

Chronic musculoskeletal pain and loss of work productivity among federal university teaching staff in Brazil

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FREE THEME ARTICLE

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Abstract Chronic musculoskeletal pain is one of the causes of work productivity loss. The aim of this study was to estimate the prevalence of chronic musculoskeletal pain among federal university teachers in Brazil and investigate the association between this condition and sociodemographic and occupational variables and work productivity loss. We conducted an analytical cross-sectional epidemiological study with 1,436 university teachers. Data on sociodemographic, occupational and pain characteristics were collected between January and May 2023 using a structured digital questionnaire. Productivity was assessed using the Work Limitations Questionnaire (WLQ-25). Prevalence of chronic musculoskeletal pain was 67.83%. A positive association was found between chronic musculoskeletal pain and working overtime and productivity loss, while a negative association was found between the condition and working in the area of health sciences, being male, and age. The prevalence of chronic musculoskeletal pain among federal university teachers is concerning, with significant productivity loss being associated with the condition.

Key words Workers' health, Chronic musculoskeletal pain, University teachers, Work productivity

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Introduction

Musculoskeletal disorders are the leading cause of disability worldwide¹. In academic settings, teachers are prone to the occurrence of these disorders due to the combination of different risk factors. In addition to common factors in the general population, such as gender, age, body mass index, smoking and physical inactivity², specific factors are associated with teaching, including low level of social support and occupational control, dissatisfaction, monotony³ and ergonomic issues (prolonged standing and/or sitting with bad posture, bending over the desk to read or mark students' work and carrying and transporting heavy books or classroom equipment)⁴.

These disorders are characterized by various concomitant or non-concomitant symptoms in the joints, ligaments, muscles, nerves, tendons and structures that support the limbs, neck and back^{5,6}. They often result in severe pain⁷, which tends to be localized in one or more regions of the body and can become chronic^{8,9}.

Chronic musculoskeletal pain can trigger a host of negative consequences, such as increased drug consumption, diminished quality of life and social interaction, early retirement due to disability, limited mobility and function, reduced ability to work and increased frequency of sick leave and presenteeism, giving rise to major socioeconomic problems^{10,11}.

Presenteeism, for example, refers to the impact of illnesses or medical conditions on work productivity¹². The annual cost of lost work productivity in the United States ranges from US\$100 to US\$10,000 per worker. Costs related specifically to pain range from US\$252 to US\$7,688 a year (median of US\$2,065)¹³, highlighting the pressing need for research into this issue.

The prevalence of chronic musculoskeletal pain in the general population varies, being more frequent among women and older people¹⁴, with some studies estimating that 20 to 30% of the adult working population suffer from this condition¹⁵. However, data on this condition in university teachers is scarce and studies tend to address pain resulting from musculoskeletal disorders rather than assessing pain chronicity or loss of work productivity^{16,17}.

A systematic review¹⁸ of the prevalence of chronic pain in Brazil revealed that only two^{19,20} of the studies in which chronic musculoskeletal pain was the primary or secondary outcome were with teachers, with neither including uni-

versity teachers. In a study of 23 pre-municipal school and primary school teachers in Serrana, São Paulo, Da Silva, Silva and Dutra (2016)¹⁹ found that the prevalence of musculoskeletal pain was 69.6% and the sites with the greatest level of pain were the lower back (30.43%), cervical spine (17.39%), shoulder (8.69%) and neck (4.34%), while Santos *et al.* (2018)²⁰ found that prevalence was 31.9% among a sample of 943 elementary and high school teachers in Londrina, in the state of Paraná.

In light of the above, the aim of this study was to: 1) estimate the prevalence of chronic musculoskeletal pain in university teachers; and 2) to analyze the association between chronic musculoskeletal pain and other sociodemographic and occupational variables and loss of work productivity.

This study is fundamental for workers' health because it provides important epidemiological data that can trigger discussions on the development of institutional policies targeting teachers. This research is relevant given the context presented above, the fact that, despite their social importance, university teachers face significant invisibility throughout their career when it comes to the impacts of the health-disease process, and the lack of literature on this topic.

