Implementation strategies to reduce the burden of low back pain

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Chapter 4

Effectiveness of multifaceted implementation strategies for the implementation of back and neck pain guidelines in health care: a systematic review

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ABSTRACT

Background: For the optimal use of clinical guidelines in daily practice, mere distribution of guidelines and materials is not enough, and active implementation is needed. This review investigated the effectiveness of multifaceted implementation strategies compared to minimal, single or no implementation strategy for the implementation of non-specific low back and/or neck pain guidelines in health care.

Methods: The following electronic databases were searched from inception to June 1st, 2015: Medline, Embase, PsycInfo, the Cochrane Library, and CINAHL. The search strategy was restricted to low back pain, neck pain and implementation research. Studies were included if their design was a randomised controlled trial, reporting on patients (age ≥18 years) with non-specific low back pain or neck pain (with or without radiating pain). Trials were eligible if they reported patient outcomes, measures of healthcare professional behaviour, and/or outcomes on healthcare level. The primary outcome was professional behaviour. Guidelines that were evaluated in the studies had to be implemented in a health care setting. No language restrictions were applied, and studies had to be published full-text in peer-reviewed journals, thus excluding abstract only publications, conference abstracts, and dissertation articles. Two researchers independently screened titles and abstract, extracted data from included studies, and performed risk of bias assessments.

Results: After removal of duplicates, the search resulted in 4,750 abstracts to be screened. Of 43 full-text articles assessed for eligibility, 12 were included in this review, reporting on 9 individual studies, and separate cost-effectiveness analyses of 3 included studies. Implementation strategies varied between studies. Meta-analyses did not reveal any differences in effect between multifaceted strategies and controls.

Conclusion: This review showed that multifaceted strategies for the implementation of neck and/or back pain guidelines in health care do not significantly improve professional behaviour outcomes. No effects on patient outcomes or cost of care could be found. More research is necessary to determine whether multifaceted implementation strategies are conducted as planned, and whether these strategies are effective in changing professional behaviour and thereby clinical practice.

BACKGROUND

The recent Global Burden of Disease Study showed that low back pain (LBP), with 83 million years lived with disability, is the leading cause of disability worldwide, while neck pain (NP) is ranked 4th with 33.6 million years lived with disability.[1-3] To assist healthcare professionals in providing best-evidence care for LBP and NP, many guidelines for these health problems have been developed.[4-5] Clinical practice guidelines are defined by the Institute of Medicine as "statements that include recommendations intended to optimize patient care that are informed by a systematic review of evidence and an assessment of the benefits and harms of alternative care options, and are aimed at improving health care quality and outcomes".[6] Most of the guidelines for LBP/NP are developed for multidisciplinary use in primary care, and are mainly national professional guidelines. The contents of these guidelines are similar. For example, the guidelines encourage similar diagnostic triages, and discourage the use of diagnostic imaging, bed rest, and referrals to specialist care unless neurological or pathological causes are suspected.[4] The use of these guidelines might improve the quality of care for patients with LBP/NP and reduce the financial and societal burden of these disorders.

For the optimal use of guidelines in clinical practice, mere distribution of the guideline and information materials among healthcare professionals is not enough and active implementation is a necessity.[7] Many studies have been conducted to investigate the effectiveness of implementation strategies. For example, the Effective Practice and Organisation of Care (EPOC) Group of the Cochrane Collaboration has published several systematic reviews on this topic. The results of various implementation strategies, such as the use of educational meetings and workshops, educational outreach, and audit and feedback have shown small effects on improvement of professional practice (6% improvement for educational meetings and outreach and 5% for audit and feedback).[8-10] In line with these findings, Grol and Wensing argued that the simultaneous use of several implementation strategies, i.e. a multifaceted or multicomponent approach to implementation is most effective in successfully implementing guidelines and thus changing practice.[7] However, a recent overview of systematic reviews of multifaceted implementation strategies by Squires et al. suggested that these strategies may not be more effective than single-component interventions.[11]

As no studies up to now specifically reviewed the effect of multifaceted implementation strategies for the implementation of non-specific LBP/NP guidelines, the current systematic review will address the following research question: ***'What is the effectiveness of multifaceted implementation strategies compared to minimal, single or no implementation strategy for the implementation of non-specific low back and/or neck pain guidelines in health care?'*** Outcomes on healthcare professional behaviour (e.g. referral for diagnostic imaging), and patient health (e.g. quality of life) will be assessed to measure adherence to the guidelines, and thereby the success of the implementation process.

METHODS

Eligibility criteria

For the purpose of this review, multifaceted strategies were defined as interventions that consist of a combination of 2 or more elements from the implementation strategies taxonomy of the EPOC classification system.[12] As this review aimed to assess the effectiveness of implementation strategies, studies were considered for this review if their design was a randomised controlled trial (RCT), involving either individual or cluster randomisation, and including a control group that received a minimal, single or no implementation strategy. Studies were eligible if reporting on patients of either gender (age ≥18 years) with non-specific LBP or NP (with or without radiating pain) of any duration. Studies of LBP or NP caused by infection, cauda equina syndrome, bone rarefaction, compression fracture of a vertebral body, tumour, or fibromyalgia were excluded. Cost-effectiveness analyses of included trials were also included. Trials were eligible if they reported measures of healthcare professional behaviour (the primary outcome for this review, patient outcomes, and/or outcomes on healthcare level). Guidelines that were evaluated in the studies had to be implemented in a health care setting (i.e. a setting where individual health care is provided to a patient), for example primary care (GP or PT), occupational health care or secondary (hospital) care. Guidelines for health care insurance were therefore excluded. No language restrictions were applied, and studies had to be published full-text in peer-reviewed journals, thus excluding abstract only publications, conference abstracts, and dissertation articles.

Information sources

The following electronic databases were searched until June 1st, 2015: Medline (Pubmed), Embase, PsycInfo, the Cochrane Library, and CINAHL (Ebsco). In close collaboration with a medical information specialist, a broad search was performed with only 2 restrictions: LBP and/or NP, and implementation. Full electronic search strategies for all 5 databases are presented in Appendix 1. In cases of ambiguity, or where full-text publications of selected abstracts could not be found, authors of the respective studies were contacted. The reference lists of all included studies were screened to identify additional studies.

Study selection and data extraction

After removal of duplicate results, 2 reviewers (AS and MD) independently reviewed all titles and abstracts identified by the electronic search. Subsequently, the reviewers engaged in a consensus method to eliminate discrepancies in the selection process. In cases where the reviewers could not come to consensus regarding study eligibility, a third reviewer (FGS or MWvT) was consulted. Full-text articles of studies were obtained when the study was deemed to meet the inclusion criteria, or in cases where perusal of title and abstract did not provide sufficient information to assess eligibility of the study. Both reviewers independently

screened all selected full-text articles for definitive eligibility, and the same consensus protocol was followed as for the screening of titles and abstracts. Using an adapted form of the 'Good practice data extraction form' of the EPOC group, study characteristics and relevant data of all included studies were independently extracted by the 2 reviewers (AS and MD). Results were discussed in order to reach consensus and assure correct interpretation of the studies. In cases where consensus could not be reached, a third reviewer (FGS) was consulted.

