



Musculoskeletal Disorders at Work among Slovenian Physiotherapists: Prevalence and Risk Factors

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Abstract

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BACKGROUND: Musculoskeletal disorders at work (MSDWs) remain the most common health problem in the European Union, particularly in Slovenia, where the prevalence of MSDWs is slightly above the European average. Despite the extensive literature on MSDWs in the health sector, there is little research on physiotherapists (PTs), especially in Europe. Our previous study showed a high prevalence of MSDWs among PTs, with the lower back, neck, and shoulder being the most affected.

AIM: The aim of this study was to investigate the prevalence of MSDWs among Slovenian PTs, ergonomic factors, and the association between MSDWs and demographics and MSDWs and ergonomic risk factors.

METHODS: The survey covered Slovenian PTs working in different health-care settings, using a non-randomized snowball sample. 198 PTs participated, after excluding 22 incomplete questionnaires, 176 PTs remained in the final sample. Data were collected through questionnaires covering demographics, ergonomic risk factors, and the incidence of pain and discomfort in the body.

RESULTS: The lifetime prevalence of MSDWs among 176 FTs was 97.7%. The most affected body regions were the neck (79.5%), upper back (59.2%) and lower back (51.7%). The 1-year prevalence of MSDWs was 94.9%, with the highest prevalence in the upper back (69.3%), neck (66.5%) and lower back (64.3%). The study identified a weak negative association between the prevalence of MSDWs and factors such as age, working life, and job satisfaction across various body regions.

CONCLUSIONS: The results of the survey confirm a high prevalence of MSDWs among Slovenian PTs, which is comparable to European surveys. Key risk factors include ergonomic load and demographic variables. These data highlight the need to improve working conditions and ergonomic measures in physiotherapy practice. The study contributes to a better understanding of MSDWs among PTs in Slovenia and provides a basis for further research and interventions to reduce the risk of MSDWs.

Introduction

Musculoskeletal disorders at work (MSDWs) are a group of painful disorders of muscles, tendons, and nerves. Examples include carpal tunnel syndrome, tendinitis, thoracic outlet syndrome, and tension neck syndrome [1]. MSDWs represent the most prevalent occupational health problems among workers in the European Union (EU), affecting all sectors and occupations [2]. The results from a European survey indicated that 58% of European workers had MSDWs within the past 12 months. The prevalence of MSDWs varies between countries, sectors, and occupations, as well as between sociodemographic groups. Slovenia reports a slightly higher prevalence (62%) of MSDWs than the average of the EU [2]. In Slovenia, MSDWs account for more than 15% of total health absenteeism and about 30% of absenteeism lasting more than a year [3].

Extensive literature exists on MSDWs in the health sector, but less research is available for the physiotherapy profession, particularly in Europe. In

our previous study [4], we conducted a systematic review of the literature, which revealed that MSDWs are highly prevalent among physiotherapists (PTs), with prevalence rates ranging from 48% to 92%. The lower back region was the most frequently affected (38–68.8%), followed by the neck (10–59.2%) and the shoulder (7–51.7%). Gorce and Jacquier-Bret [5] reported in their systematic review a prevalence of over 50% of MSDWs in PTs, with the most affected areas being the lower back (41.7 ± 19.3%), neck (36.2 ± 23.8%), and thumb (38.0 ± 40.0%).

European studies report varying prevalence rates of MSDWs among PTs, with a 1-year prevalence of 63.9% [6], a lifetime prevalence of 89% [7], and a lifetime prevalence of 84% [8]. Anyfantis and Biska [7] reported that 32.2% of injuries occurred within the first 5 years of work, with the most stressed PTs being those working as private practitioners. The most affected body regions were the lower back (38%), upper back (19%), shoulders (12%), neck (10%) and wrists (9%). Research on MSDWs among Slovenian PTs is limited.

Common risk factors for MSDWs among PTs include bending, lifting patients, working in the same

position for long periods of time, repetitive tasks, and performing manual therapy techniques [5]. Our previous study [4] found similar factors, including back strain, awkward posture, prolonged posture, frequent bending and twisting of the trunk, performing manual therapy techniques, lifting patients, repetitive tasks, work environment, and psychosocial problems. Kakaraparthi *et al.* [9] showed an association between MSDWs and age for the shoulder and lower back. Ezzatvar *et al.* [10] found an association between MSDWs and years of experience with the elbow, as well as the correlation between MSDWs and treating a large number of patients in a day, working ≥ 45 h/week and working in a sitting position for the lower back.

