

Remote work and back pain during the COVID-19 pandemic in adults and older population in South Brazil

Trabalho remoto e dores nas costas durante a pandemia da COVID-19 em adultos e idosos no Sul do Brasil

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Abstract *This article aims to investigate the association between remote work and Back Pain during the COVID-19 pandemic, and to analyze this relationship according to the body mass index. Population-based, cross-sectional study carried in two cities in southern Brazil, in individuals aged 18 years and over. Data were collected through household interviews from October to January 2020/21. Outcomes: back pain (cervical, thoracic, lumbar/acute, chronic) and pain intensity. Exposure variable: remote work. For the analyses, Poisson regression with robust adjustment for variance was used, stratified by BMI (eutrophic vs overweight/obese), and restricted to those who had worked in the past month. 1,016 had worked during the pandemic, average 42 years old (SD = 14), varying from 18 to 93 years. Remote work was performed by 7.7% of the individuals. Prevalence of back pain: 25.6% (95%CI: 19.5 to 31.7%). Overweight/obese remote workers felt pain acute cervical pain PR = 2.82 (95%CI: 1.15 to 6.92); chronic low back PR = 1.85 (95%CI: 1.04 to 3.29); acute thoracic PR = 1.81 (95%CI: 3.76 to 8.68) compared to those who did not work. About one in four remote workers reported back pain during of the COVID-19 pandemic. BMI proved to be an important moderator between outcomes and exposure variable.*

Key words *Teleworking, Back pain, COVID-19*

Resumo *O objetivo deste artigo é investigar a associação entre trabalho remoto e dores nas costas durante a pandemia da COVID-19 e analisar essa relação segundo o índice de massa corporal. Estudo transversal de base populacional realizado em duas cidades no sul do Brasil em indivíduos acima de 18 anos. Dados foram coletados por meio de entrevistas domiciliares entre outubro-janeiro de 2020-2021. Desfechos: dor nas costas (cervical, torácica, lombar/aguda, crônica) e intensidade da dor. Variável de exposição: trabalho remoto. Para as análises, foram utilizadas regressão de Poisson com ajuste robusto para variância, estratificadas pelo IMC (eutrófico vs. sobrepeso/obeso) e restritas àqueles que trabalharam no último mês. Durante a pandemia, 1.016 trabalharam, média 42 anos (DP = 14), entre 18 a 93 anos. Trabalho remoto foi realizado por 7,7% dos indivíduos. Prevalência de dor nas costas: 25,6% (IC95%:19,5 a 31,7%). Trabalhadores remotos com sobrepeso/obesidade sentiram dor aguda cervical RP = 2,82 (IC95%:1,15 a 6,92); torácica aguda RP = 1,81 (IC95%:3,76 a 8,68); lombar crônica RP = 1,85 (IC95%:1,04 a 3,29), comparados àqueles que não trabalharam. Cerca de um em cada quatro trabalhadores remotos reportou dor nas costas durante a pandemia. O IMC mostrou-se ser um importante moderador entre defechos e variável de exposição.*

Palavras-chave *Teletrabalho, Dor nas costas, COVID-19*

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Introduction

Remote work has been adopted as an alternative to ensure continuity of work during to the social confinement imposed by the COVID-19 pandemic¹⁻⁴. This, in turn, may have given rise to inadequate postural habits and back pain due to ergonomically unsuitable workplaces and also by a high workload of activities⁵⁻⁷.

In addition, in the pandemic context, the increased incidence of anxiety and depression, inadequate eating habits, less physical activity, poor sleep quality and inadequate posture may have contributed to aggravate the presence of back pain^{1,3}. This condition can contribute to demands on the public health system, in addition to bringing physical, psychological and social consequences for the individual^{8,9} nos estados. Os dias de trabalho perdidos por invalidez decorrente de dor nas costas foram calculados segundo atividade profissional. RESULTADOS: A dor nas costas idiopática foi a primeira causa de invalidez entre as aposentadorias previdenciárias e acidentárias. A maioria dos beneficiários residia em área urbana e era comerciante. A taxa de incidência de dor nas costas como causa das aposentadorias por invalidez no Brasil foi de 29,96 por 100.000 contribuintes. Esse valor foi mais elevado entre os homens e entre as pessoas mais velhas. Rondônia exibiu taxa quatro vezes superior ao esperado (RT = 4,05).

