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Epidemiological Patterns of Work-Related Musculoskeletal Disorders among Healthcare Workers in Five Reference Hospitals in the City of Douala, Cameroon

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Abstract

Introduction: Work-related musculoskeletal disorders (WRMSDs) are a public health problem and have forced many workers to quit their jobs prematurely. This study investigated the prevalence and risk factors of WRMSDs among Healthcare workers in five reference hospitals in the City of Douala-Cameroon. **Methods:** A cross-sectional study was conducted in 2022 among 561 healthcare workers working in five reference hospitals in the city of Douala, Cameroon. Participants were selected using a convenient sampling technique. Data were collected with structured questionnaires; data on the demographics and risk factors were collected using a well-designed questionnaire, while estimation of the prevalence of WRMSDs was done using the Modified Nordic questionnaire. **Results:** The overall prevalence rate of WRMSDs among healthcare workers in Douala hospitals was 83.4% (468/561). The prevalence per professional groups was as follows: 88.8% (71) for Medical Laboratory Scientists (MLS), 81.9% (289) for nurses, 21 (80.8%) for Physiotherapists (PTs) and 78.8% (41) for Medical Doctors (MDs). There was a significant difference (p = 0.001) in the prevalence of WRMSDs with respect to place of work where healthcare workers from HLD recorded the highest prevalence 89.9%, while Healthcare workers from NBDH were 2.91 times at risk (AOR = 2.91; 95% CI: 1.32 - 6.41; p = 0.001) to develop WRMSDs than healthcare

workers in the other hospitals. With respect to body region, the highest prevalence of WRMSDs was recorded on the lower back, 58.8% with the lowest at the elbows 11.2%. The age group 30 to 39 years was significantly associated with WRMSDs at level of the shoulder ($p = 0.002$), upper back ($p = 0.019$), elbows ($p < 0.001$), knees ($p = 0.006$) and ankle/feet ($p = 0.047$). Working on the same position (AOR = 2.90; 95% CI = 1.74 - 4.83; $p = 0.001$), working with vibrating objects (AOR = 1.94; 95% CI = 1.10 - 3.40; $p = 0.022$) and job stress (AOR = 1.91; 95% CI = 1.14 - 3.20; $p = 0.014$) were non-demographic risk factors associated with WRMSDs. **Conclusion:** The overall prevalence rate of WRMSDs among healthcare workers in Douala hospitals was high. The prevalence of WRMSDs is highest among MLS and nurses and the most affected body parts are; lower back, neck and upper back. Working on the same posture, stressful job, and repetitive tasks were the major risk factors associated to WRMSDs among healthcare workers in Douala hospitals.

Keywords

Work-Related Musculoskeletal Disorders, Risk Factors, Prevalence, Healthcare Workers, Douala-Cameroon

1. Introduction

Work-related musculoskeletal disorders (WRMSDs) comprise of a myriad of painful disorders that occur at the job site and affects muscles, nerves, joints, tendons, cartilage and intervertebral discs [1] [2]. They frequently result from the following risk factors: repetitive movements, vibration, higher work demands, fewer breaks, awkward postures [3]. Furthermore, most health workers are sometimes exposed to poor working and ergonomic conditions, stressful postures, prolonged standing or sitting at work, lifting or moving patients, and work monotony [4].

The prevalence of WRMSDs of above 70% has been reported in nurses [5], Physiotherapists [5] [6], Surgeons [7]. The lifetime prevalence of WRMSDs among nurses at the Central Hospital of Harare, Zimbabwe was estimated to be 95.7% [8]. Although, nurses are considered the group of healthcare workers with the highest prevalence of WRMSDs, other health professions are not exempted from the increasing burden of WRMSDs [9].

WRMSDs constitute one of the major causes of morbidity in many working populations, including health workers [10]. It is evident that healthcare workers are in constant exposure to occupational hazards such as musculoskeletal injuries as they discharge their professional duties [11]. Apart from affecting the health of these professionals, it also creates a huge burden on the health systems with consequent poor performance at the workplace, decrease productivity, loss of employments, as well as economic burden [10] [11].

Despite the emerging concern of WRMSDs in healthcare workers and the

consequences it may have in the healthcare system in particular and society at large, these disorders have been less studied among healthcare workers largely.

Furthermore, in Cameroon, the healthcare sector is still developing and monitoring and prevention of WRMSDs among healthcare workers is a major concern. Although a few studies, have addressed the prevalence and risk factors of WRMSDs in Cameroon, these studies concentrated mostly on nurses [5] [12] [13].

It is therefore necessary to determine the prevalence and risk factors of WRMSDs among nurses and all other health professionals considering larger sample sizes and, in several hospitals, which will help to inform strategies to limit the occurrence of WRMSDs among health workers in Cameroon. Thus, this study was aimed at determining the prevalence and associated risk factors of WRMSDs among healthcare workers in Douala, Cameroon.

2. Materials and Methods

2.1. Study Design

A cross-sectional study was undertaken between June and October 2022 among 561 healthcare workers from five selected reference hospitals in Douala, Cameroon.

2.2. Study Population

All participants in this study are healthcare workers working in the city of Douala, Cameroon. They were in service at the HLD, GHD, NBDH, NDH and BDH in the city of Douala, Cameroon.

These hospitals are government owned, and are among the largest hospitals in city of Douala in terms of capacity, activities and in the number of healthcare workers. Also, they are comprised of most of the working units found in reference hospitals in Cameroon: theater, intensive care, emergency, hospitalizations, outpatient departments etc.

2.3. Target Population

The study targeted physicians, laboratory technicians, nurses, physiotherapists and others who were present in the hospital at the time of the study.

2.4. Sample and Procedure

561 participants were selected from the five reference hospitals in the city of Douala, Cameroon using a non-probability sampling of convenient type, since participants were recruited according to their availability.

The sample size was calculated with the Lorenz formula: $N = p(1 - p)z^2/d^2$, where N is the minimum sample size; p is the prevalence of MSDs (78%) reported previously by Shaikh *et al.* [14] in the Arab world, z is the statistic for the desired confidence level ($z = 1.96$ for confidence at 95%), and d is the accepted margin of error ($d = 0.05$). The estimated sample size was $n = 364$. Finally, 561

participants were recruited in view of increasing the power of our study.

2.5. Selection Criteria

2.5.1. Inclusion Criteria

All full-time healthcare workers in the selected reference hospitals who consented to take part in our study have been working for at least 12 months.

2.5.2. Exclusion Criteria

Participants who had not worked for up to 12 months and who did not sign informed consent forms, students, part-time workers, visiting healthcare workers from other countries, having a MSDs before their commitment in to the healthcare profession or recent trauma, injury, surgery, motor vehicle accident, sport related injury in the past two weeks were excluded from this study.

