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ABSTRACT

Aim of the study: First, to provide a synthesis and analysis of available scientific literature regarding the level of work stress and burnout among emergency physicians. Second, to identify the effect of the specific work situation-related factors.

Methods: A systematic search was performed in NCBI PubMed and Embase. Comparative primary studies, both systematic review and cross-sectional, quantifying burnout in emergency physicians were included. Only studies published between 2011 and 2022 were retained. Synonym sets were compiled for the search key for 'burnout & stress', 'emergency', 'physician' and 'burnout & posttraumatic stress disorder'.

Results: Thirty-five papers were retained for further research. Emergency physicians scored significantly higher for all dimensions of burnout compared to other healthcare professions. Significant correlations for burnout were found with work characteristic and organizational factors. Critical incidents and aggression were identified as the most important acute work characteristics and organizational factors impacting emergency physician's mental wellbeing including the development of posttraumatic stress disorder. Moreover, personal factors such as age, personality, and coping strategies also play an important role in the development of burnout as well as work-related trauma.

Conclusion: Available studies show that emergency physicians report higher scores of emotional exhaustion and depersonalization when compared to other healthcare professionals. Work characteristics contribute to this, but work-related traumatic incidents and aggression are important determinants. Personal characteristics such as age, personality type D, previous experiences and coping strategies seem to be determining factors likewise. Emergency physicians showed a high risk for developing burnout and work stress-related problems.

Nurses, paramedics, and physicians are at risk for the development of burnout [1]. In particular, the psychological burden of caregiving is an important factor [2]. The concept of 'burnout' was defined in the early 1970s and was especially elaborated by Christina Maslach, as a psychological status resulting from of long-term emotional burden or psychological stress [3]. The first basic aspect of this syndrome is 'emotional exhaustion' (EE). When the emotional reserves are exhausted, physicians feel that they are no longer able to perform (adequately) on a psychological level. They are no longer able to concentrate on the multitasking they have to perform in order to adequately diagnose and/or treat a patient. The second aspect, 'depersonalization' (DP), manifests itself in the shape of pronounced negativity and increasing cynicism, both in thought and in behavior, towards the patient. The physicians behave without any empathy and sometimes assertively in their contacts with patients and/or family in the acute setting of the emergency department when receiving patients. The third aspect is lack of personal accomplishment (PA): a sense of diminished personal capacity and a sense of failure in achieving set goals. The physicians estimate their professional capacity much lower than their actual capabilities and ultimately have the impression that they are no longer able to achieve their professional goals to help patients in acute situations on the work floor in the emergency department [4]. Physicians are at increased risk of developing burnout if they are exposed to certain work characteristics and organizational factors such as increased workload, conflict with fellow physicians, conflict with other staff members, confrontation with death and dying, ineffective support from colleagues and supervisors, and coping with the suffering of patients [5]. Several studies show that the nature and extent of impact of these stressors could be different for each specialization within the group of physicians. Personal factors also determine whether burnout occurs [6]. Typical factors of emergency departments and the profession of

emergency physician potentially creates a series of specific stressors to which other hospital physicians are not or less exposed such as sudden extreme changes in workload, instantaneous decisions about life and death and the feelings of guilt for the failure of therapy, the unpredictable and uncontrollable flow of patients, incidents with children, confrontation with mutilations and extreme human suffering and loss of control in major incidents [5,7,8]. In addition, Posttraumatic Stress Disorder (PTSD) was linked to the confrontation with verbal and physical aggression and exposure to extreme situations. More specifically, a hindering anxiety disorder that consists of a pronounced urge to avoid anything that reminds of the traumatic incidents, as well as the occurrence of limited quality of care provided [7]. Studies reported a correlation between the degree of burnout and the
occurrence of muscle strain, obesity, insomnia, depression and the abuse of alcohol and psychotropic drugs. Furthermore, burnout also negatively affects the quality of the caregiver's private life, which is confronted with more conflict and aggression. Finally, literature shows that burnout causes a significant economic loss through increased absenteeism at work, early retirement from the profession and increased healthcare costs [7]. However, much research has been done on burnout among the global group of physicians but less attention has been paid to the differences in the composition of the stressor set of Emergency physicians compared to other professional groups. This systematic review attempts to provide an update on factors related to Emergency physicians burnout and in addition focus on the differences in factors compared to other medical specialties.