Previous studies have shown a higher risk of painful symptoms in the cervical regions and largely in the lumbar region^{1,3,6,10,11}. However, the specificity of acute pain has not been investigated, which may not show the emergence of pain in the pandemic period in specific locations^{1,3,6,10,11}. In addition, compliance with the presence of pain in overweight/obese individuals has been presented in situations of chronic pain^{10,11}.

On this regard, this study aims to investigate the association between remote work and back pain during the COVID-19 pandemic, and to analyze this relationship according body mass index (eutrophic versus overweight/obese individuals).

Methods

Population

It is a cross-sectional study carried out with a representative sample of adults and older individuals (18 years old or over) residing in the urban zone of two cities in southern Brazil (Rio

Grande/Rio Grande do Sul and Criciúma/Santa Catarina). We restricted the sample to people who reported having performed some paid work in the month prior to the interview.

The municipality of the Rio Grande has approximately 211 thousand inhabitants (96% urban), with a Human Development Index (HDI) of 0.744¹². The municipality of Criciúma, located in the extreme south of the state of Santa Catarina, about 206 km from the capital Florianópolis, with approximately 217 thousand inhabitants (98.6% residing in the urban area), with a Human Development Index (HDI) of high 0.788¹³.

This study was part of a larger study entitled “Mental COVID”, whose objective was to evaluate the impact of COVID-19 on the mental health of the population of the municipalities in two cities in southern Brazil.

Data sources

Two-stage sampling from census tracts systematically through the 2010 population census data^{12,13}, with probability proportional to the size of the sector. Afterwards, an average of 10 households per census sector was randomly selected, with an estimated 2,894 individuals.

Data were collected from October to January 2020/21 by previously trained interviewers at the domiciles selected. The interviews were conducted with all dwellers aged 18 years or over in the selected household who agreed to participate in the survey. The interviews were conducted using tablets with a pre-coded questionnaire with closed-end questions, which were later transferred to the RedCap software.

Variables

Four outcomes were studied, namely: back pain, acute back pain, chronic back pain, cervical (neck, shoulders) pain, thoracic back pain, low back pain, acute cervical pain, chronic cervical pain, acute thoracic back pain, chronic thoracic back pain, acute low back pain, chronic low back pain and back pain intensity. The outcomes were identified through the question: “During the pandemic, have you felt back pain?”. If yes, a figure was presented to the participant to identify the pain location¹⁴. Pain duration was assessed through the question “Has pain lasted more than 12 weeks, i.e., three consecutive months?” Those who answered “no” to this question were considered to have acute pain, and “yes”, chronic pain¹⁵. Intensity of back pain was investigated by means

of the question “In a scale from 0 to 10, how intense was your pain?”, and scored from zero (no pain) to 10 (most severe pain)¹⁶. Respondents were questioned about the intensity of pain felt before and during the pandemic.

The exposure (or independent) variable was remote work, determined by the following question “How social distancing imposed by the COVID-19 pandemic has affected your job/work?”. For those who responded “I continued working, but at home, remotely”, it was considered as “yes”, and the other responses, as “no”. The intervening variables used to adjust for possible confounding factors between the outcomes

and the exposure variable (remote work) are described in the supplementary material (Chart 1).

Statistical analysis

For the statistical calculations, the STATA software, version 4.0 (StataCorp LP, College Station, Texas) was used. Univariate analysis was performed using absolute and relative frequencies to describe the sample according to each variable of interest. To determine the relationship of the back pain (cervical, thoracic, lumbar/acute, chronic), outcome and the variable of exposure, the Poisson regression model¹⁷ was used

Chart 1. Description of intervening variables.

