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Work disability benefits due to musculoskeletal disorders among Brazilian private sector workers

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ABSTRACT

Objective: To evaluate the prevalence and characteristics of disability benefits due to musculoskeletal disorders (MSD) granted to Brazilian private sector workers.

Methods: This was a population-based epidemiological study of MSD-related benefits among registered private sector workers (n=32 959 329). The prevalence (benefits/10 000 workers/year) of work disability benefits was calculated by gender, age, state, Human Development Index (HDI), economic activity, MSD type and work-relatedness.

Results: The prevalence of MSD-related benefits in Brazil among registered private sector workers in 2008 was 93.6/10 000 workers. The prevalence increased with age, and was higher for women (112.2) than for men (88.1), although the former had shorter benefit duration. The gender-adjusted prevalence by state varied from 16.6 to 90.3 for non-work-related, and from 7.8 to 59.6 for work-related benefits. The Brazilian states with a high—very high HDI had the highest prevalence. The top four most common types of MSD-related benefits were due to back pain, intervertebral disc disorders, sinovitis/tenosynovitis and shoulder disorders.

Conclusion: MSD is a frequent cause of work disability in Brazil. There were differences in prevalence among economic activities and between states grouped by HDI. This study demonstrates that further evaluation of the contributing factors associated with MSD-related disability benefits is required. Factors that should be considered include production processes, political organisation, socioeconomic and educational characteristics, the compensation and recording systems, and employee—employer power relationships. These factors may play an important role in the prevalence of MSD-related disability benefits, especially in countries with large socioeconomic iniquities such as Brazil.

ARTICLE SUMMARY

Article focus
- Musculoskeletal disorders (MSD) are a major cause of disability worldwide.
- The prevalence and distribution of MSD among Brazilian workers are not well known.
- This article evaluates the prevalence and characteristics of disability benefits due to MSD granted to Brazilian private sector workers.

Key messages
- The prevalence of MSD-related benefits among registered Brazilian private sector workers in 2008 was 93.6/10 000 workers, with the top four most common benefits being due to back pain, intervertebral disc disorders, sinovitis/tenosynovitis and shoulder disorders.
- This study demonstrates that further evaluation of the contributing factors associated with MSD-related disability benefits is required and should assess the production processes, political organisation, socioeconomic and educational characteristics, the compensation and recording systems, and employee—employer power relationships.
- These factors may play an important role in the prevalence of MSD-related disability benefits, especially in countries with large socioeconomic iniquities such as Brazil.

INTRODUCTION

Musculoskeletal disorders (MSD) affect muscles, bones, nerves, tendons, ligaments, joints, cartilage and spinal discs. MSD result in malfunctioning of the musculoskeletal system with or without diagnosable injuries[1] and are a major cause of disability and time off work. For example, >600 000 American workers (of a total workforce of approximately 140 million) spend time off work due to MSD each year.[2] In 2004, MSD accounted for >57 million healthcare visits in the USA (60% of all injury-related visits). Back pain alone accounted for >53 million healthcare visits, 313.5 million bed-days and 186.7 million days off work.[3] Similarly, MSD are one of the most common occupational health issues in Brazil.[4–6] In 2002, the Brazilian National Social Security Institute recorded 105 514 cases of MSD among Brazilian workers insured for work-related disability (n=22 903 311). However, the prevalence and distribution of MSD among

ARTICLE SUMMARY

Strengths and limitations of this study
- All employed workers with a registered job in the private sector were analysed (32 959 329 workers). Prevalence was adjusted by gender, age and category of benefit (work-related or non-work-related). This initial descriptive study provides some baseline data on the magnitude of the problem. The data may be used for future comparisons and to evaluate the effectiveness of prevention programs. The strength of this paper is that it supplies information which could be useful in the implementation of an occupational health policy to reduce MSD. One of the limitations is that it only includes data from registered workers although there are many non-registered workers in Brazil. Another limitation is that this study depends on the quality of the data recorded by the National Insurer (NI) of the Brazilian Ministry of Social Insurance.

Brazilian workers are not as well described. Most Brazilian studies on MSD are limited to specific disorders/symptoms or occupations.

