Original Paper

Stress and Prevalence of Musculoskeletal Disorders Among the Nursing Personnel of a Tertiary Hospital Unit in Greece: A Cross-Sectional Study

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ABSTRACT: Background: Work-related musculoskeletal injuries and disorders (WMSD) are a significant cause of morbidity in the health care sector. Healthcare professionals are routinely exposed to various physical and psychosocial factors that increase the risk of developing a WMSD. Nurses are more susceptible to the manifestation of such disorders. Methods: A cross-sectional study was conducted during the second semester of 2020. The Nordic Questionnaire (NMQ) was used to investigate the prevalence of musculoskeletal symptoms, the Short Anxiety Screening Test (SAST) for stress detection, and a data collection sheet was developed for the registration of clinical, demographic, and anthropometric characteristics of the nursing personnel of the tertiary hospital unit of Heraklion, Crete, Greece. Results: A percentage of 82% of nurses had developed at least one musculoskeletal symptom in the last 12 months. The most common anatomical areas at which symptoms were present the last 12 months were the neck (53.9%), shoulders (50.8%), and the lower back (49.5%). The same areas were also the reported anatomical regions, most affected by musculoskeletal symptoms when stress levels were high. Absence from work was associated with the onset of musculoskeletal symptoms ($p<0.001$), while nurses' financial expenses (out-of-pocket payment) appeared to be associated with the onset of any symptom at 12 months, musculoskeletal symptoms limiting everyday activity at 12 months, and current musculoskeletal symptoms ($p=0.001$, $p=0.002$, and $p=0.002$ respectively). Conclusions: Musculoskeletal disorders were common among the nursing personnel. Higher levels of stress were related with a higher prevalence of musculoskeletal symptoms.

KEYWORDS: *Musculoskeletal disorders, stress, nurses, occupational health.*

Introduction

Work-related musculoskeletal disorders (WMSDs) are defined as isolated or combined complications in the muscles, tendons, synovial membranes (joint tissue) nerves, fasciae and ligaments, with or without tissue degeneration, attributable to work activities [1].

Malaise, impairment, disability, or continuous pain are caused by WMSDs [2].

WMSDs are responsible for morbidity in many working population groups and are known as an important occupational descriptor which can lead to increased healthcare costs, reduced productivity, and lower quality of life [3,4].

Epidemiological studies have shown that WMSDs are a significant health care issue that develops among nurses, with a prevalence ranging from 33.0% to 88.0 % worldwide [5].

The most affected anatomical regions are the lower back, neck, shoulders, arms, and wrists [5,6].

WMSDs are characterized as multifactorial [7], while some risk factors that contribute to their development in nurses are poor ergonomics, long-standing positions, and repetitive movements.

Poor working conditions as well as lifting weights (care, transport of patients to and from the bed) [8,9], which is the main source of musculoskeletal overload, increase the risk of serious injuries in the lower back and can cause acute and chronic musculoskeletal problems [10,11].

Furthermore, lifestyle (smoking, alcohol, eating habits), lack of physical activity, obesity and stress can affect the development of WMSDs [12].

WMSDs also have a significant financial impact on the sufferers as they have been connected to absence from work, reduced productivity, and early retirement, with direct and indirect socioeconomic costs.

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The negative effects of WMSDs affect not only the health of nurses but also the quality of services provided to patients [13].

Materials and Methods

Study setting and sample

Data were gathered from the University General Hospital of Heraklion in Crete, Greece, from June 2020 to December 2020.

The nursing staff of the hospital participated in the study. Specifically, men and women who had been working as nurses for at least 12 months were involved in the study.

Nursing staff that were not actively employed during data collection (e.g., nurses on sickness or other leave) were excluded.

Personnel accounted for 980 nurses and 510 questionnaires were distributed, with a rolling manner to clinics, sub-units and laboratories.