Our study was designed due to the limited research on MSDWs among PTs in Slovenia. Meh *et al.* [11] found a 1-year prevalence of MSDWs among Slovenian PTs of 92.2%, with the highest prevalence in the neck (64%) and lower back (63%). Risk factors included older age, longer working life, and treating a large number of patients in 1 day. Associations were found between MSDWs and age, and MSDWs and years of practice, especially for the shoulder and ankle/foot.

The aim of the study was to determine the prevalence of MSDWs in specific body regions among Slovenian PTs, to investigate ergonomic factors in physiotherapy practice, and to examine the association between MSDWs and demographic/ergonomic risk factors. This study builds on our previous literature review and addresses an under-researched topic. To our knowledge, this is the first study in Slovenia to establish the association between MSDWs and ergonomic factors, and it makes a significant contribution to understanding the prevalence of MSDWs among PTs and provides a basis for further research.

Methods

Study design

The study employed a descriptive and causal-non-experimental method of empirical research. It was a cross-sectional, prospective study using a quantitative data collection technique through a survey.

Selection of participants

The sample included PTs from various age groups working in primary, secondary, or tertiary care settings in the Republic of Slovenia. A non-probability snowball sampling method was used. Initially, 569 PTs accessed the questionnaire; however, 371 questionnaires were subsequently excluded due to incomplete data. A total of 325 questionnaires were

excluded, as the respondents had only clicked on the salutation. In addition, 46 questionnaires were excluded due to the respondents having only clicked on the survey, and 22 partially completed surveys were also excluded. The final sample included 176 PTs. The selection process is illustrated in Figure 1.

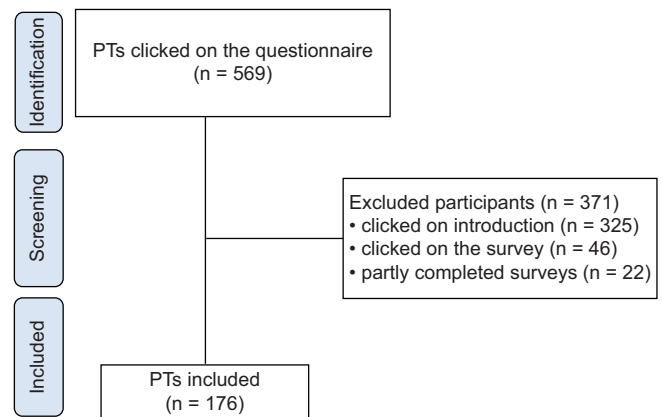


Figure 1: Participant selection process

Study tool

We used a structured measurement instrument in the form of an anonymous closed-ended survey questionnaire, which was developed based on the reviewed expert and scientific literature [11], [12], [13]. The survey was conducted using the 1 KA.si platform, an open-source application developed at the Centre for Social Informatics, Faculty of Social Sciences, University of Ljubljana [14]. The questionnaire was divided into three parts:

1. Demographic data: Questions included gender, age, level of education, years of experience in physiotherapy, working environment, area of clinical work, type of disease/disorder predominantly treated, number of patients treated per day, and job satisfaction.
2. Ergonomic risk factors: Fifteen ergonomic risk factors were evaluated. PTs reported the frequency of these factors on a five-point Likert scale from 1 to 5 (1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always).
3. Musculoskeletal problems: Questions focused on "problems," defined as 'pain or discomfort' in nine body areas. PTs indicated whether they ever had a problem and whether they had experienced it in the past 12 months, with responses of "yes" or "no" (1 = Had problems, 2 = Had no problems). These questions were derived from the Extended Nordic Musculoskeletal Questionnaire [9], [10], [11], [15], [16].

Ethical considerations

Ethical approval for this study was obtained from the Commission on Ethics in Research Involving

Human Subjects of the University of Novo Mesto Faculty of Health Science (UNM 46/2024). The research followed all ethical principles and protected the data obtained. Respondents were guaranteed anonymity. The purpose and importance of the survey were explained in the introduction of the questionnaire. The data were anonymized and used only for the purpose of the research.

Statistical analysis

Descriptive statistics were first employed to summarize the data. Subsequently, Pearson correlation coefficients were calculated to analyze the relationships between variables and MSDWs. Correlations with $p < 0.05$ were considered significant and were denoted as follows: * $p \leq 0.05$ and ** $p \leq 0.01$. The strength of the relationship for Pearson's Correlation Coefficient is interpreted according to Hinkle *et al.* [17] ($r < 0.5$ low correlation, $r = 0.5-0.7$ moderate correlation, $r > 0.7$ high correlation). The results are presented in tabular, graphical, and descriptive formats. The statistical analysis was performed using IBM SPSS version 29.

