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# A systematic review of programs and interventions for reduction of sickness absence in nursing staff with work-related musculoskeletal disorders

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## Abstract:

Negative consequences of musculoskeletal pain and injuries on the nurses' health and well-being can increase job dissatisfaction and impose high costs on healthcare centers due to lost workdays and compensation claims. This study aimed to identify policies, programs, and interventions that might be effective in the prevention and reduction of sickness absence and improvement of work outcomes in nursing staff with these problems. The systematic review was conducted according to the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines. Electronic databases were searched up to November 9-23, 2022. The keywords "musculoskeletal disorders", "nurse", "return to work", "sickness absence", and "sick leave" and their equivalents were combined using Boolean operators OR/AND. Reference lists of eligible literatures were also screened to identify related studies. In this study, a total of 3365 records were retrieved. After two rounds of screening, 15 studies were selected for qualitative synthesis. These studies included seven randomized controlled trial, five pre-post studies, two cohort, and one cross-sectional. Six types of interventions identified including back college, early workplace-based intervention, physical activity/training, psychosocial education, multifaceted intervention, and ergonomics program. There is insufficient evidence to identify effective interventions in preventing and reducing sickness absence, and improvement of work outcomes in nursing personnel with work-related musculoskeletal disorders. Numerous factors affected the occurrence of such disorders, and their consequences, therefore comprehensive strategy tailored to the injured person's needs should be considered.

## Keywords:

Musculoskeletal disorders, nursing staff, return to work, sick leave, work ability

## Introduction

Work-related musculoskeletal disorders (WMSDs) are described as a variety of conditions and injuries that have destructive and inflammatory effects on muscles, tendons, ligaments, joints, nerves, and supportive blood vessels. They cause pain or discomfort and are affected by work conditions and the work environment of employees.<sup>[1,2]</sup>

The prevalence of WMSDs is high among the general population; however, it is more destructive in clinical staff. Some evidence indicated that healthcare workers confront more to WMSDs than workers in the construction, mining, and manufacturing industries.<sup>[3-7]</sup> Among healthcare staff, those who directly take care of patients, especially nurses and nursing assistants, are more prone to have the issue with respect to the nature of their tasks.<sup>[8,9]</sup> As were reported in recent systematic

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reviews, the prevalence of WMSDs is around 33–88% among nurses.<sup>[10]</sup>

Work-related musculoskeletal disorders are known as an important occupational health problem among healthcare personnel.<sup>[9,11]</sup> The negative consequences of musculoskeletal pain and injuries on the nurses' health and wellbeing can increase job dissatisfaction and impose high costs on healthcare centers due to lost workdays and compensation claims.<sup>[5,8]</sup> Sickness absence due to musculoskeletal disorders can lead to shortage of nursing staff which is one of the major health systems challenges.<sup>[12]</sup> Nurses have 30% more sick leave than other professions. Low back pain (LBP) is the reason of 16% of these absences, while this figure is 8% in other occupations. LBP with 30–60% prevalence is the most prevalent type of musculoskeletal disorders among nurses. Shoulder disorders with 43–53% prevalence and neck pain with 30–48% are in the next ranking.<sup>[13]</sup>

The occurrence of musculoskeletal disorders is usually periodical; the affected person recovers after some days of acute conditions. Rest and avoidance of performing activities that exacerbate the condition is essential for recovery. However, the ability of musculoskeletal system for performing physical tasks might be reduced after a period of bed rest<sup>[14]</sup>; on the other hand, the more prolonged absence from work leads to less possibility of successful return to work (RTW), whereas activity and work can result in recovery.<sup>[15,16]</sup> Sickness absence has also negative psychological effects on employees.<sup>[15]</sup> Negative beliefs associated with pain might be reduced with colleagues, supervisors, and workplace social support; in addition, injured person's self-efficacy might be improved through returning to work despite persistent symptoms.<sup>[17,18]</sup>

RTW in nurses with WMSDs is of great importance in increasing quality of life of nursing personnel and reducing the costs related to sickness absence and healthcare costs. Several systematic reviews have been conducted regarding the effectiveness of various interventions for improving health and work outcomes of people with musculoskeletal disorders. However, these studies have targeted a specific diagnostic group of this field such as LBP, or investigated professional groups other than nursing,<sup>[19-21]</sup> or return to work, sickness absence and lost workdays were not reported as outcomes of these studies.<sup>[8,22-25]</sup>

Therefore, in this study we systematically reviewed policies, programs, and interventions which might be effective in reducing sickness absence and improvement of work outcomes of nursing personnel affected with a broad range of musculoskeletal disorders.

