

Prevalence and associated factors with musculoskeletal pain in professionals of the Mobile Emergency Care Service

Prevalência e fatores associados à dor musculoesquelética em profissionais do Serviço de Atendimento Móvel de Urgência

Roberto Airon Veras dos Santos¹, Maria Cristina Falcão Raposo², Renato de Souza Melo³

DOI 10.5935/2595-0118.20210013

ABSTRACT

BACKGROUND AND OBJECTIVES: The professionals who work in pre-hospital care are exposed to unhealthy environments, which can represent risk factors for the development of musculoskeletal disorders. Thus, the objective of this study was to observe the prevalence of musculoskeletal pain in professionals of the Mobile Emergency Care Service (SAMU) and identify its associated factors.

METHODS: Cross-sectional study, carried out at three SAMU bases in Pernambuco. Ninety five professionals were evaluated, of both sexes and age range between 21-58 years old, being (n=36: ambulance drivers, n=38: nursing technicians, n=15: nurses and n=6: physicians). For the musculoskeletal pain evaluation, the Nordic Questionnaire of Musculoskeletal Symptoms was used. To quantify the intensity of pain, the visual analogue scale was used.

RESULTS: Musculoskeletal pain was reported by 71.6% (n=68) of the rescuers; of these, only 18% (n=17) mentioned that they already had these pains before their SAMU labor activity. Nursing technicians were the professionals most affected by the musculoskeletal pain (89.5%), followed by nurses (73.3%), ambulance drivers (55.6%) and the physicians (50%). The lumbar spine (53.5%), knees (32.6%) and cervical spine (30.5%) were the body regions most affected by pain and the female sex was associated with musculoskeletal pain presence (p=0.024).

CONCLUSION: High musculoskeletal pain prevalence was observed among professionals of SAMU, especially in the nursing professionals. In addition, the female sex was shown to be a fac-

tor associated with musculoskeletal pain presence in this group of professionals.

Keywords: Emergency medical services, Knee joint, Low back pain, Neck pain, Occupational health.

RESUMO

JUSTIFICATIVA E OBJETIVOS: Os profissionais do atendimento pré-hospitalar estão expostos a ambientes insalubres, que podem representar fatores de risco para o desenvolvimento de distúrbios musculoesqueléticos. Sendo assim, o objetivo deste estudo foi observar a prevalência de dor musculoesquelética em profissionais do Serviço de Atendimento Móvel de Urgência (SAMU) e seus fatores associados.

MÉTODOS: Estudo de corte transversal, realizado em três bases do SAMU de Pernambuco. Foram avaliados 95 profissionais, de ambos os sexos, com faixa etária entre 21 e 58 anos, sendo (n=36: condutores socorristas, n=38: técnicos de enfermagem, n=15: enfermeiros e n=6: médicos). Para a avaliação da dor musculoesquelética foi utilizado o *Nordic Questionnaire of Musculoskeletal Symptoms* e, para quantificar a intensidade das dores, a escala analógica visual.

RESULTADOS: As dores musculoesqueléticas foram relatadas por 71,6% (n=68) dos socorristas, desses, apenas 18%(n=17) mencionaram que já apresentavam tais dores antes das suas atividades laborais no SAMU. Os técnicos de enfermagem foram os profissionais mais acometidos pelas dores musculoesqueléticas (89,5%), seguidos dos enfermeiros (73,3%), dos condutores socorristas (55,6%) e médicos (50%). A coluna lombar (53,5%), os joelhos (32,6%) e a coluna cervical (30,5%) foram regiões corporais mais acometidas pelas dores e o sexo feminino foi um fator associado à presença das dores musculoesqueléticas (p=0,024).

CONCLUSÃO: Foi observada elevada prevalência de dor musculoesquelética nos profissionais do SAMU avaliados, sobretudo nos profissionais de enfermagem, Além disso, o sexo feminino foi um fator associado à presença de dor musculoesquelética nesse grupo de profissionais.

Descritores: Articulação do joelho, Cervicalgia, Dor lombar, Saúde do trabalhador, Serviços médicos de emergência.