Intervening variables	Description
Gender	Male/female
Age (years)	Categorized by age groups: 18-39, 40-5, ≥ 60
Asset index	The economic level was analyzed using the variable “asset index”. This variable was generated from a principal component analysis, taking into account household characteristics (number of pieces in the house and number of bathrooms) and household goods (freezer, tumble dryer, air conditioning, computer, internet and car ownership). The first component was extracted, which explained about 30% of the variance of all items (eigenvalue > 2.0). Based on household characteristics and some home appliances identified in the domiciles, which were used as a socioeconomic indicator. It was categorized in terciles (from lower to higher).
Sleep quality	The following question was used to determine sleep quality: How would you evaluate your sleep quality? It was categorized as: very good, good/fair, poor, very poor
Leisure time exercise	Based on the leisure section of the International Physical Activity Questionnaire (IPAQ) and defined as individuals who are engaged in any level of physical activity during their free time.
Body mass index (BMI)	Self-reported body weight and height and categorized as underweight and normal (up to 24.9 kg/m ²); overweight (25.0 a 29.9 kg/m ²) and obese (≥ 30.0 kg/m ²).
Health variables (hypertension, depression, heart conditions)	Determined according to the following questions: Has any doctor diagnosed you as having high blood pressure/depression/heart conditions? Responses included yes, no, do not remember/do not know. For those who responded with “no” or “do not remember/do not know” it was considered “no”, and when the response was positive, “yes”. Categorized as No/Yes.
Fear of contracting Covid	Based on the Fear of COVID-19 Scale ⁴ . A score was generated in quintile and the last quintile was isolated. Categorized as No/Yes
Help with household chores	The following question was used: Have you had any help with daily chores (for example: cooking meals, cleaning the house, shopping)? Answers were: no, yes and ignored. They were dichotomized considering the “ignored” and negative responses as “no”, and the others as “yes”. Categorized as No/Yes.
Covid Symptoms	All reported symptoms (cough, sore throat, fever, difficulty breathing, tiredness, diarrhea, loss of taste/smell, shivering, headache) were put together. The responses were considered as “yes” for any symptom reported and “no” for negative responses. Categorized as No/Yes.
Worse health perception	The following question was made: How would you evaluate your overall health? Responses included: excellent, very good, good, fair and poor. The responses considered as excellent, very good and good were considered as “no”, and the responses considered as fair and poor were considered as “yes”. Categorized as No/Yes.

Source: Authors.

with adjustment for robust variance estimation to calculate crude and adjusted prevalence ratio (PR), 95% confidence intervals (95%CI) and p-values.

All analyses were restricted to individuals who had worked in the month preceding the interview. We tested interaction for sex, age, economic level and BMI. The analyses were stratified by BMI (eutrophic versus overweight/obese) due to the effect modifications. The moderating role of BMI was tested in the regression model by adding an interaction term between BMI (dichotomized as obese/non-obese) and the independent variable of interest. The significant interactions for sex, age and economic level were reported in the text. The significance level was established as 5% for two-sided tests.

Ethical aspects

This research was approved by the Human Research Ethics Committee of the Federal University of Rio Grande (FURG), with number 4.055.737.

Results

A total of 2,170 individuals were interviewed, corresponding to a response rate of 75%. Of these, 1,016 worked during the pandemic, with just over half male (50.7%), and the mean and standard deviation (SD) for age was 42 and 13.8 years, respectively, varying from 18 to 93 years old (Table 1).

A total of 7.7% (95%CI: 6.6 to 8.9%) of individuals worked remotely during the confinement period. The prevalence of back pain in this group was 25.6% (95%CI: 19.5 to 31.7%): in the cervical area it was 11.0% (95% CI: 5 to 16.5%), in the thoracic region it was 8.9% (95%CI: 3.0 to 14.9%), and in the lumbar it was 26.8% (95%CI: 17.1 to 36.4%). For those who did not work in the period, these respective prevalence were: 21.8% (95%CI: 20.0 to 23.6%), 9.4% (95%CI: 7.7 to 11.1%), 12.8% (95%CI: 12.8 to 15.3%) and 22.7% (95%CI: 20.1 to 25.2%).

When we analyzed all individuals, none significant association between remote work and back pain was observed (Table 2). But, when we stratified the analyses for BMI, significant effects were verified for overweight/obese individuals. Although without statistical significance, remote work conferred protective effect to back pain among eutrophic individuals (Table 3).

Table 1. Characteristics of the urban population who worked in Rio Grande, RS, and Criciúma, SC, Brazil, 2020 (n = 1,016).