It has been estimated that in Sao Paulo city alone approximately 310 000 workers had MSD in 2001.[7] A cross-sectional study found that 56% of the Brazilian bank workers evaluated had MSD symptoms affecting the upper limbs.[8] Other cross-sectional studies found that 39% of Brazilian pottery workers and 71% of Brazilian hairdressers had MSD.[9] [10] These data demonstrate that MSD are significant problem among Brazilian workers even though their prevalence among the larger working population is not clearly established.

Brazil accounts for approximately 65% of Central and South American trade.[11] Knowledge of the current MSD prevalence and distribution in Brazil is important for establishing the magnitude of the problem, increasing awareness, and designing and evaluating prevention programs. Therefore, the objectives of this study were to evaluate and present data on the prevalence and characteristics of MSD-related benefits among private sector workers in Brazil. In addition, because the socio-economic development of the different Brazilian states varies greatly, we also grouped and compared the prevalence of MSD-related benefits among states according to their Human Development Index (HDI).[12] [13] The HDI is a composite index that classifies countries, states and cities as developed (very high HDI >0.85, high HDI 0.70−0.85), developing (medium HDI 0.55−0.70) or underdeveloped (low HDI 0.40−0.55, very low HDI <0.40). The HDI is based on data on life expectancy, education and per capita gross domestic product.

METHODS
Brazilian policies on work absences due to health issues
Registered private sector employees contribute at least 8%, and employers at least 12%, of workers' salaries to the National Insurer (NI) of the Ministry of Social Insurance. The NI contribution covers a wide range of benefits, including maternity leave, retirement age, time off work and non-work-related disability. In addition, all employees must be insured for work-related disability; this additional NI insurance premium is paid by employers.

All absences due to disabilities must be certified by a physician. For the first 15 days of leave, benefits are paid by the employer regardless of work relatedness.[14] Thereafter, the NI pays the benefits. After 15 days of sickness absence, the worker submits a claim to the NI. The claim is reviewed by an auditor physician who determines if the worker has a work disability or not. The physician then classifies the MSD as work- or non-work-related based on epidemiological evidence, information presented by the employer or employee, and patient/ MSD history. Workers cannot be dismissed while in receipt of disability benefit, but they may be dismissed upon return to work if they received non-work-related benefits. In case of work-related disability, the worker cannot be dismissed for at least 1 year after return to work. These socio-economic and legal factors play a major role in the worker's decision to claim or not claim benefits, and demonstrate the importance of determining whether or not workers' disability is work related.

Study population
The economically active Brazilian population in 2008 was estimated to be 99 500 202. Approximately 40% of the economically active population was insured by the NI (n=39 652 510). Self-employed workers (~20% of NI insured workers) were not included because reliable information on the denominator (exposed population) was not available. Thus, all employed workers with a registered job in the private sector were analysed, resulting in a study population comprising ~80% of the NI insured workers (n=32 959 329). The study protocol was approved by the institutional research ethics board.

Case definition
Cases were defined as new MSD-related benefits granted by the NI from 1 January to 31 December 2008. Each worker received only one benefit regardless of the number of jobs he/she had. Claims filed for the same diagnosis within 60 days of return to work were considered a continuation of the previous claim.

Data sources
The information used was obtained from two databases: (1) the Unique Benefit System of the National Social Security Institute, and (2) the National Cadastre of Social Information. The first database includes all benefits granted and paid by the NI and contains information on age, diagnosis (International Classification of Diseases, 10th revision (ICD-10) codes), gender, category of benefit (work-related or non-work-related), economic activity,[15] duration, benefit cost and geographical location of employment. This database

was used to identify the cases (ie, the numerator) for prevalence calculations.

The second database, the National Cadastre of Social Information, contains information on workers in all registered companies. All new jobs generated during the preceding month are recorded. The monthly reports include the total number of employees, payroll and other information, as well as new hires and layoffs.[16] This database provided the total number of workers (ie, denominator) for our study.

We calculated the annual number of workers using the 2008 monthly average. Economic activities were classified according to the SIC-2007. The Brazilian SIC-2007 follows the UK, European NACE and United Nation's ISIC, all of which are consistent in terminology.[15] The SIC-2007 is divided into 21 (A to U) sections (eg, manufacturing), 88 divisions (eg, beverages manufacturing), and ∼700 classes with four- to five-digit codes. Finally, the HDI score of the different states was obtained from the Brazilian chapter of the United Nations Development Program.[13]

Data analysis

The prevalence of MSD-related benefits was calculated and stratified by MSD type (ICD-10), economic activity (SIC-2007), category of benefit (work- or non-work-related), gender (male or female), age group (<20, 20−29, 30−39, 40−49, 50−59 or ≥60 years of age) and state of employment. The numerator was all MSD-related benefits paid by the NI during the study period. The denominator was the total number of registered private sector workers.

