


# Impact of the COVID-19 pandemic on stress and sleep in emergency room professionals

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## Abstract

**Aims and Objectives:** To analyze stress levels, sleep quality, sleepiness and chronotypes on emergency room (ER) professionals before and during the COVID-19.

**Background:** ER healthcare professionals are exposed to high stress levels, and they often present with poor sleep quality.

**Design:** Observational study conducted into two different phases (before the COVID-19 and during the first wave of the COVID-19).

**Method:** Physicians, nurses and nursing assistants working in the ER were included. Stress, sleep quality, daytime sleepiness and chronotypes were assessed by the Stress Factors and Manifestations Scale (SFMS), the Pittsburgh Sleep Quality Index (PSQI), the Epworth Sleepiness Scale (ESS), and the Horne and Österberg Morningness-Eveningness questionnaire, respectively. The first phase of the study was performed between December 2019 and February 2020, and the second between April and June 2020. The STROBE checklist was used to report the present study.

**Results:** In total, 189 ER professionals in the pre-COVID-19 phase and 171 (of the initial 189) during COVID-19 were included. The proportion of workers with a morning circadian rhythm increased during the COVID-19, and stress levels were significantly higher during COVID-19 compared to the previous phase ( $38.34 \pm 10.74$  vs.  $49.97 \pm 15.81$ ). ER professionals with poor sleep quality presented higher stress in the pre-COVID-19 phase ( $40.60 \pm 10.71$  vs.  $32.22 \pm 8.19$ ) and during COVID-19 ( $55.27 \pm 15.75$  vs.  $39.66 \pm 9.75$ ). Similarly, workers with excessive sleepiness had higher stress in the pre-COVID-19 phase ( $42.06 \pm 10.95$  vs.  $36.64 \pm 10.24$ ) and during COVID-19 ( $54.67 \pm 18.10$  vs.  $48.44 \pm 14.75$ ). Positive associations were also found between the SFMS and the PSQI, as well as with the ESS in both phases of the study.

**Conclusions:** Emergency room professionals had increased stress levels during the COVID-19 pandemic. Stress was particularly higher in those with poor sleep quality or with excessive daytime sleepiness.

Juana Inés Gallego-Gómez and José Miguel Rivera-Caravaca shared last authorship.

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**Relevance to Clinical Practice:** These results should aim to impulse the implementation of measures to improve the working conditions of ER professionals.

**KEYWORDS**

chronotype, COVID-19, emergencies, nurses, nursing assistants, physicians, sleep quality, sleepiness, stress

## 1 | INTRODUCTION

The impact of the COVID-19 pandemic has been devastating worldwide, resulting in an unprecedented challenge for society, especially in the healthcare sector, which needed to adapt the way they care for patients. This situation has entailed great responsibility for health workers, translating into both physical and psychological high pressure due to the proximity to this disease and the extra effort to adapt their usual work to the new hospital conditions caused by the pandemic (Manzanares et al., 2021; Olagunju et al., 2021; Walton et al., 2020). This adds to previously existing high levels of stress, poor sleep quality and sleepiness in healthcare workers, particularly among the emergency staff, who represent the front line in healthcare (García-Tudela et al., 2019, 2022).

## 2 | BACKGROUND

Stress is defined as an imbalance of the organism's reaction capacity to external demands (Osorio & Cárdenas, 2017). Short-term acute exposure to stress can cause gastrointestinal problems and fatigue, while chronic exposure may lead to hypertension, cardiovascular and musculoskeletal diseases, anxiety, and depression (Basu et al., 2017; Ezenwaji et al., 2019; Navinés et al., 2021; Romswinkel et al., 2018). Emergency room (ER) physicians, nurses and nursing assistants face extreme situations in their daily clinical practice that require a quick response; hence, they work under constant pressure. In addition, these professionals deal with patients and their suffering, which entails a significant emotional and psychosocial demand that implies an overload of work, stress and negative consequences for health (Azevedo et al., 2017; Heidari et al., 2022; Munnangi et al., 2018; Pacheco, 2009).