Assessment of risk of bias of studies

The risk of bias of the included randomized trials was evaluated by 2 review authors independently (AS and MD), using The Cochrane Collaboration's tool for assessing risk of bias and the suggested risk of bias criteria for EPOC reviews.[13-14] Disagreements were resolved by consensus. The quality of the economic evaluations was not assessed, because this was outside the scope of the current review. The following criteria were assessed for high, unclear or low risk of bias for every study: Random sequence generation (selection bias); allocation concealment (selection bias); similarity of baseline characteristics and outcome measurements; follow-up; blinding of participants and personnel (performance bias); blinding of outcome assessment (detection bias); protection against contamination; incomplete outcome data (attrition bias); selective outcome reporting (reporting bias), and other bias.

Studies that had a low risk of bias score on at least 6 criteria were judged to be low risk of bias studies.[15] Studies that had 5 or less low risk of bias scores were judged to be high risk of bias studies.

Two review authors (AS and MD) independently assessed the overall quality of the evidence for all pooled outcomes using the GRADE approach.[16-19] The GRADE approach specifies 4 levels of quality. High quality rating is for randomised controlled evidence, and the quality rating can be downgraded if limitations in one or more of the following domains are encountered: Study limitations encountered in 'Risk of Bias' assessment of study; consistency of study (i.e. the similarity of estimates of treatment effects for the outcome across studies); directness of the study (i.e. the extent to which the participants, interventions, and outcomes in the studies were comparable to those defined in the inclusion criteria of this review); precision of the study (i.e. the degree of certainty surrounding an effect estimate), and publication bias (i.e. the probability of selective publication of studies and outcomes).

The overall quality of the evidence for each pooled outcome was the result of the combination of all domains, and lead to four levels of evidence [18]:

- High quality evidence: Further research is very unlikely to change the confidence in the estimate of effect;
- Moderate quality evidence: Further research is likely to have an impact on the confidence in the estimate of effect and may change the estimate;
- Low quality evidence: Further research is very likely to have an important impact on the confidence in the estimate of effect and is likely to change the estimate;

- Very low quality evidence: Any estimate of effect is very uncertain.

Data extraction

Two independent reviewers (AS and MD) extracted data from the included studies using the EPOC data collection checklist and data extraction template.[12] The data extraction form was first pilot tested using one of the included studies. Disagreements in data extraction were resolved by consensus. The following data were extracted:

- Bibliographic data (authors, title study, journal and date of publication);
- Study characteristics (study type and design, unit of allocation, duration of follow-up);
- Participant characteristics (population description (e.g. (neck or back pain) patients or (type of) professionals), total number of participants randomised, mean age, gender, severity of illness, co-morbidities);
- Setting characteristics (location, social context, clusters, withdrawals and exclusions);
- Description of intervention and control groups (content, dose, components, duration, timing, delivery, providers, number randomised to group, theory base);
- Outcomes assessed (outcome definitions, time points measured and reported, unit of measurement, outcome tool, scales, missing data);
- Study results (baseline data, comparison, outcome, subgroup, time points, results intervention and comparison).

Synthesis of results

The included studies first were categorized into types of interventions (according to the EPOC taxonomy), and types of outcome measures. Meta-analyses were separately planned and conducted for the comparison of multifaceted implementation strategies vs. controls (i.e. usual care or minimal implementation) for various outcomes. Outcomes on healthcare professional behaviour were considered indicators for guideline adherence, and thus the primary outcome for success of guideline implementation. The effects on professional behaviour were categorized into 'treatment' and 'referral' behaviour outcome groups. In the 'treatment' group, outcomes on treatment behaviour were classified into adequate patient information, advising active treatment, and prescribing medication. Outcomes on 'referral' behaviour were separately analysed for referrals for x-ray, CT or MRI scans, physical therapy, and speciality/secondary care referrals. Appendix 2 shows the data sources, and calculations used for the meta-analyses.

To calculate effects, the data for the pooled outcomes of each study were entered into Review Manager (RevMan) 5.3 software. All pooled outcome data were dichotomous or dichotomized, and for all outcomes, Odds Ratios (using random effects models) and 95% CIs were calculated in RevMan to estimate the implementation effects. To determine the presence of heterogeneity, I^2 was analysed in RevMan. When I^2 was more than 50%, the studies were judged to be heterogeneous.

RESULTS

Identification and selection of studies

The electronic search resulted in 8255 references, of which 2476 were retrieved from Medline, 4181 from Embase, 876 from CINAHL, 293 from Cochrane, and 429 from PsycInfo. After removing duplicates, titles and abstracts of 4750 records were screened. Of 43 records full-text articles were screened for eligibility. Twelve articles were included in the current review (Table 1)[20-31], and 31 articles were excluded (Table 2).[32-62] Figure 1 shows a flow chart of the inclusion process, including reasons for exclusion (several exclusion reasons per article possible) of records. Screening of reference lists of the included articles did not result in any additional inclusions.

