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Original Research

The effectiveness of incidental physical activity interventions compared to other interventions in the management of people with low back pain: A systematic review and meta-analysis of randomised controlled trials

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ABSTRACT

Objectives: To investigate the effectiveness of incidental (non-structured) physical activity interventions for the management of people with low back pain (LBP).
Design: Systematic review and meta-analyses of randomised controlled trials.
Setting: Eligible published trials from the earliest date available to November 2017.
Participants: People with non-specific LBP aged 18 years or over.
Outcome measures: Pain, disability and physical activity-related outcomes.
Results: Three trials were included (including a total of 422 participants). The quality of trials, assessed by PEDro scale, was high (7 out of 10). For pain, the pooled results did not show any significant effects between the incidental physical activity intervention and other interventions at any time point. For disability, incidental physical activity was not statistically more effective than other interventions at short-term; however, the pooled results favoured incidental physical activity at intermediate-term (weighted mean difference (WMD) = -6.05, 95%CI: -10.39 to −1.71) and long-term (WMD = −6.40 95% CI: -11.68 to −1.12) follow-ups among participants with chronic LBP. The overall quality of evidence was rated "moderate-quality" based on the GRADE system.
Conclusions: The incidental physical activity intervention provided improvement in disability in intermediate- and long-term for people with chronic LBP, although this improvement was small and may not be clinically significant.

1. Introduction

Low back pain (LBP) is a major health problem globally (Hoy et al., 2012). The lifetime prevalence of LBP is reported to be as high as 84% worldwide, whereas the prevalence of chronic LBP is around 23%, and 11–12% of people experience disabling LBP (Airaksinen et al., 2006; Balague, Mannion, Pellise, & Cedraschi, 2012; Walker, 2000). Low back pain is not only the leading cause of disability (Vos et al., 2017), but also of growing economic burden due to increasing days of absenteeism from work, loss of productivity, and cost of treatment (Hoy, Brooks, Blyth, & Buchbinder, 2010; Krismer & van Tulder, 2007; Vos et al., 2017). In addition,

Abbreviations: CI, confidence interval; GRADE, Grading of Recommendations Assessment Development and Evaluation; LBP, low back pain; MCID, minimal clinically important difference; PEDro, Physiotherapy Evidence Database; PRISMA, Preferred Reporting Items for Systematic reviews and Meta-Analyses; PROSPERO, International Prospective Register of Systematic Reviews; RCT, randomised controlled trial; RevMan, Review Manager; SD, standard deviation; SMD, standardized mean difference; WMD, weighted mean difference.

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the occurrence and chronicity of LBP have been associated with various individual, psychosocial, and occupational risk factors (Valat, 2005; van Tulder, Koes, & Bombardier, 2002).

Participation in regular physical activity is known to improve overall health status and is associated with reduced risk of all-cause mortality and chronic disease morbidity such as obesity and musculoskeletal diseases (Hamer, Ingle, Carroll, & Stamatakis, 2012; National Institute for Health and Clinical Excellence, 2014; O'Donovan, Lee, Hamer, & Stamatakis, 2017; Sadarangani, Hamer, Mindell, Coombs, & Stamatakis, 2014; Warburton, Glendhill, & Quinney, 2001; Warburton, Nicol, & Bredin, 2006). Encouraging people to participate in physical activity has benefits beyond health, including social and economic benefits (Hortobágyi & Rutgers, 2014).

Several systematic reviews have highlighted the effectiveness of different types of physical activity in the management of LBP (Dahm, Brurberg, Jamtvedt, & Hagen, 2010; Hayden, Van Tulder, Malmivaara, & Koes, 2005; Hendrick et al., 2010; Hilde, Hagen, Jamtvedt, & Winnem, 2002; Lin et al., 2011; McLain, Powers, Thayer, & Seymour, 1999; O'Connor et al., 2015; Searle, Spink, Ho, & Chuter, 2015; Smith, Littlewood, & May, 2014; Wang et al., 2012). Increasing physical activity levels as part of the overall treatment is a key outcome among these studies. However, none of the previous reviews have focused on the effect of incidental physical activity on LBP symptoms. As opposed to structured exercise, incidental physical activity is part of daily living and includes active transportation (e.g. walking or cycling), domestic chores, and non-specific ambulation in occupational or domestic settings. As such, incidental physical activity is a promising means of maintaining or increasing daily physical activity in currently inactive people (Dunn, Andersen, & Jakicic, 1998), and may be an ideal form of physical activity for several reasons: 1) it is more accessible than structured physical activity programs, 2) it does not require training, supervision, special equipment or use of gyms, 3) it is cost-effective (Sevick et al., 2000), 4) it is safe to recommend for inactive people (Physical Activity Guidelines Advisory Committee, 2008), and 5) it may promote long-term maintenance of physical activity behaviour (Dunn et al., 1998b). For all of the reasons listed above incidental physical activity is thought to offer another option to people who may find it hard to adhere to traditional exercise programs (Dunn et al., 1999; Heesch, Mâsse, Dunn, Frankowski, & Mullen, 2003; Reynolds, McKenzie, Allender, Brown, & Foulkes, 2014).

Therefore, this review aimed to investigate the effectiveness of incidental physical activity interventions for the management of people with LBP.

2. Methods

2.1. Design

This study is a systematic review and meta-analysis of published randomised controlled trials (RCT). The protocol describing the objectives and methods of this systematic review was registered with the International Prospective Register of Systematic Reviews (PROSPERO) before conducting this review (Registration number CRD42017080535). This review was conducted in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines (Moher, Liberati, & TetzlaffAltman, 2009).

2.2. Identification and selection of trials

The following databases were searched from inception to November 2017: Medline, Scopus, CINAHL, EMBASE, and CENTRAL. The search strategy included keywords relevant to incidental physical activity, LBP, and RCTs. Searches were limited to English-language publications. The reference lists of the screened papers and systematic reviews were also checked for additional papers. The full electronic search strategy is provided in the Appendix.

The inclusion criteria for the review are presented in Table 1. However, studies that gave incidental physical activity intervention as part of a back care advice or multidisciplinary program were excluded because the effect of the incidental physical activity intervention could not be isolated. Moreover, studies were excluded if they included participants who had medical conditions that could prevent physical activity participation (e.g. cardiovascular diseases such as myocardial infarction, embolism, or uncontrolled diabetes; musculoskeletal conditions; balance problems).