Results

Demographic characteristics

The sample comprised 176 PTs, with 85.2% females and 14.8% males. The mean age of the participants was 38.4 ± 11.08 years. The majority of PTs were employed in primary care settings, with 70.5% of them working with patients who have musculoskeletal problems. Over half of the PTs (53.4%) reported being satisfied with their work. Table 1 presents detailed demographic characteristics, including age distribution, level of education, years of experience, employment settings, areas of clinical work, types of diseases/disorders treated, number of patients per day, and job satisfaction.

Prevalence of MSDWs and most affected regions of the body

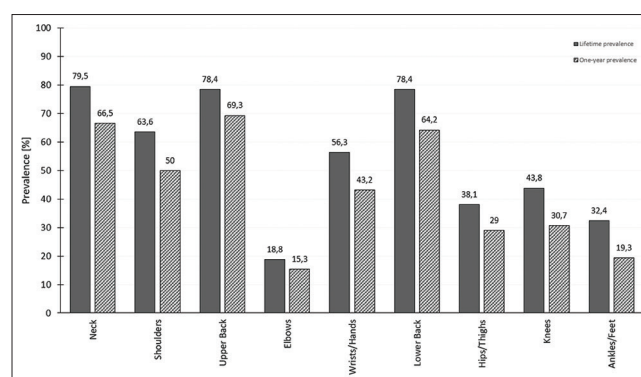
The lifetime prevalence of pain or discomfort in our sample was 97.7%, indicating that only 4 PTs did not experience pain or discomfort in any body area. The lifetime prevalence of pain or discomfort in each area in this sample was highest in the neck, upper back and lower back areas and lowest in the elbow area. The 1-year prevalence of pain or discomfort was 94.9%, showing that 167 PTs had experienced problems in at least one body area in the past 12 months. The 1-year prevalence was highest in the upper back, neck and lower back, and lowest in the elbows and ankles/feet.

Table 1: The physiotherapists' demographic data

Demographic variables	Subcategory	n	%
Sex	Male	26	14.8
	Female	150	85.2
Age	<30	52	29.5
	31-40	53	30.1
	41-50	37	21
	51>	34	19.3
Level of education	Higher School	14	8
	College	115	65.3
	University (previous)	26	14.8
	Master's (Bologna)	19	10.8
	Doctorate	2	1.1
	Time working in physiotherapy (years)	<2 years	27
	2-5 years	34	19.3
	6-10 years	30	17.0
	11-20 years	28	15.9
	21-30 years	39	22.2
	31-35 years	11	6.3
	36>years	7	4.0
Employment	Primary care	90	51.1
	Secondary care	64	36.4
	Tertiary care	22	12.5
Working environment	Health center	47	26.7
	Hospital	45	25.6
	Home of the elderly	23	13.1
	Natural health resort	18	10.2
	Rehabilitation center	9	5.1
	Private physiotherapy practice with a concession	12	6.8
	Private physiotherapy practice without a concession	14	8.0
	Other	8	4.5
	Area of clinical work	Pediatrics	36
	Geriatrics	59	33.5
	Sport field	25	14.2
	Gynecology	12	6.8
	No specific clinical specialty	70	39.8
	Other	36	20.5
Type of disease/disorders mainly treated	Musculoskeletal system	124	70.5
	Neuromuscular system	33	18.8
	Respiratory system	11	6.3
	Cardiovascular system	1	0.6
	Other	7	4.0
Number of patients per day	<10	69	39.2
	11-20	81	46.0
	21-30	16	9.1
	>31	10	5.7
Satisfaction at work	Very unsatisfied	4	2.3
	Unsatisfied	5	2.8
	Neither satisfied nor unsatisfied	20	11.4
	Satisfied	94	53.4
	Very satisfied	51	29.0
	I am not thinking about it	2	1.1

n: Number of PTs; %: Percent.

Graph 1 illustrates the lifetime and 1-year prevalence of pain or discomfort across various body areas.



Graph 1: Lifetime and 1-year prevalence of pain or discomfort in different body areas among physiotherapists

Risk factors

The most common risk factors for PTs are prolonged periods of standing, treating a large number of patients in 1 day, performing manual therapy techniques, repeating the same tasks in a bent position.