2.6. Data Collection

2.6.1. Socio-Demographic Features

Data on the demographics and risk factors were collected using a well-designed questionnaire. The questionnaires were administered face-to-face. Data collected included: demographic and personal profiles (age, sex, profession, level of education, specialty, marital status, place of work).

2.6.2. WRMSDs

WRMSDs were assessed by the modified Nordic questionnaire. The questionnaire used for this study was designed by researchers from the Institute of Public Health of Scandinavian countries which assesses WRMSDs in nine sites of the body including the neck, shoulders, elbows, wrists/thighs, knees and ankles at two different moments preceding the survey, 7 days and 12 months [15].

2.6.3. Validity and Reliability of the Research Questionnaires

After a deep literature review and assessment through an expert panel made up of the author and co-authors, the content of the questionnaires, including the modified Nordic questionnaire was validated and accepted to be used in this study. Secondly, a pretest was carried out using a construct validity test by comparing the results of filling in the self-administered questionnaires and the modified Nordic questionnaire with the results of the interviews and the results were validated by the expert panel.

The participants were asked to indicate if they had experienced trouble (such as ache, pain, discomfort, numbness, or tingling) in the following body parts (neck, shoulders, upper back, elbows, low back, thigh/hips, knees, and ankles) in the past 12 months.

2.6.4. Risk Factors

The risk factors evaluated in this study included number of working hours per day, number of work shifts, working conditions, working postures, repetitive tasks, standing or sitting for long, working with vibrating objects, use of physical

efforts, lack of physical exercise.

2.7. Data Analysis

Quantitative variables were presented as percentages (%). Then the collected data was cleaned and analyzed with the help of SPSS version 26 (SPSS Inc., Chicago, IL, USA). The normality of quantitative was checked using the Kolmogorov-Smirnov test. Pearson independence Chi^2 test was used to compare proportions of unpaired samples. Multivariate analysis was performed to determine factors associated with WRMSDs. The association between the dependent variable (presence of WRMSDs) and independent variables was quantified in logistic regression analysis by computing odds ratios (OR), their confidence interval at 95%, and p-value. Statistical significance was set at $p < 0.05$.

2.8. Ethical consideration

Ethical clearance No. 2021/1511-07/UB/SG/IRB/FHS was obtained from the Institutional Review Board (IRB) of the Faculty of health science of the University of Buea (UB) and administrative authorizations were obtained from the Douala regional delegation of public health and from the different hospital administrators. The names of the study hospitals were coded for ethical reasons. The fundamental principles of medical research according to Helsinki's Declaration were strictly respected.

3. Results

3.1. Socio-Demographic Characteristics of Healthcare Workers in Douala Hospitals

Five hundred and sixty-one (561) participants took part in this study. The average age of participants was 34.10 years. Participants between the ages of 30 and 39 were most represented (41.4%). A majority (70.6%) of the study participants were females. As concerns education, most participants (34.0%) in this study had at least a certificate in biomedical sciences. The study was largely made up of nurses (62.9%) who formed more than half of healthcare workers and that the majority came from LHD, (24.2%) and GHD, (24.2%) hospitals.

The participants had varied years of working experience, with most having 1 - 3 years of working experience (33.9%). Pertaining to marital status, more than half, 60.1% (337/561) of the participants were single while 37.1% (208/561) were married (Table 1).

3.2. The Prevalence of WRMSDs among Healthcare Workers with Respect to Medical Specialty

The overall prevalence rate for healthcare workers in Douala hospitals was 83.4% in the last 12 months.

The relationship between these variables was not significant ($p = 0.212$). Specifically, the prevalence was (88.8%) for Medical Laboratory Scientists (MLS),

followed by (81.9%) for nurses, (80.8%) for Physiotherapists (PTs) and (78.8%) for Medical Doctors (MDs) as seen in Figure 1.

Table 1. Socio-demographic characteristics of healthcare providers working in Douala hospitals.

Factor	Variable	Frequency (n)	Percentage (%)
Age group	20 - 29 years	207	36.9
	30 - 39 years	232	**41.4**
	40 - 49 years	87	15.5
	50 - 59 years	35	6.2
Sex	Male	165	29.4
	Female	396	70.6
Educational level	Certificate	191	**34.0**
	Diploma	83	14.8
	Bachelor's degree	160	28.5
	Master's degree	69	12.3
	Doctorate (Ph.D.)	40	7.1
	Others	18	3.2
Specialty	Medical Laboratory Scientists	80	14.3
	Medical Doctors	52	9.3
	Nurses	353	62.9
	Physiotherapists	26	4.6
	Others	50	8.9
Place of work (Hospital)	LHD	148	26.4
	GHD	136	24.2
	BDH	103	18.4
	NBDH	56	10.0
	NDH	115	21.0
Longevity in service	less than 1 year	148	26.4
	1 - 3 years	190	33.9
	4 - 6 years	86	15.3
	7 - 9 years	69	12.3
	10 years plus	68	12.1
Marital status	Single	337	60.1
	Married	208	37.1
	Widowed	10	1.8
	Divorced	6	1.1

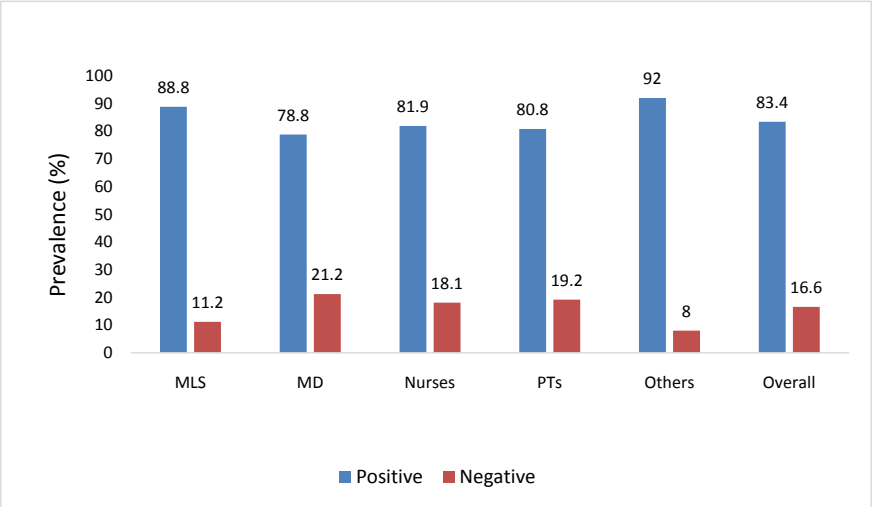

Figure 1. Association between WRMSDs and specialty.

3.3. Prevalence of WRMSDs with Respect to Different Body Parts in the Last 12 Months among Healthcare Workers in Douala

According to body regions the highest prevalence of WRMSDs was on the low back (58.8%) followed by the neck (51.0%), upper back (39.6%), shoulder (32.4%), thigh/hips (32.1%), knees (30.3%), ankle/feet (27.5%) and elbows (11.2%) respectively as shown in Figure 2.

