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Occupational ergonomic risks among ambulance personnel: insights from REBA-based assessment

Emine Gülsoy Altintaş [a] and Ülken Tunga Babaoğlu [a,b]

[a]Departmentof Occupational Health and Safety, Kırşehir Ahi Evran University, Turkey; [b]Department of Public Health, Kırşehir Ahi Evran University, Turkey

ABSTRACT

Objectives. This study aimed to determine the prevalence of musculoskeletal disorders (MSDs) among ambulance workers and evaluate their ergonomic risk using the rapid entire body assessment (REBA) method. *Methods*. The cross-sectional study involved 246 ambulance personnel working in the ambulance service. Data were collected through a structured survey. Additionally, a subset of 30 participants underwent ergonomic risk assessment using the REBA method, focusing on five common tasks. χ^2 and correlation analyses were performed to examine associations between variables. *Results.* MSD prevalence was 59.76%, with the lower back (60.2%), neck (45.1%) and shoulders (45.1%) being most affected. Significant associations were found between MSD presence and age ($p < 0.001$), height ($p = 0.004$), weight ($p = 0.023$) and years of experience ($p < 0.001$). The highest REBA risk score was for stretcher lifting (8.62), while vascular access had the lowest (2.52). Heavy lifting, multi-tasking and psychological stress were significant risk factors for MSDs (respectively $p = 0.008, p = 0.018, p = 0.016$). *Conclusions*. Ambulance personnel are exposed to high risk of MSDs as a result of the physically demanding nature of their work. Implementation of comprehensive ergonomic training programs, effective workload management strategies and use of assistive lifting devices may significantly reduce the risk of MSDs and enhance overall well-being and performance of paramedics.

KEYWORDS

workplace ergonomics; postural risk factors; pre-hospital care; work-related injuries; occupational health

1. Introduction

Ambulance personnel play an important role in healthcare as first responders. They are responsible for providing and coordinating out-of-hospital or pre-hospital emergency medical care and providing assistance as quickly as possible when needed [1]. Within unpredictable and uncontrolled work environments, ambulance personnel are subjected to various physical stressors, including patient handling, on-site transportation, occupational violence and whole-body vibration [2–4]. Other reported hazards include exposure to blood-borne pathogens, burnout, being overwhelmed, multi-tasking and time pressure [3,5,6]. Ambulance personnel are exposed to various hazards, including both physical and socio-psychological risk factors. Work-related musculoskeletal disorders (WMSDs), non-fatal musculoskeletal injuries, workers' compensation claims and lost workdays are highly prevalent. Ambulance personnel have a higher rate of workers' compensation claims compared to other healthcare professionals [7]. A healthy musculoskeletal system is very important for better task fulfillment among employees in this group and to prevent loss of work [8].

WMSDs are among the main risk factors in the development of certain diseases such as osteoarthritis, osteoporosis and sarcopenia, as well as conditions affecting multiple areas or systems of the body, such as regional pain syndromes and inflammatory diseases [9]. Many factors such as personal, physical, biomechanical and psychosocial factors play a role in the development of musculoskeletal disorders (MSDs) [10]. MSDs are the major causes of disability and cause individual suffering and financial burdens to the individual, families, industry or employer, healthcare system and society at large [11]. When MSDs arise as a direct consequence of work conditions or job-related tasks, they are classified as WMSDs. According to statistics from the European Agency for Safety and Health at Work, WMSDs were the most prevalent type of work-related health problem across the European Union in 2020 [12]. Today, these disorders are among the most significant health problems affecting the workforce and constitute one of the most important causes of disability and absenteeism among employees [13].

In the detection of MSD problems, questionnaire forms alone are insufficient [14]. Therefore, observation-based measurement tools, such as rapid entire body assessment (REBA), which is an ergonomic risk assessment method, can also be used. REBA is an easy method for occupational postural risk assessment [15,16]. REBA quantitatively evaluates the risk to which the worker is exposed during job activities and determines the priority intervention level. The REBA method is applied to identify postural disorders of the entire body in relation to muscle movements, external loads applied to the body and the type of grip [15,16]. An international standard is referenced for occupational risk assessment, and according to the International Ergonomics Association (IEA) and the World Health Organization (WHO), the REBA method is among the selected tools for preventing WMSDs [17].

The REBA method has been identified as a suitable tool for ergonomic risk evaluation in studies involving ambulance personnel [18]. In a study conducted by Davison et al. [19] in Portugal, 292 different postures of 20 emergency medical technicians (EMTs) were analyzed using the REBA method. The results indicated that 47% of the assessed postures were associated

CONTACT Ülken Tunga Babaoğlu utbabaoglu@ahievran.edu.tr

with a moderate level of ergonomic risk, while 29% posed a high risk [19]. Similarly, a study from Jordan reported a high prevalence of musculoskeletal complaints among EMTs. The occurrence of WMSDs in at least one body region was significantly associated with factors such as age, years of experience, male gender, elevated body mass index (BMI) and lower levels of education [20]. The prevalence of MSDs in occupational groups working under high physical loads, such as ambulance personnel, is more clearly revealed through such objective ergonomic assessment tools [19].