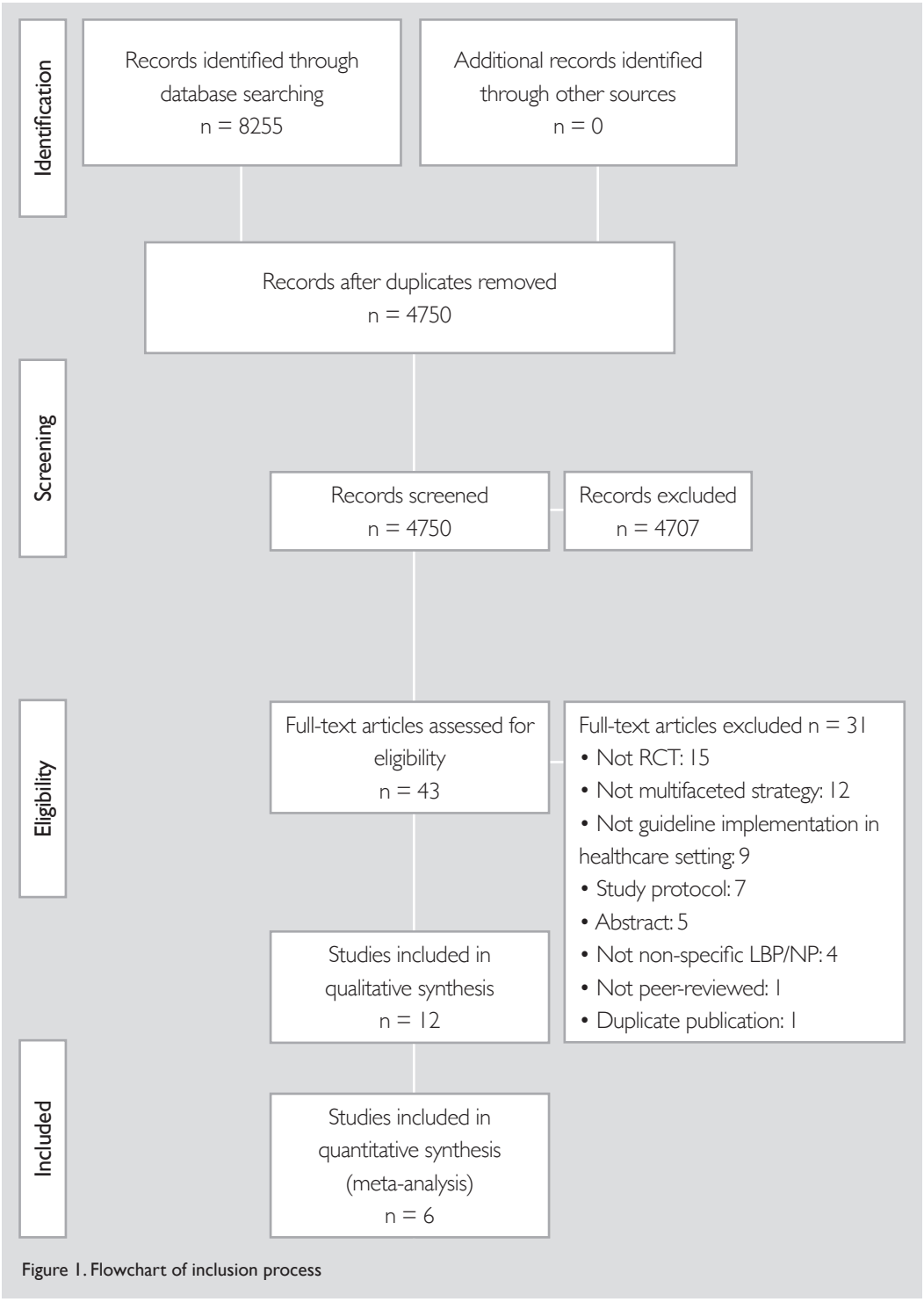

Figure 1. Flowchart of inclusion process

Table 1. References to included studies

ID	Study
I1	Becker A, Leonhardt C, Kochen MM, Keller S, Wegscheider K, Baum E, et al. Effects of Two Guideline Implementation Strategies on Patient Outcomes in Primary Care. A Cluster Randomized Controlled Trial. SPINE. 2008; 33(5):4732-480.
I2	Becker A, Held H, Redaelli M, Chenot JF, Leonhardt C, Keller S, et al. Implementation of a Guideline for Low Back Pain Management in Primary Care. A Cost-Effectiveness Analysis. SPINE. 2012; 37(8):701-710.
I3	Bekkering GE, Hendriks HJM, van Tulder MW, Knol DL, Hoeijenbos M, Oostendorp RAB. Effect on the process of care of an active strategy to implement clinical guidelines on physiotherapy for low back pain: a cluster randomised controlled trial. Qual Saf Health Care. 2005; 14:107-112.
I4	Bekkering GE, van Tulder MW, Hendriks HJM, Koopmanschap MA, Knol DL, Bouter LM, et al. Implementation of Clinical Guidelines on Physical Therapy for Patients With Low Back Pain: Randomized Trial Comparing Patient Outcomes After a Standard and Active Implementation Strategy. Phys Ther. 2005; 85:544-555.
I5	Hoeijenbos M, Bekkering T, Lamers L, Hendriks E, van Tulder M, Koopmanschap M. Cost-effectiveness of an active implementation strategy for the Dutch physiotherapy guideline for low back pain. Health Policy. 2005; 75:85-98.
I6	Bishop PB, Wing PC. Knowledge transfer in family physicians managing patients with acute low back pain: a prospective randomized control trial. The Spine Journal. 2006; 6:282-288.
I7	Dey P, Simpson CWR, Collins SI, Hodgson G, Dowrick CF, Simison AJM, et al. Implementation of RCGP guidelines for acute low back pain: a cluster randomised controlled trial. British Journal of General Practice. 2004; 54:33-37.
I8	Engers AJ, Wensing M, van Tulder MW, Timmermans A, Oostendorp RAB, Koes BW, et al. Implementation of the Dutch Low Back Pain Guideline for General Practitioners. SPINE. 2005; 6:595-600.
I9	French SD, McKenzie JE, O'Connor DA, Grimshaw JM, Mortimer D, Francis JJ, et al. Evaluation of a Theory-Informed Implementation Intervention for the Management of Acute Low Back Pain in General Medical Practice: The IMPLEMENT Cluster Randomised Trial. PLoS ONE. 2013; 8(6):e65471; doi:10.1371/journal.pone.0065471.
I10	Mortimer D, French SD, McKenzie JE, O'Connor DA, Green SE. Economic Evaluation of Active Implementation versus Guideline Dissemination for Evidence-Based Care of Acute Low-Back Pain in a General Practice Setting. PLoS ONE. 2013; 8(10):e75647; doi:10.1371/journal.pone.0075647.
I11	Rebbeck T, Maher CG, Refshauge KM. Evaluation two implementation strategies for whiplash guidelines in physiotherapy: A cluster-randomised trial. Australian Journal of Physiotherapy. 2006; 52:165-174.
I12	Schectman JM, Schroth WS, Verme D, Voss JD. Randomized Controlled Trial of Education and Feedback for Implementation of Guidelines for Acute Low Back Pain. J Gen Intern Med. 2003; 18:773-780.

