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Psychological distress among emergency medical services personnel: implications for public health preparedness and system resilience

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Abstract

Introduction Emergency Medical Services (EMS) personnel are integral to disaster and emergency response systems. Recurrent exposure to high-acuity incidents, irregular shifts, and operational pressures may increase vulnerability to psychological distress, with potential implications for workforce sustainability and system resilience. This study assessed the severity distribution and predictors of stress, anxiety, and depression among EMS personnel in the Makkah region of Saudi Arabia.

Methods A cross-sectional survey was conducted between January and April 2024 among certified EMS professionals employed for > 1 year across the Saudi Red Crescent Authority, Ministry of Health, and Ministry of National Guard Health Affairs. Participants (n = 352) completed an electronic questionnaire including sociodemographic and lifestyle variables and the Depression, Anxiety, and Stress Scale-21 (DASS-21). Analyses included descriptive statistics, chi-square tests, Mann–Whitney U tests, and logistic and multivariate linear regression. Statistical significance was set at $p < 0.05$.

Results The proportions classified as extremely severe were 12.2% for stress, 23.0% for anxiety, and 17.6% for depression. In bivariate analyses, history of mental illness was associated with higher stress, anxiety, and depression scores; however, in logistic regression it remained significant only for depression. In multivariate linear models, use of medications for noncommunicable diseases (NCDs) was positively associated with stress, anxiety, and depression, whereas longer sleep duration was inversely associated with all outcomes. Years of professional experience significantly predicted stress levels.

Conclusion EMS personnel in the Makkah region demonstrated a substantial burden of clinically significant psychological distress, particularly for severe anxiety and depression. Sleep duration and NCD medication use

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emerged as consistent correlates across outcomes, indicating potential targets for occupational health strategies. Differences in estimates compared with other Saudi studies should be interpreted cautiously due to variation in populations, instruments, cut-offs, and study periods.

Keywords Emergency medical services, Emergency Medical Technicians, Stress, psychological, Anxiety, Depressive disorder, Occupational health, Public health preparedness, Disaster planning, Resilience

Introduction

Emergency medical services (EMS) personnel constitute the frontline of prehospital emergency care and are routinely exposed to life-threatening situations, traumatic events, and high-stakes clinical decision-making. International research consistently demonstrates elevated levels of psychological distress among paramedics, including symptoms of anxiety, depression, and post-traumatic stress disorder (PTSD) [1–4]. Frequent exposure to trauma, unpredictable emergencies, shift work, sleep disruption, and workplace stressors such as conflict with patients' relatives collectively contribute to chronic psychological strain [5, 6]. A substantial proportion of EMS personnel report insufficient recovery time following distressing incidents, in one study, 69% indicated that they never had adequate time to recover after a critical event [7]. Such cumulative exposure increases the risk of depression, stress-related disorders, suicidal ideation, and other functional impairments [8].

Importantly, the consequences of poor mental health among paramedics extend beyond individual well-being. Depressive and anxiety symptoms are associated with impairments in attention, executive functioning, and decision-making, cognitive domains that are essential during emergency responses [9–11]. Sleep deprivation and fatigue further compromise clinical performance and are linked to increased risk of medical errors [12–14]. In high-acuity prehospital settings, impaired judgment and delayed decision-making may directly affect patient safety, operational effectiveness, and system readiness. Therefore, psychological distress among EMS personnel represents not only an occupational health issue but also a matter of health system performance and resilience.

In Saudi Arabia, several contextual factors may further amplify occupational stress among paramedics. The national EMS workforce is relatively limited in size compared to countries such as Australia, potentially resulting in higher workloads and more frequent or extended shifts per responder [2–4]. A comparative study reported higher rates of depression among Saudi paramedics relative to their Australian counterparts, suggesting that workforce capacity and systemic pressures may influence mental health outcomes [2]. Additionally, regulations, organizational structures, and operational demands differ across countries, which may contribute to variability in reported prevalence rates [2]. Within Saudi Arabia, a survey conducted among Saudi Red Crescent Authority (SRCA) paramedics in the Riyadh region reported stress, anxiety, and depression levels of approximately 30%, 40%, and 26.7%, respectively [9]. However, existing studies remain regionally limited and methodologically heterogeneous, and comprehensive data from other regions, particularly the Makkah region, are scarce.

