

Work Related Musculoskeletal Disorders among Nurses: Systematic Review

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Abstract

Background: With the dwindling numbers of nurses predicted to worsen; attrition from this professional occupation must be curtailed. This systematic review scrutinized the incidence and prevalence of work related musculoskeletal disorders (WMSD) among nurses as a possible attributing factor of attrition from the occupation. In addition, the examination of different intervention strategies adopted to curb the occurrence of work related musculoskeletal disorders among nurses, specifically physical exercise/therapy.

Methods: The authors complied with PRIMSA guidelines. The outcome interest was work related musculoskeletal disorders; exposure was professional nurses carrying out their duties. Seven electronic databases were systematically searched for publications meeting the following inclusion criteria; incidence and prevalence of WMSD among nurses ranging from 2003-2013. One hundred and eight articles with direct and indirect relationship to the searches were identified. After eliminating articles that did not meet the inclusion criteria, the remaining publications were assessed for quality and were subsequently mined. Forty-eight English published articles were assessed, allowing 27 publications to be used for this review. The 27 articles comprised of three longitudinal, four systematic reviews, two comparative, 14 descriptive biomechanical/ergonomic and four intervention studies.

Interpretation: The mean WMSD among these publications were 71.85%. The most vulnerable anatomical sites were the lower back, neck and shoulders. Predisposing risk factors were awkward working position sustained for prolonged periods during patient transfer, strenuous physical demands of the nursing profession, their poor health and fitness conditioning status and obesity. It is interesting to note that there is limited number of publications examining the efficacy of the different intervention strategies employed to curb WMSD among nurses.

Introduction

Work related musculoskeletal disorders (WMSD) are an important occupational health issue among all health care workers. WMSD is a collective and descriptive term for the symptoms caused or aggravated by work and characterized by discomfort, impairment, disability or persistent pain [1]. Epidemiological and ergonomic WMSD research has captured a prominent position in the arena of occupational health due to the substantial financial cost and decreased productivity among employers and employees [2]. Nurses are part of the multi-disciplinary medical team at hospitals and other medical centers that are susceptible to WMSD [3,4].

Consequences of WMSD among professional nurses are increased number of sick days per year, premature retirement and poor health [3,4]. Grabbe et al. reported that 56% of all sick days among professional nurses were due to WMSD. Trinkoff et al. reported that nurses cite WMSD, strenuous work and psychology demands are the key triggers to premature retirement [5,6]. The lower back has been identified as the most vulnerable anatomical site of WMSD among the nursing fraternity [7,8]. In the last two years (2012-2013) there has been four systematic reviews published relevant to this topic [6-9]. Yassi and Lockhart systematic review concluded a causal relationship between nursing tasks and lower back pain [9]. Their systematic review scrutinized studies published during 1980-2012 (89 articles) [9]. Whilst Schlossmacher and Amaral systematically reviewed the methods of evaluating low back injury caused by unfavorable working

conditions among nurses [7]. Schlossmacher and Amaral review examined only 12 articles [7]. Long et al. reviewed the risk factors and functional consequences of work related upper quadrant musculoskeletal disorders among midwives, nurses and physicians [6]. Long et al. examined 18 studies published during 1993-2010 [6]. The aim of this paper was to review current literature pertaining to WMSD among nurses at all anatomical sites during 2003 to 2013. This is the only systematic review that describes the kinesiology of prolonged vertebral flexion adopted by nurses during patient transfer activities. Further, the gynoid somatotype is discussed as a primary intrinsic predisposing risk factor of lower back pain and injury among nurses. Exclusive to this systematic review is the examination of different intervention strategies adopted to curb the occurrence of work related musculoskeletal disorders among nurses, specifically physical exercise/therapy. Authors' reviews of the findings of physical therapy as a treatment modality of WMSD among nurses are most favorable. Although this feasible solution may have been uncovered, due to the multi-factorial nature of the nursing profession, it may not be suitable.