INTRODUCTION

Musculoskeletal disorders (MSD) have been consolidated as one of the most relevant problems for public health, as they have affected workers in several areas with the appearance of a wide

Roberto Airon Veras dos Santos – <https://orcid.org/0000-0003-2650-1383>;
Maria Cristina Falcão Raposo – <https://orcid.org/0000-0001-7000-3168>;
Renato de Souza Melo – <https://orcid.org/0000-0002-6776-3606>.

1. University Center of Vale do Ipojuca, Department of Nursing, Caruaru, PE, Brazil.
2. Federal University of Pernambuco, Department of Statistics, Recife, PE, Brazil.
3. Federal University of Pernambuco, Department of Physiotherapy, Recife, PE, Brazil.

Submitted on April 13, 2020.

Accepted for publication on December 18, 2020.

Conflict of interests: none – Sponsoring sources: none.

Correspondence to:

Renato de Souza Melo
Rua Avelino Cândido, 32, Salgado
55018-070, Caruaru, PE, Brasil.
E-mail: renatomelo10@hotmail.com

© Sociedade Brasileira para o Estudo da Dor

variety of signs and symptoms such as pain, physical discomfort, heaviness sensation, fatigue, paresthesias and limitations of joint movements. These signs and symptoms start in an insidious way, may be reported to happen simultaneously or not, and evolve rapidly if no changes in working conditions occur^{1,2}.

The professionals who work in the pre-hospital care perform activities that cause great physical wear due to the various conditions of the patients and their degrees of dependence, besides the characteristics of the work environment³. These professionals often face risk situations to provide assistance and are exposed to unhealthy environments, places with difficult access, presence of fire, water, mud, uncontrolled electricity, often risking their own lives⁴.

Exposure to these environments is constant and intense due to the accelerated pace of demands and the many working hours that are part of the routine of pre-hospital care, leading to decreased productivity and quality of life of the worker⁵. Moreover, during pre-hospital care, some techniques for moving victims, such as the use of boards, require an intense body mechanic on the part of the rescuer and the strategy for transportation of patients may vary according to the situation faced by rescue teams⁶. The presence of danger on the location, the quantity of professionals available to perform the rescue, the diagnosis and the severity of the patient, as well as the rescue scene, all have a direct influence on the type of transport and when incorrect techniques are used the patient may suffer further trauma, just like SAMU⁶ rescuers. Because of the working conditions, which are not always favorable for the rescue of patients, the SAMU professionals are prone to develop changes in the musculoskeletal system, which can cause more severe pain and MSD.

Evidence shows that health professionals, who work in pre-hospital care or not, have high prevalence of MSD and absenteeism. These disorders have been the main cause of absence from the work of these professionals⁷⁻¹¹. There is a shortage of studies on DME in first responders, especially on musculoskeletal pain, justifying the present study, whose objective was to observe the prevalence of musculoskeletal pain and its associated factors in the SAMU professionals.

METHODS

Cross-sectional study, conducted according to the recommendations of Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) for observational studies¹²⁻¹⁴, conducted on three SAMU bases of basic and advanced support on the *agreste* of Pernambuco, including ambulance drivers, nursing technicians, nurses and physicians. It was carried on through a survey on the quantitative of professionals rescuers, totaling 104 professionals, being 36 ambulance drivers, 38 nursing technicians, 15 nurses and 15 physicians which were invited to participate in the study.

The inclusion criteria were: to be a SAMU rescuer for at least one year, to work in the basic/advanced support ambulances and in the removal of patients and to be 20 to 60 years old. All participants signed the Free and Informed Consent Term (FICT), agreeing to participate in the study. Professionals

with a history of chronic diseases of the osteomyoarticular system, fractures with plate and/or screw, contusions, recent distensions, herniated disk and rescuers who were on vacation or those recently returned from vacation were excluded.

