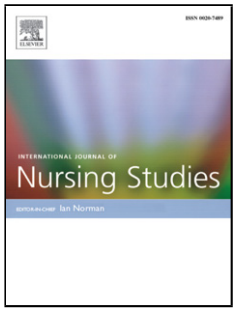

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The efficacy of interventions for low back pain in nurses: a systematic review

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Abstract

Objectives: To investigate the efficacy of interventions for the prevention and treatment of low back pain in nurses.

Design: Systematic review.

Data sources: The review was registered on the PROSPERO database (CRD42015026941) and followed the PRISMA statement guidelines. A two phase approach was used. In phase one, all randomised controlled trials included in the systematic review of Dawson et al. (2007) which reviewed interventions for low back pain in nurses until 2004 were selected. In phase two, relevant randomised controlled trials and cluster randomised controlled trials published from 2004 until December 2015 were identified by an electronic search of nine databases (Embase, CINAHL, SPORTDiscus, PsycARTICLES, Cochrane Library, Web of Science, PEDro, Scopus and MEDLINE). To be

eligible, trials had to examine the efficacy of interventions either for the prevention or treatment of low back pain in nurses. Primary outcomes of interest were any measure of pain and/or disability.
Review methods: Three reviewers independently assessed eligibility and two reviewers independently conducted a risk of bias assessment (Cochrane Back and Neck Group).
Results: Four studies were retrieved from phase one. In phase two, 15,628 titles and abstracts were scanned. From these, 150 full-text studies were retrieved and ten were eligible. Fourteen studies (four from phase one, ten from phase two) were eligible for risk of bias assessment. The included trials were highly heterogeneous, differing in pain and disability outcome measures, types of intervention, types of control group and follow-up durations. Only four of the included studies (N=644 subjects) had a low risk of bias (≥6/12). Manual handling training and stress management in isolation were not effective in nurses with and without low back pain (risk of bias, 7/12, N=210); the addition of a stretching exercise intervention was better than only performing usual activities (risk of bias, 6/12, N=127); combining manual handling training and back school was better than passive physiotherapy (risk of bias, 7/12, N=124); and a multidimensional intervention (risk of bias, 7/12, N=183) was not superior to a general exercise program in reducing low back pain in nurses.
Conclusions: Only four relevant low risk of bias randomised controlled trials were found. At present there is no strong evidence of efficacy for any intervention in preventing or treating low back pain in nurses. Additional high quality randomised controlled trials are required. It may be worth exploring the efficacy of more individualised multidimensional interventions for low back pain in the nursing population.
Keywords: intervention, low back pain, nurses, nursing aides, nursing profession, occupational, prevention, randomised controlled trial, systematic review, treatment.

Introduction

Low back pain is a common, recurrent and costly health problem worldwide (Nielens et al., 2006). Low back pain affects between 51 and 90% of people at some point during their lifetime (Airaksinen et al., 2006, Wieser et al., 2010). The course of low back pain is often characterised by a recurring pattern of complaints (Deyo and Weinstein, 2001). It has been demonstrated that low back pain is one of the main reasons for seeking medical care (Katz, 2006, Waddell, 2004). It causes an enormous medical and economic burden on individuals, families, communities, industry and governments (Dieleman et al., 2016, Hoy et al., 2010, Rossignol et al., 2009).

Nursing has been identified amongst the top professions at risk of low back pain (Jensen, 1987, Yassi and Lockhart, 2013), with low back pain rates exceeding those employed in heavy industry (Engst et al., 2005). Genevay et al. (2011) found that being a nurse is independently related to spinal pain. The year prevalence of low back pain in nurses has a mean of 70% (Abolfotouh et al., 2015, Dawson et al., 2011, June and Cho, 2011) and the lifetime prevalence ranges from 35 to 80% (Hignett, 1996, Maul et al., 2003, Vieira et al., 2006). Recurrence rates of low back pain in nurses exceed 70% (Burdorf and Jansen, 2006).

The impact of low back pain for nurses is large and includes work absenteeism, increased risk of chronicity, associated personal and economic costs, reduced nursing workforce efficiency (presenteeism), decreased quality of life, and burnout (Cohen-Mansfield et al., 1996). Unsurprisingly, several studies have demonstrated an association between work-related low back pain, negative beliefs, reduced job satisfaction and burnout or days off work in nurses (Mitchell et al., 2008, Sorour and El-Maksoud, 2012, Urquhart et al., 2013).

Initially, ergonomic factors were seen as the most important risk factor for low back pain in nurses. However, it has recently been shown that nursing can be a stressful profession and that several other individual, physical, psychosocial and lifestyle factors can play a crucial role (Adams et al., 1999, Bernal et al., 2015, Coggon et al., 2013, da Costa and Vieira, 2010, Harcombe et al., 2010, Klaber Moffett et al., 1993, Martel et al., 2010, Sorour and El-Maksoud, 2012, Stroyer and Jensen, 2008).