Methods

We conducted an analytical cross-sectional epidemiological study.

Population and sample

The study population was made up federal university teachers employed as civil servants in Brazil. The inclusion criterion was teachers employed as civil servants and the exclusion criteria were teachers appointed less than a year before the start of data collection who were retired and who had chronic cancer pain.

The sample size was determined to estimate the prevalence of chronic musculoskeletal pain in a finite population consisting of all practicing federal university teachers in the country ($n = 91,879$), based on the Statistical Synopsis of Higher Education²¹.

The calculation was performed adopting a 5% significance level, a three-point (p.p.) acceptable absolute percentage error and an estimated prevalence of chronic musculoskeletal pain of 50.0%. The calculated sample was stratified

proportionally according to the total number of teachers in each of Brazil's regions, resulting in a final sample size of 1,058 individuals distributed as follows: 10.3% from the North, 28.5% from the Northeast, 10.8% from the Midwest, 31.2% from the Southeast and 19.3% from the South.

Study location and data collection procedure

The study included all the 68 active federal universities in Brazil. The data were collected using a structured digital questionnaire accessed via a link or a QR-Code sent by e-mail. Emails were sent systematically to all the universities and to the teachers' personal emails, which were available on the institutions' websites. The data were collected between January and May 2023.

Study variables and instruments

The following sociodemographic and occupational data were used to characterize the sample: age, sex at birth (defined based on genetics rather than gender); region where the university at which the teacher works is located; area of knowledge; weekly working hours; whether the teacher works overtime; weekly overtime in hours; and other jobs.

To characterize pain and estimate prevalence, the teachers were asked to inform whether they presented musculoskeletal pain, pain duration and whether the pain had started after receiving a positive diagnosis of COVID-19. It is important to note that the International Association for the Study of Pain (IASP) currently defines chronic pain as pain that persists or recurs for longer than 3 months²²; however, for this study, chronic pain is defined as pain that has been present for at least six months, according to the IASP's own guidelines for chronic pain for research purposes²³.

The structured pain questionnaire also included a body map divided into 27 sites for respondents to identify pain location, together with guidance on how identify the region where they felt most discomfort. Pain frequency and intensity was classified using an 11-point numeric rating scale ranging from zero to 10, where zero represents no pain, 1-3 indicates mild pain, 4-6 moderate pain and 7-10 severe pain²⁴.

Loss of work productivity was estimated using the Work Limitations Questionnaire (WLQ-25), a self-administered instrument translated and cross-culturally adapted to Brazilian Por-

tuguese. The instrument consists of 25 items grouped into four domains (time management, physical demands, mental-interpersonal demands and output demands) that measure the extent to which health problems interfere with a worker's ability to perform job tasks and the impact of this interference on productivity²⁵.

In addition to estimating total productivity loss as a percentage, each domain is scored from zero (limited none of the time) to 100 (limited all of the time), indicating the amount of time in the prior two weeks the respondent was limited on the job, also as a percentage. The instrument does not classify the scores, with the higher the score, the greater the limitation and, consequently, the greater the loss of work productivity. The use of the questionnaire was authorized by the Mapi Research Trust, a non-profit organization coordinated by the authors of the original instrument, after signing a confidentiality agreement. The agreement allows access to the instrument and guidelines on how to calculate and interpret loss of work productivity data and domain scores (Work Limitations Questionnaire Version 2.2. Scaling and Scoring Version 1.2: December 2022). In accordance with the confidentiality agreement, details of the procedure are not provided in this article, but can be obtained by contacting the institution.

Data analysis

Descriptive statistics were used to analyze the sociodemographic, occupational and pain variables, including the prevalence of chronic pain and loss of work productivity.