However, the consequences of stress are particularly reflected in sleep problems, since it causes an increase in cortisol, proinflammatory cytokines and sympathetic activity, reducing parasympathetic activity and, and consequently, the quantity and quality of sleep (Herrero San Martin et al., 2020; McEwen, 2006; Said & El-Shafei, 2021; Zhou et al., 2020). On the contrary, sleep is an essential process to keep good physical and mental health status for the human being since it helps to restore physiological, cognitive and emotional functions. Lack of sleep has effects at the cellular level, on tissues and systems, affecting the emotional centres of the brain, which can cause psychiatric, autoimmune and neurodegenerative disorders, as well as cardiovascular diseases, obesity and diabetes (Berglund, 2019; Herrero San Martin et al., 2020; Huang et al., 2021;

### What does this paper contribute to the wider global community?

- This study analyses for the first time stress, sleep quality, sleepiness and chronotypes in the emergency room.
- Higher stress was observed in emergency room professionals during the COVID-19 pandemic in comparison with the previous period.
- Notably, stress was particularly higher in emergency room professionals with poor sleep quality or with excessive daytime sleepiness.

Merino-Andréu et al., 2016; Walker, 2008; Zhang et al., 2021; Zhou et al., 2020). Moreover, these inconveniences caused by poor sleep quality produce higher daytime sleepiness (Merino-Andréu et al., 2016), defined as the propensity to fall asleep (Rosales Mayor & Rey De Castro, 2010), a problem that impacts daily performance causing great harm to the physical and mental health (Herrero San Martin et al., 2020; Rosales Mayor & Rey De Castro, 2010). Altogether, these elements are closely related to the circadian rhythm, the human biological clock, which is a natural cycle that controls the activation level and a series of physical and mental changes within a 24-h period, mainly affected by the variations between light and darkness (Rodríguez-González-Moro et al., 2020). The different variants that can adopt the endogenous circadian rhythms are known as chronotype.

Likewise, the stress associated with a demanding work environment such as the suffered by healthcare professionals during the COVID-19 pandemic can have severe consequences on the health and safety of patients since it implies performance deficiencies in complex cognitive tasks and a greater number of errors in health care (Nespereira-Campuzano & Vázquez-Campo, 2017; Zhou et al., 2020). COVID-19 increased the workload of healthcare professionals, who needed to wear individual protection equipment (IPE) and completely changed the way they worked (Sangal et al., 2021; Walton et al., 2020). Additionally, the uncertainty particularly during the early stages of the pandemic (Said & El-Shafei, 2021) and the fear of infection may lead them to stay away from their relatives (Olagunju et al., 2021; Walton et al., 2020). Moreover, witnessing the high number of deaths among patients and colleagues involved a huge psychological burden (Said & El-Shafei, 2021; Walton et al., 2020). Also, some healthcare professionals were relocated to areas with

lower exposure risk due to other diseases or frail health conditions, causing feelings of guilt because of the impossibility of helping their colleagues on the frontline (Costa et al., 2021; Walton et al., 2020). This also implies a great psychological impact affecting mental health and life quality of the professionals (Walton et al., 2020).

Prior to COVID-19, the prevalence of stress, poor sleep quality and sleepiness among professionals from the ER was already high, especially in nurses and nursing assistants (García-Tudela et al., 2019, 2022; Sangal et al., 2021). However, there is scarce evidence about this topic during the COVID-19 pandemic. In particular, how stress, sleep quality and other related factors evolved in comparison with a previous period has not been investigated in deep. Herein, we aim to analyse stress levels, sleep quality, sleepiness and the chronotype in an emergency service before and during the COVID-19, to figure out the magnitude of the impact of the pandemic on these parameters in ER professionals.

### 3 | METHODS

This is an observational and prospective study conducted into two different phases. The first one, pre-COVID-19, was carried out between December 2019 and February 2020, whereas the second one was performed during the first stage of COVID-19 (between April and June 2020), including the same participants who were enrolled in the first phase of the study. The study was conducted using the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline for reporting observational studies (von Elm et al., 2014) (Appendix S1).

