

# Work - Related Musculoskeletal Disorders Among Female And Male Nursing Personnel In Greece

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**Abstract- Background.** Work-related musculoskeletal disorders (WMSDs) have a significant impact on nurses worldwide. However there is limited information on its prevalence in Greece.

**Objectives.** To explore: (1) lifetime, annual and weekly prevalence rates of WMSDs in nursing personnel and (2) the perceived (according to the nurses) risk factors for WMSDs and (3) the inter-gender differences.

**Methods.** This cross-sectional study was conducted among 300 randomly selected nurses across 15 hospitals in Greece. Data was collected via the Nordic questionnaire asking for lifetime, annual and weekly prevalence of WMSDs and a self-administered questionnaire for obtaining the socio-demographic variables and the risk factors.

**Conclusions.** Questionnaires were completed by 278 nurses (response rate 92,7%). Musculoskeletal symptoms were experienced by 84% of the participants at least once in their lifetime. The most prevalent area among nurses was low back pain (lifetime prevalence: 59,15% annual prevalence: 39,6% and weekly prevalence: 34,2%). Of the most important perceived risk factors for musculoskeletal disorders were lack of ergonomic knowledge and training as well as shortage of staff amongst nursing personnel in Greek hospitals.

**Index Terms**— musculoskeletal disorders, nurses, risk factors, injuries

## I. INTRODUCTION

Work-related musculoskeletal disorders (WMSDs) are isolated or combined problems in the muscles, tendons, synovial membranes (joint tissue) nerves, fascia (connective tissue) and ligaments, with or without tissue degeneration, caused by work [1].

Nurses as part of the multi-disciplinary medical team within hospitals and other medical centers are susceptible to WMSDs [2],[3],[4]. Their work is repetitive, demanding, requires physical effort with frequent weight lifting and moving patients around, which often includes bad postures during the manoeuvres [1], [5]. Such working conditions are

reported to be associated with mental stressors that represent risk factors for the occurrence of WMSDs [1], [5], [6]. Specifically, manual patient handling is reported as the major source of musculoskeletal load among hospital nurses [8], [9]. Manual handling of patients is extremely hazardous to healthcare workers, creating substantial risk of low back injury, even in cases with two patient handlers [10].

Research relevant to this topic has identified various individual, physical and psychosocial risk factors for common WMSDs [11], [12], [13], [14], [15], [16]. A survey in five countries (USA, Canada, England, Scotland and Germany), which included some 43,000 nurses, found that 17–39% planned to leave their job because of its high psychological and physical demands [3]. Inadequate nurse staffing and problems of uneven quality of care in hospitals are often blamed [17], [18], [2].

Ellapen and Narsigan's systematic review (2014) estimated a mean WMSDs among 27 publications to be 71.85%. The most vulnerable anatomical site of WMSDs was the vertebral column, followed by shoulders, neck, knee, ankles/feet, wrist, thighs and elbow. Lower back WMSDs yielded a 53.24% prevalence rate [4]. A total of 132 articles on prevalence of work-related pain and musculoskeletal disorders were included in another review. Reported prevalence of WMSDs pain for nurses and nursing assistants was highest in the low back, followed by shoulders and neck. Mean prevalence for low back pain was 65% for lifetime, 55% for previous year and 35% for current symptoms [19].

A number of risk factors have been implicated in the etiology of WMSDs; such as poor patient transfer technique, high physical demand of the nursing profession, non-ergonomic positions, repetitive movements, inadequate nurse staffing, poor conditioning status of the nurses and obesity, high emotional stress [1], [4], [6], [17].

In Greece, few studies have been made. Vasileiadou et al., [20] investigated low back pain in a large tertiary healthcare unit in Athens and found a 6 month low-back pain prevalence rate of 67%. Alexopoulos et al., [21] investigated the relationships between physical, psychosocial, and individual characteristics and different endpoints of musculoskeletal complaints. They reported that handling of physical loads among nurses seemed to put them at risk for the occurrence of musculoskeletal disorders. This study was carried out in six general hospitals in Athens. Low back pain was the most prevalent musculoskeletal complaint, reported by 75% of the subjects. Furthermore Alexopoulos et al., [21] analyzed cross-cultural differences between Greek and Dutch nursing personnel in association with the risk factors, relative occurrence and consequences of musculoskeletal disorders.

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In both countries similar risk factors (such as back postures and general health) were associated with the occurrence of low-back pain [22].

