https://doi.org/10.4322/rae.v15n2.e202113.en

EVALUATION OF MULTIPLE RISK FACTORS FOR THE DEVELOPMENT OF WORLD IN THE HANDS OF COUNTRY WORKERS

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SUMMARY: Many ergonomic interventions sought to solve the so-called Work-Related Musculoskeletal Disorders (WMSDs). Inadequate postures, excessive forces, handling of materials, repetitive movements have been responsible for a high number of cases, especially in the upper limbs. The purpose of this work is to identify and evaluate the risk factors that influence the development of WMSDs in the region of the hands of country workers in the health, education, industry and commerce sectors in enterprises in the backlands of Alagoas. This is a study with exploratory characteristics, seeking to understand the risk factors and musculoskeletal symptoms in the hands of these workers. Data were collected through questionnaires and ordinal logistic regression modeling was performed to evaluate their relationships. The results demonstrated that the symptoms have a multifactorial origin. Some factors may affect just one hand or both. The use of vibrating tools for more than 6 hours a day increased the chance of symptoms by six times and three times for the right and left sides of the hands, respectively. On the other hand, jobs that require the use of hands and fingers for more than an hour are up to four times more likely to report symptoms only in the right hand. It is concluded that the factors vary in intensity according to the dimension analyzed, the time of exposure to the risk and the presence of indirect action factors, such as psychosocial factors.

KEYWORDS: DORT; Logistic Regression; Hands; Dimídios; Biomechanical factors; Psychosocial variables.

INTRODUCTION

Work-Related Musculoskeletal Disorders (WMSDs) are a set of diseases that affect the bones, joints, muscles and spine (ALI et al., 2018), causing harm to the occupational health of workers. Work-related factors such as repetitive work, long working hours and work intensification increase the possibility of WMSDs appearing. Therefore, these disorders have a multifactorial origin (NAMBIEMA et al., 2020) and occur predominantly in the upper limbs (BRASIL, 2002).

Some individual factors (age, body mass index, among others) and biomechanical factors, such as physical demands and stress, act directly on WMSDs; however, in a similar way, organizational and psychosocial factors also act indirectly (BODIN et al., 2020). The recognition of these factors is relevant, because it brings benefits to employers and employees, being able to support scientific data that will assist in the development of public policies aimed at reducing the prevalence and incidence of these problems. Furthermore, they can also minimize costs related to employee health (MÉNDEZ-HERNANDEZ et al., 2012), reducing leave certificates and social security expenses (LAUX et al., 2016) and significantly improving working conditions (BISPO et al., 2020).

The use of hands to carry out work activities is one of the oldest ways used by humans to ensure conditions for their subsistence. Depending on the activity, the hands are the part most affected by typical accidents and, despite injuries, many workers return to work activities without fully reestablishing their functions, that is, still experiencing difficulties (GONÇALVES et al., 2018). Focusing on the upper limbs, it is highlighted that equipment, tools and utensils are essentially designed for right-handed people. In this sense, for claimants, this becomes a challenge, as people have significantly better muscular performance when using their dominant hand (IIDA, 2005).

Some accidents in the production environment in the upper limbs (hands and fingers) are related to the incorrect use of machines and equipment, lack of attention or excessive confidence on the part of employees in carrying out their tasks (ARAÚJO et al., 2018). Service provider workers dedicate greater efforts to training to acquire skills, not taking preventive techniques into account, for example. This scenario causes symptoms to be frequent due to the lack of adequate breaks during the workday, high pace of work or for prolonged periods (KOZAK et al., 2019).

Studies among workers in the health, education, industry and commerce sectors in enterprises in the backlands of Alagoas are scarce, and deserve greater attention in their evaluation and understanding. Therefore, this article aims to carry out a multifactorial assessment (sociodemographic, occupational, psychosocial and biomechanical) of occupational risks and their relationships with WMSD symptoms, essentially in the hands of country workers.

METHODS

The population of this research consists of 13 establishments located in the Sertão of Alagoas and Bahia, belonging to the health, industry, commerce and education sectors. The

sample was made up of individuals who met the requirements: participating voluntarily, at least 18 years old, having a permanent contract with the company and being in good health. Thus, the total sample was 420 workers.

For the development of this study, a self-administered questionnaire was applied with the objective of collecting information, which is composed of two parts related to the dependent variable (symptoms in the hands) and the independent variables (sociodemographic, biomechanical, occupational and psychosocial).

Symptoms of musculoskeletal pain in workers' hands were extracted using the adapted version of the Nordic Musculoskeletal Questionnaire (NMQ) (KUORINKA et al., 1987), with a five-level Likert scale (1 – no pain; 2 – mild pain; 3 – moderate pain; 4 – severe pain; 5 – extreme pain). The sociodemographic factors collected were sex, age, BMI (Brazilian Association for the Study of Obesity and Metabolic Syndrome, 2016), education, marital status (single and married), whether they have children and whether they practice physical activity.