Information sources were searched by one reviewer (HA). The researchers (HA and MW) independently screened the identified literature for inclusion using the protocol of this review. Disagreements were resolved by consensus or third reviewer (DS). Initially titles were screened, then abstracts and then full papers.

A paper was considered potentially relevant and its full text reviewed if, following discussion between the two independent reviewers, it could not be unequivocally excluded on the basis of its title and abstract (Moher et al., 2009; Tacconelli, 2010). The full text of all papers not excluded on the basis of title or abstract were assessed. The number of articles included and excluded at the different phases were recorded as recommended (Hicks, 2009) and presented in a PRISMA flowchart (Fig. 1). (Moher et al., 2009)

2.3. Assessment of characteristics of studies

Data were independently extracted by two reviewers (HA and MW) using a standardized data extraction form tailored to the requirements of this systematic review. Disagreements were resolved by consensus or third reviewer (DS). The extracted data included first author, year of publication, sample size, age, gender, LBP duration, types of experimental and comparison treatments, frequency and duration of treatment session, duration of whole treatment, outcome measures, and time-points of follow-up assessments. The main findings included the mean final value for each outcome, standard deviations (SD), 95% confidence intervals (CIs), and sample size. If data were missing or insufficient, we contacted the author.

2.4. Quality

The included studies were assessed for methodological quality by two reviewers (HA and MW) using the Physiotherapy Evidence Database (PEDro) scale (Maher, Sherrington, Herbert, Moseley, & Elkins, 2003). Disagreements were resolved by consensus or third reviewer (DS). When scores were available at the PEDro database, the online scores were used. This scale rates 11 items of methodological quality of RCTs as being either absent or present. The scale score range from 0 to 10, where the first item (eligibility criteria) is not scored. Studies scoring less than 7 points were considered at high risk of bias or low quality. This cut-off point has been used in previous research (Abdel Shaheed, Maher, Williams, Day, & McLachlan, 2016).

2.5. Data analysis

The outcome data were extracted and grouped according to the duration of follow-up into three measurement time points post randomisation: short-term ($\leq$3 months), intermediate-term (>3 and < 12 months), and long-term ($\geq$12 months) as recommended by the Cochrane Back Review Group (Furlan, Pennick, Bombardier,

Table 1
Inclusion criteria.

Design
• Randomised controlled trial
Participants
• People diagnosed with non-specific low back pain (acute, subacute, chronic, recurrent, persistent) aged 18 years or over
Intervention
• Any intervention of lifestyle physical activity that was provided as the main component of the treatment (i.e. was not provided only as instructions or advice for keeping active), unstructured and unsupervised. Note: studies that prescribed a supervised incidental physical activity intervention that mimics incidental physical activity in at least one of the groups were included (e.g. pedometer-driven walking program)
• The intervention aimed at promoting or increasing physical activity level.
Outcome measures
• Physical activity related outcomes (e.g. physical activity behavioural change, walking steps)
• Low back pain related outcomes (pain and/or disability)
Comparisons
• Non-physical activity interventions (e.g. passive treatment modality such as manual therapy)
• No intervention
• A 'sham' intervention
• A wait list
• Advice to "stay active or maintain usual activities"

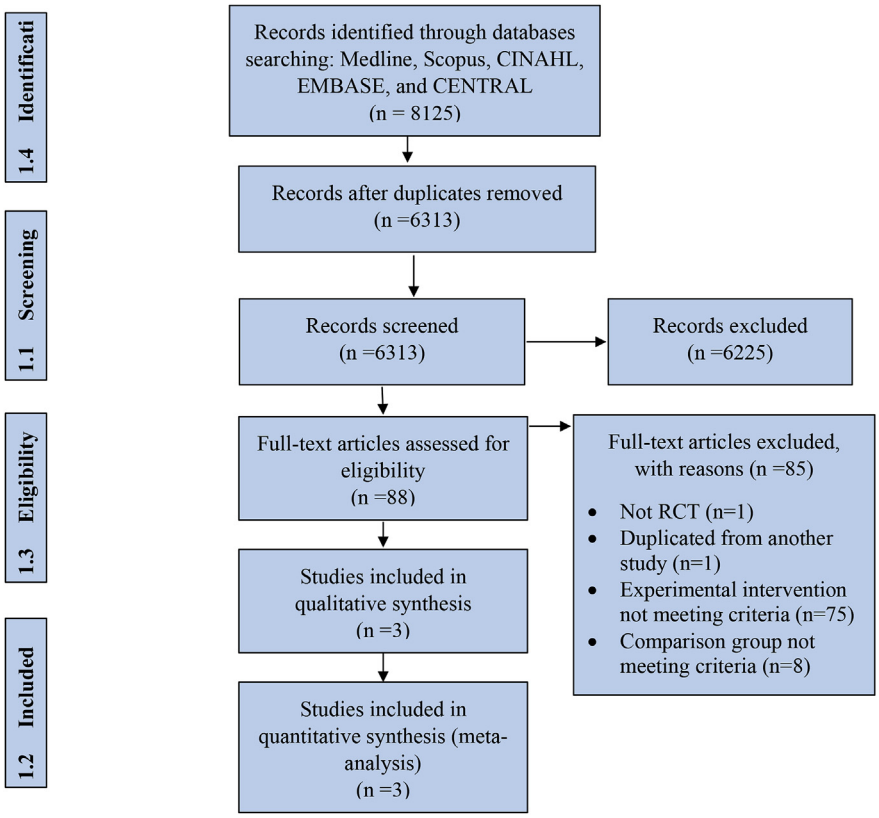

Fig. 1. Flow of trials through the review.

& van Tulder, 2009). If one study reported outcomes at multiple time points within the same time period, the outcomes closest to 2, 6 and 12 months were considered.

A meta-analysis was undertaken and the data were pooled and synthesized using Review Manager 5.3 (RevMan) program (RevMan The Cochrane Collaboration, 2014). The meta-analysis compared mean final values for the outcomes between incidental physical activity intervention and other interventions. Multiple separate meta-analyses were conducted according to the outcome (pain and disability) and measurement time points (short-, intermediate-, and long-term follow-up). To avoid double counting or unit-of-analysis error for studies that contained multiple comparisons, the shared group was split into two or more groups with smaller sample size, and included two or more comparisons (Higgins & Green, 2008).