Participants included in the study were ER professionals in charge of caring patients (physicians, nurses and nursing assistants) from the Emergency Service of a tertiary hospital (Hospital Clínico Universitario Virgen de la Arrixaca, Murcia (Spain)) who worked in this department during the last month prior enrolment, and were staff members of the Emergency Service for at least the last year. Participants diagnosed of a sleep disorder, on sick leave due to a stressful event according to DSM-5 (American Psychiatric Association, 2013) diagnostic criteria, or in treatment for a high level of stress, were excluded.

At inclusion, work-related and sociodemographic characteristics including gender, age, marital status, professional category, years of professional background and years in the emergency department were recorded in a data collection sheet. This sheet also included a question regarding optimism about work, which was self-reported using a Likert scale of 1–5 points, where 1 was the lowest value and 5 the highest value for optimism.

Information on stress was collected using the Stress Factors and Manifestations Scale (García-Tudela et al., 2022). This questionnaire includes 21 items with 5-point Likert-type scores (from 1 = not at all, to 5 = totally), and describes different manifestations of stress associated with four factors (Self-concept, Sociability, Somatisation and Illness symptoms). The maximum score on the scale is 105 points, and higher scores indicate higher stress.

In addition, three widely used self-administered questionnaires were applied:

1. The Pittsburgh Sleep Quality Index (PSQI), which identifies participants with good or poor sleep quality. This is a self-administered questionnaire with 19 questions that are included into seven components: subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of hypnotic medication and daytime dysfunction. Each component scores from 0 to 3, and the overall score varies from 0 to 21, where scores  $\leq 5$  include good sleepers and scores  $\geq 6$  poor sleepers (Buysse et al., 1989).
2. The Epworth Sleepiness Scale (ESS), which assesses the predisposition to fall asleep in eight different daily life scenarios, discriminating whether a subject suffers from daytime sleepiness. It is composed of eight items, on a scale from 0 to 3. The maximum score is 24, and a score  $\geq 11$  indicates excessive daytime sleepiness (Gandhi et al., 2021; Johns, 1991).
3. The reduced scale of the Horne and Österberg Morningness-Eveningness Questionnaire was used to assess variations in endogenous circadian rhythms (i.e. chronotypes), which identifies vespertine, intermediate and morning chronotype (Adan & Almirall, 1991).

The study was authorised by the Ethics Committee from the Catholic University of Murcia, Spain (Reference CE111707) and ratified by Ethics Committee from the Hospital Clínico Universitario Virgen de la Arrixaca. The guidelines of the 1964 Declaration of Helsinki were followed. Informed consent was required for all participants.

#### 3.1 | Sample size calculation

Estimation of the sample size was performed using WinEpi 2.0 (de Blas et al., 2006). Thus, based on a normal distribution, a sample with at least 168 participants must be selected to calculate an estimated proportion of 30% with an accepted error (or precision) of 5% and a confidence level of 95%. Assuming a potential loss of participants of 10%, the final sample size should include at least 187 participants.

#### 3.2 | Statistical analysis

Qualitative variables were presented as absolute frequencies and percentages, whereas quantitative variables were presented as mean  $\pm$  standard deviation (SD) (or median and interquartile range [IQR], as appropriate). The Pearson chi-squared test was used to compare proportions, and differences between qualitative and quantitative variables were assessed using the Student t test or the ANOVA, as appropriate. The correlation between different quantitative variables was tested using the Pearson's  $r$ .

A  $p < .05$  value was considered as statistically significant. Statistical analyses were performed with SPSS v.21.0 (SPSS, Inc.) for Windows.

## 4 | RESULTS

We initially carried out 200 contacts among ER professionals in the pre-COVID-19 phase. Of them, 189 (72.5% females, mean age  $39.85 \pm 10.65$  years) agreed to participate (response rate of 94.5%) and were included in the study. In the second phase, 18 participants were lost to follow-up due to sick leaves or derivations to other hospital departments after the start of the pandemic, thus giving a sample size of 171 (73.1% females, mean age  $38.74 \pm 10.49$  years) during the COVID-19 phase of the study.