In this study, we aimed to explore the prevalence, localization and factors perceived to be associated with WMSDs among nursing personnel in 3 different cities in Greece representing the small, medium and large population categories. Furthermore we aimed to determine if nurses in Greece had participated in ergonomic training and/or manual handling courses.

II. METHODS

In this cross-sectional study a questionnaire survey was carried out among nursing personnel. A total of 300 questionnaires were distributed to 15 hospitals in Athens, Aigio and Patra, 3 different cities of Greece from May to August 2015. These particular cities were chosen in order to represent the variety of hospitals regarding their location. From each city, the biggest general hospitals with the higher possible number of wards were chosen. Ethical approval was obtained by the ethics committee of the School of Health and Welfare, Technological Educational Institute of Western Greece.

The questionnaires had to be completed by licensed nursing personnel. Responders were eligible for inclusion if they had worked in their current job for at least one year. The study population comprised both male and female employees.

The participants (N=300) were randomly selected from the employment lists of the hospitals were invited to participate during work hours. The questionnaire developed for the study comprised three sets of questions. The first set was about demographics (age, gender, weight, height) and information about their work routine (hours per week, years in current position). The second set of questions comprised the Greek validated version of Nordic Medical Questionnaire [23]. This questionnaire divides the human body into nine anatomical regions (neck, shoulder, elbow, hand/wrist, upper back, lower back, hip/thigh, knee, and ankle/foot) and a body chart was additionally included to easily depict the affected areas. Participants were asked whether they had pain and discomfort in the indicated areas once in their lifetime, during the preceding 12 months and if those symptoms prevented their normal activity during the last year and the preceding week. The third set of questions was based on personal opinions of the participants about the risk factors of their pain/disorder, the days of absence in work due to WMSDs, the participation in any form of exercise, the participation in ergonomic training courses or manual handling courses and their participation in physiotherapy sessions for handling their pain. The last set of questions about the most predominant risk factors was through specified factors and open questions and answers. The specified factors (working hours, awkward posture etc) were taken from recent literature on occupational musculoskeletal pain/disorders.

Questionnaires were completed by 278 of the 300 (response rate 92,7%) invited nurses but 18 respondents (6,5%) were

excluded because they had worked in their current job for less than a year and 35 respondents (12,6%) were also excluded because they provided incomplete data. This left a total of 225 nurses, who were included in the study and analysis.

Data were collected within 2 weeks in each hospital. All the nursing participants were informed about the procedure prior to the completion of the questionnaires and consented to participate in the study. Data was analyzed with SPSS (version 17).

III. RESULTS

Participant characteristics

The nursing sample has an age range of 20-58. The proportion of female nurses was 80,9% (n=182) while men were 19,1% (n=43) (Table 1). The mean height and weight of the respondents were 167,6 cm and 70,6 Kg. The majority of the sample (44,9%) had been working for 5- 14 years, most of them (75.6%) working in full time contracts for 40 hours per week (Table 2).

The majority of nurses (62,2%) were employed in public hospitals with the remaining (37,8%) in private hospitals. The participants worked in orthopedic, pathological, neurology, respiratory, cardiology, psychiatric, pediatric, respiratory departments as well as emergency care, dialysis and surgical units.

Table 1. Characteristics of the nursing personnel

Personal variables	Male (N=43) 19,1%	Female (N=182) 80,9%	Total (N=225) 100%
Age (years) Mean±SD	23-50 36,57±27	20-58 36± 9,17	20-58 37,2±8,83
Weight Mean±SD	58-130 kg 82,4±13,19	42-106 kg 67,8±12,2	42-130 kg 36,537±27
Height Mean±SD	156-191 cm 177,21±7,44	150-185cm 67,8±12,2	150-191 cm 167,64±7,66
BMI (mean)	26,33	24,78	25,13

The prevalence of musculoskeletal injury

More than eight out of ten (84%) of the nurses had WMSDs at least once in their occupational lives. Prevalence rates of WMSDs were higher in the spine (low back-59% and neck-56,4%), followed by the more biomechanically complex peripheral joints such as shoulders (47,6%) and knees (40%). There were differences between genders regarding the main area of pain and discomfort with the neck (56,4%) with statistically significantly prevailing in women over men (p=0,015). Men tended to report mostly for the lumbar area (59,1%), the difference not reaching statistical significance (Table 3).

The annual prevalence rate of WMSDs in nurses was 39,6% in the lumbar area followed by the neck (28,9%) and shoulders (28,9%). The area with the lower prevalence was the elbow (7,6%) (Table 4). The most frequent areas of pain or discomfort in female participants were the low back area and the shoulders; which were more prevalent compared to men (p= 0,087 and p=0,044, respectively).

