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Work caused musculoskeletal disorders in health professionals

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ABSTRACT

Introduction: Work-related musculoskeletal disorders (WRMSDs) are the most common work-related diseases and describe a wide range of degenerative and inflammatory conditions affecting blood vessels, peripheral nerves, joints, ligaments, tendons, and muscles. WRMSDs are becoming an increasing problem in modern society. They are the second biggest cause of short-term or temporary incapacity for work just following a cold. At the workplace, health professionals represent a very vulnerable category in terms of the musculoskeletal disorders (MSDs) development. It is estimated that almost one third of all cases of absence from work among health care professionals are related to MSDs. Studies also show that a large number of health professionals report the occurrence of MSDs in one or more regions of the body, with a problem with the lower back being as one of the most common.

Methods: This article presents a non-experimental (qualitative) research, or a scientific review of the published literature where the databases were reviewed in which the key words for the review were: MSDs, work, health, intervention program, and ergonomics. Various databases were used in the preparation of this article, including PubMed, Google Scholar, Medline, Hrčak, Dabar, Science Direct, and Science Citation.

Results: The results include a review and analysis of eighteen published scientific articles in the period 2001-2020. The studies published in these articles has been conducted in the United States, Australia, Switzerland, Portugal, Slovenia, Turkey, China, Nigeria, Israel, Tunisia, Iran, Croatia, Taiwan, Bangladesh, Serbia, Macedonia, and Greece.

Conclusion: This article should indicate the magnitude of the problems of WRMSDs in health professionals and that this topic is an inexhaustible and very interesting basis for further studies by current and future researchers to create strategies for prevention and treatment of this disorder and to eliminate their causes.

Keywords: Musculoskeletal disorders; work; healthcare

INTRODUCTION

Work-related musculoskeletal disorders (WRMSDs) are the most common work-related diseases [1] and describe a wide range of degenerative and inflammatory conditions affecting blood vessels, peripheral nerves, joints, ligaments, tendons, and muscles [2]. Occupational factors related to the development of disorders of the musculoskeletal system were recognized as early as in the 18th century. However, it was not until the 1970s that a more active epidemiological research of the correlation between these conditions and occupation began, which resulted in its regular appearance in the international scientific literature. Since then, the literature references have grown significantly, and more than six thousand scientific papers have been published dealing with workplace ergonomics and WRMSDs. The relationship between musculoskeletal disorders (MSDs) and work-related factors remains the subject of much debate [3]. WRMSDs continue to represent a major challenge for workers and their employers in almost every sector [4]. They affect millions of workers across Europe and the world, and employers themselves spend billions of euros because of them [1]. Approximately 30% of all MSDs registered in the world are WRMSDs and make up for approximately 34% of lost working days [5]. Almost 24% of workers from the European Union (EU) suffer from back pain and 22% complain of muscle pain. Both of these conditions are more common among workers in the new EU

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Member States with 39% and 36%, respectively [6]. Health problems range from minor pain and disturbances to more serious health conditions that require absence from work or treatment. In severe cases, they can lead to disability and need for premature retirement. Most MSDs develop over time [1]. In the early phase, there is pain and fatigue of the affected part during work, which disappears at night and during days off, and in this phase, we do not have a decrease of work performance. In the middle phase, there is pain during work that lasts at night, and here we have a reduced work capacity for repetitive work. In the third or late phase, pain is constantly present, and the person may feel weakness and fatigue that require rest. In this phase, there is an inability to sleep and perform light work tasks [7]. Usually there is no single cause of MSDs [1]. In general, none of the causal factors act separately on their own, but a combination and interaction of several factors is required for disorder occurrence [7]. Physical risks and organizational risk factors include handling loads especially when bending, bending or rotating, repetitive or sudden movements, awkward and static body positions, vibrations, poor lighting, heat or cold in the environment, rapid pace of work, and prolonged sitting or standing in the same position [1].

WRMSDs are becoming an increasing problem in modern society. They are the second biggest cause of short-term or temporary incapacity for work just following a cold. MSDs are responsible for the disease of many working populations and represent an important occupational problem that causes increased health costs, reduced work productivity and lower quality of life [8]. At the workplace, health professionals represent a very vulnerable category in terms of the MSD's development [9]. Studies conducted in many countries around the world reveal that these disorders pose an important problem among healthcare professionals [5]. It is estimated that almost one third of all cases of absence from work among health care professionals are related to MSDs. Studies also show that a large number of health professionals report the occurrence of MSDs in one or more regions of the body, with a problem with the lower back being as one of the most common [8].