The ergonomic factor of vibration is the least frequently encountered by PTs in their work environment. Table 2 represents the prevalence and distribution of various ergonomic risk factors experienced by PTs, as rated on a five-point Likert scale from 1 (never) to 5 (always).

Correlation between MSDWs and demographic variables

The lifetime prevalence of MSDWs across various body areas was analysed in relation to several demographic variables, as detailed in Table 3. Significant weak negative correlations were observed between age and MSDWs in the neck ($r = -0.166$, $p = 0.028$), shoulders ($r = -0.252$, $p = 0.001$), wrists/hands ($r = -0.149$, $p = 0.048$), hips/thighs ($r = -0.267$, $p < 0.001$) and knees ($r = -0.166$, $p = 0.028$). Similarly, significant weak negative correlations were identified between working hours and MSDWs in the neck ($r = -0.152$, $p = 0.045$), shoulders ($r = -0.215$, $p = 0.004$) and hips/thighs ($r = -0.221$, $p = 0.003$). Employment status showed a significant weak negative correlation with MSDWs in the ankles/feet ($r = -0.157$, $p = 0.035$). The working environment variable exhibited a significant weak negative correlation with MSDWs in the wrists/hands ($r = -0.152$, $p = 0.044$). Furthermore, a significant weak positive correlation was observed between job satisfaction and MSDWs in the shoulders ($r = 0.180$, $p = 0.017$).

A weak negative correlation was observed between the 1-year prevalence of MSDWs and age in the shoulder ($r = -0.214$, $p = 0.004$) and hip/thigh ($r = -0.191$, $p = 0.011$) regions. Similarly, there was a weak negative association between the 1-year prevalence of MSDWs and working life in the shoulder ($r = -0.219$, $p = 0.004$) and hip/thigh ($r = -0.171$, $p = 0.023$) regions. In addition, a weak positive association was identified between the 1-year prevalence of MSDWs and job satisfaction in the shoulder region ($r = 0.150$, $p = 0.047$) (Table 4).

Correlation between MSDWs and risk factors

The correlation between the lifetime prevalence of MSDWs and various risk factors was analyzed.

A significant weak negative correlation was observed between prolonged static positions and MSDWs in the neck ($r = -0.171$, $p = 0.023$). Working in uncomfortable positions showed significant weak negative correlations with MSDWs in the neck ($r = -0.183$, $p = 0.015$) and knees ($r = -0.197$, $p = 0.010$). Repetitive tasks had a significant weak negative correlation with MSDWs in the shoulders ($r = -0.169$, $p = 0.026$) and knees ($r = -0.173$, $p = 0.023$). The number of patients treated on a single day was found to be significantly and weakly negatively correlated with MSDWs in the shoulders ($r = -0.191$, $p = 0.012$). Performing manual therapy techniques showed a significant weak negative correlation with MSDWs in the wrists/hands ($r = -0.203$, $p = 0.009$). There was a significant weak negative correlation between point pressure on the body and MSDWs in the neck ($r = -0.191$, $p = 0.013$) and wrists/hands ($r = -0.209$, $p = 0.007$). Working while physically fatigued showed significant weak negative correlations with MSDWs in the neck ($r = -0.150$, $p = 0.047$), shoulders ($r = -0.163$, $p = 0.032$), and hips/thighs ($r = -0.156$, $p = 0.041$). The occurrence of reaching or working away from the body was found to be significantly and weakly negatively correlated with the occurrence of musculoskeletal disorders in the neck ($r = -0.270$, $p < 0.001$), shoulders ($r = -0.202$, $p = 0.010$), lower back ($r = -0.223$, $p = 0.003$), hips/thighs ($r = -0.215$, $p = 0.006$), knees ($r = -0.166$, $p = 0.026$), and ankles/feet ($r = -0.149$, $p = 0.047$). A lack of breaks was found to be significantly and weakly negatively correlated with MSDWs in the shoulders ($r = -0.165$, $p = 0.029$). A significant weak negative correlation was observed between vibration exposure and MSDWs in the neck ($r = -0.190$, $p = 0.014$). The results also demonstrated a significant weak negative correlation between work scheduling and MSDWs in the shoulders ($r = -0.154$, $p = 0.037$) and wrists/hands ($r = -0.191$, $p = 0.012$) (Table 5).