The prevalences of MSD-related benefits, standardised by gender and age, were calculated for comparison with economic activities using the total population as reference. The prevalences of MSD-related benefits that were work- and non-work-related were calculated. The prevalence figures were presented as benefits/10 000 workers/year. Prevalence ratios (PR) were calculated by dividing the prevalence among females by the prevalence among males, and the prevalence of non-work-related benefits by the prevalence of work-related benefits. In addition, we compared the prevalence of MSD-related benefits among the states according to their HDI.[12 13] We grouped states as having high−very high HDI (>0.80), medium−high HDI (>0.70, <0.80) or medium−low HDI (<0.70).

RESULTS

In 2008, the Brazilian Social Security Institute granted 1 384 242 disability benefits to registered private sector workers. Among these, 304 933 were MSD-related (ICD-10, category XIII), resulting in a prevalence of 93.6 MSD-related benefits/10 000 workers/year.

Table 1 presents the distribution and characteristics of MSD-related benefits by age group, gender, benefit category (non-work-related or work-related) and MSD type (ICD-10 classification). Most benefits were paid to

30−49-year-old workers (59%). The duration of the benefits increased with age. The prevalence of MSD-related benefits was higher for women (112.2) than for men (88.1), but the former had a shorter duration of benefit, regardless of the benefit category and MSD type. The PR for non-work-related to work-related MSD benefits was 2.1. Most benefits paid were due to back problems (45%).

Table 2 shows that there was a large variation in the prevalence of MSD-related benefits between Brazilian states and between age groups. There were differences between prevalence when the states were grouped by HDI.[12] States with high−very high HDI had the highest prevalence of MSD-related benefits. Gender-adjusted prevalence by state varied from 16.6 to 90.3 for non-work-related benefits, and from 7.8 to 59.6 for work-related benefits. The differences between the highest and lowest prevalence of MSD-related benefits by age group were: <20 years, 20 times; 20−29 years, 8 times; 30−39 years, 6 times; 40−49 years, 4 times; 50−59 years, 5 times; and 60+ years, 4 times.

Table 3 shows the prevalence and prevalence ratios for the 22 economic activities with the highest prevalence of MSD-related benefits. The prevalence was higher among females than among males. The overall PR was 1.3, meaning that women received 30% more MSD-related benefits than men. There were also differences in gender-adjusted, and gender-, age- and category of benefit-adjusted prevalence among the economic activities, with sewage workers having the highest prevalence of benefits, followed by programming/broadcasting activities and wood/products manufacturing (except furniture).

Table 4 shows the prevalence of MSD-related benefits for the most frequent types of MSD by gender and benefit category. The four most common types of MSD-related benefits were due to back pain, intervertebral disc disorders, sinovitis/tenosynovitis and shoulder disorders. In general, women had more benefits, and non-work related benefits were more frequent.

DISCUSSION

The prevalence of MSD-related benefits/10 000 registered Brazilian private sector workers in 2008 was 94. The prevalence increased with age, and was higher for women (112) than for men (88), although the former had shorter benefit duration. The gender-adjusted prevalence by state varied from 17 to 90 for non-work-related, and from 8 to 60 for work-related benefits. The most common types of MSD-related benefits were due to back pain, intervertebral disc disorders, sinovitis/tenosynovitis and shoulder disorders.

The demands of the work tasks within the industries are likely related to MSD among registered Brazilian private sector workers. MSD may occur when the musculoskeletal system is used beyond its physiological limits due to cumulative or single event exposures to one or multiple long lasting and/or excessive exertions.[17]

Table 1 Frequency, median age, duration, cost of benefits and income replacement for Brazilian private sector workers receiving MSD-related benefits in 2008

