue need to be considered to enhance the mental well-being of HCWs.

Keywords Depression · Fatigue · Healthcare workers · Mental health

Introduction

Depression is a frequent mental health condition with a high morbidity and mortality rate and is one of the leading causes of disease burden worldwide (Phillips et al. 2009). World Health Organization defined work as a critical social factor affecting physical and mental health (World Health Organization 2023). Healthcare workers (HCWs) are among the most susceptible to psychological distress and depression (Olaya et al. 2021). Heavy workloads, lengthy hours, a fast pace, a lack of physical or psychological safety, the need for ongoing care, moral conflicts, perceived job security, bullying at work, and a lack of social support are just a few of the variables that contribute to higher stress among healthcare workers. Fatigue, depression, anxiety disorders, sleeping problems, and other ailments might emerge from psychological distress (Khanal et al. 2020; Muller et al. 2020). Depression raises the possibility of burnout in doctors (Shanafelt et al. 2002) and is associated with decreased adherence to best practice guidelines, a higher risk of medical errors, and prescription errors (West et al. 2006; Fahrenkopf et al. 2008). Consequently, depression has a noticeable negative impact on healthcare quality (Wallace et al. 2009), necessitating rapid actions to increase HCWs' well-being and the efficiency of the healthcare system (Olaya et al. 2021).

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HCWs also suffer from fatigue. Fatigue does not only occur in patients but also among healthy people (Aaronson et al. 1999). Fatigue had several definitions in the literature and different classifications but according to American Nursing Diagnosis Association (NANDA), fatigue is defined as one experiencing an overwhelming sustained sense of exhaustion and decreased capacity for physical and mental work that is not relieved at rest (Su et al. 2022). It typically happens after a period in which the HCWs have spent a lot of effort caring for the patients under their care (Back et al. 2014).

We expect a high prevalence of fatigue and depression among HCWs owing to the high work stresses and overload. Therefore, this study aims to assess the prevalence of depression and fatigue among HCWs and to assess factors associated with depression and fatigue.

Participants and methods

Study type

This cross-sectional survey was conducted post-COVID-19 from November 28, 2022, to January 28, 2023.

Study population

The study included Egyptian HCWs of both sexes. HCWs who are not currently working or on sick leave were excluded from the survey.

Participants were invited to respond to the survey via emails and social media platforms such as WhatsApp. The link was distributed to over 2000 HCWs, the response rate was 75.5%.

Tool

Google Docs were used as a tool for constructing the online questionnaire. The main benefits of Google Docs are that it is easy to use, widely available, saves time and money, and is safe to use. The online questionnaire included clarification of the aim of the study, consent to participate, sociodemographic data, the PHQ-9 questionnaire for depression assessment, and the Fatigue Assessment Scale (FAS).

The PHQ-9 questionnaire is a self-rating questionnaire that consists of nine depression criteria from the DSM-IV (Spitzer et al. 1999). Each item is rated from "none at all" (score 0) to "almost daily" (score 3). The total score ranges from 0 to 27, where 0–4 means no depression, 5–9 = mild depression, 10–14 = moderate depression, and ≥15 means severe depression (Merz et al. 2011).

The FAS scale is a 10-item scale developed by Michielsen et al. (2003) to assess fatigue symptoms. Each item is answered using a five-point Likert scale with 1 = never to 5 = always. Items 4 and 10 are reverse scored. Total scores can range from ten, which indicates the lowest level of fatigue, to 50, which means the highest. A score of 22 or higher indicates substantial fatigue that affects daily life (De Vries et al. 2004).

A pilot study was conducted on 15 participants to assess clarity, applicability, and response to the questionnaire.

Sample size estimation

Based on a previous study by Elbay et al. (2020), 64.7% of HCWs suffer from depression. To achieve a 95% confidence level and a margin of error of 5%, a minimum sample size of 353 participants will be needed. The sample size was calculated using a sample size calculator by Wan Nor Arifin (2023).

Ethical consideration

Data were collected anonymously after a full explanation of the aim of the study. Additionally, the first question was written consent for participating in the survey. Participants have been assured about the confidentiality of the collected data. IRB of the National Cancer Institute, Cairo University (approval number: 2211-510-022) and IBR of the Ministry of Health was obtained (approval number: 20-2022/24).

Statistical methods

Data were analyzed using SPSS statistical package version 26. Numerical data were summarized as means and standard deviations (SD) or medians and ranges, while qualitative data were described as frequencies and percentages. The relation between qualitative data was determined using the Chi-square test. Logistic regression was applied to calculate the odds ratio (OR), and its 95% confidence intervals (CI) were calculated to estimate the risk. All significant factors affecting depression and fatigue score (at p-value 0.1) on univariate analysis were entered in multivariate analysis using the stepwise logistic regression method. Spearman correlation was used to correlate continuous data. A probability (p-value) equal to or less than 0.05 is considered significant.

Results

Participants' characteristics

This study involved 1511 Egyptian healthcare workers. The mean age of the participants was 37.4±7.7 years ranging from 26 to 71 years; 73% were females and 71.9% were married. Smokers constituted 6.5% of the overall sample,

and 88.1% of the participants lived in urban areas. Approximately one-fourth (25.3%) complained of chronic disease. Nearly half of the participants (42.4%) were specialists and 21.8% were residents. Physicians represented 77.8% of the participants; 44% were medical and 28.3% were surgical. Approximately 42% of the participants are studying for a postgraduate degree. Nearly half of the participants (52.2%) work in a public hospital and 18.1% in a university hospital. The median working hours were 8 h (range 2-18 h), 36.9% of the participants worked more than 8 h per day, and 82.6% of the workplace is the same as the residences (Table 1).