3.4. The Prevalence of WRMSDs with Respect to Place of Work (Hospital)

There was a significant difference ($p = 0.001$) in the prevalence of WRMSDs with respect to place of work. Healthcare workers from HLD recorded the highest prevalence (89.9%, $p = 0.001$) as seen in Figure 3.

3.5. Association of Socio-Demographic Factors with Prevalence of Work-Related Musculoskeletal Disorders at Different Body Regions

We further looked at the association of the prevalence of WRMSDs with respect to body region (Neck, shoulder, upper back, elbows, lower back, thighs/hips, knees and ankle/feet) within some socio-demographic factors (Age group, sex, hospital/place of work and longevity in service). Statistical analysis revealed that when we consider age group, there was a significant association in the prevalence of WRMSDs with respect to shoulder (39.6%, $p = 0.002$), upper back (42.8%, $p = 0.019$), elbows (34.9%, $p < 0.001$), knees (38.8%, $p = 0.006$) and ankle/feet (38.3%, $p = 0.047$). The prevalence was higher in the age group of 30 - 39 years. Also, when considering sex, there was a significant difference in the prevalence of WRMSDs at the level of the Knees (76.5%, $p = 0.004$) and Ankle/feet (77.3%, $p = 0.033$) in which females. Considering place of work (hospital), there was a significant difference in the prevalence of WRMSDs at the level of the

lower back (30.6%; p = 0.007) in which the highest prevalence was recorded at the LHD. Furthermore, concerning longevity of service of healthcare workers, there was a significant difference in the prevalence of WRMSDs at the level of the elbow (27.0%; p = 0.001) in which those who had worked for 1 - 3 years had the highest prevalence (Table 2).

3.6. Demographic Risk Factors Associated with WRMSDs

Multivariate logistic regression analysis showed that healthcare workers from NBDH were 2.91 times at risk (AOR = 2.91; 95% CI: 1.32 - 6.41) to have WRMSDS than healthcare workers of the other hospitals. Age group, longevity in service and educational level, were not significantly associated with WRMSDs, but the age group 30 - 39 years (AOR = 4.41; 95% CI: 0.92 - 21.08) and 7 - 9 years longevity in service (AOR = 1.74; 95% CI: 0.65 - 4.66) were at higher risk of developing WRMSDs while participant with a doctorate degree (AOR = 2.11; 95% CI: 0.36 - 12.50) were less likely to develop respectively WRMSDs (Table 3).

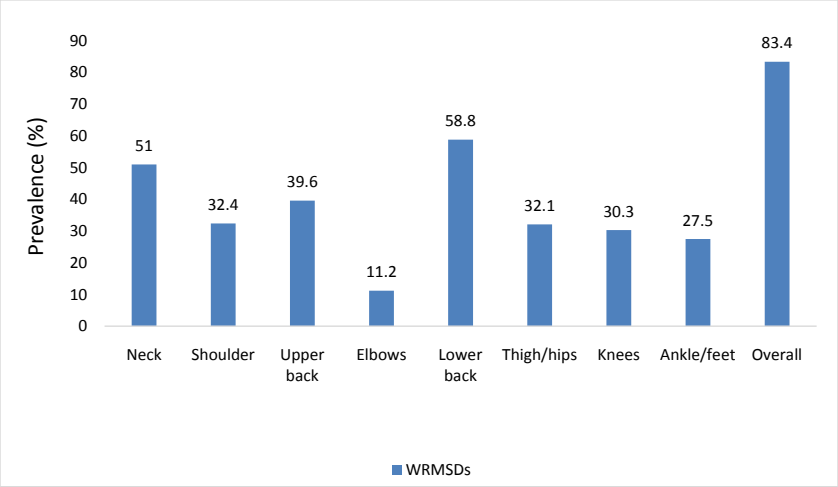

Figure 2. Prevalence of WRMSDs for different body parts in the last 12 months.

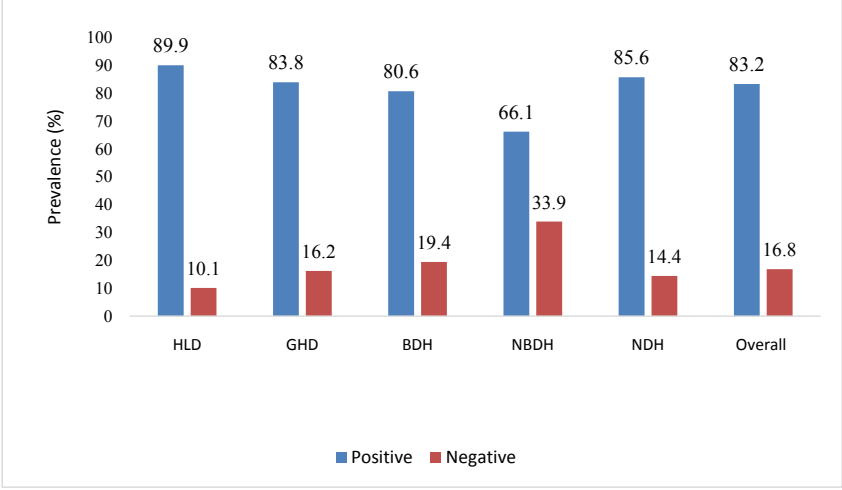

Figure 3. Prevalence of WRMSDs with respect to place of work/hospital.

Table 2. Association of socio-demographic factors with prevalence of WRMSDs at different body regions.

Factor	Variable	Neck %	Shoulder %	Upper back %	Elbow %	Lower back %	Thighs/hips %	Knees %	Ankle/feet %
Age group (years)	**20 - 29**	34.6	30.2	30.2	20.6	37.0	31.7	31.2	32.5
	30 - 39	41.3	**39.6**	**42.8**	**34.9**	41.5	42.2	**38.8**	**38.3**
	40 - 49	17.8	22.0	18.5	31.7	14.8	16.7	10.6	9.7
	50 - 59	6.3	8.2	8.6	12.7	6.7	9.4	10.6	9.7
	p-value	***0.414***	***0.002***	***0.019***	***<0.001***	***0.926***	***0.085***	***0.006***	***0.047***
Sex	**Male**	26.2	26.4	26.6	27.0	28.2	25.6	23.5	22.7
	Female	78.8	73.4	73.0	71.8	74.4	76.5	76.5	77.3
	p-value	***0.091***	***0.274***	***0.233***	***0.654***	***0.445***	***0.168***	***0.004***	***0.033***
Place of work (Hospital)	**LHD**	**26.6**	26.9	24.3	23.8	**30.6**	27.2	24.7	28.6
	GHD	23.8	**28.0**	26.6	36.5	25.8	27.8	28.2	27.9
	BDH	16.4	15.4	18.0	7.9	16.4	13.9	14.1	15.6
	NBDH	9.4	8.2	7.7	11.1	7.3	6.7	7.1	5.2
	NDH	23.8	21.4	23.4	20.6	20.0	24.4	25.9	22.7
	p-value	***0.478***	***0.440***	***0.352***	***0.064***	***0.007***	***0.069***	***0.059***	***0.106***
Longevity	**<1 year**	25.5	22.5	21.2	12.7	25.5	22.8	19.4	21.4
	1 - 3 years	36.7	32.4	34.2	27.0	34.2	38.3	36.5	33.8
	4 - 6 years	13.6	15.4	16.2	15.9	15.5	12.2	14.1	15.6
	7 - 9 years	10.1	13.7	12.2	20.6	12.7	11.7	16.5	14.9
	>10 years	14.0	15.9	16.2	23.8	12.1	15.0	13.5	14.
	p-value	*0.163*	*0.252*	*0.059*	***0.001***	*0.981*	*0.169*	*0.060*	*0.406*