Table 2. References to excluded full-text studies

ID	Study
E1	Ammendolia C, Hogg-Johnson S, Pennick V, Glazier R, Bombardier C. Implementing evidence-based guidelines for radiography in acute low back pain: a pilot study in a chiropractic community. Journal of Manipulative and Physiological Therapeutics. 2003; 27(3):170-179.
E2	Bussières A, Laurencelle L, Peterson C. Diagnostic Imaging Guidelines Implementation Study for Spinal Disorders. A Randomized Trial with Postal Follow-ups. The Journal of Chiropractic Education. 2010; 24(1).
E3	Bekkering GE, Hendriks HJM, Van Tulder MW. Effectiviteit van een actieve implementatiestrategie van de KNGF-richtlijn 'Lage-rugpijn'. Ned Tijdschr Fysiother. 2005; 115(3):62-67.
E4	Cherkin D, Deyo RA, Berg AO, Bergman JJ, Lishner DM. Evaluation of a Physician Education Intervention to Improve Primary Care for Low-Back Pain 1: Impact on Physicians. SPINE. 1991; 16(10): 1168-1172.
E5	Cunningham CG, Flynn TA, Toole CM, Ryan RG, Gueret PWJ, Bulfin S, et al. Working Backs Project – implementing low back pain guidelines. Occupational Medicine. 2008; 58:580-583.
E6	Taramona Espinoza CP, Skupin M, Montezuma D, Sandouk Z, Drake S. Adherence to guidelines for low back pain imaging: comparison of a teaching and non-teaching clinic. Abstracts from the 35th Annual Meeting of the Society of General Internal Medicine. JGIM. 2012; 27":Suppl 2:S99-574; doi: 10.1007/s11606-012-2038-0.
E7	Evans DW, Foster NE, Underwood M, Vogel S, Breen AC, Pincus T. Testing the effectiveness of an innovative information package on practitioner reported behaviour and beliefs: The UK Chiropractors, Osteopaths and Musculoskeletal Physiotherapists Low back pain ManagemENT (COMPLeMENT) trial. BMC Musculoskeletal Disorders. 2005; 6(41); doi:10.1186/1471-2474-6-41.
E8	Fleuren M, Dusseldorp E, Van den Bergh S, Vlek H, Wildschut J, Van den Akker E, et al. Implementation of a shared care guideline for low back pain: effect on unnecessary referrals. International Journal for Quality in Health Care. 2010; 22(5):415-420.
E9	Jensen CE, Riis A, Pedersen KM, Jensen MB, Petersen KD. Study protocol of an economic evaluation of an extended implementation strategy for the treatment of low back pain in general practice: a cluster randomised controlled trial. Implementation Science. 2014; 9:140.
E10	Lang E, Kastner S, Liebig K, Neundörfer B. Interventions for improvement of primary care in patients with low back pain: how effective are advice to primary care physicians on therapies and a multimodal therapy program arising out of cooperation of outpatient health care structures? Schmerz. 2002; 16:22-33.
E11	McKenzie JE, French SD, O'Connor DA, Grimshaw JM, Mortimer D, Michie S, et al. IMPLEmenting a clinical practice guideline for acute low back pain evidence-based management in general practice (IMPLEMENT): Cluster randomised controlled trial study protocol. Implementation Science. 2008; 3:11; doi:10.1186/1748-5908-3-11.
E12	McKenzie JE, O'Connor DA, Page MJ, Mortimer SD, French SD, Walker BF. Improving the care for people with acute low-back pain by allied health professionals (the ALIGN trial): A cluster randomised trial protocol. Implementation Science. 2013; 5(86).
E13	Mortimer D, French SD, McKenzie JE, O'Connor DA, Green SE. Protocol for economic evaluation alongside the IMPLEMENT cluster randomised controlled trial. Implementation Science. 2008; 3:12; doi:10.1186/1748-5908-3-12.

Continued Table 2. References to excluded full-text studies

ID	Study
E14	Rasmussen FØ. Kunnskapsbasert ryggomsorg – en pilotstudie om etterutdanning av allmennleger. Tidsskrift for Den norske legeforening. 2002; 122:1794-6.
E15	Rebbeck TJ, Refshauge KM, Maher CG. Use of clinical guidelines for whiplash by insurers. Aust Health Rev. 2006; 30(4):442-449.
E16	Rebbeck T, Stewart M, Cameron I, Stewart J. Treatment of chronic whiplash: a systematic review and clinical guidelines. Physiotherapy. 2011; 97:s1.
E17	Rebbeck T, Macedo LG, Maher CG. Compliance with clinical guidelines for whiplash improved with a targeted implementation strategy: a prospective cohort study. BMC Health Services Research. 2013; 13(213).
E18	Rebbeck T, Macedo L, Paul P, Trevena L, Camron ID. General practitioners' knowledge of whiplash guidelines improved with online education. Australian Health Review. 2013; 37:688-694.
E19	Richings K, Taylor C, Morris J. Changing GPS guideline adherence in relation to ordering plain lumbar spine X-rays for NSLBP: the role of the physiotherapist. Physiotherapy. 2011; 97:s1.
E20	Riis A, Jensen CE, Bro F, Maindal HT, Petersen KD, Jensen MB. Enhanced implementation of low back pain guidelines in general practice: study protocol of a cluster randomised controlled trial. Implementation Science. 2013; 8(124).
E21	Rossignol M, Abenhaim L, Séguin P, Neveu A, Collet JP, Ducruet T, et al. Coordination of Primary Health Care for Back Pain: A Randomized Controlled Trial. SPINE. 2000; 25(2):251-259.
E22	Rutten G, Harting J, Bartholomew LK, Oostendorp RAB, De Vries NK. Results of the pilot study of a multilevel intervention to improve adherence to evidence based guidelines for low back pain. Physiotherapy. 2011; 97:s1.
E23	Rutten GM, Harting J, Bartholomew LK, Braspenning J, Van Dolder R, Heijmans MFGJ, et al. Development of a theory- and evidence-based intervention to enhance implementation of physical therapy guidelines for the management of low back pain. Archives of Public Health. 2014; 72(1).
E24	Sandner-Kiesling A, Gspurning E, Granitz GG, Thalhammer G. "Rückenschmerz.ade" – A disease management project for the implementation of guidelines in the treatment of chronic low back pain. European Journal of Pain (Poster Sessions). 2009; 13:S55-S285.
E25	Shenoy S. Cluster randomized controlled trial to evaluate the effectiveness of a multifaceted active strategy to implement low back pain practice guidelines: effect on competence, process of care and patient outcomes in physical therapy. Dissertation at University of Pittsburgh, School of Health and Rehabilitation Sciences, 2013.
E26	Slater H, Briggs AM, Smith AJ, Bunzli S, Davies SJ, Quintner JL. Implementing evidence-informed policy into practice for health care professionals managing people with low back pain in Australian rural settings: a preliminary prospective single-cohort study. Pain Medicine. 2014; 15:1657-1668.
E27	Stiell IG, Clement CM, Grimshaw J, Brison RJ, Rowe BH, Schull MJ, et al. Implementation of the Canadian C-Spine Rule: a prospective 12 centre cluster randomised trial. BMJ. 2009; 339:b4146.

Continued Table 2. References to excluded full-text studies

ID	Study
E28	Suman A, Schaafsma FG, Elders PJM, Van Tulder MW, Anema JR. Cost-effectiveness of a multifaceted implementation strategy for the Dutch multidisciplinary guideline for nonspecific low back pain: design of a stepped-wedge cluster randomised controlled trial. BMC Public Health. 2015; 15:522; doi:10.1186/s12889-015-1876-1.
E29	Tracey NG, Martin JB, McKinstry CS, Mathew BM. Guidelines for lumbar spine radiography in acute low back pain: effect of implementation in an accident and emergency department. The Ulster Medical Journal. 1994; 63(1):12-17.
E30	Twomey P. Making the best use of a radiology department: an example of implementation of a referral guideline within a primary care organisation. Quality in Primary Care. 2003; 11:53-9.
E31	Van Dulmen SA, Maas MJ, Staal B, Rutten G, Kiers H, Nijhuis-Van der Sanden M, et al. Effectiveness of Peer Assessment for Implementing a Dutch Physical Therapy Low Back Pain Guideline: cluster randomized controlled trial. PHYS THER. 2014; 94:1396-1409.