Many disciplines are involved in providing advice and in work to prevent WRMSD as well as to reduce its consequences [4]. Solving the problem of MSDs helps to improve the lives of workers, and it also represent a good business strategy [1]. Protecting the health of workers is an integral part of general health and daily life. Occupational health and safety require a multidisciplinary approach in which it is usually sufficient to discontinue exposure, reduce the duration or intensity of exposure to a risk factor and return the worker to adapted working conditions or an adapted workplace. Health and safety at the workplace are a major factor in sustainable development. It has been scientifically confirmed that organizations that manage occupational safety and health well have improved productivity and economic development [10].

METHODS

This article presents a non-experimental (qualitative) research, or a scientific review of the published literature where the databases were reviewed in which the key words for the review were: MSDs, work, health, intervention program, and ergonomics. Various databases were used in the preparation of this article, including: PubMed, Google Scholar, Medline, Hrčak, Dabar, Science Direct, and Science Citation.

Out of a total of 61 scientific papers found, 18 articles were selected as they dealt with the same issues or WRMSDs in health professionals.

RESULTS

The results include a review and analysis of 18 published scientific articles in the period 2001-2020. (Table 1). The studies published in these articles has been conducted in the United States (US), Australia, Switzerland, Portugal, Slovenia, Turkey, China, Nigeria, Israel, Tunisia, Iran, Croatia, Taiwan, Bangladesh, Serbia, Macedonia, and Greece.

DISCUSSION

As stated in the introduction, health professionals, or health professionals at their workplace, represent a very vulnerable category in terms of the occurrence of MSDs caused by occupation. Studies conducted in many countries around the world reveal that these disorders pose an important problem among healthcare professionals [5]. A total of 9614 health professionals from seventeen countries were surveyed in these 18 research articles. The results of our survey show that of the total number of surveyed health professionals, most had personal experience with MSDs caused by work. Of these, the largest number is related to pain in the lower back, neck, arms, and knees.

It is estimated that almost one third of all cases of absence from work among health care professionals are related to MSDs. Research also shows that a large proportion of health professionals report the occurrence of MSDs in one or more regions of the body, with a problem with the lower back being one of the most common [8].

By an insight into the review study, we can state that all health professionals are at high risk of MSDs caused by work, but three occupations within the health profession have a much more expressed risk of developing these disorders, namely nurses, physiotherapists, and dentists.

West and Gardner [11] in their study based on the obtained data indicate that the frequency of injuries of the musculoskeletal system exceeds the official statistics, but shows similar trends with studies conducted in Victoria (Australia), the United Kingdom, the US, and Canada.

Salik and Özcan [12] found in their study that the rate of MSDs in physiotherapists in Izmir (Turkey) is high, which they attribute to the severity of the profession itself. Adegoke et al. dealt with the same issue [9] and concluded that the prevalence of WRMSDs among physiotherapists in Nigeria is much higher than most values reported by colleagues worldwide.

Vodanović et al. [18] in a study among dentists in Croatia state that dentists have a high frequency of work-related health problems, among which MSDs take the first place. Furthermore, Ranjova et al. [22] came up with similar data stating that the prevalence rate among dentists in the public