## Materials and Methods

The present study is a systematic review of publications relating to reducing sickness absence and improvement of work-related outcomes of nursing personnel with WMSDs. The study was conducted based on Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.<sup>[26]</sup>

### Search strategy

This study was conducted during November 2022 reviewing published English papers in the field of prevention and reduction of sickness absence and improvement of work outcomes of nursing personnel affected with WMSDs. For this purpose, electronic databases were searched up to 9 November (for PubMed and Scopus), 16 November (Embase), 18 November (Web of Science), and 23 November 2022 (CINAHL). Using OR and AND, keywords were combined and written in search box of databases included [(musculoskeletal diseases" OR "orthopedic disorders") AND ("nurse" OR "nursing personnel", OR "registered nurse") AND ("return to work" OR "back to work" OR "sickness absence" OR "sick leave" OR "disability leave" OR "sick day" OR "illness day")]. All synonyms of the keywords were included using MESH strategies and Emtree terms.

### Study selection and quality assessment

The search results were exported to the EndNoteX8 software, and duplicated studies were removed using this software. Two researchers (RS and HF) screened title and abstract of studies independently based on relevance to study objectives. When the researchers felt that the abstract or title was potentially useful, full text of studies was retrieved and considered based on inclusion and exclusion criteria. If discrepancies occurred between reviewers, the reasons were identified and a final decision was made based on third reviewer's judgment (AA). Two authors (RS and AA) assessed the methodological quality and grade of evidence of included studies with the Joanna Briggs Institute (JBI) tools. The purpose of this appraisal is to assess the methodological quality of a study and to determine the extent to which a study has addressed the possibility of bias in its design, conduct and analysis. Each of the items from the checklists were judged with yes (low risk of bias, score 1), no (high risk of bias), or cannot tell (unclear, score 0). Total scores were used to grade the methodological quality of each study [Table 1].<sup>[27]</sup>

### Inclusion and exclusion criteria

All English studies with interventional and observational design were included in this systematic review. Studies which investigated policies, programs, or interventions for prevention or reduction of sickness absence due to WMSDs of any region of the body, i.e., neck, shoulders, back, legs, or hands or improvement of return to work or work ability in

nursing staff affected with WMSDs of any gender and age of over 18 years were included in the study. Studies that about half of their participants experienced these problems were included. Studies that their full text were not available, conference abstracts, review studies, letters to the editors, and book chapters were excluded from this study.

### Data extraction and analysis

Two authors (RS and HF) independently extracted the data based on a checklist developed by the researchers [Table 2]. Qualitative synthesis was carried out to analyze the extracted data.

## Results

### Study characteristics

The initial electronic databases search resulted in a retrieval of 3365 documents. After removing duplicates and conducting two round of screening 15 papers (1 cross-sectional, 2 cohort, 5 pre-post, and 7 randomized controlled trial) were included for qualitative analysis. The PRISMA flow diagram of selection process is displayed in Figure 1.

The majority of affected nursing staff of studies was female. Approximately 80% of nursing staff of included studies worked in hospitals and others in nursing homes. Four studies were conducted before the year 2000,<sup>[28,29,39,40]</sup> two studies between 2000 and 2010,<sup>[30,41]</sup> and the other nine studies after 2010.<sup>[31-38,42]</sup> The studies were mainly conducted in European countries (60%) and in the USA (33%). Most the identified intervention programs consisted of more than one component including physical, behavioral, psychological training and also engineering and administrative controls. Intervention programs were implemented at different places such as workplace, clinics, and physiotherapy centers by diverse type of providers such as physicians, physiotherapists, psychologists, sport specialists, and workplace managers and supervisors. The identified interventions mainly focused on the pain of the back region of the body and could be considered both as primary and secondary prevention strategies.

### Results of quality assessment

Quality assessment of the included studies was performed using the JBI's quality appraisal tools.<sup>[27]</sup> Approximately half of the studies had randomized controlled design,