We planned to conduct subgroup analyses to examine the results for specific categories including: LBP types (e.g. acute, subacute and chronic) and incidental physical activity intervention types (e.g. pedometer-based walking). However, due to the small number of included studies, there was insufficient data to conduct these analyses.

Pain and disability outcomes were converted to a common 0–100 mm scale (0, no pain or disability; 100, worst pain or disability). All outcomes were presented as continuous data (mean

values). As all measures of outcomes were similar and converted to the common scale, the weighted mean difference (WMD) was used rather than standardized mean difference (SMD). All data analyses were performed using RevMan, which uses the generic inverse variance method (Deeks & H, 2010). The mean final values and SD for each outcome were used to calculate WMD. When only the CIs were reported, the SD was calculated using the RevMan calculator. A minimal clinically important difference (MCID) of 20 mm (0-100 scale) in pain and 10 mm (0-100 scale) in disability was considered in this review (Ostelo & HCW de Vet, 2005). When the mean difference was less than the estimated MCID, the treatment effect was considered small and not clinically significant.

Studies included in the meta-analysis were considered to be clinically and methodologically homogeneous on the basis of similarities in study design, participants' characteristics, intervention methods, and outcomes studied. Statistical heterogeneity among studies was assessed using *I* (Walker, 2000). A value of *I* (Walker, 2000) greater than 50% was considered as large heterogeneity (Higgins et al., 2003). In this case, a random effects model was used; otherwise a fixed effects model was used (Higgins & Green, 2008). The statistical significance was considered when the *p* value was less than 0.05. We planned to assess publication bias using funnel plot and Egger's test (Egger, Smith, Schneider, & Minder, 1997), as appropriate (Guyatt et al., 2011a; Sterne et al., 2011).

2.6. Grading of the overall quality of evidence

The Grading of Recommendations Assessment, Development and Evaluation (GRADE) (Atkins et al., 2004a, 2004b; Furlan et al., 2015) was used to investigate the overall quality of evidence for each outcome. The quality of evidence was categorised as:

- High quality: further research is very unlikely to change the confidence in the estimate of effect.
- Moderate quality: further research is likely to have an important impact in the confidence in the estimate of effect.
- Low quality: further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
- Very low quality: any estimate of effect is very uncertain.

The GRADE starts with a baseline rating of high for RCTs. This baseline rating can then be downgraded for each outcome by one level when each of the following 5 criteria is met (Higgins & Green, 2011; Ryan & Hill, 2016):

- Poor study design (>25% of participants were from studies rated as low quality) (Guyatt et al., 2011b; Saragiotto et al., 2016).
- Inconsistency of effects (large heterogeneity (I (Walker, 2000) $\geq$ 50%)) (Guyatt et al., 2011c; Oliveira et al., 2016).
- Imprecision (sample size<400 participants for each outcome) (Oliveira et al., 2016).
- Publication bias.
- Indirectness was not assessed because this review included a specific population, participants with non-specific LBP, relevant outcomes and direct comparisons (Guyatt et al., 2014; Oliveira et al., 2016).

3. Results

3.1. Flow of trials through the review

After implementing the search strategy 8125 studies were identified. After removing duplicates, 6313 studies remained for further screening. Screening these studies by titles and abstracts identified 88 studies that were eligible for assessment by full paper. Of these, only three studies (Hartvigsen, Morso, Bendix, & Manniche, 2010; Krein et al., 2013; McDonough et al., 2013) met the inclusion criteria and were included in this review. We contacted the main authors of two studies (Hartvigsen et al., 2010; Krein et al., 2013) for additional data on the outcome results not contained in the study, and they provided us with the primary outcomes only. The flow of studies through the review is depicted in Fig. 1.

3.2. Characteristics of the included studies

3.2.1. Quality

The mean PEDro scores of the included studies was 7 out of 10. All studies were assessed as high quality (score $\geq$7). All studies were RCTs and had participants with similar baselines characteristics. One study (McDonough et al., 2013) failed to conceal allocation. Assessors were only blinded in one study (McDonough et al., 2013) while therapists and participants were not blinded in any study. A complete description of the methodological quality of the included studies is presented in Table 2.

3.2.2. Participants

The three studies included a total of 422 participants (mean age, 49.3 years), with approximately equal distribution of females and males (48.4% female versus 51.6% male). All trials included participants diagnosed with chronic LBP (lasting > 3 months). The characteristics of the included studies are described in Table 3.

3.2.3. Interventions

A walking program was the sole intervention for all studies, with one study (Hartvigsen et al., 2010) prescribing Nordic walking and two studies (Krein et al., 2013; McDonough et al., 2013) prescribing pedometer-based walking programs. The total duration of the interventions ranged from two to 12 months.

The interventions included in the comparison groups were advice to remain active only (Hartvigsen et al., 2010), education and advice to remain active (McDonough et al., 2013), and usual care (Krein et al., 2013).

3.2.4. Outcome measures

Two studies (Krein et al., 2013; McDonough et al., 2013) used the numerical rating scale to measure pain, whilst one study (Hartvigsen et al., 2010) used the LBP Rating Scale. Three measurements were used to evaluate disability, the LBP Rating Scale (Hartvigsen et al., 2010), the Oswestry Disability Index (McDonough et al., 2013), and the Roland-Morris Disability Questionnaire (Krein et al., 2013), and each was used only in a single trial. All studies evaluated physical activity behavioural change using objective measurements consisting of either an Actigraph accelerometer (Hartvigsen et al., 2010) or pedometer (Krein et al., 2013; McDonough et al., 2013), and in addition, one study (McDonough et al., 2013) used the International Physical Activity Questionnaire.

3.3. Main findings

All studies were suitable for quantitative meta-analysis. We were able to conduct meta-analyses for pain and disability; however, there was insufficient data to conduct meta-analyses for physical activity variables including physical activity behavioural change and/or walking steps due to the low number of studies and the different methods used in measuring physical activity or walking steps. Publication bias was not assessed because there was less than 10 included studies to adequately assess the funnel plot or

Table 2
Pedro scores of the included studies.