TABLE 1. Overview of research studies and outcomes

Citation	Country	Main aims and purpose	Materials and methods	Results	Conclusion
West and Gardner [11]	Australia	This study aimed to investigate the nature, prevalence, job risk factors, and consequences of occupational injuries, with particular focus on musculoskeletal injuries, experienced by physiotherapists in North and Central Queensland	All physiotherapists on the Queensland Physiotherapists Registration Board list for 1997/98, who lived in the North and Central regions of the state, were sent a questionnaire In total, 445 questionnaires were mailed but 23 were returned having not reached their intended recipient (total 412 received). Two hundred and seventeen respondents returned completed questionnaires, giving a response rate of 53%. The questionnaire was divided into two sections. Part A was completed by all respondents (n=217) and yielded information on age, sex, year of graduation, work history, current hours per week of direct patient contact, and type of patient currently being treated. Part B was answered only by those who had experienced a work-related musculoskeletal injury, as defined above (n=119)	Fifty-five percent of respondents had experienced a work-related injury and 40% had experienced injury in the previous year. The most injured body areas were the low back, hands, and neck. Over half (56%) of the initial episodes of injury occurred within 5 years of graduation. The job risk factors of most concern to injured respondents were sustained demanding postures, manual therapy techniques, repetition, working while injured and excessive workloads. Injured respondents chose to work while injured and not to take time off on workers compensation or have surgery. Following injury, 38% of respondents changed work settings Most injured physiotherapists modified their techniques to continue working	This study presents descriptive data on the occupational injuries of physiotherapists in North and Central Queensland. They have a prevalence of work-related musculoskeletal injury in excess of official statistics but showing similar trends to studies reported in Victoria (Australia), United Kingdom, USA and Canada The official measures of occupational injury do not include most of the work-related musculoskeletal injuries of physiotherapists in this survey. More emphasis needs to be placed on the reporting of injuries by physiotherapists themselves. Perhaps a more appropriate injury surveillance method should be developed and implemented by the profession
Salik and Özcan, (2004) [12]	Turkey	This study was planned to collect data about causes, prevalence, and responses to WRMSDs reported by physiotherapists employed in Izmir, Turkey	A two-page survey with closed ended questions was used as the data collected method. This survey was distributed to 205 physiotherapists working in Izmir, Turkey, and 120 physiotherapists answered. Questions included occupational history of physiotherapists and musculoskeletal symptoms, special areas, tasks, job-related risk factors, injury prevention strategies, and responses to injury	85% of the physiotherapists have had a musculoskeletal injury once or more in their lifetime. Injuries have been occurred mostly in low back (26%), hand-wrist (18%), shoulders (14%), and neck (12%). The highest risk factor in causing the injury was transferring the patient at 15%. 69% of physiotherapists visited a physician for their injury and 67% of the respondents indicated that they had not limited their patient contact time as a result to their injury	According to the results of this study, the rate of MSDs in physiotherapists in Izmir-Turkey has been found to be high due to their profession. Respondents felt that a change in work habits was required to decrease the risk of another injury
Adegoke et al. [9]	Nigeria	Physiotherapists are known to be prone to WRMSDs but its prevalence among physiotherapists in Nigeria has not been reported. This study investigated the prevalence and work factors of WRMSDs among physiotherapists in Nigeria	A cross-sectional survey was administered to physiotherapists in different parts of Nigeria using a 2- part questionnaire with items adopted from questionnaires used for similar studies around the world. Two hundred and seventeen copies of the questionnaire were distributed for self-administration but 126 physiotherapists (80 male and 46 female) returned completed surveys for a 58.1% response	Reported 12-month prevalence of WRMSDs among Nigerian physiotherapists was 91.3%. Prevalence of WRMSDs was significantly higher in female physiotherapists and those with lower body mass index. The low back (69.8%) was the most commonly affected body part, followed by the neck (34.1%). Fifty percent of the physiotherapists first experienced their WRMSDs within 5 years of graduation and the highest prevalence (61.7%) was found among physiotherapists younger than 30 years. Treating large number of patients in a day was cited by most (83.5%) of the respondents as the most important work factor for their	The prevalence of WRMSDs among physiotherapists in Nigeria is higher than most values reported for their counterparts around the world. The coping strategies and work factors of WRMSDs among Nigerian physiotherapists are mostly similar to those of their counterparts elsewhere

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TABLE 1. (*Continued*)