Regarding the professional category of the workers, the proportion of participants in the pre-COVID-19 phase compared to the COVID-19 phase was 30.7% versus 24.6% for physicians, 39.2% versus 42.7% for nurses and 30.2% versus 32.7% for nursing assistants. Other details are presented in Table 1.

TABLE 1 Descriptive variables during pre-COVID-19 and COVID-19 phases in emergency room professionals.

	Pre-COVID-19 <i>n</i> = 189	During COVID-19 <i>n</i> = 171	<i>p</i> -value
Age (years), mean (SD)	$39.85 \pm 10.65$	$38.74 \pm 10.49$	.321
Gender, <i>n</i> (%)			
Male	52 (27.5%)	46 (26.9%)	.896
Female	137 (72.5%)	125 (73.1%)	
Marital status, <i>n</i> (%)			
Single	62 (32.8%)	55 (32.2%)	.950
Living with couple	109 (57.7%)	98 (57.3%)	
Divorced	18 (9.5%)	18 (10.5%)	
Profession, <i>n</i> (%)			
Nurses	74 (39.2%)	73 (42.7%)	.432
Physicians	58 (30.7%)	42 (24.6%)	
Nursing assistants	57 (30.2%)	57 (32.7%)	
Experience in emergency service (years), mean (SD)	$7.40 \pm 7.83$	$5.54 \pm 6.88$	.017
COVID-19, <i>n</i> (%)			
Positive	-	25 (14.6%)	N/A
Negative	-	146 (85.4%)	

Abbreviation: SD, standard deviation.

## 4.1 | Sleep quality, sleepiness and chronotype

In the pre-COVID-19 phase, 73% of the ER professionals presented with poor quality of sleep, whereas during COVID-19, it decreased to 66.1% ( $p = .153$ ) (Table 2). Although the proportion of ER professionals with poor sleep quality decreased in the COVID-19 phase, the overall PSQI score remained almost identical ( $8.21 \pm 4.13$  vs.  $8.27 \pm 4.73$ ,  $p = .902$ ).

In terms of sleepiness, 31.2% of the workers referred to be affected by excessive sleepiness before the pandemic, decreasing during COVID-19 to 24.6% ( $p = .160$ ) (Table 2). Accordingly, there was a non-significant decrease in the ESS ( $8.47 \pm 4.25$  vs.  $7.86 \pm 4.33$ ,  $p = .179$ ).

During the pre-COVID-19 phase, the proportion of ER professionals with a morning chronotype was 29.6%, whereas 70.4% had an intermediate or vespertine chronotype. These proportion significantly changed during COVID-19 as the number of workers with a morning chronotype increased to 39.8% compared to 60.2% with an intermediate or vespertine chronotype ( $p = .043$ ) (Table 2). The Morningness-Eveningness questionnaire score was similar in both phases of the study ( $15.62 \pm 3.74$  vs.  $16.30 \pm 3.40$ ,  $p = .075$ ).

## 4.2 | Analysis of stress

The overall reported levels of stress in ER professionals increased significantly during the COVID-19, as reflected by the Stress Factors and Manifestations Scale ( $38.34 \pm 10.74$  before COVID-19 vs.  $49.97 \pm 15.81$  during COVID-19,  $p < .001$ ). Nevertheless, COVID-19-positive workers had not significantly higher levels of stress ( $54.84 \pm 20.18$  vs.  $49.28 \pm 14.82$ ,  $p = .198$ ).

TABLE 2 Sleep variables during pre-COVID-19 and COVID-19 phases in emergency room professionals.