2. The aim of the study

The aim of the present study was twofold: First, to provide an analysis and synthesis of the available scientific literature on the level of work stress and burnout among Emergency physicians, and second, compare the specific work situation-related factors to other professional groups of medical specialties. As such, this study aimed to stimulate and challenge initiatives towards the development of research endeavors on burnout in Emergency physicians from detection to prevention.

3. Methodology

A systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidance. A systematic search was performed in the data sources NCBI PubMed and Embase. Comparative primary studies, both longitudinal and cross-sectional, quantifying burnout in Emergency physicians were included. Articles in PubMed that were 'ahead of print' yet fully available, were also eligible for inclusion. Only the studies published between 2011 and 2022 in English, French or Dutch, were included. A supplementary addition could be made by hand searches. Synonym
sets were compiled for the search key for 'burnout & stress', 'emergency', 'physician' and 'burnout and posttraumatic stress disorder'.

3.1. Sources, selection of the studies and data extraction

For each study, the design, reseach methodology and validity of the research instruments as Strengthening the Reporting of observational studies in Epidemiology (STROBE) were assessed before proceeding to the analysis of the results. It is an instrument which includes a checklist of items to include in observational research articles and then takes into account cohort, case-control, cross-sectional studies, and conference abstracts. One reviewer (FS) searched PubMed and Embase for suitable papers. Results were adjudicated through consensus discussion between two authors (FS and BW). In case of doubt or discrepancies, the other authors (PVB, HDC and EF) advised on the final decision which articles to include in the study. Data extracted from articles included information concerning the publication, the study population/target group involved, and outcomes of interest. Publication items included the first author, year of publication, the country in which the data were collected, and date of data collection. Subject data collected included the sample size, the response rate, male/female ratio, the burnout scores used, the calculated burnout ratio, the scores of exhaustion, depersonalization, and personal accomplishment. Finally, the significant determinants for Emergency physicians burnout were included in the data extraction (Figure **1).**

4. Results

4.1. Sources and selection of the studies The flowchart in Figure 1 depicts the article selection process. We initially identified 439 papers in PubMed and 420 papers in Embase, that appeared to be suitable. After the removal of duplicates, and three consecutives exclusion emergency physicians, 35 studies were selected for further research.
4.2. Concerning the quality assessment of the included studies we notice All studies were assessed with the EAI (Epidemiological Appraisal Instrument) [9]. This is a recognized

methodological quality assessment for epidemiological studies. The results for all included studies are listed in Table 1. Thirty-three studies were cross-sectional.
and two systematic reviews.

4.3. As for the respondents and research design

we note Only 16 studies focused on Emergency physicians. Eleven studies involved emergency medicine residents and trainees. Four out of 35 studies compared emergency physicians to other physician groups [8,10–12] and 6 studies made the comparison with nurses [13–15,33–35]. In several studies, the target group turned out to be small compared to the entire population sample. The survey by Nguyen et al. had a response rate of 18.7% which is marginal [13]. Seven studies surveyed a wider population that also included paramedics [8,13,14,16,33–35]. The studies of Q. Zhang et al. and D. Verougstraete et al. were systematic reviews [17,18]. Some interesting studies made the interesting comparison between physicians and nurses in their article. Somville F. et al. [7] also showed that the incidence of posttraumatic stress disorder appears to be much higher among emergency physicians than among other physicians and even emergency department nurses. One of the reasons for this may be the varying degrees of exposure to traumatic events and their occupational hazards. Schooley B. et al. [15] showed that the emotional exhaustion and depersonalization scores were high in all relevant occupational groups, although the scores on personal accomplishment were low. A statistically significant difference was shown between nurses and medical technicians ($P < 0.05$) for emotional exhaustion; and between physicians and both nurses and medical technicians ($P < 0.05$) for personal accomplishment. However, no difference between the groups was found for depersonalization. Age, gender, economic well-being and income level were all significant, while patient load and marital status had no significance.