Citation	Country	Main aims and purpose	Materials and methods	Results	Conclusion
				WRMSDs. The most commonly adopted coping strategy identified was for the therapists to modify their position and/or the patient's position (64.3%). Majority of the respondents (87.0%) did not leave the profession but 62.6% changed and/or modified their treatment because of their WRMSDs	
Rozenfeld et al. [13]	Israel	Although PTs have extensive knowledge of body mechanisms and injury prevention, WRMSDs are quite common in this population. The purposes of this study were: to determine the prevalence and impact of WRMSD among Israeli PTs; to investigate WRMSD risk factors and to identify preventive strategies used by PTs; and to compare the risk of injuries in two professional settings: RCs and OPCs	The sample included all PTs (n=182) working in five RCs (n=112) and six OPCs of the Maccabí Healthcare Services (n=70) in the Tel Aviv area. All participants had at least a bachelor's degree in physical therapy, which is mandatory to work in authorized institutes, had been employed for at least 1 year in their present place of employment and worked a minimum of 20 hours/ week, primarily treating adults. The five-page modified Cromie (2000) questionnaire with stamped return envelope was distributed at the participants' workplace	Ninety-three PTs (93%) reported WRMSD or symptoms during their professional life, 80% reported WRMSDs symptoms during past year (annual prevalence). The highest lifetime prevalence rates for WRMSD were in the lower back (79.6%), neck (59%), upper back (54%), and wrist and thumbs (46.2%). Symptoms began gradually for 73% of the injured PTs; 16% experienced sudden pain and in 11% injury was caused by an accident. Fifty PTs (45%) reported the first episode of WRMSD during the first 5 years of practice, 21.5% experienced the first episode after 5-15 years of practice and 20.5% as PT students. The remainder experienced WRMSD after 15 or more years of practice	The results of this study show high prevalence of WRMSD in the Israeli PT population. The results show a relationship between likelihood of developing WRMSD in the lower back/shoulder area and hours of rehabilitation treatment delivery, a relationship between the likelihood of developing WRMSD in the wrist/thumb area and hours of manual treatment delivery. Providing on-going in-service training programs regarding WRMSD prevention was suggested. Future research studies should test the effectiveness of the interventional preventive programes
Serranheira et al. [14]	Portugal	Healthcare workers, namely RN, are frequently exposed to WRMSDs risk factors. Identifying the symptoms of these disorders is one of the first epidemiological steps to managing them. This study aims to identify WRMSDs prevalence symptoms in Portuguese RN	All Portuguese nurses (males and females) were invited to participate in this national MSD survey from a call on the Board web site. Responders had to accept the invitation writing their own e-mail at the "Survey Monkey platform questionnaire" webpage. After that, they received a link to answer online. The used questionnaire is an adaptation of the NMQ that was frequently used in Portugal	Results show high symptoms prevalence (past 12 months) in the lower back (60.6%), the upper back (44.5%), and the neck (48.6%). Nurses' activity, especially patient hygiene in bed, is a strong contributor (p<0.05) to pain in the upper back (OR=1.39 [1.09-1.80]) and lower back (OR=1.4 [1.08-1.84]). Patient holdup without mechanical support has the highest relationship (p<0.05) between work tasks and symptoms in the past 12 months in the upper back (OR=1.50 [1.19-1.90])	Results denote a high WRMSDs symptoms prevalence in Portuguese nurses. Although, these results were no different from some other studies and they all indicate that nurses are at risk to develop WRMSDs
Jellad et al. [15]	Tunisia	MSD represent a significant occupational problem among hospital staff; however, data on musculoskeletal health of hospital staff are sparse This study sought to determine the prevalence of MSD, their epidemiologic data and the associated risk factors	A previously self-administered questionnaire sought information on demographics, prevalence and pattern of MSD, associated risk factors was employed as the survey instrument. A total of 520 questionnaires were distributed to hospital staff but only 433 questionnaires was valid. Eighty-seven of the returned questionnaires were excluded because of incomplete data	The prevalence of MSD among hospital staff was 65.4%. MSD occurred mostly in low back (74.5%), neck (38.1%), and knees (31.1%). Subjective factors associated to MSD were professional factors and personal factors. Professional factors were: Over work, kind of work, physical and mental stress, and guard. Personal factors were activities outside of work such as sports and agriculture, aging, and hereditary	A high proportion of hospital staff reported MSD at some body site with the low back being injured most often. Education programs on prevention and coping strategies for MSDs are recommended for hospital staff to reduce the rate of occupational hazards and also promote efficiency in patient care

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TABLE 1. (*Continued*)