The highest weekly prevalence rate of WMSDs in nurses was the lumbar area (34,2%) followed by the neck (29,8%).The area with the lowest prevalence was the elbow again (7,6%).The only statistically difference regarding pain, between men and women was found in the shoulder region (p=0,001).

**Table 2. Working hours per week of the nursing personnel**

	Total (n=225) (N and percentage)	Women (n=182) (N and percentage)	Men (n=43) (N and percentage)
10-39 hours	12 (5,3%)	12 (6,6%)	0
40 hours	170 (75,6%)	135 (74,2%)	35 (81,4%)
41+ hours	43 (19,1%)	35 (19,2%)	8 (18,6%)

**Table 3. WRSMDs lifetime prevalence of the nursing personnel**

Body areas	Women n=(182) (N and percentage)	Men (n=43) (N and percentage)	Total (225) (N and percentage)	P value
Neck	112 (61,5%)	15 (34,9%)	127 (56,4%)	0,015
Shoulders	92 (50,5%)	15 (34,9%)	107 (47,6%)	0,064
Elbows	26 (14,2%)	2 (4,7%)	28 (12,4%)	0,008
Wrists/hands	75 (41,2%)	10 (23,3%)	85 (37,8%)	0,028
Thoracic	56 (30,7%)	3 (7%)	59 (26,2%)	0,001
Lumbar area	111 (60,9%)	22 (51,2%)	133 (59,1%)	0,238
Hip/s	65 (35,7%)	8 (18,7%)	73 (32,4%)	0,031
Knee/s	76 (41,7%)	14 (32,6%)	90 (40%)	0,267
Foot/ankle	47 (25,8%)	11 (25,6%)	58 (25,8%)	0,974

**Table 4. WMSDs prevalence reported the last 12 months**

Body region	Women (n=182) (N and percentage)	Men (n=43) (N and percentage)	Total (n=225) (N and percentage)	P value
Neck	57 (31,3%)	8 (18,6%)	65 (28,9%)	0,098
Shoulders	58 (31,9%)	7 (16,2%)	65 (28,9%)	0,044
Elbows	16 (8,8%)	1 (2,3%)	17 (7,6%)	0,151
Wrists/hands	45 (24,7%)	8 (18,6%)	53 (23,6%)	0,404
Thoracic	32 (17,6%)	1 (2,3%)	33 (14,7%)	0,011
Low back area	77 (42,3%)	12 (27,9%)	89 (39,6%)	0,087
Hips	41 (22,5%)	4 (9,3%)	45 (20%)	0,053
Knees	51 (28%)	11 (25,5%)	62 (27,6%)	0,761
Foot/ ankles	27 (14,8%)	8 (18,6%)	35 (15,6%)	0,530

**Consequences and risk factors of WMSDs**

The participants were asked what they thought the cause of WMSDs was (perceived risk factors). The main perceived cause of WMSDs according to survey participants was the staff shortage within hospitals (88,9%) followed by the prolonged standing position (84,9%) during working hours, techniques of manual handling (84%), the lack of manual aids (71,6%) and the lack of ergonomic training (60,9%). Less prevalent were the psychological causes (43,1%) (Table5).

The majority of the nurses (70,6%) did not receive physiotherapy for their WMSDs pain/disorder. Only 124 nurses (55,1%) were involved in exercising. The main form of exercise was aerobic exercise (21,8%) followed by walking (11,1%). The remaining 101 nurses (44,9%) did not exercise at all.

From the participating nurses only 26 (11,6%) had attended ergonomic courses and 78 nurses (34,7%) had participated in manual handling courses.

**Table 5. Perceived Causes/ Risk factors of WMSDs**

Perceived Causes/Risk factors	N and percentage prevalence
Working hours	115 (51,1%)
Manual handling	189 (84%)
Awkward posture	184 (81,8%)
Long hour standing position	191 (84,9%)
Repetition - performing the same motion or series of motions continually or frequently	136 (60,4%)
Lack of exercise	159 (70,7%)
Psychological factors	97 (43,1%)
Continuous shifts	114 (50,7%)
Organizational factors	124 (55,1%)
Lack of ergonomic training	137 (60,9%)
Lack of manual handling aids	161 (71,6%)
Age	131 (58,2%)
Inadequate staff	200 (88,9%)

#### IV. DISCUSSION

Nurses are vulnerable to WMSDs, especially lower back pain. Prevalence rates of WMSDs in nursing personnel in Greece are no different from other studies [11], [12], [13], [14], [15], [16]. The results indicate that both low back complaints and neck-shoulder complaints are major health problems in this professional group.

