

# Frequency of musculoskeletal symptoms among police officers: systematic review

## *Frequência de sintomas musculoesqueléticos entre policiais: revisão sistemática*

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### ABSTRACT

**BACKGROUND AND OBJECTIVES:** Musculoskeletal symptoms are considered one of the major health problems among police officers. However, no study has synthesized the frequency of these disorders in different parts of the body in this population. The study aimed to describe the frequency of musculoskeletal symptoms in different body regions of the police officers.

**CONTENTS:** A search was conducted in the electronic databases Pubmed/Medline, Web of Science, LILACS, and Scielo, as well as a manual search in the references of the articles. Ten of the 4025 possible studies found were included, which reported different types of musculoskeletal symptoms frequency in different body regions and periods. The frequency of musculoskeletal symptoms within 12 months ranged from 42-52% for the lower back, 34-43% for the knees, 7-32% for the shoulders, 7-27% for the wrists/hands/fingers, 29-42% for the neck, 18-28% for ankle/foot, 8-10% for elbow, 22-45% for upper back and 12-18% for hip/thigh.

**CONCLUSION:** The frequency of musculoskeletal symptoms in police officers was high, especially in the lumbar, dorsal, knee, neck, and shoulder regions. Preventive measures such as physical activity and ergonomic adaptations to reduce these symptoms in this population are necessary.

**Keywords:** Epidemiology, Pain, Police, Prevalence.

### RESUMO

**JUSTIFICATIVA E OBJETIVOS:** Os sintomas musculoesqueléticos são considerados um dos maiores problemas de saúde entre policiais, porém nenhum estudo sintetizou a frequência desses distúrbios em diferentes partes do corpo nessa população. O objetivo deste estudo foi descrever a frequência dos sintomas musculoesqueléticos nas diferentes regiões do corpo de policiais.

**CONTEÚDO:** Foi conduzida uma busca nas bases eletrônicas Pubmed/Medline, *Web of Science*, LILACS e Scielo, bem como busca manual nas referências dos artigos. Foram incluídos 10 dos 4.025 possíveis estudos encontrados, os quais reportaram diversos tipos de frequência de sintomas musculoesqueléticos em diferentes regiões do corpo e períodos. A frequência de sintomas musculoesqueléticos no período de 12 meses variou entre 42-52% para região lombar, 34-43% para joelhos, 7-32% para ombros, 7-27% para punhos/mãos/dedos, 29-42% para pescoço, 18-28% para tornozelo/pé, 8-10% para cotovelo, 22-45% para parte superior das costas e 12-18% para quadril/coxa.

**CONCLUSÃO:** A frequência de sintomas musculoesqueléticos em policiais foi alta, principalmente nas regiões lombares, dorsais, joelhos, pescoço e ombros. Devem ser realizadas medidas preventivas, tais como atividades físicas e adaptações ergonômicas, visando a redução desses sintomas nessa população.

**Descritores:** Dor, Epidemiologia, Polícia, Prevalência.

### INTRODUCTION

Musculoskeletal diseases are one of the major health problems related to work in different professions<sup>1,2</sup>, among which, the police activity stands out due to their physically demanding character<sup>3,4</sup>. The activities commonly performed by most police officers require that they remain in uncomfortable static or repetitive positions, such as sitting in police vehicles<sup>3,5</sup>, as well as using personal protective equipment such as duty belts, weapons and ballistic vest which generates high physical overload<sup>5,6</sup> that could put them at risk of developing musculoskeletal symptoms (MSS)<sup>3,7,8</sup>, with higher prevalence in the lower back<sup>3,9</sup>.

The high prevalence of MSS related to the police work can lead to absenteeism, decrease in productivity, overburdening other police officers, decreasing the population's security, and increasing costs for the treatment and rehabilitation of police officers on leave of absence<sup>10</sup>. Approximately 18.5% of sick pay and disability retirement reported in Brazil in 2014 were caused by musculoskeletal diseases, which significantly impacted the country's socioeconomic profile, with spending

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reaching 534.5 million reals<sup>11</sup>. In addition, studies with Brazilian police officers have reported a prevalence of low back pain around 41.5-51.5%<sup>9,12</sup>.