Instruments

Greek versions of the Nordic questionnaire for the analysis of musculoskeletal symptoms (NMQ) [14,15] and of the Short Anxiety Screening Test (SAST) [16,17] were implemented to investigate musculoskeletal symptoms and stress.

Additional information concerning socio-demographic and anthropometric characteristics of the nursing staff (age, gender, cohabitation, clinical comorbidity, weight, height, BMI, health habits etc.) was gathered using a customized data collection tool.

The Greek version of the standardized Nordic Musculoskeletal Questionnaire (NMQ) (general form) was used to identify participants having musculoskeletal problems.

The NMQ is a self-administered questionnaire, designed for the purpose of screening for musculoskeletal disorders (MSDs) in epidemiological studies and has been translated and validated into the Greek language.

The use of NMQ to measure MSD prevalence in nursing staff has been applied in various studies [18,19], enquiring the impact of working conditions.

The NMQ consists of 27 items examining MSDs, while assessing the degree of debilitation during the last year, exploring the presence of symptoms during the last week, and classifying the severity of the reported symptoms [14].

The Short Anxiety Screening Test (SAST) is a 10-item measure of distress rated on a 4-point response scale.

It generates scores between 10 and 40; a higher score indicating a higher degree of stress.

The SAST has also been validated in the Greek language [16].

A data collection sheet was developed for the registration of clinical, demographic and anthropometric characteristics of the nursing staff of the University General Hospital of Heraklion such as gender, place and date of birth, nationality, marital status, number of persons cohabiting, number of children, age of children, years of education, level of education, health habits (smoking, alcohol, sleep, physical activity), weight, height, body mass index, morbidity (blood pressure, coronary heart disease, diabetes, etc.), number of sick days, out-of-pocket payment expenses and number of medicines used on a daily basis.

Ethical considerations

The participation of individuals in the research was deemed voluntary, yet necessary.

The questionnaires were anonymous and did not contain personal data of patients or individuals from which the participants' identity could be revealed under any circumstances.

Printed material with the distributed questionnaires was strictly anonymous without any possibility to relate personal information with responses or scale rating.

The answers were completely confidential and only members of the research team had access to them.

The answers were used exclusively for research purposes and were subject to quantitative and/or qualitative processing as a whole.

No partial information was published except for the investigation findings in the current report.

The study was approved by the Research Ethics Committee of the University of Crete (REC-UoC), Greece (protocol number 66/13.03.2020), and by the relevant ethics committee of the 7th healthcare district of Greece (protocol number 33435, date of approval July 24th, 2020).

All participants gave their consent by completing anonymous questionnaires.

This study was approved as a part of a MSc thesis, within the Postgraduate Studies Committee of the Medical School of the University of Crete.

Analysis of data

Statistical analysis was performed using the IBM SPSS Statistics 26.0 software and a level of acceptance was set at a=0.05.

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The comparison between different means for continuous scales (e.g., SAST, age etc.) was assessed using an independent samples t-test, while ANOVA was used for comparison of more than two groups (e.g., categorizing anxiety as positive, marginal, or negative).

When categorical variables or categorized data were used, their association with the existence of musculoskeletal disorders was tested using a Pearson chi-square (χ^2) statistic.

Differences in the total number of analysed cases were observed due to missing values in questionnaire items.

Results

Participation rate and sample characteristics

Out of the 510 questionnaires distributed, with a rolling manner to clinics, sub-units and laboratories, 262 (51.4%) were collected.

Of those, 221 were partly or totally completed, (response rate 42.9%).

165 participants (75.3%) were from Crete, 44 persons from Athens and the rest of Greece, and 10 respondents from outside of Greece.

Women made up the majority of the sample, including 184 participants and a percentage of 83.3%, while 131 (59.3%) were married and 72 (32.6%) were single.

In terms of education, a small percentage, namely 41 persons have received secondary education, 22.9%, while 28 (15.6%) attended postgraduate studies (master/PhD).