Characteristic	No. of claims	Median age	Median no. of days off work	Median benefit cost (R$)	Median income replacement (R$)
Age group (years)					
<20	1653	19	46	743.24	463.14
20−29	56 951	26	53	1082.82	579.47
30−39	87 890	35	62	1531.54	722.48
40−49	93 296	44	67	1881.93	827.63
50−59	56 423	53	71	1852.75	768.87
≥60	8720	62	76	1778.00	695.52
Gender					
Male	170 849	40	66	1909.56	852.94
Female	134 084	40	61	1246.36	579.13
Benefit category					
Non-work-related	205 772	41	64	1601.25	722.49
Work-related	99 161	39	62	1480.17	684.15
MSD type (ICD-10)					
Arthropathies	64 059	40	68	1718.31	728.57
Systemic connective tissue disorders	1576	35	81	1784.19	612.10
Dorsopathies	137 350	42	64	1587.58	725.01
Soft tissue disorders	95 973	38	60	1199.83	678.16
Osteopathies/ chondropathies	3541	34	79	2061.17	718.42
Other MSD and connective tissue disorders	2434	34	64	1588.11	690.05

ICD-10, International Classification of Diseases, 10th revision; MSD, musculoskeletal disorders.

However, MSD are multifactorial in nature; genetics, morphology and psychosocial characteristics, in addition to biomechanical factors act together to precipitate these disorders.[17]

Women received more MSD-related benefits than men, but these benefits were of shorter duration. Men had a higher prevalence of MSD-related benefits than women in only six of the top 22 economic activities. These six activities employ predominantly male workers. Other studies also found higher prevalence of MSD among women.[18] The higher prevalence of MSD among women may be related to differences in work characteristics, and home and parenthood activities.[19]

Systemic connective tissue disorders (eg, those affecting the skin and blood vessels) had longer duration, independent of gender and benefit category. Soft tissue disorders (eg, those affecting muscles and tendons) had the shortest duration. This difference in duration is due to the fact that systemic connective tissues disorders take longer to heal than more localised muscle and/or tendon injuries.[20 21]

Sewage workers had 7.9 times, and programming and broadcasting workers had 2.4 times more MSD-related benefits than the general population of registered Brazilian private sector workers. For work-related benefits, sewage workers had 9.5 times, and workers involved in the manufacture of wood and wood products had 3.1 times higher prevalence than the total population. Job characteristics and occupational ergo-nomic stressors are important aetiological factors for MSD of the lower back and upper extremities.[22] Working in small, confined spaces and the heavy workload of sewage industry employees may contribute to the higher prevalence of MSD-related benefits among these workers than among most other economic activities. In addition, being municipal employees and having low socioeconomic status could also have contributed to the high prevalence of MSD found among sewage workers.[23 24] Despite the fact that sewage workers are employed under the same regulations as the private sector, as employees of mixed public/private companies they enjoy higher job security than private sector employees. Lund found that municipal workers from Sweden and Denmark contributed disproportionally to disability absence longer than 7 days.[25]

The factors affecting disability benefits for program-ming and broadcasting workers may be different. No studies on the risks affecting this economic activity were found; however, these workers are exposed to several established biomechanical and psychosocial risks including highly repetitive precision tasks, awkward postures, computer work, temporal pressure and stress, maximisation of minor mistakes, shift work and fatigue.[1 17 26] In one study, it was found that Brazilian systems analysts' mental and physical health were affected by working conditions including workload, equipment, work environment and workstation design, gender and level of worker participation.[27] Other factors

Table 2 Prevalence of MSD-related benefits/10 000 registered Brazilian private sector workers in 2008, by state and HDI per age group: crude and adjusted prevalence by gender, age and category of benefit (g/a/cb)