Results of the depression and fatigue score

The median depression score was 13, ranging from 0-27. Mild depression was found in 26.1% of the participants, 26.8% reported moderate, and 43.1% had severe depressive symptoms. Fatigue symptoms were found in 88.7%, with a median score of 33 (range 10-50) (Table 2).

Factors associated with depression symptoms

Table 3 shows the relationship between depression and sociodemographic characteristics. Age ≤ 35 years was associated with more depressive symptoms than age > 35 years (OR 1.6, $p < 0.001$). Women more commonly exhibit depressive symptoms than men (OR 1.4, $p = 0.011$). Single participants have more depressive symptoms (OR 2.3, $p = 0.002$). Rural residents suffer from moderated and severe depression more frequently than urban residents (OR 1.7, $p = 0.005$). Participants suffering from chronic disease have higher depressive symptoms than those without chronic conditions (OR 1.3, $p = 0.025$). Residents and specialists have higher depressive symptoms than professors (OR 2.6, 2.3, respectively, $p < 0.001$). Depressive symptoms were more common in postgraduate students (OR 1.7, $p < 0.001$). Surgical specialists had more depressive symptoms (OR 1.5, $p = 0.018$). Participants working at public hospitals had higher depressive symptoms (OR 1.9, $p < 0.001$). Those working > 8 h had more depressive symptoms than others working less than 8 h (74.6% vs. 67.2%, OR 1.4, $p = 0.002$). Healthcare workers working at different places than their residence had higher depressive symptoms (OR 1.7, $p = 0.005$). There were no statistical differences in depressive symptoms in relation to the presence of children and smoking (Table 3).

Factors associated with fatigue symptoms

The factors affecting the fatigue symptoms are presented in Table 4. Age ≤35 years was associated with more fatigue than age > 35 years (92.1% vs. 86%, OR 2.1, $p < 0.001$). The female gender was associated with more fatigue symptoms (OR 1.7, $p = 0.001$). Single participants suffer more from fatigue (OR 2.7, $p = 0.011$). Residence and working as a specialist were associated with more fatigue symptoms (OR 2.9, 2.2, $p = 0.001$, $p = 0.007$, respectively). Postgraduate

Table 1 Characteristics of the participants

Characteristics	$n = 1511$
Age (years)	
Mean ± SD	37.4±7.7
Range	26-71
Gender	
Female	1103 (73.0%)
Male	408 (27.0%)
Marital status	
Single	341 (22.6%)
Married	1086 (71.9%)
Divorced/widow	84 (5.6%)
Presence of children (n=1170)	1076 (92.0%)
Smoking	99 (6.5%)
Residence	
Rural	180 (11.9%)
Urban	1331 (88.1%)
Chronic disease	383 (25.3%)
Position	
Professor/Assistant professor	101 (6.7%)
Assistant lecturer	96 (6.4%)
Lecturer	142 (9.4%)
Consultant	201 (13.3%)
Resident	330 (21.8%)
Specialist	641 (42.4%)
Current Postgraduate student	636 (42.1%)
Job	
Physician	1175 (77.8%)
Pharmacy	211 (14.0%)
Physiotherapy	69 (4.6%)
Dentist	56 (3.7%)
Specialty in physician (n=1175)	
Assistive	255 (21.7%)
Academic	70 (6.0%)
Medical	517 (44.0%)
Surgical	333 (28.3%)
Workplace	
University Hospital	273 (18.1%)
Public hospital	788 (52.2%)
University/public + private	315 (20.8%)
Private	135 (8.9%)
Working h/day, Median (range)	8 (2-18)
Working > 8 h/day	558 (36.9%)
Working days/week, Median (range)	4 (3-7)
Is the place of work the same as the residence?	1248 (82.6%)

SD, standard deviation, Assistive includes radiology and clinical pathology

Table 2 Prevalence of depression and fatigue among healthcare workers

Depression score	13 (0-27)*
No	61 (4.0%)
Mild	394 (26.1%)
Moderate	405 (26.8%)
Severe	651 (43.1%)
Fatigue score	33 (10-50)*
No	171 (11.3%)
Yes	1340 (88.7%)

*Median (range)

student participants had more fatigue symptoms (OR 2.0, $p < 0.001$). No relationship was found between fatigue symptoms and the presence of children, smoking, residence, chronic disease, specialty, workplace, or working hours.

Table 5 shows the multivariate analysis of factors affecting depression and fatigue. The factors independently affecting depression were female gender, single, living in a rural area, working > 8 h/day, having chronic disease, studying for postgraduate study, and working at a public hospital. The independent factors affecting fatigue were age ≤ 35 years, female gender, and studying for postgraduate degrees. Depression and fatigue scores were positively correlated (r = 0.767, $p < 0.001$) (Fig. 1).

Discussion

This study demonstrated that most HCWs had moderate or severe depression (26.8% and 43.1%, respectively). Several studies indicated an increased prevalence of depression among healthcare workers after the COVID-19 pandemic due to the extreme workload to which they were exposed. These results were similar to a cross-sectional Moroccan study on 1250 physicians and nurses and showed that 72.5% of their sample had mild to severe depression (Bouaddi et al. 2023).

