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Bibliographic Data	
Authors	Yamato TP, Maher CG, Saragiotto BT, and et al.
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PMID	
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Other information if relevant	

Methods	
Aim of study	To evaluate the effectiveness of Pilates in patients with chronic non-specific low back pain (LBP).
Design	Meta-analyses of randomized clinical trials

PICOS	
Population from which participants are drawn	Adults age 16 or older recruited from primary, secondary, or tertiary care seeking care for chronic, non-specific CLBP that persisted for 12 weeks or more or recruited from the community. Their condition was not associated with pathological entities and they had no contraindications to exercise therapy.
Intervention being evaluated	Exercise therapy that explicitly states that the intervention was based upon the Pilates principles (i.e. centering, concentration, control, precision, flow, breathing and posture) or at least three of these elements, or the therapists were described as certified Pilates instructors or had previous training in Pilates exercises. Pilates exercises mainly involve isometric contractions (i.e. contraction without joint movement) of the core muscles, which make up the muscular center responsible for the stabilization of the body, both while it is moving or at rest.
Comparison or control intervention	Minimal interventions or no intervention, placebo, or other types of exercise including general exercise.
Outcomes	Primary outcomes were pain intensity, disability, global impression of recovery, and quality of life. The secondary outcomes were return to work and adverse effects. All outcomes must have been measured with a valid and reliable instrument.
Study types	Randomized controlled trials, excluding trials with quasi-random allocation procedures

Study selection	
Search date of literature review	March 2014
Databases in literature search	EMBASE, MEDLINE, CENTRAL, CINAHL, SPORTDiscus (EBSCO), and Physiotherapy Evidence Database (PEDro). The search included the reference lists of eligible papers, previous published reviews on Pilates, as well as trial registry websites such as ClinicalTrials.gov, and the World Health Organization International Clinical Trials Registry Platform (WHO ICTRP).
How authors assessed study quality (risk of bias and other considerations	Cochrane risk of bias tool using the 12 criteria recommended by the Cochrane Collaboration and the Cochrane Back Review Group. A low risk of bias was defined as studies fulfilling 6 or more of the 12 internal validity criteria, and high risk met fewer than 6 criteria. GRADE (Grades of Recommendation, Assessment, Development and Evaluation) profiles were used to evaluate the overall quality of the evidence and the strength of the recommendations.
Additional information if relevant	The clinical relevance of each of the pooled results was also assessed. Between-group differences of at least 20% were considered as clinically important. For effect sizes, three levels were defined as: small (MD < 10% of the scale), medium (MD 10% to 20% of the scale), or large (MD >20% of the scale).

Results	
Number of studies screened	126 records were screened
Number of studies selected for analysis of results	10 RCTS were selected with 510 participants. Included studies were published between 2006 and 2014. Study sample sizes ranged from 17 to 87 participants. One study was not used in any meta-analyses.
Whether authors elected to perform meta-analysis to pool study results statistically and type of meta-analysis done (fixed effect or random effects, heterogeneity, etc)	Results were combined in a meta-analysis using a random-effects model if $I^2 < 50\%$. If substantial heterogeneity $I^2 > 50\%$ was present, studies were not pooled, but results were described in the text. When I^2 values were slightly higher than 50%, and no clear heterogeneity by visual inspection was identified, the results were combined into a meta-analysis using a random-effects model, and the evidence was downgraded for inconsistency in the quality of evidence assessment. In total, 7 comparisons were made, each comparison divided into 2 time points (short-term < 3 months, and intermediate $\geq$ 3 to 12 months) where results were pooled and a meta-analysis was performed. None of the trials reported long-term outcomes. For continuous outcomes, mean differences (MD) and 95% confidence intervals (CIs) were calculated for each analysis. For dichotomous variables, risk ratios (RR) with 95% confidence intervals (CIs) were used to calculate treatment effects.

Quality of studies as assessed by authors	A total of 70% (7 of 10) of the included trials had a low risk of bias, which included 84% of all participants (n =427). Six trials met the criteria for adequate randomization and allocation concealment. A total of 8 trials attempted to blind the outcome assessor, but only 2 studies blinded the participants. Eight trials provided adequate information about missing data and kept this below 20% for short and intermediate-term outcomes. Published protocols or registered trials were available for 4 trials. All included RCTs were at low risk of bias for selective reporting. The examination of publication bias with funnel plots was not possible because too few studies were included in the meta-analysis.
Effect sizes reported for primary outcomes (mean differences, standardized mean differences, response ratios, etc)	- Pooled data from 2 low risk of bias trials (146 participants) showed that Pilates reduces pain and improves disability compared with minimal intervention with statistically significant and clinically important medium effect sizes for pain (mean difference MD -10.54, 95% CI -18.54 to -2.62) and disability (MD -11.17, 95% CI -18.41 to -3.92) at intermediate term follow-up. - Pooled data from 2 low risk of bias trials showed there was no statistically significant or clinically important difference between Pilates and other exercises on improving disability at short-term (MD -3.29, 95% CI -6.82 to 0.24,149 participants) or intermediate-term follow-up (MD -0.91, 95% CI -5.02 to 3.20 151 participants). - Only low quality evidence was presented for all other primary outcomes.
Effect sizes reported for additional outcomes (mean differences, standardized mean differences, response ratios, etc)	One trial reported minor adverse events in both groups for 7 participants. None of the included trials evaluated return to work. Only low quality evidence was presented for the secondary outcome of function.
Additional information if relevant –summary of results	Pilates is at least as effective as general exercises, and may be more effective than minimal interventions for pain reduction and improving disability at intermediate term follow-up.