Multiple linear regression was used to analyze the association between the variables. Model quality was assessed using the coefficient of determination (R^2). The best result (0.12) was obtained by including the following independent variables using the stepwise variable selection procedure: presence of chronic musculoskeletal pain, geographical region, teacher's area of knowledge, age, sex at birth, weekly working hours, overtime, amount of overtime in hours and other jobs. The dependent variable was loss of work productivity.

The individual significance of the correlation coefficients for each independent variable was calculated using Student's t-test and the overall significance of the model was determined using the F-test, resulting in a value of 6.87. All analyses were performed using R version 4.3.1, adopting a 95% confidence interval and significance level of $p \leq 0.05$ ²⁶.

Ethical considerations

The study was approved by the Federal University of São Carlos' (CEP/UFSCar) research ethics committee (Reference code No. 5,741,976 and CAAE 60437222.5.0000.5504). All participants signed a digital informed consent form.

Results

The study recruited 1,619 participants, of whom 183 (11.30%) were not included in the final sample because they did not agree to take part in the study or did not meet the inclusion and exclusion criteria. The sociodemographic and occupational characteristics of the final sample ($n = 1,436$), which attained the estimated regional totals, is shown in Table 1.

The mean age of the sample was 47.57 years (standard deviation: 9.07), and most respondents were from the Southeast and the area of health sciences, female, worked 40 hours a week and had an exclusive employment contract. Of the 85 respondents who did not have an exclusive employment contract, 69 (81.18%) reported having another job. Most of the participants ($n = 1,031$; 71.80%) worked overtime. Of these, 366 (25.49%) worked between 6 and 10 hours a week overtime and 284 (19.78%) worked more than 10 hours a week.

Of the respondents who had been diagnosed with COVID-19 ($n = 754$), only 48 (6.37%) reported that pain began after getting the disease. The most frequently mentioned regions of pain were the lower back, upper scapular and cervical regions (Table 2).

Most of the respondents ($n = 805$; 82.65%) reported feeling moderate or severe pain, with 54.41% ($n = 530$) saying they felt pain five to seven days a week, 27.10% ($n = 264$) three to four days a week and 18.48% ($n = 180$) one to two days a week. Regarding work limitations in the prior two weeks, respondents with chronic pain obtained higher scores than those without chronic pain in all domains of the WLQ-25 and mean loss of productivity in teachers with chronic musculoskeletal pain was higher when compared to teachers without pain (7.83% and 5.41%, respectively) (Table 3).

The prevalence of chronic musculoskeletal pain was 67.83%.

The results of the multiple linear regression revealed that having chronic musculoskeletal pain and working overtime was positively asso-

ciated with loss of productivity, while working in the area of health sciences, being male and being younger showed a negative association.

When all the model variables were held constant, chronic musculoskeletal pain was associated with a 2.23-point increase in loss of work productivity (8.95%) and a 1.08-point increase in overtime (4.33%). In contrast, working in the area of health sciences, being male and being younger were associated with a 1.45-point (5.82%), 1.0-point (4.01%) and 0.05-point (0.20%) decrease in loss of work productivity, respectively (Table 4). These results show an association between the variables without implying causation.

Discussion

By determining the prevalence of chronic musculoskeletal pain among federal university teachers in Brazil, this study achieved its first objective. However, comparing this rate with other studies proved to be difficult, with an extensive review of the literature finding no information on prevalence of musculoskeletal pain in university teachers. Regardless of this gap in the literature, the prevalence rates found by this study are alarmingly high and should be a concern for clinicians, researchers and federal higher education institutions. However, selection bias may have occurred and pain prevalence may have been affected by the fact that the study was conducted in the post-pandemic period, which led to changes in work processes.

When compared to the prevalence of chronic musculoskeletal pain in the general population, our results are similar to those of other studies with Brazilian adults reporting rates of 62.50%²⁷ and 59.85%²⁸. Lower rates were found in the general population by Cimas *et al.* (2017) (35.7%)²⁹, Latina *et al.* (2019) (44%)³⁰ and Chen *et al.* (2021) (48.72%)³¹. A meta-analysis of 122 studies by Jackson *et al.* (2015)³² also found a lower prevalence of chronic musculoskeletal pain in the general adult (26%) and elderly (39%) populations; however, the rate was higher in workers (86%). These differences may be explained by the use of different pain and the fact that all samples did not include workers.