Material and Methods

The authors followed standard practices for systematic reviews (PRIMSA) [10]. In regards to defining the participants, interventions, comparisons, outcomes and study designs (PICOS) according to PRIMSA checklist guidelines, the participants were professional nurses, the intervention is not a therapeutic intervention but is interpreted as an exposure; namely performing nursing duties, the

comparison in various articles in this review were comparisons to the general population at large, outcome of interest was (i) WMSD symptoms, musculoskeletal disorders, incidence and prevalence of WMSD in the previous 12 months and point prevalence, (ii) functional consequences of these symptoms on the affected individual in relation to their occupational, and, (iii) symptoms attributable to the individual's occupational activities and environment (not to trauma sustained from leisure activities). Reporting of the associations to WMSD was; risk factors associated to WMSD and anatomical site of injury and/or pain. The exclusion criteria were; (i) publications prior

2003, and (ii) publications of healthcare personnel and/or staff, who were not nurses.

A literature search and selection of peer-reviewed and professional journal publications were conducted, in the following search engines; PubMed, Medline, Science Direct, Ebscohost, Biomed, CINAHL and Embase (Figure 1). Key search words were: nurses, WMSD, occupational injury, musculoskeletal disorders, musculoskeletal symptoms, occupational epidemiology and intervention. The inclusion criteria for publication selection were: professional nurses.