Variable	N	%
Gender		
Male	515	50.7
Female	501	49.3
Age (yr)		
18-39	456	44.9
40-59	443	43.6
60 or over	117	11.5
Asset index (tercile)*		
1 (lower)	260	26.1
2	346	34.7
3 (higher)	391	39.2
Sleep quality		
Very good/good	739	72.7
Fair	187	18.4
Poor/very poor	90	8.9
Physical activity		
No	786	77.4
Yes	230	22.6
Body mass index *		
Underweight/normal	342	35.3
Overweight	383	39.5
Obese	244	25.2
Depression		
No	941	92.6
Yes	75	7.4
Fear of contracting COVID-19*		
No	836	83.6
Yes	164	16.4
Help with household chores		
No	452	44.5
Yes	564	55.5
Covid symptoms		
No	754	74.2
Yes	262	25.8

% Prevalence; *numbers may not add to total due to missing values.

Source: Authors.

Among overweight/obese individuals (Table 4), it was observed that the occurrence of back pain was PR = 1.59 (95%CI: 1.15 to 2.19) higher for the individuals who worked remotely. With respect to the kind and location of pain, remote workers had PR = 2.82 (95%CI: 1.15 to 6.92) more probability to present acute pain in the cervical area, and PR = 1.85 (95%CI: 1.04 to 3.29) more probability to present chronic low back pain, when compared to those who did not work

Table 2. Adjusted analysis in Poisson regression models for factors associating work and back pain during the COVID pandemic in adult and older in population in Rio Grande, RS, and Criciúma, SC, Brazil, 2020 (n = 1,016).

Exposure: remote work (yes)	Crude analysis			Adjusted analysis *		
	Effect measure PR	95% CI	p-value	Effect measure PR	95% CI	p-value
Outcomes:						
Back pain	1.31	0.96;1.79	0.085	1.34	0.98;1.84	0.068
Acute back pain	1.11	0.65;1.91	0.697	1.09	0.64;1.84	0.748
Chronic back pain	1.49	0.96;2.33	0.077	1.57	0.98;2.50	0.059
Cervical (neck, shoulders) pain	1.38	0.69;2.79	0.360	1.29	0.64;2.58	0.474
Thoracic pain	0.82	0.38;1.75	0.597	0.95	0.44;2.06	0.891
Low back pain	1.22	0.82;1.83	0.328	1.24	0.84;1.84	0.268
Acute cervical (neck, shoulders) pain	2.46	1.11;5.44	0.027	2.11	0.89;5.00	0.089
Chronic cervical (neck, shoulders) pain	0.66	0.19;2.27	0.501	0.61	0.19;2.00	0.409
Acute thoracic pain	0.74	0.21;2.54	0.623	0.78	0.24;2.55	0.676
Chronic thoracic pain	0.86	0.33;2.24	0.760	1.06	0.40;2.81	0.903
Acute low back pain	0.88	0.42;1.85	0.739	0.85	0.42;1.72	0.654
Chronic low back pain	1.53	0.91;2.56	0.105	1.69	0.98;2.92	0.058
Back pain intensity	1.19	0.85;1.66	0.299	1.25	0.89;1.74	0.193

BMI: Body Mass Index; PR: prevalence ratio; 95%CI: 95% confidence interval. * Adjustment for gender, age, asset index, sleep quality, physical activity, depression, fear of contracting COVID, help with household chores, COVID symptoms.

Source: Authors.

Table 3. Adjusted analysis in Poisson Regression models for factors associating work and back pain during the COVID pandemic in adult and older with normal BMI in population in Rio Grande, RS and Criciúma, SC, Brazil, 2020 (n = 342).