From a conceptual perspective, the mental health challenges faced by EMS personnel are consistent with established occupational stress frameworks, including the Job Demand–Control–Support (JDCS) model and the Conservation of Resources (COR) theory [14–15]. These models emphasize the role of high job demands, limited recovery opportunities, and resource depletion in the development of psychological strain. Applied to the Saudi EMS context, heavy workloads, unpredictable emergencies, and restricted recovery time may progressively erode psychological resources and increase vulnerability to distress.

Despite growing recognition of these challenges, there remains a lack of comprehensive regional data on the prevalence and determinants of psychological distress among prehospital care providers in Saudi Arabia [9]. In particular, limited attention has been given to the association between mental health outcomes and factors such as years of professional experience and lifestyle-related behaviors. Accordingly, the present study aims to assess the prevalence of stress, anxiety, and depression among EMS personnel in the Makkah region of Saudi Arabia and to examine their associations with selected occupational and lifestyle factors.

Materials and methods

Study design

This study employed a cross-sectional design to estimate the prevalence of stress, anxiety, and depression among EMS personnel in the Makkah region. This approach enables the collection of data from a large and diverse sample, allowing for the comparison of subgroups within the population [16].

Study setting and population

The study was conducted across EMS stations affiliated with the SRCA, Ministry of Health (MOH) hospitals, and the Ministry of National Guard Health Affairs (MNGHA) within the Makkah region. Data collection took place over a three-month period from January to April 2024. A structured electronic questionnaire was distributed

both electronically and through in-person outreach to enhance accessibility and participation.

Participants were selected using convenience sampling. The sampling frame included all certified EMS personnel employed in the Makkah region under SRCA, MOH, and MNGHA. Recruitment was conducted via official institutional mailing lists and direct outreach at EMS stations. A total of 423 individuals responded, 71 were excluded for not meeting eligibility criteria, resulting in a final analytic sample of 352 participants (response rate: 83.2%).

Eligibility criteria required participants to be certified EMS personnel currently working in the Makkah region with at least one year of professional experience. The one-year minimum employment threshold was applied to ensure adequate exposure to the operational and psychological demands of prehospital emergency care. The initial year of service often represents a role-transition period, therefore, restricting inclusion to personnel with ≥ 1 year of experience aimed to enhance the validity of prevalence estimates by focusing on individuals with sustained occupational exposure.

The minimum required sample size was calculated using Cochran's formula for cross-sectional studies, assuming a prevalence of 50% (to maximize sample size), a 95% confidence level, and a 5% margin of error. This yielded a required sample of 384 participants. To account for potential non-response or incomplete surveys, the target sample size was increased by approximately 10% to 423.

Data collection method

Data were collected via an online survey hosted on Google Forms. The SRCA distributed the survey through flyers and email invitations, while the research team further disseminated it via social media platforms and direct outreach. To minimize the risk of duplicate responses, the survey was configured to accept a single response per user account. In addition, responses were screened during the data cleaning phase for potential duplication based on identical demographic patterns and response timestamps. No duplicated entries were identified. While Google Forms does not fully eliminate the possibility of duplicate entries, data screening procedures were implemented to identify and remove potential duplicates.

Table 1 DASS-21 severity classification for depression, anxiety, and stress [17]

Severity Level	Depression	Anxiety	Stress
Normal	0–9	0–7	0–14
Mild	10–13	8–9	15–18
Moderate	14–20	10–14	19–25
Severe	21–27	15–19	26–33
Extremely Severe	≥ 28	≥ 20	≥ 34

Study instrument

The survey instrument consisted of three structured components: demographic characteristics, lifestyle-related variables, and the Depression, Anxiety, and Stress Scale–21 (DASS-21).

The demographic section collected information on age, marital status, city of employment, educational level, years of professional experience, monthly income, and self-reported history of mental illness.

The lifestyle section assessed selected behavioral and health-related factors, including smoking status, average sleep duration, caffeine consumption (coffee, tea, and energy drinks), and the use of medications for noncommunicable diseases (NCDs). For screening purposes, participants were asked to self-report whether they had ever been diagnosed by a physician with common chronic conditions, including hypertension, diabetes mellitus, cardiovascular disease, asthma or other chronic respiratory diseases, and other long-term medical conditions. Responses were recorded as yes/no. Participants were additionally asked whether they were currently taking prescribed medications for any of these conditions. The final section employed the Depression, Anxiety, and Stress Scale–21, originally developed by Lovibond (1995) [17]. The DASS-21 is a shortened version of the 42-item DASS and has demonstrated adequate reliability and convergent and discriminant validity in both clinical and non-clinical populations. Previous studies have reported strong internal consistency for the DASS-21 subscales, with Cronbach's alpha coefficients typically ranging from 0.81 to 0.97 for depression, anxiety, and stress domains [17–19]. These findings support the psychometric robustness of the instrument across diverse cultural contexts. The instrument consists of 21 items divided into three subscales (depression, anxiety, and stress), with seven items per domain. Participants rated each item on a 4-point Likert scale ranging from 0 (did not apply to me at all) to 3 (applied to me very much or most of the time). Subscale scores were summed and multiplied by two to obtain final scores, which were categorized according to established severity thresholds (Table 1).