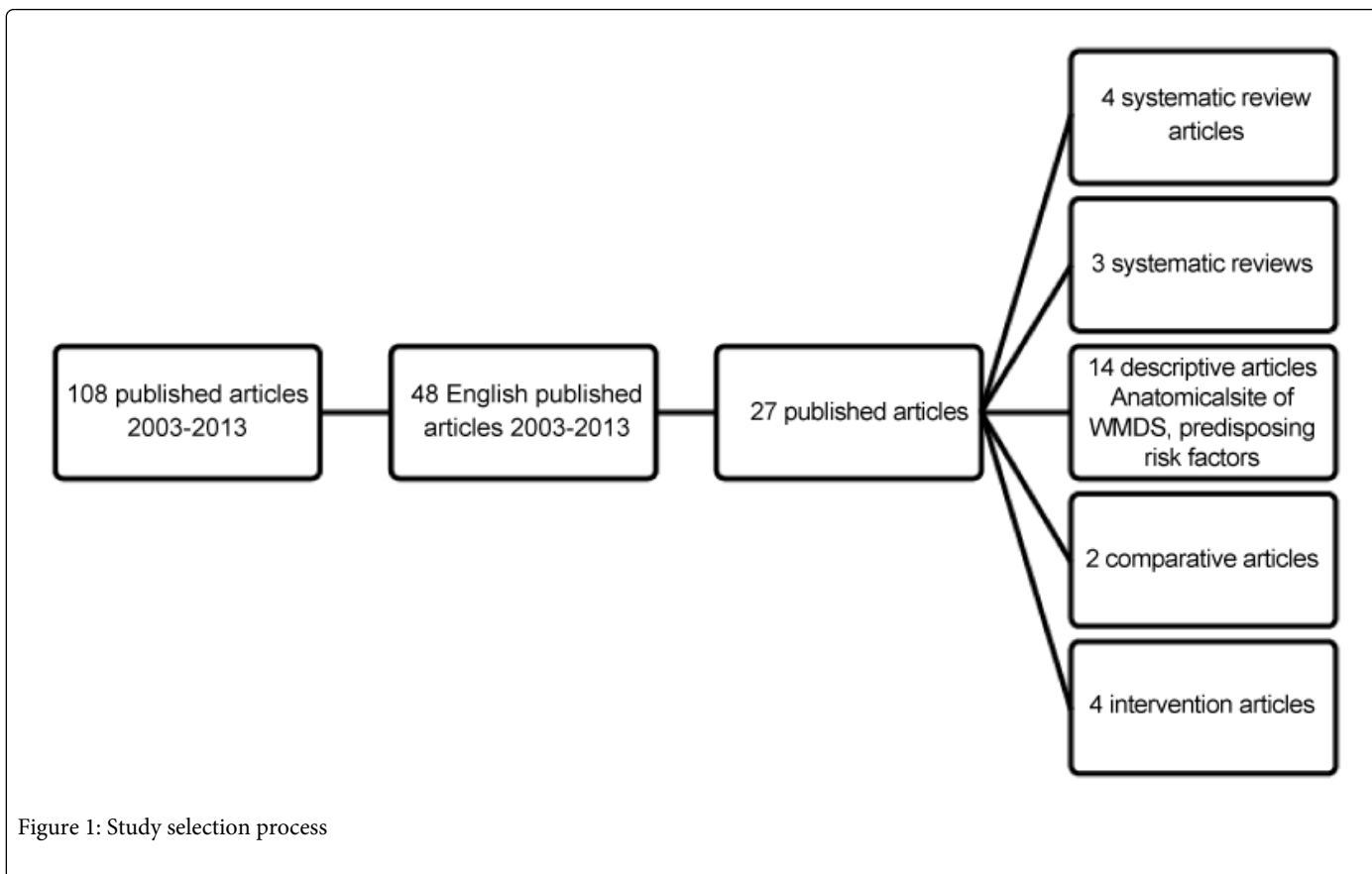


Figure 1: Study selection process

Author	Title	Findings
Long et al. 2012 [6]	Work related upper quadrant musculoskeletal disorders in midwives, nurses and physicians: a systematic review of risk factors and functional consequences	There is a high prevalence of upper quadrant musculoskeletal disorders in midwives, nurses and physicians.
Schlossmacher and Amaral, 2012 [7]	Low back injuries related to nursing professionals working conditions: a systematic review	A complete assessment of the existence of overload in the work of nurses requires a comprehensive method such as an ergonomic evaluation assessment of unfavorable working conditions.
Long, et al. 2013 [8]	The prevalence of work related neck, shoulder and upper back musculoskeletal disorders among midwives, nurses and physicians: a systematic review	There is a high prevalence of neck, shoulder and upper back this cohort.
Yassi & Lockhart, 2013 [9]	Work-relatedness of low back pain in nursing personnel: a systematic review	There is casual relationship between nursing tasks and low back pain.

Table 1: Systematic review of WMSD among nurses (2012-2013)

Results

Forty-eight English publications were identified, however after stringent evaluation according to the exclusion criteria only 27 publications were utilized for this review. The sum of the all nurses involved in these investigations was 13317. There was 71.85% prevalence of WMSD. The result of the literature search is synthesized into five tables. Table 1 describes the systematic review of the last four publications [6-9]. Table 2 describes the chronological overview of

WMSD among nurses specific to anatomical sites and identifying predisposing risk factors during the period of 2003-2013 [10-23].

Table 3 provides an overview of the comparative studies between nurses and other populations in relation to WMSD during the period 2006-2013 [24,25]. Table 4 defines the overview of the longitudinal studies of WMSD among nurses during 2003-2008 [3,26,27]. Table 5 describes the different intervention studies that attempted to curb WMSD among nurses during 2003-2013 [28-31].