Ambulance personnel who work in diverse settings are at risk for MSDs. It is necessary to evaluate the professional movements they frequently perform during patient interventions from an ergonomic perspective. This study aims to examine the relationship between the socio-demographic characteristics, professional knowledge and the presence of MSDs among healthcare workers serving in ambulance health services, and to identify work movements that cause MSDs using the REBA scale.

2. Materials and methods

2.1. Study design

The design of the study consists of two stages. In the first stage, the relationship between the socio-demographic characteristics, occupational information and the presence of MSDs of health workers employed in the ambulance service was analyzed. In the second stage, REBA scales were used to identify workstations as the source of MSDs. In order to achieve these aims, the study was of a mixed-methods design (Figure 1).

2.2. Population and sample selection

The number of emergency aid stations in Turkey is 3290. According to 2022 data from the Ministry of Health, the average number of ambulance service was 2.071, and the average number of applications to emergency health services in 2023 was 25.921 people [21]. The population of the study consists of the personnel working in the national ambulance services of a city in the Central Anatolia region. In the province where the study was conducted, there are a total of 19 emergency health service stations within national ambulance services. Doctors, EMTs, health officers and midwives/nurses work at the stations. It was planned to include the entire team intervening with the patients, in the study ($N = 300$). Those who were on leave during the study did not want to participate, and those who had just started working in the last year were not included in the study. A total of 246 (82.0%) people were included in the study.

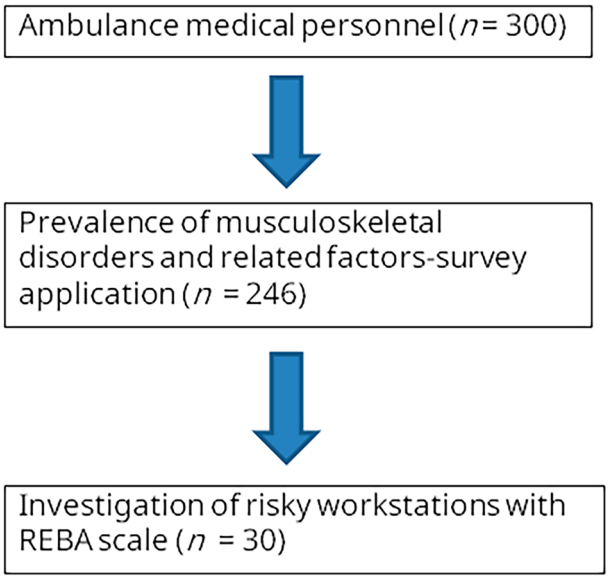

Figure 1. Study design.
Note: REBA = rapid entire body assessment.

2.3. Data collection tool

In the first phase of the study, a questionnaire developed from the literature review was administered [9,11,20]. The questionnaire consists of three sections: socio-demographic information, professional information and musculoskeletal system-related issues. After explaining the purpose and method of the study to the participants, their consent was obtained. Filling out the questionnaire took an average of 10 min. In the first phase of the study, 246 (82.0%) individuals were reached.

In the second phase of the study, the REBA scale was used. A sample was taken for the REBA calculation. In the power analysis, 30 people were calculated at an 80% power level, with an α value of 0.05 and a $1 - \beta$ value of 0.2 [22,23]. Thirty healthcare workers were randomly selected from the individuals who participated in the survey. The researchers identified the five most frequently performed work postures during the job (Figure 2). These frequently performed work postures were selected not only based on their repetition during routine tasks, but also to evaluate the potential emergence of awkward body positions that may pose ergonomic risks. While the identified work postures were being performed, posture photographs of the 30 individuals included in the study were taken. REBA scores were calculated from the photographs. For each REBA calculation, the MSD risk was assessed using the REBA assessment worksheet (Figure 3) [24].

The REBA method was developed by Hignett and McAtamney in 2000 [15] to analyze postural positions. It is designed to identify unpredictable working postures in many sectors. A score between 1 and 15 is determined based on the bending, stretching and load exposure of the torso, neck, lower leg, upper leg, wrist and ankle during working postures. The calculated REBA score determines the risk level for postures related to the specified body part. These risk levels are classified as negligible, low, medium, high and very high [15].

2.4. Ethical permissions

This study has been approved by the Non-Interventional Research Ethics Committee of Kırşehir Ahi Evran University (Decision no.: 2023-12/82; date: June 20, 2023) and the necessary permissions were obtained from the Kırşehir Provincial Health Directorate.