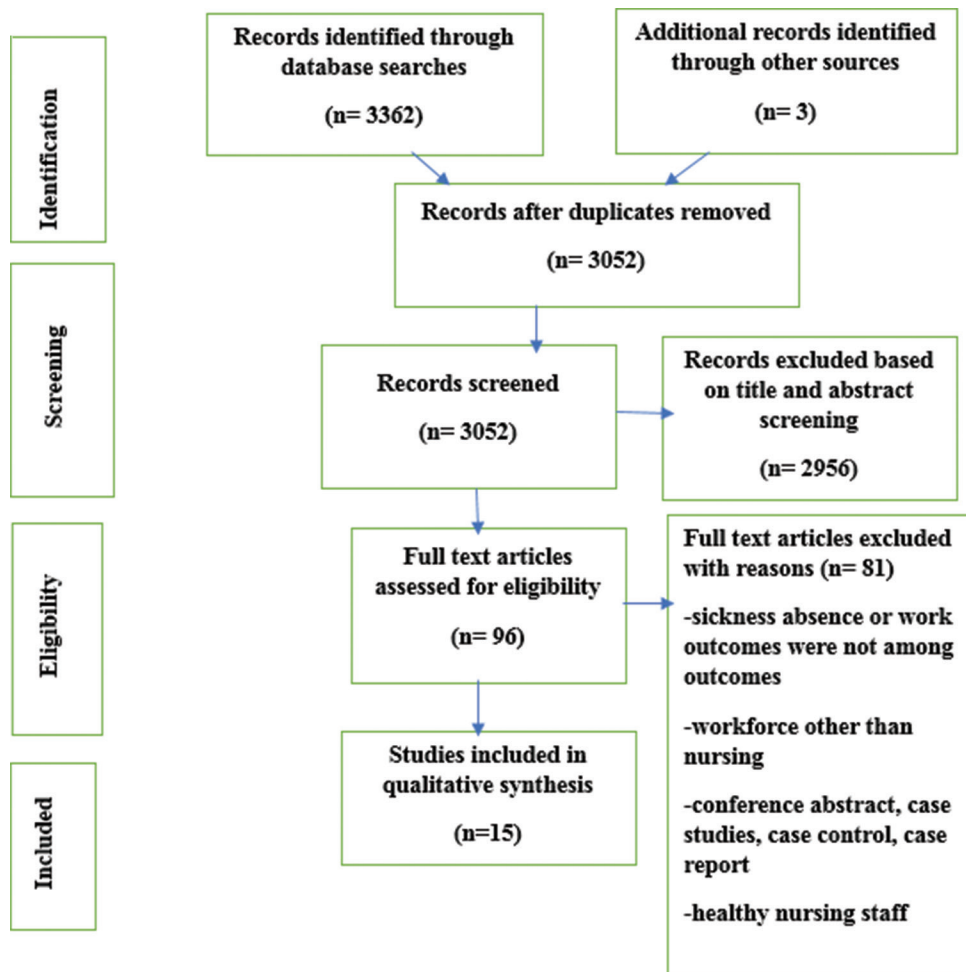


Figure 1: PRISMA<sup>[26]</sup> flow diagram of selection process of studies

**Table 1: The quality of the final extracted articles using JBI Critical Appraisal Tools<sup>[27]</sup>**

Pre-post studies	Transparency of cause and effect	Similarity of participants other than intervention of interest	Existence of control group	Multiple measurements of outcome pre and post the intervention	Completion of follow up	Similarity of outcomes measurement	Reliability of instrument	Appropriate statistical analysis	Total score					
Yassi et al. <sup>[28]</sup> 1995	Yes	Unclear	Yes	Yes	Unclear	Yes	Yes	Yes	7/9					
Garg & Owen <sup>[29]</sup> 1992	Yes	Unclear	No	Yes	Unclear	Yes	Yes	Yes	5/9					
Owen et al. <sup>[30]</sup> 2002	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	7/9					
Kusma et al. <sup>[31]</sup> 2019	Yes	Unclear	No	Yes	Unclear	Yes	Yes	Yes	5/9					
Kurowski et al. <sup>[32]</sup> 2019	Yes	Unclear	No	Yes	Unclear	Yes	Yes	Yes	5/9					
<b>Cohort studies</b>	<b>Similarity of two groups</b>	<b>Similarity of exposure measurement</b>	<b>Valid &amp; reliable measurement of exposure</b>	<b>Identification of confounding factors</b>	<b>Strategies to deal with confounding factors</b>	<b>Groups free of outcomes at the start</b>	<b>Valid &amp; reliable measurement of outcomes</b>	<b>Enough follow up time</b>	<b>Completion of follow up and analysis</b>	<b>Strategies to address incomplete follow up</b>	<b>Appropriate statistical analysis</b>			
Koch et al. <sup>[33]</sup> 2014	Unclear	Yes	No	No	Yes	Yes	Yes	Yes	Unclear	No	Yes	6/11		
Anyan et al. <sup>[34]</sup> 2013	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes	7/11		
<b>Cross-sectional inclusion</b>	<b>Criteria for sample &amp; subjects</b>	<b>Description of study sample &amp; subjects</b>	<b>Valid &amp; reliable measurement of exposure</b>	<b>Standard criteria for measurement of condition</b>	<b>Identification of confounding factor</b>	<b>Strategies to deal with factor</b>	<b>Valid &amp; reliable measurement of outcomes</b>	<b>Enough follow up time</b>	<b>Completion of follow up and analysis</b>	<b>Strategies to address incomplete follow up</b>	<b>Appropriate statistical analysis</b>	<b>Total score</b>		
Kolu <sup>[35]</sup> et al. 2016	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8/8		
<b>RCTs</b>	<b>True randomization for assignment</b>	<b>Allocation concealment</b>	<b>Similarity of groups at baseline</b>	<b>Blindness of participants</b>	<b>Blindness of providers</b>	<b>Blindness of assessors</b>	<b>Similarity of treatments except intervention</b>	<b>Completion of follow up &amp; analysis of differences</b>	<b>Analysis of participants in groups which randomized to</b>	<b>Similarity of outcome measurement</b>	<b>Reliable outcome measurement</b>	<b>Appropriate statistical analysis</b>	<b>Trial design appropriateness</b>	<b>Total score</b>
Becker et al. <sup>[36]</sup> 2017	Yes	Unclear	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	10/13	
Becker et al. <sup>[37]</sup> 2020	Yes	Unclear	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	10/13	
Andersen et al. <sup>[38]</sup> 2015	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11/13	
Gundewall et al. <sup>[39]</sup> 1993	No	Unclear	Yes	No	No	No	Yes	Yes	Unclear	Yes	Yes	Yes	7/13	
Linton et al. <sup>[40]</sup> 1989	No	Unclear	Yes	Unclear	Unclear	Unclear	Yes	Unclear	Unclear	Yes	Yes	Yes	5/13	
Manzel & Robinson <sup>[41]</sup> 2006	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	7/13	
Rasmussen et al. <sup>[42]</sup> 2016	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11/13	