We observed more depressive symptoms in younger HCWs (≤35 years) than those above 35 years. These results are similar to a global online survey of 2555 individuals from 63 countries, which showed that younger age groups were more vulnerable to stress, depression, and anxiety symptoms (Varma et al. 2021). This might explain the results in our study that residents and specialists have higher depressive symptoms than professors ($p < 0.001$), which could be attributed to exposure to more working hours, shifts, and higher workload according to the seniority working schedules and rules applied in the hospitals.

Female HCWs had more depressive symptoms than males ($p = 0.011$), similar to a study by Khalaf et al. (2020), which showed that females HCWs scored significantly more than males upon assessing depression. Usually, women are more prone to depression than men, which may be attributed to the traditional societal gender roles besides the female hormonal fluctuations that function as a trigger for depression (Albert 2015). The prevalence of major depression is higher in women than men (Cyranowski et al. 2000).

Single participants had more depressive symptoms ($p = 0.002$). Bulloch et al. (2017) found that singles had an elevated risk of depression compared to married couples, also unmarried people were found to have poorer mental health (Bell 2014).

Physicians living in rural areas experience more depressive symptoms than those who live in urban areas ($p = 0.005$). This is similar to a study by Probst et al. (2006), who showed a higher prevalence of depression among rural than urban populations (6.1% versus 5.2%). This might be multifactorial due to the lack of public transportation, poor infrastructure, limited availability of services, inadequate well-equipped hospitals, and restricted access to training facilities.

HCWs suffering from chronic diseases had higher depressive symptoms than those without chronic diseases ($p = 0.025$). This agreed with a population-based cross-sectional study by Boing et al. (2012), which showed that depression was 1.44 times higher among those reporting one chronic disease and 2.25 times higher among those reporting two or more diseases than those with no diseases. There is a bidirectional relationship between chronic illness and depression, and patients with chronic diseases such as hypertension, coronary heart disease, and diabetes have a high incidence of depression (Ma et al. 2021). Depression is associated with hormonal and physiological changes, such as high levels of cortisol, its effect on the autonomic nervous system, and the hypothalamic-pituitary axis, which may result in chronic diseases (Boing et al. 2012).

Postgraduate participants showed more depressive symptoms than others ($p < 0.001$). In global research that surveyed 2279 individuals from 26 countries and 234 institutions, graduate students were six times more likely to have depression than the general population (Evans et al. 2018). This could be explained by the increasing demands to attain a work–life balance, the duty to earn money for living, and to continue education.

In our study, surgical doctors suffered more from depressive symptoms ($p = 0.018$). These results were similar to a Saudi cross-sectional study conducted on 153 surgeons, where 27.5% of them had depression (Hariri et al. 2023). In another broader research conducted on members of the American College of Surgeons (Shanafelt et al. 2009), 40% of the responded surgeons screened positive for symptoms of depression. This could be related to working more hours per week and spending more nights on call per week, leading to inadequate time for their personal life and family. This was in line with the results of the current study, which showed that HCWs working more than 8 h had more depressive symptoms than those who worked less than 8 h (74.6% vs. 67.2%, $p = 0.002$).

Table 3 Relation of depression symptoms with sociodemographic and work characteristics of the participants ($n = 1151$)

	n	Depression		OR	95% CI	*p*-value
		No-mild ($n = 455$)	Moderate-severe ($n = 1056$)			
Age (years)						
> 35	844	290 (34.4%)	554 (65.6%)	1		
≤ 35	667	165 (24.7%)	502 (75.3%)	1.6	1.3–2.0	<0.001
Gender						
Male	408	143 (35%)	265 (65%)	1		
Female	1103	312 (28.3%)	791 (71.7%)	1.4	1.1–1.7	0.011
Marital status						
Divorced/ Widow	84	31 (36.9%)	53 (63.1%)	1		
Single	341	70 (20.5%)	271(79.5%)	2.3	1.4–3.7	0.002
Married	1086	354 (32.6%)	732 (67.4%)	1.2	0.8–1.9	0.419
Presence of children						
No	94	33 (35.1%)	61 (64.9%)	1		
Yes	1076	352 (32.7%)	724 (67.3%)	1.1	0.7–1.7	0.636
Smoking						
No	1412	433 (30.7%)	979 (69.3%)	1		
Yes	99	22 (22.2%)	77 (77.8%)	1.5	0.9–2.5	0.077
Residence						
Urban	1331	417 (31.3%)	914 (68.7%)	1		
Rural	180	38 (21.1%)	142 (78.9%)	1.7	1.1–2.4	0.005
Chronic disease						
No	1128	357 (31.6%)	771 (68.4%)	1		
Yes	383	98 (25.6%)	285 (74.4%)	1.3	1.03–1.7	0.025
Position						
Professor/Assistant professor	101	45 (44.6%)	56 (55.4%)	1		
Lecturer	142	70 (49.3%)	72 (50.7%)	0.8	0.4– 1.4	0.466
Assistant lecturer	96	32 (33.3%)	64 (66.7%)	1.6	0.9– 2.8	0.108
Consultant	201	67 (33.3%)	134 (66.7%)	1.6	0.9– 2.6	0.058
Residence	330	77 (23.3%)	253 (76.7%)	2.6	1.7– 4.2	<0.001
Specialist	641	164 (25.6%)	477 (74.4%)	2.3	1.5– 3.6	<0.001
Postgraduate student						
No	875	302 (34.5%)	573 (65.5%)	1		
Yes	636	153 (24.1%)	483 (75.9%)	1.7	1.3–2.1	<0.001
Job						
Physician	1175	373 (31.7%)	802 (68.3%)	1		
Pharmacy	211	51 (24.2%)	160 (75.8%)	1.5	1.0– 2.0	0.129
Physiotherapy	69	15 (21.7%)	54 (78.3%)	1.7	0.9–3.0	0.084
Dentist	56	16 (28.6%)	4 (71.4%)	1.2	0.6–2.1	0.618
Specialty in physician						
Assistive	255	93 (36.5%)	162 (63.5%)	1		
Academic	70	25 (35.7%)	45 (64.3%)	1.03	0.6–1.8	0.907
Medical	517	164 (31.7%)	353 (68.3%)	1.2	0.9–1.7	0.188
Surgical	333	91 (27.3%)	242 (72.7%)	1.5	1.1–2.2	0.018
Workplace						
University Hospital	273	107 (39.2%)	166 (60.8%)	1	1.4–2.6	
Public hospital	788	199 (25.3%)	589 (74.7%)	1.9	1.4–2.6	<0.001
University/public + private	315	102 (32.4%)	213 (67.6%)	1.3	0.9–1.9	0.391
Private	135	47 (34.8%)	88 (65.2%)	1.2	0.8–1.9	0.086