Over recent decades, significant resources have been invested in an attempt to reduce the prevalence of low back pain among nurses. Interventions have been mostly focused on physical characteristics such as lifting, and the use of ergonomic devices. This included low back pain education and awareness training (Guthrie et al., 2004, Hodder et al., 2010, Kindblom-Rising et al., 2011), manual handling training (Hodder et al., 2010, Yassi et al., 2001) and various means of mechanical lifts and lift assists (Engst et al., 2005, Guthrie et al., 2004, Pellino et al., 2006) such as lift teams (Edlich et al., 2004), transfer belts and mechanical floor lifts (Evanoff et al., 2003, Li et al., 2004) and ceiling lifts (Alamgir et al., 2009, Engst et al., 2005, Li et al., 2004). A systematic review by

Dawson et al. (2007) revealed that unidimensional interventions, such as manual handling training or stress management as a sole treatment option, were ineffective. They highlighted the potential role for multidimensional interventions to treat and prevent low back pain in nurses (Dawson et al., 2007).

Since this systematic review by Dawson et al. (2007), no recent systematic reviews have been conducted. Therefore the aim of this systematic review is to determine whether there are more recent interventions showing efficacy in either the (i) prevention of low back pain in nurses who are pain free or (ii) treatment of low back pain in nurses.

Methods

Literature Search Strategy

This review was registered on the PROSPERO database (CRD42015026941) and has been reported in accordance with the PRISMA statement (Moher et al., 2009).

A two phase approach was taken to expedite the search process while preserving rigour and preventing bias. In phase one, randomised controlled trials included in the systematic review of Dawson et al. (2007) which reviewed interventions for low back pain in nurses up until December 2004, were selected. In phase two, all relevant randomised controlled trials and cluster randomised controlled trials published since the previous review and meeting the inclusion criteria (see below) were identified by;

- A search of nine electronic databases (Embase, CINAHL, SPORTDiscus, PsycARTICLES, Cochrane Library, Web of Science, PEDro, Scopus and MEDLINE) from 2004 till December 2015 using the search strategy recommended by the Cochrane Back and Neck Group (Figure 1).
- Scanning the reference lists of previous systematic reviews and the eligible studies for further references.

Three independent reviewers (WVH, NDD, JDR) conducted the electronic searches across all databases. The strategy had five components which were combined: (1) lumbar AND (2) pain AND (3) nurse AND (4) randomised controlled trial and NOT (5) non-musculoskeletal conditions (e.g. cancer). The specific focus of the search was any intervention (prevention or treatment) for low back pain in nurses. All randomised controlled trials from phase one and two were assessed for eligibility using strict inclusion and exclusion criteria and were all critically appraised using the same risk of bias assessment, even if they had been appraised in the original review by Dawson et al. (2007)(Figure 1).

Inclusion and exclusion criteria

Study design

Only studies (from phase one and two) of completed randomised controlled trials published in peer-reviewed journals written in English, German, French or Dutch were included.

Population

Studies including nurses with non-specific low back pain between 18 and 65 years of age were included. Low back pain was defined as pain in the area bounded by the bottom of the rib cage and the buttock creases and without dominant patho-anatomical findings. Participants needed to have a minimum of one episode of low back pain causing pain and/or disability and/or seeking care and/or sick leave in the previous two years. Studies involving participants with specific pathologies/conditions (e.g. pregnancy, "red flag" disorders (e.g. spinal cord compression/cauda equina, spinal cord injury, cancer, fracture) or neurological, cardiac, renal or respiratory, rheumatological conditions) were excluded. Low back pain prevention studies could also include non-low back pain subjects.

All grades of nurses, nursing aides, nursing assistants, nursing students and home care workers were eligible. Studies including other cohorts (e.g. administrative- or technical staff) where the data of the nursing cohort could not be extracted were excluded.

Interventions

Any non-surgical intervention for the prevention or treatment of low back pain in nursing staff was eligible, including educational/advice booklets. Only studies on surgical treatments were excluded. No studies were excluded on the basis of the comparator/control group used.

Clinical Outcomes

Primary outcomes of interest were any measure of pain and/or disability. Secondary outcome of interest was health care consumption. Eligible studies were required to have at least 12 weeks follow-up data of primary and secondary outcomes after the completion of treatment, since there is a common trend of early rapid improvement in outcomes during immediate follow-up after treatment for low back pain (Artus et al., 2010).

Study selection

The standard protocol for selecting studies, as advised in the Method Guideline for systematic reviews of the Cochrane Back and Neck Group (Furlan et al., 2015), was followed. After the removal of duplicates, three reviewers independently screened the titles, abstracts and keywords and removed irrelevant citations according to the selection criteria. Reviewers kept a record of their

reasons for the inclusion or exclusion of studies. The screened lists were compared between the three reviewers. To minimise the risk of excluding studies incorrectly, any studies that were initially chosen by only one or two reviewers were included for the next stage of the review. The full-text version of an article was obtained if the title and abstract seemed to fulfil the inclusion criteria or if study eligibility was unclear. Disagreements on study eligibility were resolved by discussion, or where necessary using a consensus meeting with a fourth reviewing author (KOS). Original study authors were emailed if clarification was needed on randomization methods, risk of bias criteria, availability of separate data for the nursing cohort, or the precise interventions provided. Nine authors were mailed for additional information in this manner and all authors replied.