33% had before-after design, 6.6% were cross-sectional, and 13% cohort. Only three studies (20%) had good quality rating (two randomized controlled trials,<sup>[38,42]</sup> and one cross-sectional<sup>[35]</sup>). The quality of 53.3% of studies was moderate, and 26.7% of studies had poor quality. More details were provided in Table 1.

Studies were grouped according to type of interventions. Back college, early workplace-based intervention, physical activity/training, psychosocial education, multifaceted interventions, and ergonomics program were six categories of interventions identified from these 15 included studies. Characteristics of included studies with programs and interventions for reducing sickness absence or improving work-related outcomes of nursing personnel with WMSDs are presented in Table 2.

### Back college

Back college/school is a treatment program that provides active education to group of patients on the anatomy of the back, biomechanics, and appropriate situation of the body, ergonomics, and back exercises.<sup>[43]</sup> Physical, ergonomic, and behavioral/psychological education and application instructions indicated positive effect on pain, sick leave, and work ability in two studies.<sup>[31,33]</sup> However, these studies were of poor quality and had no control group for comparison.

### Early intervention

Early intervention is planned to deliver right care at right time to prevent long-term disability related to MSD and to restore functioning. Early intervention programs at workplace provide adaptations to assist injured persons continue working.<sup>[44]</sup> Yassi *et al.* in their study evaluated early on-site interdisciplinary rehabilitation program for nurses with back injury.<sup>[28]</sup> The results showed positive effect on lost time, work status, pain, and disability in intervention group compared to group with usual care.

### Physical activity/training

Physical activity, e.g., aerobic fitness and muscle strengthening in three studies<sup>[35,38,39]</sup> provide positive results regarding sickness absence and in one of these studies<sup>[38]</sup> on work ability.

### Cognitive behavioral/psychosocial therapy

Cognitive behavioral therapy is a psychological treatment to manage the problems using techniques that change the way of thinking and behaving.<sup>[45,46]</sup> Beneficial effect of cognitive behavioral therapy provided early for the treatment of pain and depression due to back pain has been shown.<sup>[45]</sup> Menzel *et al.* in their study suggested that work absence of nursing personnel might be declined through effective treatment of pain and/or depression, as there is considerable relationship between depression and work absence.<sup>[41]</sup>

Another study showed that performing an early work-related psychosocial coaching intervention accompanying with individual physiotherapy compared with physiotherapy alone had positive effect on musculoskeletal pain severity and subjective work ability at short-term.<sup>[36]</sup> However, no long-term effect of this intervention was observed regarding work ability.<sup>[37]</sup>

### Multifaceted intervention

Musculoskeletal pain is affected by interaction between biological, physical, and psychosocial determinants.<sup>[7,8,24,47]</sup> Thus, biopsychosocial model has been introduced to target these factors. Multifaceted interventions, which have been investigated in various studies under the title of multidisciplinary, multimodal, multicomponent, and multidimensional programs, incorporate several interventions to manage different aspects of these problems.<sup>[47-49]</sup>

Although most the identified interventions in this review could be categorized as multifaceted, as they comprised of more than one component, two studies specifically were categorized in this group consisting of ergonomics, physical and behavioral education.<sup>[40,42]</sup> The results of these studies showed positive but not significant effect on sickness absence, and in one study<sup>[42]</sup> negative effect on work ability compared to waiting list control group.

### Ergonomics program

Ergonomics is a branch of knowledge that introduces interactions among work-force and other factors of work system and provides appropriate interventions to improve people's well-being and efficiency of the work system.<sup>[1,50]</sup> Ergonomics programs in this review mainly focused on the provision of patient lifting and transferring equipment, and training in their use, and workplace adaptations in four studies<sup>[29,30,32,34]</sup> reduced the back problems and their recurrence, lost and restricted workdays.

## Discussion

Work disability and sickness absence is a complex issue, and not merely the consequence of health condition.<sup>[51-54]</sup> Accordingly, focusing on psychological and socioeconomic aspects and interventions based on workplace and early interventions are considered as new patterns for dealing with work disability. Therefore, regular interactions of healthcare, workplace and social security systems along with affected persons are required to reduce work disability and to facilitate return to work of workers with MSDs.<sup>[51]</sup> In this study, we reviewed interventions which might be effective in reducing sickness absence, and for improvement of work-related outcomes of nursing staff with WMSDs.