In relation to biomechanical factors, data were collected to evaluate how many hours per day the worker was exposed to the following situations: working while standing; sitting work; work with a twisted torso; work handling loads; work performing repetitive movements; work using hands and fingers, and work using hand tools. These factors were categorized as rarely (less than 1 hour per day), frequently (between 1 and 6 hours per day) and always (more than 6 hours per day).

Occupational factors were considered to be professional category, work environment, time worked in the company, time worked per week, time worked between holidays, whether you have another job and variation in activities based on items from the Copenhagen Psychosocial Questionnaire. II -COPSOQ II) (PEJTERSEN et al., 2010).

The psychosocial factors extracted were “psychological demands”, “control over work”, “job insecurity”, “support from co-workers”, which were measured using the Job Content Questionnaire (JCQ) (KARASEK et al., 1998) ; “the meaning of work”, “commitment to the workplace”, “job satisfaction” and “work-family conflict” were assessed using COPSOQ II (PEJTERSEN et al., 2010) and the categories of perception of reward and excessive commitment of workers, which was verified by items from the Effort–Reward Imbalance (ERI) Questionnaire (SIEGRIST et al., 1996). “Physical demands” and “effort” were assessed using items from the JCQ (KARASEK et al., 1998) and the ERI (SIEGRIST et al., 1996), respectively. An item about motivation was also considered as a psychosocial factor. All items used a five-point Likert scale as an alternative response (1 - never; 2 - rarely; 3 - sometimes; 4 - often; and 5 - always).

All data collected via JCQ, COPSOQ II and ERI items had their internal consistency and reliability assessed using Cronbach's alpha (α) and Mcdonald's Omega (ωt). The confirmatory factor analysis (CFA) data adjustment was performed using Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) test. Using an ordinal logistic regression model, the relationship between the factors and WMSD symptoms was verified, and the odds ratio (OR) was extracted by the model, to demonstrate the increase or reduction in the chances of workers developing musculoskeletal disorders.

Observations that behaved as leverage points (influential and inconsistent) were excluded. Finally, the accuracy of the models was estimated, considering good precision to be

those with a value above 50% (SILVA et al., 2017). Such statistical procedures were all carried out with the aid of the R software (R CORE TEAM, 2020) version 3.6.3.

RESULTS

To characterize the sample, data collected via items from the Nordic questionnaire, JCQ, COPSOQ II and ERI were used, whose internal consistency and reliability were assessed using Cronbach's alpha (α) and Mcdonald's Omega (ωt), the parameters used for the results were: greater than or equal to 0.70 with ωt > α (ZINBARG et al., 2005). Test results have been shown to be reliable and have good internal consistency. Bartlett's sphericity test and KMO are in agreement with what is said by Hair et al. (2009), presenting $\chi2=63.55$ ($p = 0.000$), $\chi2=211.11$ ($p = 0.000$) and $\chi2=38.49$ ($p = 0.002$); and KMO equal to 0.73, 0.74 and 0.76, respectively, for the COPSOQ II, JCQ and ERI items. The CFA results are presented in (Table 1). Values of F<0.30 and h2 <0.20 were excluded from the study.