Three instruments were used for the assessments: the evaluation sheet with personal data and aspects related to work activity, the Nordic Questionnaire of Musculoskeletal Symptoms (NQMS)¹⁵, which was used for the evaluation of musculoskeletal pain, and the visual analog scale (VAS)¹⁶, to quantify the intensity of the pain reported.

Assessments were conducted in a reserved room to avoid possible embarrassments of professionals in exposing musculoskeletal pain before their SAMU directors, superiors and work colleagues.

The evaluation of musculoskeletal pain was performed by the NQMS, an instrument validated for the Brazilian population¹⁵ that consists of dichotomous choices regarding the presence or absence of osteomuscular symptoms in the cervical spine, shoulder, arm, forearm, wrist and hand, thoracic spine, lumbar spine, hip, thigh, knee, leg, ankle and foot, providing data on these symptoms at different time periods. In this study, the only osteomuscular symptom evaluated was musculoskeletal pain of the last seven days, whose intensity was quantified by the VAS, which consists of a 100 mm horizontal line, in which zero represents the absence of pain and 10 intense pain¹⁷.

The study was approved by the Research Ethics Committee of the University Center of Vale do Ipojuca (UNIFAVIP), according to the report number: 1.046.368.

Statistical analysis

Gender, age, body mass index, duration of the weekly working-hours and the time spent working at SAMU were used as possible factors associated with musculoskeletal pain. To test the normality of quantitative variables, the Kolmogorov-Smirnov test was used. The Mann-Whitney test was used to compare the means of two groups for cases of non-normality of the data and the Student *t* test, compatible with normal distribution. For the dichotomous variables, Pearson's Chi-square independence tests or Fisher's Exact were used when necessary.

The data was tabulated in Microsoft Office Excel version 2010 by two independent researchers (double data entry) to avoid typing errors¹⁸, ensuring greater reliability, and was transferred to the Statistical Package for the Social Sciences (SPSS) version 20.0, in which all analyses were performed, adopting the 5% level of statistical significance.

RESULTS

Ninety five professionals were included: 36 ambulance drivers, 38 nursing technicians, 15 nurses and 6 physicians, constituting a sample for convenience (Table 1). Nine physicians were excluded because they didn't meet the eligibility criteria.

There was no association between musculoskeletal pain and age ($p=0.970 - t$ Student), BMI ($p=0.073 - t$ Student) and weekly

Table 1. Sample features

	All (n=95)	Drivers (n=36)	Technicians (n=36)	Nurses (n=15)	Physicians (n=6)
Age (years)	34.4±0.75	34.6±1.29	34.5±1.14	33.5±1.47	35.8±4.68
BMI	26.4±5.19	28.1±4.97	27.2±4.81	21.7±6.45	27.7±2.37
SAMU working months*	48.5±3.70	52.7±6.34	46.4±5.54	50.4±10.6	32.0±9.21
Weekly working hours**	64.6±2.34	40.9±24.5	65.8±23.4	63.0±20.0	70.0±17.6

BMI: Body Mass Index; SAMU = Mobile Emergency Assistance Service; * Months; **Hours.

Table 2. Prevalence of musculoskeletal pain

Musculoskeletal pain	All (n=95)	Drivers (n=36)	Technicians (n=36)	Nurses (n=15)	Physicians (n=6)
In the last seven days	68 (71.6)	20 (55.6)	34 (89.5)	11 (73.3)	03 (50.0)
Already felt pain before working at SAMU	17 (18.0)	06 (16.7)	09 (23.7)	01 (6.7)	01 (16.7)
Almost always feel pain at the end of the working day	16 (16.8)	04 (11.1)	10 (26.3)	02 (13.3)	0 (0)
Sometimes feel pain at the end of the working day	37 (39.0)	10 (27.8)	15 (39.5)	09 (60.1)	03 (50.0)
Rarely feel pain at the end of the working day	21 (22.1)	09 (25.0)	09 (23.7)	02 (13.3)	01 (16.7)
Feel no pain at the end of the working day	21 (22.1)	13 (36.1)	04 (10.5)	02 (13.3)	02 (33.3)
Already missed work due to pain	12 (12.6)	05 (13.9)	04 (10.5)	02 (13.3)	01 (16.7)
Already rescheduled shift due to the pain	10 (10.5)	04 (11.1)	05 (13.2)	01 (6.7)	0 (0)

SAMU = Mobile Emergency Assistance Service.

working ($p = 0.847 - t$ Student). The same occurred with the working time at SAMU ($p = 0.362 -$ Mann-Whitney).