In addition to providing relevant information on the prevalence of chronic musculoskeletal pain among teachers, this study helps to understand the associations between this condition and other sociodemographic and occu-

Table 1. Sociodemographic and occupational characteristics and presence of chronic musculoskeletal pain in teachers at Brazilian federal universities: absolute numbers and percentages. Brazil (n = 1,436).

	With chronic musculoskeletal pain		Without chronic musculoskeletal pain		Total	
	N	%	N	%	N	%
Region						
Southeast	311	31.93	179	38.74	490	34.12%
Northeast	247	25.36	112	24.24	359	25.00%
South	219	22.48	87	18.83	306	21.31%
Midwest	101	10.37	53	11.47	154	10.72%
North	96	9.86	31	6.71	127	8.84%
Teacher's area of knowledge						
Health Sciences	248	25.46	122	26.41	370	25.77%
Applied Social Sciences	135	13.86	74	16.02	209	14.55%
Human Sciences	144	14.78	62	13.42	206	14.35%
Engineering	113	11.60	50	10.82	163	11.35%
Biological Sciences	113	11.60	49	10.61	162	11.28%
Exact and Earth Sciences	92	9.45	66	14.29	158	11.00%
Linguistics, Literature and Arts	74	7.60	19	4.11	93	6.48%
Agricultural Sciences	55	5.65	20	4.33	75	5.22%
Sex at birth						
Female	622	63.86	243	52.6	865	60.24%
Male	352	36.14	219	47.4	571	39.76%
Weekly working hours						
40 EEC	927	95.17	424	91.77	1351	94.08%
40	26	2.67	22	4.76	48	3.34%
20	21	2.16	16	3.46	37	2.58%
Overtime						
No	241	24.74	164	35.5	405	28.20%
Yes	733	75.26	298	64.5	1031	71.80%
Weekly overtime in hours						
Less than 1	2	0.21	0	0	2	0.14%
Between 1 and 5	254	26.08	125	27.06	379	26.39%
Between 6 and 10	264	27.10	102	22.08	366	25.49%
More than 10	213	21.87	71	15.37	284	19.78%
Other jobs						
No	938	96.30	429	92.86	1367	95.19%
Yes	36	3.70	33	7.14	69	4.81%

EEC = exclusive employment contract.

Source: Authors.

pational variables and loss of work productivity.

The findings showing a positive association between having chronic musculoskeletal pain and loss of work productivity can be explained by difficulties in carrying out work activities associated with the profession, such as those requiring long periods of concentration, walking around the classroom or internship settings and maintaining sustained or static postures while feeling pain.

Literature on loss of productivity associated with chronic musculoskeletal pain among

university teachers is also limited. We therefore drew on studies with workers from different economic sectors with musculoskeletal disorders or associated pain, which found that percentage productivity loss ranged from 2.2%³³ to 13.26%³⁴. An international multicenter prospective survey with individuals aged between 21-55 years diagnosed with rheumatoid arthritis found that percentage productivity loss in the overall sample was 7.0%. The rate was highest in Colombia (7.8%), followed by Argentina (7.5%), Mexico (6.5%) and Brazil (5.9%)³⁵.

Higher percentage productivity losses than the present study were found in Brazilian nurses with musculoskeletal symptoms (8.8%)³⁶ and Portuguese workers with neck, upper limb and middle and low back pain (10.5%)³⁷.

Working overtime was also positively associated with productivity loss, reflecting the crisis in higher education teaching work resulting from academic capitalism and the commodification of education. Worsening working terms and conditions are intrinsically linked to the productivist model, which has become normalized in the academic environment and is characterized by the adoption of “voluntary servitude” by teachers, who self-intensify work to increase their competitiveness in comparative assessment processes³⁸. As a result, teachers end up working long hours, which is confirmed by the literature³⁹.