**Table 2: Characteristics of included studies with interventions for reducing sickness absence and improvement of work outcomes in nursing staff with WMSDs**

Category of intervention	Author/year	Setting	Study design/ follow up	Population/ sample size	Intervention	Comparison	Outcome	Main finding	Effect
Back college	Kusma et al. <sup>[31]</sup> 2019	three hospitals of the Hospital Group of the Statutory Accident Insurance, Germany	single group pre-post study, 6 months	insured person as a healthcare worker with exposure to heavy lifting at the workplace as well as work related low back pain or lumboschialgia, n=570	Three-week inpatient training course (Back college): medical training therapy, physiotherapy and cognitive behavior modification and patient education provided by an interdisciplinary team at rehabilitation center	-	Socio-demographic data, Pain, drug use & sick leave due to lumbar spine, Health-related quality of life	Average number of sick leave days due to lumbar spine illness and back pain decreased. General state of health, quality of life and work ability indices improved. Back friendly behavior recorded more often.	Positive significant regarding sick leave
Early intervention	Koch et al. <sup>[34]</sup> 2014	Institution for Statutory Accident Insurance and Prevention, Health and Welfare Services, Germany	Retrospective cohort study/ four years	All insurance holders with lumbar spine symptoms/1282 nurses	Three-week Back College: physical therapy, physiotherapy, sport medical training, psychological health training, lecture on the biomechanics of the spinal column, nutritional advice, training in medical devices and aids, workplace support after 12 weeks, and five-day refresher course after 12 and 18 months through interdisciplinary team at rehabilitation center	-	Back pain, work ability, periods of inability to work from lumbar spine symptoms during the last 12 months (sick leave) in number of weeks	Pain reduced significantly. 15.2% of the participants reported that they were currently unable to work and 83.5% were able to work. About 16% reported slight, one third (30.4%) reported moderate and about half reported high current work ability.	Positive regarding work ability and sick leave
Early intervention	Yassi et al. <sup>[28]</sup> 1995	Large tertiary care hospital, Canada	Pre- post program analysis/One year	All registered nurses on the study wards affected with compensable soft tissue back injuries	Early work place intervention through multidisciplinary team: standardized comprehensive rehabilitation of assessment and treatment, and modified work within seven weeks of lost time injury and for a maximum period of seven weeks and a graded program of work hardening for nurses remaining out of work, with weekly reassessment	To seek care through their routine care givers	Number of injuries, number of lost time injuries, time loss, and worker's compensation board expenditure, pain and functional ability	Marked reduction in the number of back injuries and total time lost (22.7% and 29% respectively) occurred in the study group. Every nurse who entered the program returned to their normal job at follow-up. Average compensation expenditure per injury and per lost time injury also reduced in the study group.	Positive
Physical activity	Kolu et al. <sup>[35]</sup> 2017	Local municipal hospitals, Finland	Retrospective cross-sectional study/6 months	Finnish female nursing personnel with recurrent nonspecific low back pain/n=219	150 minutes of moderate-intensity leisure time physical activity a week and muscle conditioning, muscle strength training at least twice a week	Nurses who did not meet the physical activity recommendations	Meeting of physical activity recommendations, cardiorespiratory fitness, and neuromuscular fitness, health care and sickness absence related costs	Health-care costs, sick leave, productivity losses and also risk of disability pension decreased.	Positive

Contd...