The highest annual prevalence of WMSDs in nurses according to body sites in this study was the low back followed by the neck and then shoulders. However, previous studies have documented variability rates of work-related low back pain (LBP) in nurses from various populations for a 12-month time period: Smith et al (Korea) 19,8% [24], Smith and Leggat (Australia) 59.0% [25], Lagerström et al (Sweden) 64.0% [26], Niedhammer et al (France) 41.1% [27], Yip (Hong Kong) 40.6% [28], Smedley et al (England) 45.0% [29], Limpcomb et al (USA) 29.0% [30], Fabunmi et al (Nigeria) 79.4% [31 and Tinubu et al South West Nigeria (78%) [32]. It is important to notice that cultural differences in the perception and reporting of pain and disorders variations in instrument and organizational differences in hospitals could be attributed for the variation in rates of WMSDs across the different studies [32].

Previous studies also suggest that female gender, physical factors and psychosocial factors are important risk factors. Musculoskeletal injuries and symptoms are prevalent in nurses and are largely associated with strenuous patient handling [33]. The majority of nurses (84 %) believe that manual handling is a risk factor for WMSDs. Despite that, only the one third of our participants participated in manual handling courses. In 2011, California enacted legislation that required acute-care hospitals to implement safe patient handling (SPH) policies and programs. According to this law employers should provide safety devices and a safe patient handling policy, replacing manual lifting with lifting devices and use of lift teams. In order to assess the early phase of this legislation, researchers conducted an epidemiological

assessment of organizational SPH practices, musculoskeletal symptoms, and perceptions in a random sample of 396 registered nurses. 60% of respondents were aware of the SPH law, and 33% reported changes in their hospital's patient handling policies or programs since the law went into effect [33]. Perhaps this is an important issue for the governmental policies within Greece to consider. Furthermore nowadays numerous mechanical equipment which is designed to help in patient handling should be available. Promoting the use of devices for lifting and transferring patients within the hospital might decrease musculoskeletal disorders.

Both genders had high prevalence rates of musculoskeletal symptoms in low back, shoulders and neck regions (Table 3). Any work requiring repetitive flexion and/or twisting for long periods is a risk of causing low back pain for both genders [42]. Neck and shoulder pain affect between 6-76% of the working population annually [34]. In this study female and male nurses presented significant differences in their WMSDs disorders in neck ( $p=0,015$ ), wrists ( $p=0,028$ ), thoracic area ( $p=0,001$ ) and hips ( $p=0,031$ ). Evidence indicates that musculoskeletal disorders and gender differences seems to be more distinct for neck and upper-extremity disorders [35]. Zwart et al., (2001) analyzed associations of gender in upper arm musculoskeletal disorders in a number of occupational groups and confirmed that women had the higher risk [37]. Anatomical variability between genders (eg. female wider pelvis) may explain the significant difference. One also possible explanation about gender differences in some areas is imbalance in domestic work [36]. These differences should be taken into consideration in the implementation of intervention programs. Gender influence on epidemiological studies are recommended [37].

Hospitals are facing challenges to providing care that is of consistently high quality in a rapidly changing and uncertain environment [2]. A recent Commonwealth Fund survey of doctors in five countries found that doctors ranked the nurse staffing levels of hospitals as one of their most serious concerns in being able to provide top-quality health care [3].

Inadequate nurse staffing is a serious problem in hospitals. According to Aiken et al. [2] and another report from five [3] countries, only 30–40% of registered nurses considered their staff power sufficient for providing high-quality care. In this study, also 88.9% of nurses complained about the inadequate staffing in hospitals, a problem obviously magnified by the financial crisis.

43% of participating Greek nursing personnel believe that WMSDs is caused by psychological factors. A systematic review by Barnel et al., (2015) suggested that psychological risk factors at the workplace are associated with musculoskeletal disorders in nursing personnel. Seventeen articles were selected in this review and the researchers identified an association between high psychological demands with prevalent pain at any anatomic site<sup>(38)</sup>. The association of burn out and physical diseases has not been extensively studied. Burnout was an important correlate of cardiovascular diseases among men and musculoskeletal disorders among women in a healthy population study in

Finland [39]. Langballe et al. (2009) investigated the relationship of burnout and musculoskeletal pain in 7 occupational groups in Norway (including nurses). This study showed that the relationship between exhaustion and musculoskeletal pain was relatively high in nurses of both genders. In future associations of burnout and musculoskeletal pain need to be investigated and these associations may promote more precise diagnosis and intervention strategies [40].