Citation	Country	Main aims and purpose	Materials and methods	Results	Conclusion
Feng et al. [16]	China	Studies from western countries show that dentists are vulnerable to WMSDs of the neck and upper extremities, but little is known about their epidemiology among members of this rapidly growing profession in China. This study aims to investigate the prevalence of WMSDs and identify potential risk factors associated with their occurrence in the dental profession in China	A cross-sectional survey was carried out in 52 different hospitals in a large metropolitan city in China. A total of 304 questionnaires were distributed to respondents identified through stratified random sampling and 272 dentists (121 females and 151 males) completed the survey. The response rate was 89.5% Visual analogue score was used to record neck and upper limb musculoskeletal symptoms on a body chart. Work-related risk factors, including physical and psychosocial factors, were accounted for in the regression analysis	88% of the dentists reported at least one MSD and 83.8% suffered from neck pain. In the multivariate analyses, working hours per day were associated with neck pain (OR=1.43; 95% CI=1.03-1.98). Inability to select the appropriate size of dental instrument was associated with shoulder (OR=2.07; 95% CI=1.00-4.32) and wrist/hand (OR=2.47; 95% CI=1.15-5.32) pain. As for psychosocial factors, high job demand was associated with symptoms in the shoulder (OR=1.09; 95% CI=1.00-1.18), elbow (OR=1.11; 95% CI=1.03-1.19), and wrist/hand (OR=1.09; 95% CI=1.02-1.17) Regular physical exercise was associated with decreased neck pain (OR=0.37; 95% CI=0.14-1.00)	This study has identified an alarmingly high prevalence of neck and upper extremity WMSDs among dentists in China, much higher than that in the western countries. The symptoms of neck pain increased with the number of working hours per day. The inability to select the appropriate size of dental instruments was associated with higher odds of shoulder, wrist/hand, and comorbid pain. High job demands were associated with higher odds of pain in all the body regions investigated. Both physical workload and psychosocial stress factors need to be taken into account when considering preventative measures. A multidisciplinary approach with primary prevention, early intervention and continuous education about the potential effects of dentistry-related risk factors should be employed
Mirmohammadi et al. [17]	Iran	The objective of this research was to assess the severity and prevalence of WMSDs among hospital health care staffs, and determination of human factors risk factors	The subjects of the current study were health care staffs and nurses n=110 (37 male and 73 female) in a public hospital. Ten body regions were evaluated in the workplaces for human factors assessment using NMQ. Quick Exposure Check tool was used to evaluate the working postures to determine the WMSDs risk and action level for prevention	The results from NMQ and the evaluation of postures illustrated that, there was a significant relationship between occurrence of back pain and neck pain and workgroups (p<0.005). The QEC tool assessment showed that there is a high risk for WMSDs among health care staffs who carrying or transferring/relocating the patients (L=4) and there is a medium action level for nurses who working in standing position for long time (L=3). A significant difference was observed for sex of subjects, it revealed that the female nurses are in higher risk compare to male nurses	These results illustrated that female nurses and health care staffs are more tendency to involve and occurrence of WMSDs compare to male staffs. A periodic educational program as well as back school practice can play a main role in prevention and reducing the MSDs resulted
Vodanović et al. [18]	Croatia	Explore the health status among dentists in Croatia with regard to the symptoms of musculoskeletal, cutaneous, visual, auditory, and neurological disorders	A total of 800 randomly selected dental practitioners from all parts of Croatia were invited by e-mail to participate in an anonymous and voluntary online survey related to the occupational health disorders. All subjects had at least 1 year experience in clinical practice. Based on the available and relevant literature in a close cooperation with physicians of different specialties (orthopedist, dermatologist, otolaryngologist, ophthalmologist, and neurologist) a questionnaire for the assessment of a dentist's overall health status was	The most common health problem in dentists were MSDs with pain in upper back, lower back, shoulders, hands, fingers, legs, and feet followed by dermatological disorders. The most common reasons for asking a doctor for help were pain in upper back (36.8%) in females and pain in lower back (36.1%) in males	Occupational and work-related diseases or disorders have become increasingly common among dental professionals and can initiate a series of events that could result in a too early career ending. Croatian dentists have a high prevalence of occupational health problems. Musculoskeletal, sight, and skin disorders were among most commonly reported health problems. The first and most important step in protecting against occupational diseases is to improve dental health professional's awareness and understanding of occupational and work-

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TABLE 1. (*Continued*)

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			developed. The questionnaire was divided into 3 sections. The first section included demographic questions regarding gender, age, and work duration. The section two dealt with the awareness of dental practitioners regarding the occupational health disorders. The third section dealt with symptoms of musculoskeletal, dermatological, sight, hearing, and neurological disorders		related diseases. Dental professionals need to recognize the significant impact of occupational diseases on health
Shieh et al. [19]	Taiwan	To examine whether the prevalence of LBP increased in hospital nurses with high patient care workload	This study is a cross-sectional survey which adopted the US Department of Health and Human Services definition of LBP it is considered as chronic and/or acute pain experienced in the regions of lumbosacral, buttock, or upper leg. We focused on the nonspecific type of LBP in this study. Data used in this study were collected using the "Low Back Pain in Nurses" questionnaire, adopted from a previous study. A total of 992 RN working at a medical center in the central region of Taiwan were invited to participate in the self-administered questionnaire survey which they were asked to complete in their own leisure time. With informed consents, 796 (80.2%) participants completed valid questionnaires	Among all nurses with eligible questionnaires, 567 (72.0%) had LBP. Mean daily hours of working, standing, and walking were persistently longer in the LBP group. Results from multivariate logistic regression analysis showed that daily working for 1 hour longer is linked to a 35% (95% CI=2-78%) greater risk of LBP. Compared with <2 years of service as nurse, nurses with 2-5 years of service had the highest risk (OR=2.11, 95% CI=1.07-4.18). LBP risk was also higher for nurses with chore duty responsibilities (OR=1.99, 95% CI=1.12-3.53) and other back related disorders (OR=4.43, 95% CI=1.99-9.86)	Results suggest that longer daily working hours and a large number of cared patients per shift should be discouraged to prevent musculoskeletal problems such as LBP in RN
Rahman et al. [20]	Bangladesh	This study sought to determine the prevalence and distribution of WMSDs among two different groups of health care professionals (doctors and nurses) working in a tertiary care hospital in Dhaka city and to find out the multiple risk factors that contribute to the development of WMSDs	This descriptive type of cross-sectional study was conducted during the period January to December 2016 among 160 health care professionals (doctors, nurses) working in a tertiary care hospital named NITOR in Dhaka city To determine the prevalence and distribution of WMSDs among health care professionals a validated research instrument SNQ has been used, which records the prevalence of MSD in terms of musculoskeletal symptoms (ache, pain, discomfort) in the preceding 12 months	The study result revealed that out of 160 (100.0%) health care professionals 109 (68.1%) had musculoskeletal pain or discomfort in the past 12 months and 51 (31.9%) had not, and it was also found that 57 (61.3%) doctors and 52 (77.6%) nurses had musculoskeletal pain or discomfort in the past 12 months and the prevalence of WRMSDs in different body region in the past 12 months, where more than 1 site involvement 46 (42.2%), followed by neck 19 (17.4%), shoulder 15 (13.8%), lower back 13 (11.9%), hips 8 (7.3%), and hand/fingers 5 (4.6%)	Based on the findings of the present study, it can be concluded that a high proportion of health care professionals had WMSDs, and the affected site reported more than one body region, followed by neck, shoulder, lower back, and other sites among them. In this study, working in the same positions for long periods, treating excessive number of patients in 1 day, inadequate training on injury prevention, working in awkward or cramped positions were found to be the commonly reported risk factors for the development of WMSDs. From the study, it was observed nurses had the high prevalence of WRMSDs than doctors. Last but not the least it can be recommended that education programs on prevention and coping strategies for MSDs be made mandatory for health care professionals to reduce the rate of WMSDs among them and to promote efficiency in patient care