4.4. Research tools and variables

In almost all studies, the outcome variable 'burnout' was quantified using the Maslach Burn-out Inventory (MBI). The MBI is an internationally used questionnaire, developed by Maslach and Jackson, which provides 22 questions with four answer options. Three scales describe participants feelings of burnout [4]: emotional exhaustion, depersonalization, and personal accomplishment. Burnout is quantified by the sum of the answers from each dimension, as we already explained in the introduction. Not all researchers presented their results as such [5,8,19–21,33]. Most of the 35 studies use the cut-off values as described by Maslach [22]. Cutoff values for the three dimensions of burnout have been determined for several professional groups, including physicians (EE 16, DP 8 and PA 17). Several types of scales were used to quantify determinants. These were partly self-designed scales for demographic and organizational variables, among other variables. We have made a general overview of the burnout scales used and their cut-offs of the various groups of respondents involved in the respective studies in Table 2. Concerning more information about stress factors. We noticed interesting articles with the most prominent article of Estryn-Behar M [8]. Somville F. et al. [5] stated that the exposure to, and occurrence and perceived risk of, occupational hazards and, more clearly, exposure to COVID-19 (88%) and its occurrence (10%), as well as concerns about these hazards, appear to be high in physicians working in the emergency department. The concerns about each of these outcomes are predictable by the assumed exposure, the

occurrence and the perceived risks. Somville F. et al. [7] reported that emergency physicians are regularly exposed to work-related traumatic events and hectic working conditions. The results of that study showed that the levels of anxiety, depression, somatic complaints and post-traumatic stress reactions are effectively high in emergency physicians. The occurrence of violence is accompanied by psychological problems, perceived fatigue and somatic complaints, but the occurrence of situations that increase the risk of burnout is linked to all outcomes. Estryn-Behar M. et al. [8] explained in his results that they indicate that the intention to leave the profession was quite widespread among French physicians and even more among emergency physicians (17.4% and 21.4% respectively) and that burnout was much more common (42% respectively). .4% and 51.5%). Among the study

sample and among emergency physicians, work-family conflict (OR = 4.47 and OR = 6.14, respectively) and the quality of teamwork (OR = 2.21 and OR = 5.44, respectively) were linked to burnout in a multivariate analysis. The risk factors were clearly more common among emergency physicians than among other physicians. A severe lack of quality teamwork appears to be linked to a higher risk of intention to leave the profession (OR = 3.92 among physicians in the study sample and OR = 4.35 among emergency physicians), and burn- out doubled the risk of intention to leave the profession in the multivariate
analysis.

4.5. Study population and variables

We found in Table 1, which explicitly reports the ratio of men and women (Gender column M-F), that there were more male ED physicians than female ED physicians. Except for one article after Soltanifar et al. [17] which only included women. The percentage of males in EDs ranged from 0% to 91%, with a higher percentage of males among the emergency physicians compared to other hospital physicians (Table 1). Overall, the age variance was between 20 and 67 years. But of course this varies from study to study. Most physicians were under the age of 45. The majority of the respondents were married or cohabiting and almost half had one or more children. Most studies appeared to include emergency physicians versus physicians of other specialties. Nine studies surveyed a wider population that included other healthcare workers such as nurses and paramedics [8,11,13–15,17,33–35]. The mean seniority in emergency care was beneath 15 years [18,23–25,43,44]. As far as stated, approximately 80% of the respondents had a full-time mandate and 20% worked half-time or less. Emergency care providers scored significantly higher for emotional exhaustion in all studies. Likewise, they scored significantly higher for depersonalization (DP) and significantly lower for sense of personal accomplishment (PA) in eight studies compared to caregivers in intensive care unit and other disciplines and departments [8,12,14,15,26,33–35]. We note that the studies by Alqahtani et al. and Nguyen et al. show low burnout scores, in contrast to all other studies in this review [12,16]. Neither in their methodology nor in their discussion is this clearly explained why this was the case. But emergency physicians scored worse on EE and DP but scored better on PA in comparison with other caregivers in the emergency department [15,27]. Concerning the fact that individuals are categorized into four distinct personality types based on their behavior, attitudes, and responses to stress. We noted that the type D personality among emergency physicians and hospital physician physicians accounted for nearly a third of a recent study. Type D Personality: People with a Type D personality tend to be more anxious, more concerned, and have a more negative view of what they are doing or

how they are feeling. They are also more introverted and have a strong tendency to keep their emotions to themselves. This in contrast to the A, B, C types. Somville F. et al. [6] indicated that Type D personality ranged from 28.5% to 29.1% among emergency physicians and other hospital physicians. In addition, even after adjusting for work-related and organizational factors, emergency physicians with Type D personality were seven times more likely to be at high risk of burnout. As a result, this study provided a new perspective on the links between burnout, stress and Type D personality. Type D personality may represent a personality-related risk factor for burnout among emergency physicians.