Statistically significant at $p < 0.05$; n = prevalence of WRMSDs; N = study population.

Table 3. WRMSDs Associated with demographics.

Factors	Variables	WRMSDs (+)	Adjusted odds ratio (95% CI)	Crude odds ratio (95% CI)	p-value
Age group	20 - 29 years	82.6 (171)	1	1	
	50 - 59 years	94.3 (33)	4.15 (0.80 - 21.01)	3.47 (0.80 - 1.15.14)	0.091
	40 - 49 years	79.3 (69)	3.16 (0.65 - 15.35)	3.13 (0.72 - 13.60)	0.153
	30 - 39 years	84.1 (195)	4.41 (0.92 - 21.08)	4.30 (0.94 - 19.65)	0.063
Sex	Female	84.3 (334)	1	1	
	Male	81.2 (134)	1.51 (0.90 - 2.53)	1.25 (0.77 - 2.00)	0.123
	Others	88.9 (16)	1	1	
Educational level	Certificate	82.2 (157)	1.64 (0.32 - 8.49)	1.73 (0.38 - 7.89)	0.557
	Diploma	80.7 (67)	1.67 (0.31 - 9.07)	1.91 (0.40 - 9.16)	0.554
	Bachelor	85.6 (137)	1.08 (0.20 - 5.80)	1.34 (0.29 - 6.23)	0.926
	Masters	87.0 (60)	1.22 (0.21 - 7.09)	1.20 (0.24 - 6.15)	0.826
	Doctorate	77.5 (31)	2.11 (0.36 - 12.50)	2.32 (0.45 - 12.05)	0.410

Continued

Place of work (Hospital)	**NDH**	**85.6 (101)**	**1**	**1**	
	LHD	89.9 (133)	0.56 (0.25 - 122)	0.67 (0.32 - 1.41)	0.143
	GHD	83.8 (114)	1.08 (0.51 - 2.29)	1.15 (0.58 - 2.28)	0.840
	BDH	80.6 (83)	1.44 (0.68 - 3.03)	1.43 (0.70 - 2.91)	0.343
	NBDH	66.1 (37)	2.91 (1.32 - 6.41)	3.05 (1.43 - 6.49)	**0.008**
Longevity	≥10 years	85.3 (58)	1	1	
	<1 year	81.1 (120)	1.56 (0.56 - 4.33)	1.35 (0.62 - 2.97)	0.396
	1 - 3 years	85.3 (162)	1.09 (0.41 - 2.90)	1.35 (0.76 - 2.40)	0.862
	4 - 6 years	83.7 (72)	1.27 (0.46 - 3.54)	1.13 (0.47 - 2.72)	0.646
	7 - 9 years	81.2 (56)	1.74 (0.65 - 4.66)	1.35 (0.55 - 3.32)	0.267
Marital status	**Divorced**	**66.7 (4)**	**1**	**1**	
	Single	84.0 (283)	0.24 (0.04 - 1.56)	0.38 (0.07 - 2.14)	0.137
	Married	83.2 (173)	0.30 (0.05 - 1.90)	0.40 (0.07 - 2.30)	0.201
	Widowed	80.0 (8)	0.37 (0.03 - 4.58)	0.40 (0.05 - 4.98)	0.437

3.7. Non-Demographic Risk Factors Associated with WRMSDs among HealthCare Workers Working in Douala Hospitals

The study revealed that some participants (34.6%) have had some pre-existing conditions that predisposed them to developing work-related musculoskeletal disorders. Working on the same position for a long time was significantly associated (90.6%; p = 0.001) with WRMSDs, whereby healthcare workers who accepted that they worked on the same position had higher odds of association (AOR = 2.90; 95% CI = 1.74 - 4.83, p = 0.001) with WRMSDs compared to those who didn't work on the same position. Although standing for long was significantly associated (χ^2 = 8.037; p = 0.005) with WRMSDs, there were no significant odds of association when comparing between those who said they stand for long and those who said they don't stand for long during duty. More so, doing repetitive task was significantly associated (87.3; p < 0.001), with WRMSDs. Furthermore, working with vibrating objects showed significant association (89.2%; p = 0.006) with WRMSDs in which healthcare workers who worked with vibrating objects were about 2 times more likely to develop WRMSDs (AOR = 1.94; 95% CI = 1.10 - 3.40, p = 0.006) compared to those who did not work with vibrating objects. Also, healthcare workers who complained of stressful job were significantly associated (89.6%; p = 0.001) with WRMSDs in which, those who complained of stressful job had nearly 2 time the risk to have (AOR = 1.91; 95% CI = 1.14 - 3.20, p = 0.014) WRMSDs compared to those who did not complain of stressful job. Also, participants who accepted that they were sometimes assisted with tasks were significantly associated (87.6%; p = 0.005) with WRMSDs but this factor was not a significant risk of WRMSDs. Doing stretching exercises after work and being familiar with ergonomic postures did show any significant odds of association with WRMSDs (Table 4).

Table 4. Non-demographic Risk Factors Associated with WRMSDs.