The 12 included articles were based on 8 individual studies, of which 4 based their implementation strategy on theory and described the development of their strategy. Three studies separately reported cost-effectiveness analyses, and one study described outcomes on patient and professional levels in 2 separate articles. One study was targeted at patients with a whiplash, while all other studies were on non-specific LBP. Table 3 provides a summary of the included studies and their characteristics. A great variety of intervention elements was applied across the studies, and several outcomes were measured. The guidelines implemented in the included studies had similar objectives such as: encouraging activation, restoration of normal functioning, and exercise, while discouraging referrals for secondary care and diagnostic imaging. Appendix 3 lists the excluded full-text articles with reasons for their exclusion.

Table 3. Characteristics of included studies

Study ID	Design & Participants	Guideline recommendations
11. Becker et al. 2008	Cluster randomised controlled trial (RCT) with 3 arms 1378 LBP patients 126 General practitioners (GPs) (118 GP practices)	GP guideline: - Early activation - Symptomatic pain relief - Optional manual therapy - Multidisciplinary treatment (physiotherapy, psychotherapy, back schools, massage)
12. Becker et al. 2012	Cost-effectiveness analysis (CEA) of Becker et al. 2008 (study 11)	See Becker et al. 2008 (11)
13. Bekkering et al. 2005(a)	Cluster RCT 500 LBP patients 113 physiotherapists (PTs) (68 PT practices)	PT guideline: - Active treatment approach - Adequate patient information - Activation - Optional behavioural approach - Restore physical functioning - Improve participation/return to work - Limiting treatment sessions
14. Bekkering et al. 2005 (b)	Cluster RCT 500 LBP patients 113 PTs (68 PT practices)	See Bekkering et al 2005(a) (13)

Intervention - Theory based? - Development described?	Outcomes	Authors' conclusion
Implementation group 1: - 3 interactive seminars - Information packages - 2 educational visits Implementation group 2: - All elements from implementation group 1 + - Motivational counselling strategies Control: Guideline by mail Intervention not theory based; Development of intervention not described	Patient level: 1. Functional capacity 2. Days in pain 3. Overall activity 4. Days of sick leave 5. Quality of Life (QoL)	Active implementation of the guideline results in slightly better outcomes during 6 months follow-up that its postal dissemination. Results are more distinct when motivational counselling strategies are additionally applied.
-	Cost of care: 1. Absence from work 2. Direct, indirect & total healthcare costs 2. Functional capacity CER 3. Overall activity CER 4. QoL CER	Both implementation groups showed lower direct and indirect costs as well as better patient outcomes during follow-up compared with controls, and showed superiority in cost-effectiveness to control.
Implementation: - Guideline by mail - 2 training sessions Control: Guideline by mail Intervention theory based; Development of intervention described in separate paper	Professional level: 1. Limiting n treatment sessions in patients with normal course 2. Setting functional treatment goals 3.Use active interventions 4. Provide adequate information & advice 5. Adherence to all previous recommendations	The active strategy moderately improved adherence to guidelines. Active strategies are recommended to implement the clinical guidelines on physiotherapy for LBP.
Implementation: - Guideline by mail - 2 training sessions Control: - Guideline by mail Intervention theory based; Development of intervention described in separate paper	Patient level: 1. Physical Functioning 2. Pain 3. Sick leave (n days off work in last 6 weeks) 4. Pain coping 5. Pain beliefs	Physical functioning and pain improved substantially in the first 12 weeks. No additional benefit to applying active strategy to implement physical therapy guidelines for patients with LBP. Active implementation not recommended if patient outcomes are to be improved.

Continued Table 3. Characteristics of included studies

Study ID	Design & Participants	Guideline recommendations
15. Hoeijenbos et al. 2005	CEA of Bekkering et al. 2005(a) & (b) (study 13 & 14)	See Bekkering et al 2005(a) (13)
16. Bishop et al. 2006	Prospective RCT with 3 arms 428 LBP patients	Unknown

Intervention - Theory based? - Development described?	Outcomes	Authors' conclusion
-	Cost of care: 1. Direct medical costs 2. Productivity costs (absenteeism) 3. Efficiency loss 4. Hindrance during unpaid work 5. QoL 6. Annual costs (direct & productivity costs) 7. Cost-effectiveness	During 1-year follow-up, no differences were found in QoL, direct medical costs and productivity costs. Active implementation appears not to be cost effective as compared to standard strategy.
Implementation group 1: - Guideline + letter per mail - Guideline reminders relevant to specific periods of clinical course Implementation group 2: - All elements from implementation group 1 + - Lay language version of guideline for patients (sent to patient) - Lay language guideline reminder relevant to specific periods of clinical course for patients (sent to patient) Control: No intervention Intervention not theory based; Development of intervention not described	Professional level: 1. Adherence to patient assessment 2. Adherence to guideline treatment recommendations	Largely unsuccessful in improving concordance with guideline treatment recommendations.

Continued Table 3. Characteristics of included studies

Study ID	Design & Participants	Guideline recommendations
17. Dey et al. 2004	Cluster RCT 2187 LBP patients 54 GP practices	GP guideline: - Diagnostic triage for minority of patients - Treatment in primary care - Return to normal function - No use of x-ray, bed rest, secondary care - Recommend simple analgesics and exercise - Optional PT
18. Engers et al. 2005	Cluster RCT 616 consultations for 531 LBP patients 67 GPs	GP guideline: - Activation and treatment - Adequate patient information and advice - Time contingent treatment - Restore normal functioning - Assess psychosocial risk factors - No imaging or lab - Optional non-steroid analgesics

Intervention - Theory based? - Development described?	Outcomes	Authors' conclusion
Implementation: - Educational outreach visit - Poster reinforcing guideline recommendations - Patient text recommended by guideline - Referral form for fast-track PT - Referral form for direct access to back clinic Control: - Poster reinforcing guideline recommendations - Patient text recommended by guideline Intervention partly based on theory; Development of intervention described	Professional level: 1. Referral for X-ray 2. Issuing of sickness certificate 3. Prescription opioids/muscle relaxants 4. Referral to secondary care 5. Referral for PT or educational programme	No significant differences between groups in proportion of patients referred to X-ray, issues with sickness certificate, prescribed opioids/muscle relaxants, or referred to secondary care. Significantly more patients in implementation group referred to physiotherapy or back clinic. Mostly unchanged management of patients with LBP.
Implementation: - 1 workshop - Patient education card - Guideline for occupational physicians - 2 scientific articles on LBP management by GPs - Collaboration tool for collaboration with PT Control: No intervention Intervention theory based; Development of intervention described	Professional level: 1. Number of referrals to a therapist 2. Prescription of time-contingent pain medication 3. Prescription of paracetamol vs. NSAIDS 4. Adequacy of patient education	Implementation strategy modestly improved implementation of the guideline and produced small concomitant changes in patient management. Implementation strategy produced fewer referrals to therapists during follow-up consultations.