A high prevalence of musculoskeletal pain was observed in 71.6% ($n = 68$) of rescuers, and 18% ($n = 17$) reported that they already had the pain before starting the activity in SAMU (Table 2).

The lumbar spine, knees and cervical spine were the regions most affected by musculoskeletal pain and where the pain was most intense (Table 3).

Table 3. Location and intensity of musculoskeletal pain

Locations	n (%)	Mean±SD
Cervical spine	29 (30.5)	4.92±0.21
Shoulders	26 (27.4)	3.40±0.16
Arms	16 (16.8)	2.08±0.31
Forearm	16 (16.8)	1.52±0.59
Fist and hand	18 (18.9)	1.73±0.18
Thoracic spine	28 (29.4)	3.76±0.25
Lumbar spine	51 (53.5)	5.30±0.30
Hips	16 (16.8)	2.22±0.38
Thigh	15 (15.8)	1.30±0.24
Knee	31 (32.6)	4.34±0.24
Leg	22 (23.1)	1.50±0.18
Ankle and foot	14 (14.7)	1.07±0.17

SD = Standard deviation.

However, there was a significant association between the presence of musculoskeletal pain and pain in females ($p = 0.024 -$ Pearson's Chi-square) (Table 4).

Table 4. Association between musculoskeletal pain and gender

	Pain (n= 68)	No pain (n= 27)
Male	46 (64.8)	25 (35.2)
Female	22 (91.7)	02 (8.3)

$p = 0.024$

DISCUSSION

A high prevalence of musculoskeletal pain was observed in SAMU professionals. The data showed that young people with significant productive capacity had a high frequency of musculoskeletal pain, suggesting that the pain is related to their work activity characteristics, which can compromise their performance, harm the assistance to victims and also risk the lives of these professionals.

The high prevalence of musculoskeletal pain observed may be related to a common feeling of SAMU professionals, as evidenced by the study¹, which reported that rescuers often ignore their own physical discomfort and pain to guarantee the rescue and survival of the victim receiving assistance. In this study, most of the evaluated professionals presented musculoskeletal pain and were in full exercise of their activities, something that, although praiseworthy and altruistic, may contribute to the development of MSD in rescuers.

Ergonomic risks are also mentioned as causes of MSD in rescuers, such as poor posture during care of victims, causing temporary and often permanent withdrawal of SAMU professionals. The lack of physical fitness is another factor that can compromise health and impair performance, in addition to the extensive working hours to which the professionals

are submitted, which in some cases can reach up to 24 uninterrupted hours¹⁹.

Another possible cause of musculoskeletal pain in SAMU professionals is the handling of patients in the most varied conditions, such as the removal of victims from inside a vehicle and from places of difficult access, with restricted physical space, besides the need to contain agitated patients²⁰. A study²¹ observed that 70% of MSD in rescuers were related to the management of patients, however, a limitation of this study is that the cause of pain was not pointed out.

Besides ergonomic and biomechanical factors, psychosocial risks can contribute to musculoskeletal pain in SAMU professionals, such as insufficient work resources, inadequate physical space, reduced staff, organization of task distribution, intensive control, strict rules, valuation of hierarchies, emotional exhaustion and tiredness²².

The association of these factors and the increase in traumatic occurrences are the main factors for the appearance of musculoskeletal pain, which is associated with the multifactorial aspect of the risks¹⁹.

Three studies observed the prevalence of pain and MSD in SAMU professionals, but only one assessed rescuers from advanced units, including physicians, like the present study. The others assessed only professionals from basic units²³⁻²⁵.