Factor	Variable	*WRMSDs* (+)	Adjusted odds ratio (95% CI)	Crude odds ratio (95% CI)	p-value
Working hours per day	8 hours	79.3 (172)	1.04 (0.49 - 2.06)	1.47 (0.77 - 2.78)	0.991
	9 hours and 10 hours	86.5 (212)	0.78 (0.38 - 1.60)	0.87 (0.45 - 1.69)	0.510
	Above 10 hours	84.8 (84)	1	1	
Number of work shifts	One	91.2 (31)	0.29 (0.07 - 1.22)	0.33 (0.09 - 1.25)	0.091
	Two	82.5 (203)	0.60 (0.28 - 1.29)	0.72 (0.36 - 1.44)	0.192
	Three	84.8 (190)	0.58 (0.27 - 1.26)	0.61 (0.30 - 1.24)	0.170
	Above 3	77.2 (44)	1	1	
Working on the same position	NO	72.4 (160)	2.90 (1.74 - 4.83)	3.67 (2.30 - 5.86)	**0.001**
	YES	90.6 (308)	1	1	
Standing for long	NO	78.4 (192)	1.28 (0.76 - 2.17)	1.91 (1.21 - 2.99)	0.345
	YES	87.3 (276)	1	1	
Sitting for long	NO	82.0 (310)	0.99 (0.57 - 1.74)	1.39 (0.84 - 2.28)	0.978
	YES	86.3 (158)	1	1	
Repetitive task	NO	71.0 (66)	1.55 (0.84 - 2.87)	2.49 (1.48 - 4.18)	0.160
	YES	85.9 (402)	1	1	
Working with vibrating objects	NO	80.2 (287)	1.94 (1.10 - 3.40)	2.04 (1.22 - 3.40)	**0.022**
	YES	89.2 (181)	1	1	
Job stressfulness	NO	75.9 (192)	1.91 (1.14 - 3.20)	2.74 (1.72 - 4.37)	**0.014**
	YES	89.6 (276)	1	1	
Stretching exercises after work	NO	81.8 (293)	1.24 (0.73 - 2.11)	1.39 (0.86 - 2.24)	0.434
	YES	86.2 (175)	1	1	
Ergonomic postures	NO	83.0 (289)	0.78 (0.46 - 1.32)	1.09 (0.68 - 1.70)	0.356
	YES	84.0 (178)	1	1	
Help with task	NO	74.8 (101)	1.44 (0.76 - 2.72)	1.75 (0.99 - 3.08)	0.261
	SOMETIMES	87.6 (227)	0.77 (0.43 - 1.40)	0.73 (0.42 - 1.27)	0.395
	QUITE OFTEN	83.8 (140)	1	1	
Physical efforts	NO	80.2 (207)	1.06 (0.63 - 1.780)	1.53 (0.98 - 2.39)	0.817
	YES	86.1 (261)	1	1	

4. Discussion

Despite the fact that several researches have reported s WRMSDs among healthcare workers, these disorders still constitute a major cause of disability, work-absenteeism, and abandonment. Also, most of the published studies in Cameroon focused on either one or two of the different healthcare professional groups. It is therefore interesting to provide data on WRMSDs among healthcare

workers in hospitals in Douala, Cameroon. Furthermore, there is currently little knowledge in Cameroon in this regard. Thus, monitoring the prevalence and risk factors associated with WRMSDs among healthcare workers is important to inform adequate preventive measures. This study therefore, aimed at determining the prevalence and associated factors of work-related musculoskeletal disorders in five healthcare facilities in the city of Douala-Cameroon.

The overall prevalence of WRMSDs among healthcare workers in the accessed hospitals was 83.4%. Data on the overall prevalence of WRMSDs is scarce, as most studies consider individual healthcare professions. However, the prevalence rate obtained in this study was higher than that reported by Shaikh *et al.* [14] in the Arab world, who reported the prevalence of WRMSDs among healthcare workers ranging from 43% to 78%. This difference in results could be explained by differences in the study design and location. Also, this high prevalence comforts the common reality that in sub-Saharan Africa, the healthcare worker to population ratio is very low. For example, in Ethiopia, one physician was serving for 9979 population, one nurse for 1705 and 1 midwife for 5491 people in the year 2020 [16]. In the same regard, SSA as a whole had 18 physicians per 100,000 population, ranging from 60 in South Africa to 2 in Mozambique in the year 2010 [16]. All these added to the increasing migration of African trained healthcare workers to developed countries for better working conditions or salaries. The fewer workers with respect to the population demanding medical attention and the poor working conditions may be a non-negligible source of WRMSDs [16] [17].

Regarding the various healthcare professions considered, the prevalence of WRMSDs in nurses was found to be 82% which is slightly lower to that reported by Kofi-Bediako *et al.* [18] who reported a prevalence of 94%, Krishnan *et al.* [19] and Shuai-Yang *et al.* [20], who reported 97% of the nurses had at least a WRMSD for the last 12 months. This difference could be explained by differences in the study site, design and population. This corroborates reports in literature where females are more likely to have WRMSDs than males [21] [22], while the study of Yang *et al.* [20] considered only nurses at the intensive care unit. Also, their studies were conducted in just one hospital, contrarily to ours where five different structures were considered which could be a source of variability given these hospitals are not the same categories (they ranged from first to fourth category in the health pyramid). Physiotherapists registered a prevalence of 80%, which is similar to that reported by Buh *et al.* [5] in Cameroon who reported 78% and fall in the prevalence range of 55% to 91% reported by Milhem *et al.* [23]. Generally, nurses and physiotherapists report high prevalence rates of WRMSDs as they perform many physically demanding activities that are associated with increased risk of WRMSDs including transfers of patients, excessive repetitive movements [24] [25]. However, the prevalence for physiotherapists was higher than the 6% - 71% range reported by Chenyu-Yu *et al.* [26] in Taiwan. This lower prevalence rate of WRMSDs among physiotherapists in Taiwan

may be due to differences in the practice of the profession in terms of the physical techniques used.

The prevalence of WRMSDs among physicians reported in this study was 78.8%, slightly lower than that reported in nurses. Our prevalence rate was very high compared to the 20% reported by Rambabu *et al.* [27] among medical doctors. Our higher prevalence could be explained by the fact that our study did not specify the prevalence per medical specialty. In this study, laboratory technicians registered the highest prevalence rate (89%). This high prevalence among laboratory technicians could be attributed to the fact they adopt prolonged positions either in standing or sitting, which has been identified as a key risk factor to WRMSDs. This result was higher than that obtained by López-González *et al.* [28] in Spain (80%), this difference could be explained by differences in sample size which was high in their study (460) compared to only 80 considered in our study. Also differences in study sites could also be accountable as Spain is a developed country and is likely to have more sophisticated equipment and better working conditions.

The study found that the overall prevalence of WRMSDs was highest on the low back (59%), followed by the neck, and lowest in the Elbows (51%). The finding is in line with that of the study by Mekonen [29] in Ethiopia, Krishnan *et al.* [19] and Jacquier-Bret and Gorce [30] who all reported lower back was involved in >60% of the cases. These findings are in line with reports in literature where low back pain is a major public health problem affecting hundreds of millions of individuals worldwide [28] [31]. Similarly, in Malysia, Krishnan and his team in their study to evaluate the incidence of WRMSDs in different anatomical locations among nurses found that, the common body parts reported were: Lower back, neck, shoulders, and upper back [19]. Furthermore, the biomechanics constraints of the lower back region are reported to be more than in other joints among most workers including healthcare workers, explaining why the lower back is more affected [32].