Authors' Conclusions	
Key conclusions of study authors	- There is adequate quality evidence that Pilates is more effective than minimal intervention in the intermediate term as the benefits were consistent for pain intensity and disability, with effect sizes being considered medium. - When Pilates was compared with other exercises, the results were less clear, and this review found no clinically important difference on improving disability at short-term or intermediate-term follow-up. Pilates is probably not more effective than other exercises for disability in the short and intermediate term. - Pilates appears to be an effective treatment compared to minimal intervention, but when compared to other types of exercises the effect sizes tend to be smaller or no difference in effectiveness is observed. - No high quality evidence on the effectiveness of Pilates for chronic non-specific low back pain (LBP) was provided primarily because there were only a few small studies available. Of the 4 adequate meta-analyses reported in this critique, all pooled estimates are based on only 2 studies. - The decision to use Pilates for chronic low back pain may be based on the patient's or care provider's preferences, and costs. - In the future, there is an urgent need for large, high quality trials to evaluate Pilates for low back pain that include more than 40 participants in each trial.
Additional information if relevant	

Comments by DOWC staff

- This review found that Pilates had a clinically important effect for pain reduction and improved disability compared with a minimal intervention for chronic low back pain at intermediate term follow-up.
- The results of this study show no clinically important difference between Pilates and other exercises on improving disability at short-term or intermediate-term follow-up.
- Thus, while there is some evidence for the effectiveness of Pilates for low back pain, there is no conclusive evidence that it is superior to other forms of exercises. Exercise therapy is recommended for patients with low back pain, but there seems to be no clear difference in effectiveness between the various forms of exercise.
- The trials included in this review were conducted in Australia, South America, Europe or Asia, with adult participants from primary or tertiary care. There was some small variability in the populations included, but this does not appear to affect the generalizability of the findings.
- Study quality was mostly downgraded due to inconsistency and imprecision related to high heterogeneity and insufficient pooled sample size.
- The authors downgraded the quality of meta-analyses for imprecision if single studies had fewer than 400 participants. This cutoff may be a bit overly stringent resulting in evaluations that may not appropriately reflect the quality of the analyses. Some of the included studies were truly small and imprecise, while others were of moderate size, yet all the analyses were downgraded for imprecision, since none of the studies had more than 400 participants.
- The main limitation of this review was the low number of trials and small sample sizes per comparison, outcome and follow-up period, preventing sensitivity analyses from being conducted and making it not possible to assess for publication bias. One unpublished study was found by the authors indicating potential publication bias. As unpublished studies are more likely to report negative findings, it is possible that this review's conclusions are overly optimistic. One included study was funded by a Pilates clinic, indicating that source of funding must be considered a potential conflict. However, this study did not find Pilates to be superior to general exercise.
- None of the trials reported long-term outcomes, which would be important to consider for patients with chronic LBP.
- Minor or no adverse events were reported in the included trials.
- Only 10 trials could be included in this review, which compromises the quality of the evidence provided. Also, the sample sizes in general were small (ranging from 17 to 87 participants). Only 5 studies with a low risk of bias were included in the meta-analyses presented in this critique. Therefore, the results of this review and this critique cannot be considered robust.
- Future studies should include larger studies in order to reduce wide confidence intervals resulting in nonsignificant results. If larger studies had been included in the pooled analyses, perhaps more conclusive results would have been found.

Assessment by DOWC	
Overall assessment as suitability of evidence for the guideline ☒ High quality ☐ Adequate ☐ Inadequate	High quality Cochrane meta-analysis supporting good evidence that Pilates is more effective in reducing pain and improving disability compared with a minimal intervention at intermediate term follow-up, but Pilates is equally as effective as other forms of exercise in improving disability at short- or intermediate-term follow-up for the treatment of patients with chronic non-specific low back pain.
If inadequate, main reasons for recommending that the article not be cited as evidence	

Additional references if relevant