Continued Table 3. Characteristics of included studies

Study ID	Design & Participants	Guideline recommendations
19. French et al. 2013	Cluster RCT 112 GPs (92 GP practices)	GP guideline: - No x-ray or other imaging - Activation
110. Mortimer et al. 2013	CEA of French et al. 2013 (study 19)	See French et al. 2013 (19)
111. Rebbeck et al. 2006	Cluster RCT 103 patient with whiplash 27 PTs	PT guideline: - Activation - Exercise - Multidisciplinary treatment - Pulsed electromagnetic therapy

Intervention - Theory based? - Development described?	Outcomes	Authors' conclusion
Implementation: - 2 educational workshops - Film footage of workshop (DVD) - Electronic resources for acute LBP Control: - Printed copy of guideline - Written reminder on how to access electronic guideline Intervention theory based; Development of intervention described in separate paper	Professional level: 1. Behavioural constructs 2. Behavioural simulation outcomes (vignettes) 3. X-ray & CT referral (administrative data)	Implementation strategy led to small changes in GP intention to guideline adherence, but no statistically significant changes in actual behaviour.
-	Cost of care: Cost-effectiveness of implementation strategy versus standard dissemination from health sector perspective	Active implementation entails significant additional upfront investment that may not be offset by health gains and/or reductions in health services utilization of sufficient magnitude to render active implementation cost-effective.
Implementation: - Dissemination of guideline - Workshop by opinion leaders - Follow-up educational outreach visit - Laminated copy of algorithms outlining process of care - Appointment cards - Marketing material Control: No intervention Intervention not theory based; Development of intervention not described	Patient level: 1. Disability 2. Disability due to acute whiplash 3. Global Perceived Effect 4. Patient satisfaction with care from GP, care from PT, and patient version of guidelines Professional level: 1. Knowledge of guidelines 2. Clinical practice 3. PT satisfaction with guidelines, intervention, and patient version of guidelines 4. Cost of care	No significant differences between groups for any of the patient outcomes at any time. Although active implementation increased guideline-consistent behaviour, cost of care was not affected.

Continued Table 3. Characteristics of included studies

Study ID	Design & Participants	Guideline recommendations
112. Schectman et al. 2003	RCT with 4 arms 2020 patients in baseline year; 2046 patients in study year 75 physicians 21 Nurse practitioners (NPs)/ Physician assistants (PAs)	GP guideline: - Imaging only in suspicion of red flags - Subspecialty referral only in suspicion of red flags - Referral to PT in lack of improvement after 6 weeks

Intervention - Theory based? - Development described?	Outcomes	Authors' conclusion
Implementation group 1: - 1 educational session by clinical leaders - Copy of the guideline - Audit report summarizing performance during baseline year, highlighting of over- and underutilization, and explaining rationale for classifications - Individual follow-up visit (including another audit report of study year) Implementation group 2: - All elements from implementation group 1 + - Patient education material - Reminder to use patient education material Control group 1: No intervention Control group 2: Patient intervention only Intervention not theory based; Development of intervention not described	Professional level: 1. Guideline consistent behaviour 2. Utilization of services Patient level: 1. Beliefs about care of back pain	The 4 groups collapsed into 2 (clinician intervention vs. no clinician intervention) for analysis and reporting. Implementation was associated with an increase in guideline consistent behaviour, but patient education materials did not enhance guideline effectiveness and were poorly adopted.

In Table 4, intervention elements according to the EPOC taxonomy are shown for the included studies. Nine types of elements could be identified. Next to the obvious dissemination of clinical practice guidelines, educational material and educational meetings were the most commonly applied elements. Local opinion leaders, audit & feedback, reminders, and organizational interventions were not used as often, and only 3 studies applied a patient mediated intervention element. The implementation strategies of most studies consisted of 4 to 5 intervention elements. Table 5 shows the types of outcomes that were measured in the included studies. Most studies measured physician treatment adherence to guideline recommendations, and the number of referrals to secondary care, medical diagnostics, and/or physical therapy. Only 3 studies reported outcomes on patient level.

Table 4. Interventions of included studies according to EPOC taxonomy (all on professional level unless stated otherwise)

Study ID	Clinical Practice Guidelines	Educational materials	Educational meetings	Educational outreach visits	Local opinion leaders Educational outreach visits	Audit & Feedback	Reminders	Other (organizational)	Patient mediated	Total
Becker et al. 2008 (11)	X	X	X	X					X	5
Bekkering et al. 2005 (13&14)	X	X	X			X	X			5
Bishop et al. 2006 (16)	X	X					X		X	4
Dey et al. 2004 (17)	X	X		X				X		4
Engers et al. 2005 (18)	X	X	X					X		4
French et al. 2013 (19)	X	X	X							3
Rebbeck et al. 2006 (111)	X	X	X	X	X					5
Schectman et al. 2003 1(12)	X	X	X	X	X	X			X	7
Total	8	8	6	4	2	2	2	2	3	

Table 5. Grouped outcome measures of included studies (all on professional level unless stated otherwise)

Study ID	Knowledge	Diagnostics	Treatment	Referral	Sickness certificates	Other	Patient outcomes
Becker et al. 2008 (11)							X
Bekkering et al. 2005 (13&14)			X				X
Bishop et al. 2006 (16)		X	X				
Dey et al. 2004 (17)			X	X	X		
Engers et al. 2005 (18)			X	X			
French et al. 2013 (19)	X			X			
Rebbeck et al. 2006 (111)	X		X			Satisfaction	X
Schectman et al. 2003 (112)				X			
Total	2	1	5	4	1	1	3

Quality of included studies

Figure 2 shows the risk of bias judgement of the included randomized trials. With only 2 studies [16,19] judged to have a high risk of bias according to the predefined cut-off point, overall quality of the included studies was good. Blinding of participants and personnel (performance bias) was judged to be a source of high risk of bias in all but 2 studies [13,111]. Other sources of bias like a follow-up of at least 80%, blinding of outcome assessment, and selective reporting were considered a risk of bias in a few studies only. For four of the nine studies, the risk of bias based on similarity of baseline outcome measurements was unclear. Table 6 shows the summary of findings table, including the assessment of the quality of the evidence using the GRADE system.