Study	Random allocation	Concealed allocation	Group similarity at baseline	Participant blinding	Therapist blinding	Assessor blinding	<15% dropouts	Intention-to-treat analysis	Between-group difference reported	Point estimate and variability reported	Total (0 −10)
Hartvigsen (2010) (Hartvigsen et al., 2010)	Y	Y	Y	N	N	N	Y	Y	Y	Y	7
Krein (2013) (Krein et al., 2013)	Y	Y	Y	N	N	N	Y	Y	Y	Y	7
McDonough (2013) (McDonough et al., 2013)	Y	N	Y	N	N	Y	Y	Y	Y	Y	7

Abbreviations: Y, yes; N, No.

Table 3
Characteristics of the included studies.

Author (year)	Totalsample size	Age (year) mean (SD)	Gender (%Female)	LBP duration	Types of interventions	Session duration and frequency	Interventionduration	Outcome	Time-points of follow-up assessments
Hartvigsen (2010) (Hartvigsen et al., 2010)	136	46.7 (11)	71.6	CLBP	Experimental: supervised Nordic walking (G1), and unsupervised Nordic walking (G2); Comparison: advice to remain active	G1: 45 min for 2 times/ week; G2:NR	2 months	Pain (LBPRS); Disability (LBPRS); Physical activity behavioural change (Actigraph accelerometer)	10, 26 and 52 weeks
Krein (2013) (Krein et al., 2013)	229	51.6 (12.6)	12.5	CLBP	Experimental: pedometer-based, Internet-mediated intervention walking program + usual care; Comparison: usual care	NR	12 months	Pain (NRS); Disability (RDQ); Daily walking steps (pedometer)	6 and 12 months
McDonough (2013) (McDonough et al., 2013)	57	49.5	61	CLBP	Experimental: graded pedometer-driven walking + education and advice to remain active; Comparison: education and advice to remain active	Daily	2 months	Pain (NRS); Disability (ODI); Physical activity behavioural change (IPAQ-SF); Daily walking steps (ActivPAL accelerometer)	9 weeks and 6 months

Abbreviations: CLBP, Chronic Low Back Pain; G, Group; IPAQ-SF, International PA Questionnaire-Short Form; LBP, Low Back Pain; LBPRS, Low Back Pain Rating Scale (0-100); NR, Not Reported; NRS, Numerical Rating Scale (0-10); ODI, Oswestry Disability Index (0-100); RDQ, Roland-Morris Disability Questionnaire (0-24).

Egger's test of publication bias.

3.3.1. Low back pain related outcomes

3.3.1.1. Short-term follow-up. Two studies (Hartvigsen et al., 2010; McDonough et al., 2013) provided data for the effect of incidental physical activity on pain and disability for short-term follow-up (Fig. 2 and Fig. 3). The pooled results showed that neither intervention was more effective for reducing pain (WMD = 1.01, 95% CI: -5.97 to 7.99, $p = 0.78$, $I^2 = 0\%$) or disability (WMD = −3.36 95% CI: -8.93 to 2.21, $p = 0.24$, $I^2 = 0\%$). The quality of evidence for both pooled results was rated "moderate quality" according to the GRADE approach (Table 4).

3.3.1.2. Intermediate-term follow-up. Three studies (Hartvigsen et al., 2010; Krein et al., 2013; McDonough et al., 2013) were included in the analyses to investigate the effect of incidental physical activity on pain and disability for intermediate-term follow-up (Figs. 2 and 3). For pain, the pooled results showed no statistically significant difference between the interventions (WMD = −3.53, 95% CI: -7.69 to 0.63, $p = 0.10$, $I^2 = 0\%$). For disability, the pooled results favoured incidental physical activity (WMD = −6.05, 95% CI: -10.39 to −1.71, $p = 0.006$, $I^2 = 0\%$); however, the difference between groups was not clinically important (MCID < 10 of 100 scale). The quality of evidence for both pooled results was rated "moderate quality" according to the GRADE approach (Table 4).

3.3.1.3. Long-term follow-up. At long-term follow-up, two studies (Hartvigsen et al., 2010; Krein et al., 2013) were included in the analyses for pain and disability (Figs. 2 and 3). The pooled results showed no statistically significant difference between the interventions in reducing pain (WMD = −1.71 95% CI: -6.71 to 3.30, $p = 0.5$, $I^2 = 0\%$). With regard to disability, the pooled results favoured incidental physical activity (WMD = −6.40 95% CI: -11.68 to −1.12, $p = 0.02$, $I^2 = 0\%$); however, the difference between groups was not clinically important (MCID < 10 of 100 scale). The quality of evidence for both pooling was rated "moderate quality" according to the GRADE approach (Table 4).

3.3.1.4. Physical activity related outcomes. Of the three included studies, data were available for physical activity variables for only two studies. One study (Krein et al., 2013) found an increase of around 700 steps per day during the first six months in the walking group compared to the usual care group. However, the step-count improvements were not sustained for the entire 12 months. The other study (McDonough et al., 2013) found that the participants in the walking group demonstrated an increase in daily walking steps of 59% and perceived a greater improvement in their physical