HDI classification: index State: index	Age group (years)							g/a/cb
	<20	20−29	30−39	40−49	50−59	≥60	Crude	Adj
Medium−low: 0.68	4.8	30.2	62.4	109.3	177.8	120.8	67.9	66.3
Alagoas: 0.68	3.3	43.9	77.8	134.5	219.2	148.1	88.0	84.9
Maranhão: 0.68	5.8	20.9	51.1	89.6	144.0	101.8	53.3	53.5
Medium−high: 0.75	6.2	35.5	62.8	102.5	156.0	132.7	65.1	65.1
Acre: 0.75	0.0	10.9	33.6	68.3	83.1	99.2	32.5	34.7
Mato Grosso: 0.79	10.3	40.7	75.7	136.2	236.5	285.7	80.0	88.7
Amapá: 0.78	10.1	17.5	24.0	47.7	85.0	59.4	26.5	30.3
Amazonas: 0.78	1.9	74.4	130.8	148.7	165.3	137.9	105.4	108.0
Bahia: 0.74	5.4	36.9	67.7	127.3	196.2	148.5	76.2	75.1
Ceará: 0.72	4.7	29.7	42.3	68.2	113.7	84.5	45.7	46.1
Rondônia: 0.78	8.3	32.6	76.7	127.3	180.1	182.3	68.4	76.5
Roraima: 0.75	0.0	32.8	47.0	78.6	195.1	170.0	50.1	57.6
Rio Grande do Norte: 0.74	18.9	50.8	64.1	95.8	144.4	155.2	69.1	69.2
Sergipe: 0.74	2.5	28.0	54.8	83.9	119.7	89.4	53.1	52.8
Tocantins: 0.76	1.7	17.3	37.7	71.7	120.8	121.1	41.5	42.1
Pará: 0.76	1.3	36.7	84.4	147.3	241.7	201.1	87.4	88.1
Paraíba: 0.72	4.3	29.6	40.9	59.6	91.0	70.5	45.4	42.5
Pernambuco: 0.72	7.5	29.7	54.1	82.8	107.9	73.3	53.9	52.3
Piauí: 0.71	2.4	17.0	27.6	59.0	106.9	161.0	38.4	37.4
High−very high: 0.82	12.1	53.5	99.0	156.7	210.9	154.9	97.2	97.5
Mato Grosso do Sul: 0.80	10.1	63.0	105.9	167.3	253.4	212.8	107.3	111.3
Paraná: 0.82	16.5	72.1	115.6	176.0	261.3	204.8	112.2	117.1
Espírito Santo: 0.80	12.4	42.3	89.5	162.6	260.6	228.3	97.0	97.4
Goiás: 0.80	8.3	35.7	67.3	104.2	155.8	152.7	64.1	67.9
Rio Grande do Sul: 0.83	16.1	66.4	112.7	173.2	227.5	168.3	110.0	109.7
Rio de Janeiro: 0.83	11.8	68.4	121.6	172.5	186.0	99.7	115.9	109.1
Minas Gerais: 0.80	8.3	40.5	75.0	119.7	175.6	139.5	76.1	75.8
Distrito Federal: 0.87	11.1	37.3	61.0	91.6	133.0	132.8	61.5	61.1
Santa Catarina: 0.84	25.8	84.8	151.2	253.2	373.8	318.0	147.0	156.3
São Paulo: 0.83	9.8	46.9	93.3	150.0	200.2	147.0	90.8	91.4
Brazil: 0.75	11.6	51.5	94.1	150.1	206.4	154.5	93.6	93.6

Adj, adjusted; HDI, Human Development Index; MSD, musculoskeletal disorders.

likely associated with the high prevalence of MSD-related benefits among programming and broadcasting workers are their higher level of education in comparison to most other occupational groups evaluated, their easier access to healthcare due to their higher wages, and possibly their increased ability to claim disability because of their educational level and worker−employer relationships.

In most Brazilian states, the prevalence of MSD-related benefits increased with age up to the 50−59 age group and then decreased for the 60+ age group. The lower prevalence for the 60+ age group versus the 50−59 age group may be related to the fact that female workers are eligible to retire at 60 and male workers at 65. However, reaching the eligible retirement age does not mean that workers actually retire. The decreased income upon retirement and the increased life expectancy lead workers to remain in the workforce after reaching retirement age. Also, some workers return to the work force soon after retiring. For example, for the 50−59 age group, men represent 67.2% of the working population, while for the 60+ age group, men represent 76.3% of the

workforce. This is further illustrated by the fact that in six states the prevalence of MSD-related benefits continued to increase in the 60+ age group.