5.Discussion of results

The current study examined research related to stress and burnout, which was conducted over the last decade among emergency physicians and emergency medicine residents. Concerning basic characteristics of the respondents, not all studies gave an equally clear representation of the basic characteristics of their population. This means that these measures can only approximately be interpreted. This finding may give rise to a bias effect in connection with an extrapolation of the results obtained. The percentage of males in emergency departments ranged from 0% to 91%, with a higher percentage of males among emergency physicians compared to other hospital physicians as shown in Table 1. So there is a reasonable spread variation in the gender population in the results of the various studies. This may be due to the fact that it is often mixed groups of emergency care providers that are used in the dies. Considering all the studies together, age was between 20 and 67 years. This may also be related to the fact that the studies used a population of emergency responders from different disciplines. The vast majority of physicians in the studies were under the age of 45. This is not surprising because in the last 10 years, emergency departments hired more specific emergency physicians. The majority of the respondents was married or cohabiting and about half 50% of them had at least one child. Most studies appeared to include emergency physicians versus physicians of other specialties. One can argue that in the nine studies which surveyed a wider population that also included paramedics [8,11,13–15,17,33– 35], the degree of total burnout rate could be influenced, due to the use of a mixed population of physicians and non-physicians. The mean seniority in emergency care was beneath 15 years [18,23,25,33–35], is also understandable to us, given that the branch of specific discipline of emergency physicians has only existed on its own for decades. The fact that emergency physicians scored worse on EE and DP, but better on PA compared to paramedics and other healthcare providers, may be explained by their specific occupational activity in the emergency department [15,27]. The ultimate responsibility for the entire emergency care management lies in their hands. However, their work autonomy gives them the opportunity to develop better than other care providers in an ED. Already in the older study by Escribà-Agüir, a stronger inverse correlation between self- monitoring and EE was found in specialized emergency care providers [8]. It is true that the contacts of other care providers with patients are more extensive and last longer than those of Emergency physicians. Verbal aggression, threats and violence are directed more often at the emergency physicians than at other care providers. This may explain the lower scores of the EE and DP and the higher score of PA in the emergency physicians [5].

In Emergency physicians, several stress factors were identified, both in the quantitative and the qualitative studies on determinants for work stress and burnout. The majority of the

studies investigated a relationship between the stress factors present and work characteristic factors [5,8,10–12,14,19,20,28–31,33–39]. Other studies distinguish between classical daily stressors and striking stressors, especially the acutely pronounced stressors and the more chronically occur ring stressors [5,8,10–12,14,20,28,30,36–41]. The influence of the violent environment in which one has to work, is another consideration [14,36,42,43].

Personal factors such as age and gender of Emergency physicians were identified in the study as relevant for feeling of burnout. This pattern may also be reflected in the response to stress factors according to age and gender in Emergency physicians. Several studies indicated that the personality structure of the Emergency physicians, including Type D personality, may play a role in the occurrence of burnout [6,22]. Furthermore, environmental factors are put forward as/reported to be an important determinant when defining work stress and/or burnout [5,8,10– 12,14,28,30,32–35,44]. Generally, the studies included in this review, show that Emergency physicians are strongly influenced by the stress impact of work and burnout. They confirm the individual characteristics as well as the specific nature of Emergency physicians in their professional activity, stress factors and population. A clearer look at the nature and severity of these stress factors is important for management of the consequences and prevention, both in professional well-being and physical health, as well as in environmental and economic areas. This may lead to a better understanding of the increased absenteeism in the emergency department. And also a better understanding of why emergency physicians permanently leave the emergency department or switch professions [8,26,33,39].