Author	Title	Findings
Smith et al. 2003 [11]	Musculoskeletal disorders among female nurses in a rural Japanese hospital	Most prevalent anatomical site of WMSD was lower back, shoulder, neck, knees and upper back. Working in the surgical department significantly increased WMSD among the nurses.
Menzel et al. 2004 [12]	The physical workload of nursing personnel: association with musculoskeletal discomfort	There was a significant association between wrist and knee pain and the number of patient handling tasks performed per hour interacting with the load lifted.
Smith et al. 2004 [13]	Musculoskeletal disorders among professional nurses in Mainland China	Most prevalent anatomical site of WMSD was lower back, neck, shoulders and upper back, which was positively associated with mental pressure of nursing. Alcohol consumption was perceived to reduce WMSD.
Smith et al. 2004[13]	Musculoskeletal complaints and psychosocial risk factors among Chinese hospital nurses	The lower back was commonly reported body site of WMSD, followed by neck, shoulders and upper back. High mental pressure, boring tasks and limited work support were identified as significant risk factors. Physical and manual material handling was not positively associated with WMSD.
Yeung et al. 2005 [15]	The relationship between protective and risk characteristics of acting and experienced workload, and musculoskeletal disorders cases among nurses	Most prevalent anatomical site of WMSD was lower and upper back, hands/wrists and knees/lower legs. There was a positive relationship between workload and WMSD.
Smith et al. 2005 [16]	Epidemiology of musculoskeletal symptoms among Korean hospital nurses	Most vulnerable anatomical sites of WMSD were shoulder, lower back, neck, lower legs and hand/wrists. Manual handling of patient (transfer technique) predispose nurse to WMSD.
Choobineh et al. 2006 [17]	Association between perceived demands and musculoskeletal disorders among hospital nurses of Shiraz University of Medical Sciences: A questionnaire survey	Lower back pain was the prevalent symptom associated to the perceived physical demand of nursing.
Smith et al. 2006 [18]	A detailed analysis of musculoskeletal disorder risk factors among Japanese nurses	Most vulnerable anatomical sites of WMSD were shoulders, lower and upper back. Manual handling and physical tasks of nurses predispose these nurses to WMSD.
Naidoo and Coopoo (2007) [19]	The health and fitness profiles of nurses in KwaZulu-Natal	Overall poor health and fitness profiles and a high incidence of back pain correlating with increased body fat percentages.
Cameron et al. 2008 [20]	Musculoskeletal problems experienced by older nurses in hospital settings	Most prevalent anatomical site of WMSD was lower and upper back, neck and shoulders. Inadequate sleep, poor shift rotation, shifts longer than 12 hours and patient handling were attributing risks factors.
Skotte and Fallentin (2008) [21]	Low back injury risk during repositioning of patients in bed: the influence of handling technique, patient weight and disability	Repositioning technique and use of friction reducing devices have higher influence on low back load of nurses that patient's weight and disability.
Choobineh et al. 2010 [22]	Perceived demands and musculoskeletal disorders in operating room nurses of Shiraz City Hospitals	Most prevalent anatomical site of WMSD was lower back that was positively associated with physical demands and manual material handling.
Daraiseh et al. 2010	Low back symptoms among hospital nurses, associations to individual factors and pain in multiple body regions	High prevalence of lower back, upper back, neck and shoulders. Lower back pain was due to awkward working posture, unintentional disregard of safe practices and transfer of pain due to biological factors.
Anap et al. 2013 [24]	Work related musculoskeletal disorders among hospital nurses in rural Maharashtra, India	High prevalence of lower back, shoulder, neck and knee pain due to working in a sustained position for prolonged duration, bending, twisting, lifting and treating excessive number of patients.

Table 2. Chronological overview of the WMSD among nurses specific to anatomical sites, identifying predisposing risk factors (2003-2013)

Discussion

The results will be discussed in the following headings; anatomical site of WMSD, risk factors predisposing nurses to WMSD and physical activity intervention programs.

Anatomical sites of WMSD

The most vulnerable anatomical site of WMSD were; vertebral column, followed by shoulders, neck, knee, ankles/feet, wrist, thighs and elbow [11-23]. Further stratification of the prevalence of the vertebral column revealed the lower back to most susceptible to WMSD followed by the neck, upper back and pelvic complex (hips) [13-18]. Lower back WMSD had 53.24% prevalence among the publications. The predisposing mechanism of lower back WMSD will be discussed later.