2.5. Statistical analysis

In the analysis of the data, descriptive statistics such as the count (n), percentage, median and quartiles (Q_1–Q_3) were used. For the normality tests of continuous variables, the Kolmogorov–Smirnov and Shapiro–Wilk test p value, histograms and probability plots were considered ($p < 0.001$). The results indicated a statistically significant deviation from normal distribution. Therefore, non-parametric tests (Kruskal–Wallis test and Mann–Whitney U test) were appropriately used for further analysis. The Pearson χ^2 test was used when appropriate

Figure 2. Most common work postures.

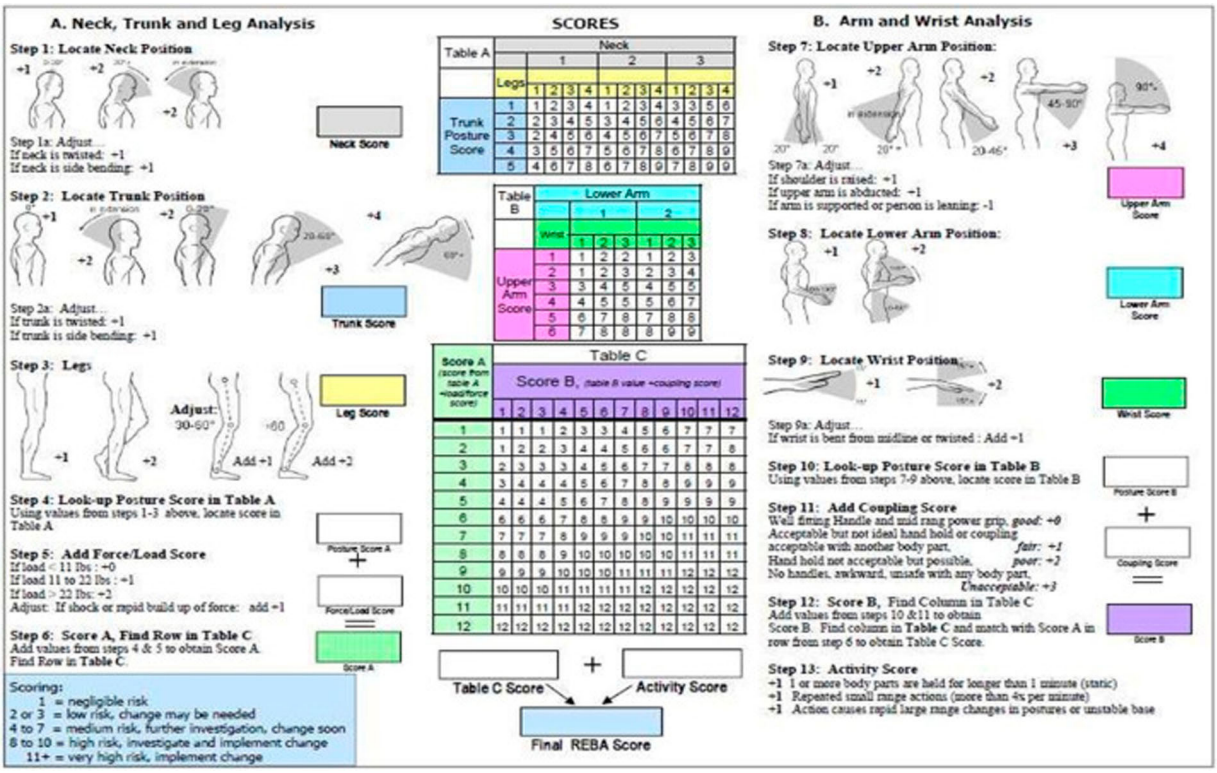

Figure 3. Rapid entire body assessment (REBA) worksheet [24].

for categorical variables. In the χ^2 analysis, adjusted residuals were calculated to identify categories showing significant differences at the cell level. Standardized residuals greater than ± 1.96 or less than ± 1.96 were considered a significant difference at the $p < 0.05$ level. In intergroup comparisons, the Kruskal–Wallis test or the Mann–Whitney *U* test was conducted based on the number of groups being compared. Statistically, $p < 0.05$ was considered significant. SPSS version 26.0 was used for the analyses.

3. Results

Of the ambulance personnel who participated in the study, 54.50% ($n = 134$) were women, with a median age of 30.50 years ($Q_1 = 27.75$–$Q_3 = 39.25$) and a mean BMI of 22.97 ($Q_1 = 21.37$–$Q_3 = 25.97$). According to the BMI classification, 25.20% ($n = 62$) were overweight and 5.30% ($n = 13$) were obese. The average height of the participants was measured as 168.50 cm ($Q_1 = 160.75$–$Q_3 = 177.25$) and the average weight was measured as 69.00 kg ($Q_1 = 60.00$–$Q_3 = 76.50$). In total, 40.20% of the participants ($n = 99$) reported engaging in regular physical exercise. When examining their educational backgrounds, 58.90% ($n = 145$) had a bachelor's degree or higher. Of the participants, 42.70% ($n = 105$) were paramedics, 45.90% ($n = 113$) were EMTs and 11.40% ($n = 28$) were from other professional groups. In total, 95.90% ($n = 236$) of the participants in the study were working shifts. When the duration of work in the current unit was examined, it was found that 48.8% ($n = 120$) of the participants had been working for 0–5 years. It was determined that the total working duration of the participants averaged 11.00 years ($Q_1 = 7.00$–$Q_3 = 16.00$).