Table 1 – Summary of factors by AFC

Biomechanical Factors					**Psychosocial Factors**										
Independent variables	F	h2	F*	h2*	**Independent variables**	F	h2	F*	h2*	**Independent variables**	F	h2	F*	h2*
Physical demands	0,45	0,2	0,45	0,2	Meaning of work	0,55	0,3	0,55	0,3	Control over work	0,45	0,2	0,45	0,2
	0,45	0,2	0,45	0,2		0,86	0,74	0,87	0,75		0,45	0,2	0,45	0,2
	0,45	0,2	0,45	0,2		0,66	0,44	0,66	0,44		0,45	0,2	0,45	0,2
	0,45	0,2	0,45	0,2	Commitment to the workplace	0,64	0,4	0,67	0,44		0,45	0,2	0,45	0,2
	0,45	0,2	0,45	0,2		0,71	0,51	0,74	0,55		0,45	0,2	0,45	0,2
Effort	0,75	0,57	0,76	0,57		0,34	**0,12**	-	-		0,45	0,2	0,45	0,2
	0,75	0,57	0,75	0,56	Psychological demands	0,45	0,2	0,45	0,2	Job Satisfaction	0,5	0,25	0,5	0,3
	-0,28	**0,08**	-	-		0,45	0,2	0,45	0,2		0,42	0,2	0,42	0,2
	0,55	0,3	0,55	0,3		0,45	0,2	0,45	0,2		0,78	0,61	0,78	0,6
	0,33	**0,11**	-	-		0,45	0,2	0,45	0,2		0,82	0,67	0,82	0,7
	0,46	0,22	0,46	0,22		0,45	0,2	0,45	0,2	Social support from coworkers	0,45	0,2	0,45	0,2
Occupational factors					Job insecurity	0,45	0,2	0,45	0,2		0,45	0,2	0,45	0,2
Independent variables	F	h2	F*	h2*		0,45	0,2	0,45	0,2		0,45	0,2	0,45	0,2
Independent variables	0,45	0,2	0,45	0,2		0,45	0,2	0,45	0,2		0,45	0,2	0,45	0,2
						0,45	0,2	0,45	0,2		0,45	0,2	0,45	0,2
						0,45	0,2	0,45	0,2		0,45	0,2	0,45	0,2
					Social support from supervisors	0,45	0,2	0,45	0,2	Motivation	0,45	0,2	0,45	0,2
						0,45	0,2	0,45	0,2	Control work family	0,7	0,5	0,7	0,5
						0,45	0,2	0,45	0,2		0,9	0,82	0,9	0,8
						0,45	0,2	0,45	0,2		0,57	0,33	0,57	0,3
						0,45	0,2	0,45	0,2	Reward	0,72	0,51	0,71	0,5
					Excessive commitment	0,43	0,2	0,44	0,21		0,95	0,9	0,95	0,9
						0,57	0,32	0,57	0,33		0,7	0,5	0,7	0,5
						0,23	**0,05**	-	-		0,43	0,2	0,42	0,2
						0,59	0,35	0,6	0,36		**0,05**	**0**	-	-
						0,84	0,71	0,83	0,68		**0,08**	**0,01**	-	-
						0,71	0,5	0,71	0,5					

Note 1: F* and h2* are the values of F and h2 after deleting items.
Note 2: Excluded items present F and h2 values in bold.

Source: Authors (2021)

The profile of the majority of workers who participated in the research were women aged between 18 and 44, married, with at least one child and a BMI classified as normal, but with some tendency to be overweight (Table 2). Despite this trend, a little more than half of the workers reported practicing physical activity. With regard to education, professionals are most prominently grouped into two groups, secondary education and complete higher education.

Table 2 – Summary of sociodemographic factors by economic activity

Variables	**Health (n=167)**		**Industry (n=59)**		**Education (n=159)**		**Business (n=35)**		**Geral (n=420)**	
	Nº	**%**	**Nº**	**%**	**Nº**	**%**	**Nº**	**%**	**Nº**	%
Biological sex										
Feminine	134	80,24	21	35,59	122	76,73	27	77,14	304	72,38
Masculine	33	19,76	38	64,41	37	23,27	8	22,86	116	27,62
Age										
18-44 years old	119	71,26	47	79,66	107	67,30	30	85,71	303	72,14
45 years or older	48	28,74	12	20,34	52	32,70	5	14,29	117	27,86
BMI (kg/m²)										
Under weight	3	1,80	1	1,69	2	1,26	3	8,57	9	2,14
Normal weight	64	38,32	33	55,93	103	64,78	17	48,57	217	51,67
Overweight	65	38,92	20	33,90	38	23,90	12	34,29	135	32,14
Type I obesity	24	14,37	5	8,47	13	8,18	3	8,57	45	10,71
Type II obesity	7	4,19	0	0,00	3	1,89	0	0,00	10	2,38
Type III obesity	4	2,40	0	0,00	0	0,00	0	0,00	4	0,95
Education										
Incomplete Elementary	5	2,99	19	32,20	0	0,00	4	11,43	28	6,67
Complete fundamental	4	2,40	11	18,64	2	1,26	2	5,71	19	4,52
Incomplete midfielder	1	0,60	9	15,25	0	0,00	5	14,29	15	3,57
Full medium	84	50,30	18	30,51	19	11,95	22	62,86	143	34,05
Incomplete higher	9	5,39	0	0,00	27	16,98	0	0,00	36	8,57
Graduated	60	35,93	2	3,39	71	44,65	2	5,71	135	32,14
Postgraduate	4	2,40	0	0,00	40	25,16	0	0,00	44	10,48
marital status										
Single	81	48,50	26	44,07	74	46,54	19	54,29	200	47,62
Married	86	51,50	33	55,93	85	53,46	16	45,71	220	52,38
Children										
Yes	113	67,66	51	86,44	102	64,15	24	68,57	290	69,05
No	54	32,34	8	13,56	57	35,85	11	31,43	130	30,95
Physical activity										
Does not perform	71	42,51	25	42,37	85	53,46	20	57,14	201	47,86
Perform	96	57,49	34	57,63	74	46,54	15	42,86	219	52,14

Source: Authors (2021)

The description of professionals in each sector (Table 3) is, in general, homogeneous. The health sector is the only group that presents a higher percentage of overweight prevalence, even the category indicating physical activity. Education professionals have a higher level of education, having completed a higher education course. Finally, only in the industrial sector is the male participation rate higher than that of females. Table 4 presents data on biomechanical factors. As a diagnosis of work positions and movements, activities that require repetitive

movements range from up to 1 hour (43.81%) of the working day. Only 9 workers (2.14%) carry out activities with hand tools for more than 6 hours, but 91.9% work in a period of less than 1 hour, while the use of hands and fingers is carried out for more than 6 hours per most workers (44.76%).