Risk of bias assessment

Two reviewers (WVH, MOK) independently conducted a risk of bias assessment of all eligible studies from phase one and two using the criteria advised by the Cochrane Back and Neck Group (Furlan et al., 2015). The consensus risk of bias assessment scores for all studies are shown in Table 1. The following types of bias were assessed: selection bias (criteria 1, 2, 9), performance bias (criteria 3, 4, 10, 11), attrition bias (criteria 6, 7), detection (or measurement) bias (criteria 5, 12) and reporting bias (criterion 8). Differences in the reviewers' assessment of risk of bias were discussed during a consensus meeting. There was a discussion with a third reviewing author (KOS) when disagreement persisted. A total score was computed, and low risk of bias was defined as fulfilling six or more (>50%) of the internal validity criteria (range 0-12).

Data extraction

Data were extracted from each eligible study and cross-checked by two reviewers in a consensus meeting. The data extracted included: (1) characteristics of the studies, (2) characteristics of the interventions, (3) characteristics of the outcomes, and (4) a results summary.

Data analysis

Studies were grouped according to the intervention used and the study population (treatment only, or mixed prevention and treatment). Where possible, studies were thereafter grouped according to the time of follow-up and type of control group.

Meta-analysis

Meta-analysis was not possible as studies were too heterogeneous in design and methodology, namely; in preventive or treatment design, types of interventions, types of control group, pain and disability outcome measures used and the time of follow-up.

Results

Literature search and study selection

Figure 1 summarises the search results and selection of the studies, following the PRISMA statement guidelines (Liberati et al., 2009). In phase one, the randomised controlled trials included in Dawson et al. (2007) were selected. This paper included eight randomised controlled trials. Four studies were excluded, as they were either not randomised (Josephson et al., 1996) or had less than 12 weeks follow-up post intervention (Alexandre et al., 2001, Allen and Wilder, 1996, Gundewall et al., 1993). The remaining four randomised controlled trials from Dawson et al. (2007) were included in this review (Best, 1997, Horneij et al., 2001, Linton et al., 1989, Yassi et al., 2001).

In phase two, searching the databases yielded 23,751 potentially relevant studies. 8,123 duplicates were removed and 15,628 titles and abstracts were scanned. 150 full-text studies were retrieved with 140 studies being excluded as they did not meet the eligibility criteria. Searching the reference lists of the included studies did not result in the inclusion of other studies. Reasons for exclusion included lack of appropriate randomisation, including non-nursing subjects in the study population, an inadequate follow-up period, Iranian language, and failing to measure appropriate outcome measures. Ten studies matched these inclusion criteria (Ajimsha et al., 2014, Chen et al., 2014, Ewert et al., 2009, Jaromi et al., 2012, Jensen et al., 2006, Kamioka et al., 2011, Roussel et al., 2015, Svensson et al., 2011, Svensson et al., 2009, Warming et al., 2008). A total of 14 studies were therefore included in the review (four from phase one and ten from phase two).

Risk of bias assessment

The Cochrane Back and Neck Group risk of bias assessment scores are shown in Table 1. Four studies included in this systematic review were deemed to have a low risk of bias (≥6/12) (Table 1). Ten studies were deemed to have a high risk of bias (<6/12) (Table 1). Following the Method Guideline for systematic reviews of the Cochrane Back and Neck Group (Furlan et al., 2015), we only included the randomised controlled trials with low risk of bias in this results section. Common methodological limitations identified across these four studies included lack of information on allocation concealment, assessor blinding, co-interventions and compliance to treatment. There was insufficient information (based on the studies and communication with the authors) to evaluate whether the interventions in the randomised controlled trials were given as planned.