Although some studies have reported the prevalence rates of MSS among police from different countries, there is no review study systematizing such findings. The results of this review will help authorities linked to public health and security to understand the problem, with the allocation of necessary resources for the prevention and rehabilitation practices of police officers with MSS. This study aimed to summarize the frequency of MSS among police officers.

## CONTENTS

The review and writing process for this article was carried out following the guidelines of the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA)<sup>13</sup>.

The articles were searched in Pubmed/Medline, *Web of Science*, LILACS, and Scielo databases. The definition of the keywords was based on the Medical Subject Headings (MeSH) system, covering the following specific terms referring to the frequency of symptoms or musculoskeletal disorders in the different body regions of the police officers: “prevalence”, “incidence”, “musculoskeletal”, “disorder”, “symptom”, “disease”, “discomfort”, “complaint”, “trauma disorder”, “musculoskeletal injury”, “police”, “law enforcement”. The logical operators AND/OR were used with no additional filters.

### Inclusion and exclusion criteria

The inclusion criteria were studies in Portuguese, English, and Spanish, with a randomized, quasi-experimental, cross-sectional, or case-control design that reported the prevalence of MSS

**Table 1.** Exclusion criteria of the studies

Exclusion code (EX)	Notes
Ex1. Non-original studies	Reviews and other secondary research (for example, results of conference proceedings).
Ex2. Non-police population	Studies that evaluated exclusively other populations (for example, firefighters, military personnel, prison officers), other than police.
Ex3. With no frequency measurements	Studies that did not show the frequency of musculoskeletal disorders in one or more parts of the body.
Ex4. Lack of relationship with the subject of the study	Studies that did not measure the frequency of MSS.
Ex5. Symptoms reported during courses	Studies that reported MSS in police officers while participating in police courses, as they do not reflect the daily police work.
Ex6. Other languages	Studies not written in English, Spanish, or Portuguese.
Ex7. Animal studies	Animal studies

MSS = musculoskeletal symptoms.

in police populations. The exclusion criteria are described in table 1.

The search process for the articles ended in November 2018. After the selection in the databases, articles in duplicate were excluded. All articles were input in a library of a specific software to store bibliographic references (Zotero<sup>®</sup>, Center for History and New Media at George Mason University, USA).

For the final selection of articles, three more steps were followed. In the first moment, the titles of the articles were read with the exclusion of those that did not meet the established criteria. In the second stage, the abstracts of the articles were read, and those that met the inclusion criteria were selected, and those that did not have sufficient information to make a decision on inclusion or exclusion. Finally, in the third stage, the selected articles were analyzed in full, remaining only those that met the inclusion criteria. At this stage, the references of the eligible articles were also analyzed in an attempt to find new references for the review, which might not have been found during the process. All stages were conducted independently by two reviewers, in order to avoid any bias in the selection of the manuscripts. At each stage, the reviewers compared the articles, and when faced with a divergence, they read again for the final decision. If the divergence remained, a third evaluator was consulted.

Data on authorship, year of publication, study design, sample description, sample size, measurement instrument, as well as the main prevalence results of any MSS were extracted.