Among the psychosocial factors addressed, almost all had a higher prevalence in the 'high' classification (Table 5). The majority of workers have high meaning for work (68.33%), high motivation (56.9%), high commitment (56.90%), high support from co-workers (56.19%) and high reward (54.05%). Low job stability was highlighted by 55.71% of respondents and conflict between work and family was low for 52.86% of workers.

Table 3 – Summary of occupational factors by economic activity

Variables	Health (n=167)		Industry (n=59)		Education (n=159)		Business (n=35)		Geral (n=420)	
	Nº	%	Nº	%	Nº	%	Nº	%	Nº	%
Desktop										
Private	34	20,35	59	100,00	2	1,26	35	100,00	130	30,95
Public	133	79,65	0	0,00	157	98,74	0	0,00	290	69,05
Time worked at the company (years)										
Less than or equal to 1 year	35	20,95	3	5,08	20	12,58	16	45,71	74	17,62
Between 2 and 15 years old	99	59,28	54	91,53	75	47,17	17	48,57	245	58,33
Between 16 and 30 years old	24	14,37	2	3,39	60	37,74	2	5,71	78	18,57
More than 30 years	9	5,39	0	0,00	5	3,14	0	0,00	23	5,48
Hours worked per week										
Less than or equal to 15 hours	2	1,20	16	27,12	19	11,95	25	71,43	62	15,00
Between 16 and 40 hours	114	68,26	0	0,00	126	79,25	0	0,00	240	57,00
Between 41 and 60 hours	49	29,34	43	72,88	12	7,55	10	28,57	114	27,00
More than 60 hours	2	1,20	0	0,00	2	1,26	0	0,00	4	1,00
Working time between vacations (in months)										
Less than or equal to 6 months	2	1,20	0	0,00	31	19,5	0	0,00	33	7,86
Between 7 and 11 months	88	52,69	16	27,12	57	35,85	3	8,57	164	39,05
More than 11 months	77	46,11	43	72,88	71	44,65	32	91,43	223	53,1
Another job										
Yes	55	32,93	2	3,39	59	37,11	4	11,43	120	28,57
No	112	67,07	57	96,61	100	62,89	31	88,57	300	71,43

Source: Authors (2021)

Table 4 – Summary of biomechanical factors by economic activity

Variables	Health (n=167)		Industry (n=59)		Education (n=159)		Business (n=35)		Geral (n=420)	
	Nº	%	Nº	%	Nº	%	Nº	%	Nº	%
Work in a standing position										
Less than 1 hour	19	11,38	4	6,78	15	9,43	6	17,14	44	10,48
Between 1 and 6 hours	50	29,94	4	6,78	109	68,55	17	48,57	180	42,86
More than 6 hours	98	58,68	51	86,44	35	22,01	12	34,29	196	46,67
Works in a sitting position										
Less than 1 hour	49	29,34	51	86,44	50	31,45	13	37,14	163	38,81
Between 1 and 6 hours	101	60,48	5	8,47	95	59,75	20	57,14	221	52,62
More than 6 hours	17	10,18	3	5,08	14	8,81	2	5,71	36	8,57