With respect to the distribution of WRMSDs according to place of work (hospital), we found a significant association ($p = 0.001$) between place of work and WRMSDs where workers at the LHD which is one of the largest in the city of Douala were more likely to have WRMSDs. This indicates that the work conditions and work load may vary among different category hospitals. This corroborates reports by Larese *et al.* [33] where nurses working at a General hospital were more likely to have back pain than those at district level. In the same regard, the study of Munabi *et al.* [34] reported nurses working at public hospitals were more likely to suffer from WRMSDs than those in the private settings. This comforts the fact that some hospitals be it public or private could have high demand than others making healthcare workers in these hospitals to be at risk of WRMSDs if proper care is not taken in order to match the healthcare workers with the sick population they receive and treat. It is interesting that our study addressed the distribution of WRMSDs with respect to different category hos-

pital facilities, for differences might be observed which can inform hospital specific strategies to limit or prevent WRMSDs among health workers. Therefore, future studies in this regard will add more knowledge on WRMSDs among healthcare workers.

Regarding the association of some demographic variables with the prevalence of WRMSDs, sex was found to be significantly associated with WRMSDs (Knees, ankle/foot), in line with reports of European foundation [22] and Cavallari *et al.* [21] where the female sex was reported to be at a higher risk for WRMSDs than the males. Age was equally found to be associated with WRMSDs in this study for the following body regions (shoulders, upper back, elbow, knee, ankle/feet), in line with reports from Okunribido and Wynn [35] where age is considered an independent risk factor for WRMSDs.

This may be explained by the fact that, as we grow older, our musculoskeletal systems are likely to undergo modifications including muscle rigidity and bones becoming more brittle [36]. However, some regions like lower back pain did not show a positive association with different age groups, which may be explained by the fact that the lower back is a serious public health problem where young adults just like older population are greatly concerned. This goes in line with reports by Ganesan *et al.* [37] who stated "low back pain is an emerging problem in adolescents with the highest incidence around the third decade" probably linked to stress, smoking, and obesity. Furthermore, longevity in service was also found to be associated with some of the WRMSDs (elbows), which may be due to exposure to poor posture, force, vibration, and repetition for longer time considered to be risk factors of WRMSDs [38]. Interestingly, WRMSDs in the lower back was significantly associated with place of work (hospital) which corroborates reports in literature aforementioned where healthcare workers in larger hospitals with high demand may be more likely to sustain WRMSDs [34].

With respect to the risk factors of WRMSDs; our study reported working in the same position, job stress, working with vibrating objects are significantly associated with WRMSDs. These results are partly in line with those reported by Andrasfay *et al.* [38] where posture, overwork are risk factors for WRMSDs, but disagrees in that, other risk factors cited were repetitive tasks. This difference may be explained by difference in risk factors assessment between both studies and also differences in study design. Contrarily to the study of Andrasfay *et al.* [38] this result is similar to that reported by Yasobant *et al.* [10], where work stress, adopting prolonged posture (standing or sitting) and working in awkward positions were found to be associated to WRMSDs in healthcare workers. These similarities could be explained by the similarity in the study design, as well as to the nature of the job for healthcare workers, who generally work under stress to save or ameliorate the lives of their patients and may sometimes border less about their own health.

There is therefore need for further studies to focus on many more risk factors, as living out some aspects would not permit to adequately establish these risk

factors, and also in order of priority. Among other aspects that were associated to WRMSDs involved marital status and type of healthcare profession. It was found that the different health professions were associated with WRMSDs, the highest prevalence was recorded among medical laboratory technicians and nurses whereas relatively and significantly low for professions such as physicians and physiotherapists.

With respect to marital status, there was a significant difference between married and unmarried participants. This is in line with the study of Oranye and Bennett [39] who reported a significant association between unmarried status and WRMSDs. On the contrary, this result is not in line with that by Heidari *et al.* [40] who found no significant association between marital status and WRMSDs among nurses. This difference may be explained by difficulties in the population of study, as they worked specifically on nurses. Also, the study site and cultural differences as well as the sampling method may have accounted for the difference in results.

5. Strengths and Limitations of the Study

A major strength of this study is that it considered work-related musculoskeletal disorders among healthcare workers. As of now, several studies have focused only on professional healthcare groups such as nurses and physicians. Another major strength of the study is that associations between WRMSDs and the different hospitals involved in the study were made, and it was demonstrated that WRMSDs among healthcare workers could differ with respect to the hospital setting they work in. However, there were a few limitations to the study: firstly, the different units of work in the hospitals were not considered in the analysis and secondly; the risk factors were not separated into environmental, work, and personal risk factors. In future studies, we seek to evaluate these risk factors into the above categories, this will permit us to consider almost all factors susceptible to be associated with WRMSDs among healthcare workers.

Despite the above limitations, the results of this study are robust as it concerns healthcare workers and not just single professional groups. More so, it is the first study in Cameroon to assess the prevalence and risk factors of WRMSDs, considering many professional health groups. The results are therefore pertinent to inform healthcare workers as well as stakeholders on the need to brainstorm on preventing WRMSDs among healthcare workers.

6. Conclusion

The overall prevalence of WRMSDs among healthcare workers and healthcare facilities is high in Douala-Cameroon, agreeing with many studies around the world. MLS and nurses were more affected by WRMSDs, with the highest prevalence from LHD. The lower back, neck, upper back and shoulders were the commonest body parts affected by WRMSDs among healthcare workers. Working on the same posture, stressful job, and vibrations among others were the

major risk factors in developing WRMSDs among healthcare workers in Douala hospitals. Further studies on healthcare workers controlling variability in the sample sizes in individual professions and considering the work unit in the hospital may provide more insights into WRMSDs among healthcare workers in Douala hospitals, Cameroon.

Abbreviations

MD: Medical Doctor
PT: Physiotherapist
SSA: Sub-Saharan Africa
CVDs: Cardiovascular Disorders
MSDs: Musculoskeletal Disorders
MLS: Medical Laboratory Scientist
WRCVDs: Work-Related Cardiovascular Disorders
WRMSDs: Work-Related Musculoskeletal Disorders

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Ethical Consideration

Ethical clearance No. 2021/1511-07/UB/SG/IRB/FHS was obtained from the Institutional Review Board (IRB) of the Faculty of health science of the University of Buea (UB) and administrative authorizations were obtained from the Douala regional delegation of public health and from the different hospital administrators. This study respected the ethical principles of the European Union. The fundamental principles of medical research according to Helsinki's Declaration were strictly respected.

Consent for Publication

All authors consented and accepted for this article to be submitted for publication.

Availability of Data and Materials

Most data generated or analyzed during this study are included in this article. Also, all findings that support the result of this study are included below.