Table 3 (continued)

	n	Depression		OR	95% CI	*p*-value
		No-mild ($n = 455$)	Moderate-severe ($n = 1056$)			
Working hours/day						
≤ 8 h	953	313 (32.8%)	640 (67.2%)	1		
> 8 h	558	142 (25.4%)	416 (74.6%)	1.4	1.1–1.8	0.002
Work the same as the residence						
Yes	1248	388 (31.1%)	860 (68.9%)	1		
No	263	67 (25.5%)	196 (74.5%)	1.7	1.2–2.5	0.005

OR, Odds ratio; *CI*, Confidence interval

Participants who work at public hospitals had higher depressive symptoms ($p < 0.001$). This could highlight the importance of the work environment, which could be the reason for the risk of depression.

In this study, we observed a high prevalence of fatigue among Egyptian HCWs (88.7%). Our findings were higher than those in other international studies, with 46.4% in US physicians (Tawfik et al. 2018) and 73.7% in Chinese (Teng et al. 2020). Contrarily, the prevalence of fatigue was similar in some Arab countries. A recent study on Lebanese physicians revealed a rate of fatigue of 66.1% (Sfeir et al. 2022), and another study reported a 69% fatigue rate in Saudi physicians (Arab and Khayyat 2017). Different definitions of fatigue, various assessment methods, and inconsistent cut-off points may explain the varying prevalence of fatigue among physicians.

We observed a variable level of fatigue among various age groups. In line with other research (Cai et al. 2018), participants aged ≤ 35 reported noticeably higher fatigue levels than those above 35. Older HCWs have more experience and skills, while younger colleagues are always involved in strenuous activities, more working hours, shifts, and higher workloads. Additionally, they might not have the necessary professional skills to do the work independently.

The high prevalence of fatigue was most evident in Egyptian residents and specialists and was less in consultants. Also, postgraduate education and training periods were associated with higher fatigue levels among Egyptian HCWs. Our findings are concordant with a study of US physicians (Dyrbye et al. 2014), which implies that various aspects of stress may be more severe at the beginning of a physician's career, with postgraduate education being the most potent stress.

Female physicians were more likely to experience fatigue in the current study, which is consistent with earlier literature (Tian et al. 2020). However, other studies claimed no gender difference in fatigue (Liu et al. 2018; Hou et al. 2020). Also, single physicians are more likely to experience fatigue than married. IN addition, no relationship was found between the presence of children and fatigue symptoms. This is inconsistent with other studies (Cai et al. 2018; Liu et al. 2018) that reported the constraints and duties of job and family might exacerbate fatigue. This may be explained by the fact that balanced social life and family support could be a protective factor in coping with fatigue among Egyptian physicians.

It was previously described that higher workloads and longer working hours were associated with higher physician fatigue (Helkavaara et al. 2011). However, our study found no relationship between working hours and fatigue symptoms. Similar studies suggested heavy workloads with the lowest cost per service (Olson 2017), the work environment, violence, and conflicts at work (Helkavaara et al. 2011; Chemali et al. 2019) may be responsible for the higher prevalence of physician fatigue. However, comparisons made between the prevalence of fatigue in different working environments in Egypt revealed no significant difference in fatigue prevalence between universities, public or private hospitals, and medical facilities.

Our results revealed a significant positive correlation between depression and fatigue scores. These results are consistent with previous research (Robinson et al. 2015; Corfield et al. 2016; Teng et al. 2020), showing that fatigue can cause negative emotions and promote depression. A similar study in Sweden revealed that depression was a risk factor for higher fatigue levels (Adamsson and Bernhardsson 2018). They stated that depression could lower a physician's capacity to handle stress, which can result in increased rates of fatigue.

The high prevalence of physician fatigue in Egypt is a disturbing finding. Expanding the results and examining the underlying aspects will require additional research. However, it is undeniable that fatigue is a global symptom among healthcare workers after the COVID-19 epidemic, and greater attention needs to be paid to dealing with this problem to preserve workplace efficiency and safety in healthcare settings.