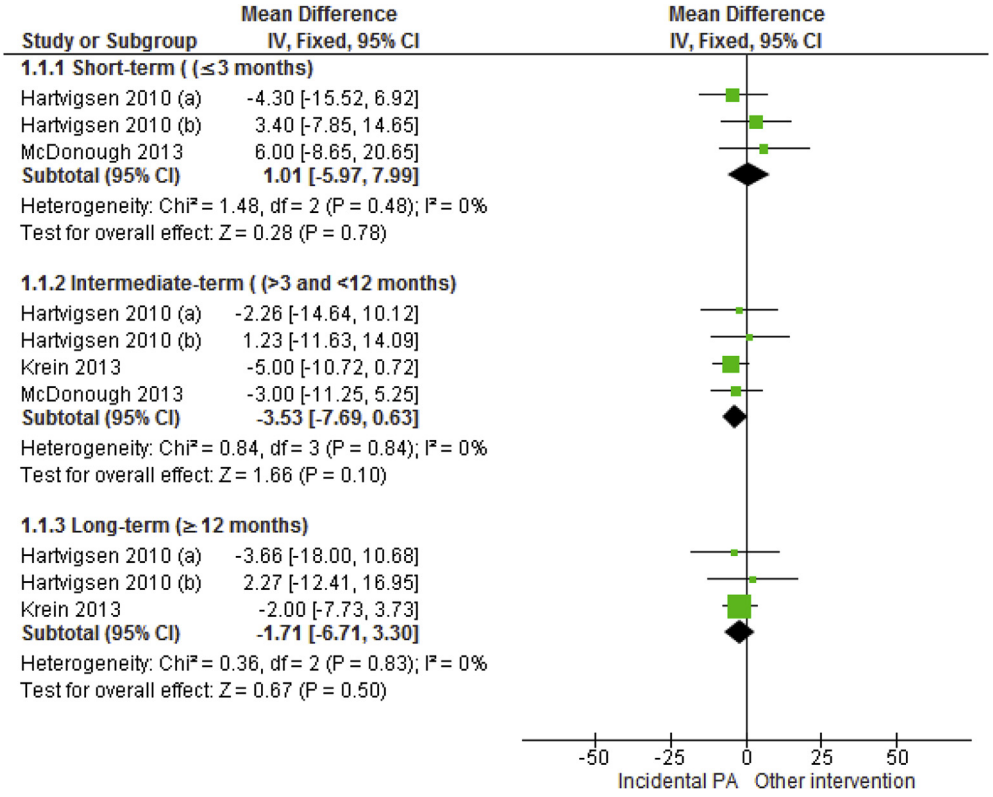

Fig. 2. Forest plot of incidental physical activity versus other interventions for pain outcome.

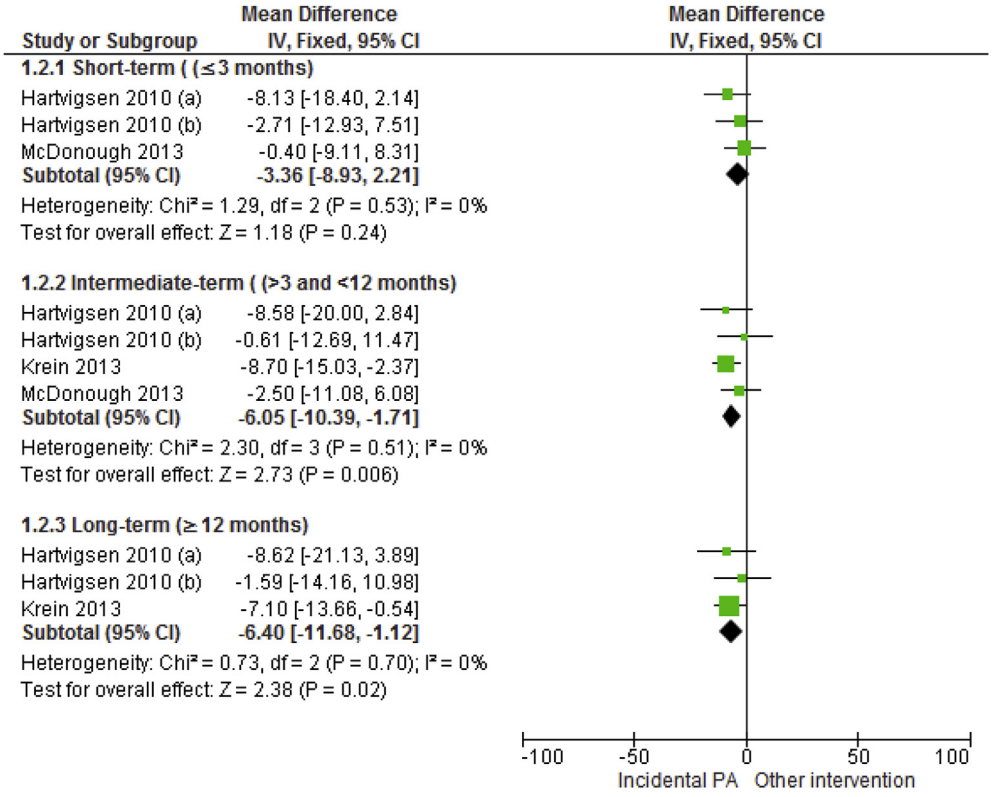

Fig. 3. Forest plot of incidental physical activity versus other interventions for disability outcome.

Table 4
Grade assessment.

Outcome	N⁰ of studies	Study design	Quality assessment						Effect Relative effect (95% CI)	Quality importance
			Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Other considerations		
Effect of incidental physical activity on pain										
Pain Short-term	2 (3 comparisons)	RCT	No serious risk of bias	No serious inconsistency	Undetected[a]	Serious imprecision[b]	Undetected[c]	None	WMD 1.01 (−5.97 to 7.99)	⊕⊕⊕⊖ Moderate Due to downgrade for imprecision
Pain Intermediate-term	3 (4 comparisons)	RCT	No serious risk of bias	No serious inconsistency	Undetected[a]	Serious imprecision[b]	Undetected[c]	None	WMD -3.53 (−7.69 to 0.63)	⊕⊕⊕⊖ Moderate Due to downgrade for imprecision
Pain Long-term	2 (3 comparisons)	RCT	No serious risk of bias	No serious inconsistency	Undetected[a]	Serious imprecision[b]	Undetected[c]	None	WMD -1.71 (−6.71 to 3.30)	⊕⊕⊕⊖ Moderate Due to downgrade for imprecision
Effect of incidental physical activity on disability										
Disability Short-term	2 (3 comparisons)	RCT	No serious risk of bias	No serious inconsistency	Undetected[a]	Serious imprecision[b]	Undetected[c]	None	WMD -3.36 (−8.93 to 2.21)	⊕⊕⊕⊖ Moderate Due to downgrade for imprecision
Disability Intermediate-term	3 (4 comparisons)	RCT	No serious risk of bias	No serious inconsistency	Undetected[a]	Serious imprecision[b]	Undetected[c]	None	WMD -6.05 (−10.39 to −1.71)	⊕⊕⊕⊖ Moderate Due to downgrade for imprecision
Disability Long-term	2 (3 comparisons)	RCT	No serious risk of bias	No serious inconsistency	Undetected[a]	Serious imprecision[b]	Undetected[c]	None	WMD -6.40 (−11.68 to −1.12)	⊕⊕⊕⊖ Moderate Due to downgrade for imprecision

Abbreviations: CI: Confidence Interval; RCT: Randomised Controlled Trial; WMD: Weighted Mean Difference.
[a] Indirectness was not assessed because this review included specific population, participants with non-specific LBP, and relevant outcomes results.
[b] Downgrade one level for imprecision (fewer than 400 participants, total).
[c] No downgrade for publication bias, as publication bias could not be detected due to low number of included studies (<11 studies included).

activity levels.