6.Limitations and strengths of this study

The majority of the studies (33 studies of the 35) had a cross-sectional design. The stress factors to which one is exposed in a chronic way give rise to feelings of burnout and thus repeated measurements in study populations provide a better look at the correlation between burnout and work characteristics and organizational as well as other factors. All the studies focused more on the impact of the various stress factors on the various dimensions used to explain the burnout syndrome that occurred as a result of these factors. To a limited extent, personal or environmental interference factors were considered in the interpretation of the data. This review does give the impression that burnout is an event that is influenced by a series of factors from an approach of multiple stress factors and environmental factors. Therefore, an extensive combination of validated surveys is indicated to limit interference of the outcome by dimensions that were not surveyed. Some possible interfering factors should be considered. The absence of effective randomization in some selected studies may affect the generalizability of the results found. Persons with a significant degree of burnout and/or type D have a greater pattern of absence as a result of illness and therefore non- respondents to a survey design and impact study results and deeper insights into the phenomenon of burnout of a certain professional group at risk such as Emergency physicians. Several authors indicate that with some limitations at an international level, the MBI scores of care providers should be compared in view of the large differences in status in the professional field, their education level, job activity and tasks in the various countries. It is therefore not an obstacle to compare these groups with each other in this review as we have already noted and explained in Table 1 (the different emergency department professionals in the studies) and in

Table 2 (the differences in threshold values of the different emergency department professionals in the studies).

7.Conclusion

The impact of burnout, both on a psychosocial and physical level, as well as on work characteristics and organizational factors, and finally as well as economically, cannot be ignored. Emergency physicians also have their own specific potential risks to stress factors. The 35 studies show that several aspects of stress factors play a role in relation to burnout. The Emergency physicians score even lower than emergency nurses and other physicians. They score higher on emotional exhaustion and depersonalization and lower for personal accomplishment than other occupational groups. As far as the personal factors are concerned, the influence on whether burnout occurs is an item that should be considered. An important factor remains exposure to work-related traumatic events which can be an important factor in contracting posttraumatic stress disorder. Coaching and psychological support programs as support and prevention of burnout are recommended. In addition, self-control over the life work balance, emergency activity and social support by work environment and service heads are protective determinants against the development of burnout. Job satisfaction and peer support are protective factors likewise. All the above factors provide an impetus for the development of a multi- level approach to work stress management in emergency departments and emergency care policies regarding the quality of professional well-being of Emergency physicians and the quality of their care for the patient. Further research on the multiple factors in work stress and burnout among Emergency physicians is recommended. This review provides a solid basis for developing a way to manage work stress and prevent burnout in Emergency physicians.

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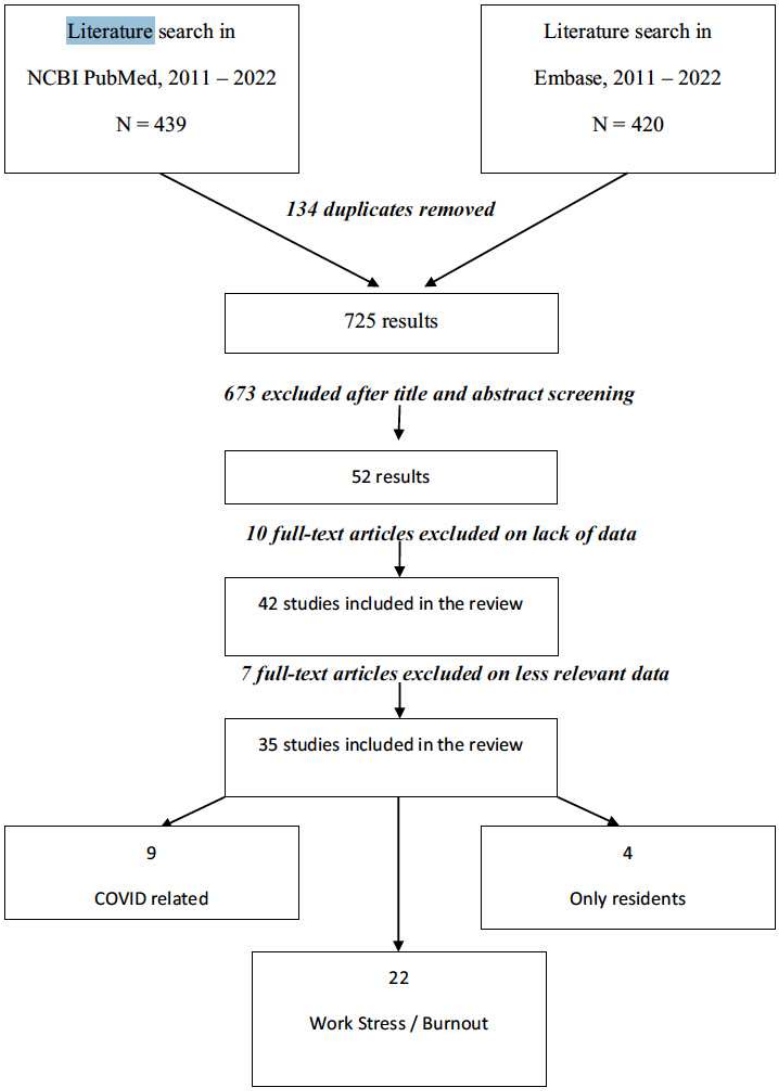