Risk factors predisposing nurses to WMSD

Risk factors were divided into extrinsic and intrinsic factors. The extrinsic factors included the following:

Author	Title	Findings
Alexopoulos and Burdorf (2006) [25]	A comparative analysis on musculoskeletal disorders between Greek and Dutch nursing personnel	In both countries awkward postures places stress on the nurses lower back which produces lower back pain.
Chung et al. 2013 [26]	Risk of musculoskeletal disorders among Taiwanese nurses cohort: a nationwide population based study	Nurses are at risk of WMSD, which is on the increase.

Table 3. Overview of the comparative studies between nurses and other population in relation to WMSD (2006-2013)

Author	Title	Findings
Maul et al. 2003 [27]	Course of low back pain among nurses: a longitudinal study across eight years	It has become evident that lower back pain poses a persistent problem among nurses.
Trinkoff et al. 2006 [3]	Longitudinal relationship of work hours, mandatory overtime, and on-call to musculoskeletal problems in nurses	Adverse working schedules are significantly related to nurse WMSD. Healthier schedules, less overtime and reducing work on days off would minimize risk of WMSD and recovery time.
Engkvist (2008) [28]	Back injuries among nurses-A comparison of the accident processes after a 10 year follow-up	Poor education and application of manual patient handling and transfer tasks predispose nurses to back injuries

Table 4. Overview of the longitudinal studies of WMSD among nurses (2003-2008)

Author	Title	Findings
Proper et al. 2003 [29]	The effectiveness of worksite physical activity programs on physical activity, physical fitness and health	Physical exercise is strong therapeutic modality to reduce lower back pain and enhance quality of life
Smedley et al. 2003 [30]	Impact of ergonomic intervention on back pain among nurses	Education on the application of proper patient transfer technique reduces lower back pain.
Warming et al. 2008 [31]	Little effect of transfer technique instruction and physical fitness training in reducing low back pain nurses: a cluster randomized intervention study	Education of the application of proper transfer technique has no effect. However, physical training seems to minimize bouts of lower back pain among nurses.
Yuan et al. 2009 [32]	An intervention to promote health related physical fitness among nurses	Nurses who regular exercise lower the risk of lower back pain

Table 5. Overview of the intervention studies that attempted to curb WMSD among nurses (2003-2013)

Maintaining these deviated postures for prolonged periods daily, produces abnormal force couple relationships among the paraspinal musculature, producing muscle damage [8,26]. Many nurses do not practice proper lifting techniques when transferring patient (they do

i) Physical demands of the nursing profession include bending and twisting [23,24]

ii) Physical demands of nurse-patient interaction include; turning, bathing, dressing, seating the patient in the bed and/or chair and transferring the patient. There were different tasks: stretcher to bed, bed to chair, bed to toilet [21,22].

Anap et al. postulated that the above mentioned physical tasks do contribute to the prevalence of WMSD [24]. Many of the above tasks require the nurse to alter her body position from the anatomical ideal posture to ensure that the task is completed successfully [23]. In addition many tasks require the nurse to maintain these deviated postural alignments for prolonged periods of time which increases the risk of WMSD [16,23,25]. Transferring of patients requires the nurse to flex their vertebral column for prolonged duration, exerting isometric muscle contraction to maintain their static posture or to slowly lower a heavier patient to the chair (eccentric muscle contractions) [30].

not bend their knees and brace their lower back) [30,31]. Poor lifting technique practiced by nurses when transferring patients, places excessive stress on their lower back facilitating lower back musculoskeletal injuries [13,14].

Intrinsic risk factors pertain to nurse's characteristics.

The primary intrinsic risk factor is obesity of nurses [17,19],

A second intrinsic risk is the poorly conditioned status of nurses [19]

The primary intrinsic predisposing risk factor of lower back injury among nurse is related to their gynoid somatotype of obesity [30]. Gynoid somatotype is commonly described as a pear shaped, where the increased accumulation of body fat is found around the waist and hips. Literature reports that nurses' average body mass index is 31.7kg/m² that exceed the ACSM guidelines [19]. Naidoo and Coopoo correlated the gynoid somatotype of obese nurses to the prevalence of lower back injuries which is supported by Choobineh et al. [17,19]. The excess body fat around the waist and hip causes anterior pelvic tilt which produces an abnormal force couple relationship between the hip extensors and flexors. Hip flexors became tight while the hip extensors are elongated and weaker [33]. Smedley et al. reported that nurses were poorly conditioned when compared to general population [30]. In a physically demanding occupation poor physical condition increases the risk of WMSD [19,30].

