

Musculoskeletal Disorders in EMS

Creating Employee Awareness

By Thomas F. Fisher and Stephen F. Wintermeyer

Costs associated with work-related musculoskeletal disorders (WRMSDs) can be high for both the employer and employee. Employers incur medical and replacement costs when a trained employee is unable to work (Dailey, 2006). In addition to lost wages, an employee may experience psychological and psychosocial issues among other issues (Keough & Fisher, 2001). WRMSDs are financially burdensome in terms healthcare costs, and loss of productivity and wages. These costs must be controlled and prevention of these disorders may decrease their associated expenses (Fisher, Brodzinski-Andreae & Zook, 2009; Fisher, 2003).

Emergency medical services (EMS) personnel are at increased risk for occupational injury with reported injuries including falls, being struck by objects and lifting. They frequently complain of musculoskeletal pain (Heick, Young & Peek-Asa, 2009). Among EMS personnel, these

complaints could be a result of awkward postures when bending, reaching, twisting or performing repetitive motions while completing their tasks.

Ambulances are equipped with specific medical supplies, including airway and ventilation equipment, automated external defibrillators, patient transfer equipment and other supplies for emergency response. EMS equipment is often heavy and awkward, and can place EMS personnel at risk of injury if not carried properly. This combination and the additional weight of the stretcher and patient makes maneuvering much more awkward for EMS personnel.

Statement of the Problem

Due to the nature of job tasks such as transferring patients, quickly loading and unloading an ambulance, call sites (confined spaces) and carrying equipment, EMS personnel are at a higher risk for WRMSDs. National Association of Emergency Medical Technicians surveyed 1,356 members and found that 47% of EMS personnel reported suffering a back injury while performing necessary job requirements (Dailey, 2006).

Injuries among EMS personnel are occurring at an alarming rate in the U.S. According to the U.S. Department of Labor (DOL), EMS personnel have the highest rate of injury compared to any other line of work (Maguire, Hunting, Guidotti, et

IN BRIEF

- SH&E professionals must understand the need to control physical risk factors in the workplace, because these may be contributing to work-related musculoskeletal disorders (WRMSDs).
- Employers must learn how to prevent WRMSDs and provide injury prevention education and training.
- Controlling and reducing physical risk factors may reduce WRMSDs and may help the organization's bottom line.
- Educating workers about strategies to reduce physical risk factors for these injuries, while increasing awareness of their body mechanics during occupational performance, is significant.

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al., 2005). In 2006, BLS reported that emergency medical technicians and paramedics had an MSD incidence rate that was seven times that of private industry (BLS, 2007). Research is needed to assess this trend and how it might be addressed. This study was designed to determine whether EMS personnel can identify the physical risk factors that influence WRMSDs and are aware of interventions to decrease the physical risk factors for WRMSDs.

Physical Risk Factors & Rate of Injury

Grayson, Dale, Bohr, et al. (2005), conducted worksite evaluations of 133 injured employees at an acute-care hospital, a major airline company and a large university to determine physical risk factors associated with their job tasks. Physically stressful job tasks were identified and explored through interviews and observation. After the worksite evaluations, awkward postures, repetitive motions, high force requirements and extended reaching were identified as physical risk factors associated with their job tasks. These are the same risk factors associated with WRMSDs (Tjepkema, 2003).

EMS personnel are at risk for musculoskeletal injuries because they participate in patient transfers that require physical effort. Galinsky, Waters and Malit (2001) discussed the physical demands primarily related to patient transfers by home healthcare workers. According to the authors, patient transfers are the leading cause of work-related injuries. Lifting a human body is much different from lifting an object because of the uneven weight distribution within the body and the fact that there is no good place to handle the body. The unpredictability of a human in terms of behavior may be a factor as well. Other factors that put home healthcare workers at risk include manipulating objects within their work environment and carrying heavy equipment.

Lavender, Conrad, Reichelt, et al. (2007), reported EMS personnel often stand beside the bed or hospital gurney and use a bed sheet to lift patients during lateral transfers. This maneuver may cause friction from sliding the lifting injured person. Dragging the person across the bed to the stretcher can increase back loading and lead to potential injuries for the workers performing the maneuver.