The 5 most relative comorbidities among partcipants were B-12 deficiency; accounting for a percentage of 25.5%, Irritable Bowel Syndrome (16.7%), Anemia (13%), Dyslipidaemia (12.6%) and Hypertension (12.1%).

Anatomical regions affected

The results for the nine anatomical areas according to NMQ, the 1-year prevalence, the prevalence of daily limitations due to reported symptoms, and the point prevalence (musculoskeletal symptoms during last week) are depicted in Table 1.

Table 1. Time period and symptoms (n%): Twelve-month prevalence of any musculoskeletal (MSK) symptoms, reported symptoms limiting everyday activity in the last 12 months, any musculoskeletal symptoms during the last week.

Time period and symptoms	12-month prevalence of any MSK symptoms	12-month prevalence of MSK symptoms limiting everyday activity	Any MSK symptom during last week
Affected area	**% (n)/Valid n**	**% (n)/Valid n**	**% (n)/Valid n**
Neck	53.9 (110)/204	43.0 (83)/193	41.5 (80)/193
Shoulders	50.8 (102)/201	33.3 (63)/189	30.9 (58)/188
Elbows	15.0 (30)/201	11.7 (21)/180	8.4 (15)/178
Wrists/Hands	34.5 (69)/200	29.1 (53)/182	20.4 (37)/181
Upper Back	15.7 (30)/191	13.2 (23)/174	12.3 (21)/171
Lower Back	49.5 (99)/200	41.0 (75)/183	32.6 (60)/184
Hips	29.5 (57)/193	22.7 (40)/176	21.0 (37)/176
Knees	29.3 (58)/198	20.8 (37)/178	18.5 (33)/178
Ankles	15.8 (31)/196	14.9 (26)/174	12.6 (22)/175
Any area	82.1 (174)/212	69.8 (143)/205	62.9 (129)/212

174 participants (82.1%) reported having musculoskeletal problems in any area during the previous 12 months, while 143 (69.8%) respondents reported that symptoms in any area were severe enough to limit their everyday activity during the same period, and 129 (62.9%) any symptoms during the last week.

Musculoskeletal symptoms in the last 12 months were most common in the neck (53.9%), shoulders (50.8%), and lower back (49.5%).

Symptoms limiting everyday activity were mostly reported in the neck (43.0%), lower back (41.0%), and shoulders (33.3%).

Any musculoskeletal symptoms during the last week showed similar trends of occurrence (Table 1).

A graphical representation of these findings is visualized in Figure 1.