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TABLE 1. (*Continued*)

Citation	Country	Main aims and purpose	Materials and methods	Results	Conclusion
Božić [21]	Serbia	The main aims of this study were: To determine the prevalence of lumbar pain among nurses, to examine the relationship between socio-demographic characteristics (age, gender, number of children, level of education), years of service in health care, body mass index, smoking and lumbar pain in nurses, determine the impact of lifting heavy load, overtime and stress on the prevalence of lumbar pain in nurses, and propose measures to prevent lumbar pain in nurses	Survey was conducted to perform analysis of risk factors for the occurrence of lumbar pain in nurses, was conducted at the Institute for Health Protection of Children and Youth of Vojvodina, Clinical Center of Vojvodina, General Hospital in Sombor, General Hospital in Subotica, and General Hospital in Sremska Mitrovica. Data were collected by direct anonymous surveys of nurses. A modified Nordic Questionnaire for the analysis of musculoskeletal symptoms based on the SNQ for the Analysis of Musculoskeletal Symptoms was used as a data source for the examination of lumbar pain in nurses	The study included 512 nurses. The respondents were mostly female (89%), with an average age of 38 years. The prevalence of lumbar pain among nurses in the past 12 months was about 94%. Two-thirds of nurses had moderate or severe lumbar pain in the past 12 months. In the study, there is a statistically highly significant correlation between BMI increase and lumbar pain. Significantly higher prevalence of lumbar pain occurs in female respondents and those with completed high school. Only about 8% of respondents changed jobs due to lumbar pain	As a preventive measure, it is necessary to emphasize the reduction of physical load on the lower back and the reduction of manual carrying of loads, which can be achieved using beds with adjustable height, introduction of mechanical equipment and creating teams for lifting and carrying patients. Applying an adequate ergonomic approach, better organization of work, a stimulating atmosphere at work, and the willingness of the competent structures to show greater care for employees, would reduce the incidence of lumbar pain
Rendžova et al. [22]	Macedonia	The aim of our study was to examine the presence of MSDs among dentists at the university dental clinic in correlation with risk factors	A questionnaire survey was carried out among 78 dental practitioners aged between 20 and 60 years old, employed at the university dental clinic. Questions included data on physical and psychosocial workload, perceived general health and occurrence of musculoskeletal complaints in the past 12 months, chronic complaints, frequency and length of breaks, exercising habits as well as medical care seeking	Pain in the back, neck, and shoulders (84.6%/85.9%) was the most common complaint among the majority of respondents, while reduced range of movement was noticed among significantly fewer subjects, mostly between 40 and 60 years of age. Prolonged statistic position was considered to be one of the main causes of MSDs (82.05%), while 73.08% of respondents stated at least two more reasons beside this one	The percentage of MSDs prevalence among dentists in public health sector is high. More extensive surveys should be undertaken to cover larger group of dentists from both private and public sector, to get complete analysis of the prevalence of occupational disorders in our country. Consequently, appropriate measures should be taken to inform and educate dentists regarding MSD. Awareness should be raised pointing out that dentistry, as a profession, is susceptible to high risk of occupational disorders and injuries. Ignorance and avoidance of the MSDs symptoms could lead to early career ending and therefore it is important to have a knowledge regarding its prevention
Anyfantis and Biska [23]	Greece	The aim of this study is to investigate MSDs experienced by physiotherapists in Greece, their causes and specific measures, and good practices followed. Additional emerging risk factors will be examined	The study was conducted in the second half of 2015 in the regions of central and northern Greece. It covered all working categories such as public hospitals (32.9%), private RCs (37.7%), and private practices (29.4%). In total, 320 questionnaires were distributed to physiotherapists for completion. There were 252 responses, giving a response rate of 79%	Analysis indicated that 89% of the respondents had experienced a work-related MSD; 32.2% of those injuries occurred within the first 5 years of working. The most lumbered physiotherapists were those working as private practitioners and almost half of the injured respondents chose to work while injured. The most common measure taken to tackle work related MSDs was found to be physical therapy sessions. Job satisfaction and psychosocial issues were also identified as side-effects of the economic slowdown	Physiotherapists in Greece were found to suffer from MSDs; workplace musculoskeletal injuries were quite common but under-reported. The body parts most affected were the lower back, the upper back, the shoulders, and the neck. There was a strong correlation between the workplace setting and the number of MSDs. A well-defined occupational safety and health management system and strict administration steering were found to reduce MSDs. The economic slowdown experienced in Greece during the execution of this study placed additional pressure on physiotherapists