The DASS-21 was administered in both English and Arabic to enhance comprehension among participants. The Arabic version was reviewed for linguistic clarity prior to distribution.

The demographic and lifestyle components were adapted from a previously published study examining occupational stress and health-related behaviors among healthcare personnel [16]. The original instrument was reviewed and adapted to ensure contextual relevance for EMS personnel in the Makkah region. Modifications were limited to minor wording adjustments, contextual clarification of selected items, harmonization of response formats, and the addition of items related specifically to

caffeine consumption patterns and medication use for noncommunicable diseases. No structural or conceptual domains of the original instrument were altered. Written permission to adapt the instrument for research purposes was obtained from the original authors via email prior to data collection. The full English version of the survey instrument is provided as Supplementary Material (File SM1_Questionnaire).

Data analysis

Responses were exported from Google Forms to Microsoft Excel for cleaning and coding and subsequently analyzed using IBM SPSS Statistics, version 29 (IBM Corp., Armonk, NY, USA). Descriptive statistics (frequencies and percentages) were used to summarize categorical variables, while means with standard deviations summarized continuous variables. Only complete responses from eligible participants were included in the analyses. Bivariate analysis included chi-square tests to assess associations between categorical variables and mental health outcomes. The Mann–Whitney U test was used to compare continuous, non-normally distributed outcomes between two groups.

Predictor variables for the regression models were selected based on a combination of theoretical considerations (Job Demand–Control–Support model and Conservation of Resources theory), prior empirical evidence from studies on EMS mental health, and exploratory evaluation of variables collected in this study. Potential confounders identified from previous research, including age, marital status, and years of professional experience, were included as covariates in multivariable models to adjust for their influence on the associations of interest.

For multivariate analysis, logistic regression was used to model binary outcomes, and linear regression was used for continuous outcomes. For logistic regression analyses, DASS-21 outcomes were dichotomized as normal (coded 0) versus any level of symptoms (mild to extremely severe; coded 1). History of mental illness was coded as 0 (no) and 1 (yes). Sleep duration was analyzed descriptively using categorical bands (< 6, 6–8, and > 8 h) and was entered into regression models using the underlying continuous measure (hours per night). Categorical predictors were entered using indicator coding with appropriate reference categories. Model assumptions, including linearity, independence of errors, homoscedasticity, and absence of multicollinearity, were tested and met before interpreting results. Statistical significance was set at $p < 0.05$. Multicollinearity diagnostics were performed prior to model estimation.

Selection bias was addressed by inviting EMS personnel across multiple institutions (SRCA, MOH, MNGHA) within the region. Information bias was minimized through the use of a standardized and previously validated instrument (DASS-21) and uniform data collection procedures.

Ethical approval

This study was reviewed and approved on August 27, 2023, by the institutional review board (IRB) of King Abdullah International Medical Research Center (KAIMRC) in Jeddah, Saudi Arabia (Ref. No. SP23J/129/08). The study was also approved by the Research Ethics Committee of SRCA, and Ministry of Health. All methods were carried out in accordance with relevant guidelines and regulations, including the Declaration of Helsinki and local ethical requirements.

Results

Sample characteristics

A total of 352 EMS personnel participated in the study, representing diverse sociodemographic, employment, and lifestyle profiles (Table 2). Slightly over half of the respondents (51.4%) resided in Makkah, followed by Jeddah (37.8%), Taif (9.4%), and Alqunfudhah (1.4%). The most common age group was 24–29 years (37.5%), and the majority were employed at the Saudi Red Crescent Authority (45.2%). More than half of the participants were married (55.1%) and held a bachelor's degree in EMS (59.9%). Most respondents reported between 1 and 4 years of professional experience (40.1%) and a monthly income between 8,000 and 12,000 SAR (37.5%). The majority (87.2%) reported no history of diagnosed mental illness.