Author's Contributions

M.K.B: Study conception, design, data collection, analysis, results interpretation

and writing. B.M.O.S: Study conception, design, writing and editing. M.N.J: data collection, writing and editing. F.C.B: results interpretation, writing, and editing. B.L.C.E: data collection, writing and editing. A.A.C.N: study design and editing. A.N.P.B: study design and editing. E.S.H: results interpretation, writing, and editing. B.B: study design, editing and validation. M.S.H: study design, editing and validation. All Authors fully reviewed the manuscript.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Yang, S., Li, L., Wang, L., Zeng, J. and Li, Y. (2020) Risk Factors for Work-Related Musculoskeletal Disorders among Intensive Care Unit Nurses in China: A Structural Equation Model Approach. *Asian Nursing Research*, **14**, 241-248. https://www.sciencedirect.com/science/article/pii/S1976131720300669 https://doi.org/10.1016/j.anr.2020.08.004

[2] Anap, D.B., Iyer, C. and Rao, K. (2013) Work Related Musculoskeletal Disorders among Hospital Nurses in Rural Maharashtra, India: A Multi Centre Survey. *International Journal of Research in Medical Sciences*, **1**, 101-107. https://doi.org/10.5455/2320-6012.ijrms20130513

[3] El Far, H.E., Albitar, E.A.E.F., Araby, E.M., Nabil, N. and Hassan, O.M. (2020) Patterns of Work-Related Musculoskeletal Disorders among Health Care Workers. *The Egyptian Journal of Hospital Medicine*, **81**, 2325-2334. https://doi.org/10.21608/ejhm.2020.131251

[4] Munabi, I.G., Buwembo, W., Kitara, D.L., Ochieng, J. and Mwaka, E.S. (2014) Musculoskeletal Disorder Risk Factors among Nursing Professionals in Low Resource Settings: A Cross-Sectional Study in Uganda. *BMC Nursing*, **13**, Article No. 7. https://doi.org/10.1186/1472-6955-13-7

[5] Buh, F.C., Kuate-Takam, A.B., Vusheng, V. and Ngeh, E. (2021) Prevalence and Risk Factors of Work-Related Musculoskeletal Disorders among Nurses and Physiotherapists in Douala. *International Journal of Advanced Research and Review*, **6**, 35-47.

[6] Kinaci, E. and AtaoĞLu, S. (2020) Work Related Musculoskeletal Disorders among the Physiotherapists: Sample of a Region in Turkey. *Türkiye Klinikleri Journal of Medical Sciences*, **5**, 495-502. https://doi.org/10.5336/healthsci.2019-71762

[7] Vaidya, A., Sainju, N.K. and Joshi, S.K. (2015) Work Related Musculoskeletal Disorders among Surgeons Working in a Tertiary Care Hospital in Kathmandu, Nepal. *International Journal of Occupational Safety and Health*, **5**, 6-10. https://doi.org/10.3126/ijosh.v5i2.17948

[8] Chiwaridzo, M., Makotore, V., Dambi, J.M., Munambah, N. and Mhlanga, M. (2018) Work-Related Musculoskeletal Disorders among Registered General Nurses: A Case of a Large Central Hospital in Harare, Zimbabwe. *BMC Research Notes*, **11**, Article No. 315. https://doi.org/10.1186/s13104-018-3412-8

[9] Tariah, H.A., Nafai, S., Alajmi, M., Almutairi, F. and Alanazi, B. (2020) Work-Related Musculoskeletal Disorders in Nurses Working in the Kingdom of Saudi Arabia. *Work* (*Reading*, *Mass.*), **65**, 421-428. https://doi.org/10.3233/WOR-203094

[10] Yasobant, S. and Rajkumar, P. (2014) Work-Related Musculoskeletal Disorders among Health Care Professionals: A Cross-Sectional Assessment of Risk Factors in a Tertiary Hospital, India. *Indian Journal of Occupational and Environmental Medicine*, **18**, 75-81. https://doi.org/10.4103/0019-5278.146896

[11] Kgakge, K., Hlongwa, M. and Ginindza, T. (2021) The Distribution of Work-Related Musculoskeletal Disorders among Nurses in Sub-Saharan Africa: A Scoping Review Protocol. *Systematic Reviews*, **10**, Article No. 229. https://doi.org/10.1186/s13643-021-01774-7

[12] Esembeson, M., Abia, W., Longdoh, N.A., Cyrille, N., Mokake, D., Nde-Fon, P., Ngunde, P.J. and Halle-Ekane, G.E. (2020) Prevalence of Work-Related Musculoskeletal Disorders and Risk Factors amongst Nurses of Buea and Tiko Health Districts, South West Region, Cameroon. *International Journal of Trend in Scientific Research and Development*, **4**, 1216-1223.

[13] Ngunde, P.J., Akade, N.-B.N., Solange, D.M., *et al.* (2021) Musculoskeletal Disorders among Workers in the Cameroon Railways Corporation-Camrail, Douala, Cameroon. *Revue de Médecine et de Pharmacie*, **10**, 3-4.

[14] Shaikh, S., Siddiqui, A.A., Alshammary, F., Amin, J. and Agwan, M.A.S. (2021) Musculoskeletal Disorders among Healthcare Workers: Prevalence and Risk Factors in the Arab World. In: Laher, I., Ed., *Handbook of Healthcare in the Arab World*, Springer, Cham, 1-39. https://doi.org/10.1007/978-3-319-74365-3_129-1

[15] Kuorinka, I., Jonsson, B., Kilbom, A., Vinterberg, H., Biering-Sørensen, F., Andersson, G., *et al.* (1987) Standardised Nordic Questionnaires for the Analysis of Musculoskeletal Symptoms. *Applied Ergonomics*, **18**, 233-237. https://doi.org/10.1016/0003-6870(87)90010-X

[16] Ethiopian Ministry of Health (2020) Facts Sheets Ethiopia 202: Human Resource for Health. https://www.moh.gov.et/site/fact-sheets#:~:text=Human%20Resource%20for%20Health%3A&text=Regarding%20health%20professional%20to%20population,more%20than%2017%2C000%20health%20posts

[17] Collins, F.S., Glass, R.I., Whitescarver, J., Wakefield, M. and Goosby, E.P. (2010) Public Health. Developing Health Workforce Capacity in Africa. *Science*, **330**, 1324-1325. https://doi.org/10.1126/science.1199930

[18] Kofi-Bediako, A.A., Sama, G., Yarfi, C., Ed-Bansah, D. and Acquah, A.A. (2021) Work-Related Musculoskeletal Disorders among Nurses at the Ho Teaching Hospital, Ghana. *Proceedings of the* 2021 *HFES* 65*th International Annual Meeting*, Baltimore, 4-7 October 2021, 1291-1294. https://doi.org/10.1177/1071181321651342