The study²³ evaluated the prevalence of pain in SAMU professionals from Porto Alegre, using a questionnaire of work-related habits. This study interviewed 113 ambulance drivers, nursing technicians, nurses, physicians and telephonists. Of these, 92.9% presented musculoskeletal pain, i.e., very high prevalence of pain, as identified in the present study, where the highest prevalence of musculoskeletal pain was observed in nursing professionals, 89.5% in technicians and 73.3% in nurses, values higher than the general prevalence of pain in all professionals of SAMU, which was 71.6%.

These results are in line with the study²⁴, which identified osteomuscular disorders in 95% of the sample, consisting of 20 ambulance drivers, nursing technicians and nurses, of both sexes, aged between 20 and 60 years old. This study also used the NQMS for the evaluation of musculoskeletal disorders, as in the present research.

Similarly, another study²⁵ evaluated 100 professionals of the nursing team of the Recife's SAMU, being 25 nurses, 57 technicians and 18 nursing assistants, using a check-list type questionnaire for the mapping of osteomuscular symptoms in different body regions, identifying a prevalence of 80%, which can be considered high.

However, none of the studies that investigated osteomuscular disorders in SAMU²³⁻²⁵ professionals presented their results in a stratified way, demonstrating in which of the analyzed professions the prevalence of musculoskeletal pain was higher, as presented in this study, which facilitates the implementation of intervention programs in a targeted, precise and individualized way according to the real need of each professional category.

The results of this study corroborate the findings of international investigations, pointing out that musculoskeletal pain

has often been observed in professionals of emergency services and that the lumbar spine has been the area most affected by pain²⁶⁻²⁸.

In this study, the lumbar spine, knees and cervical spine were the body regions most affected by musculoskeletal pain and also where the intensity of pain was higher, characterizing moderate pain. These findings are also in line with studies investigating the SAMU²³⁻²⁵ professionals' MSD, demonstrating that spinal pain is a frequent symptom in rescuers.

The main factors associated with back pain are poor posture during work activities and physical overloads, which generate injury mechanisms in intervertebral discs and compression of the nerve roots²⁹. One of the activities that rescuers perform the most and that requires physical strength is the lifting of the victims to the stretcher, when placing them in the ambulance or transporting them from one stretcher to another, already in the intra-hospital care. Repetitive weight lifting has been a cause of MSD, such as lower back and lower limb pain³⁰, justifying the spinal and knee pain identified in the sample of this study.

Other studies³¹⁻³⁷ also reported that pain in the lumbar spine was an outcome frequently observed in health professionals, justifying why MSD and mainly low back pain have been some of the main causes of absenteeism³⁸⁻⁴⁰, of relocation to other functions or withdrawal from the rescuer's activity due to disorders related to their work activity¹⁹.

Although they present high prevalence of musculoskeletal pain, including back pain, the rescuers included in this study presented low frequency of absenteeism (12.6%) or changes in shifts (10.5%), which may be related to the average age of the sample, which was 34.4±0.75 years old, i.e., young professionals, enthusiastic about their work, even in the face of apparently unfavorable physical conditions.

However, this situation brings concern, because rescuers over 39 years old were 6% more likely to develop musculoskeletal pain^{23,31}, despite this study not identifying an association between age and musculoskeletal pain.

In any case, there was a significant association between the presence of musculoskeletal pain and the female gender, possibly due to their job added to domestic work. Thus, women working in the health field are part of a risk group for the development of MSD, since these professions require greater physical effort and these professionals already accumulate efforts resulting from the activities at home^{41,42}.

As this study identified a high prevalence of musculoskeletal pain in SAMU professionals, the data may contribute to foster health promotion actions and prevent MSD, stimulating the development of health promotion plans for rescuers by the municipal health secretariats and SAMU coordinators, aiming at improving quality of life and mental health, as well as reducing stress and anxiety levels of these professionals. The results found can also promote periodic training and permanent interventions, improving the rescuers' knowledge about occupational and biomechanical risks, so that they adopt preventive behavior on MSD.