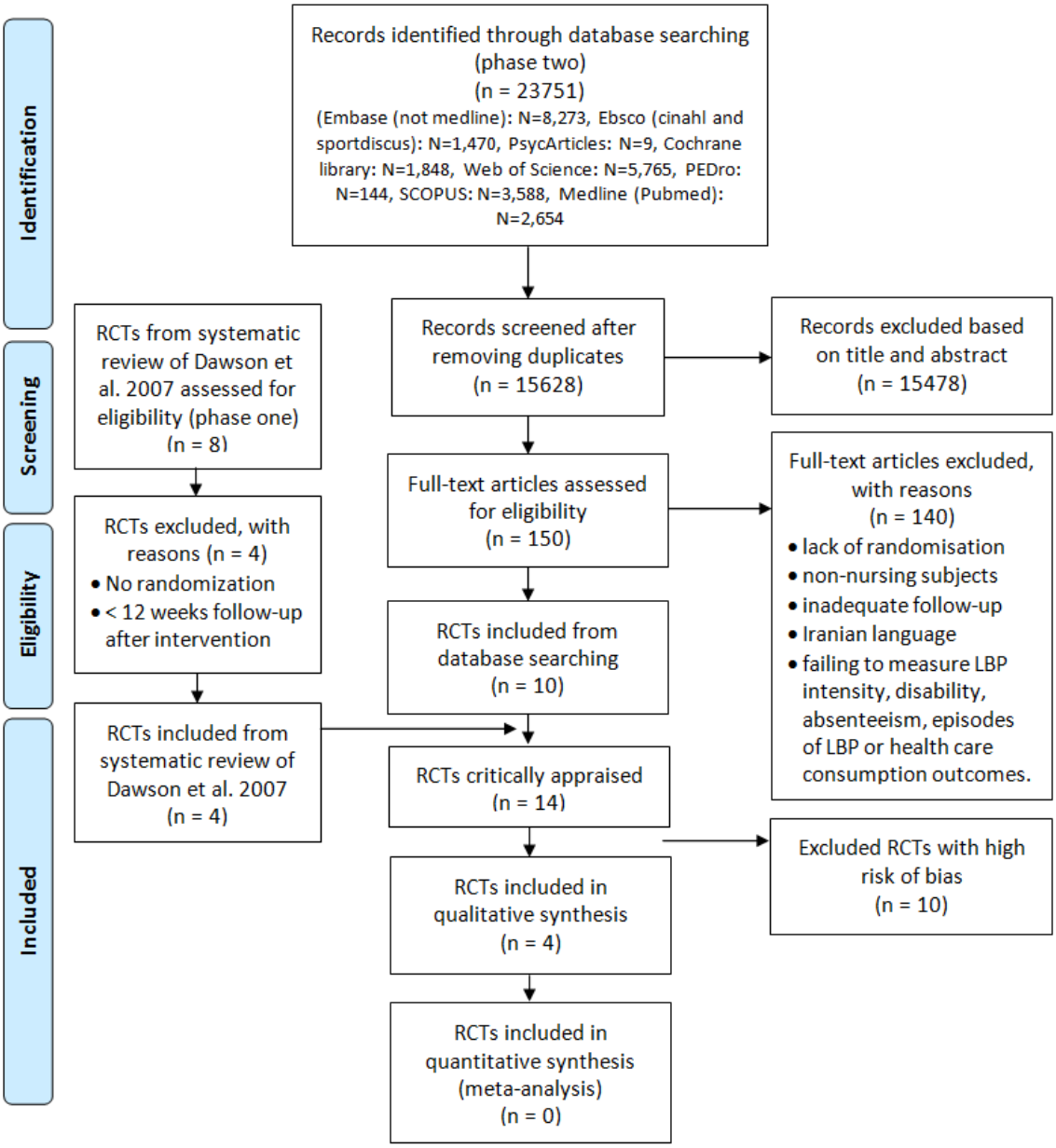

Figure 1: PRISMA study flow diagram. RCT: Randomised Controlled Trials.

	Author	1	2	3	4	5	6	7	8	9	10	11	12	13	Total (/12)
1	***Ajimsha et al. 2014***	+	?	-	-	-	+	-	+	+	?	?	+	-	5
2	***Best 1997 (cluster)***	+	?	-	-	-	-	-	+	+	-	?	+	?	4
3	***Chen et al. 2014***	+	+	-	-	?	+	+	+	-	?	?	+	?	6
4	***Ewert et al. 2009***	+	+	-	-	-	+	+	+	+	?	?	+	?	7
5	***Horneij et al. 2001***	+	-	-	-	-	-	+	+	+	?	?	+	?	5
6	***Jaromi et al. 2012***	+	?	-	-	+	+	-	+	+	?	+	+	?	7
7	***Jensen et al. 2006 (cluster)***	+	+	-	-	?	+	-	+	+	?	+	+	?	7
8	***Kamioka et al. 2011 (cluster)***	+	+	-	-	?	-	-	+	+	?	-	+	?	5
9	***Linton et al. 1989***	+	-	-	-	-	+	-	+	+	?	?	+	?	5
10	***Roussel et al. 2015***	+	?	-	-	-	-	+	+	+	?	?	+	-	5
11	***Svensson et al. 2009 (cluster)***	+	?	-	-	?	-	+	+	+	?	-	+	-	5
12	***Svensson et al. 2011 (cluster)***	+	?	-	-	?	-	+	+	+	?	-	+	-	5
13	***Warming et al. 2008 (cluster)***	+	?	-	-	-	-	+	+	-	?	-	+	-	4
14	***Yassi et al. 2001 (cluster)***	+	-	-	-	-	+	-	+	+	?	?	+	?	5

Specification of 1 – 12 criteria:

1. Was the method of randomization adequate?
2. Was the treatment allocation concealed?
3. Was the patient blinded to the intervention?
4. Was the care provider blinded to the intervention?
5. Was the outcome assessor blinded to the intervention?
6. Was the drop-out rate described and acceptable?
7. Were all randomised participants analyzed in the group to which they were allocated?
8. Are reports of the study free of suggestion of selective outcome reporting?
9. Were the groups similar at baseline regarding the most important prognostic indicators?
10. Were co-interventions avoided or similar?
11. Was the compliance acceptable in all groups?
12. Was the timing of the outcome assessment similar in all groups?
13. Are other sources of potential bias unlikely?