Regarding lifestyle characteristics, 41.5% were nonsmokers, 37.8% were current smokers, and 17.6% were former smokers. Most participants (81.0%) reported no use of medications for noncommunicable diseases, while 6.3% were taking prescription medications. Coffee was the predominant source of caffeine intake (76.1%). In terms of sleep duration, 59.9% reported sleeping 6–8 h per night, whereas 27.6% reported sleeping fewer than 6 h.

Prevalence of stress, anxiety, and depression

Table 3 presents the distribution of severity levels for stress, anxiety, and depression among EMS personnel. Half of the respondents (50.0%) reported stress levels within the normal range, whereas 40.3% exhibited moderate to extremely severe stress, including 12.2% classified as extremely severe.

For anxiety, 46.9% fell within the normal range, while 48.3% demonstrated moderate to extremely severe symptoms, including 23.0% in the extremely severe category.

Regarding depression, 42.0% of participants reported normal levels, whereas 46.0% experienced moderate to extremely severe symptoms, including 17.6% classified as extremely severe.

Table 2 Sociodemographic, employment, and lifestyle characteristics of EMS personnel in the Makkah region ($n = 352$)

Variables	*n* (%)
City of Residence	
Jeddah	133 (37.8)
Makkah	181 (51.4)
Taif	33 (9.4)
Alqunfudhah	5 (1.4)
Age	
18–23	12 (3.4)
24–29	132 (37.5)
30–35	121 (34.4)
36–40	60 (17.0)
41–45	20 (5.7)
> 45	7 (2.0)
Place of Employment	
Ministry of Health	87 (24.7)
Saudi Red Crescent Authority	159 (45.2)
MNGHA	13 (3.7)
Private sector	75 (21.3)
Other	18 (5.1)
Marital Status	
Single	152 (43.2)
Married	194 (55.1)
Divorced	6 (1.7)
Widowed	0 (0.0)
Education	
Emergency Medical Technician	120 (34.1)
Emergency Medical Services (Bachelor's)	211 (59.9)
EMS with master's degree	20 (5.7)
EMS with PhD	1 (0.3)
Years of Experience	
1–4	141 (40.1)
5–9	103 (29.3)
10–14	62 (17.6)
15–19	33 (9.4)
≥ 20	13 (3.7)
Monthly Income (SAR)	
< 8,000	54 (15.3)
8,000–12,000	132 (37.5)
13,000–17,000	117 (33.2)
> 17,000	49 (13.9)
History of Mental Illness	
Yes	45 (12.8)
No	307 (87.2)
Smoking Status	
Nonsmoker	146 (41.5)
Smoker	133 (37.8)
Ex-smoker	62 (17.6)
Unknown	11 (3.1)
Medications for NCDs	
No NCDs	285 (81.0)
Yes, nonprescription medication	15 (4.3)
Yes, prescription medication	22 (6.3)
Unknown	30 (8.5)
Caffeine Intake	

Table 2 (continued)

Variables	*n* (%)
Coffee	268 (76.1)
Tea	56 (15.9)
Other stimulant beverages	1 (0.3)
None	27 (7.7)
Hours of Sleep	
< 6	97 (27.6)
6–8	211 (59.9)
> 8	44 (12.5)

Note: SAR = Saudi Arabian Riyal; MNGHA = Ministry of National Guard Health Affairs; EMS = Emergency Medical Services; NCDs = Noncommunicable Diseases

Table 3 Severity distribution of stress, anxiety, and depression among EMS personnel

	Stress *n* (%)	Anxiety *n* (%)	Depression *n* (%)
Normal	176 (50.0%)	165 (46.9%)	148 (42.0%)
Mild	34 (9.7%)	17 (4.8%)	42 (11.9%)
Moderate	54 (15.3%)	57 (16.2%)	67 (19.0%)
Severe	45 (12.8%)	32 (9.1%)	33 (9.4%)
Extremely severe	43 (12.2%)	81 (23.0%)	62 (17.6%)

Overall, these findings suggest a considerable burden of clinically significant psychological distress within this EMS workforce.

Differences based on mental illness history

A Mann-Whitney U test showed that participants with a history of mental illness scored significantly higher on stress, anxiety, and depression than those without such a history (Table 4, all $p < 0.001$).

Participants with a history of mental illness reported significantly higher mean scores for stress, anxiety, and depression compared with those without such a history (all $p < 0.001$). In addition, the severity distribution indicated that individuals with a history of mental illness were more likely to present with severe or extremely severe symptoms across all three mental health domains.