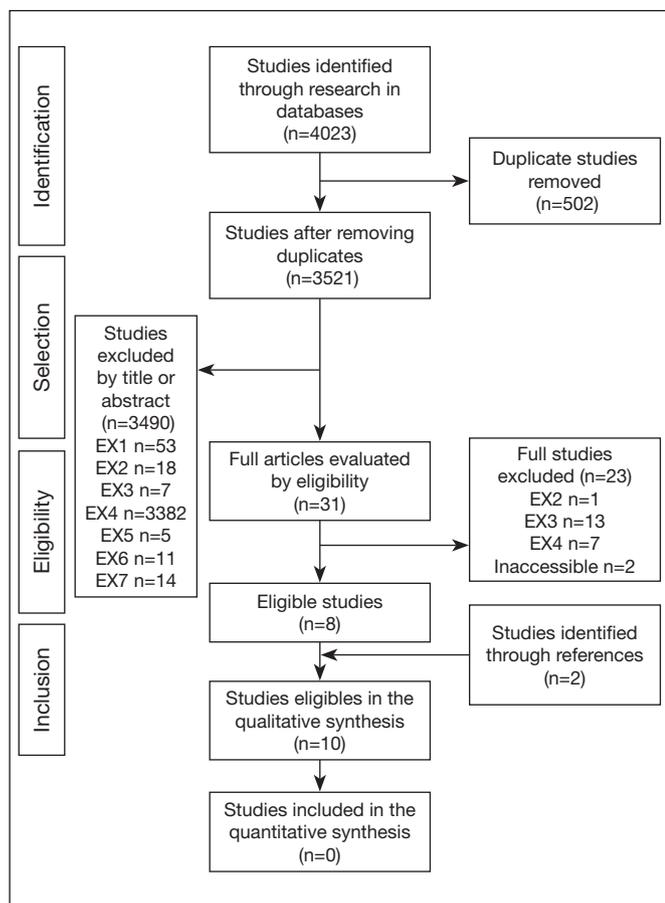
### Selection of the studies

The searches in the databases identified 4023 possible studies related to the investigated topic, and 502 were excluded because they were duplicated. After reading the titles and abstracts, 3490 articles were excluded because they did not meet the previously defined criteria. Thirty-one articles remained for the reading of the full text. After analyzing the articles in full, seven studies were excluded because they had no relation with the analyzed topic, 13 because they did not present frequency values, one for evaluating a non-police population, and yet, it was not possible to access two studies. Finally, two studies were identified through searches in the references, totaling ten studies included in this review (Figure 1).

### Characteristics of the studies

Five studies were conducted in Brazil, three in Canada, one in Sweden and one in the United Kingdom. Eight studies had a sample equal to or greater than 100 individuals, and seven evaluated people of both genders. Seven studies were conducted after the year 2000, six as of 2015. All were characterized as observational studies based on a cross-sectional design. Pain assessment was performed using questionnaires, being the Nordic Musculoskeletal Questionnaire (NMQ)<sup>14</sup>, the most used.

The ten studies that analyzed the frequency of MSS in police officers had different characteristics concerning the body regions, the moments, and periods investigated. Three presented the prevalence of symptoms in the last seven days and/or 12 months in the low back; knees; dorsal region; shoulders; wrists, hands and fingers; neck; ankles and feet; hips and thighs; elbows; forearms. One study showed the frequency of chronic musculoskeletal



**Figure 1.** Flowchart of the procedures to select the studies included in this systematic review

pain in the last three months in four regions of the body: upper back or neck; lower back; shoulders or arms; hips, legs, knees or feet. Two studies showed the frequency of pain, specifically in the back region. One study showed the frequency of low back pain before and after a work shift. One study showed the frequency of MSS reported or treated in the last year by the civil and military police. Table 2 shows the characteristics of the studies included in the review, describing the place where they were conducted, the characterization of the sample, the data collection instruments, and the main findings.

The analysis of the MSS frequency in different anatomical regions in the last seven days and/or 12 months showed that the most affected areas by discomfort are the lumbar region, dorsal region, neck and knees<sup>9,12,18</sup>. In the seven-day period, the frequency of discomfort varied between 25.2-26.8% in the lumbar region, 14.9-19.5% in the knees, 12.2-16.4% in the dorsal region, 14.5-17.1% on the shoulders, 9.5-17.1% on wrists, hands and fingers, 12.2-14.5% on the neck, 4.9-13% on ankles and feet, 7.3-9.9% on hips and thighs, 9-5.3% on the elbows and 4.9-5.0% on the forearms<sup>9,12</sup>. In the 12-month period, the frequency varied between 41.5-51.5% in the lumbar region, 34.4-43% in the knees, 22-45% in the dorsal region, 29-41.5% in the neck, 7-32.4% on the shoulders, 18-28.2% on ankles and feet, 7-26.8% on wrists, hands and fingers, 12.2-18.3% on hips and thighs, 7.3-11.5% forearms and 8-9.8% in the elbows<sup>9,12,18</sup>. Investigating the anatomical regions and the different periods, a study<sup>3</sup> observed frequency values of discomfort in the last three months of 43.2% in the lower back, 38.0% in the hips, legs, knees or feet, 33.7% in the upper back or neck and 25.5% in the shoulders or arms.