	Pre-COVID-19 <i>n</i> = 189	During COVID-19 <i>N</i> = 171	<i>p</i> -value
Sleep quality, <i>n</i> (%)			
Poor	138 (73%)	113 (66.1%)	.153
Good	51 (27%)	58 (33.9%)	
Daytime sleepiness, <i>n</i> (%)			
Sleepiness	59 (31.2%)	42 (24.6%)	.160
No sleepiness	130 (68.8%)	129 (75.4%)	
Chronotype, <i>n</i> (%)			
Morning	56 (29.6%)	68 (39.8%)	.043
Intermediate/vespertine	133 (70.4%)	103 (60.2%)	

Note: Instruments used: Sleep Quality (PSQI); Daytime sleepiness (ESS); Chronotype (Horne and Österberg Morningness-Eveningness Questionnaire).

**TABLE 3** Scores of the Stress Factors and Manifestations Scale during pre-COVID-19 and COVID-19 phases according to different variables in emergency room professionals.

	Stress pre-COVID-19, Mean (SD)	<i>p</i> -value	Stress during COVID-19, Mean (SD)	<i>p</i> -value
Gender				
Male	34.87 ± 8.52	.002	46.72 ± 15.99	.103
Female	39.66 ± 11.22		51.17 ± 15.65	
Profession				
Nurses	36.42 ± 10.72	.094	52.04 ± 17.20	.336
Physicians	40.48 ± 10.90		48.64 ± 15.12	
Nursing assistants	38.65 ± 10.32		48.27 ± 14.33	
Sleep quality				
Poor	40.60 ± 10.71	<.001	55.27 ± 15.75	<.001
Good	32.22 ± 8.19		39.66 ± 9.75	
Daytime sleepiness				
Sleepiness	42.06 ± 10.95	.001	54.67 ± 18.10	.026
No sleepiness	36.64 ± 10.24		48.44 ± 14.75	
Chronotype				
Morning	36.09 ± 10.62	.062	47.18 ± 17.08	.060
Intermediate/vespertine	39.29 ± 10.69		51.82 ± 14.72	

Note: Instruments used: Sleep Quality (PSQI); Daytime sleepiness (ESS); Chronotype (Horne and Österberg Morningness-Eveningness Questionnaire).

Abbreviation: SD, Standard deviation.

In particular, differences in stress were found between males and females, with higher scores in females in the pre-COVID-19 phase (39.66 ± 11.22 vs. 34.87 ± 8.52;  $p = .002$ ). Among the different professional categories, the stress levels during the pre-COVID-19 phase were similar, although there was an increase in the overall score for all professionals (Table 3).

However, stress levels were much higher in ER professionals with poor sleep quality compared to those with appropriate sleep quality, in both the pre-COVID-19 phase (40.60 ± 10.71 vs. 32.22 ± 8.19;  $p < .001$ ) and the COVID-19 phase (55.27 ± 15.75 vs. 39.66 ± 9.75;  $p < .001$ ). Similarly, stress was increased in ER professionals with excessive sleepiness compared to those with no sleepiness during the pre-COVID-19 phase (42.06 ± 10.95 vs. 36.64 ± 10.24;  $p = .001$ ) and also during the COVID-19 phase (54.67 ± 18.10 vs. 48.44 ± 14.75;  $p = .026$ ). Regarding chronotype, we found a trend toward slightly higher stress in ER professionals with an intermediate/vespertine profile (Table 3).

Finally, the relation of stress with sleep quality, sleepiness and circadian chronotype was also investigated by correlations. Thus, during the pre-COVID-19 phase, we observed a positive correlation between the Stress Factors and Manifestations Scale and the PSQI ( $R = .369$ ;  $p < .001$ ), as well as the ESS ( $R = .286$ ;  $p < .001$ ). During the COVID-19 phase, the correlation between the Stress Factors and Manifestations Scale and the PSQI was even stronger ( $R = .689$ ;  $p < .001$ ), and the correlation between the Stress Factors and Manifestations Scale and the ESS was still present ( $R = .249$ ;  $p = .001$ ).