(Contd...)

TABLE 1. (*Continued*)

Citation	Country	Main aims and purpose	Materials and methods	Results	Conclusion
Akodu and Ashalejo [24]	Nigeria	This study investigated the association between WRMSDs and work ability among nurses in South-west Nigeria	A cross-sectional survey was conducted with 135 nurses (126 females and 9 males) in tertiary, secondary, and private hospitals in Lagos state using 2 validated standard self-administered questionnaires. The instruments captured information on personal characteristics and reported on WMSDs and work ability using the Modified Standard NMQ and WAI	The point and 12-month prevalence of WMSDs was 95 (70.4%) and 81 (60%) among respondents, respectively. Lower back pain (35, (43.2%) was the most common work-related MSD. Approximately half of the respondents 64 (47.4%) reported good work ability and 125 (92.6%) reported that work ability was physically and psychologically demanding. The results showed a significant association between sex (p=0.047) work status (p=0.020) and work ability. There was no significant association between the 12-month prevalence of WMSDs and work ability of nurses in Lagos state (p=0.406)	This study indicated good work ability, but a high prevalence of WMSDs among nurses in Lagos state. The job risk factors mostly reported by nurses were working in awkward and cramped positions. Furthermore, the work ability of nurses in Lagos state had no influence on the prevalence of WMSDs
Hanania et al. [25]	US	To evaluate the prevalence of and risk factors associated with work-related musculoskeletal injuries among radiation therapists in the US	Approximately 16,000 radiation therapists were identified and electronically mailed a modified NMQ. For inclusion in the analysis, participants were required to be actively employed during the preceding 12-month period and hold a current position as a radiation therapist. Descriptive statistics, univariate and multivariate analyses, and text analysis were performed to assess personal and work-related factors that correlated with injury risk	Contact was established with 5827 radiation therapists (contact rate, 37%). Of these, 2747 responded (cooperation rate, 47%), of which 1867 met inclusion criteria. Prevalence of work-related musculoskeletal injuries at 12 months was 76%, with the most common site-specific injury in the lumbar back (20%) followed by the neck (17%) and shoulders (15%). An incident rate of 33 injuries per 100 full-time equivalents per year was calculated. Multiple logistic regression analyses revealed the following variables to be significantly associated with increased injury risk: Female sex, a body mass index of 30 or greater, and tobacco use. Daily exercise was associated with decreased risk. Patient transfers, body mechanics, and heavy lifting were the primary reported sources of injuries	In this national survey of radiation therapists, the prevalence of work-related musculoskeletal injuries appears concerningly high. Injuries among radiation therapists might contribute to loss of practice productivity due to missed worked days, as evidenced by a high estimated incident rate. Further research is needed to determine root causes of work-related injuries in this population and interventions that focus on addressing modifiable risk factors. By decreasing risk of these injuries among radiation therapists, departments can benefit from decreased personal, societal, and radiation oncology practice-specific costs
Hämmig [26]	Switzerland	Musculoskeletal and SDs have been reported to be very common among health care and hospital workers and particularly nurses. They are assumed or found to be a result of psychological stress and/or physical strain or pain. However, no other study so far – at least in a hospital setting and for Switzerland – has considered and investigated musculoskeletal as well as SDs in consequence of or rather in association with both physical workload and psychological stress	Cross-sectional survey data of 1232 health professionals were used and analyzed. Data were collected in 2015/16 among the health care workforces of three public hospitals and two rehabilitation clinics in the German speaking part of Switzerland. Musculoskeletal and SDs were assessed by three items taken from the Swiss Health Survey, a 2-item measure of accumulated low back, back, neck and shoulder pain and a single-item measure of problems in getting to sleep or sleeping through. Stratified and adjusted bivariate logistic and multivariate	Almost every fourth of the studied health professionals reported severe or even very severe MSDs and nearly every seventh severe SDs. These prevalence rates were significantly or at least slightly higher among nurses than among physicians and other healthcare workers. General stress, work stress, physical effort at work, and particularly a painful or tiring posture at work were found to be clear and strong risk factors for MSDs, whereas only general and work-related stress were found to be significantly associated with SDs. There was no or only weak association between MSDs and SDs	MSDs among health professionals in this study are found to be clearly work-related, that is, to be primarily and quite strongly associated with physically demanding and psychologically stressful work and with general stress. In contrast, SDs have proven not to be work-related. SDs turned out to be only or mainly associated with general stress and – against expectations – only weakly associated with musculoskeletal pain and not at all with physical strain and psychological stress at work. As a result, MSDs (unlike SDs) are more prevalent