Tam and Yeung (2006) studied nonemergency ambulance personnel involved in patient transfers to determine physical risk factors associated with low back pain. Thirty-eight male participants completed a questionnaire, performed a lifting test and were evaluated for cardiovascular fitness. This was followed by an isokinetic test on trunk muscle performance. Personal, physical, psychosocial and exposure factors were examined. The results showed age, rating of perceived exertion, job satisfaction, fatigue after work, and self-perceived work load were among risk factors associated with low back pain in nonemergency ambulance personnel.

Maguire, et al. (2005), investigated the epidemiology of work-related injuries among EMS personnel. They calculated the injury rate and compared results with other occupational groups. Data collected included date of incident, age, gender, cause of injury, type of injury, body part(s) injured, job title, lost workdays and a short narrative. Their retrospective analysis of incident reports obtained from two urban agencies showed sprains, strains and tears as the most common type of injury, with injuries to the back occurring most often. EMS personnel were injured most frequently when assisting patients. Results also showed that the injury rate for EMS personnel was 34.6 injuries per 100 full-time workers, which was higher than the injury rates for any other industry reported by the U.S. DOL.

Heick, et al. (2009), studied occupational injuries among EMS providers. They found that back injuries were the leading injuries which required medical treatments. These acute back injuries, reported by 12.8% of survey respondents, led to restricted workdays and to numerous workers' compensation claims. These researchers also discovered that nearly 30% of the 675 respondents reported an injury

Table 1
Demographics

	No. of participants	% of participants
Gender		
Male	66.0	57.4
Female	49.0	42.6
Total	115.0	100.0
Ethnicity		
Caucasian	102.0	88.7
African American	3.0	2.6
Hispanic	2.0	1.7
Asian	2.0	1.7
Other	6.0	5.2
Total	115.0	100.0
Age		
18 to 30	43.0	37.4
31 to 40	43.0	37.4
41 to 50	12.0	10.4
51 to 60	16.0	13.9
> 60	1.0	0.9
Total	115.0	100.0
Years of ambulance experience		
1 to 3	22	19.1
4 to 6	25	21.7
7 to 10	21	18.3
> 10	46	40.0
Total	114.0	99.1

while on duty within the past 12 months. Other sprains and strains were reported by 6.8% of respondents; however, fewer of these injuries required the level of care of the back injuries.

In summary, these studies demonstrate a need for employers to address WRMSDs can be addressed via various interventions, including ongoing injury prevention education by a qualified instructor; eliminating physical risk factors wherever feasible; and providing an awareness that WRMSDs can be

minimized in most cases. This is true for emergency medical personnel as well as other occupations with similar physical work demands (e.g., heavy lifting, awkward postures, confined spaces, repetition of certain tasks throughout a shift). It is essential to understand these preventive measures and their potential influence on an organization's bottom line. SH&E specialists understand these issues and the need for employers to pay attention.

Equipment & Ambulance Design

Paramedic safety and the efficiency of ambulance design also could be a factor when examining WRMSDs among EMS personnel. Ferreira and Hignett (2005) followed 14 paramedics over 6 weeks and used link analysis to examine patient compartment layout versus task performance. Movement of position, communication and attention to task were recorded and categorized as links. Postural analysis examined body posture and activity that created a risk score/action category.

Action category scales were then compared regarding emergency versus nonemergency transport to hospital and tasks performed while the ambulance was stationary versus in transit. It was found that during an 8-hour shift, 24% of paramedics spent an average of 1 hour and 52 minutes treating patients within the ambulance compartment, a confined space environment that may hinder proper body mechanics as well.

Examining the work environment and observing employees performing their work tasks is important. Without such observation, recommending, accommodating or suggesting change to the work condition is inappropriate. Health professionals, occupational therapists, vocational counselors, health educators, athletic trainers and safety pro-

fessionals have expertise in advising on environmental modifications/adaptations and job fit.

Higher action categories (more possible assuming of awkward postures) also were discovered when treating an emergency patient over a non-emergency patient and when the ambulance was stationary compared to in motion. The investigators noted that the seat considered the "work seat" (or attendant seat) or the seat that most of the equipment surrounded was not the most frequently used seat. The preferred working location forced personnel to sit forward or stand to treat patients in order to access necessary equipment. The analyses showed more than 40% of the personnel were using inappropriate postures that could be corrected.