Exposure: remote work (yes)	Crude analysis			Adjusted analysis *		
	Effect measure PR	95%CI	p-value	Effect measure PR	95%CI	p-value
Outcomes:						
Back pain	0.78	0.33; 1.84	0.21	0.79	0.32; 1.92	0.591
Acute back pain	0.74	0.21; 2.59	0.632	0.76	0.19; 3.01	0.688
Chronic back pain	0.82	0.24; 2.79	0.746	0.89	0.26; 3.02	0.844
Cervical (neck, shoulders) pain	1.21	0.23; 6.44	0.820	1.15	0.22; 5.88	0.869
Thoracic pain	0.61	0.14; 2.68	0.504	0.74	0.17; 3.19	0.686
Low back pain	0.61	0.19; 1.98	0.402	0.56	0.20; 1.54	0.257
Acute cervical (neck, shoulders) pain	1.37	0.13; 14.27	0.792	1.30	0.04; 44.9	0.883
Chronic cervical (neck, shoulders) pain	1.10	0.12; 10.36	0.935	0.71	0.22; 2.25	0.551
Acute thoracic pain	**	**	**	1.81	3.76; 8.68	< 0.001
Chronic thoracic pain	0.97	0.21; 4.36	0.965	0.91	0.18; 4.53	0.906
Acute low back pain	0.76	0.17; 3.39	0.714	0.61	0.16; 2.34	0.468
Chronic low back pain	0.41	0.05; 3.18	0.393	0.70	0.11; 4.59	0.707
Back pain intensity	0.54	0.23; 1.27	0.155	0.50	0.19; 1.31	0.158

BMI: Body mass index; PR: Prevalence ratio; 95%CI: 95% confidence interval. * Adjustment for gender, age, asset index, sleep quality, physical activity, depression, fear of contracting COVID, help with household chores, COVID symptoms. **Acute thoracic back pain (Crude analysis): there was not enough n for the analysis.

Source: Authors.

Table 4. Adjusted analysis in Poisson Regression models for factors associating work and back pain during the Covid pandemic in adult and older with overweight/obesity BMI in population in Rio Grande, RS and Criciúma, SC, Brazil, 2020 (n = 627)

Exposure: remote work (yes) Outcomes:	Crude analysis			Adjusted analysis *		
	Effect measure PR	95%CI	p-value	Effect measure PR	95%CI	p-value
Back pain	1.56	1.12; 2.16	0.009	1.59	1.15; 2.19	0.006
Acute back pain	1.39	0.75; 2.59	0.288	1.41	0.79; 2.54	0.244
Chronic back pain	1.67	1.00; 2.77	0.049	1.67	0.98; 2.85	0.059
Cervical (neck, shoulders) pain	1.47	0.74; 2.93	0.266	1.39	0.72; 2.69	0.328
Thoracic pain	0.96	0.39; 2.32	0.918	1.10	0.47; 2.61	0.818
Low back pain	1.44	0.94; 2.21	0.095	1.47	0.98; 2.20	0.064
Acute cervical (neck, shoulders) pain	3.10	1.30; 7.43	0.012	2.82	1.15; 6.92	0.025
Chronic cervical (neck, shoulders) pain	0.54	0.13; 2.34	0.407	0.50	0.12; 2.05	0.334
Acute thoracic pain	1.25	0.34; 4.64	0.737	1.17	0.41; 3.39	0.765
Chronic thoracic pain	0.77	0.22; 2.68	0.683	1.01	0.31; 3.32	0.991
Acute low back pain	1.02	0.42; 2.45	0.966	1.04	0.48; 2.25	0.930
Chronic low back pain	1.80	1.04; 3.13	0.036	1.85	1.04; 3.29	0.038
Back pain intensity	1.46	1.02; 2.07	0.037	1.51	1.07; 2.13	0.018

BMI: Body mass index; PR: Prevalence ratio; 95%CI: 95% confidence interval. * Adjustment for gender, age, asset index, sleep quality, physical activity, depression, fear of contracting COVID, help with household chores, COVID symptoms.

Source: Authors.

remotely. In the same line, the intensity of back pain was PR = 1.51 (95%CI: 1.07 to 2.13) higher for individuals who worked remotely during the pandemic when compared to those who did not work remotely (Table 4). The effect of remote work on back pain was higher for men at the cervical area, women at the lumbar area, middle-aged adults and poorer individuals. (p-value of interaction < 0.1).

Discussion

This study shows that individuals who worked remotely during the COVID-19 pandemic were more likely to feel Back Pain^{2,3}, with higher risk of pain in the cervical and thoracic regions, and chronic pain at the lower back as well as more intense back pain, being observed especially in overweight/obese individuals when compared to eutrophic ones.