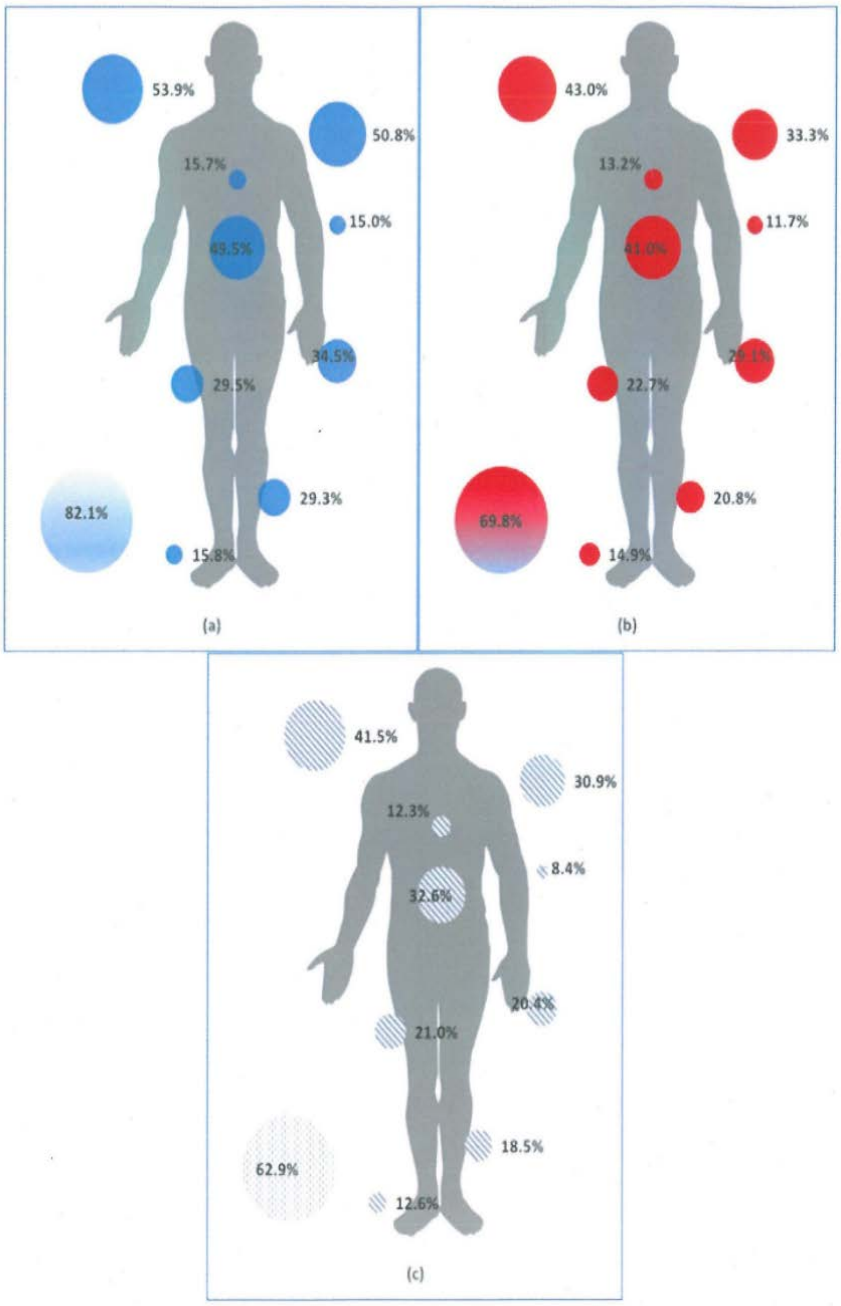

Figure 1. Visualization of anatomical areas: (a) Twelve-month prevalence of any kind of musculoskeletal (MSK) symptoms (b) self-reported symptoms limiting everyday activity in the last 12 months, and (c) any musculoskeletal symptoms during the last week.

Stress levels

The SAST was used for stress assessment among the participants. Correlation between SAST scores (positive≥24, marginal 22-23, negative≤21) and musculoskeletal symptoms are shown in Table 2.

The 12-month prevalence of musculoskeletal symptoms for the neck seems to be higher when SAST is positive (77.8%) compared to the marginal SAST (66.7%) and SAST≤21 (39.3%) ($p<0.01$).

A relationship between SAST and 12-month musculoskeletal symptoms was observed for the shoulders and the lower back ($p=0.008$, $p=0.004$ respectively).

Finally, any affected area with MSK symptoms during the last 12 months is mostly related to a positive SAST assessment (92.9%) compared to a marginal SAST, (91.2%) or negative SAST (74.6%) (Table 2).

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Table 2. Association between SAST score and: (a) 12-month prevalence of any musculoskeletal symptoms, (b) 12-month prevalence of musculoskeletal symptoms limiting everyday activity, and (c) prevalence of musculoskeletal (MSK) symptoms during the last 7 days.