The findings show that being younger is associated with decreased productivity loss, which may be explained by the fact that younger people tend to find it easier to cope with physical work demands and learn and adapt to new technologies and processes, contributing to greater work efficiency and less productivity loss. Younger people may also be more motivated to demonstrate performance and develop their careers or less saturated with work demands, maintaining enthusiasm and task engagement. A systematic review showed that some studies reported that younger individuals had higher production rates, while others found no differences between age groups⁴⁰.

Our findings also show that being male was associated with a decrease in lost productivity. This may be partially explained by hormonal differences⁴¹, with high levels of testosterone having been shown to raise the pain threshold⁴², and sociocultural roles. In this respect, men are traditionally driven to be the main financial provider in the household, thus taking on less domestic and childcare responsibilities. Furthermore, they are conditioned by social norms that discourage expression of vulnerability to not report difficulties, leading them to prioritize formal work and productivity, even in adverse conditions.

However, this result should be interpreted with caution, since various factors can influence the association between sex at birth and productivity loss. A study with 10,407 employees from 37 companies in the Netherlands found greater likelihood of productivity loss among men⁴³, while another study of employees and self-employed individuals from different economic sectors found that productivity loss was

Table 2. Topographic location of the pain in federal university teachers in Brazil (n = 974).

Location of the pain	Feel pain in the region		Don't feel pain in the region	
	N	%	N	%
Lower back	503	51.64%	471	48.36%
Upper scapular	500	51.33%	474	48.67%
Cervical	391	40.14%	583	59.86%
Shoulders	379	38.91%	595	61.09%
Hips	321	32.96%	653	67.04%
Knees	274	28.13%	700	71.87%
Upper back	215	22.07%	759	77.93%
Wrists	207	21.25%	767	78.75%

Source: Authors.

Table 3. Domain scores (time management, physical demands, mental-interpersonal demands and output demands) and loss of productivity based on the WLQ-25 among federal university teachers in Brazil (n = 1,436).

Domain	With chronic musculoskeletal pain		Without chronic musculoskeletal pain	
	Mean	SD	Mean	SD
Time management	27.18	22.59	16.39	19.82
Physical demands	40.85	34.56	37.94	41.77
Mental-interpersonal demands	24.87	21.62	16.32	17.55
Output demands	29.66	25.06	18.53	21.75
Loss of productivity (%)	7.83	5.01	5.41	4.60

SD = standard deviation.

Source: Authors.

Table 4. Results of the multiple linear regression performed to estimate the effect of variables on the loss of work productivity among federal university teachers in Brazil. Brazil.

	Estimated Statistics		Confidence interval (95%)	
	Correlation coefficient	P-value	Lower limit	Upper limit
Region				
Southeast	-0.69	0.19	-1.73	0.34
Northeast	-0.15	0.77	-1.23	0.91
South	-0.29	0.60	-1.40	0.81
Midwest *	9.80	0.00	6.27	13.33
North	0.92	0.17	-0.41	2.25
Area of knowledge				
Health Sciences	-1.45	0.04	-2.85	-0.05
Applied Social Sciences	-0.40	0.59	-1.89	1.09
Human Sciences	0.37	0.62	-1.12	1.86
Engineering	-0.80	0.30	-2.33	0.72
Biological Sciences	0.19	0.80	-1.35	1.73
Exact and Earth Sciences	-0.44	0.57	-1.97	1.09
Linguistics, Literature and Arts	-0.13	0.87	-1.82	1.56
Agricultural Sciences *	9.80	0.00	6.27	13.33
Sex at birth				
Female *	9.80	0.00	6.27	13.33
Male	-1.00	0.00	-1.64	-0.37
Weekly working hours				
40 – EEC	-1.42	0.27	-3.98	1.13
40	-1.36	0.24	-3.68	0.95
20 *	9.80	0.00	6.27	13.33
Overtime				
No *	9.80	0.00	6.27	13.33
Yes	1.08	0.00	0.40	1.75
Other jobs				
No *	9.80	0.00	6.27	13.33
Yes	-1.76	0.12	-4.00	0.48
Chronic musculoskeletal pain				
No *	9.80	0.00	6.27	13.33
Yes	2.23	0.00	1.58	2.88
Age (years)	-0.05	0.00	-0.08	-0.01

EEC = exclusive employment contract. * Intercept; Student's t-test p-value; statistical significance: $p \leq 0.05$; 95% confidence interval.