Differences between the state prevalence of MSD-related benefits were observed for all age groups, with young workers (<20 years old) having the highest variation. This may be explained by the healthy worker effect, where exposed individuals who developed MSD may have left employment earlier in their careers. Thus, only workers who are genetically and/or physically less prone to develop MSD remain in their jobs.[28] However, over time, more and more workers develop MSD due to the cumulative effects of prolonged exposure to the risk factors for MSD.[17] Also, the differences between states may be related to differences in economic activity and job categories. In addition, the duration of the benefits increased with age, as was reported in previous studies and reviews, and may be related to slower healing and changes in the characteristics of collagen and elastin with age.[29 30]

Some states had up to 60% higher gender-adjusted, and up to 70% higher age-adjusted MSD-related benefits

Table 3 Prevalence of MSD-related benefits/10 000 registered Brazilian private sector workers in 2008 per economic activity, gender (g) and category of benefit (cb): crude and adjusted prevalence by g, age (a) and cb (g/a/cb)

Economic activity	Non-work-related					Work-related					Both				
	Female	Male	PR	Crude	g/a adj	Female	Male	IRR	Crude	g/a adj	Female	Male	PR	Crude	g/a/cb adj
Sewage	670.9	334.5	2.0	369.6	382.5	433	220.2	2	242.1	253.4	1103.9	554.7	2	611.7	628.7
Programming/broadcasting activities	254.3	111.2	2.3	151.6	154.4	129	34.3	3.8	62.0	67.0	383.3	145.5	2.6	213.6	219.0
Wood/products manufacturing (not furniture)	154	84.6	1.8	90.6	112.1	147.8	65.7	2.2	74.5	95.9	301.8	150.3	2	165.1	205.7
Other transport equipment manufacturing	83.9	151.4	0.6	139.5	126.2	50.7	66.8	0.8	63.1	62.0	134.6	218.2	0.6	202.6	186.1
Building construction	68.6	145.9	0.5	130.7	102.8	36.1	87.8	0.4	78.0	60.5	104.6	233.7	0.4	208.7	161.5
Residential care activities	188.2	114.2	1.6	160.8	116.1	56.4	26.4	2.1	45.9	31.1	244.6	140.6	1.7	206.7	145.5
Motor vehicles/trailers/semi-trailers manufacturing	94.8	113.6	0.8	108.0	107.5	74.6	69.6	1.1	68.5	71.5	169.4	183.2	0.9	176.5	177.1
Forestry/logging	156.7	81.7	1.9	85.5	112.1	93.5	51.2	1.8	53.1	67.3	250.2	132.9	1.9	138.6	177.3
Coal mining/lignite	69.6	147.8	0.5	139.6	111.6	0	96.1	0	89.3	51.7	69.6	243.8	0.3	228.9	161.5
Food products manufacturing	125.4	73.8	1.7	83.7	98.3	127.9	50.7	2.5	68.2	80.6	253.2	124.5	2	151.9	176.9
Computer/electronic/optical products manufacturing	132.3	72.8	1.8	93.8	104.6	132	30.8	4.3	70.6	72.3	264.3	103.6	2.6	164.4	175.0
Furniture manufacturing	129.6	69.8	1.9	78.4	95.4	112.9	41.8	2.7	53.9	70.0	242.5	111.6	2.2	132.3	163.5
Postal/courier activities	101.4	87.7	1.2	89.3	81.6	70.4	50.6	1.4	54.4	51.1	171.8	138.3	1.2	143.7	131.3
Water transport	100.2	105.9	0.9	103.0	84.3	39.4	48.3	0.8	46.2	37.1	139.6	154.1	0.9	149.2	120.1
Coke/refined petroleum products manufacturing	106.1	70.3	1.5	72.1	76.0	92.7	43.5	2.1	47.5	57.0	198.7	113.8	1.7	119.6	131.5
Textiles manufacturing	121.5	72.9	1.7	86.5	90.3	84.4	35.6	2.4	50.9	52.8	205.9	108.5	1.9	137.3	141.5
Electrical equipment manufacturing	102.4	76	1.3	80.0	88.2	96.6	36.6	2.6	50.7	59.5	198.9	112.6	1.8	130.7	146.0
Rubber/plastic products manufacturing	101	77.5	1.3	80.6	91.8	77.6	45.1	1.7	51.7	58.6	178.6	122.5	1.5	132.4	148.7
Land/pipeline transport	109.7	90.4	1.2	90.5	85.6	47.3	45.2	1	44.4	40.4	157.1	135.5	1.2	134.9	124.5
Beverages manufacturing	80.8	97.5	0.8	91.9	91.8	49.7	49	1	47.5	49.0	130.5	146.6	0.9	139.4	139.2
Crop/animal production/hunting/related services	115.2	59	2.0	66.8	77.0	95.1	38.2	2.5	47.0	56.9	210.3	97.1	2.2	113.8	132.4
Others	69.2	50.3	1.4	56.0	56.2	30.5	20.6	1.5	23.8	24.2	99.7	70.9	1.4	79.8	76.5
Brazil	74.9	59.9	1.3	63.1	63.1	37.3	28.2	1.3	30.4	30.4	112.2	88.1	1.3	93.6	92.5

The population prevalence was the standard.
adj, adjusted; IRR, incidence risk ratio; MSD, musculoskeletal disorders; PR, prevalence ratio.