Physical activity intervention programs

There is limited literature pertaining to the impact that physical activity acts as a protective measure against WMSD when adhered to by nurses [29-32]. Yuan et al. documented that nurses who regularly participate in physical activity and exercise lower their risk of WMSD [32]. Proper et al. and Warming et al. supported the notion that physical therapy (exercises) is a strong therapeutic modality to resolve the symptoms of lower back injuries and enhances quality of life [29,31]. However the primary limitation to adherence to regular physical activity participation among nurses due to their lack of time [3,4]. Generally nurses work long hours each day (ranges from 8-12 hours) thereby providing limited or no time for physical activity [20]. It has been recommended by Proper et al. to implement health and wellness programs at the nurses' occupational environment [29]. In addition the employer should make provision in the nurses' daily occupational activity to adhere to a well prescribed physical activity programs [29].

The efficacy of lumbar stabilization exercises for patients with musculoskeletal lower back pain (MLBP)

Common signs and symptoms of MLBP are para-spinal and abdominal muscle atrophy, decreased lumbo-pelvic hip complex (core) strength and endurance, decreased and poor synchronization of neural firing, poor proprioception [34-37]. In order for lumbar stabilization exercises to be considered an effective therapeutic intervention to combat MLBP, it has to negate the aforementioned common signs and symptoms.

Lumbar stabilization exercises are instrumental in producing para-spinal muscle hypertrophy, increased strength and endurance [35-37]. Hides et al. demonstrated that lumbar stabilization exercises prevent recurrent MLBP by nine-time less in patients who adhere to core stabilization programs in comparison to those patients who do not [36]. O' Sullivan et al. reported when spondylyolysis and spondylyolysis patients adhered to a lumbar stabilization exercise programs, their lower back pain was decreased, function and quality of life improved [37].

One of the earliest benefits derived from an exercise stability programs is enhanced neuromuscular efficiency [34]. In fact improvements in neuromuscular efficiency occur before muscle hypertrophy. Exercise physiologists attribute the early gains in muscle strength and endurance is due to enhanced neuromuscular efficiency [34]. The enhanced neuromuscular efficiency occur due to; (i) increase in the number of motor units being recruited during muscle contractions, (ii) increased firing rate of each motor unit, and, (iii) improved synchronization of motor units firing [33].

Other intervention to combat WMSD among nurses

Smith et al. reported that Chinese nurses resorted to regular alcohol consumption to help cope with pain of WMSD [13]. This intervention has its obvious malady to alcoholism and chronic diseases.

Ergonomic-education on the application of proper patient transfer techniques has been an idea which received considerable attention. Engkvist et al. has identified poor patient transfer technique has the primary culprit of lower back pain among nurses [17,28]. However, Warming et al. reported that education on the application of proper patient transfer to nurses did not eliminate the incidence of lower back pain [31]. There is a need for other intervention studies to be conducted to provide clinical empirical evidence of its value in combating WMSD.

Conclusion

This systematic review has identified that nurses are vulnerable to WMSD, especially lower back pain and injury. The predisposing risk factors of lower back pain and injury are poor patient transfer technique, high physical demand of the nursing profession, poor conditioning status of the nurses, obesity. A primary limitation of this review is the limited number experimental intervention studies that have been conducted to combat the WMSD among nurses. The only intervention that seems to alleviate lower back pain and injury among nurses is the adherence to a regular supervised exercise programs however nurses are not keen to adopt this intervention strategy. Further research should be conducted to determine other intervention strategies to negate WMSD among nurse, which they will adhere too.

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