[19] Krishnan, K.S., Raju, G. and Shawkataly, O. (2021) Prevalence of Work-Related Musculoskeletal Disorders: Psychological and Physical Risk Factors. *International Journal of Environmental Research and Public Health*, **18**, Article No. 9361. https://doi.org/10.3390/ijerph18179361

[20] Yang, S., Lu, J.M., Zeng, J.Q., Wang, L.Q. and Li, Y.L. (2018) Prevalence and Risk Factors of Work-Related Musculoskeletal Disorders among Intensive Care Unit Nurses in China. *Workplace Health & Safety*, **67**, 275-287. https://doi.org/10.1177/2165079918809107

[21] Cavallari, J.M., Ahuja, M., Dugan, A.G., Meyer, J.D., Simcox, N., Wakai, S. and Garza, J.L. (2016) Differences in the Prevalence of Musculoskeletal Symptoms

among Female and Male Custodians. *American Journal of Industrial Medicine*, **59**, 841-852. https://doi.org/10.1002/ajim.22626

[22] European Foundation for the Improvement of Living and Working Conditions (2008) Women More Risk of Musculoskeletal Disorders. https://www.eurofound.europa.eu/publications/article/2008/women-more-at-risk-of-musculoskeletal-disorders

[23] Milhem, M., Kalichman, L., Ezra, D. and Alperovitch-Najenson, D. (2016) Work-Related Musculoskeletal Disorders among Physical Therapists: A Comprehensive Narrative Review. *International Journal of Occupational Medicine and Environmental Health*, **29**, 735-747. https://doi.org/10.13075/ijomeh.1896.00620

[24] Ellapen, T.J. and Narsigan, S. (2014) Work-Related Musculoskeletal Disorders among Nurses: Systematic Review. *Journal of Ergonomics*, **S4**, S4-003. https://doi.org/10.4172/2165-7556.S4-003

[25] Vieira, E.R., Schneider, P., Guidera, C., Gadotti, I.C. and Brunt, D. (2016) Work-Related Musculoskeletal Disorders among Physical Therapists: A Systematic Review. *BMR*, **29**, 417-428. https://doi.org/10.3233/BMR-150649

[26] Chen, C.Y., *et al.* (2022) Work-Related Musculoskeletal Disorders among Physical Therapists in Taiwan. *Medicine*, **101**, e28885. https://doi.org/10.1097/MD.0000000000028885

[27] Rambabu, T. and Suneetha, K. (2014) Prevalence of Work Related Musculoskeletal Disorders among Physicians, Surgeons and Dentists: A Comparative Study. *Annals of Medical and Health Science Research*, **4**, 578-582. https://doi.org/10.4103/2141-9248.139327

[28] López-González, M.J., González, S. and González-Menéndez, E. (2021) Prevalence of Musculoskeletal Problems in Laboratory Technicians. *International Journal of Occupational Safety and Ergonomics*, **27**, 840-851. https://doi.org/10.1080/10803548.2019.1646531

[29] Mekonnen, T.H. (2019) Work-Related Factors Associated with Low Back Pain among Nurse Professionals in East and West Wollega Zones, Western Ethiopia, 2017: A Cross-Sectional Study. *Pain and Therapy*, **8**, 239-247. https://doi.org/10.1007/s40122-019-0129-x

[30] Jacquier-Bret, J. and Gorce, P. (2023) Prevalence of Body Area Work-Related Musculoskeletal Disorders among Healthcare Professionals: A Systematic Review. *International Journal of Environmental Research and Public Health*, **20**, Article No. 841. https://doi.org/10.3390/ijerph20010841

[31] Latina, R., Petruzzo, A., Vignally, P., Cattaruzza, M.S., Vetri Buratti, C., Mitello, L., Giannarelli, D. and D'Angelo, D. (2020) The Prevalence of Musculoskeletal Disorders and Low Back Pain among Italian Nurses: An Observational Study. *Acta Biomedica*, **91**, e2020003.

[32] Ramond-Roquin, A., Bodin, J., Serazin, C., Parot-Schinkel, E., Ha, C., Richard, I., Petit Le Manach, A., Fouquet, N. and Roquelaure, Y. (2015) Biomechanical Constraints Remain Major Risk Factors for Low Back Pain. Results from a Prospective Cohort Study in French Male Employees. *The Spine Journal*, **15**, 559-569. https://doi.org/10.1016/j.spinee.2013.05.040

[33] Larese, F. and Fiorito, A. (1994) Musculoskeletal Disorders in Hospital Nurses: A Comparison between Two Hospitals. *Ergonomics*, **37**, 1205-1211. https://doi.org/10.1080/00140139408964898

[34] Munabi, I.G., Buwembo, W., Kitara, D.L., Ochieng, J., Nabirye, R.C. and Mwaka, E.S. (2014) Musculoskeletal Disorders among Nursing Staff: A Comparison of Five

Hospitals in Uganda. *The Pan African Medical Journal*, **17**, Article No. 81. https://doi.org/10.11604/pamj.2014.17.81.3213

[35] Okunribido, O. and Wynn, T. (2010) Ageing and Work-Related Musculoskeletal Disorders: A Review of Recent Literature. Contemporary Ergonomics and Human Factors, Buxton, 50 p.

[36] Medline Plus. Aging Changes in the Bones-Muscles-Joints 2023. https://medlineplus.gov/ency/article/004015.htm#:~:text=Muscles%20may%20become%20rigid%20with,tone%2C%20even%20with%20regular%20exercise.&text=Bones%20become%20more%20brittle%20and,pain%2C%20stiffness%2C%20and%20deformity

[37] Ganesan, S., Acharya, A.S., Chauhan, R. and Acharya, S. (2017) Prevalence and Risk Factors for Low Back Pain in 1355 Young Adults: A Cross-Sectional Study. *Asian Spine Journal*, **11**, 610-617. https://doi.org/10.4184/asj.2017.11.4.610

[38] Andrasfay, T., Raymo, N., Goldman, N. and Pebley, A.R. (2021) Physical Work Conditions and Disparities in Later Life Functioning: Potential Pathways. *SSM—Population Health*, **16**, Article ID: 100990. https://doi.org/10.1016/j.ssmph.2021.100990

[39] Oranye, N.O. and Bennett, J. (2018) Prevalence of Work-Related Musculoskeletal and Non-Musculoskeletal Injuries in Health Care Workers: The Implications for Work Disability Management. *Ergonomics*, **61**, 355-366. https://doi.org/10.1080/00140139.2017.1361552

[40] Heidari, M., Borujeni, M.G., Rezaei, P. and Kabirian Abyaneh, S. (2019) Work-Related Musculoskeletal Disorders and Their Associated Factors in Nurses: A Cross-Sectional Study in Iran. *Malaysian Journal of Medical Sciences*, **26**, 122-130. https://doi.org/10.21315/mjms2019.26.2.13