Table 4 Relation of fatigue symptoms with sociodemographic and work characteristics of the participants ($n = 1151$)

	n	Fatigue		OR	95% CI	*p*-value
		No ($n = 171$)	Yes (n=1340)			
Age (years)						
> 35	844	118 (14%)	726 (86%)	1		
≤ 35	667	53 (7.9%)	614 (92.1%)	2.1	1.4–2.9	<0.001
Gender						
Male	408	64 (15.7%)	344 (84.3%)	1		
Female	1103	107 (9.7%)	996 (90.3%)	1.7	1.2–2.4	0.001
Marital status						
Divorced/ Widow	84	12 (4.3%)	72 (85.7%)	1		
Single	341	20 (5.9%)	321 (94.1%)	2.7	1.3–5.7	0.011
Married	1086	139 (12.8%)	947 (87.2%)	1.1	0.6–2.1	0.696
Presence of children						
No	1076	139 (12.9%)	937 (87.1%)	1		
Yes	94	12 (12.8%)	82 (87.2%)	1.014	0.5–1.9	0.966
Smoking						
No	1412	161 (11.4%)	1251 (88.6%)	1		
Yes	99	10 (10.1%)	89 (89.9%)	1.1	0.6–2.2	0.693
Residence						
Urban	1331	157 (11.8%)	1174 (88.2%)	1		
Rural	180	14 (7.8%)	166 (92.2%)	1.6	0.9–2.8	0.110
Chronic disease						
No	1128	135 (12.0%)	993(88.0%)	1		
Yes	383	36(9.4%)	347 (90.6%)	1.3	0.9–1.9	0.170
Position						
Professor/Assistant professor	101	18 (17.8%)	83 (82.2%)	1		
Lecturer	142	27 (19.0%)	115 (81.0%)	.9	0.5–1.8	0.814
Assistant lecturer	96	10 (10.4%)	86 (89.6%)	1.9	0.8–4.3	0.141
Consultant	201	36 (17.9%)	165 (82.1%)	.9	0.5–1.9	0.985
Residence	330	23 (7.0%)	307 (93.0%)	2.9	1.5–5.6	0.002
Specialist	641	57 (8.9%)	584 (91.1%)	2.2	1.2–3.9	0.007
Postgraduate student						
No	875	123 (14.1%)	752 (85.9%)	1		
Yes	636	48 (7.5%)	588 (92.5%)	2	1.4–2.8	<0.001
Job						
Physician	1175	141 (12.0%)	1034 (88%)	1		
Pharmacy	211	17 (8.1%)	194 (91.9%)	1.6	.9–2.6	0.099
Physiotherapy	69	6 (8.7%)	63 (91.3%)	1.4	.6–3.4	0.411
Dentist	56	7 (12.5%)	49 (87.5%)	.9	.4–2.1	0.911
Specialty in physician						
Assistive	255	36 (14.1%)	219 (85.9%)	1		
Academic	70	7 (10.0%)	63 (90%)	1.5	0.6–3.5	0.370
Medical	517	62 (12.0%)	455 (88.0%)	1.2	0.8–1.9	0.405
Surgical	333	36 (10.8%)	297 (89.2%)	1.4	0.8–2.2	0.227
Workplace						
University Hospital	273	39 (14.3%)	234 (85.7%)	1		
Public hospital	788	80 (10.2%)	708 (89.8%)	1.5	0.9–2.2	0.063
University/public + private	315	33 (10.5%)	282 (89.5%)	1.4	0.9–2.3	0.161
Private	135	19 (14.1%)	116 (85.9%)	1.02	0.6–1.8	0.954
Working hours/day						
≤ 8 hours	953	115 (12.1%)	838 (87.9%)	1		

Table 4 (continued)

	n	Fatigue		OR	95% CI	*p*-value
		No (n = 171)	Yes (n=1340)			
> 8 hours	558	56 (10%)	502 (90.0%)	1.2	0.9–1.7	0.229
Work the same as the residence						
Yes	1248	149 (11.9%)	1099 (88.1%)	1		
No	263	22 (8.4%)	241 (91.6%)	1.5	0.9–2.4	0.096

Table 5 Multivariate analysis of factors associated with depression and fatigue

	p-value	OR	95% CI for OR	
			Lower	Upper
Depression score				
Sex (female vs. male)	0.003	1.5	1.2	2.0
Working hours (> 8 h vs. ≤ 8 h)	0.001	1.6	1.2	2.1
Marital status				
Single versus divorced/widow	0.003	2.3	1.3	3.8
Married versus divorced/widow	0.350	1.1	0.8	2.3
Residence (rural vs. urban)	0.046	1.5	1.01	2.2
Chronic disease (yes vs. no)	0.006	1.5	1.1	1.9
Postgraduate study (yes vs. no)	<0.001	1.6	1.2	1.9
Workplace				
Public vs. University Hospital	<0.001	1.9	1.4	2.6
University/public + private vs. University Hospital	0.314	1.2	0.8	1.6
Private vs. University Hospital	0.311	1.1	0.8	1.8
Fatigue score				
Age (≤35 vs. >35 years)	0.003	1.8	1.2	2.5
Postgraduate student (yes vs. no)	0.006	1.7	1.2	2.5
Gender (female vs. male)	0.003	1.7	1.2	2.3

Finally, in the current study, there was a significant positive correlation between depression and fatigue scores ($p < 0.001$). This relation could be explained by the fact that depression and fatigue have been associated with increased activation of the inflammatory process of the immune system, which affects the peripheral and central nervous systems (Lee and Giuliani 2019).