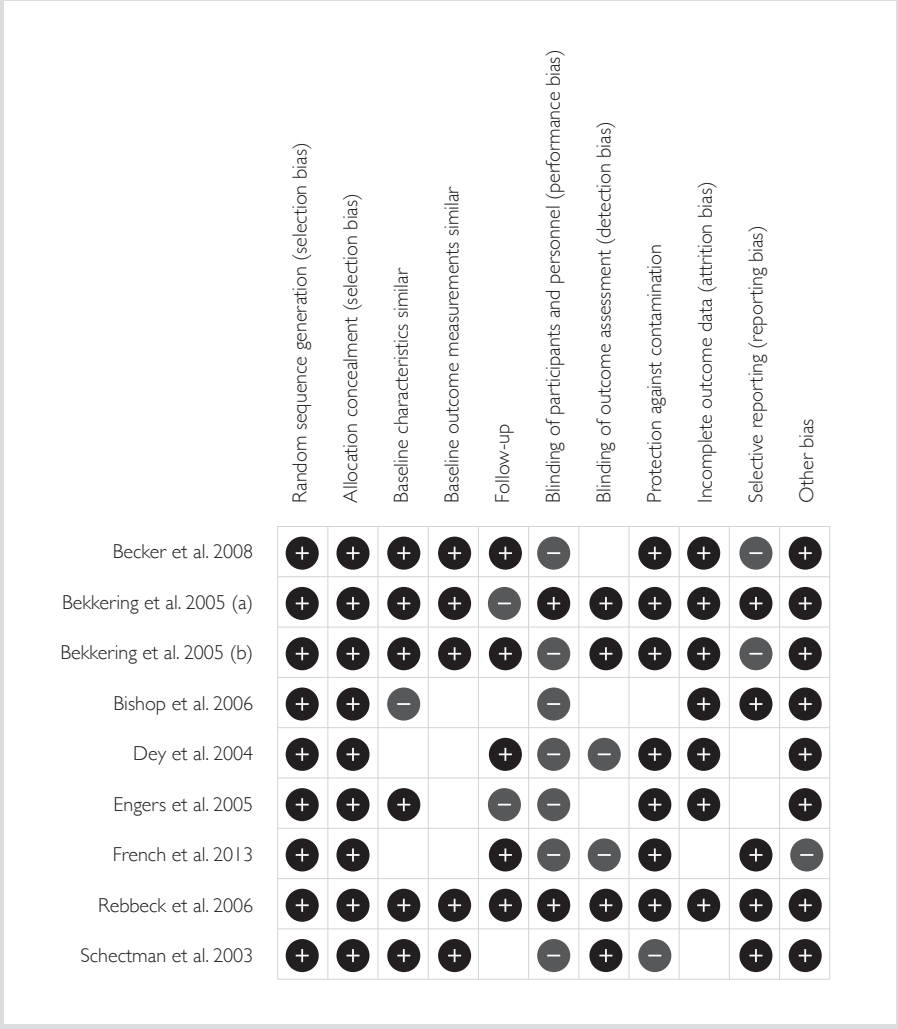

Figure 2. Risk of bias for included studies

Table 6. Summary of findings

Multifaceted implementation strategies compared to usual, minimal or no implementation strategies for the implementation of neck and back pain guidelines in health care						
Patient or population: neck and back pain guidelines **Setting:** health care **Intervention:** multifaceted implementation strategies **Comparison**: usual, minimal or no implementation strategies						
Outcomes	**Anticipated absolute effects* (95% CI)**		Relative effect (95% CI)	№ of participants (studies)	Quality of the evidence (GRADE)	Comments
	Risk with usual, minimal or no implementation strategies	**Risk with multifaceted implementation strategies**				
Referral rates for X-rays follow up: range 3 months to 2 years	**Study population**		**OR 0.93** (0.75 to 1.15)	157175 (3 RCTs)	⊕⊕⊕◯ MODERATE [1]	
	13 per 1000	**12 per 1000** (10 to 15)				
Referral rates for CT/MRI scans follow up: range 12 months to 2 years	**Study population**		**OR 0.82** (0.57 to 1.16)	154988 (2 RCTs)	⊕⊕◯◯ LOW [1,2]	
	7 per 1000v	**6 per 1000** (4 to 9)				
Referral rates for physiotherapy follow up: range 3 months to 2 years	**Study population**		**OR 0.74** (0.42 to 1.32)	4849 (3 RCTs)	⊕◯◯◯ VERY LOW [3,4]	
	505 per 1000	**430 per 1000** (300 to 574)				
Referral rates for secondary/specialty care follow up: range 3 months to 2 years	**Study population**		**OR 1.16** (0.39 to 3.40)	4233 (2 RCTs)	⊕◯◯◯ VERY LOW [3,4]	
	496 per 1000	**533 per 1000** (277 to 770)				

Continued Table 6. Summary of findings

Multifaceted implementation strategies compared to usual, minimal or no implementation strategies for the implementation of neck and back pain guidelines in health care						
Patient or population: neck and back pain guidelines **Setting:** health care **Intervention:** multifaceted implementation strategies **Comparison**: usual, minimal or no implementation strategies						
Outcomes	**Anticipated absolute effects* (95% CI)**		Relative effect (95% CI)	№ of participants (studies)	Quality of the evidence (GRADE)	Comments
	Risk with usual, minimal or no implementation strategies	**Risk with multifaceted implementation strategies**				
Provision of adequate patient information follow up: range 16 weeks to 12 months	**Study population**		**OR 0.85** (0.57 to 1.27)	1727 (3 RCTs)	⊕⊕◯◯ LOW [4,5]	
	452 per 1000	**412 per 1000** (320 to 511)				
Medication prescription follow up: range 16 weeks to 12 months	**Study population**		**OR 0.87** (0.72 to 1.06)	3414 (3 RCTs)	⊕⊕◯◯ LOW [3,5]	
	272 per 1000	**245 per 1000** (212 to 284)				
Advising active treatment follow up: range 16 weeks to 12 months	**Study population**		**OR 0.69** (0.48 to 0.99)	1727 (3 RCTs)	⊕⊕◯◯ LOW [3]	
	398 per 1000	**313 per 1000** (241 to 396)				
***The risk in the intervention group** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI). **CI**: Confidence interval; **OR**: Odds ratio						
GRADE Working Group grades of evidence **High quality:** We are very confident that the true effect lies close to that of the estimate of the effect **Moderate quality:** We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different **Low quality**: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect **Very low quality**: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect						

Effect on professional behaviour

Referral behaviour

Figures 3 to 6 show that multifaceted implementation is not more effective than usual care or minimal implementation in improving guideline concordant referral behaviour. The statistical heterogeneity of the pooled studies is high.