Table 1: Risk of bias assessment based on the Cochrane Back and Neck Group risk of bias criteria. Dark grey shaded studies: low risk of bias (≥6/12), grey shaded studies: high risk of bias (<6/12).

Population

The sample sizes of the four included low risk of bias studies ranged from 50 to 790 participants, involving predominantly female participants from ten different countries. The average age of participants ranged from 30.7 to 45 years.

Intervention characteristics

Table 2 represents the characteristics and content of the interventions of the four low risk of bias studies. One study evaluated stretching exercises (Chen et al., 2014); one study a combination of ergonomics with back school (Jaromi et al., 2012); one study manual handling training versus a stress management program (Jensen et al., 2006); and one study a multidimensional intervention (Ewert et al., 2009). One study had a mixed design, meaning that it studied the prevention and treatment effect, involving both non-low back pain and low back pain subjects (Jensen et al., 2006) and three studies had a treatment design, involving only people with low back pain (Chen et al., 2014, Ewert et al., 2009, Jaromi et al., 2012).

Clinical outcome measures

Four studies reported a pain intensity outcome measure (e.g. Visual Analogue Scale (VAS), Numerical Rating Scale (NRS), West Haven-Yale Multidimensional Pain Inventory (WHYMPI)) (Chen et al., 2014, Ewert et al., 2009, Jaromi et al., 2012, Jensen et al., 2006). No study reported results for disability, low back pain episodes/frequency, absenteeism (sick leave days in general or low back pain-related sick leave) and health care consumption.

Table 2: Characteristics of included studies

Study	Design	Methods	Partici-pants	Intervention	Control	Inclusion criteria low back pain	Primary outcomes	Secondary outcomes	Results	Risk of bias score
Chen et al. 2014	Treatment	RCT, 2 groups, Follow-up: 2, 4 and 6 months	127 nurses	Stretching exercise program: warming-up, stretching (back, neck and lower legs) and automobilisation exercises (flexion, extension, rotation of back) (50 min), performed 3x/week, duration of 6 months	Perform usual activities	1) low back pain > 6 months, 2) low back pain with > 4/10 on VAS	Pain intensity in past 12 weeks (VAS, 0-10)	None	Stretching exercise program had significant improvements in pain (p=0.040, p=0.011, p=0.002) and self-efficacy at all follow-up measures.	6/12
Ewert et al. 2009	Treatment	RCT, 2 groups, Follow-up: 3 and 12 months	183 nurses or professionals with comparable professional status (same professional task load and status)	Multidimensional program (17 sessions of 1.75 hours, 1 session of 45 minutes): *1) 11 physical exercise program units* (warm-up, strengthening- and stretching exercises, low impact aerobics and relaxation exercises), *2) 5 psychological units* (cognitive behavioural therapy), *3) 7 segmental stabilization units* (focusing on co-contraction of multifidi, pelvic floor muscles and transverses abdominis) and *4) 8 ergonomic and workplace units* (focusing on advice and practice of proper lifting techniques and work-related postures)	General physical exercises program (same as intervention) and instructions for a home-training program (strengthening- and stretching exercises), 11 sessions of 1 hour program	At least one low back pain episode in the previous 2 years	1) Pain intensity (WHYMPI, pain subscale, 0-6) 2) Pain interference (WHYMPI, pain interference subscale, 0-6)	None	A multidimensional intervention is not superior to a general exercise program in reducing low back pain intensity, interference and improving general health.	7/12
Jaromi et al. 2012	Treatment	RCT, 2 groups, Follow-up: 6 and 12 months	124 nurses (112 at 12 months follow-up)	50 minutes sessions: manual handling training (10 minutes) and back school (40 minutes; 20 minutes muscle strengthening and 20 minutes stretching exercises), 1x/week, duration of 6 weeks	Passive physiotherapy: 1)TENS (30 minutes), 2)heat (reusable hot pack) 3)Swedish massage in lumbosacral region (1x/week) 4)passive osteokinematic mobilisation 5)ultrasound 1x/week, duration of 6 weeks	> 3 months of low back pain with or without referred pain, currently having an active diagnosis of low back pain	Pain intensity in past week (VAS, 0-10)	None	Significantly decreased low back pain intensity in both groups post-intervention, with back school significantly better at 6- and 12 months follow-up (p<0.001).	7/12