Implementing labor gymnastics can be a valid alternative, since some studies have observed that good posture associated with relaxation techniques during the shift intervals and adequate physical preparation prevent injuries and pain caused by labor activities⁴. Moreover, exercises with music, relaxation, massages and physiotherapeutic exercises are effective in reducing anxiety, stress and musculoskeletal pain⁴³⁻⁴⁷. These measures can be taken by the authorities responsible for SAMU in order to prevent MSD, providing better working conditions for the rescuers.

Randomized and controlled clinical trials should be conducted to allow assessment of the impact of periodic training, workout gymnastics and reduced working hours for the professionals, offering more time for rescuers to engage in physical activities monitored by those responsible for SAMU. The results of these studies may guide the Municipal Health Secretariats and SAMU coordinators in relation to the most effective measures for preventing and intervening in musculoskeletal pain, carrying out evidence-based actions and reducing MSD risks for SAMU professionals, so that they can perform their duties in better conditions and with less occupational risks.

CONCLUSION

A high prevalence of musculoskeletal pain in SAMU workers, especially in nursing professionals, was observed. The lumbar spine, the knees and the cervical spine were the regions with higher prevalence and intensity of pain. The female gender was a factor associated to the presence of musculoskeletal pain in this group of professionals.

AUTHORS' CONTRIBUTIONS

Roberto Airon Veras dos Santos

Data Collection, Writing – Preparation of the original

Maria Cristina Falcão Raposo

Statistical analysis, Writing – Preparation of the original, Writing – Reviewing and Editing

Renato de Souza Melo

Conceptualization, Project Management, Research, Methodology, Writing – Preparation of the original, Writing – Review and Editing, Supervision