Bivariate associations

Chi-square analyses identified several significant associations (Table 5). Stress was significantly associated with years of experience ($p = 0.027$), medication use for NCDs ($p < 0.001$), smoking status ($p = 0.011$), and sleep duration ($p < 0.001$). Anxiety was significantly associated with medication use ($p = 0.003$), sleep duration ($p < 0.001$), and energy drink consumption ($p = 0.041$). Depression showed significant links with medication use ($p = 0.006$) and sleep duration ($p = 0.006$). All variables examined, including those without statistically significant associations, are presented in Table 5 to provide a complete overview of the bivariate analyses.

Multivariable regression analyses

Multivariable regression analyses were performed to examine predictors of psychological outcomes among EMS personnel. Logistic regression was used to assess whether a history of mental illness predicted dichotomized stress, anxiety, and depression outcomes. History of mental illness was significantly associated with depression ($p = 0.034$), but not with stress or anxiety.

Additionally, multivariate linear regression models were conducted to identify predictors of continuous stress, anxiety, and depression scores. Greater years of experience were significantly associated with higher stress scores (B = 0.883, 95% CI: 0.17–1.59, $p = 0.015$). The use of medications for noncommunicable diseases was positively associated with stress (B = 1.733, 95% CI: 0.45–3.02, $p = 0.008$), anxiety (B = 1.687, 95% CI: 0.45–2.92, $p = 0.008$), and depression (B = 1.723, 95% CI: 0.42–3.03, $p = 0.015$).

Longer sleep duration was significantly associated with lower scores across all three domains: stress (B = – 4.516,

Table 4 Differences in stress, anxiety, and depression by history of mental illness among ems personnel including severity distribution (Mann–Whitney U Test, $n = 352$)

Variable	History of Mental Illness	Normal *n* (%)	Mild *n* (%)	Moderate *n* (%)	Severe *n* (%)	Extremely Severe *n* (%)	Mean ± SD	*P*-value
Stress	Yes	10 (15.6)	8 (12.5)	14 (21.9)	15 (23.4)	17 (26.6)	25.11 ± 11.99	< 0.001**
	No	110 (41.8)	48 (18.2)	54 (20.5)	27 (10.3)	24 (9.1)	15.58 ± 11.33	
Anxiety	Yes	12 (18.8)	7 (10.9)	13 (20.3)	14 (21.9)	18 (28.1)	18.84 ± 12.74	< 0.001**
	No	140 (53.2)	42 (16.0)	39 (14.8)	26 (9.9)	16 (6.1)	10.76 ± 10.80	
Depression	Yes	9 (14.1)	8 (12.5)	13 (20.3)	17 (26.6)	17 (26.6)	23.60 ± 11.61	< 0.001**
	No	128 (48.6)	45 (17.1)	44 (16.7)	27 (10.3)	19 (7.2)	12.89 ± 11.43	

Note: Severity levels are based on DASS-21 cut-off scores. Percentages represent the proportion within each subgroup. P-value is highly significant (< 0.001)

Table 5 Associations between lifestyle and demographic factors with stress, anxiety, and depression among EMS personnel (Chi-square test, $n = 352$)

Variable	Category	No *n* (%)	Yes *n* (%)	*P*-value
Stress				
Years of experience	1–4 years	83 (58.9)	58 (41.1)	0.027*
	5–9 years	45 (43.7)	58 (56.3)	
	10–14 years	23 (37.1)	39 (62.9)	
	15–19 years	17 (51.5)	16 (48.5)	
	≥ 20 years	8 (61.5)	5 (38.5)	
Medications for NCDs	No, NCDs	157 (55.1)	128 (44.9)	< 0.001*
	Yes, nonprescription medication	3 (20.0)	12 (80.0)	
	Yes, prescription medication	5 (22.7)	17 (77.3)	
	Unknown	11 (36.7)	19 (63.3)	
Smoking status	Non-smoker	88 (60.3)	58 (39.7)	0.011*
	Smoker	55 (41.4)	78 (58.6)	
	Ex-smoker	29 (46.8)	33 (53.2)	
	Unknown	4 (36.4)	7 (63.6)	
Hours of sleep	< 6 h	31 (32.0)	66 (68.0)	< 0.001*
	6–8 h	118 (55.9)	93 (44.1)	
	> 8 h	27 (61.4)	17 (38.6)	
Anxiety				
Medications for NCDs	No, NCDs	145 (50.9)	140 (49.1)	0.003*
	Yes, nonprescription medication	3 (20.0)	12 (80.0)	
	Yes, prescription medication	4 (18.2)	18 (81.8)	
	Unknown	13 (43.3)	17 (56.7)	
Hours of sleep	< 6 h	27 (27.8)	70 (72.2)	< 0.001*
	6–8 h	115 (54.5)	96 (45.5)	
	> 8 h	23 (52.3)	21 (47.7)	
Energy drinks	No	147 (49.2)	152 (50.8)	0.041*
	Yes	18 (34.0)	35 (66.0)	
Depression				
Medications for NCDs	No, NCDs	131 (46.0)	154 (54.0)	0.006*
	Yes, nonprescription medication	3 (20.0)	12 (80.0)	
	Yes, prescription medication	3 (13.6)	19 (86.4)	
	Unknown	11 (36.7)	19 (63.3)	
Hours of sleep	< 6 h	28 (28.9)	69 (71.1)	0.006*
	6–8 h	97 (46.0)	114 (54.0)	
	> 8 h	23 (52.3)	21 (47.7)	