Of the participants, 21.54% ($n = 53$) reported that they had at least one chronic illness, and 59.76% ($n = 147$) had MSDs

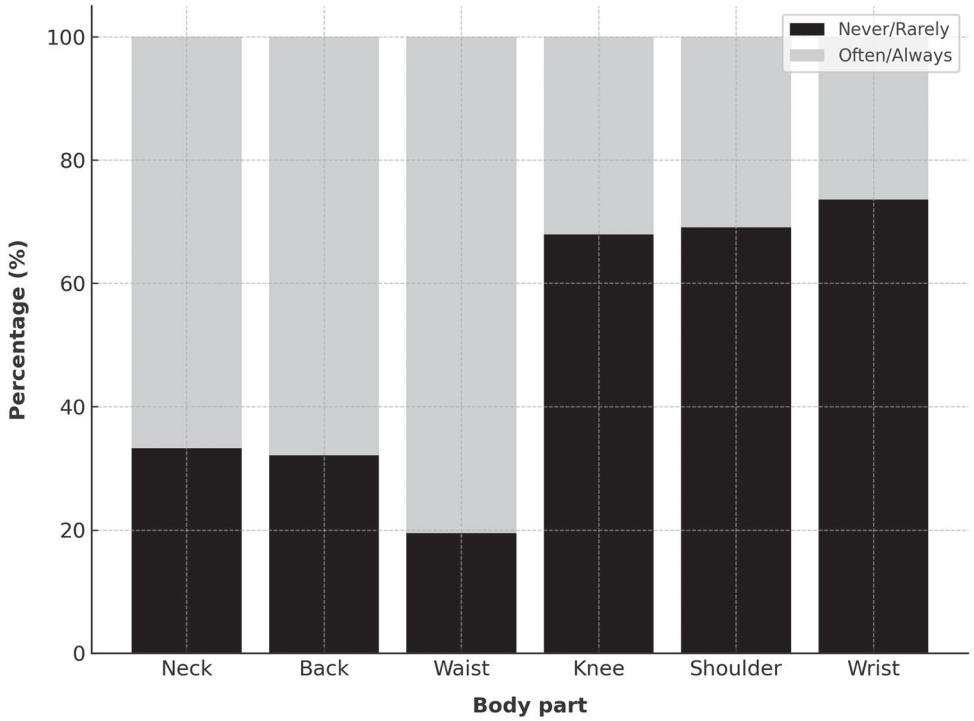

Figure 4. Presence of musculoskeletal disorders (MSDs) among participants.

related to occupational exposure. A total of 97.15% of the participants ($n = 239$) reported lifting heavy objects during work, 96.34% ($n = 237$) reported that their jobs were physically demanding, 79.27% ($n = 195$) reported standing for long periods, 95.53% ($n = 235$) reported having to perform several tasks simultaneously and 98.37% ($n = 242$) reported repeating the same movement multiple times. When the participants were asked about MSDs, 60.2% ($n = 148$) reported that their lower back and 45.10% ($n = 111$) reported that their neck and back always hurt (Figure 4). Based on these data, the ergonomic load experienced by ambulance personnel is understood.

The socio-demographic characteristics of the ambulance services personnel who participated in the study were compared with the presence of MSDs in the past year. The median age of those who reported MSDs was 36.00 years ($Q_1 = 30.00$–$Q_3 = 40.00$), which was higher than the age 28.00 years ($Q_1 = 25.00$, $Q_3 = 33.00$) for those without disorders. The association between age and the presence of MSDs was statistically significant ($p < 0.001$). The median height of those reporting a MSD was measured at 167.00 cm ($Q_1 = 162.00$–$Q_3 = 173.00$), while those without a disorder was measured at 170.00 cm ($Q_1 = 164.00$–$Q_3 = 178.00$). The association between height and the presence of MSDs was statistically significant ($p = 0.004$). The median weight of those reporting MSDs was 65.00 kg ($Q_1 = 60.00$–$Q_3 = 70.00$), while for those without disorders was 69.00 kg ($Q_1 = 60.00$–$Q_3 = 78.00$). The association between weight and the presence of MSDs was statistically significant ($p = 0.023$). The median time spent in the profession by those reporting MSDs was 14.00 years ($Q_1 = 10.00$–$Q_3 = 16.00$), while for those without disorders it was 8.00 years ($Q_1 = 3.00$–$Q_3 = 12.00$). The difference between the time spent in the profession and the presence of MSDs was statistically significant ($p < 0.001$). This difference was due to the employees who had worked in their unit for 6–10 years and 16 years or more. In these groups, it was found that more people than expected were experiencing MSDs. Among employees who have worked for 16 years or more, 9.50% ($n = 14$) have MSDs, while the remaining 3.00% ($n = 3$) do not. Among employees who have worked for 6–10 years, 40.20% ($n = 59$) have MSDs, while 22.20% ($n = 22$) do not. No statistically significant differences were found between the presence of MSDs and the participants' gender ($p = 0.122$), BMI ($p = 0.680$) or regular exercise status ($p = 0.103$) (Table 1). Based on these findings, it is understood that age, height and length of service significantly increase the risk of MSDs among ambulance service personnel. This may have broader implications for occupational health strategies in emergency medical services (EMS).