In this study only 26 (11,6%) nurses answered that they have participated in ergonomic courses; a relatively small number of nurses. However, the association between WMSDs and course participation was not explored further in this study. Studies have found that ergonomic factors correlate with musculoskeletal symptoms [41], [42]. "Ergonomic training includes training in the identification of risk factors for WMSDs, proper work practice, selection of appropriate equipment, correct use of equipment and workstation adjustment"<sup>(41,42)</sup>. Hospitals and their managers should recognize problems by establishing systematic methods for identifying ergonomics concerns in their workplace. Educational programs on prevention and coping strategies for musculoskeletal disorders are recommended to minimize the risk of a disorder or injury. Future prospective controlled studies on ergonomics workplace interventions should aim to identify cost effectiveness [43].

Ergonomic adjustments and physiotherapy interventions could play an important role in prevention and treatment of WMSDs. The majority of the participants did not receive physiotherapy for their pain or disorder. A systematic review by Verhagen et al., (2001) summarizes the results on the effectiveness of ergonomic adjustments and physiotherapy interventions in participants with work related arm, neck and shoulder complaints. 21 trials and 5 subgroups of interventions (massage, manual therapy, exercises, ergonomics and energized splint) were evaluated. According to this study there is limited evidence for the effectiveness of various interventions (eg. effectiveness of exercises compared to massage; breaks during computer work compared to no breaks) [44]. Further research focusing on the benefits of physiotherapy interventions combined with ergonomic adjustments and training is necessary to minimize risk factors for musculoskeletal disorders on the nursing personnel as well as alleviate symptoms.

More than half of the participants answered that they were engaged into some form of exercise. Evidence supports the relation between physical activity and health outcomes [45], [46]. Increased injury rates have been negatively associated with physical activity [47]. A number of studies have shown that physically active nurses present with less symptoms of low back pain as well as improved psychosocial behavior [48], [49], [50], [51]. In a survey carried out in South Africa, there was positive evidence that low back pain among nurses may be due to reduced or no participation in physical activities (52). Yip (2001) suggested that participation in regular physical activity improves job related muscle pains by increasing and maintaining the musculoskeletal system 'in shape'[53].

The primary limitation of this study was the number of nurses involved, which was relatively small compared to some of the other studies. However, in studies with much bigger samples, such as Smith et al.'s [54] study in Japan, encompassing 844 completed questionnaires for annual prevalence of WMSDs, yielded similar percentages. Our study was also exposed to the inherent limitation of all cross-sectional, self-reported studies with regard to misinterpretation of questions by the participants or exaggeration of their WMSDs. Participants in the present study worked in a variety of hospitals and wards, hence exposed to different risks for musculoskeletal disorder. Given many environmental and social changes in the health care industry (economic crisis, people living longer with chronic diseases and/or wanting to be home during illness) higher prevalence levels may shift to different populations—home health care and long term care nurses [19]. The present survey was conducted in 3 cities in central Greece but further investigations should now be undertaken in southern and northern Greece, in order to obtain a thorough overview of the problem from a national perspective.

## V. CONCLUSION

The prevalence of WMSDs is high among Greek nursing personnel. The highest prevalence of injury is to the low back, neck area followed by shoulders. Over eight out of ten nurses (84%) had WMSDs at least once in their lives, whereas lifetime, annual and weekly prevalence rates of WMSDs were higher in the spine.

This is the first study to our knowledge exploring the perceived risk factors among Greek nursing personnel. Frequent manual handling of patients, inadequate staffing in hospitals and the lack of ergonomic knowledge were the perceived risk factors for WMSDs for the Greek nurses in this study.

In conclusion, this study demonstrated that Greek nurses are at risk of having WMSDs and that ergonomic intervention programs for training and education could be beneficial to the nurses, as they are appreciated as important factors for prevention of work-related musculoskeletal disorders. These results of the present study also indicate the need for preventive programs in the hospital environment in order to control more severe musculoskeletal disorders in Greek nurses. Further research is needed to investigate the profile of musculoskeletal disorders in nurses according to the specific hospital wards or departments. Investigation of WMSDs in nurses in home health care and long-term care facilities could be also beneficial.