The analysis revealed significant correlations between the 1-year prevalence of MSDWs and a number of risk factors, as detailed in Table 6. A significant weak negative correlation was observed between prolonged static positions and MSDWs in the shoulders ($r = -0.189$, $p = 0.017$) and ankles/feet ($r = -0.164$, $p = 0.030$). The prevalence of MSDWs was significantly

Table 2: Prevalence and distribution of ergonomic risk factors experienced by physiotherapists

Risk factors	1—never, n (%)	2—rarely, n (%)	3—neither rarely nor often, n (%)	4—often, n (%)	5—always, n (%)	\bar{x}	SD
Prolonged static positions	9 (5.1)	74 (42.0)	39 (22.2)	52 (29.5)	2 (1.1)	2.8	0.96
Working in uncomfortable positions	1 (0.6)	61 (34.7)	52 (29.5)	59 (33.5)	3 (1.7)	3.0	0.88
Bending	1 (0.6)	38 (21.6)	48 (27.3)	79 (44.9)	10 (5.7)	3.3	0.90
Standing working position	1 (0.6)	13 (7.4)	22 (12.5)	110 (62.5)	30 (17.0)	3.9	0.79
Transfer of patients	17 (9.7)	66 (37.5)	23 (13.1)	55 (31.3)	15 (8.5)	2.9	1.19
Repetitive tasks	2 (1.1)	30 (17.09)	50 (28.4)	80 (45.5)	14 (8.0)	3.4	0.90
Treating a large number of patients in 1 day	1 (0.6)	23 (13.1)	30 (17.0)	83 (47.2)	39 (22.2)	3.8	0.96
Performing manual therapy techniques	0 (0)	28 (15.9)	37 (21.0)	92 (52.3)	19 (10.8)	3.6	0.88
Point pressure on the body	13 (7.4)	46 (26.1)	53 (30.1)	57 (32.4)	7 (4.0)	3.0	1.02
Working while physically fatigued	12 (6.8)	66 (37.5)	50 (28.4)	43 (24.4)	5 (2.8)	2.8	0.98
Reaching or working away from the body	10 (5.7)	80 (45.5)	52 (29.5)	30 (17.0)	4 (2.3)	2.7	0.91
Working at an inappropriate height	42 (23.9)	81 (46.0)	30 (17.0)	22 (12.5)	1 (0.6)	2.2	0.96
Lack of breaks	25 (14.2)	66 (37.5)	45 (25.6)	33 (18.8)	7 (4.0)	2.6	1.07
Vibrations	72 (40.9)	74 (42.0)	20 (11.4)	9 (5.1)	1 (0.6)	1.8	0.87
Work scheduling	34 (19.3)	79 (44.9)	30 (17.0)	31 (17.6)	2 (1.1)	2.4	1.02

%, Percent, \bar{x} : Average, SD: Standard deviation.

Table 3: Correlation of lifetime prevalence of MSDWs in different body areas with demographic variables

Demographic variables	Correlation coefficient	Neck	Shoulders	Upper back	Elbows	Wrists/hands	Lower back	Hips/thighs	Knees	Ankles/feet
Age	r	-0.166*	-0.252**	-0.069	-0.134	-0.149*	-0.082	-0.267**	-0.166*	-0.065
Working hours	r	-0.152*	-0.215**	-0.066	-0.062	-0.119	-0.066	-0.221**	-0.132	-0.032
Employment	r	0.059	0.046	-0.026	-0.120	0.029	-0.085	-0.032	-0.078	-0.157*
Working environment	r	0.064	0.112	0.007	0.027	-0.152*	-0.056	0.055	-0.021	-0.094
Job satisfaction	r	0.118	0.180*	0.098	-0.059	-0.009	-0.060	-0.014	0.035	0.072

r: Correlation coefficient; *: $p \leq 0.05$; **: $p \leq 0.01$; bold text: Significant differences.