As presented in Table 2, 99.30% ($n = 146$) of the heavy lifters reported having MSDs, while 0.70% reported not having any MSDs. A statistically significant difference was found in the prevalence of MSDs between those who lifted heavy objects while performing their profession and those who did not ($p = 0.018$). A statistically significant difference was found between the perception of the job as physically difficult and the presence of MSDs ($p = 0.003$). Among those who reported that the job was physically difficult, 99.30% ($n = 146$) reported having MSDs, while 91.90% ($n = 91$) did not report MSDs. Among those who reported that the job was psychologically difficult, 98.60% ($n = 145$) reported having MSDs, while 91.90% ($n = 91$) reported not having any MSDs. A statistically significant difference was found between the perception of the job as psychologically difficult and the presence of MSDs ($p = 0.016$). While 98.60% ($n = 145$) of those who reported doing multiple tasks simultaneously had MSDs, 90.90% ($n = 90$) reported not having any MSDs. A statistically significant difference was found between multi-tasking and the presence of MSDs ($p = 0.008$). These findings highlight that MSDs in emergency ambulance personnel increase ergonomic risks due to both physical workload and perceived psychological demands.

Table 1. Comparison of the presence of musculoskeletal disorders and socio-demographic characteristics of the participants.

Variable	Presence of MSDs				
	Yes ($n = 147$)		No ($n = 99$)		
	n	%	*n*	%	*p*
Gender					
Woman	86	58.50	48	48.50	0.122
Man	61	41.50	51	51.50	
Classification of BMI					
Weak	1	0.70	1	1.00	0.680
Normal	103	70.50	64	65.30	
Overweight and above	42	28.80	33	33.70	
Daily exercises					
Yes	53	36.10	46	46.50	0.103
No	94	63.90	53	53.50	
Term in the unit he/she works for (years)					
0–5	55	37.40	65	65.70	**0.001**[a]
6–10	59	40.20	22	22.20	
11–15	19	12.90	9	9.10	
16 and above	14	9.50	3	3.00	
	Median	Q_1–Q_3	Median	Q_1–Q_3	
Age	36.00	30.00–40.00	28.00	25.00–33.00	<**0.001**[b]
BMI	22.77	21.39–25.78	23, 0.29	21.30–26.04	0.666[b]
Height	167.00	162.00–173.00	170.00	164.00–170.00	**0.004**[b]
Weight	65.00	60.00–70.00	69.00	69.00–78.00	**0.023**[b]

[a] χ^2 test.
[b] Mann–Whitney *U* test.
Note: Bold data are statistically significant ($p < 0.005$). BMI = body mass index; MSD = musculoskeletal disorder; Q_1 = 25th percentile; Q_3 = 75th percentile.

Table 2. Comparison of the presence of musculoskeletal disorders and occupational characteristics of the participants.

Variable	Presence of MSDs				*p*
	Yes ($n = 147$)		No ($n = 99$)		
	n	%	%	*n*	
Is heavy lifting a requirement of your profession?					
Yes	146	99.30	93	93.90	**0.018**[a]
No	1	0.70	6	6.10	
Standing for long periods at work					
Yes	122	83.00	73	73.70	0.079
No	25	17.00	26	26.30	
Is your work physically demanding?					
Yes	146	99.30	91	91.90	**0.003**[a]
No	1	0.70	8	8.10	
Perceived work pressure					
Yes	145	98.60	91	91.90	**0.016**[a]
No	2	1.40	8	8.10	
Doing more than one job at the same time					
Yes	145	98.60	90	90.90	**0.008**[a]
No	2	1.40	9	9.10	
Consecutive case attendance					
Yes	144	98.00	89	89.90	**0.006**[a]
No	3	2.00	10	10.10	
Experience an ergonomic problem while using the stretcher during the case?					
Yes	103	70.10	38	38.40	**0.001**[b]
No	44	29.90	61	61.60	

[a] Fisher's exact test.
[b] Pearson's χ^2 test.
Note: Bold data are statistically significant ($p < 0.005$). MSD = musculoskeletal disorder.