Table 2: continued

Study	Design	Methods	Subjects	Intervention	Control	Inclusion criteria low back pain	Primary outcomes	Secondary outcomes	Results	Risk of bias score
Jensen et al. 2006	Mixed: Prevention and treatment	Cluster RCT, 3 groups, Follow-up: 2 years	210 eldercare workers	*1) Transfer technique intervention:* Stockholm training concept; reduce biomechanical load on back, minimise asymmetric postures and prevent sudden unexpected loads. Combination of practical classroom education (2x4 hours for each worker) and instruction at the work site for 6 months. *2) Stress management intervention:* prevention of burnout and development of strategies for stress management. Group sessions of 2 hours every 2 weeks for 20 weeks. Assignments for implementation in daily practice.	Lessons of their own choice, not related to intervention program but of same duration (not about transfer techniques or stress management) (e.g. on skin care, proper treatment of a person with diabetes, work, and asthma and safety procedures in chemicals handling).	None. Participants were health care workers with and without low back pain	Pain intensity (NRS, 0-10) in past 3 months and past year	None	No significant differences in low back pain intensity in the past 3 months (p= 0.16) or past year (p=0.10) at 2 year follow-up.	7/12

Abbreviations: RCT: Randomised Controlled Trial, VAS: Visual Analogue Scale, WHYMPI: West Haven-Yale Multidimensional Pain Inventory, SF-36: Short Form 36, NRS: Numeric Rating Scale.

Analysis of intervention efficacy, grouped per intervention

For each intervention randomised controlled trials have been described separately according to whether they evaluated treatment of existing low back pain (including only nurses with low back pain) or mixed prevention and treatment (including nurses with and without low back pain). No study evaluated prevention of low back pain only.

Manual Handling training – 2 studies – mixed + treatment

Treatment

Jaromi et al. (2012) reported that a combination of manual handling training and back school resulted in a statistically significant reduction of low back pain intensity (100mm VAS) at six months and one-year follow-up compared to passive physiotherapy in nurses with low back pain.

Mixed

Jensen et al. (2006) showed no statistically significant effect of manual handling training on low back pain intensity (NRS) at two-year follow-up, compared to training of equal duration but unrelated to the intervention (not about transfer techniques) in nurses with and without low back pain.

Multidimensional intervention – 1 study – treatment

Ewert el al. (2009) revealed that there was no statistically significant difference between a multidimensional intervention (general exercise program, cognitive behavioural approach, segmental stabilization exercises and ergonomic and workplace-specific advice) and the same general exercise program. Both interventions showed small-to-moderate effects at three and 12 months follow-up in reducing low back pain intensity (-0.41 points for multidimensional intervention (effect size: 0.45) versus -0.45 points for the exercise intervention (effect size: 0.42) at 12 months follow-up, WHYMPI questionnaire, 0-6 pain intensity subscale) and changing pain interference (-0.61 points for multidimensional intervention (effect size: 0.58) versus -0.52 for exercise intervention (effect size: 0.47) at 12 months follow-up, WHYMPI questionnaire, 0-6 pain interference subscale) in nurses with low back pain.

Stretching exercises – 1 study – treatment

Chen et al. (2014) reported that stretching exercises resulted in statistically significant lower pain scores (VAS) at two, four and six month follow-up compared to the control group (usual activities) in nurses with low back pain.

Stress management – 1 study – mixed

Jensen et al. (2006) found no statistically significant differences in low back pain intensity (NRS) in the past three months or past year at two year follow-up for a stress management program compared to different lessons (not about stress management) of the same duration in nurses with and without low back pain.

Discussion

This systematic review investigated the efficacy of interventions for the prevention and treatment of low back pain in nurses. The included trials were very heterogeneous, differing in pain and disability outcome measures, types of intervention, types of control group and the duration of follow-up. Therefore, a meta-analysis was not possible to perform. Nevertheless, there are some important findings regarding the efficacy, or lack thereof, for several types of interventions, which will now be discussed in detail.

Manual handling training

Treatment

A combination of manual handling training and Back School resulted in a statistically significant reduction of low back pain intensity at six months and one-year follow-up compared to passive physiotherapy in one study with a low risk of bias (Jaromi et al., 2012). Furthermore, the absolute change in pain intensity at one year follow-up was 51.34 points (86% reduction), which exceeds the Minimal Clinical Important Difference, based on either a 15 point, or 30% reduction as the threshold (Ostelo et al., 2008). Nevertheless, there are reasons for caution. Firstly, only low back pain intensity was measured and there is no information on disability levels. Secondly, the control intervention (passive physiotherapy) is not recommended by the European guidelines (Airaksinen et al., 2006) nor the National Institute for Health and Care Excellence (NICE) guidelines (NICE, 2016). The consensus now is that a passive physiotherapy approach has only short term benefit for patients with persistent low back pain (Savigny et al., 2009). Indeed, the control group displayed significant reductions in low back pain intensity immediately after the intervention. As there was a long-term (12 months) outcome measure for pain intensity, any intervention with an active component might do better than passive physiotherapy in the long-term.

Mixed

In nurses with and without low back pain a manual handling training intervention showed neither statistically nor clinically significant effects on low back pain intensity compared to training of equal

duration, but which was unrelated to the intervention (not about transfer techniques) (see Table 2 for details) (Jensen et al., 2006).