	SAST and 12-month prevalence of MSK, any symptoms				SAST and 12-month prevalence of MSK symptoms limiting everyday activity				SAST and prevalence of MSK, any symptoms during the last 7 days			
	Positive ≥24	Marginal (22-23)	Negative ≤21		Positive ≥24	Marginal (22-23)	Negative ≤21		Positive ≥24	Marginal (22-23)	Negative ≤21	
	% (n)	% (n)	% (n)	p	% (n)	% (n)	% (n)	p	% (n)	% (n)	% (n)	p
Neck	77.8 (42)	66.7 (22)	39.3 (46)	<0.01	63.0 (34)	45.2 (14)	32.4 (35)	<0.001	67.9 (36)	50.0 (15)	26.4 (29)	<0.001
Shoulders	60.4 (32)	62.5 (20)	43.1 (50)	0.008	44.0 (22)	30.0 (9)	29.4 (32)	0.175	44.0 (22)	24.1 (7)	26.6 (29)	0.061
Elbows	15.7 (8)	15.2 (5)	14.5 (17)	0.920	14.9 (7)	6.7 (2)	11.7 (12)	0.548	10.6 (5)	6.9 (2)	7.8 (8)	0.806
Hands/wrists	50.9 (27)	25.0 (8)	29.6 (34)	0.079	34.7 (17)	10.7 (3)	16.3 (17)	0.012	34.7 (17)	10.7 (3)	16.3 (17)	0.012
Upper Back	25.0 (12)	10.0 (3)	13.3 (15)	0.112	21.7 (10)	15.4 (4)	8.8 (9)	0.094	19.6 (9)	11.5 (3)	9.1 (9)	0.200
Lower back	67.3 (35)	54.8 (17)	40.2 (47)	0.004	61.5 (32)	40.7 (11)	31.7 (33)	0.002	46.2 (24)	25.0 (7)	27.9 (29)	0.047
Hips	39.2 (20)	30.0 (9)	25.0 (28)	0.182	29.8 (14)	17.2 (5)	21.0 (21)	0.368	31.3 (15)	17.9 (5)	17.0 (17)	0.124
Knees	37.3 (19)	26.7 (8)	26.5 (31)	0.349	27.7 (13)	14.8 (4)	19.2 (20)	0.352	23.4 (11)	18.5 (5)	16.3 (17)	0.586
Ankles	20.4 (10)	12.9 (4)	14.7 (17)	0.580	20.0 (9)	11.1 (3)	13.7 (14)	0.513	17.4 (8)	7.4 (2)	11.8 (12)	0.430
Any area	92.9 (52)	91.2 (31)	74.6 (91)	0.004	82.5 (47)	68.8 (22)	63.8 (74)	0.042	80.4 (45)	62.5 (20)	54.7 (64)	0.005

Additionally, the 12-month prevalence of musculoskeletal symptoms limiting everyday activity was higher for the neck when SAST was positive (63.0%) in comparison to marginal (45.2%), and negative (32.4%, p<0.001).

Similar results were observed for the hands/wrists with prevalence for positive scores being 34.7%, for SAST scores equal to 22-23; 10.7%, and for SAST≤21; 16.3% (p<0.012).

There was a correlation between any musculoskeletal symptoms during the last 7 days and stress levels for the neck (67.9%, p<0.001), wrists/hands (34.7%, p=0.012), lower back (46.2%, p=0.047), and for any affected area (80.4%, p=0.005) (SAST≥24) (Table 2).

MSK symptoms and BMI, absence from work, and out-of-pocket payment.

BMI was not found to be associated with musculoskeletal symptoms, while absence from work and nurses' personal financial expenses seem to have a positive correlation with the existence of musculoskeletal symptoms (MSK) (Table 3).

Table 3. Correlation between BMI, absence from work, participants' personal expenses and musculoskeletal symptoms.