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REFERENCES

- [1] C.M. Lelis, M.R.B Battaus, F.C.T. de Freitas, F.L.R. Rocha, M.H.P. Marziale, M.L.C.C. Robazzi, "Work-related musculoskeletal disorders in nursing professionals: an integrative literature review", *Actapaul. Enferm*, vol 25, 2012, pp. 3.
- [2] L.H. Aiken, S.P. Clarke, D.M. Sloane, J.A. Sochalski, R. Busse, H. Clarke et al. "Nurses' report on hospital care in five countries", *Health Aff*, vol 20, 2001, pp.43-53.
- [3] Common wealth Fund. "Doctors in Five Countries See Decline in Health Care Quality", vol 6, 2000, pp. 1-4.
- [4] T. J. Ellapen, S. Narsigan. "Work Related Musculoskeletal Disorders among Nurses: Systematic Review", *J Ergonomics*, vol S4 2014, pp. S4-003.
- [5] T.S. Magnano, M.T. Lisboa, R. H. Griep. "Stress, psychosocial aspects of the work and musculoskeletal disorders in nursing workers", *Rev Enferm UERJ*, vol 17, 2009, pp. 118-23.
- [6] A. Lorusso, S. Bruno, N. L'Abbate, "A review of low back pain and musculoskeletal disorders amongst Italian nursing Personnel", *Ind Health*, vol 45, 2007 pp. 637-644.
- [7] Y.C. Chung, C. T. Hung, S.F. Li, H.M. Lee, S.G. Wang, S.C. Chang, L.W. P. Lee-Wen , C.N. Huang, J.H. Yang JH. "Risk of musculoskeletal disorder among Taiwanese nurses cohort: a nationwide population-based study", *BMC Musculoskelet Disord*, vol 14, 2013, pp. 144.
- [8] R. Abedini, A.R. Choobineh, J. Hasanzadeh , "Patient manual handling risk assessment among hospital nurses" *Work*, vol 50, 2015, pp. 669-675
- [9] S.J. Lee, J. Faucett, M. Gillen, N. Krause, "Musculoskeletal pain among critical-care nurses by availability and use of patient lifting equipment: an analysis of cross-sectional survey data" *Int J Nurs Stud*, vol 50, 2013, pp.1648-1657.
- [10] M.A. Hudson, "Texas passes first law for safe patient handling in America: landmark legislation protects health-care workers and patients from injury related to manual patient lifting" *J Long Term Eff Med Implants*, vol 15, 2005, pp. 559-66.
- [11] M.H. Long, V. Johnston, F. Bogossian, "Work-related upper quadrant musculoskeletal disorders in midwives, nurses and physicians: A systematic review of risk factors and functional consequences" *Appl Ergon*, vol 43, 2012, pp. 455-467.
- [12] M.H. Long, F.E. Bogossian, V. Johnston, "The prevalence of workrelated neck, shoulder, and upper back musculoskeletal disorders among midwives, nurses, and physicians: a systematic review", *Workplace Health Saf*. vol 61, 2013, pp. 223-229.
- [13] R. Schlossmacher, F.G. Amaral, "Low back injuries related to nursing professionals working conditions: a systematic review", vol 41, 2012, pp. 5737-5738.
- [14] A. Yassi, K. Lockhart, "Work-relatedness of low back pain in nursing personnel: a systematic review", *Int J Occup Environ Health* vol 19, 2013, pp. 223-244.
- [15] B. Sherehiy, W. Karwowski, T. Marek. "Relationship between risk factors and musculoskeletal disorders in the nursing profession: a systematic review", *Occup Ergon*, vol 4, 2004, pp. 241-279.