**Table 2: Contd...**

Category of intervention	Author/year	Setting	Study design/follow up	Population/sample size	Intervention	Comparison	Outcome	Main finding	Effect
	Gundewall et al. <sup>[39]</sup> 1993	Geriatric hospital, Sweden	Normalized prospective randomized study/13 months	Nurses and nurse's aides/ n=69	Training and practicing exercise program (back muscle strengthening program) each session 20 minutes by physiotherapist during work hours, average six session at month, lasted 13 months	No program except training on how to fill report cards	Intensity of the pain, lost work days, isometric back muscle strength	Incidence and intensity of back pain and the work absence due to LBP reduced. One subject had been absent from work 28 days because of LBP, at one occasion in the training group compared to 12 subjects with 155 days at 17 occasions in the control group (p<0.004).	Positive significant regarding work absence
	Andersen et al. <sup>[38]</sup> 2015	Municipality hospital, Denmark	Parallel randomized controlled trial, three months	Nurses and nurses' aides, n=54	Standardized tailored physical activity (TPA) intervention: standardized combination of aerobic fitness and strength training for 50 minutes, three times per week over ten weeks during work hours by physiotherapist	health guidance for 1.5 h to all participants	Sickness absence due to musculoskeletal troubles, general pain, work ability, productivity and kinesiophobia, aerobic capacity, hand-grip strength	More participants from TPA (18) compared to reference group (15) had no sickness absence because of musculoskeletal troubles, the difference was not significant (p=0.40). Work ability and other outcomes showed significant improvements.	Positive but not significant regarding sickness absence but positive for work ability
Psychosocial education	Menzel & Robinson <sup>[41]</sup> 2006	550-bed tertiary care academic medical center, Florida, US	Randomized clinical trial/12 weeks	Registered nurses and nursing assistants with a history of back Pain, n=32	Cognitive behavioral therapy (CBT) intervention in the form of stress and pain management small group sessions led by psychologists offered one day per week in 1.5-hour sessions over a six-week period at medical center	Waiting list	Stress, pain, disability, mood, hours absence from work	Work absence reduced with successful treatment of either pain or depression or both.	Positive not significant
	Becker et al. <sup>[36]</sup> 2017	Five hospitals in the Paderborn region, Germany	Randomized Controlled trial/just after the intervention and three months	Registered nurses who were not on sick leave at the time of the study and had MSD at the time of the examination. IG (n=34), CG (n=34)	Weekly individual physiotherapy unit (10x45 min) for 10 weeks by physiotherapists at local physiotherapy centers, an additional introductory psychoeducational group session (1x90 min), five individual single coaching sessions by supervisors and management consultant, every 14 days (5x90 min) and a final group session (1x90 min)	Weekly individual physiotherapy unit (10x45 min) for 10 weeks	MSC and Functional status of the locomotor system, pain severity during everyday movements and impairments due to pain in everyday life, work ability, work-related psychological wellbeing	Pain severity reduced significantly. Self-assessed work ability regarding the physical demands improved significantly in the intervention group compared to the control group (P=0.034). No intervention effects were observed on current work ability compared with lifetime best, or on work ability regarding to psychological demands.	Positive for work ability

Contd...

**Table 2: Contd...**

Category of intervention	Author/year	Setting	Study design/ follow up	Population/ sample size	Intervention	Comparison	Outcome	Main finding	Effect
	Becker et al. <sup>[97]</sup> 2020	Same as previous study	Follow up study of randomized controlled trial/24 months after the intervention	Registered nurses, n=44 Intervention group (IG)= 24, control group (CG)= 20	Same as previous study	Same as previous study	Same as previous study	Spinal mobility of the vertebral column increased. In contrast to the 2nd follow-up (Becker et al. 2017), where work ability improved and irritation and emotional exhaustion decreased more obviously in the IG than in the CG, no long-term effects occurred in these outcomes at 3rd follow-up.	No long-term effects for work ability
Multifaceted intervention	Rasmussen et al. <sup>[43]</sup> 2016	Nursing homes or home care of municipality, Denmark	Pragmatic stepped wedge cluster randomized controlled trial with four groups/15 months	Workers in elderly care either in nursing homes or in home care/ n=594	Multi-faceted intervention: participatory ergonomics (two three-hours workshops and two one-hour follow-up meetings), physical training (one hour weekly by physiotherapists and occupational therapist during work time with short brochure with illustrations of the exercises) and CBT (two three-hour workshops guided by a therapist) lasted 12 weeks	Waiting list	Need for recovery, physical capacity, kinesiophobia, physical exertion, muscle strength, fear avoidance, occupational lifting, support from management, and work ability and sickness absence due to LBP.	Significant reduction in work ability was observed in fully adjusted model (-0.30, 95% CI-0.57 to-0.04). No significant change but a numerical reduction of 0.05 days per month occurred in sickness absence due to LBP. Physical capacity, maladaptive pain behavior and kinesiophobia showed improvement.	Negative with significant reduction in work ability and positive with not significant effect in sickness absence
	Linton et al. <sup>[40]</sup> 1989	Large Swedish hospital, Sweden	Controlled study/six months	Licensed practical nurses or nursing aides with back pain, n=66	Physical (walking, swimming, jogging, cycling), and ergonomic education with application training (four h/ day) and behavioral (pain control, life style management, risk analysis), and application training (twice per week) by physical therapist and psychologist at clinic during a 5-week period.	Waiting list	Pain intensity, sleep quality and fatigue ratings, anxiety, pain behavior, activities of daily living, depression, helplessness, marital satisfaction, pain related absenteeism, medication usage	A broken trend for increasing amounts of pain-related absenteeism and work days lost were observed although not impressive in study group compared to control group. Greater improvements also occurred for all other outcomes in study group.	Positive but not significant

Contd...



Table 2: Contd...