4. Discussion

The aim of this review was to investigate the effectiveness of incidental physical activity interventions for the management of people with LBP. This review found moderate quality evidence that incidental physical activity interventions reduced the disability in people with chronic LBP at intermediate- and long-term follow-up. This improvement in disability scores in favour of incidental physical activity was small and not likely to be clinically important for management of LBP, with mean change scores (6.05 and 6.40 at intermediate- and long-terms, respectively).

The pooled results also found a moderate quality evidence that incidental physical activity interventions were not more effective from other interventions for disability and pain in the short-term, and for pain in the intermediate- and long-terms. All of the above results were of moderate quality evidence according to the GRADE approach, and that means that "further research is likely to have an important impact in the confidence in the estimate of effect". Yet, the results should be interpreted carefully as the GRADE does not downgrade the quality of evidence if the evidence is generated by small number of studies.

Even though the treatment effect was small, there was a progressive reduction in disability (3.36, 6.05 and 6.40 at short-, intermediate- and long-term follow up, respectively). Owing to the small number of included studies, it was not possible to investigate whether this progressive decrease in disability was due to the type or intensity of physical activity, or even due to maintaining regular engagement in physical activity. When the trials were considered individually, the trial conducted by Krein et al. (Krein et al., 2013) found that an increase in daily walking step counts was associated with the improvement in pain and disability. However, these results were not maintained at 12 months, and may be explained by poor long term adherence to regularly meeting daily steps count targets. Furthermore, the trial conducted by McDonough et al. (McDonough et al., 2013) reported that participants who increased their daily walking steps by 59%, demonstrated an improvement in functional disability and pain at six months. Future studies should investigate different types and intensities of incidental physical activity and measure the association between the change in these variables and LBP outcomes. Further studies should also consider measuring the engagement of participants with the incidental physical activity intervention and adherence to treatment, for example, by measuring the number of walking steps achieved per day, which may give further insight on the association between these factors and LBP. It should also be noted that only one study (Krein et al., 2013) included people classified as inactive at baseline (defined as <150 min/week of combined moderate and vigorous physical activity), and the other two studies included all people whether classified as inactive or active. Including active people may confound the results as they may not respond to the intervention program which is usually prescribed for inactive people. Therefore it might be more appropriate to only include people classified as inactive in future trials.

While the purpose of the current review was to assess the effectiveness of incidental physical activity interventions on all types of LBP, all of the included studies only included participants with chronic LBP. Therefore, the results of the current review are only relevant to people with chronic LBP. Although we had planned to conduct subgroup analyses for the effectiveness of incidental physical activity on each type of LBP separately, the small number of included studies prevented us from conducting the analyses for participants with acute and sub-acute LBP. Although the evidence

indicated that the treatment effects of incidental physical activity interventions were small and not clinically important, it may still be appropriate to prescribe to people with LBP as many are inactive and at increased risk of chronic disease (Ryan et al., 2009). Therefore, the incidental physical activity may still have important role in decreasing risk factors for chronic disease in a population that are insufficiently active.

Several limitations should be considered when interpreting the results of the current review. The first limitation is the low number of trials and small sample sizes included in this review, which prevented us from conducting subgroup and sensitivity analyses. A second limitation that should be noted is that in these types of studies, it is very difficult to blind participants or therapists to the treatment, which may affect the methodological quality of the included studies. Therefore, in all studies the participants and therapists were not blinded to the intervention which may be considered a source of bias and therefore may lead to overestimating or underestimating the effect size of the intervention. A third limitation is that the potential for publication bias in the included trials could not be assessed due to the small number of trials included.

The strengths of this systematic review include that it: 1) used a rigorous, transparent and comprehensive literature search strategy including five databases, and 2) included studies that were assessed to be of high quality, using the PEDro scale, in the analyses.

In conclusion, in people with chronic LBP, an incidental physical activity intervention resulted in intermediate and long term reduction in disability, although the magnitude of this improvement was small and may not be clinically important. Due to the small number of included studies we are unable to make definitive recommendations on the effectiveness of incidental physical activity for the management of LBP. Yet, the overall benefits of physical activity should be considered when determining to use it in the management of LBP. Our results highlight the need for further research on incidental physical activity as an intervention for LBP, in particular in people who are inactive.

Conflicts of interest

The authors have no conflicts of interest to declare.

Ethical approval

Not applicable.

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HA, MM, ES, MP and DS have developed the study protocol. HA performed the literature search and searched the information sources. HA and MW screened the identified literature for inclusion independently, and disagreements were resolved by DS. HA and MW extracted the data independently. HA drafted the manuscript. HA, MM, ES, MP and DS contributed to the analysis interpretation and critical revision of the manuscript. All authors approved the final version.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ptsp.2018.12.008.

References

Abdel Shaheed, C., Maher, C. G., Williams, K. A., Day, R., & McLachlan, A. J. (2016). Efficacy, tolerability, and dose-dependent effects of opioid analgesics for low back pain: A systematic review and meta-analysis. *JAMA Internal Medicine, 176*(7), 958–968.

Airaksinen, O., Brox, J. I., Cedraschi, C., Hildebrandt, J., Klaber-Moffett, J., Kovacs, F., et al. (2006). Chapter 4 European guidelines for the management of chronic nonspecific low back pain. *European Spine Journal, 15*(Suppl 2), S192–S300.

Atkins, D., Best, D., Briss, P. A., Eccles, M., Falck-Ytter, Y., Flottorp, S., et al. (2004). Grading quality of evidence and strength of recommendations. *BMJ (Clinical research ed), 328*(7454), 1490.

Atkins, D., Eccles, M., Flottorp, S., Guyatt, G. H., Henry, D., Hill, S., et al. (2004). Systems for grading the quality of evidence and the strength of recommendations I: Critical appraisal of existing approaches the GRADE working group. *BMC Health Services Research, 4*(1), 38.

Balague, F., Mannion, A. F., Pellise, F., & Cedraschi, C. (2012). Non-specific low back pain. *Lancet (London, England), 379*(9814), 482–491.