and weakly negatively correlated with the duration of uncomfortable working positions, as evidenced by the following correlations: neck ($r = -0.256$, $p < 0.001$), shoulders ($r = -0.207$, $p = 0.007$), upper back ($r = -0.177$, $p = 0.022$), lower back ($r = -0.171$, $p = 0.028$), and knees ($r = -0.188$, $p = 0.014$). Bending was found to have a significant weak negative correlation with MSDWs in the neck ($r = -0.225$, $p < 0.001$), upper back ($r = -0.166$, $p = 0.034$), and lower back ($r = -0.160$, $p = 0.042$). A significant weak negative correlation was observed between repetitive tasks and MSDWs in the shoulders ($r = -0.202$, $p = 0.008$), lower back ($r = -0.151$, $p = 0.048$), and knees ($r = -0.168$, $p = 0.031$). The treatment of a large number of patients in a single day was found to be significantly and weakly negatively correlated with MSDWs in the shoulders ($r = -0.166$, $p = 0.027$). The application of manual therapy techniques was found to be significantly and weakly negatively correlated with MSDWs in the wrists and hands ($r = -0.195$, $p = 0.010$). Point pressure on the body was significantly and weakly negatively correlated with MSDWs in the shoulders ($r = -0.217$, $p = 0.006$), upper back ($r = -0.238$, $p = 0.003$), wrists/hands ($r = -0.219$, $p = 0.005$), and knees ($r = -0.161$, $p = 0.039$). Working while physically fatigued showed significant weak negative correlations with MSDWs in the neck ($r = -0.216$, $p = 0.007$), shoulders ($r = -0.342$, $p < 0.001$), upper back ($r = -0.259$, $p < 0.001$), wrists/hands ($r = -0.187$, $p = 0.020$), lower back ($r = -0.154$, $p = 0.047$), hips/thighs ($r = -0.175$, $p = 0.031$), and ankles/feet ($r = -0.193$, $p = 0.018$). There was a significant negative correlation between reaching or working away from the body and MSDWs in the neck ($r = -0.282$, $p < 0.001$), shoulders ($r = -0.226$, $p = 0.004$), upper back ($r = -0.204$, $p = 0.009$), lower back ($r = -0.220$, $p = 0.003$), hips/thighs ($r = -0.166$, $p = 0.028$), knees ($r = -0.150$, $p = 0.045$), and ankles/feet ($r = -0.190$, $p = 0.020$). Lack of breaks showed significant weak negative correlations with MSDWs in the shoulders ($r = -0.240$, $p = 0.003$), upper back ($r = -0.160$, $p = 0.040$), hips/thighs ($r = -0.153$, $p = 0.045$), and knees ($r = -0.164$, $p = 0.030$). Vibration exposure was found to be significantly and weakly negatively correlated with MSDWs in the neck ($r = -0.189$, $p = 0.014$). The results demonstrated a

significant weak negative correlation between work scheduling and MSDWs in the shoulders ($r = -0.167$, $p = 0.027$) and wrists/hands ($r = -0.252$, $p = 0.003$).

Discussion

The purpose of this study was to investigate the prevalence and distribution of MSDWs among PTs over their lifetime and in the past year, with a focus on ergonomic factors and the association between MSDWs and demographic and ergonomic risk factors. The study aimed to identify specific body areas most affected by pain or discomfort and to assess the potential impact of various workplace risk factors on these outcomes.

The lifetime prevalence of pain or discomfort was 97.7%, which is consistent with other studies [7], [18]. This indicates that musculoskeletal pain is a nearly universal experience for PTs, underscoring the physically demanding nature of their profession. The lifetime prevalence of MSDWs was highest in the neck, upper, and lower back, which aligns with the ergonomic challenges and physical tasks correlated with physiotherapy practice. PTS also commonly reported discomfort in the shoulders and wrists/hands.

Previous studies [7], [18], [19], [20] found the highest lifetime prevalence in the lower back, but our study indicates a slightly lower lifetime prevalence between the neck and lower back. A recent study in Slovenia reported a high lifetime prevalence of 99%, with the most affected areas being the neck and lower back [11]. Both studies, including ours, found the least affected areas to be the elbows, hips/thighs, and ankles/feet. Kinaci and Ataoğlu [8] reported the lower back and neck as the most affected areas at least once in their lifetime.

The 1-year prevalence of pain or discomfort in our study was 94.9%, with the most affected body regions being the neck, upper and lower back, and the least affected regions being the elbows and ankles/feet. Other authors have also reported high prevalence

Table 4: Correlation between 1-year prevalence of MSDWs and demographic variables

Demographic variables	Correlation coefficient	Neck	Shoulders	Upper back	Elbows	Wrists/hands	Lower back	Hips/thighs	Knees	Ankles/feet
Age	r	0.047	-0.214**	-0.026	-0.042	-0.075	0.066	-0.191*	-0.065	0.016
Working hours	r	0.018	-0.219**	-0.031	0.020	-0.115	0.026	-0.171*	-0.086	0.036
Employment	r	0.065	0.016	-0.038	-0.078	0.027	-0.079	-0.031	-0.139	-0.085
Working environment	r	0.010	0.002	-0.066	0.026	-0.128	-0.060	-0.005	-0.042	-0.098
Job satisfaction	r	0.078	0.150*	0.057	-0.054	0.034	0.005	0.040	0.042	0.107

r: Correlation coefficient; *: $p \leq 0.05$; **: $p \leq 0.01$; bold text: Significant differences.