The REBA scores of the five identified job positions, which are the most performed in ambulance health services, were adapted and calculated for the health personnel on duty, and the distribution is presented in Table 3. The highest REBA score was found to be 8.62 for the stretcher lifting. The lowest REBA score was found to be 2.52 for opening an intravenous line (Table 4).

Table 3 presents the relationship between the study variables and the REBA scores of the participants. The study results showed a significant relationship between gender and the REBA score during blood pressure measurement ($p = 0.031$), indicating that men had a higher risk in their working posture compared to women. Participants working in shifts had a better ergonomic posture during the transfer of the patient to the stretcher ($p = 0.041$). Those experiencing back pain had a higher REBA score during patient transfer to the stretcher compared to those not experiencing back pain ($p = 0.047$). Those who struggled while carrying the stretcher were found to have a high REBA score for stretcher lifting ($p = 0.049$). When examining the correlation of REBA scores with age, weight, height, BMI and years in the profession, a positive correlation was found between the REBA score during blood pressure measurement on the stretcher and height ($r = 0.370$, $p = 0.048$). During blood pressure measurement, as height increased, the REBA score also increased. A positive correlation was found between the REBA score and height during the process of lifting the patient with a stretcher ($r = 0.429$, $p = 0.020$). As the height increased during the lifting of the patient on the stretcher, the REBA score also increased. A negative correlation was found between the REBA score and age ($r = -0.402$, $p = 0.031$) while positioning the patient on the stretcher. During the positioning of the patient on the stretcher, the REBA score decreased as the age increased. A positive correlation was found between the REBA score during stretcher lifting and weight ($r = 0.395$, $p = 0.034$). When examining the correlation of other REBA scores with age, weight, height, BMI and years in the profession, no statistical difference was found ($p > 0.005$) (Table 3). These data highlight the interaction between individual characteristics and ergonomic risk. The relationships observed between REBA scores and variables such as gender, height, age and reported back pain underscore the importance of personalized ergonomic adjustments. They support the notion that ergonomic problems are prevalent among EMS personnel worldwide.

4. Discussion

The findings indicate that musculoskeletal complaints are more common among individuals who are older, taller and have lower body mass. Occupational factors associated with an increased incidence of MSDs include longer duration of professional experience, frequent engagement in heavy lifting, exposure to physical and psychological stress, and performing multiple simultaneous tasks.

Occupational ergonomic factors include excessive physical effort, difficult posture, repetitive work, hand–arm vibration, kneeling or squatting, climbing and crawling. In a study covering the WHO countries in 2019, it was noted that back pain increases with age, peaking particularly in the age groups 45–49 and 50–54 years. Healthcare costs and productivity losses were found to be at the highest levels, especially in the age groups 55–59 and 45–49 years [25]. In this study, the median age of those with MSDs was higher than that of those without. As age increases, the duration spent in the profession and the exposure time have an impact.

This study shows that as the duration of occupational exposure increases, MSDs may also increase. Especially noteworthy is the significant increase in the reporting rate of disorders among those who have worked in the profession for 6–10 years. According to the literature, the risk of MSDs increases with the duration of employment among paramedics and ambulance personnel especially in individuals who have worked under physically demanding conditions for many years [25,26].

In a study conducted among dentists, no difference was found between the REBA score and BMI [27]. In a cohort study examining the relationship between ergonomic injuries and BMI among healthcare workers, no independent relationship was found between BMI and the incidence of ergonomic injuries. In this study, no relationship was found between the distribution of BMI and MSDs. According to the results of this study, it is not recommended to adapt working conditions based on individual BMI levels [28]. However, the data are contradictory. In another pilot study, it was reported that patients with a BMI of 35 and above experienced pain complaints [29]. In a global study examining the burden of disease, MSDs have been associated with high BMI [26]. When the height and weight parameters were examined according to the presence of MSDs, it was found that those reporting musculoskeletal complaints had lower height and weight. Upon examining BMI, this difference does not exist.

In a study conducted among EMTs, the prevalence of MSDs was found to be between 30 and 88% [30]. In this study, it was determined that more than half of the participants had MSDs, with the most common complaints being back, neck and shoulder pain. In studies conducted with ambulance personnel, it was reported that the prevalence of MSDs ranged between 42 and 53%. The most frequently affected areas reported were the arms, neck and shoulders [31,32]. In this profession, narrow spaces and stairs contribute to back and waist injuries, but cardiopulmonary resuscitation (CPR) procedures especially cause these injuries [30,33].

Lifting, working in improper postures and carrying heavy loads, which involve physical strain, have been found to be associated with MSDs. Specific tasks related to the working environment of EMTs, such as heavy lifting with and without stretchers, safety mechanism procedures, transporting patients to ambulances and physical exertion during CPR procedures, have been identified as factors causing MSDs, particularly back pain [32,34]. In this study, MSDs were found to be more common among those who lifted heavy objects and reported physical strain. According to studies, in this occupational group, lifting loads and excessive strain are the most common causes of injuries, accounting for 56% of them [4].