		1-year prevalence of MSK symptoms		1-week prevalence of MSK symptoms
		Any MSK symptom	MSK symptoms limiting everyday activity	
		% (n)	% (n)	% (n)
BMI (Kg/m^2)	<25	38.0 (65)	39.3 (55)	34.9 (44)
	25-30	38.0 (65)	36.4 (51)	38.1 (48)
	>30	24.0 (41)	24.3 (34)	27.0 (34)
	p-value	0.137	0.899	0.157
Absence due to MSK symptoms (days)	None	64.0 (96)	56.3 (71)	58.1 (68)
	Up to 1 week	18.7 (28)	21.4 (27)	20.5 (24)
	Up to 2 weeks	8.0 (12)	10.3 (13)	9.4 (11)
	>2 weeks	9.3 (14)	11.9 (15)	12.0 (14)
	p-value	0.090	<0.001	0.012
Personal financial Expenses for MSK symptoms (€)	1-30	38.1 (56)	33.6 (42)	33.9 (39)
	31-100	21.1 (31)	25.6 (32)	27.0 (31)
	100 +	5.4 (8)	6.4 (8)	6.1 (7)
	p-value	0.001	0.002	0.002

Absence from work seems to be related to musculoskeletal symptom severity.

About 21.4% of patients with everyday limiting MSK symptoms the last year reported absence from work lasting up to one week due to their symptoms, whereas 18.7% of patients with no specific symptom severity during the last year were similarly absent from work for the same reason.

Costs were associated with any form of musculoskeletal symptoms at 12 months (p=0.001), musculoskeletal symptoms limiting everyday activity at 12 months (p=0.002) and musculoskeletal symptoms during the previous week (p=0.002).

About 35% of respondents spent 0€ on musculoskeletal symptoms, while about 6% paid over 100€ regardless of the severity and extent of the symptoms.

Discussion

It is well-expected that nurses have a higher prevalence of musculoskeletal disorders than other health professionals.

The cause of the development of musculoskeletal disorders in the workplace is multifactorial [7,8], increasing the risk of acute and chronic musculoskeletal injuries [11].

At the same time, the manifestation of musculoskeletal disorders among nurses has been associated with absence from work [5], and even resignation or retirement [7,13].

Main findings

The results of the present study showed a high prevalence of musculoskeletal symptoms in 8 out of 10 nurses.

This finding is in accordance with other national as well as international studies [2,20-22] with oscillating frequencies from 71.85% to 89.0%.

Most of the above studies used the Nordic Questionnaire as a tool for the detection of musculoskeletal symptoms, as we did in the present study.

However, in comparison to the studies of Ellapen&Narsigan, 2014 and Yan et al., 2017 the prevalence of musculoskeletal symptoms in the present study is higher [2,20].

The most commonly affected anatomical area seems to be the neck (53.9%), followed by the shoulders (50.8%), the lower back (49.5%), the wrists/hands (34.5%), hips (29.5%), knees (29.3%), ankles (15.8%), upper back (15.7%) and elbows (15.0%).

Likewise, Azma et al., 2016 and Long et al., 2013 reported that the most affected area was the neck representing 48.9% and 45.0% respectively [7,23].

However, the prevalence of musculoskeletal symptoms in the neck was higher in the present study.

In other studies, nevertheless, the most commonly affected area was the lower back, while in the study of Lin et al, 2020 were the shoulders [2,21,24-28].

Cultural differences in the perception and reporting of pain symptoms, as well as different workload and physical duties, could be responsible for the variation of musculoskeletal disorders between different studies [13].

In our study, nurses also displayed high levels of stress.

High levels of stress have been linked to an increase of the prevalence of musculoskeletal symptoms.

In the study of Campo et al., nurses who had high levels of anxiety and depression bore a higher risk of developing musculoskeletal disorders than those who had lower levels [29].

Accordingly, in the present study, an increase in the prevalence of musculoskeletal symptoms was observed as stress levels increased.

The most affected area among the participants with high SAST score was the neck (77.7%), followed by the lower back (67.3%) and the shoulders (60.4%).

Smedley et al., 2003, suggested that nursing staff with stress were more likely to develop musculoskeletal pain in the neck or shoulders [30].

The results of the present study resemble the study of Amin et al., 2018, where the most affected area was the neck and shoulders in relation to the reported stress of nurses [31].

A systematic review by Bernall et al., 2015, showed that psychological risk factors in the workplace are associated with the development of musculoskeletal disorders in nurses [32].