Source: Authors.

greater among women⁴⁴. These differences confirm the need to investigate the influence of work activities on the loss of work productivity among men and women, in addition to the factors mentioned above.

The area of knowledge that was negatively associated with productivity loss was health sciences. This can be explained by the knowledge these professionals hold of anatomy, physiology, kinesiology, ergonomics, pain management and other aspects related to the functioning of the human body, allowing them to better adapt

work practices and personal care to cope with chronic musculoskeletal pain. In addition, they are trained to deal with the population's health problems and may therefore feel more motivated and prepared to engage in self-care, resulting in higher levels of work productivity.

This study examined the complexity of the topic in question, making an important contribution to existing knowledge about the prevalence of chronic musculoskeletal pain and its association with other variables and productivity loss among Brazilian university teachers.

Our findings make a significant contribution to research efforts in Brazil aimed at informing public policies targeting this group⁴⁵.

The development of actions aimed at promoting the health of federal university teaching staff is vital to reduce the costs of productivity loss. Functional limitations caused by chronic musculoskeletal pain compromise the quality of teaching, research and extension activities, often resulting in the reallocation of tasks to other staff, which can result in work overload for these workers, triggering new cases of illness. In more serious cases, where limitations lead to prolonged sick leave, it may be necessary to hire substitute teachers, increasing federal government costs.

This situation highlights the urgent need to implement preventive interventions to ensure academic quality and financial sustainability, such as ergonomic programs to promote work and workplace adaptations, encouraging regular breaks, physical exercise, stretching and relaxation, and guidance on pain self-management. It is also essential to rethink the organizational model in federal higher education institutions, which is currently characterized by long working hours, pressure to produce, unrealistic targets, inadequate working conditions and resource shortages.

Finally, to effectively tackle this problem, federal public universities need to vigorously and strategically integrate the health of teaching staff into institutional development plans, addressing this issue in an interprofessional manner with a view to enhancing the quality of life and well-being of faculty members, strengthening the quality of academic activities and reaf-

firming institutional commitment to the promotion of excellence and social development through higher education.

Conclusions

This study presents worrying first-of-its-kind data on the health of public university teachers in Brazil. Our findings reveal a high prevalence of chronic musculoskeletal pain, which, together with overtime, is associated with loss of work productivity, highlighting the need to discuss the health of these workers, whose social importance is unquestionable. The data presented serve to broaden scientific knowledge on this issue, providing valuable inputs to help shape public policies aimed at promoting the health of federal university teaching staff in Brazil.

Furthermore, by understanding the characteristics and measures of work limitations, the impact of chronic musculoskeletal pain and the sociodemographic and occupational variables that play a role in productivity loss, this study can help promote the design and implementation of effective health and safety at work actions by the government and university managers.

One of the limitations of this study is selection bias, with teachers with chronic musculoskeletal pain potentially feeling more motivated to participate in the research, possibly affecting the pain prevalence rate.

Finally, future research should consider using different research designs and methodologies such as longitudinal studies and probabilistic sampling and include teachers from other types of universities (both public and private).

Collaborations

MJS Pinto, VA Mininel and P Hortense: worked on the administration of the study, from its conception and development (writing the introduction, objectives, method – data collection and analysis, results and discussion) to the final editing and revision. LV Pereira, TO Sato and AA Napoleão: worked on the final editing and revision of the article.

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Data availability statement

The data sources adopted in the research are indicated in the article's body.

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