These results challenge the widely held belief that training in manual handling and/or ergonomics is a critically important aspect in the prevention and treatment of low back pain in nurses (Engkvist, 2006, Engst et al., 2005, Garg and Kapellusch, 2012, Guthrie et al., 2004, Pompeii et al., 2009). There is no consistent evidence to support the widespread and popular application of isolated manual handling training and "no-lift" policies (manual handling training and minimise transfer and lifting strain by using lifting devices) (Dawson et al., 2007, Jensen et al., 2006, Martimo et al., 2008, Warming et al., 2008). This is supported by recent literature in nursing (Hartvigsen et al., 2005, Kay et al., 2012, Martimo et al., 2008) and other working populations (Clemes et al., 2010, Hogan et al., 2014, Verbeek et al., 2012).

This strongly contrasts with widely held beliefs that manual handling training is the most important aspect in the prevention and treatment of low back pain in nurses (Engkvist, 2006, Engst et al., 2005, Garg and Kapellusch, 2012, Guthrie et al., 2004, Pompeii et al., 2009). Instead of narrowly considering lifting and transferring tasks, there may be value in focusing more on sustained and repetitive non-lifting nursing tasks (e.g. making beds, sitting, clearing up/cleaning, preparatory tasks) (Engels et al., 1994, Freitag et al., 2007, Harber et al., 1987, Hodder et al., 2010, Holmes et al., 2010, Mitchell et al., 2008) and cumulative stress-related low back pain in the workplace as opposed to only focussing on lifting and transferring tasks (Holmes et al., 2010). Indeed, nurses spend far more time in non-lifting activities which, while relatively unloaded, can be performed exhibiting end of range lumbar postures, highlighting the complex nature of the tasks healthcare workers perform (Freitag et al., 2007, Hodder et al., 2010).

Multidimensional interventions

Despite the fact that the application of multidimensional interventions in nurses and nursing students have been recommended previously (Lagerstrom et al., 1998, Mitchell et al., 2010, Mitchell et al., 2009, Zinzen et al., 2000), only one low risk of bias randomised controlled trial could be included in this systematic review.

Ewert et al. (2009) demonstrated that both exercise- and multidimensional interventions were effective. However, the differences were very small, suggesting no superior effect and a lack of efficacy for the extra components of the multidimensional intervention (cognitive behavioural approach, segmental stabilization exercises and ergonomic and workplace-specific advice). This is not very surprising since it is widely known that exercise and advice to stay active can have a positive effect on low back pain (Airaksinen et al., 2006, NICE, 2016, Van Wambeke et al., 2017).

Furthermore, some of the additional non-exercise aspects of the multidimensional intervention such

as ergonomics (Hignett, 2003, Hogan et al., 2014, Martimo et al., 2008) or spinal stabilizing exercises (Deyo et al., 2009, Ferreira et al., 2007, Gubler et al., 2010, Unsgaard-Tondel et al., 2010, Wong et al., 2014) do not appear to enhance the effect of exercise. Our findings are consistent with a recent systematic review (O'Keeffe et al., 2016) showing no clinically significant differences for pain and disability between physical, behavioural and/or psychologically informed and combined interventions. Another recent Cochrane review revealed that multidimensional biopsychosocial interventions, which also included more psychosocial aspects, were only marginally more effective than usual care or physical treatments for people with chronic low back pain (Kamper et al., 2015). Furthermore, it may be that multidimensional interventions are more effective for nurses with low back pain (secondary or tertiary prevention) and not for primary prevention, also suggested by Ijzelenberg et al. (2007).

Stretching exercises

One study demonstrated a benefit of stretching exercises in treating low back pain in nurses compared to usual activities (Chen et al., 2014), whereby low back pain decreased more than the Minimal Clinical Important Difference of 1.5/10 or >30% improvement (Ostelo et al., 2008) after six months follow-up. This stretching program consisted of 50 minutes of warming-up, stretching and automobilisation exercises for six months. The conclusion that stretching is effective in treating low back pain in nurses should be considered with caution due to the combination with other modes of exercises (e.g. warming-up, automobilisation, etc...), which are recommended for the management of persistent low back pain (NICE, 2016).

Stress management

One study showed that a stress management program in isolation was not effective in preventing and treating low back pain in nurses with and without low back pain (Jensen et al., 2006). The intervention was of considerable duration (20 week program) and appeared to have a good content (Table 2). This finding is in line with a recent systematic review showing only small, not clinically meaningful and short-term effects on pain intensity and physical functioning of a mindfulness-based stress reduction intervention in patients with low back pain compared to usual care and no significant differences compared to other active interventions (Anheyer et al., 2017). There are numerous factors that contribute to stress (work, familial, past experiences, beliefs...), which may be different for each individual. Therefore stress can be difficult to change and every person may react differently to stress. While both job-related stress and personal stress can be important risk factors for low back pain in nurses (Bernal et al., 2015, da Costa and Vieira, 2010), it is unlikely to be the only

risk factor (Mitchell et al., 2010), and might be best addressed as part of a more comprehensive low back pain management strategy.