REFERENCES

1. Lelis CM, Battaus MRB, Freitas FCT, Rocha FLR, Marziale MHP, Robazzi MLCC. Work-related musculoskeletal disorders in nursing professionals: an integrative literature review. *Acta Paul Enferm*. 2012;25(3):477-82.
2. Magnago TS, de Lima AC, Prochnow A, Ceron MD, Tavares JP, Urbanetto Jde S. Intensity of musculoskeletal pain and (in) ability to work in nursing. *Rev Lat Am Enfermagem*. 2012;20(6):1125-33.
3. Leite PC, Silva A, Merighi MA. Female nurses and the osteomuscular disturbances related to their work. *Rev Esc Enferm USP*. 2007;41(2):287-91.
4. Barboza MC, Milbrath VM, Bielemann VM, de Siqueira HC. Work-related musculoskeletal disorders and their association with occupational nursing. *Rev Gaúcha Enferm*. 2008;29(4):633-8.
5. Ramalho-Neto H, Borba EO, Neves EB, Macedo RMB, Ulbricht L. Características do atendimento pré-hospitalar intradomiciliar em Curitiba-PR. *J Health Sci Inst*. 2013;31(2):155-60.
6. Alexandre NMC, Angerami ELS, Moreira-Filho DC. Back pain and nursing. *Rev Esc Enferm USP*. 1996;30(2):267-85.
7. Fernandes CS, Couto G, Carvalho R, Fernandes D, Ferreira P. Self-reported work-related musculoskeletal disorders among health professionals at a hospital in Portugal. *Rev Bras Med Trab*. 2018;16(3):353-9.
8. Roberts MH, Sim MR, Black O, Smith P. Occupational injury risk among ambulance officers and paramedics compared with other healthcare workers in Victoria, Australia: analysis of workers' compensation claims from 2003 to 2012. *Occup Environ Med*. 2015;72(7):489-95.
9. Senmar M, Pour FZ, Soleimani P, Yamini M, Rafiei H. The prevalence of musculoskeletal disorders among nurses working in emergency department. *J Prev Epidemiol*. 2019;4(2):e12.
10. Sedrez JA, Kasten APS, Chaise FO, Candotti CT. Fatores de risco para doenças cardiovasculares e osteomusculares relacionadas ao trabalho em profissionais do atendimento pré-hospitalar de urgência: uma revisão sistemática. *Rev Bras Med Trab*. 2017;15(4):355-63.
11. Vasconcelos DV, Silva LM, Lima LAMS, Pinho MMR, Motta PD, Dantas ST, et al. Absenteísmo em dois hospitais públicos de Minas Gerais: perfil epidemiológico. *Rev Med Minas Gerais*. 2017;27(Suppl 1):S4-10.
12. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening of Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *J Clin Epidemiol*. 2008;61(4):344-9.
13. Malta M, Cardoso LO, Bastos FI, Magnanini MM, Silva CM. STROBE initiative: guidelines on reporting observational studies. *Rev Saude Publica*. 2010;44(3):559-65.
14. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening of Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *Int J Surg*. 2014;12(12):1495-9.
15. Pinheiro FA, Tróccoli BT, Carvalho CV. Validity of the Nordic Musculoskeletal Questionnaire as morbidity measurement tool. *Rev Saude Publica*. 2002;36(3):307-12.
16. Campbell WI, Lewis S. Visual analogue measurement of pain. *Ulster Med J*. 1990;59(2):149-54.
17. Ludington E, Dexter F. Statistical analysis of total labor pain using the visual analog scale and application to studies of analgesic effectiveness during childbirth. *Anesth Analg*. 1998;87(3):723-7.
18. Monteiro ET, Albuquerque SP, Melo RS. Organ and tissue donation in a public hospital of Pernambuco. *Rev Bioét*. 2020;28(1):69-75.
19. Lúcio MG, Torres MC, Gusmão CMP. Riscos ocupacionais do atendimento pré-hospitalar: uma revisão bibliográfica. *Interfaces Científicas – Saúde e Ambiente*. 2013;1(3):69-77.
20. Célia Rde C, Alexandre NM. Musculoskeletal disorders and quality of life in health care providers working with patient transportation. *Rev Bras Enferm*. 2003;56(5):494-8.
21. Kim H, Dropkin J, Spaeth K, Smith F, Moline J. Patient handling and musculoskeletal disorders among hospital workers: analysis of 7 years of institutional workers' compensation claims data. *Am J Ind Med*. 2012;55(8):683-90.
22. Araújo LKR, Oliveira SS. Mapping of psychosocial risks in the SAMU/DF. *Psicol Cienc Prof*. 2019;39:e184126,1-12.
23. Chaise FO, Furlanetto TS, Candotti CT, Kasten AP, Vieira A, Paiva LL. Pain, cumulative trauma disorders and cardiovascular disease in professional of SAMU 192 Porto Alegre/RS. *Rev Ter Ocup Univ São Paulo*. 2018;29(3):204-14.
24. Saçala R, Luvizotto JR, Oselame GB, Neves EB. Related musculoskeletal disorders work process pre-hospital care. *Rev Univ Vale do Rio Verde*. 2017;15(2):751-8.
25. Santos-Júnior BJ, Silveira CLS, Araújo EC. Work conditions and ergonomic factors of health risks to the nursing team of the mobile emergency care/SAMU in Recife-PE city. *Rev Enferm UFPE*. 2010;4(1):245-53.
26. Weaver MD, Patterson PD, Fabio A, Moore CG, Freiberg MS, Songer TJ. An observational study of shift length, crew familiarity, and occupational injury and illness in emergency medical services workers. *Occup Environ Med*. 2015;72(11):798-804.
27. Aljerian N, Alshehri S, Masudi E, Albawardi AM, Alzahrani F, Alanazi R. The prevalence of musculoskeletal disorders among EMS personnel in Saudi Arabia, Riyadh. *Egyptian J Hosp Med*. 2018;73(1):5777-82.
28. Zhang Q, Dong H, Zhu C, Liu G. Low back pain in emergency ambulance workers in tertiary hospitals in China and its risk factors among ambulance nurses: a cross-sectional study. *BMJ Open*. 2019;9(9):e029064.
29. Vacari DA, Ulbricht L, Schneider FK, Neves EB. Main methods for posture diagnosis of the lumbar spine. *Rev Educ Fis/UEM*. 2013;24(2):305-15.
30. Mauro MYC, Veiga AR. Health problems and occupational risks in hospital: nursing workers perceptions. *Rev Enferm UERJ*. 2008;16(1):64-9.
31. Studnek JR, Crawford JM, Wilkins JR 3rd, Pennell ML. Back problems among emergency medical services professionals: the LEADS health and wellness follow-up study. *Am J Ind Med*. 2010;53(1):12-22.
32. Moreira RF, Sato TO, Foltran FA, Silva LC, Coury HJ. Prevalence of musculoskeletal symptoms in hospital nurse technicians and licensed practical nurses: associations with demographic factors. *Braz J Phys Ther*. 2014;18(4):323-33.
33. Rambabu T, Suneetha K. Prevalence of work-related musculoskeletal disorders among physicians, surgeons, and dentists: a comparative study. *Ann Med Health Sci Res*. 2014;4(4):578-82.
34. Santos EC, Andrade RD, Lopes SG, Valgas C. Prevalence of musculoskeletal pain in nursing professionals working in orthopedic setting. *Rev Dor*. 2017;18(4):298-306.