Dahm, K. T., Brurberg, K. G., Jamtvedt, G., & Hagen, K. B. (2010). Advice to rest in bed versus advice to stay active for acute low-back pain and sciatica. *Cochrane Database of Systematic Reviews, 6*, CD007612.

Deeks, J. J., & H, J. P. (2010). Statistical algorithms in review manager 5. Statistical methods group of the Cochrane collaboration. Available from http://tech.cochrane.org/revman/documentation/Statistical-methods-in-RevMan-5.pdf. (Accessed 1 November 2015).

Dunn, A., Andersen, R., & Jakicic, J. (1998). *Lifestyle physical activity interventions. History, short- and long-term effects, and recommendations*.

Dunn, A. L., Andersen, R. E., & Jakicic, J. M. (1998). Lifestyle physical activity interventions: History, short- and long-term effects, and recommendations. *American Journal of Preventive Medicine, 15*(4), 398–412.

Dunn, A. L., Marcus, B. H., Kampert, J. B., Garcia, M. E., Kohl, H. W., 3rd, & Blair, S. N. (1999). Comparison of lifestyle and structured interventions to increase physical activity and cardiorespiratory fitness: A randomized trial. *JAMA, 281*(4), 327–334.

Egger, M., Smith, G. D., Schneider, M., & Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. *BMJ (Clinical research ed), 315*(7109), 629–634.

Furlan, A. D., Malmivaara, A., Chou, R., Maher, C. G., Deyo, R. A., Schoene, M., et al. (2015). Updated method guideline for systematic reviews in the Cochrane back and neck group. *Spine, 40*(21), 1660–1673, 2015.

Furlan, A. D., Pennick, V., Bombardier, C., & van Tulder, M. (2009). Updated method guidelines for systematic reviews in the Cochrane Back Review Group. *Spine, 34*(18), 1929–1941, 2009.

Guyatt GH, AD Oxman, R Kunz, J Woodcock, J Brozek, M Helfand, et al. GRADE guidelines: 8. Rating the quality of evidence–2014;indirectness. Journal of Clinical Epidemiology;64(12):1303-1310.

Guyatt, G. H., Oxman, A. D., Kunz, R., Woodcock, J., Brozek, J., Helfand, M., et al. (2011). GRADE guidelines: 7. Rating the quality of evidence–inconsistency. *Journal of Clinical Epidemiology, 64*(12), 1294–1302.

Guyatt, G. H., Oxman, A. D., Montori, V., Vist, G., Kunz, R., Brozek, J., et al. (2011). GRADE guidelines: 5. Rating the quality of evidence–publication bias. *Journal of Clinical Epidemiology, 64*(12), 1277–1282.

Guyatt, G. H., Oxman, A. D., Vist, G., Kunz, R., Brozek, J., Alonso-Coello, P., et al. (2011). GRADE guidelines: 4. Rating the quality of evidence–study limitations (risk of bias). *Journal of Clinical Epidemiology, 64*(4), 407–415.

Hamer, M., Ingle, L., Carroll, S., & Stamatakis, E. (2012). Physical activity and cardiovascular mortality risk: Possible protective mechanisms? *Medicine & Science in Sports & Exercise, 44*(1), 84–88.

Hartvigsen, J., Morso, L., Bendix, T., & Manniche, C. (2010). Supervised and non-supervised nordic walking in the treatment of chronic low back pain: A single blind randomized clinical trial. *BMC Musculoskeletal Disorders, 11*, 30.

Hayden, J. A., Van Tulder, M. W., Malmivaara, A. V., & Koes, B. W. (2005). Meta-analysis: Exercise therapy for nonspecific low back pain. *Annals of Internal Medicine, 142*(9), 765–775.

Heesch, K. C., Mâsse, L. C., Dunn, A. L., Frankowski, R. F., & Mullen, P. D. (2003). Does adherence to a lifestyle physical activity intervention predict changes in physical activity? *Journal of Behavioral Medicine, 26*(4), 333–348.

Hendrick, P., Wake, AM Te, Tikkisetty, A. S., Wulff, L., Yap, C., & Milosavljevic, S. (2010). The effectiveness of walking as an intervention for low back pain: A systematic review. *European Spine Journal, 19*(10), 1613–1620.

Hicks, C. M. (2009). *Research methods for clinical therapists: Applied project design and analysis*. Elsevier Health Sciences.

Higgins, J. P. T., & Green, S. (2008). *Cochrane handbook for systematic reviews of interventions*. Cochrane Book Series.

Higgins, J. P., & Green, S. (2011). Cochrane handbook for systematic reviews of interventions version 5.1. 0. *The cochrane collaboration, 5*(0).

Higgins, J. P. T., Thompson, S. G., Deeks, J. J., & Altman, D. G. (2003). Measuring inconsistency in meta-analyses. *BMJ (Clinical research ed), 327*(7414), 557–560.

Hilde, G., Hagen, K. B., Jamtvedt, G., & Winnem, M. (2002). Advice to stay active as a single treatment for low back pain and sciatica. *Cochrane Database of Systematic Reviews*, (2), CD003632.

Hortobágyi, T., & Rutgers, H. (2014). *The future of health and fitness: A plan for getting europe active by 2025*.

Hoy, D., Bain, C., Williams, G., March, L., Brooks, P., Blyth, F., et al. (2012).