Future research and clinical implications

Despite the fact that low back pain in nurses is very common and is the leading cause of disability and work absenteeism in this population (Cohen-Mansfield et al., 1996, Engst et al., 2005, Yassi and Lockhart, 2013), only four low risk of bias studies could be included in this systematic review. There was only one low risk of bias randomised controlled trial investigating the efficacy of a multidimensional intervention compared with another active intervention. The three other low risk of bias randomised controlled trials, while having a good design and good methodology, only compared unidimensional interventions with poor control interventions (e.g. no intervention, waiting list), known to have effects that are small to moderate at best (O'Keeffe et al., 2017). Based on contemporary research all these interventions appear insufficient in providing individualised care and do not seem to target different factors across the biopsychosocial spectrum (patient-centred approach). It might be worth exploring the efficacy of a patient-centred approach based on a multidimensional clinical reasoning framework to target the dominant underlying factors for low back pain (O'Sullivan, 2005). Rather than simply combining several interventions in general, it may be important to focus on the patient-specific individual interaction of dominant pain provocative behaviours from a multidimensional/multifactorial perspective. In patients with low back pain physical (posture- and movement behaviour, loading exposures) (O'Sullivan, 2005), neurophysiological (neuro-immune system, stress), psychological (cognitions, emotions and stress) (Pinheiro et al., 2016), social (socioeconomic, cultural, work, home environment) (Hoogendoorn et al., 2000), lifestyle (sleep, activity levels) (Kelly et al., 2011) and non-modifiable (genetics, patho-anatomical, sex, life stage) factors are implicated. In each individual there is variable, fluctuating and unique interaction between all these different factors (O'Sullivan, 2012, O'Sullivan et al., 2016). There is preliminary evidence showing that this type of approach has efficacy in reducing pain and disability in subjects with persistent low back pain (Fersum et al., 2013). The possibility that persistent low back pain patients will not respond significantly, even when such an approach is used, cannot be dismissed.

This systematic review clearly demonstrates the need for adequately powered high quality randomised controlled trials, which examine the efficacy of interventions to prevent and/or treat low back pain in nurses. Ideally, these randomised controlled trials should use recommended and standardised outcome measures, have long term follow-up (minimum six months) and appropriate control group(s) which control for confounding variables such as placebo, attention, duration of care etc. rather than waiting list or 'live as usual' control groups.

In strong contrast with the widely held strong belief that isolated “no-lift” policies are the most important aspect in the prevention and treatment of low back pain in nurses, this systematic review demonstrates that there is no consistent evidence to support their widespread application. The authors highlight the importance of focusing more on sustained and repetitive non-lifting manual nursing tasks (e.g. bending and sitting) and cumulative stress-related low back pain on the workplaces in the prevention and treatment of low back pain among nurses.

Limitations

There are some potential limitations related to this systematic review. (1) The search was limited to published studies only, which may introduce a risk of publication bias. (2) For the randomised controlled trials published before 2004, we depended on the search strategy of Dawson et al. (2007), though any risk was minimised as we carefully checked their original search terms and also searched the reference lists of their included trials. (3) It is possible that bias was introduced by the way studies were selected or search criteria were established. However, this was minimised since the Cochrane Back and Neck Group guidelines for systematic reviews were strictly followed (Furlan et al., 2015). (4) What we considered as primary outcomes (pain and disability) was not always the same as in the original study.

Conclusion

This systematic review demonstrated very few low risk of bias randomised controlled trials have evaluated relevant interventions for nurses with low back pain. After removing the high risk of bias studies (ten), only four low risk of bias studies could be included. From this systematic review it can be concluded that there is no strong evidence for any intervention in treating or preventing low back pain in nurses. Manual handling training and stress management in isolation were not effective in nurses with and without low back pain. The addition of a stretching exercise program was better than performing usual activities; combining manual handling training and back school was better than passive physiotherapy and a multidimensional intervention was not superior to a general exercise intervention in reducing low back pain in nurses. It may be worth exploring, with high quality randomised controlled trials, the efficacy of multidimensional interventions which are more specifically tailored to the needs of individual nurses.

Contribution

What is already known about the topic?

- Low back pain in nurses and nursing aides is a common, recurrent and costly health problem, and is one of the leading causes of disability.
- Nursing has been identified amongst the top professions at risk of low back pain, even exceeding those in heavy industry.
- It is unclear what interventions are effective in the prevention, or treatment, of low back pain among nurses.

What this paper adds

- There is no strong evidence for any intervention in preventing or treating low back pain in nurses.
- The widespread use of "no-lift" policies and strong focus on "correct" lifting technique is not supported by strong evidence.
- Additional high quality randomised controlled trials are required to examine the efficacy of more targeted multidimensional interventions for low back pain among nurses.

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