Figure 1. Flow diagram of strategy to search literature for 'work stress and burnout in emergency physicians' between 2011 – 2022.

Table 1. Selected studies with specific design information and results.

Reference	Research design	Speciality	Sample size	Response rate	Gender M– F	Measure of burnout	Diagnostic Criteria	Burnout Rate	High Emotional Exhaustion	High Depersonalization	Low Personal Accomplishment	Significant determinants for EM physicians burnout explained by various stressors
M. Estryn-Behar et al. [1]	CS	4799 physicians, 538 EM physicians	5337	66%	57.5% – 42.5%	CBI	CBI score >/ = 3	51.5%	not mentioned	not mentioned	not mentioned	work-family conflict, quality of teamwork as stress at work
M. Jalili et al. [2]	CS	EM residents en practioners	188	88%	91% – 9%	MBI	not mentioned	not mentioned	0,37	0,39	0,46	19 stressors, like shortage of equipment, problem with work physical environment, and relationship with other services
J.K Takayesu et al. [3]	CS	residents	289	75%	59 %- 41%	MBI	high EE/DP or low PA	0,65	0,33	0,59	0,59	having a significant other or spouse, poor global job satisfaction, lack of administrative autonomy, lack of clinical autonomy, intolerance of uncertainty
S.A.M. Abdo et al. [4]	CS	248 nurses, 266 physicians(ED)	514	N:100%, P:89.9%	27.7% – 72.3 %	MBI	high EE and DP and low PA	0,66	46.9%	44.9%	97.7%	age, sex, frequency of exposure to work-related violence, years of experience, work burden, supervision and work activities
M. Howlett et al. [5]	CS	ED staff members (nurses/EP)	616	51%	15.2% – 84.8%	MBI (CISS: coping)	not mentioned	not mentioned	not mentioned	not mentioned	not mentioned	Emotion-oriented coping
Lu et al. [6]	CS	EM attending physicians and residents	155	49.7%	62.3% – 37.7%	MBI	high EE or high DP	57.1%	16%	38%	6%	Positive screen for depression and low career satisfaction
Ben-Ithzak et al. [7]	CS	EM physicians	200	35%	70% – 30%	MBI	high EE or high DP	71.4%	61%	51%	17%	Extent to which work stress provides meaning and degree of worry
Salmoirago-Blotcher et al. [9]	CS	EM physicians	422	32.7%	71.4% – 28.6%	2-item validated version of MBI	not mentioned	27.2%	not mentioned	not mentioned	not mentioned	No significant relationship with religious/spiritual indicators
Schooley et al. [8]	CS	EM physicians	38	100%	54% – 46%	MBI + Demographics	not mentioned	not mentioned	71.05%	78.94%	28.94%	No significant relationship with number of patient encounters per day
Zafar et al. [10]	CS	EM physicians	52	92.2%	41.3% – 58.7%	MBI-HSS	high EE or high DP or low PA	not mentioned	aOR = 2.48*	aOR = 0.32*	not mentioned	No significant relationship with experience of physical attack or verbal abuse or current mental distress as work stress
Hamdan et al. [11]	CS	EM physicians	215	65.8%	76.8% – 23.2%	MBI-HSS	not mentioned	not mentioned	72.3%	32.1%	32.1%	Exposure to workplace violence and younger workers (≤30 years)
Lu et al. [12]	CS	EM trainees	54	66.7%	60.3% – 39.7%	MBI	high EE or high DP	70%	not mentioned	not mentioned	not mentioned	No significant relationship with postgraduate year
Lu et al. [13]	CS	EM trainees	89	65.2%	60.3% – 39.7%	MBI	high EE or high DP	53.4%	not mentioned	not mentioned	not mentioned	no important determinants such as work stress were retained
O. Yuguero et al. [14]	CS	EM physicians	245	40.8%	33% – 67%	MBI	MBI>/ = 31	not mentioned	not mentioned	not mentioned	not mentioned	low levels of empathy(high JSPE score)
Lu et al. [15]	CS	EM trainees	53	50.9%	70.4% – 29.6%	MBI	high EE or high DP	77.8%	not mentioned	not mentioned	not mentioned	no important determinants such as work stress were retained
Rajan et al. [16]	CS	EM physicians	124	80%	45.2% – 54.8%	MBI-HSS	high EE or high DP or low PA	not mentioned	66.7%	53.8%	30.1%	Younger doctors (≤40 years)
Soltanifar et al. [17]	CS	Female EM physicians	108	71%	0 %- 100%	MBI	not mentioned	not mentioned	42.9%	11.7%	55.8%	Significant relationship between lower job statisfaction and high EE-score
Truchot et al. [18]	CS	Young EM physicians (<5 years)	1280	34%	47% – 53%	Modified MBI	not mentioned	not mentioned	23%	10%	not mentioned	Female physician and workload of more than 48 hours a week
Chernoff et al. [19]	CS	EM physicians	30	77%	32% – 68%	OLBI	not mentioned	70%	not mentioned	not mentioned	not mentioned	History of depression