A systematic review of the global prevalence of low back pain. *Arthritis & Rheumatism, 64*(6), 2028–2037.
Hoy, D., Brooks, P., Blyth, F., & Buchbinder, R. (2010). The Epidemiology of low back pain. *Best Practice & Research Clinical Rheumatology, 24*(6), 769–781.
Krein, S. L., Kadri, R., Hughes, M., Kerr, E. A., Piette, J. D., Holleman, R., et al. (2013). Pedometer-based internet-mediated intervention for adults with chronic low back pain: Randomized controlled trial. *Journal of Medical Internet Research, 15*(8), e181.
Krismer, M., & van Tulder, M. (2007). Low back pain (non-specific). *Best Practice & Research Clinical Rheumatology, 21*(1), 77–91.
Lin, C. W., McAuley, J. H., Macedo, L., Barnett, D. C., Smeets, R. J., & Verbunt, J. A. (2011). Relationship between physical activity and disability in low back pain: A systematic review and meta-analysis. *Pain, 152*(3), 607–613.
Maher, C. G., Sherrington, C., Herbert, R. D., Moseley, A. M., & Elkins, M. (2003). Reliability of the PEDro scale for rating quality of randomized controlled trials. *Physical Therapy, 83*(8), 713–721.
McDonough, S. M., Tully, M. A., Boyd, A., O'Connor, S. R., Kerr, D. P., O'Neill, S. M., et al. (2013). Pedometer-driven walking for chronic low back pain: A feasibility randomized controlled trial. *The Clinical Journal of Pain, 29*(11), 972–981.
McLain, K., Powers, C., Thayer, P., & Seymour, R. J. (1999). Effectiveness of exercise versus normal activity on acute low back pain: An integrative synthesis and meta-analysis. *The Online Journal of Knowledge Synthesis for Nursing, 6*(7). no pagination.
Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine, 6*(7), e1000097.
National Institute for Health and Clinical Excellence. (2014). Physical activity: Exercise referral schemes. Available from https://www.nice.org.uk/guidance/ph54. (Accessed 4 May 2017).
O'Connor, S. R., Tully, M. A., Ryan, B., Bleakley, C. M., Baxter, G. D., Bradley, J. M., et al. (2015). Walking exercise for chronic musculoskeletal pain: Systematic review and meta-analysis. *Archives of Physical Medicine and Rehabilitation, 96*(4), 724–734. E3.
Oliveira, C. B., Franco, M. R., Maher, C. G., Lin, CW Christine, Morelhao, P. K., Araujo, A. C., et al. (2016). Physical activity interventions for increasing objectively measured physical activity levels in patients with chronic musculoskeletal pain: A systematic review. *Arthritis Care & Research, 68*(12), 1832–1842.
Ostelo, R. W. J. G., & HCW de Vet. (2005). Clinically important outcomes in low back pain. *Best Practice & Research Clinical Rheumatology, 19*(4), 593–607.
O'Donovan, G., Lee, I., Hamer, M., & Stamatakis, E. (2017). Association of "weekend warrior" and other leisure time physical activity patterns with risks for all-cause, cardiovascular disease, and cancer mortality. *JAMA Internal Medicine, 177*(3), 335–342.
Physical Activity Guidelines Advisory Committee. (2008). Physical activity guidelines advisory committee report. Available from https://health.gov/paguidelines/guidelines/chapter6.aspx.
RevMan The Cochrane Collaboration. (2014). *Review manager (RevMan). 5.3*. Copenhagen: The Nordic Cochrane Centre: The Cochrane Collaboration.
Reynolds, R., McKenzie, S., Allender, S., Brown, K., & Foulkes, C. (2014). Systematic review of incidental physical activity community interventions. *Preventive Medicine, 67*, 46–64.
Ryan, C. G., Grant, P. M., Dall, P. M., Gray, H., Newton, M., & Granat, M. H. (2009). Individuals with chronic low back pain have a lower level, and an altered pattern, of physical activity compared with matched controls: An observational study. *Australian Journal of Physiotherapy, 55*(1), 53–58.
Ryan, R., & Hill, S. (2016). *How to GRADE the quality of the evidence*. Cochrane consumers and communication group.
Sadarangani, K. P., Hamer, M., Mindell, J. S., Coombs, N. A., & Stamatakis, E. (2014). Physical activity and risk of all-cause and cardiovascular disease mortality in diabetic adults from great Britain: Pooled analysis of 10 population-based cohorts. *Diabetes Care, 37*(4), 1016–1023.
Saragiotto, B. T., Maher, C. G., Yamato, T. P., Costa, L. O., Costa, L. C., Ostelo, R. W., et al. (2016). Motor control exercise for nonspecific low back pain: A Cochrane review. *Spine, 41*(16), 1284–1295.
Searle, A., Spink, M., Ho, A., & Chuter, V. (2015). Exercise interventions for the treatment of chronic low back pain: A systematic review and meta-analysis of randomised controlled trials. *Clinical Rehabilitation, 29*(12), 1155–1167. https://doi.org/10.1177/0269215515570379.
Sevick, M. A., Dunn, A. L., Morrow, M. S., Marcus, B. H., Chen, G. J., & Blair, S. N. (2000). Cost-effectiveness of lifestyle and structured exercise interventions in sedentary adults: Results of project ACTIVE. *American Journal of Preventive Medicine, 19*(1), 1–8.
Smith, B. E., Littlewood, C., & May, S. (2014). An update of stabilisation exercises for low back pain: A systematic review with meta-analysis. *BMC Musculoskeletal Disorders, 15*(1).
Sterne, J. A., Sutton, A. J., Ioannidis, J. P., Terrin, N., Jones, D. R., Lau, J., et al. (2011). Recommendations for examining and interpreting funnel plot asymmetry in meta-analyses of randomised controlled trials. *BMJ (Clinical research ed), 343*, d4002.
Tacconelli, E. (2010). Systematic reviews: CRD's guidance for undertaking reviews in health care. *The Lancet Infectious Diseases, 10*(4), 226.
van Tulder, M., Koes, B., & Bombardier, C. (2002). Low back pain. *Best Practice & Research Clinical Rheumatology, 16*(5), 761–775.
Valat, J. P. (2005). Factors involved in progression to chronicity of mechanical low back pain. *Joint Bone Spine, 72*(3), 193–195.
Vos, T., Abajobir, A. A., Abate, K. H., Abbafati, C., Abbas, K. M., Abd-Allah, F., et al. (2017). Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990-2016: A systematic analysis for the global burden of disease study 2016. *The Lancet, 390*(10100), 1211–1259.
Walker, B. F. (2000). The prevalence of low back pain: A systematic review of the literature from 1966 to 1998. *Journal of Spinal Disorders, 13*(3), 205–217.
Wang, X. Q., Zheng, J. J., Yu, Z. W., Bi, X., Lou, S. J., Liu, J., et al. (2012). A meta-analysis of core stability exercise versus general exercise for chronic low back pain. *PLoS One, 7*(12), e52082.
Warburton, D. E., Glendhill, N., & Quinney, A. (2001). The effects of changes in musculoskeletal fitness on health. *Canadian journal of applied physiology = Revue canadienne de physiologie appliquee, 26*(2), 161–216.
Warburton, D. E. R., Nicol, C. W., & Bredin, S. S. D. (2006). Health benefits of physical activity: The evidence. *Canadian Medical Association Journal : Canadian Medical Association Journal, 174*(6), 801–809.