Category of intervention	Author/year	Setting	Study design/ follow up	Population/ sample size	Intervention	Comparison	Outcome	Main finding	Effect
Ergonomics program	Anyan et al. <sup>[34]</sup> 2013	University of Utah Health Care, US	Retrospective study classified into three distinct periods (pre, interim and post installation of overhead lifting system/11 years	45 injured patient care providers in burn trauma intensive care unit (73% nurses), with the majority having lower back injury (71%).	Installation of five overhead lifting systems (OLS) in burn unit, semiannual safe lifting education and assistive lifting safe lifting techniques, proper body mechanics, and assistive equipment operation with all staff members by physical therapists at work site	De-identified claims data from other ICUs at this facility with no OLS	Numbers of back injury (number of injuries per 100 employee-years), cost to workers' compensation, missed workdays	Ninety five percent of all claims occurred in the pre period, resulting in 94% of all the missed workdays. No missed day was observed in burn unit at the post installation period. Overall costs and missed workdays reduced significantly after installation of OLS systems.	Positive
	Garg & Owen <sup>[29]</sup> 1992	Nursing care facility, US	Pre-post intervention study/eight months in unit one and four months in unit two	Nursing assistants (NAs) employed at least half-time/ n=57	Ergonomic intervention strategy: selecting patient transferring devices, training NAs in the use of these devices at least two training sessions of two hours (two to three weeks per unit) by researchers, modifying toilets and shower rooms, and applying techniques to patient care	-	Number of reportable injuries, severity rates (lost day or restricted work-day), acceptability rates, and biomechanical measures of task demands, ratings of perceived exertion	Severity rate for back injuries was 317 per 200000 work-hours as compared to 634 before intervention. Profound decrease in lost and restricted work days occurred, which were reduced to zero in the two units during the last four months of the intervention.	Positive
	Owen et al. <sup>[30]</sup> 2002	Medical-surgical units of two rural hospitals, US	Quasi experimental study/Five years	Nursing personnel/ experimental site: n=37, control hospital, n=20	Ergonomic program: purchasing of assistive devices and training 2.5 hours all nursing personnel, at the experimental site on the use of devices by hospital managers	One-hour in-service training on usual methods of lifting and transferring the patients	Perceived exertion to shoulders and lower back, patient comfort, patient security, number of injuries, lost workdays, restricted workdays	Perceived physical stress, number of back injuries, lost and restricted workdays decreased. Patients comfort and security improved.	Positive
	Kurowski et al. <sup>[32]</sup> 2019	large nursing home corporation, US	Pre-post study, three and six years	1308 resident handling (RH) related claims, 77% were direct care clinical staff	Needs assessment of residents, providing resident handling (RH) devices, staff training on policies and operation of equipment and equipment maintenance by third party company at worksite	Non-RH related injuries and lost time	Period of first disability, resident handling related injuries, lost time injuries, paid lost workdays, and recurrence of lost time	Number of RH related lost time injuries, and lost time back injuries reduced, length of first episode of disability also decreased significantly. 30000 avoided days of disability occurred during six years follow up, due to reduction in RH-related lost time recurrences. The impact sustained at long term.	positive

Numerous interventions have been investigated by several studies in different settings and designs. Six categories of interventions were identified in this study consisting the back college, early workplace-based intervention, physical activity training, psychosocial education, multifaceted interventions and ergonomics program. Back college/school incorporated physical, psychological, and ergonomic education and instruction on their application might have positive effect on pain and work outcomes in nursing personnel. However, included studies in this review regarding this intervention had poor methodology and poor-quality rating. Back school in two experimental studies of nursing personnel also revealed positive results regarding the pain reduction of spine and correct execution of patient lifting techniques. Albeit effects on work-related outcomes were not investigated.<sup>[55,56]</sup> Elders *et al.* in a systematic review showed that back school consisting of exercise, improvement of functional status, education about working procedures and lifting techniques improved RTW in the intervention group. However, interventions in the subacute stage of back pain, i.e., during two months, had more hopeful results.<sup>[57]</sup> Other review in contrast concluded that effectiveness of back school for chronic low back pain is uncertain due to low to very low-quality evidence, and effect on work status was not reported in included studies.<sup>[43]</sup> “Back school” as an educational strategy for spine care should be more investigated for secondary prevention of sickness absence due to WMSDs in more high-quality studies.

Participation in early multidisciplinary workplace rehabilitation program can reduce lost time due to musculoskeletal injuries and can be helpful for successful return to work of nurses with these problems although, based on one pre-post study with moderate quality. Implementing each intervention is closely related to the time of incidence and the progress of such problems. Therefore, timely intervention is necessary primarily to prevent these conditions, and if occur for the prevention of more negative consequences such as sickness absence, healthcare costs, and the issue of patient care in this professional group.<sup>[24,58]</sup> Previous reviews in other and more general professional groups also confirm these findings.<sup>[52,59-61]</sup> Carroll *et al.* revealed that early interventions and stakeholders’ participation including health professionals, employers, and employees in work modifications for RTW of persons on sick leave with musculoskeletal conditions were more effective than other workplace-based interventions, e.g., exercise.<sup>[52]</sup> Opposite results with uncertainty were observed in a systematic review conducted by Cochrane *et al.*, in people with regional musculoskeletal pain.<sup>[20]</sup>