Conclusion and recommendations

Identifying and studying the factors that negatively affect physicians' mental health may help develop effective interventions for reducing depression and fatigue.

Limitations

The online survey has a lower response rate compared to the physical survey. Healthy-worker bias may be a source of selection bias as we excluded healthcare workers who are not working currently. The convenience sampling method for participant selection is another source of selection bias. We used the logistic regression model to estimate predictors

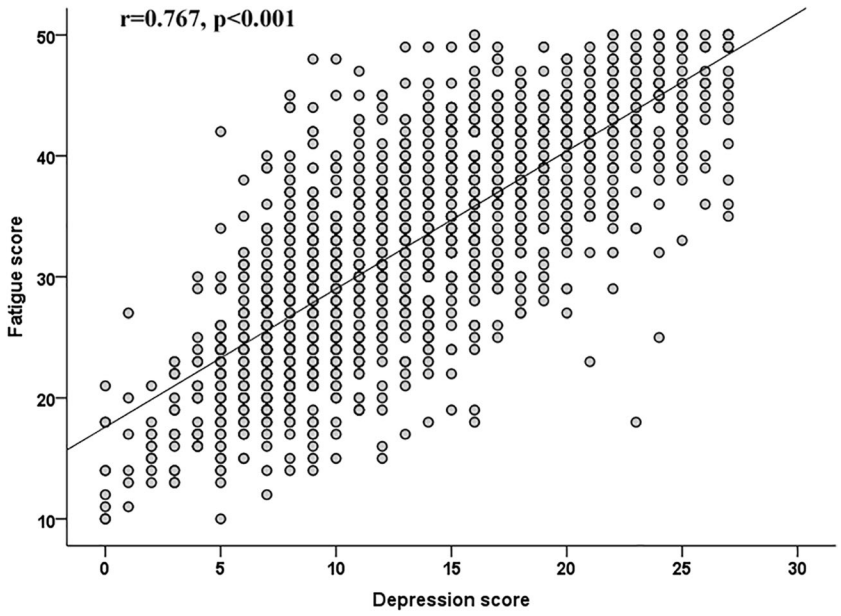

Fig. 1 Correlation between fatigue and depression score

of depression and fatigue. The calculated odds ratio of this model may overestimate the prevalence ratio. The generalizability of results is limited as the survey does not represent all the professions in the Egyptian healthcare system; the study did not include nurses, also the participants were self-selected, which may compromise the generalizability of the results. Moreover, owing to the cross-sectional study design, no conclusions regarding causality can be drawn; it is only used to generate a hypothesis.

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Author contribution Shaimaa Abdalaleem Abdalgeleel: Writing - original draft preparation, formal analysis.
Manar Moneer: Writing – review, and editing.
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Mahmoud M. Samir: Writing - original draft preparation.
Ola Osama Khalaf: Writing - original draft preparation.
Rasha Mahmoud Allam: Writing - original draft preparation, Formal analysis.
All co-authors have seen and agree with the contents of the manuscript.

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Data availability The datasets used during this study are available from the corresponding author.

Code availability Not applicable.

Declarations

Ethical approval IRB of the National Cancer Institute, Cairo University (approval number: 2211-510-022) and IBR of the ministry of health was obtained (approval number: 20-2022/24).

Consent to participate Not applicable.

Consent for publication Not applicable.

Conflict of interest The authors have no conflicts of interest to declare.

References

Aaronson LS, Teel CS, Cassmeyer V, Neuberger GB, Pallikkathayil L, Pierce J, Press AN, Williams PD, Wingate A (1999) Defining and measuring fatigue. Image J Nurs Sch Image J Nurs Sch 31(1):45–50. https://doi.org/10.1111/j.1547-5069.1999.tb00420.x

Adamsson A, Bernhardsson S (2018) Symptoms that may be stress-related and lead to exhaustion disorder: a retrospective medical chart review in Swedish primary care. BMC Fam Pract 19(1):172. https://doi.org/10.1186/s12875-018-0858-7

Albert PR (2015) Why is depression more prevalent in women. J Psychiatry Neurosci 40(4):219–221. https://doi.org/10.1503/jpn.150205

Arab AA, Khayyat HY (2017) Risk of fatigue among anesthesia residents in Saudi Arabia. Saudi Med J 38(3):292–296. https://doi.org/10.15537/smj.2017.3.17511

Back AL, Deignan PF, Potter PA (2014) Compassion, compassion fatigue, and burnout: key insights for oncology professionals. Am Soc Clin Oncol Educ Book 34(1):e454–e459. https://doi.org/10.14694/edbook_am.2014.34.e454

Bell A (2014) Life-course and cohort trajectories of mental health in the UK, 1991–2008–a multilevel age–period–cohort analysis. Soc Sci Med 120:21–30. https://doi.org/10.1016/j.socscimed.2014.09.008

Boing AF, Melo GR, Boing AC, Moretti-Pires RO, Peres KG, Peres MA (2012) Associação entre depressão e doenças crônicas: um estudo populacional. Rev Saude Publica 46(4):617–623. https://doi.org/10.1590/s0034-89102012005000044

Bouaddi O, Abdallahi NM, Fadel Abdi CM, Hassouni K, Jallal M, Benjelloun R, Belrhiti Z, Nejjari C, Khalis M (2023) Anxiety, stress, and depression among healthcare professionals during the COVID-19 pandemic: a cross-sectional study in Morocco. Inquiry 60:469580221147377. https://doi.org/10.1177/00469580221147377