Ambulance personnel are required to make difficult medical decisions and deal with serious psychiatric conditions [35]. In emergency medical service personnel with low job satisfaction, lumbar problems are more frequently observed [30]. In this study, in line with the literature, MSDs are more frequently observed in those who are psychologically strained at work. The relationship between psychological conditions and MSDs may be because stress-induced muscle activity, similar to that in low-load static tasks, can initiate the same processes [35].

REBA evaluates individuals' physical condition, the pressure on their limbs and activities such as repetitive tasks. According to the REBA scale, lifting a stretcher is a high-risk movement for

Table 3. Relationship between study variables and the REBA scores of the participants.

Variable	*n*	%	Opening a vascular access REBA score		*p*	Blood pressure REBA score		*p*	Putting the patient on a stretcher REBA score		*p*	Positioning the patient on the stretcher REBA score		*p*	Lifting the stretcher REBA score		*p*
			Mdn	Q1–Q3		*Mdn*	Q1–Q3		*Mdn*	Q1–Q3		*Mdn*	Q1–Q3		*Mdn*	Q1–Q3	
Gender																	
Male	16	53.30	2.50	2.00–3.00	0.940	3.00	2.00–3.00	**0.031**[a]	3.00	3.00–3.75	0.294	7.00	6.00–7.00	0.854	9.00	8.00–10.00	0.355
Women	14	46.70	2.00	2.00–2.00		2.00	2.00–3.00		3.00	3.00–3.00		6.50	6.00–7.00		8.00	8.00–9.00	
Education level																	
Pre–undergraduate	6	20.00	2.50	2.00–3.25	0.432	3.00	3.00–3.25	0.347	3.00	2.75–3.25	0.820	7.00	5.75–7.00	0.347	8.50	7.75–10.00	0.940
Postgraduate	24	80.00	2.00	2.00–3.00		2.00	2.00–3.00		3.00	3.00–3.00		6.00	6.00–7.00		8.50	8.00–9.00	
Daily exercise																	
Yes	11	36.67	2.00	2.00–3.00	0.672	2.00	2.00–3.00	0.703	3.00	3.00–4.00	0.640	6.00	6.00–7.00	0.764	9.00	8.00–10.00	0.420
No	19	63.33	2.00	2.00–3.00		3.00	3.00–3.00		3.00	3.00–3.00		7.00	6.00–7.00		8.00	8.00–9.00	
Perceived work pressure																	
Yes	29	96.67	2.00	2.00–3.00	0.733	3.00	2.00–3.00	0.533	3.00	3.00–3.00	0.933	7.00	6.00–7.00	0.600	8.00	8.00–9.00	0.267
No	1	3.33	2.00	2.00–2.00		2.00	2.00–2.00		3.00	3.00–3.00		7.00	7.00–7.00		10.00	10.00–10.00	
Work shifts																	
Rotating	28	93.33	2.50	2.00–3.00	0.777	2.50	2.00–3.00	1.000	3.00	3.00–3.00	0.901	7.00	6.00–7.00	**0.041**[a]	8.00	8.00–9.00	0.257
Morning	2	6.67	2.50	2.00–2.50		2.50	2.00–2.50		3.00	3.00–3.00		4.00	4.00–4.00		9.50	9.00–9.50	
Occupation																	
EMT	15	50.00	2.00	2.00–3.00	0.172	2.00	2.00–3.00	0.312	3.00	3.00–3.00	0.147	7.00	6.00–7.00	0.459	8.00	8.00–9.00	0.300
Paramedics	9	30.00	2.00	2.00–2.50		3.00	2.00–3.00		3.00	3.00–4.00		6.00	4.00–7.00		9.00	8.00–10.00	
Other	6	20.00	3.00	2.00–3.00		3.00	2.00–3.75		3.00	2.75–3.00		7.00	4.00–7.00		8.50	7.75–10.25	
Lower back pain																	
Yes	24	80.00	2.00	2.00–3.00	0.853	2.00	2.00–3.00	0.280	3.00	3.00–3.00	0.610	7.00	6.00–7.00	**0.047**[a]	8.00	8.00–9.00	0.108
No	6	20.00	2.00	2.00–4.50		3.00	2.00–4.50		3.00	3.00–3.25		6.50	2.00–7.25		9.50	8.00–10.25	
Stretcher transport																	
Yes	8	26.67	2.00	2.00–2.75	0.662	2.25	2.00–2.75	0.185	3.00	3.00–3.00	0.765	6.00	6.00–7.00	0.629	8.00	8.00–8.00	**0.049**[a]
No	22	73.33	2.00	2.00–3.00		3.00	2.00–3.00		3.00	3.00–3.00		7.00	6.00–7.00		9.00	8.00–10.00	