- [16] B.R. da Costa, E.R. Vieira, "Risk factors for work-related musculoskeletal disorders: A systematic review of recent longitudinal studies", *Am J Ind Med*, vol 53, 2010, pp. 285-323.
- [17] T. Freimann, D. Coggon, E. Merisalu, L. Animägi, M. Pääsuke, "Risk factors for musculoskeletal pain amongst nurses in Estonia: a cross-sectional study", *BMC Musculoskelet Disord.*, vol 14, 2013;14: pp. 334.
- [18] A. Tezel. "Musculoskeletal complaints amongst a group of Turkish nurses", *Int J Neuroscience*, vol 115, 2005, pp. 871-880.
- [19] K. G. Davis, S.E. Kotowski, "Prevalence of Musculoskeletal Disorders for Nurses in Hospitals, Long-Term Care Facilities, and Home Health Care: A Comprehensive Review", *Hum Factors*, vol 57, .2015, pp. 754-792.
- [20] A. Vasilidou, G.G. Karvountzis, A. Soumilas A et al, « Occupational low-back pain in nursing staff in a Greek hospital". vol 21, *J Adv Nurs*, vol 21, 1995, pp. 125-130.
- [21] E.C. Alexopoulos, A. Burdorf, A. Kalokerinou, "Risk factors for musculoskeletal disorders among nursing personnel in Greek hospitals", *Int Arch Occup Environ Health*, vol 76, 2003, pp.289-294.
- [22] E.C. Alexopoulos, A. Burdorf, A. Kalokerinou, "A comparative analysis on musculoskeletal disorders between Greek and Dutch nursing personnel", *Int Arch Occup Environ Health*, vol 79, 2006, pp.82-88.
- [23] M. Antonopoulou M, C. Ekdahl, M. Sgantzos, N. Antonakis, C. Lionis, "Translation and validation into Greek of the standardised Nordic questionnaire for the musculoskeletal symptoms", *Eur J of Gen Practice*, vol 10, 2004, pp.35-36.
- [24] D.R. Smith, K.J.C. Myung, J. Kim, Z. Yamagata, "Musculoskeletal disorders among staff in South Korea's largest nursing home", *Environ Health and Prev Med*, vol 8, 2003, pp. 23-28.
- [25] D.R. Smith, P.A. Leggat, "Musculoskeletal disorders among rural Australian nursing students", *Aust J Rural Health*, vol 12, 2004, pp. 241-245.
- [26] M. Lagerström, K. Bremme, P. Eneroth, C.G. Janson, "Occupational and individual factors related to musculoskeletal symptoms in five body regions among Swedish nursing personnel", *Int Arch Occup Environ Health*, vol 68, 1995, pp. 27-35.
- [27] I. Niedhammer, F. Lert, M.J. Marne, "Back pain and associated factors in French nurses", *Int Arch Occup Environ Health*, vol 66,1994, pp.394-357.
- [28] Y.B. Yip, "A study of work stress, patient handling activities and the risk of low back pain among nurses in Hong Kong", *Journal of advanced nursing*, vol 36, 2001, pp. 794-804.
- [29] J. Smedley, P. Egger, C. Cooper, D. Coggon , "Manual handling activities and risk of low back pain in nurses" *Occup Environ Med*, vol 52, 1995, pp. 160-163.
- [30] J. Lipscomb, A. Trinkoff, B. Brady, J. Geiger-Brown, "Health Care System Changes and Reported Musculoskeletal Disorders among Registered Nurses", *Am J Public Health*, vol 94, 2004, pp.1431-1436.