Bulloch AG, Williams JV, Lavorato DH, Patten SB (2017) The depression and marital status relationship is modified by both age and gender. J Affect Disord 223:65–68. https://doi.org/10.1016/j.jad.2017.06.007

Cai S, Lin H, Hu X, Cai YX, Chen K, Cai WZ (2018) High fatigue and its associations with health and work-related factors among female medical personnel at 54 hospitals in Zhuhai, China. Psychol Health Med 23(3):304–316. https://doi.org/10.1080/13548506.2017.1361038

Chemali Z, Ezzeddine FL, Gelaye B, Dossett ML, Salameh J, Bizri M, Dubale B, Fricchione G (2019) Burnout among healthcare providers in the complex environment of the Middle East: a systematic review. BMC public health 19(1):1337. https://doi.org/10.1186/s12889-019-7713-1

Corfield EC, Martin NG, Nyholt DR (2016) Co-occurrence and symptomatology of fatigue and depression. Compr Psychiatry 71:1–10. https://doi.org/10.1016/j.comppsych.2016.08.004

Cyranowski JM, Frank E, Young E, Shear MK (2000) Adolescent onset of the gender difference in lifetime rates of major depression: a theoretical model. Arch Gen Psychiatry 57(1):21–27. https://doi.org/10.1001/archpsyc.57.1.21

De Vries J, Michielsen H, Van Heck GL, Drent M (2004) Measuring fatigue in sarcoidosis: the Fatigue Assessment Scale (FAS). Br J Health Psychol 9(3):279–291. https://doi.org/10.1348/1359107041557048

Dyrbye LN, West CP, Satele D, Boone S, Tan L, Sloan J, Shanafelt TD (2014) Burnout among US medical students, residents, and early career physicians relative to the general US population. Acad Med 89(3):443–451. https://doi.org/10.1097/acm.0000000000000134

Elbay RY, Kurtulmuş A, Arpacıoğlu S, Karadere E (2020) Depression, anxiety, stress levels of physicians and associated factors in Covid-19 pandemics. Psychiatry Res 290:113130. https://doi.org/10.1016/j.psychres.2020.113130

Evans TM, Bira L, Gastelum JB, Weiss LT, Vanderford NL (2018) Evidence for a mental health crisis in graduate education. Nat Biotechnol 36(3):282–284. https://doi.org/10.1038/nbt.4089

Fahrenkopf AM, Sectish TC, Barger LK, Sharek PJ, Lewin D, Chiang VW, Edwards S, Wiedermann BL, Landrigan CP (2008) Rates of medication errors among depressed and burnt-out residents: prospective cohort study. BMJ 336(7642):488–491. https://doi.org/10.1136/bmj.39469.763218.be

Hariri N, Bawahab N, Banoon E, Alshamat RA, Almadani N, AlQashqri H (2023) Prevalence of depression and anxiety disorders among surgical doctors in public hospitals in Makkah City, Saudi Arabia: an analytical cross-sectional study. Cureus 15(1):e33225. https://doi.org/10.7759/cureus.33225

Helkavaara M, Saastamoinen P, Lahelma E (2011) Psychosocial work environment and emotional exhaustion among middle-aged employees. BMC research notes BMC Res Notes 4:101. https://doi.org/10.1186/1756-0500-4-101

Hou T, Zhang R, Song X, Zhang F, Cai W, Liu Y, Dong W, Deng G (2020) Self-efficacy and fatigue among non-frontline health care workers during COVID-19 outbreak: a moderated mediation model of posttraumatic stress disorder symptoms and negative coping. PloS one 15(12):e0243884. https://doi.org/10.1371/journal.pone.0243884

Khalaf OO, Khalil MA, Abdelmaksoud R (2020) Coping with depression and anxiety in Egyptian physicians during COVID-19 pandemic. MECPsych 27:63. https://doi.org/10.1186/2Fs43045-020-00070-9

Khanal P, Devkota N, Dahal M, Paudel K, Joshi D (2020) Mental health impacts among health workers during COVID-19 in a low resource setting: a cross-sectional survey from Nepal. Global Health 16(1):89. https://doi.org/10.1186/s12992-020-00621-z

Lee CH, Giuliani F (2019) The role of inflammation in depression and fatigue. Front Immunol 10:1696. https://doi.org/10.3389/fimmu.2019.01696

Liu L, Xu P, Zhou K, Xue J, Wu H (2018) Mediating role of emotional labor in the association between emotional intelligence and fatigue among Chinese doctors: a cross-sectional study. BMC Public Health 18(1):881. https://doi.org/10.1186/s12889-018-5817-7

Ma Y, Xiang Q, Yan C, Liao H, Wang J (2021) Relationship between chronic diseases and depression: the mediating effect of pain. BMC Psychiatry 21(1):436. https://doi.org/10.1186/s12888-021-03428-3

Merz EL, Malcarne VL, Roesch SC, Riley N, Sadler GR (2011) A multigroup confirmatory factor analysis of the Patient Health Questionnaire-9 among English-and Spanish-speaking Latinas. Cultur Divers Ethnic Minor Psychol 17(3):309–316. https://doi.org/10.1037/a0023883

Michielsen HJ, De Vries J, Van Heck GL (2003) Psychometric qualities of a brief self-rated fatigue measure: The Fatigue Assessment Scale. J Psychosom Res 54(4):345–352. https://doi.org/10.1016/s0022-3999(02)00392-6