Table 5: Correlation Between lifetime prevalence of MSDWs and ergonomic risk factors

Risk factors	Correlation coefficient	Neck	Shoulders	Upper back	Elbows	Wrists/hands	Lower back	Hips/thighs	Knees	Ankles/feet
Prolonged static positions	r	-0.171*	-0.134	-0.075	-0.072	-0.051	-0.133	-0.009	-0.080	-0.084
Working in uncomfortable positions	r	-0.183*	-0.077	-0.132	0.006	0.028	-0.054	-0.110	-0.197**	-0.032
Bending	r	-0.111	-0.046	-0.073	-0.096	0.066	-0.088	-0.072	-0.066	-0.012
Repetitive tasks	r	-0.127	-0.169*	-0.076	-0.050	-0.043	-0.076	0.067	-0.173*	-0.054
Treating a large number of patients in 1 day	r	-0.056	-0.191*	-0.020	-0.145	0.042	0.024	0.046	-0.042	0.001
Performing manual therapy techniques	r	-0.126	-0.108	-0.032	-0.047	-0.203**	0.015	-0.002	-0.135	0
Point pressure on the body	r	-0.191*	-0.123	-0.119	-0.088	-0.209**	-0.065	-0.050	-0.117	-0.123
Working while physically fatigued	r	-0.150*	-0.163*	-0.127	-0.044	-0.045	-0.099	-0.156*	-0.072	-0.124
Reaching or working away from the body	r	-0.270**	-0.202**	-0.131	-0.123	-0.049	-0.223**	-0.215**	-0.166*	-0.149*
Working at an inappropriate height	r	-0.134	-0.107	-0.037	0.039	0.080	-0.080	-0.020	-0.044	-0.008
Lack of breaks	r	-0.078	-0.165*	-0.144	-0.122	-0.095	-0.066	-0.102	-0.077	-0.061
Vibrations	r	-0.190*	-0.010	-0.085	-0.115	0.034	-0.021	0.097	-0.074	-0.043
Work scheduling	r	-0.070	-0.154*	-0.092	-0.143	-0.191*	0.002	-0.099	-0.067	-0.039

r: Correlation coefficient, *: $p \leq 0.05$, **: $p \leq 0.01$, bold text: Significant differences.

rates [6], [9], [11], [16]. Meh *et al.* [11] reported the neck and lower back as the most affected areas and elbows and ankles/feet as the least affected. The prevalence of lower back pain or discomfort has also been confirmed by other studies [9], [15], [16].

The most common risk factors for PTs include standing for long periods, treating a large number of patients in 1 day, performing manual therapy techniques, repeating the same tasks, and bending, with vibration being the least frequently encountered ergonomic factor. The literature identifies similar risk factors contributing to MSDWs among PTs [7], [9], [15], [16], [18], [19], [20], [21], including back strain, awkward and prolonged postures, frequent bending, performing manual therapy techniques, lifting patients, repetitive tasks, work environment challenges, and psychosocial issues.

Our study also investigated the correlation between MSDWs and demographic variables. We identified a weak negative association between the lifetime prevalence of MSDWs and age in various body regions, including the neck, shoulder, wrists/hands, hip/thigh, and knee. In addition, there was a negative correlation between the lifetime prevalence of MSDWs and working life in the neck, shoulders, and hips/thighs. The lifetime prevalence of MSDWs also showed a negative correlation with the working environment for wrists/hands, with employment for ankles/feet, and with job satisfaction for shoulders. For the 1-year prevalence of MSDWs, we observed a weak negative association with age in the shoulder and hip/thigh regions, a negative correlation with working life in the shoulder and hips/thighs, and a negative correlation with job satisfaction in the shoulder. Similar associations were

found by Meh *et al.* [11] and Kakaraparthi *et al.* [9], although Desai and Shah [22] reported higher MSDW prevalence in younger PTs.

We conclude that the weak negative associations between the lifetime prevalence of MSDWs in different body regions and occupational factors suggest that working away from the body, working when physically tired, uncomfortable working postures, repetitive tasks, and poor work distribution are important risk factors for the occurrence of MSDWs in PTs. The results also showed a weak negative correlation between the 1-year prevalence of MSDWs and various risk factors in the workplace. The most significant negative impacts are working while physically fatigued, reaching or working away from the body, working in uncomfortable positions, lack of breaks, and point pressure on the body. These factors negatively affect different body regions, especially the shoulders, lower back, neck, upper back, knees, wrists/hands, hips/thighs, and ankles/feet. So far, we have not found studies that could investigate the correlation between risk factors and MSDWs.