(*Continued*)

Table 1. (Continued).

Reference	Research design	Speciality	Sample size	Response rate	Gender M– F	Measure of burnout	Diagnostic Criteria	Burnout Rate	High Emotional Exhaustion	High Depersonalization	Low Personal Accomplishment	Significant determinants for EM physicians burnout explained by various stressors
Dyrbye et al. [20]	CS	EM residents (4th year) responded	299	not mentioned	49.1% – 50.9%	2-item tool from MBI	high EE or high DP	53.8%, RR = 1.32**	not mentioned	not mentioned	not mentioned	Female physician and higher anxiety score – adverse relationship with higher empathy score
Perera et al. [21]	CS	EM physicians	118	72%	61.7% – 39.3%	MBI-HSS	high EE or high DP	66.2%	mean EE-score = 26.46	mean DP-score = 11.96	mean PA-score = 31.51	Female physician and fewer years of practice
Lin et al. [22]	CS	EM residents	7213	21.1%	57.8 %- 42.2%	MBI-HSS	high EE or high DP	76.1%	46.1%	72.5%	30.6%	no important determinants such as work stress were retained
Alqahtani et al. [23]	CS	EM physicians	95	100%	29.1% – 70.9%	MBI	high EE and high DP and low PA	18.9%	81.1%	24.2%	27.4%	No significant relationship with work-related characteristics
Q. Zhang et al. [24]	SR	EM physicians	1943	not mentioned	not mentioned	MBI	high EE and DP	40%	40%	41%	35%	no important determinants such as work stress were retained
R. Lim et al. [25]	CS	EM physicians	427	90%	55.6% – 44.4%	MBI-HSS	EE > 27; DP > 10; PA < 34	86.1%	mean score 34.07	mean score 16.35	mean score 45.64	young age, CCFP-EM trained, high PHQ-9 scores(indication for depression)
M.D. Lall et al. [26]	CS	EM physicians	1102	82%	55.1% – 44.9%	LSEP survey/self-reported burnout	not mentioned	33% (32% M and 37.3% W)	not mentioned	not mentioned	not mentioned	not mentioned
D. Verougstraete et al. [27]	SR	EM physicians and residents	n m	not mentioned	not mentioned	82% MBI/18% MBI others	not mentioned	25,4%–> 71,4% (EM), 55,6%–>77,9%(ER)	not mentioned	not mentioned	not mentioned	not mentioned
M. C. T. Dimitriu et al. [28]	CS	A:50=EM, radiology, ICU/B: 50 other speciality	100	100%	58.0% – 42.0%	MBI	high EE and DP and low PA	76%(66%vs 86%)	A: 36%; B: 50%	A: 8%; B: 10%	A: 22%; B: 26%	Threat posed by Covid-19, working in normal wards (instead of front line)
L. O. Somnez et al. [29]	CS	GP, residents, specialists, EM physicians	141	not mentioned	58.2% – 41.8%	MBI	not mentioned	not mentioned	(high)	(moderate)	(moderate)	younger age, shorter duration of employment
J. Nguyen et al. [30]	CS	EM physicians, during Covid	890	18.7%	72.9% – 27.1%	adapted MBI-HSS	not mentioned	74.7%	not mentioned	not mentioned	not mentioned	work related emotional strain and anxiety, isolation from family and friends, and increased workload.