## 5 | DISCUSSION

In this study performed in two different phases, we found that the proportion of ER professionals with a morning chronotype increased during COVID-19. In addition, stress levels increased during the COVID-19, and were higher in those workers with poor sleep quality and those with higher referred sleepiness in both the pre-COVID-19 and during COVID-19 phases. To date, there is no previous study analysing -at the same time stress, sleep quality, sleepiness and the chronotype in all the ER professional categories working in the ER.

Regarding to sleep quality, our results indicate an overall poor quality, showing a worse sleep quality than the majority of studies published to date, both pre-COVID (García-Tudela et al., 2019; Han et al., 2016) and during COVID-19 (Bilgiç et al., 2021; Costa et al., 2021; Sahin et al., 2022; Wang et al., 2020), and comparable to the results from other authors (Herrero San Martin et al., 2020; Meo et al., 2021). Sleep quality among our cohort before and during COVID was similar, but other studies have found larger differences despite not including the same target population. For example, in the article by Olagunju et al. (2021) the prevalence of sleep problems during the COVID-19 pandemic was higher in comparison with the pre-COVID-19 stage, and in the study by Wu and Wei (2020), sleep quality worsened by more than 150% in professionals caring for COVID-19 patients compared to those who did not. The proportion of workers with poor sleep quality in the pre-COVID-19 phase was numerically higher than in the COVID-19 phase. This slight improvement in sleep quality during the pandemic may be due to the

lockdown and the decrease in social activities at night during these months. In most of the studies pre-COVID-19 (Valente et al., 2019) or during COVID-19 (Costa et al., 2021; Wang et al., 2020; Zhou et al., 2020), there was a higher sleep quality compared to our study, although we also found few studies in which the proportion of poor sleep quality was higher than in our study (Bilgiç et al., 2021; Meo et al., 2021).

In terms of sleepiness, our research showed that more ER professionals presented excessive sleepiness during the pre-COVID-19 phase than during COVID-19, despite this was not significant. In other studies before the COVID-19, the levels of sleepiness were higher than in our study (García-Tudela et al., 2019; Valente et al., 2019). On the contrary, sleepiness was significantly lower than we found, in other studies carried out during COVID-19 (Costa et al., 2021; Herrero San Martin et al., 2020).

Concerning to stress, our results are in line with most of the previous evidence since females reported higher levels of stress (García-Tudela et al., 2019, 2022; Nespereira-Campuzano & Vázquez-Campo, 2017; Sahin et al., 2022; Sánchez-Vera et al., 2015). Moreover, we found a significant increase in the overall levels during the pandemic in comparison with pre-COVID-19, even though there were only a few months of difference. However, several studies concluded that being in an emergency department and working in the frontline against COVID-19 was related to higher levels of stress (Manzanares et al., 2021; Rajcani et al., 2021), anxiety (Lu et al., 2020) and worse sleep quality (Meo et al., 2021; Wu & Wei, 2020), as well as a higher likelihood of post-traumatic stress (Emre et al., 2021). Thus, our results can be explained by the high physical and psychological pressure to which these ER professionals were subjected and are in accordance with other studies showing a high proportion of stress in healthcare workers during the COVID-19 pandemic (Bilgiç et al., 2021; Kuo et al., 2020; Manzanares et al., 2021; Rajcani et al., 2021; Said & El-Shafei, 2021). In the study by Manzanares et al. (2021), besides finding high stress levels, high resilience levels were observed despite COVID-19. Kuo et al. (2020) found moderated stress levels, with 17.1% of healthcare professionals suffering from severe stress, while Bilgiç et al. (2021) reported high levels of stress among nurses. In the study by Said and El-Shafei (2021), there was a significantly higher proportion of stress among workers attending COVID-19 patients compared to professionals from another hospital who did not attend COVID-19 patients. Likewise, Rajcani et al. (2021) showed higher cortisol levels in the hair of nurses during the pandemic in comparison with the period before, finding an important progression of stress levels in workers during COVID-19, as we also did.