Work in a squatting position										
Less than 1 hour	158	94,61	57	96,61	154	96,86	53	151,43	403	95,95
Between 1 and 6 hours	7	4,19	2	3,39	5	3,14	1	2,86	15	3,57
More than 6 hours	2	1,20	0	-	0	-	0	-	2	0,48
Upper limbs in uncomfortable position										
Less than 1 hour	102	61,08	29	49,15	93	58,49	24	68,57	248	59,05
Between 1 and 6 hours	50	29,94	11	18,64	61	38,36	4	11,43	126	30,00
More than 6 hours	15	8,98	19	32,20	5	3,14	7	20,00	46	10,95
Lower limbs in uncomfortable position										
Less than 1 hour	88	52,69	21	35,59	84	52,83	24	68,57	217	51,67
Between 1 and 6 hours	56	33,53	12	20,34	71	44,65	4	11,43	143	34,05
More than 6 hours	23	13,77	26	44,07	4	2,52	7	20,00	60	14,29
Works with a curved torso										
Less than 1 hour	90	53,89	24	40,68	104	65,41	24	68,57	242	57,62
Between 1 and 6 hours	65	38,92	14	23,73	109	68,55	11	31,43	144	34,29
More than 6 hours	12	7,19	21	35,59	1	0,63	0	-	34	8,10
Works with twisted torso										
Less than 1 hour	115	68,86	13	22,03	120	75,47	32	91,43	280	66,67
Between 1 and 6 hours	37	22,16	13	22,03	38	23,90	3	8,57	91	21,67
More than 6 hours	15	8,98	33	55,93	1	0,63	0	-	49	11,67
Works using hands/fingers										
Less than 1 hour	34	20,36	2	3,39	36	22,64	6	17,14	78	18,57
Between 1 and 6 hours	52	31,14	0	-	93	58,49	9	25,71	154	36,67
More than 6 hours	81	48,50	57	96,61	30	18,87	19	54,29	188	44,76
Carrying a load of up to 6kg										
Less than 1 hour	119	71,26	40	67,80	109	68,55	24	68,57	292	69,52
Between 1 and 6 hours	40	23,95	10	16,95	47	29,56	10	28,57	107	25,48
More than 6 hours	8	4,79	9	15,25	3	1,89	1	2,86	21	5,00
Carrying load from 6kg to 15kg										
Less than 1 hour	154	92,22	54	91,53	132	83,02	34	97,14	374	89,05
Between 1 and 6 hours	12	7,19	3	5,08	25	15,72	1	2,86	41	9,76
More than 6 hours	1	0,60	2	3,39	2	1,26	0	-	5	1,19
Carrying load from 16kg to 25kg										
Less than 1 hour	149	89,22	49	83,05	156	98,11	34	97,14	388	92,38
Between 1 and 6 hours	14	8,38	6	10,17	3	1,89	1	2,86	24	5,71
More than 6 hours	4	2,40	4	6,78	0	-	0	-	8	1,90
Repetitive movements										
Less than 1 hour	78	46,71	3	5,08	85	53,46	18	51,43	184	43,81
Between 1 and 6 hours	38	22,75	0	-	69	43,40	13	37,14	120	28,57
More than 6 hours	51	30,54	56	94,92	5	3,14	4	11,43	116	27,62
Use of hand tools										
Less than 1 hour	156	93,41	42	71,19	154	96,86	34	97,14	386	91,90
Between 1 and 6 hours	10	5,99	10	16,95	4	2,52	1	2,86	25	5,95
More than 6 hours	1	0,60	7	11,86	1	0,63	0	-	9	2,14

Source: Authors (2021)

Table 5 – Summary of psychosocial factors by economic activity

Variables	**Health (n=167)**		**Industry (n=59)**		**Education (n=159)**		**Business (n=35)**		**Geral (n=420)**	
	Nº	**%**	**Nº**	**%**	**Nº**	**%**	**Nº**	**%**	**Nº**	%
Meaning of work										

Low meaning	32	19,16	30	50,85	56	35,22	15	42,86	133	31,67
High meaning	135	80,84	29	49,15	103	64,78	20	57,14	287	68,33
Commitment to the workplace										
Low commitment	78	46,71	23	38,98	65	40,88	15	42,86	181	43,10
High commitment	89	53,29	36	61,02	94	59,12	20	57,14	239	56,90
Psychological demands										
Low demands	75	44,91	30	50,85	75	47,17	24	68,57	204	48,57
High demands	92	55,09	29	49,15	84	52,83	11	31,43	216	51,43
Control over work										
Low control	65	38,92	52	88,14	55	34,59	22	62,86	194	46,19
High control	102	61,08	7	11,86	104	65,41	13	37,14	226	53,81
Physical demands										
Low demands	74	44,31	16	27,12	96	60,38	19	54,29	205	48,81
High demands	93	55,69	43	72,88	63	39,62	16	45,71	215	51,19
Job insecurity										
Low stability	100	59,88	28	47,46	89	55,97	17	48,57	234	55,71
High stability	67	40,12	31	52,54	70	44,03	18	51,43	186	44,29
Motivation										
Low motivation	74	-	15	25,42	72	45,28	15	42,86	176	41,90
High motivation	93	55,69	44	74,58	87	54,72	20	57,14	244	58,10
Supervisor support										
Low support	73	43,71	27	45,76	79	49,69	21	60,00	200	47,62
High support	94	56,29	32	54,24	80	50,31	14	40,00	220	52,38
Support from co-workers										
Low support	66	39,52	20	33,90	82	51,57	16	45,71	184	43,81
High support	101	60,48	39	66,10	77	48,43	19	54,29	236	56,19
Effort										
Low effort	76	45,51	36	61,02	74	46,54	19	54,29	205	48,81
High effort	91	54,49	23	38,98	85	53,46	16	45,71	215	51,19
Reward										
Low reward	79	47,31	19	32,20	78	49,06	17	48,57	193	45,95
High reward	88	52,69	40	67,80	81	50,94	18	51,43	227	54,05
Excessive commitment										
Low commitment	85	50,90	30	50,85	70	44,03	22	62,86	207	49,29
High commitment	82	49,10	29	49,15	89	55,97	13	37,14	213	50,71
Job satisfaction										
Low satisfaction	76	45,51	20	33,90	84	52,83	14	40,00	194	46,19
High satisfaction	91	54,49	39	66,10	75	47,17	21	60,00	226	53,81
Work-family conflict										
Low conflict	95	56,89	30	50,85	76	47,80	21	60,00	222	52,86
High conflict	72	43,11	29	49,15	83	52,20	14	40,00	198	47,14