**Table 2.** Characteristics and results of the studies included in the review

Authors	Location	Characterization of the sample	Design and measurement instrument	Main results
Finkelstein <sup>15</sup>	Ontario, Canada.	346 men	Cross-sectional design. A proprietary questionnaire including questions about back pain (Do you have problems with back pain?), personal habits (including smoking and alcohol consumption), and parenting.	33% of police officers reported having problems with back pain.
Brown et al. <sup>16</sup>	Ontario, Canada.	805 police officers (716 men and 89 women)	Cross-sectional design. A proprietary questionnaire including questions about low back pain.	Prevalence of chronic back pain 54,9% Leave of absence in the last year: 24.7% (of those who reported suffering from chronic low back pain)
Gyi and Porter <sup>8</sup>	United Kingdom	80 traffic cops (79 men and 1 woman; age = 37.65 ± 7.7 years) 91 general service officers (87 men and 4 women; age=36.8±9.1 years)	Cross-sectional design. Nordic Musculoskeletal Questionnaire (NMQ).	Prevalence of low back problems for more than eight days in the last 12 months: traffic cops = 29%; general service 15%
Minayo, Assis and Oliveira <sup>17</sup>	Rio de Janeiro, Brazil	2566 (both the genders)	A proprietary questionnaire with questions about health problems presented or treated in the last year.	Pain in the neck, back and spine: civil police = 42%; military police = 38.8%; joint sprain or dislocation: civil police = 18.3%; military police = 23.8%; another muscle or tendon problem: civil police = 17.0%; military police = 18.5%

Continue...

**Table 2.** Characteristics and results of the studies included in the review – continuation

Authors	Location	Characterization of the sample	Design and measurement instrument	Main results
Trindade et al. <sup>12</sup>	Araçatuba, SP, Brazil	262 military police officers (216 men and 46 women; age 37±7.2 years)	Cross-sectional design. NMQ and questionnaire with information on absenteeism.	Prevalence of symptoms in the last 12 months: lumbar region 51.5%; dorsal region 45%; neck 36.3%; knee 34.3%; shoulder 32.4%; ankle 28.2%; wrists, hands and fingers 23.3%; hips and thighs 18.3%; forearm 11.5%; elbow 8% Prevalence of symptoms in the last 7 days: lumbar region 25.2%; dorsal region 16.4%; knee 14.9%; neck 14.5%; shoulder 14.5%; ankle and feet 13%; hips and thighs 9.9%; wrists, hands and fingers 9.5%; elbow 5.3%; forearm 5.0% Prevalence of sick leave due to musculoskeletal disorders was 35.3% for police officers in administrative functions and 23.5% in operational functions.
Douma, Cote and Lacasse <sup>10</sup>	Quebec, Canada	3589 police officers (68% men and 32% women)	Cross-sectional design. NMQ and questionnaire with information on absenteeism. Additional questions on self-reported low back pain symptoms for more than three months (chronic).	Back pain: sometime in life: 91.5%; in the last 12 months: 67.7%; chronic low back pain: 28.7%
Marins and Del Vecchio <sup>9</sup>	Pelotas, RS, Brazil	41 federal highway police officers Age=40.5±6.3 years	Cross-sectional design. NMQ and questionnaire with information on absenteeism.	Prevalence of symptoms in the last 12 months: lumbar region 41.5%; knees 41.5%; neck 41.5%; shoulders 29.3%; wrists, hands, fingers 26.8%; dorsal region 22.0%; ankles and feet 19.5%; hips and thighs 12.2%; elbows 9.8%; 7.3% forearm. Prevalence of symptoms in the last seven days: lumbar region 26.8%; knees 19.5%; shoulders 17.1%; wrists, hands, fingers 17.1%; neck 12.2%; dorsal region 12.2%; hips and thighs 7.3%; forearm 4.9%; ankles and feet 4.9%; elbows 4.9% Leave of absence in the last year: shoulders 9.8%; neck 2.4%; wrists, hands and fingers 4.9%; dorsal region 4.9%; forearm 2.4%; lumbar region 14.6%; knees 22%; ankles and feet 9.8%; 7.3% elbows; hips and thighs 7.3%
Brage et al. <sup>24</sup>	Pernambuco, PE, Brazil	28 officers of the motorcycle patrol group (27 men and 1 woman; age=34±5 years)	Cross-sectional design. NMQ and visual analog pain scale	Prevalence of symptoms in the last 12 months: neck 29%; shoulder 7%; dorsal region 36%; wrist and hands 7%; lumbar region 50%; hip and thigh 14%; knees 43%; ankle and feet 18%
Cardoso et al. <sup>19</sup>	Nova Cruz, RN, Brazil	97 military police officers (age=39.3±5.3 years)	Cross-sectional design. A proprietary questionnaire using the Oswestry Disability Index, Numerical pain classification scale, with 10 points.	Prevalence of low back pain before a work shift: 58.8% Prevalence of low back pain after a work shift: 89.7% Besides, it was observed that the intensity of low back pain after the work shift was statistically higher than before the work shift (before: 2.00±2.12; after 4.34±2.51; p<0.001; paired t-test).
Larsen et al. <sup>3</sup>	Sweden	4114 police officers analyzed (3028 men and 1063 women; 23 losses)	Cross-sectional design. A proprietary online questionnaire, self-administered, including questions about musculoskeletal pain. Each item was evaluated with the question: "Over the past three months, did you feel pain in [region] after work...?" The alternative answers were in a 5-point scale (1=none/rarely, 2=a few days a month, 3=1 day a week, 4=a few days a week or 5=every day).	Prevalence of musculoskeletal pain in the last three months: without pain 37.3%; pain in a single site 19.7%; pain in several sites 41.3%. Leave of absence 1.7%, the prevalence of musculoskeletal pain in the four sites of the body: Upper back or neck 33.7%; lower back 43.2%; shoulders or arms 25.5%; hips, legs, knees or feet 38.0%