F. Somville et al. [31]	CS	EM physicians and other physicians	497	64.2% > 39.4%	54% – 46%	UBOS	not mentioned	47%	not mentioned	not mentioned	not mentioned	age, exposure/occurrence of burnout, violence, occurrence of Covid-19
J. Chang et al. [32]	CS	EM residents	22	55%		MBI-HSS	high EE/DP or low PA	not mentioned	mean score 2.47	mean score 2.57	mean score 4.61	threat posed by Covid-19, cumulative stress due pandemic, PTSD
A. Tabur et al. [33]	CS	67 nurses, 87 physicians(ED), 200 health staff	354	50%	17.2% –82.8	MBI	not mentioned	53.4%	not mentioned	not mentioned	not mentioned	work-related anxiety, increased workload, threat posed by Covid-19
R. Petrino et al. [34]	CS	223 nurses, 1614 physicians(ED), 41 paramedics, 47 others	1925	not mentioned	52.3% – 47.5%	MBI	high EE/DP or low PA	62%	48.5%	46.5%	47.4%	female, understaffed, having less experience, threat posed by Covid-19
M. Alwhaibi et al. [35]	CS	67 nurses, 36 physicians(ED), 27 pharmacists, 9 others	139	not mentioned	56.7% – 43.3%	MBI	high EE/DP or low PA	not mentioned	61.8%	58.3%	41.0%	workplace, female physician, workload

Abbreviations: CS: cross-sectional, EM : emergency physicians, CBI: Copenhagen Burnout Inventory, MBI: Maslach Burnout Inventory, MBI-HSS: Maslach Burnout Inventory Human Services Scale, LSEP: Longitudinal Survey of Emergency Physicians CISS: Coping Inventory for Stressful Situations OLBI: Oldenburg Burnout Inventory, EE: Emotional Exhaustion, DP: Depersonalisation, PA: Personal Accomplishment, ER: Emergency Room.

Table 2. Cut-off scores for the MBI-HSS, MBI-GS, UBOS-A and OLBI for human services occupations.

MBI-HSS	Target respondents	Cut off	Normative values
Emotional Exhaustion	Physicians and nurses (1)	≥26	Mn(SD) 23.80 (11.80)
	Mental Health personnel (2)	≥21	
Depersonalisation	Physicians and nurses (1)	≥9	Mn(SD) 7.13 (6.25)
	Mental Health personnel (2)	≥8	
Personal Accomplishment	Physicians and nurses (1)	≤33	Mn(SD) 13.53 (8.15)
	Mental Health personnel (2)	≤28	
MBI-GS/UBOS-A			
Emotional Exhaustion	Human service personnel (3)	≥2.38	Mn(SD) 1.78 (0.99)
Depersonalisation	Human service personnel (3)	≥1.60	Mn(SD) 1.12 (0.77)
Personal Accomplishment	Human service personnel (3)	≤3.70	Mn(SD) 4.21 (0.80)
OLBI			
Emotional Exhaustion	Mental Health personnel (4)	≥2.25	Mn(SD) 2.15 (0.52)
Depersonalisation	Mental Health personnel (4)	≥2.10	Mn(SD) 2.15 (0.52)

Cut-off scores for MBI-HSS [45;46], MBI-GSI and UBOS-A [47] and OLBI [48].