Source: Authors (2021)

Table 6 presents a summary of workers' levels of musculoskeletal discomfort in their hands. In general, the left hand reports less discomfort, 69.05% of the sample described being pain-free; however, it has the highest percentage for extreme pain (5.25%). While the right hand presented a higher percentage of moderate pain (13.81%) and severe pain (5.71%). Figure 1 shows the same information by economic activity performed, for the item 'mild pain' the highest incidence on the right hand is in the commerce sector (17%) and for the left hand it is in education (18%), the item ' moderate pain' occurs in 17% for education professionals in the right hand, and in 16% for industry, for the left limb. On both sides, the perceived intensity of

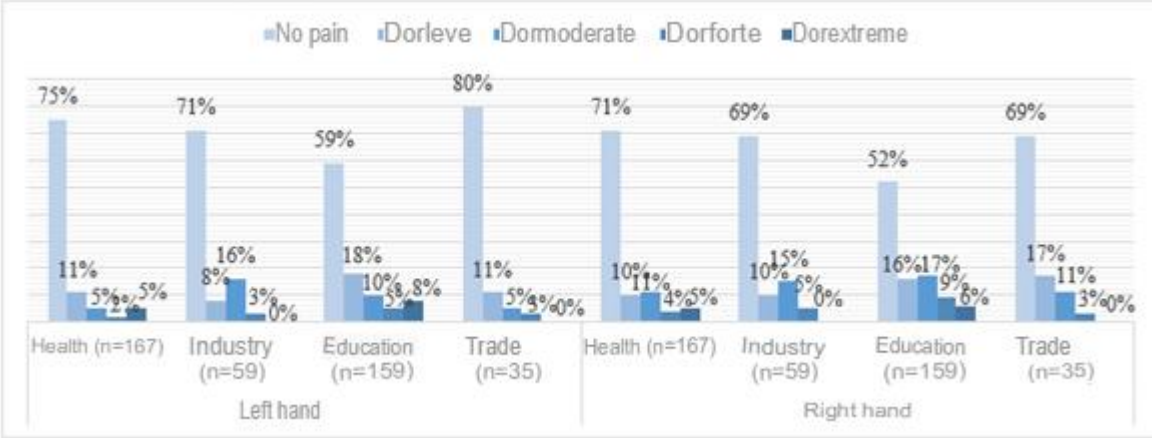
strong and extreme pain stands out among education workers, 'severe pain' with 9% and 5% and 'extreme pain' with 6% and 8% for the right and left hand, respectively.

Table 6 - Levels of musculoskeletal discomfort

Variables	Right hand		Left hand	
	Nº	%	Nº	%
Painless	266	63,33	290	69,05
Mild pain	55	13,10	56	13,33
Moderate pain	58	13,81	37	8,81
Strong pain	24	5,71	15	3,57
Extreme pain	17	4,05	22	5,24

Source: Authors (2021)

Figure 1 - Levels of musculoskeletal discomfort by economic activity



Source: Authors (2021)

Table 7 displays the results of the ordinal logistic regression models for the hands, so that the precision of the model, demonstrated by accuracy, for the right side was 65% and for the left side, 69%, proving its acceptability. There is a noticeable similarity in the risk factors in relation to the sides, the results indicate that some of these contribute to greater chances for a certain side of the body. The existing factors that have a chance of developing WMSD in this model for both sides are, in the case of sociodemographic data, education; for biomechanists, vibrant tools; and, for psychosocial issues, job satisfaction. On the other hand, when analyzing the elements: BMI, children, repetitive movements, work using hands and fingers and excessive commitment, it is observed that they only fit the model for the right hand. Otherwise, physical activity, uncomfortable lower limbs, physical demands and support from co-workers, only for the left hand.