Note: NCDs – Noncommunicable Diseases. *$p < 0.05$

95% CI: −6.52 to − 2.51, $p < 0.001$), anxiety (B = − 3.179, 95% CI: −5.08 to − 1.28, $p = 0.001$), and depression (B = − 3.572, 95% CI: −5.57 to − 1.57, $p < 0.001$). Smoking status was not significantly associated with stress ($p = 0.137$), and energy drink intake was not significantly associated with anxiety ($p = 0.689$). All regression results are presented in Table 6.

Discussion

This study aimed to estimate the prevalence of mental health symptoms, specifically stress, anxiety, and depression, among EMS personnel in the Makkah region and to explore associations between years of experience, lifestyle habits, and psychological distress. The study included 352 participants and revealed several important findings. Half of the sample reported stress levels within the normal range, while the remainder demonstrated varying degrees of stress severity. Anxiety and depression followed similar patterns, with substantial proportions of the sample experiencing moderate to extremely severe symptoms.

Significant associations were identified between stress and years of experience, use of medications for noncommunicable diseases, smoking status, and hours of sleep. Anxiety was significantly associated with medication use for noncommunicable diseases, sleep duration, and energy drink consumption, whereas depression was significantly associated with medication use and sleep duration.

Table 6 Multivariable regression models for psychological outcomes among EMS personnel ($n = 352$)

Outcome	Model Type	Predictor	Estimate	SE	*p*-value
Stress	Logistic	History of Mental Illness	−0.016	0.033	0.640
Anxiety	Logistic	History of Mental Illness	0.005	0.034	0.809
Depression	Logistic	History of Mental Illness	−0.060	0.023	0.034*
Stress	Linear	Years of Professional Experience	0.883 (0.17–1.59)	—	0.015*
Stress	Linear	Medications for NCDs	1.733 (0.45–3.02)	—	0.008*
Anxiety	Linear	Medications for NCDs	1.687 (0.45–2.92)	—	0.008*
Depression	Linear	Medications for NCDs	1.723 (0.42–3.03)	—	0.015*
Stress	Linear	Hours of Sleep (hours/night)	−4.516 (−6.52 to −2.51)	—	< 0.001*
Anxiety	Linear	Hours of Sleep (hours/night)	−3.179 (−5.08 to −1.28)	—	0.001*
Depression	Linear	Hours of Sleep (hours/night)	−3.572 (−5.57 to −1.57)	—	< 0.001*
Stress	Linear	Smoking Status	1.101 (−0.36–2.56)	—	0.137
Anxiety	Linear	Energy Drink Intake	−0.219 (−1.29–0.85)	—	0.689

Note: Logistic regression results are presented as unstandardized coefficients (B) with standard errors (SE). Linear regression results are presented as unstandardized coefficients (B) with 95% confidence intervals. DASS-21 outcomes in logistic models were dichotomized as normal versus any symptoms (mild to extremely severe). Categorical predictors were entered using indicator coding with appropriate reference categories. NCDs = noncommunicable diseases. *$p < 0.05$

The data reveal a concerning mental health landscape, with a significant portion of the sample experiencing elevated levels of stress, anxiety, and depression. While the majority fell within the normal range for each condition, a substantial percentage reported clinically relevant symptoms. For stress, 50.0% reported normal levels, but 12.2% reported extremely severe stress. Similarly, for anxiety, 46.9% were within the normal range, yet 23.0% had extremely severe anxiety, and for depression, 42.0% were normal, whereas 17.6% reported extremely severe depression.