The results of our study suggest the need for ergonomic interventions aimed at improving the workplace of PTs and the well-being of PTs at work. We can choose between educational, environmental-architectural, organizational, and psychological interventions to reduce both the physical and psychological burden on PTs and thus the risk of MSDWs.

Strengths and limitations

Our study has some limitations. Our sample is not representative, so we cannot generalize the results

Table 6: Correlation between 1-year prevalence of MSDWs and ergonomic risk factors

Risk factors	Correlation coefficient	Neck	Shoulders	Upper back	Elbows	Wrists/hands	Lower back	Hips/thighs	Knees	Ankles/feet
Prolonged static positions	r	-0.137	-0.189*	-0.089	-0.074	-0.042	-0.137	-0.032	-0.103	-0.164*
Working in uncomfortable positions	r	-0.256**	-0.207**	-0.177*	0.006	-0.119	-0.171*	-0.106	-0.188*	-0.125
Bending	r	-0.225**	-0.095	-0.166*	-0.034	0.006	-0.160*	-0.027	-0.054	-0.090
Repetitive tasks	r	-0.118	-0.202**	-0.105	0.059	-0.090	-0.151*	0.020	-0.168*	-0.107
Treating a large number of patients in 1 day	r	-0.070	-0.166*	-0.022	-0.101	-0.027	-0.008	0.018	-0.042	0.019
Performing manual therapy techniques	r	-0.044	-0.129	-0.144	0.029	-0.195**	0.047	0.022	-0.136	-0.005
Point pressure on the body	r	-0.126	-0.217**	-0.238**	-0.002	-0.219**	-0.089	-0.065	-0.161*	-0.102
Working while physically fatigued	r	-0.216**	-0.342**	-0.259**	0.021	-0.187*	-0.154*	-0.175*	-0.118	-0.193*
Reaching or working away from the body	r	-0.282**	-0.226**	-0.204**	-0.061	-0.111	-0.220**	-0.166*	-0.150*	-0.190*
Working at an inappropriate height	r	-0.022	-0.101	0.042	0.006	-0.046	-0.167*	0.002	-0.093	-0.049
Lack of breaks	r	-0.055	-0.240**	-0.160*	-0.068	-0.138	-0.148	-0.153*	-0.164*	-0.139
Vibrations	r	-0.189*	-0.099	-0.092	-0.105	-0.071	-0.081	0.058	-0.064	-0.100
Work scheduling	r	-0.017	-0.167*	-0.117	-0.127	-0.252**	-0.022	-0.067	-0.125	-0.108

r: Correlation coefficient, *: $p \leq 0.05$, **: $p \leq 0.01$; Bold text: Significant differences.

to the whole population of PTs. As this was an online cross-sectional study, self-reported by PTs, there was a potential for recall and information bias. PTs may have overestimated or underestimated pain or discomfort. Furthermore, discomfort may be subjectively widely understood. During data collection, we encountered a poorer responsiveness of PTs to the survey question. As a limitation, we also did not ask about PTs' level of physical activity, so it is likely that physically active PTs experience MSDWs at different levels and frequencies compared to physically inactive PTs.

Our work provides a good basis for PTs to conduct further research. It would be worthwhile to investigate the knowledge of ergonomic principles among PTs and their application in physiotherapy practice, as well as the causal relationship between the application of ergonomic principles and the incidence of MSDWs.

Conclusions

The purpose of this study was to investigate the prevalence of MSDWs among PTs over their lifetime and in the past year, as well as the association between MSDWs and demographic and ergonomic risk factors. Our findings indicate the physically demanding nature of the PT profession. The most affected areas were the neck, upper, and lower back, with shoulders and wrists/hands also commonly reported, aligning with the physical tasks and ergonomic challenges of physiotherapy practice. In addition, the study identified a weak negative association between the prevalence of MSDWs and factors such as age, working life, and job satisfaction across various body regions. Common occupational risk factors include prolonged standing, treating a large number of patients in 1 day, manual therapy techniques, repetitive tasks, and uncomfortable postures. These results underscore the need for ergonomic interventions and improved work conditions to mitigate the incidence of MSDWs among PTs.

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