Among the factors obtained as significant for the hands, the factor that presented a greater chance was education in the incomplete high school category (Table 5), indicating that the chance of the individual reporting a new level of symptom in the left hand increases by 11 times for the 'incomplete average' response category. Another fact that stands out is for the category of complete higher education in which the chance for the individual to present WMSD increases by almost seven times (OR= 6.87) for the right hand and almost 12 times (OR=11.83)

for that category. For BMI, there was direct significance only for type I obesity, with a 2.31% chance of presenting symptoms in the hands and an indirect relationship for overweight, with a 0.45% lower chance.

On the other hand, for biomechanical factors, the use of tools that vibrate the hands presented more significant chances for the right hand, being up to six times (OR=6.37) for individuals who carry out activities of this type for more than six hours per day. day, while for the left side there is three times more (OR=3.37), for the number of hours less than specified the relationship was inverse, with 0.61% less chance of developing symptoms. For psychosocial factors, high job satisfaction was linked to the report of pain relief, being up to 24% and 18% for the right and left hand, respectively.

Table 7 – Levels of musculoskeletal discomfort and risk factors

Variables	**Right hand (n=417)**	**Left hand (n=420)**
	Accuracy 65%	**Accuracy 69%**
	OR (95% CI) *p-value*	**OR (95% CI) *p-value***
Sociodemographic Factors		
BMI		
Normal weight	1,00 (Reference)	1,00 (Reference)
Under weight	0,00 (0,00 - 5,33x10^26) 0,81	-
Overweight	**0,55 (0,33 - 0,94) 0,03***	-
Type I obese	**2,31 (1,14 - 4,69) 0,02***	-
Type II obese	0,00 (0,00 - 1,07x10^25) 0,81	-
Type III obese	0,00 (0,00 - 1,01x10^41) 0,87	-
Education		
Incomplete fundamental	1,00 (Reference)	1,00 (Reference)
Complete fundamental	2,10 (0,29 -15,17) 0,46	2,21 (0,19 - 25,41) 0,52
Incomplete midfielder	2,68 (0,33 - 21,35) 0,35	**11,81 (1,12 - 124,19) 0,04***
Full medium	**6,85 (1,43 - 32,89) 0,02***	**8,50 (1, 07 - 67,45) 0,04***
Incomplete higher	**6,63 (1,22 - 36,14) 0,03***	6,33 (0,72 - 55,65) 0,09
Graduated	**6,87 (1,43 - 33,03) 0,02***	**11,83 (1,48 - 94,25) 0,02***
Postgraduate	3,99 (0,75 - 21,39) 0,11	6,43 (0,73 - 56,42) 0,09
Children		
None	1,00 (Reference)	1,00 (Reference)
At least one	**0,51 (0,31 - 0,84) 0,01***	-
Physical activity		
Does not perform	1,00 (Reference)	1,00 (Reference)
Perform	-	**0,62 (0,40 - 0,98) 0,04***
Biomechanical Factors		
Repetitive movements		
Less than 1 hour	1,00 (Reference)	1,00 (Reference)
Between 1 and 6 hours	**0,35 (0,19 - 0,64) 0,00***	-
More than 6 hours	**0,40 (0,21 - 0,75) 0,00***	-
Tools that vibrate hands		
Less than 1 hour	1,00 (Reference)	1,00 (Reference)
Between 1 and 6 hours	0,39 (0,12 - 1,28) 0,12	0,39 (0,13 - 1,17) 0,0929
More than 6 hours	**6,37 (2,52 - 16,05) 0,00***	**3,37 (1,29 - 8,76) 0,01***
Works using hands and fingers		
Less than 1 hour	1,00 (Reference)	1,00 (Reference)
Between 1 and 6 hours	**4,21 (1,76 - 10,10) 0,00***	-

More than 6 hours	**2,78 (1,13 - 6,8) 0,03***	-
Uncomfortable lower limbs		
Less than 1 hour	1,00 (Reference)	1,00 (Reference)
Between 1 and 6 hours	-	**2,30 (1,34 - 3,94) 0,00***
More than 6 hours	-	1,68 (0,88 - 3,26) 0,11
Psychosocial factors		
Job satisfaction		
Low satisfaction	1,00 (Reference)	1,00 (Reference)
High satisfaction	**0,76 (0,66 - 0,89) 0,00***	**0,82 (0,70 - 0,97) 0,02***
Psychosocial factors		
Excessive commitment		-
Low commitment	1,00 (Reference)	1,00 (Reference)
High commitment	**1,01 (1,01 - 1, 19) 0,02***	-
Physical Demands		-
Low demand	1,00 (Reference)	1,00 (Reference)
High demand	-	**1,22 (1,09 - 1,36) 0,00***
Support from Coworkers		
Low support	1,00 (Reference)	1,00 (Reference)
High support	-	**0,63 (0,46 - 0,85) 0,00***

Note: * indicates a significant relationship (in bold) with a p-value less than 0.05.
Source: Authors (2021)

DISCUSSION

According to Table 4, the sectors participating in this study have a 36% prevalence of hand pain. Specifying severe and extreme pain, there is a prevalence of around 9%. The relationship of factors in hand pain symptoms indicated an association with biomechanical, psychosocial and sociodemographic factors. The sectors of economic activities covered in this research are predominantly distinct and require specific skills and abilities to carry out the work. The results found in this study strengthen the association between risk factors in the workplace and the development of musculoskeletal disorders both on both sides of the hand and separately.