Regarding specifically to back pain, another study<sup>10</sup> found that 91.5% of the sample had back pain at some time in their life, 67.7% in the last 12 months, and 28.7% had chronic low back pain. Another survey with Canadian police officers<sup>16</sup> found a frequency of 54.9% of chronic low back pain. Another study reported that 33% of police officers reported problems with back pain<sup>15</sup>. Study<sup>19</sup> identified low back pain frequency values of 58.8% before a work shift and 89.7% after a work shift. Another study<sup>17</sup> investigating the frequency of MSS in civil and military police officers in the last year showed symptoms related to pain in the neck, back and spine (civil officers = 42%; military officers = 38.8%), torsion or joint dislocation (civil officers) = 18.3%; military officers = 23.8%) and other muscle or tendon problems (civil officers = 17.0%; military officers = 18.5%). A study<sup>8</sup> comparing different occupations observed a frequency of low back problems for more than eight days in the last 12 months in 29% of traffic cops and 15% in general services officers.

This is the first systematic review that synthesized the results of studies that investigated the frequency of MSS in police officers. Although it is an occupation in all parts of the world, with a significant number of workers, few specific studies on their musculoskeletal health have been found in the literature, despite police officers being constantly exposed to numerous risk factors for the development of work-related musculoskeletal disorders<sup>18</sup>, as demonstrated by the study<sup>10</sup> in which the presence of chronic low back pain was related to working time.

Eight of the ten studies that comprised the review were conducted in the American continent, five in Brazil. The organization of the police work and the dynamics of violence are factors that not only compromise the country's economy but also affect the health of citizens, placing the police officer at the center of a combination of forces, demanding constant combat, which is also fought with the precariousness of their work that can endanger their physical and mental health<sup>20</sup>. Perhaps, due to the importance of the work of these professionals in a country where violence has been increasing, associated with the reduction in headcount in the field, the number of researches about these professionals has shown to be higher in Brazil.

The cross-sectional design was used in all investigative studies of the review. The speed and low cost presented by the cross-sectional design when compared to other epidemiological designs were important factors for its choice. However, an important limitation, which is the possibility of reverse causality, must be remembered. In the specific case of this study, such bias does not affect its results since the investigation focused exclusively on the location and frequency of pain in each anatomical site.