- [31] A.A. Fabunmi, J.O. Oworu, N.A. Odunaiya "Prevalence of musculoskeletal disorders among nurses in University College Hospital, Ibadan", *West African Journal of Nursing*, vol 19, 2008, pp. 21–25.
- [32] B.M.S. Tinubu, C.E. Mbada, A.L. Oyeyemi, A. Fabunmi, "A Work-Related Musculoskeletal Disorders among Nurses in Ibadan, South-west Nigeria: a cross-sectional survey" *BMC Musculoskeletal Disorders*, vol 11, 2010, p.12.
- [33] S.J. Lee, J.H. Lee, R.R. Gershon, "Musculoskeletal Symptoms in Nurses in the Early Implementation Phase of California's Safe Patient Handling Legislation", *Res Nurs Health*, vol 38, 2015, pp. 183-193.
- [34] R.M. Collins, D.C. Janse Van Rensburg, J.S. Patricios, "Common work-related musculoskeletal strains and injuries" *S Afr Fam Prac*, vol 53, 2011, pp. 240-246.
- [35] W.E. Hooffman, M.N.M. van Poppel, A.J. van der Beek, P.M. Bongers, W. van Mechelen, "Gender differences in the relations between work-related physical and psychosocial risk factors and musculoskeletal complaints", *Scand J Work Environ Health*, vol 30, 2004, pp. 261-278.
- [36] L. Strazdins, G. Bammer, "Women, work and musculoskeletal health", *SocSci Med*, vol 58, 2004, pp. 997-1005.
- [37] B.C. De Zwart, M.H. Frings-Dresen, A. Kilbom, "Gender differences in upper extremity musculoskeletal complaints in the working population", *Int Arch Occup Environ Health*, vol 74, 2001, pp. 21-30.
- [38] D. Bernal, J. Campos-Sema, A. Tobias, S. Vargas-Prada, F.G. Benavides, "Work-related psychosocial risk factors and musculoskeletal disorders in hospital nurses and nursing aides: A systematic review and meta-analysis", *International Journal of Nursing Studies*, vol 52, 2015, pp. 635-648.
- [39] T. Honkonen, K. Ahola, M. Pertovaara, E. Isomet, R. Kalimoa, E. Nykyrid, A. Aromaa, J. Lonnqvist, "The association between burnout and physical illness in the general population—results from the Finnish Health, 2000, *Journal of Psychosomatic Research*, 2006, pp. 59 – 66.
- [40] E.M. Langballe, S.T. Innstrand, K.A. Hagtvet, E. Falkum, A.O. Gjerlow, "The relationship between burnout and musculoskeletal pain in seven Norwegian occupational groups, *Work*, vol 32, 2009, pp.179–188.
- [41] V. Hoe, M. Urquhart, H. Kelsall, M. Sim, "Ergonomic design and training for preventing work-related musculoskeletal disorders of the upper limb and neck in adults". *Cochrane Database of Systematic Reviews*, 2012(8).
- [42] NIOSH 2001 National Institute for Occupational Safety and Health (NIOSH). National Occupational Research Agenda for Musculoskeletal Disorders: Research Topics for the Next Decade. A Report by the NORA Musculoskeletal Disorders Team. DHHS (NIOSH) Publication No. 2001-117. Cincinnati, OH: US Department of Health and Human Services, 2001.
- [43] P.A. Rothmore, J.P. Karnon, "Ergonomics and musculoskeletal injury prevention interventions in healthcare: Are they worth it?", *Ergonomics Australia*, vol 8, 2014, p.1.
- [44] A.P. Verhagen, C. Karels, S.M. Bierma-Zeinstra, A. Feleus, S. Dahaghin, A. Burdorf, H.C. De Vet, B. W. Koes, "Ergonomic and physiotherapeutic interventions for treating work-related complaints of the arm, neck or shoulder in adults. A Cochrane systematic review", *Eura Medicophys*, vol 43, 2007, pp.391-405.
- [45] J. R. Morrow, L.F. DeFina, D. Leonard, E. Trudelle-Jackson, M.A. Custodio, "Meeting Physical Activity Guidelines and Musculoskeletal Injury: The WIN Study", *Med Sci Sports Exerc*, vol 44, 2012, pp. 1986–1992.
- [46] Physical Activity Guidelines Advisory Committee. Physical activity guidelines advisory committee report, 2008. Washington, DC: U.S. Department of Health and Human Services. 2008; 683.
- [47] E.N. Howard, L.F. DeFina, D. Leonard, M.A. Custodio, J.R. Morrow, "Physical activity and musculoskeletal injuries in women: the Women's Injury Study", vol 22, 2013, pp. 1038-1042.
- [48] M. Lela, J.M. Frantz, "The Relationship between Low Back Pain and Physical Activity among Nurses in Kanombe Military Hospital", *AJPAP*, vol 4, 2012, pp. 63 – 66.
- [49] Z. Roupa, A. Vassilopoulos, P. Sotiropoulou, "The problem of lower back pain in nursing staff and its effect on human activity", *Health Science Journal*, vol 4, 2008, pp. 219-225.
- [50] E.R. Vieira, S. Kumar, H.J. Coury, Y. Narayan, "Low back problems and possible improvements in nursing jobs" *Journal of Advanced Nursing*, vol 55, 2006, pp. 79-89.
- [51] A. Karahan, N. Bayraktar, "Determination of the usage of body mechanics in clinical settings and the occurrence of low back pain in nurses" *International Journal of Nursing Studies*, vol 41, 2004, pp. 67-75.
- [52] B. Naude, W. Mudzi, M.V. Mamabolo, P.J. Becker, "Low back pain among hospital employees in Gauteng, South Africa: Point prevalence and associated factors", *Occupational Health Southern Africa*, 2009, pp.24-30.
- [53] Y.B. Yip, "A study of work stress, patient handling activities and the risk of low back pain among nurses in Hong Kong", *Journal of Advanced Nursing*, vol 36, 2001, pp. 794-804.
- [54] D.R. Smith, M. Mihashi, Y. Adachi, H. Koga, T. Ishitake, "A detailed analysis of musculoskeletal disorder risk factors among Japanese nurses" *Journal of Safety Research* vol 37, 2006, pp. 195-200.

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