Of the factors that are present only in the right hand, it can be mentioned that the prevalence is in biomechanical factors (Repetitive movements and Work using hands and fingers) and for the left hand in psychosocial factors (Physical Demands and Support from co-workers) . On the other hand, the factors of education, tools that vibrate the hands and job satisfaction are present in both hands.

Most of the risk factors were mainly for the right hand, possibly due to the sample being right-handed. This observation finds support in Iida (2005), which indicates the existence of a dominant hand to carry out the activities. Dimate-Garcia and Rodríguez-Romero (2021) also point out that being right-handed is statistically associated with the appearance of symptoms in the hands and that this is linked to the dominance relationship.

Several studies include 'vibrating tools' as one of the risk factors responsible for WMSDs in the hands. As can be seen in the study by Xu et al. (2017), and prolonged exposure to hand-transmitted vibrations is associated with an increased risk of hand-arm vibration syndrome. Bovenzi et al. (2016) point out that with increased exposure to vibration, the occurrence of WMSDs increases, both in the hands and in the elbows, forearms and wrists. Complementing, Veisi et al. (2019) demonstrates the importance of the relationship between

the sizing of tools and the symptoms in the hands and the anthropometry of the operators, being able to reduce symptoms and improve posture.

Regarding education data, the final model shows that pain increases according to the worker's level of education, changing mainly after high school. This can be confirmed through the study by Guertler et al. (2021), in which they show that workers on shellfish farms, most of whom have less education, believe that they can better identify risks and receive training in occupational health and safety than those with more education, even though they suffer almost three times more accidents.

This study demonstrated an increase in the chances of pain for workers who perform repetitive movements. In the study by Park et al. (2021) there were results from the comparison of ergonomic risk factors for WMSDs between kitchen workers and other employees, showing that repetitive movements of the hands or arms have a proportion of 73.98% versus 54.25%. A study of hairdressers by Chen et al. (2010) points out that ergonomic risk factors such as the relatively greater effort and wrist speed of female hairdressers combined with prolonged exposure may be responsible for the higher rate of hand/wrist pain in hairdressers than in barbers. For Kozak (2019), hands are among the most affected parts of the body in hairdressers, indicating as causes the lack of breaks between activities exceeding tolerance limits, unfavorable posture, prolonged periods of standing, combined with constant repetition and fast pace .

Studies indicate that the influence of psychosocial factors is not direct, but is associated with the adoption of unfavorable postures and inappropriate movements (GOVINDU, 2017). There is also an association between physical demands and hand pain. According to Batista et al. (2019), within the health sector, work demand becomes a considerable risk factor due to insufficient time for work in activities outside the work environment, such as health care and leisure time. Maciel et al. (2019) show that among 53.8% of the sample, made up of nurses and technicians, they suggest the existence of musculoskeletal symptoms associated with the activities carried out by these professionals, pointing to the prevalence of musculoskeletal disorders in the hands as equivalent to 9.7%. And also the lack of support and support as directed by Silva et al. (2019) is also a potential risk factor.

CONCLUSION

The results indicated that hand pain has a multifactorial origin for the research participants. It is important to consider the differences presented on both sides of the body, with some factors inducing symptoms in only one hand, associated more with the right hand. Despite this, the left hand presented the highest percentage of extreme pain (5.71%). As for the sectors, it was pointed out that education and industry were the ones that presented the highest levels of discomfort in the left hand, respectively, and the education and commerce sectors for the right hand.

Among the most significant factors for hand pain are vibrations from vibrating tools and repetitive movements. However, the model was relevant to hand pain associated with the level of education, which was not as supported in the literature. Thus, the study reports findings that are rarely found scientifically.

From this, assertive mitigating actions on working conditions can be implemented to improve the quality of life, health and safety of workers, in addition to converting into positive effects on productivity, avoiding organizational costs and other losses. These measures must be aimed at ergonomics, work organization and governed by regulatory standards and other current legislation; in such a way that it is proposed to place employees as a key point in the entire production process. It is important to highlight that, due to its multifactorial origin, the model may vary according to the sample and its analyzed items, leading to the conclusion that other parts of the body and even other factors not mentioned may influence hand pain. .

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