Muller AE, Hafstad EV, Himmels JP, Smedslund G, Flottorp S, Stensland SØ, Stroobants S, Van de Velde S, Vist GE (2020) The mental health impact of the covid-19 pandemic on healthcare workers, and interventions to help them: a rapid systematic review. Psychiatry Res 293:113441. https://doi.org/10.1016/j.psychres.2020.113441

Olaya B, Pérez-Moreno M, Bueno-Notivol J, Gracia-García P, Lasheras I, Santabárbara J (2021) Prevalence of depression among healthcare workers during the COVID-19 outbreak: a systematic review and meta-analysis. J Clin Med 10(15):3406. https://doi.org/10.3390/jcm10153406

Olson KD (2017) Physician burnout—a leading indicator of health system performance? Mayo Clin Proc 92(11):1608–1611. https://doi.org/10.1016/j.mayocp.2017.09.008

Phillips MR, Zhang J, Shi Q, Song Z, Ding Z, Pang S, Li X, Zhang Y, Wang Z (2009) Prevalence, treatment, and associated disability of mental disorders in four provinces in China during 2001–05: an epidemiological survey. The Lancet 373(9680):2041–2053. https://doi.org/10.1016/s0140-6736(09)60660-7

Probst JC, Laditka SB, Moore CG, Harun N, Powell MP, Baxley EG (2006) Rural-urban differences in depression prevalence: implications for family medicine. Fam Med 38(9):653–660

Robinson RL, Stephenson JJ, Dennehy EB, Grabner M, Faries D, Palli SR, Swindle RW (2015) The importance of unresolved fatigue in depression: costs and comorbidities. Psychosomatics 56(3):274–285. https://doi.org/10.1016/j.psym.2014.08.003

Sfeir E, Rabil JM, Obeid S, Hallit S, Khalife MC (2022) Work fatigue among Lebanese physicians and students during the COVID-19 pandemic: validation of the 3D-Work Fatigue Inventory (3D-WFI) and correlates. BMC Public Health 22(1):292. https://doi.org/10.1186/s12889-022-12733-9

Shanafelt TD, Bradley KA, Wipf JE, Back AL (2002) Burnout and self-reported patient care in an internal medicine residency program. Ann Intern Med 136(5):358–367. https://doi.org/10.7326/0003-4819-136-5-200203050-00008

Shanafelt TD, Balch CM, Bechamps GJ, Russell T, Dyrbye L, Satele D, Collicott P, Novotny PJ, Sloan J, Freischlag JA (2009) Burnout and career satisfaction among American surgeons. Ann Surg 250(3):463–471. https://doi.org/10.1097/sla.0b013e3181ac4dfd

Spitzer RL, Kroenke K, Williams JB (1999) Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. Primary Care Evaluation of Mental Disorders. Patient Health Questionnaire. JAMA 282(18):1737–1744. https://doi.org/10.1001/jama.282.18.1737

Su Y, Cochrane BB, Yu SY, Reding K, Herting JR, Zaslavsky O (2022) Fatigue in community-dwelling older adults: A review of definitions, measures, and related factors. Geriatr Nurs 43:266–279. https://doi.org/10.1016/j.gerinurse.2021.12.010

Tawfik DS, Profit J, Morgenthaler TI, Satele DV, Sinsky CA, Dyrbye LN, Tutty MA, West CP, Shanafelt TD (2018) Physician burnout, well-being, and work unit safety grades in relationship to reported medical errors. Mayo Clin Proc 93(11):1571–1580. https://doi.org/10.1016/j.mayocp.2018.05.014

Teng Z, Wei Z, Qiu Y, Tan Y, Chen J, Tang H, Wu H, Wu R, Huang J (2020) Psychological status and fatigue of frontline staff two months after the COVID-19 pandemic outbreak in China: A cross-sectional study. J Affect Disord 275:247–252. https://doi.org/10.1016/j.jad.2020.06.032

Tian F, Shu Q, Cui Q, Wang L, Liu C, Wu H (2020) The mediating role of psychological capital in the relationship between occupational stress and fatigue: a cross-sectional study among 1,104 Chinese physicians. Front Public Health 8:12. https://doi.org/10.3389/fpubh.2020.00012

Varma P, Junge M, Meaklim H, Jackson ML (2021) Younger people are more vulnerable to stress, anxiety and depression during COVID-19 pandemic: A global cross-sectional survey. Prog Neuropsychopharmacol Biol Psychiat 109:110236. https://doi.org/10.1016/j.pnpbp.2020.110236

Wallace JE, Lemaire JB, Ghali WA (2009) Physician wellness: a missing quality indicator. Lancet 374(9702):1714–1721. https://doi.org/10.1016/s0140-6736(09)61424-0

West CP, Huschka MM, Novotny PJ, Sloan JA, Kolars JC, Habermann TM, Shanafelt TD (2006) Association of perceived medical errors with resident distress and empathy: a prospective longitudinal study. JAMA 296(9):1071–1078. https://doi.org/10.1001/jama.296.9.1071

WN Arifin APA (2023) Sample size calculator (web). Retrieved from http://wnarifin.github.io. , accessed in 2022

World Health Organization (2023) COVID-19 and the social determinants of health and health equity: Evidence brief. https://www.who.int/teams/social-determinants-of-health, accessed in 2023