	Median (Q_1–Q_3)	Correlation coefficient	*p*	Correlation coefficient	*p*	Correlation coefficient	*p*	Correlation coefficient	*p*	Correlation coefficient	*p*
Age (years)	30.50 (27.75–39.25)	0.00	1.000	–0.121	0.530	0.005	0.980	–0.402	**0.031**[a]	–0.174	0.366
Weight (kg)	69.00 (60.00–76.50)	0.26	0.162	0.219	0.254	0.388	**0.034**[a]	0.233	0.224	0.395	**0.034**[a]
Height (cm)	168.50 (160.75–177.25)	0.28	0.128	0.370	0.048	0.196	0.300	0.363	0.053	0.429	**0.024**[a]

Note: Bold data are statistically significant ($p < 0.005$). EMT = emergency medical technician; Q_1 = 25th percentile; Q_3 = 75th percentile; REBA = rapid entire body assessment.
[a]Data are statistically significant ($p < 0.05$).

Table 4. Distribution of REBA scores by workstation of the participants.

Activity	Final REBA score	*SD*	Reference REBA score	REBA score	Risk level	REBA prevention
Opening a vascular access	2.52	1.02	2–3	1	Low	May be necessary
Blood pressure	2.62	0.90	2–3	1	Low	May be necessary
Putting the patient on a stretcher	6.14	1.43	4–7	2	Middle	Required
Positioning the patient on the stretcher	3.07	0.53	4–7	2	Middle	Required
Lifting the stretcher	8.62	1.08	8–10	3	High	Required in a short time

Note: REBA = rapid entire body assessment.

emergency department workers, and moving a patient onto a stretcher and positioning a patient on a stretcher were actions that required intervention as per reference values. Tirgar et al. [36] reported in a study conducted with surgeons that the REBA score ranged from 4 to 7, indicating a medium risk level and the need for interventions to reduce associated occupational hazards. In another study conducted by Ratzon et al. [37] with hospital nurses, an improvement in the REBA score and the postures of nurses, which are considered a risk factor for work-related MSDs, was reported, but no significant difference was observed in the number of painful body parts or the level of musculoskeletal pain. The etiology of MSDs is multifactorial, involving physical and psychosocial factors related to the work environment, so preventive strategies should consider all of its aspects.

4.1. Strengths and limitations

This study has several strengths. First, it had a relatively large sample size ($n = 246$) and a high response rate (82%), enhancing the reliability of the results within the local EMS population. Second, in addition to self-reported questionnaire data, the study employed the REBA method, a validated and objective tool, to evaluate postural risks during actual work-related tasks. Furthermore, the identification and analysis of five frequent and ergonomically demanding job postures offer practical implications for workplace interventions. However, the study also has limitations. It was limited to a single region, which may affect the generalizability of the findings. The cross-sectional design limits causal inference. Also, MSD prevalence was self-reported, which may introduce recall bias. Future research should consider multicenter, longitudinal designs with clinical assessment to improve robustness.

However, the study also has limitations. First, the sample was limited to a single region, which restricted the generalizability of the findings to a broader population of ambulance personnel. A cross-sectional design hinders causal inferences between occupational exposures and MSDs, necessitating longitudinal studies for a more comprehensive understanding. Additionally, MSD prevalence was assessed through self-reported questionnaires, which may introduce recall bias or subjective variability; the integration of objective clinical assessments could enhance data reliability. Future research should address these limitations by including a larger, multi-regional sample, objective assessments and long-term follow-up studies to improve workplace ergonomics and health outcomes for emergency medical personnel.

5. Conclusion

Healthcare workers serving in ambulance health services carry significant risks for MSDs. Factors such as age, years spent in the profession and physical workload have been found to increase the frequency of MSDs. A large portion of the employees is exposed to high physical strain due to the necessity of heavy lifting, standing for long periods and performing repetitive movements as part of their jobs.

It has been shown that ambulance healthcare personnel need to use safer ergonomic work positions. Additionally, it has been determined that MSDs are more frequently observed in individuals working under psychological stress. In line with these results, it is necessary to develop strategies to reduce ergonomic risks for emergency healthcare workers. Among these strategies, appropriate training programs, encouragement of regular physical exercise, optimization of workload and the use of ergonomic equipment are essential. Additionally, the implementation of supportive policies that alleviate employees' psychological burden can contribute to the reduction of MSDs. It is recommended to develop ergonomic arrangements and workplace health programs with a multidisciplinary approach to better protect the occupational health and safety of employees working in emergency health services,.

Generative artificial intelligence

ChatGPT was utilized for the English language translation of part of the article.

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ORCID

Emine Gülsoy Altintaş http://orcid.org/0000-0002-8623-3512
Ülken Tunga Babaoğlu http://orcid.org/0000-0003-0275-0537

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