About the professional category, the highest levels of stress during the pre-COVID-19 phase were reached by physicians, whereas nurses showed the highest stress scores during the COVID-19 phase, which is in accordance with previous evidence (Kuo et al., 2020; Manzanares et al., 2021). Furthermore, the most increase in stress compared to other categories was found in nurses, which may be due to closer contact of these professionals with COVID-19 patients.

Another relevant finding of the present study is the association (and positive correlation) between the level of stress, poor sleep quality, and sleepiness, both before and during the COVID-19 pandemic. Previous studies also found a direct association between stress and poor sleep quality, and between poor sleep quality and sleepiness. For example, da Rocha and De Martino (2010) and Dong et al. (2017) found a positive correlation between stress and poor sleep quality in their studies on nurses. This could be because stress can cause sleep difficulties and restlessness during sleep, as well as contribute to waking up early or during dreams, which would negatively affect sleep quality (Jowkar et al., 2022). Following the pandemic, an increased number of articles addressed the complex issue of stress, probably due to the stressful situation brought on by COVID-19 globally. Demir et al. (2022) even suggest that the psychological effects of the COVID-19 pandemic began with its outbreak, before direct contact with COVID-19 patients. Indeed, in this context of COVID-19, multiple studies have shown a direct relationship between stress and poor sleep quality in healthcare workers and other populations (Bilgiç et al., 2021; Bodys-Cupak et al., 2022; Bruce et al., 2022; David et al., 2022; Jowkar et al., 2022; Karimi et al., 2022; Kim et al., 2022). Another study that compared stress and sleep disorders during the first wave of COVID-19 and 9 months later found that this association was not only cross-sectional but also longitudinal (Ballesio et al., 2022). On the contrary, other studies (Costa et al., 2021; Herrero San Martin et al., 2020) have shown a positive association between sleepiness and poor sleep quality, using the same instruments that we used in the present research.

These results are consistent with the stress response process and the activation of the hypothalamic-pituitary-adrenal axis, which favours wakefulness and hinders sleep due to the release of hormones such as adrenocorticotropin and cortisol (Lo Martire et al., 2020). This association would also be supported by another model, the diathesis-stress model in relation to sleep disorders, whereby the predisposition of each person would cause the appearance of sleep problems when exposed to stressors (Ballesio et al., 2022).

However, none of the previous studies investigated specifically the association between stress, poor sleep quality and sleepiness, at the same time. In fact, there is only a previous study (García-Tudela et al., 2019) from our group and prior to the pandemic investigating this issue in which these three variables were correlated. To the best of our knowledge, the present study is the first in this field after the appearance of COVID-19 and helps to demonstrate that these variables have a direct impact on each other.

## 5.1 | Limitations

There are some limitations in relation to this study. First, this study was performed in a single centre, and it would be interesting to extend the study in other regions of the world including other target populations. Second, all the professional categories from the ER were included and evaluated together. Since it could be a limitation, this methodology allowed us to show data representing the

full staff members of the ER, and not excluding any ER worker in charge of caring/treating patients. Third, the data were collected from self-reported questionnaires, that is mainly assessed with subjective reports. Although it would be desirable to use also objective tests such as polysomnography to assess sleep quality or cortisol levels to assess stress levels, this was not the routine clinical practice, and more importantly, these were not feasible in the context of COVID-19. In addition, our aim was to record how the ER workers really feel independently of the results from an objective measurement, and the questionnaires and tests used are widely validated and used worldwide, to guarantee the reliability of the data.

## 6 | CONCLUSION

In this study including ER professionals from an emergency department, the proportion of workers with a morning chronotype increased during the COVID-19 pandemic. During COVID-19, the overall levels of stress increased significantly, and they were particularly higher in ER professionals with poor sleep quality or with excessive sleepiness in both the pre-COVID-19 and the COVID-19 phases.

## 7 | RELEVANCE TO CLINICAL PRACTICE

Emergency departments should include mental health policies in their strategic plans. Our results should aim to impulse the implementation of measures to improve the working conditions of emergency healthcare professionals.

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This research received no external funding.

### CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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