(Contd...)

TABLE 1. (*Continued*)

Citation	Country	Main aims and purpose	Materials and methods	Results	Conclusion
			linear regression analyses were performed to calculate measures of association (adjusted OR, standardized beta coefficients), to control for potential confounders, and to compare different health professions (nurses, physicians, therapists, other)		among the physically burdened (hospital) nurses than among other healthcare workers. Preventing work-related MSDs or rather combined and accumulated (low) back, neck, and shoulder pain therefore requires mainly a reduction of the physical workload, whereas SDs or more precisely severe problems in falling or staying asleep can be prevented most effectively by reducing the general stress level
Meh et al. [27]	Slovenia	This study aimed to determine the prevalence of WMSD on a sample of physiotherapists from Slovenia and to identify associations between demographic/anthropometric variables, job satisfaction, and physical activity with WRMSD aiming to contribute to the development of effective prevention and control strategies	The cross-sectional prospective study included physiotherapists from two prominent governmental rehabilitation institutions, the IMR University Medical Centre Ljubljana and the URI, Republic of Slovenia. The extended NMQ was used to obtain data from a sample of 102 physiotherapists. Data were presented with descriptive statistics and processing was performed with the Spearman's rank correlation coefficient for non-parametric variables. The level of statistical significance was set as $p \leq 0.05$	The 1-year prevalence of WMSD was 92.2%. One-year prevalence of WMSD was highest for the neck (64%) and lower back (63%). Higher age and more years of practice were correlated with WMSD for shoulders and ankles/feet areas. Several patients treated by a physiotherapist were a risk factor for difficulties in the neck and multiple body areas. The level of physical activity was not correlated with WMSD in different body areas	The prevalence of WMSD found in our study sample was among the highest compared to other countries, despite probably having similar working conditions as elsewhere in Europe. The first WMSD of Slovenian physiotherapists mostly did not occur in the first 5 years of practice as other studies reported, which could be explained as a result of a good educational training of young physiotherapists. Possible reasons for the high prevalence of WMSD could be that our study sample represented only secondary and tertiary levels of health care; another reason could also be non-ergonomic and hard-working conditions during their careers. Physiotherapists are mostly adequately physically active, however, that did not turn out to be effective WMSD prevention in our sample. The relatively high prevalence is indicating the need for better interventions and prevention of WMSD in Slovenian physiotherapists

OR: Odds ratios; CI: Confidence interval, WRMSDs: Work-related musculoskeletal disorders; PTs: Physical therapists; RCs: Rehabilitation centers; OPCs: Outpatient clinics; RN: Registered nurses; NMQ: Nordic musculoskeletal questionnaire; MSD: Musculoskeletal disorders; LBP: Low back pain; US: United States; NITOR: National Institute of Traumatology and Orthopedic Rehabilitation; SNQ: Standardized Nordic Questionnaire; WAI: Work Ability Index; SDs: Sleep disorders; IMR: Institute of Medical Rehabilitation; URI: University Rehabilitation Institute

health sector in Macedonia is high. Božić [21] in his study on nurses' states that the prevalence of lumbar pain among nurses in the past 12 months was about 94%, which indicates the very high vulnerability of this population to the development of MSDs caused by work. A similar study was conducted by Akodu and Ashalejo [24] and reached the results where it can be seen that 70.4% of nurses in Lagos (Nigeria) in the past 12 months had some of the disorders of the musculoskeletal system.

CONCLUSION

This article should indicate the magnitude of the problems of WRMSDs in health professionals and that this topic is an inexhaustible and very interesting basis for further studies by current and future researchers to create strategies for prevention and treatment of this disorder and to eliminate their causes.

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