Performing physical exercises continuously at workplace and in leisure time may have promising effects on

reducing musculoskeletal pain and consequently sickness absence. Tulder *et al.* in a systematic review of “exercise therapy for low back pain” showed that specific exercises were not more effective compared to active or inactive interventions for treatment and RTW of acute LBP patients. But for patients with chronic LBP, exercises might be helpful to improve return to usual activities and work.<sup>[62]</sup> Also, the results of a meta-analysis by Kool *et al.*, with strong evidence displayed that exercise therapy as a single intervention or as one component of multidisciplinary interventions reduced sick leave days in nonspecific non-acute LBP patients significantly at one-year follow-up. However, the research for this result for more than one year was insufficient.<sup>[63]</sup> Also low-quality evidence provided limited support for the effectiveness of physical activity in reducing sickness absence in employees in another review study.<sup>[64]</sup>

Psychosocial/Cognitive behavioral treatment can also have positive effect on pain and work outcomes, i.e., sickness absence and work ability at short term. In this regard, Richmond’s systematic review on the effect of cognitive behavioral therapy for LBP showed inconsistent results regarding work disability that was assessed through patient reported measure of lost workdays; however, this intervention had positive long-term effect on pain, disability, and quality of life compared to being on waiting list or usual care and other active treatments for LBP patients.<sup>[45]</sup> In opposition, Finnes *et al.* reported positive effect of psychological treatment on sickness absence compared with usual care for both mental and MSDs disorders.<sup>[65]</sup> These findings implied the necessity for conducting more high-quality researches on this type of treatment for improving the work-related outcomes of nursing personnel with WMSDs.

Present systematic review showed conflicting results for the effectiveness of multifaceted interventions in reduction of sickness absence due to WMSDs and improvement of work ability in nursing personnel. These findings contrast with the results of previous studies.<sup>[19,47,58,66]</sup> Kamper *et al.* showed that multidisciplinary biopsychosocial rehabilitation interventions appeared to be more effective than physical treatment, but not than usual care with respect to work outcomes for workers with chronic low back pain.<sup>[47]</sup> Moreover, Norlund *et al.*, in a meta-analysis of five studies from Scandinavian countries with approximately similar background, demonstrated that multidisciplinary interventions including multiple disciplines of vocational rehabilitation had positive effect of 21% on RTW.<sup>[19]</sup>

Ergonomics interventions mainly patient’s lifting and transferring equipment and related policies and training showed promising results on reducing the injuries and lost workdays associated with WMSDs, although studies

were not of sufficient quality. A systematic review on preventive effect of technical aids on musculoskeletal complaints in healthcare workers indicated that such patient handling devices may reduce injuries related to musculoskeletal system, although the impact of the intervention on RTW or sickness absence was not investigated, and the quality of evidence was very low.<sup>[22]</sup> Nastasia and Gaspard in a scoping review revealed that rehabilitation programs including ergonomics had positive effect on sustainable RTW for workers with WMSDs. However, they stated that the content of ergonomic interventions and the way of their execution differed across studies.<sup>[67]</sup> Moreover, the results of two other studies confirmed the effectiveness of these programs in prevention and reduction of the risk of WMSDs. However, the effect on work outcomes was not mentioned in those studies.<sup>[68,69]</sup> In contrast, there was not enough evidence for the effectiveness of such interventions in reduction the risk of MSDs in dental care practitioners.<sup>[1]</sup> In total, findings of our study were in line with Richardson's *et al.* study on identifying interventions for prevention and reduction of MSDs and the impact of them in nurses. We perceived that the majority of interventions that can reduce the MSDs among nurses, can also be effective for the reduction of negative consequences of these problems such as absenteeism.<sup>[8]</sup>

### Limitations and suggestions

Our study had some limitations. Gray literature was not considered in this review. Many studies had methodological limitations, e.g., lack of control group, high dropout rate, and not-blinding which result in bias. However, blinding was not possible since most of the interventions were investigated in the workplace. In addition, this study focuses on work-related outcomes rather than clinical outcomes such as pain, disability, and quality of life. Further, included studies in our review used different scales for measuring outcomes. Additionally, some categories of interventions were investigated in few studies, hence generalizing the results should be performed with care, and conducting more research with robust methodology can help discover their effects. Considering follow-up time is an important factor to observe outcome of interest and the success of interventions,<sup>[24]</sup> even though in present study different time-frames were reported for identified categories of interventions. It is also worth mentioning that, because of the context of healthcare environments, and the patients' conditions, nurses have high level of physical and mental pressure that might impede the correct implementation of identified interventions. So future research should consider these complexities into account and should introduce the accurate methods of implementing these interventions to yield effective results.

### Conclusion

Overall, there was insufficient evidence regarding the effectiveness of identified categories of interventions for preventing and reducing sickness absence associated with WMSDs and for improvement of work outcomes in nursing personnel with WMSDs. Numerous factors affect the incidence and prevalence of WMSDs, and sickness absence duo to these problems, so a comprehensive strategy in accordance with the injured person's needs should be considered. Moreover, feasibility considerations, e.g., time, cost, country and workplace context, and commitment of important stakeholders, should be taken in to account for general implementation of such intervention programs. Also, if selected for implementing should be sustained over time in order to maintain effects in long term.

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### Conflicts of interest

There are no conflicts of interest.

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