Even though we did not investigate the ergonomic and postural issue, we hypothesized that the strong association of cervical pain can be due to high muscular tension caused by poor posture and the gravitational force exerted by the head on the cervical spine, which may have a nega-

tive impact, conducive to acute pain, especially in overweight/obese individuals^{6,18}. On the other hand, our results also showed that eutrophic individuals reported acute pain in the thoracic region, which suggests that such symptoms can be explained by the transition of the workplace to remote work and the excessive use of laptops/cell phones, with postures inadequate¹⁹.

In addition, the ergonomic aspect in the sitting position makes that the activation of the lumbar muscles is very low, which can lead to deconditioning and an overload on other structures such as ligaments and intervertebral discs⁷. Activation of the superficial lumbar multifidus muscles, internal oblique and spinal erector muscles diminishes at passive sitting and standing postures, but increases at erect postures, indicating a stabilizing postural role for these muscles²⁰. Therefore, poor postures, sedentary lifestyle and obesity can develop or worsen pain in this area, and even evolve to chronicity or higher pain severity^{1,21}.

In this view, we analyzed the effects for those overweight/obese individuals to evaluate the result about back pain. It is clear that this group is more likely to infer chronic pain mainly in the lumbar region, where the impact is greater when compared to eutrophic individuals^{10,11}.

Studies^{1,3} have shown that being physically inactive during the confinement may contribute to obesity and aggravate pain symptoms in remote workers. There are evidences about the effect of obesity on the degenerative process of intervertebral disks, which can suggest that this chronic disease is associated with chronic back pain²², especially during the productive period of human life when exposure to work stresses and lack of physical activity are present in the long run, and aggravated with social distancing^{1,21,23}.

It should be noted that these teleworkers may have been exposed to workloads with excessive use of computer in ergonomic conditions be potentially worse. Working hours tend to increase due to the lack of clear limits between what is the workplace and the individual's home. The activities that were performed face-to-face, such as meetings, have also become online. Thus, there is practically no break time since the activities have become restricted to computer/mobiles. All this load imposed may contribute to more stress and, consequently, more back pain¹⁻⁴.

As limitations, it is not possible to identify causal relations because it is a cross-sectional study. For instance, it is not known if the individuals who reported low back pain already had chronic pain before working remotely or if the chronicity was set during social distancing, i.e., pain felt for over three months¹⁵. Furthermore, it is possible that some result can be affected by a recall bias, especially acute pain due to the fact that the individual may not remember a short episode of back pain, which may have underestimated the results of associations with pain. Our study did not evaluate the ergonomics of home environments, it is only assumed that there is no

suitable environment for remote work, however, it showed that these workers reported having a greater chance of pain in regions that are often related to ergonomics^{2,6,19}. Some results such as chronic back pain ($p = 0.059$) and low back pain ($p = 0.064$) were probably affected by low statistical power in those overweight/obese individuals. Finally, it should be noted that the variables collected were self-reported, and this may be subject to some bias, such as the BMI, which may not match reality.

As strengths, this is the only population-based study conducted in Brazil on this topic, and one of the few studies worldwide that had a representative sample of the population. In addition, the interviews were conducted personally in the individuals' homes, which included people with no access to the internet.

In conclusion, our study found that approximately one in four remote workers experienced Back Pain during the restrictive measures of the COVID-19 pandemic. It was observed that these workers, especially the overweight/obese ones were more likely to experience acute pain in the cervical and the thoracic regions, and chronic pain in the lower back, showing that BMI is an important moderator between outcomes and exposure variable. Exposure to ergonomically inappropriate environments and with longer working hours may have had a negative impact on back pain during the pandemic¹⁻⁴. Given the above, it is considered important to implement actions virtually for pain management in this population, with ergonomic, physical and psychological guidelines. Prevention of back pain among the productive population is the best way to reduce disabilities and additional costs to public health.

Collaborations

E Saes-Silva drafted the first version and performed data analysis. MO Saes and RD Meucci critically reviewed the manuscript. SC Dumith, F Meller and A Schäfer conceived the study and critically reviewed the manuscript.

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