Table 4 Prevalence of MSD-related benefits/10 000 registered Brazilian private sector workers in 2008, by type of MSD (ICD-10), gender and category of benefit

MSD type	Non-work-related				Work-related				Both			
	F	M	PR	Total	F	M	PR	Total	F	M	PR	Total
Back pain (dorsalgia)	20.0	15.9	1.3	16.8	9.5	12.9	0.7	11.1	29.5	28.8	1.0	27.9
Intervertebral disc disorders	8.5	10.7	0.8	9.5	0.9	2.0	0.4	1.6	9.4	12.8	0.7	11.1
Sinovitis/tenosynovitis	9.0	2.9	3.1	5.0	11.0	3.1	3.5	5.9	20.0	6.0	3.3	10.9
Shoulder disorders	6.9	3.7	1.9	4.7	8.5	4.4	1.9	5.7	15.4	8.1	1.9	10.5
Knee disorders	3.2	8.6	0.4	6.3	0.5	1.2	0.4	0.9	3.7	9.8	0.4	7.2
Other joint disorders	3.7	2.5	1.5	2.8	1.4	0.9	1.6	1.1	5.2	3.4	1.5	3.9
Other enthesopathies	2.2	0.9	2.4	1.4	2.2	1.1	2.0	1.5	4.5	2.1	2.1	2.9
Knee arthrosis	2.3	1.9	1.2	2.0	0.2	0.2	0.9	0.2	2.5	2.1	1.2	2.2
Other soft tissue disorders	3.1	0.9	3.5	1.7	0.5	0.2	2.6	0.3	3.7	1.1	3.3	2.0
Other arthrosis	1.2	1.1	1.1	1.1	0.2	0.2	0.8	0.2	1.4	1.3	1.1	1.3
Cervical disc disorders	1.3	0.8	1.7	0.9	0.2	0.1	1.4	0.2	1.5	0.9	1.7	1.1
Hip arthrosis	0.7	1.0	0.7	0.9	0.0	0.1	0.5	0.0	0.7	1.1	0.7	0.9
Other bursopathies	0.9	0.5	1.9	0.6	0.2	0.1	2.4	0.1	1.1	0.5	2.0	0.7
Other back problems	0.6	0.3	2.3	0.4	0.5	0.2	2.9	0.3	1.1	0.4	2.5	0.6
Patellar disorders	0.8	0.4	2.0	0.6	0.1	0.1	1.2	0.1	0.9	0.5	1.9	0.6
Soft tissue disorders	0.5	0.2	2.5	0.3	0.5	0.2	2.6	0.3	1.0	0.4	2.6	0.6
Spondylosis	0.6	0.5	1.1	0.5	0.1	0.1	0.8	0.1	0.6	0.6	1.1	0.6
Others	9.2	7.1	1.3	7.6	0.8	1.1	0.8	0.9	10.1	8.2	1.2	8.6
All MSD	74.9	59.9	1.3	63.1	37.3	28.2	1.3	30.4	112.2	88.1	1.3	93.6

F, female; ICD-10, International Classification of Diseases, 10th revision; M, male; MSD, musculoskeletal disorders.

than the general population of Brazilian workers. The highest prevalence was found among the states with high−very high HDI, and the lowest prevalence was found among the states with medium−high HDI. This is an interesting finding indicating higher prevalence among the most productive and populous areas and is supported by the facts that productivity and gross domestic product (which is part of the HDI calculation) are closely related, and that 78% of registered Brazilian private sector workers live in states with high−very high HDI. This finding may be related to the more repetitive nature of tasks in more industrialised environments, but is likely also related to under-reporting in less developed environments with fewer jobs available. The reasons for and implications of these findings need to be further explored and are likely related to socio-politico-economical issues found in Brazil and other developing countries.[31]

Back pain, intervertebral disc disorders, sinovitis/tenosynovitis and shoulder disorders were responsible for approximately 64% of all MSD-related benefits, 57% of all non-work-related benefits and 80% of all work-related benefits. Back pain-related benefits were the most common for both genders and categories of benefit. Men had a higher prevalence of work-related back pain benefits, while women had a higher prevalence of non-work-related back pain benefits, and more work- and non-work-related sinovitis/tenosynovitis benefits.