35. Maciel-Junior EG, Trombini-Souza F, Maduro PA, Mesquita FO, Silva TF. Self-reported musculoskeletal disorders by the nursing team in a university hospital. *BrJP*. 2019;2(2):155-8.
36. Dong H, Zhang Q, Liu G, Shao T, Xu Y. Prevalence and associated factors of musculoskeletal disorders among Chinese healthcare professionals working in tertiary hospitals: a cross-sectional study. *BMC Musculoskeletal Disord*. 2019;20(1):175.
37. Gaowgzeh RAM. Low back pain among nursing professionals in Jeddah, Saudi Arabia: prevalence and risk factors. *J Back Musculoskeletal Rehabil*. 2019;32(4):555-60.
38. Marques DO, Pereira MS, Souza ACS, Vila VSC, Almeida CCOF, Oliveira EC. Absenteeism – illness of the nursing staff of a university hospital. *Rev Bras Enferm*. 2015;68(5):594-600.
39. Mizuhira VF, Soler ZASG, Oliveira KA de. Absenteeism among nursing professionals: integrative review. *J Nurs UFPE*. 2015;9(5):7936-46.
40. Rocha FP, Saito CA, Pinto TCNO. Sickness absenteeism among health care workers in a public hospital in São Paulo, Brazil. *Rev Bras Med Trab*. 2019;17(3):355-62.
41. Célia Rde C, Alexandre NM. Ergonomics aspect and musculoskeletal symptoms in a transport sector. *Rev Gaucha Enferm*. 2004;25(1):33-43.
42. Brulin C, Gerdl B, Granlund B, Hoog J, Knutson A, Sundelin G. Physical and psychosocial work-related risk factors associated with musculoskeletal symptoms among home care personnel. *Scand J Caring Sci*. 1998;12(2):104-10.
43. Mimura C, Griffiths P. The effectiveness of current approaches to workplace stress management in the nursing profession: an evidence-based literature review. *Occup Environ Med*. 2003;60(1):10-5.
44. Bost N, Wallis M. The effectiveness of a 15-minute weekly massage in reducing physical and psychological stress in nurses. *Aust J Adv Nurs*. 2006;23(4):28-33.
45. Dobson JL, McMillan J, Li L. Benefits of exercise intervention in reducing neuropathic pain. *Front Cell Neurosci*. 2014;8:102.
46. Campos TF, Maher CG, Steffens D, Fuller JT, Hancock MJ. Exercise programs may be effective in preventing a new episode of neck pain: a systematic review and meta-analysis. *J Physiother*. 2018; 64(3):159-65.
47. Gomes-Neto M, Lopes JM, Conceição CS, Araújo A, Brasileiro A, Sousa C, et al. Stabilization exercise compared to general exercises or manual therapy for the management of low back pain: a systematic review and meta-analysis. *Phys Ther Sport*. 2017;23:36-42.