Psychosocial factors associated with the development of musculoskeletal disorders, including but not limited to the highly demanding environment of health workers, the lack of supervision, and the lack of support from superiors [31], lead to the development of acute and chronic stress and the manifestation of burnout syndrome.

In the systematic review of Chemali et al., 2019, the prevalence of burnout syndrome in nurses was found to be the highest among professional caregivers [34].

The association between burnout syndrome and the onset of illness has not been extensively studied, and future studies are needed to investigate this association to establish prevention and intervention programs [21].

No significant association was found between participant BMI and reported musculoskeletal symptoms.

This is an unexpected finding, since many reports in the literature associate increased BMI with higher musculoskeletal symptom prevalence and severity [22,35].

In our study, one out of four nurses had an increased BMI, and no correlations were found in terms of symptom prevalence and current manifestations.

Work-related musculoskeletal disorders have been linked to absence from work, reduced productivity, and early retirement with direct and indirect socioeconomic costs [13].

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This study also found that nurses who report musculoskeletal symptoms limiting everyday activity request more days off from work.

In a prospective cohort study by Andersen et al, 2012, female caregivers reported pain mainly in the lower back and secondarily in anatomical areas such as the neck/shoulders, and knees.

These musculoskeletal symptoms were associated with absence from work and the use of sick leave for at least 8 weeks [27].

In Greece, Alexopoulos et al., 2004, investigated the correlation between musculoskeletal pain and absence from work [36].

The most affected areas were the lower back, neck, and shoulders.

The high rates of pain and injury that nurses face contribute to absence from work, inadequate staffing, and increased workload.

It also creates temporary or permanent disability with significant financial consequences due to workers' compensation and medical expenses [37].

Implications of the study

Prevention and intervention initiatives to minimize the occurrence of musculoskeletal symptoms in the sector of health care, and particularly in nurses, would constitute a fertile ground for constructive discussion.

Limitations of the study

In spite of the relatively limited sample size, a percentage of 22.6% of the personnel of the University General Hospital of Heraklion, Crete was attained, since 221 questionnaires were gathered from a staff reservoir counting for 980 persons.

Nevertheless, all questionnaire items were not completed, hence differences in the total number of analyzed cases occurred due to missing values in various questionnaire domains.

The main limitation of the study is that it is based on self-reported symptoms of musculoskeletal disorders that were not verified by clinical examination.

Therefore, the prevalence of musculoskeletal symptoms may not be accurately estimated.

Moreover, due to the lack of supervision by the researcher during the completion of the questionnaires, several questionnaires were returned after some days of distribution, so it is possible that there are a few biases, as data reflect a mixed time reporting.

There is some risk of influences in responses after some discussion on the topic or study content between colleagues.

However, the nature of anonymous information requested on symptoms or stress is not related to collectively delicate matters or ideas, to which one can reply with motivation of what is expected as an answer.

Furthermore, the survey was conducted during a rather difficult time during the COVID-19 pandemic, which had important social and economic consequences worldwide.

This has led to an even greater increase in the workload of nurses, which produced higher levels of stress.

Finally, this is a cross-sectional study that cannot offer information on the causal correlation between exposure (occupational activity) and outcome (development of musculoskeletal disorders) but only suggests a possible link between them.

Therefore, possible risk cofactors can mask and blur the net contribution of occupational activity.

Conclusion

Musculoskeletal disorders among the nursing personnel of the University General Hospital of Heraklion are a common health problem that has also been observed in other national and international studies.

In addition, stress appears to be associated with the development of musculoskeletal disorders in nurses, acting as a potential contributing factor for the development of WMSDs.

Taking into consideration the findings of the present study, it would be beneficial to discuss prevention and intervention initiatives to reduce the occurrence of musculoskeletal symptoms in the field of health care, and especially in nurses.

However, more studies are needed to investigate possible risk factors for developing musculoskeletal disorders in nurses in relation to stress and overall occupational risk.

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Conflict of interests

None to declare

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