Risk factors for back pain include heavy physical work, awkward postures, lifting, negative affectivity, low level of job control, high psychological demands and work dissatisfaction, younger age, female gender, race,

smoking, increased weight and co-morbidities.[1] Risk factors for wrist/hand MSD (including sinovitis/tenosynovitis) include heavy physical work, awkward postures, repetitive work, prolonged computer work, distress, older age, female gender, smoking, increased weight and co-morbidities.[1] Complex interactions between work and home activities result in different exposures between men and women. These differences may help explain our findings.

The analyses of the states grouped by HDI may indicate under-reporting and consequently lack of access to social security benefits by workers in states with lower HDI. However, other factors should be considered, such as the migration of industrial enterprises from traditional industrial areas to less developed states because of tax benefits and lower labour costs. Another point to consider is that some states have a larger geographical area and greater socioeconomic variability. In addition, some states have higher industrial concentration in and around their capital cities, and more family based small agricultural enterprises in the countryside, possibly resulting in an unrepresentative mean HDI for these states. City level HDI comparisons may help to clarify these issues in future studies. Another issue to be considered is that the quality of the data including issues related to reporting and recording in different states and the databases in general may have affected the presented results. These issues are common to all studies with secondary analysis of previously recorded data. However, the direction of these potential influences cannot be ascertained.

Despite significant economic advances during the last decade, Brazil still lacks efficient occupational health

and safety surveillance systems and effective prevention programs.[30] This initial descriptive study will help to establish baseline data on the magnitude of the problem. The data may be used for future comparisons and to evaluate the effectiveness of prevention programs. Our findings may not be detailed enough to promote specific prevention programs, but they clearly demonstrate the need for such initiatives. Understanding the scale and distribution of MSD among Brazilian workers is a first step towards more effective data recording and better design of prevention programs.

MSD is a frequent cause of work disability in Brazil. There were differences in the prevalence between economic activities and between the states grouped by HDI. This study demonstrates that further evaluation of the factors associated with MSD-related disability benefits is required. Factors that should be considered include the production processes, political organisation, socioeconomic and educational characteristics, the compensation and recording systems, and employee–employer power relationships. These factors may play an important role in the prevalence of MSD-related disability benefits, especially in countries with large socioeconomic iniquities such as Brazil.

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STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation: **Action taken by the authors**
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract: **included**
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found: **done**
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported: **explained**
Objectives	3	State specific objectives, including any prespecified hypotheses: **stated**
Methods		
Study design	4	Present key elements of study design early in the paper: **presented**
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection: **described**
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants: **described**
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.: **outcome** (MSD-related benefits**) defined**
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group: **the sources of data were described.**
Bias	9	Describe any efforts to address potential sources of bias: **Discussed**
Study size	10	Explain how the study size was arrived at: **Described – pop-based study**
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why: **Descriptive study; groups described**
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding: **population-based descriptive study.**
		(*b*) Describe any methods used to examine subgroups and interactions: **not within the scope of the study, but intended for future studies.**
		(*c*) Explain how missing data were addressed: **observational study of all data available.**
		(*d*) If applicable, describe analytical methods taking account of sampling strategy: **not applicable.**
		(*e*) Describe any sensitivity analyses: **not applicable**
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed: **reported**
		(b) Give reasons for non-participation at each stage: **not applicable**
		(c) Consider use of a flow diagram: **not applicable**
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders: **characteristics described**
		(b) Indicate number of participants with missing data for each variable of interest: **not applicable.**

Outcome data	15*	Report numbers of outcome events or summary measures: **reported**
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included: **provided**
		(*b*) Report category boundaries when continuous variables were categorized: **not applicable**
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period: **not applicable**
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses: **not applicable**

Discussion

Key results	18	Summarise key results with reference to study objectives: **done**
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias: **discussed**
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence: **given**
Generalisability	21	Discuss the generalisability (external validity) of the study results: **discussed**

Other information

Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based: **Given**

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.