In some cases, employers ask employees to perform tasks without safe and proper lifting devices and/or training. Employers may cite equipment cost and efficacy, as well as the cost of providing training to develop competency with lifting and handling. In smaller organizations, such training is delivered by human resources staff who often are already stretched with job responsibilities. SH&E professionals could provide oversight of this training, and expertise on use of the devices and workspace design.

Study Design & Participants

A nonexperimental study was designed to explore the knowledge of EMS personnel from a metropolitan urban hospital ambulance service in the Midwest. Specifically, personnel were asked about their knowledge of the physical risk factors and injury prevention strategies associated with WRMSDs. Inclusion criteria was employment with the ambulance service as either an emergency medical technician or a paramedic. Participants completed written consent to participate. Once informed consent was signed, a survey was completed.

Instrumentation

Participants completed a survey created by the research team. Topics explored included physical risk factors of WRMSDs associated with the job, types of disorders associated with these risk factors, interventions required (if any), ambulance setup/equipment/supplies and understanding of physical risk factors.

Data Collection & Analysis

Data collection took place over 6 weeks. Data obtained were entered into a spreadsheet on PASW Version 17.0. Each item from the questionnaire was organized and coded.

Demographics

Of the potential 200 employees, 115 participated (57.5%). Sixty-six (57.4%) of the participants were male, while 49 (42.6%) were female. Forty-three (37.4%) participants were between ages 18 and 30; 43 (37.4%) were between ages 31 and 40; 12 (10.4%) participants were between ages 41 and 50; and 16 (13.9%) were between ages 51 and 60. One (0.9%) participant was older than age 60. Twenty-two

(19.1%) participants had 1 to 3 years' ambulance experience; 25 (21.7%) had 4 to 6 years' ambulance experience; 21 (18.3%) had 7 to 10 years' ambulance experience; and 46 (40.0%) had more than 10 years' ambulance experience (Table 1).

Of 115 participants, 68 (59.1%) reported experiencing a WRMSD while employed as an EMS provider. Of these, 61 (89.7%) sought treatment. The types of injuries reported were sprains/strains (52), tears (9), fractures (9), dislocations (6), chronic pain (14) and other (7).

The highest rate of injury involved the back/trunk, with 43 incidents reported by participants. Twenty-one participants reported injuries to the upper extremity, 23 reported injuries to the lower extremity and 4 reported injuries to the head/neck (Table 2).

To determine whether these workers were aware of physical risk factors that influence WRMSDs, the survey contained an open-ended question. This required some reflection on the part of each participant. All reported something, with some listing one risk factor and others listing several. The investigators categorized the answers into eight categories: lifting patients, heavy equipment, environmental factors, poor body mechanics, ambulance setup/design, combative patients, poor physical health and other.

Of the 115 participants, 88 (76.5%) listed lifting patients as a risk factor. Thirty-five (30.4%) participants listed heavy equipment as a risk factor; 24 (20.9%) listed environmental factors as a risk factor; 23 (20%) listed poor body mechanics; 12 (10.4%) listed ambulance setup/design; six (5.2%) listed combative patients; and four (3.5%) listed poor physical health (Table 3, p. 34). Thirteen (11.3%) participants listed items that did not fit into one of risk factor categories.

Finally, when asked, "Are there interventions to prevent physical risk factors with the job tasks you need to perform?" some participants were unsure. In fact, of 115 participants, 32 (27.8%) answered that there were no interventions to prevent physical risk factors. Sixty-one (53.0%) participants answered that there were interventions to prevent the risk factors, while 21 (18.3%) said they did not know whether there were interventions; one (0.9%) participant did not answer.

Participants were asked to list the interventions that they perceived could prevent physical risk factors on the job. Nineteen (31.1%) of the 61 participants identified purchasing new or updated equipment; 18 (29.5%) listed education on proper body mechanics; 15 (24.6%) said calling for assistance when needed; 10 (16.4%) listed exercise; 2 (3.3%) stated improving ambulance setup; and 2 (3.3%) answered other (Table 4, p. 34).