All studies were conducted using questionnaires, used in population surveys, due to their practicality, lower financial cost, and collection time. However, the reliability of the questionnaire depends on the probability of being in accordance with the gold standard, accuracy.

The NMQ was the most used to collect the site and frequency of MMS among police officers, which facilitates the comparison, even if the versions used are those validated for the countries in which they were applied. This questionnaire is validated in different languages and with different populations. It is used

worldwide to evaluate musculoskeletal symptoms, as well as in combination with an ergonomic approach in different occupational groups<sup>21</sup>. One study described that the use of the instrument could be recommended due to its practicality and speed of completion, particularly in epidemiological studies, in which the feasibility of applying it in large samples is often the criterion for choosing the method to be used<sup>14</sup>.

Although 10 articles were included, the heterogeneity of the periods analyzed and the difference in the definitions of the cases prevented the inclusion of a frequency meta-analysis. Collectively analyzing the findings of the selected studies, it was observed that police officers suffer from MSS predominantly in the lumbar, knees, and dorsal regions<sup>3,9,10,12,15,17-19</sup>. Besides, according to studies that investigated the prevalence of MSS in several anatomical regions, it is noteworthy that the neck and shoulders are also among the main sites with symptoms of discomfort mentioned by the police officers<sup>3,9,12,18</sup>.

The high frequency of discomfort symptoms in the lower back, dorsal, knees, neck, and shoulder regions may be associated with several factors related to the police officers' duties. For instance, the overload due to the inherent activities of the profession that require extreme physical demand during some working periods, such as running, jumping, fighting to handcuff someone who resists the arrest<sup>4</sup>. Additionally, it is important to mention the overload of the personal protective equipment used by these officers, such as, for example, ballistic vest, lethal and non-lethal weapons, which add a physical overload of approximately 10kg<sup>6,22</sup>. Also, inadequate postures during several working hours in the sitting position, for those officers in administrative functions or driving cars or motorcycles<sup>8</sup>.

It is important to note that musculoskeletal disorders can evolve to even more severe problems, such as absenteeism, and, thus, influence the work activity and job performance, as well as negatively impact the economic and social aspects<sup>23</sup>. The prevalence of leave of absence due to musculoskeletal disorders was 35.3% for police officers in administrative functions and 23.5% in operational functions<sup>12</sup>. A study showed that the federal highway patrol officers reported absenteeism in the last year due to MSS in the knee and lumbar regions, respectively, in the order of 22 and 14.6%<sup>9</sup>.

In order to avoid absenteeism, studies have investigated the effect of physical exercise programs in the prevention or treatment of MSS in the public security professionals<sup>24,25</sup>. Thus, a study<sup>24</sup> that conducted a randomized controlled clinical trial with the helicopter pilots of the US Air Force, in which the intervention group had a 12-week muscle strengthening training of the central body, showed a reduction in the symptoms of low back pain and disability at the end of the study period. Another study<sup>25</sup> concluded that a supervised exercise program in the workplace was safe and effective in improving the muscle endurance of the lower back and the *core* in firefighters, helping to prevent future pain in the lower back. Therefore, police institutions should consider investing in physical exercise programs to prevent leave of absence due to these disorders.

Despite the methodological care observed in carrying out the present study, some limitations must be described. First, by

presenting police populations from different countries, as well as police institutions and, therefore, work tasks with different characteristics such as police officers in the administrative sector and motorcyclists, and by the definitions of MSS cases, the frequencies found must be analyzed with caution. Also, because most studies adopted self-reported reports of pain and its frequency, and without validated medical tests, the frequency may have been underestimated due to memory bias, especially those related to longer periods.

## CONCLUSION

The studies analyzed showed that the most affected areas by symptoms of musculoskeletal discomfort among police officers are the lumbar, dorsal, knee, and neck regions. There is a need for further studies evaluating the risk factors associated with MSS related to the police work, as well as controlled clinical trials with physical exercise programs to reduce the functional disability and intensity of the most prevalent MSS in this population.

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