In comparison with Almutairi et al. [20], which reported normal ranges of 69.5%, 60%, and 73.3% for stress, anxiety, and depression respectively, and extremely severe cases of 0%, 1.3%, and 0%, the present findings demonstrate markedly lower proportions within the normal range and substantially higher proportions of extremely severe symptoms. These discrepancies may reflect differences in study populations (EMS-specific versus broader healthcare samples), timing of data collection, sampling strategies, regional operational pressures, workforce shortages, and variability in institutional mental health support systems. Such methodological and contextual differences should be considered when interpreting cross-study comparisons.

In the context of stress, years of experience, medications for noncommunicable diseases, and sleep duration were key determinants. EMS staff with more years of experience reported higher stress levels potentially reflecting cumulative occupational exposure to high-pressure environments. Medication use for noncommunicable diseases was also significantly associated with increased stress suggesting a comorbidity burden. Conversely, each additional hour of sleep was associated with a 4.52-point reduction in stress scores, underscoring the protective role of restorative sleep.

A similar pattern emerged for anxiety. Medication use for noncommunicable diseases was associated with higher anxiety scores, while longer sleep duration predicted lower anxiety levels. The consistent association between insufficient sleep and poorer mental health across all three domains underscores a potentially modifiable occupational risk factor. Energy drink intake did not significantly predict anxiety, which contrasts with prior studies suggesting links between caffeine intake and anxiety symptoms. This discrepancy may relate to contextual or consumption-pattern differences.

For depression, significant predictors included medication use for noncommunicable diseases, sleep duration, and history of mental illness. EMS personnel on medications for chronic conditions reported higher depression scores. Each additional hour of sleep was associated with a 3.57-point reduction in depression scores. A history of mental illness was also associated with higher depression levels, highlighting the sustained vulnerability of individuals with prior psychiatric conditions.

From a theoretical perspective, these findings can be interpreted through established occupational stress frameworks. According to the JDCS model, insufficient sleep reflects limited recovery in the presence of sustained job demands, thereby amplifying psychological strain [21]. Similarly, the COR theory posits that chronic illness represents depletion of physical and psychological resources, increasing vulnerability to stress [15]. The association between longer professional experience and higher stress may also reflect cumulative exposure to demands without proportional recovery or control.

Beyond individual predictors, the Saudi context introduces structural and cultural dimensions that refine understanding of EMS mental health. Unlike many high-income countries where structured psychosocial support and employee assistance programs are embedded within EMS systems, Saudi Arabia has limited formalized

pathways for occupational mental health care [22–24]. Cultural reliance on family and religious coping strategies, while protective in some respects, may also reduce professional help-seeking due to stigma [25, 26]. Workforce shortages may further intensify demands and restrict recovery opportunities. These contextual factors likely contribute to the elevated prevalence observed in this sample and extend international occupational stress models beyond Western contexts.

Moreover, the high prevalence of extremely severe anxiety and depression should be viewed not only as an occupational health issue but as a potential systems-level vulnerability. Psychological distress among frontline responders may compromise decision-making, increase burnout, and reduce workforce retention, ultimately affecting emergency system resilience and care quality [27, 28]. From a health security perspective, maintaining the psychological well-being of EMS personnel is essential for effective responses to routine emergencies, mass casualty incidents, and public health crises [29–32].

Policy implications and future research

The findings underscore the need for structured, system-level interventions to strengthen psychological resilience among EMS personnel. International evidence suggests that peer-support programs, structured debriefing models, and confidential access to psychological counseling can improve mental health outcomes in emergency services settings [33–35]. The consistent protective effect of adequate sleep observed across all models further supports implementation of fatigue risk management systems, optimized shift scheduling, and mandatory recovery periods.

Given the strong association between medication use for noncommunicable diseases and psychological distress, integrated occupational health strategies addressing both chronic disease management and mental health support may be particularly beneficial. EMS agencies should consider routine mental health screening, early intervention pathways, and tailored support for personnel with prior psychiatric histories [36–39].

Emerging technologies may also offer innovative avenues for strengthening psychological preparedness and resilience in high-demand emergency settings. Immersive simulation and virtual reality (VR)–based training platforms allow EMS personnel to engage in high-fidelity, stress-exposure scenarios within controlled and psychologically safer environments. Recent evidence suggests that VR-supported disaster preparedness exercises can enhance engagement, situational awareness, and perceived readiness among healthcare trainees [40]. Beyond technical skill acquisition, such approaches may contribute to stress inoculation, adaptive coping development, and team coordination under pressure. Future intervention studies should examine whether technology-enhanced training models can reduce psychological distress and improve long-term occupational resilience among EMS providers in Saudi Arabia.