Discussion

Twenty-seven participants (23.5%) reported ambulances did not have the appropriate equipment and supplies needed to do the job safely without injury. They listed a power cot and better maintenance of ambulances and/or equipment as possible

solutions. Twenty-eight (24.3%) participants believed ambulance equipment/supplies are not arranged appropriately to minimize WRMSD risks. Explanations for this included lack of organization and consistency of the various ambulances, unsecured equipment, heavy equipment and poor ambulance ergonomics. Many of these barriers can be eliminated.

Nearly 60% of participants reported a WRMSD while employed as an EMS provider. This is a significant number and should get the attention of employers in this sector.

The physical risk factors identified in this study are similar to those found in previous literature. Heick, et al. (2009), as well as Grayson, et al. (2005), reported WRMSDs could be a result of the cumulative nature of assuming awkward postures, when repetitively bending, reaching or using twisting motions during job tasks. Maguire, et al. (2005), found injuries occurred most often while assisting patients.

The most common reason for not using proper body mechanics when engaging in work tasks is attributed to the minimal time EMS personnel have to think about protecting their own bodies. When an emergency occurs, EMS personnel must respond quickly. Even when they have been trained on the proper methods for handling patients and protecting themselves, EMS personnel may not have the environmental space or sufficient time to perform tasks in the safest manner for their bodies. The main focus is addressing the emergency.

However, in most situations, time allows for use of available equipment. Employees should never hesitate to ask a coworker for help when the situation has been assessed and it is determined that it requires at least two people. Pausing and analyzing the situation with both patient and worker in mind is the best approach.

Surprisingly, 32 participants in this study believed no interventions were available to prevent the physical risk factors for WRMSDs, and 21 were unsure whether such interventions exist. With almost 60% of these employees already reporting previous injuries and 56% unsure of WRMSD interventions, these workers are at risk. Educating this population about strategies to reduce physical risk factors at the workplace is worth exploring.

Limitations & Strengths

Limitations to this study include: 1) the survey tool used was developed by the team of investigators for this study; and 2) the participants may have

Table 2
WRMSDs

Type of injury	No. of participants	% of participants
Sprains/strains	52	53.6
Chronic pain	14	14.4
Fractures	9	9.3
Tears	9	9.3
Dislocations	6	6.2
Other	7	7.2
Total	97	100.0
Affected body part		
Back/trunk	43	47.3
Lower extremity	23	25.3
Upper extremity	21	23.1
Head/neck	4	4.4
Total	91	100.0

Table 3

Physical Risk Factors for WRMSDs

	No. of participants	% of participants
Lifting patients	88	76.5
Heavy equipment	35	30.4
Environmental factors	24	20.9
Poor body mechanics	23	20.0
Ambulance setup/design	12	10.4
Combative patients	6	5.2
Poor physical health	4	3.5
Other	13	11.3

not answered items honestly even though guaranteed anonymity. Because participants were from one large metropolitan employer, it is difficult to generalize to all workers in this service area.

However, because of the number of participants (115), this case study has merit. More than 50% of the potential participants consented to complete the survey, and supervisors supported the study and allowed participation. The study offers suggestions of preventing WRMSDs and two of the coinvestigators are occupational and environmental medicine physicians, with expertise in emergency medicine.

Conclusion

Kinnane, Garrison, Coben, et al. (1997), reviewed literature on interventions to avoid work-related injuries. They suggested identifying persons at risk for injury, providing prevention counseling, collecting injury data, surveying residences and institutions for injury risk and hazards, conducting educational programs, developing media campaigns and advocating legislative changes. Like those researchers, this study recommends taking action to prevent worker injuries.

This study examined EMS workers' awareness of physical risk factors for WRMSDs and possible interventions for their prevention. Future research should determine the best interventions to help inform occupational therapy, occupational health, safety and occupational medicine professionals. Research should be completed to determine how to most effectively implement the interventions. **PS**

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Table 4

Possible Interventions Identified for WRMSDs

	No. of participants	% of participants
No	32	27.8
Yes	61	53.0
New or updated equipment	19	31.1
Education on proper body mechanics	18	29.5
Call for assistance when needed	15	24.6
Exercise	10	16.4
Better ambulance setup	2	3.3
Other	2	3.3
Unsure	21	18.3
No answer	1	0.9