Future research should employ longitudinal designs to clarify temporal relationships and evaluate the effectiveness of organizational interventions. Qualitative studies examining cultural perceptions of mental health care among Saudi EMS personnel may provide valuable insights for context-sensitive policy development.

Limitations

This study was conducted exclusively within the Makkah region, which may limit the generalizability of the findings to other regions in Saudi Arabia and to settings with different geographic, organizational, cultural, or demographic characteristics. In addition, EMS work environments and operational workloads may differ substantially between regions and institutions, which could influence both lifestyle behaviors and mental health outcomes.

Second, the study relied on a voluntary, self-administered online questionnaire and convenience sampling, which introduces the risk of selection bias. Although EMS personnel across SRCA, MOH, and MNGHA were invited, respondents may differ systematically from non-respondents. Individuals experiencing higher distress could have been more motivated to participate, potentially inflating prevalence estimates, while those with severe symptoms might have avoided participation due to stigma, potentially leading to underestimation. The online format further limits control over participation conditions and may influence response patterns.

Third, all measures were self-reported, which increases vulnerability to reporting bias, recall bias, and social desirability effects. This is particularly relevant in contexts where mental health stigma may affect disclosure. Similarly, the assessment of noncommunicable diseases and medication use was based on self-report screening items rather than clinical verification, which may have introduced misclassification.

Fourth, while the DASS-21 is a widely used instrument with established psychometric robustness, the survey included both English and Arabic versions to enhance comprehension, and the Arabic wording was reviewed for clarity prior to dissemination. However, formal psychometric validation within the present sample (e.g., internal consistency estimates) was not performed, and measurement equivalence across language versions cannot be fully assured.

Finally, the cross-sectional design precludes causal inference and does not allow determination of temporal relationships between predictors and psychological outcomes. Although key covariates were included in multivariable models, residual confounding from unmeasured

factors, such as workload intensity, exposure to critical incidents, organizational climate, and access to mental health resources, may have influenced the observed associations.

Conclusions

This study demonstrates a substantial burden of psychological distress among EMS personnel in the Makkah region, with particularly high levels of extremely severe anxiety and depression. A considerable proportion of the sample reported clinically significant symptoms, highlighting an urgent occupational health concern within this workforce.

Multivariate analysis identified sleep duration and the use of medications for noncommunicable diseases as consistent predictors of stress, anxiety, and depression, while longer work experience and prior mental illness were additionally associated with increased psychological vulnerability. These findings indicate that both physical health comorbidities and modifiable lifestyle factors contribute to mental health outcomes among EMS personnel.

Targeted organizational strategies addressing sleep recovery, chronic disease support, and routine mental health screening should be prioritized to strengthen workforce resilience and safeguard the sustainability of prehospital care services.

Abbreviations

EMS	Emergency Medical Services
NCDs	Noncommunicable Diseases
DASS-21	Depression, Anxiety, and Stress Scale-21
SRCA	Saudi Red Crescent Authority
MOH	Ministry of Health
MNGHA	Ministry of National Guard Health Affairs
KAIMRC	King Abdullah International Medical Research Center
HMI	History of Mental Illness
YE	Years of Experience
MND	Medications for Noncommunicable Diseases
SS	Smoking Status
HR	Hours of Sleep
EDI	Energy Drink Intake
SAR	Saudi Arabian Riyal

Supplementary Information

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Supplementary Material 1

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Author contributions

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Data availability

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

Declarations

Institutional review board statement

This study was reviewed and approved on August 27, 2023, by the Institutional Review Board (IRB) of King Abdullah International Medical Research Center (KAIMRC) in Jeddah, Saudi Arabia (Ref. No. SP23J/129/08). The study was also approved by the Research Ethics Committee of the Saudi Red Crescent Authority (SRCA) and the Ministry of Health.

Informed consent

Informed consent was obtained from all subjects involved in the study. Participation was voluntary, anonymous, and based on completion of a consent-approved survey instrument. Completing the questionnaire was interpreted as provision of informed consent, as approved by the IRB.

Competing interests

The authors declare no conflicts of interest. K.G. serves as a Guest Editor for the International Journal of Environmental Research and Public Health, however, this role had no influence on the review process or the content of this manuscript.

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