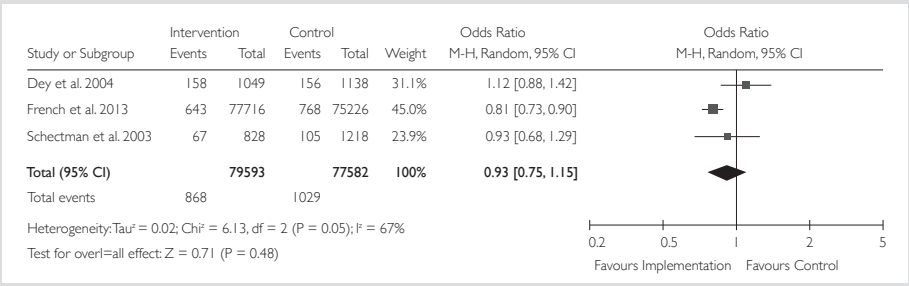

Figure 3. Pooled analysis for referral rates for X-rays (moderate quality evidence)

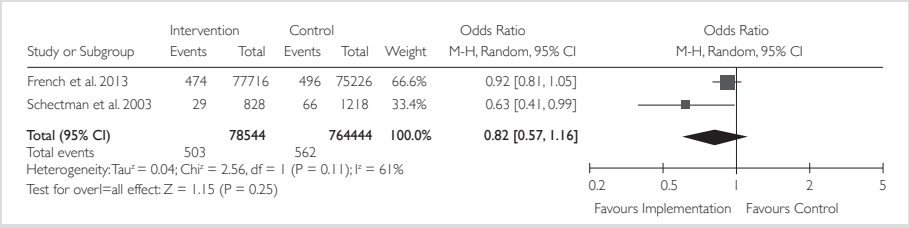

Figure 4. Pooled analysis for referral rates for CT/MRI scans (low quality evidence)

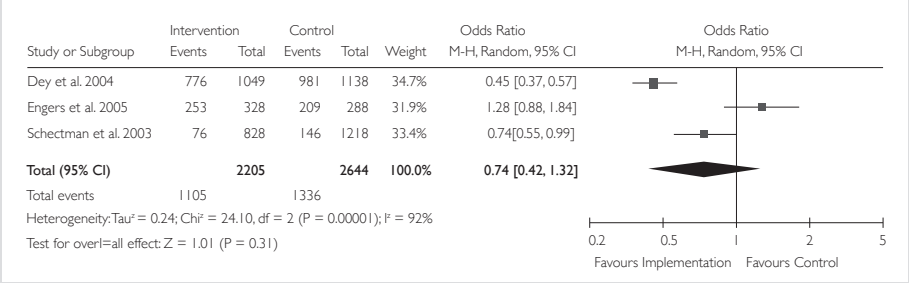

Figure 5. Pooled analysis for referral rates for physiotherapy (very low quality evidence)

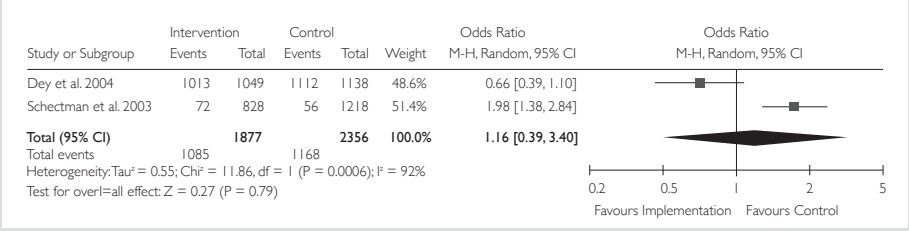

Figure 6. Pooled analysis for referral rates for secondary/specialty care (very low quality evidence)

Treatment behaviour

Figures 7 to 9 show that there is no statistically significant difference between multifaceted implementation and usual care or minimal implementation in providing adequate patient information and prescribing medication. However, active treatment was more often advised in the multifaceted implementation groups than in the control groups (Figure 9, OR 0.69; 95%CI 0.48 to 0.99).

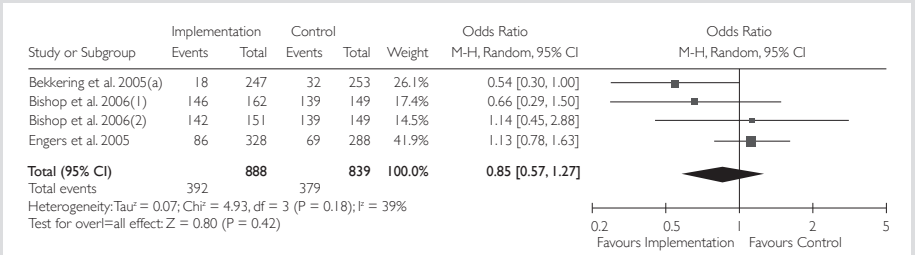

Figure 7. Pooled analysis for the provision of adequate patient information (low quality evidence)

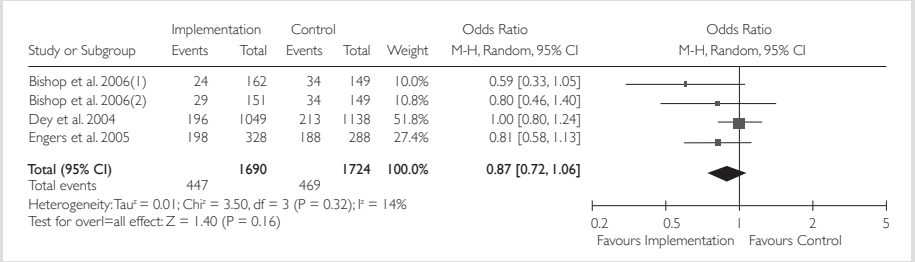

Figure 8. Pooled analysis for medication prescription (low quality evidence)

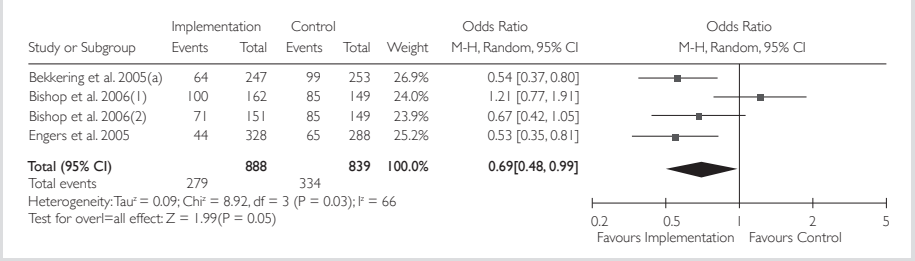

Figure 9. Pooled analysis for advising active treatment (low quality evidence)

Effect on patient outcomes

Table 7 shows the results for patient outcomes at 12 months follow-up. Three studies reported outcomes on patient level [11, 14, 111]. The most common patient outcomes measured

were functional capacity or disability, days of sick leave, and QoL. No significant differences on 12-month follow-up were found for any of these outcomes.

Table 7. Patient outcomes at 12 months follow-up

	Outcome measure		
Study	Functional capacity	Days of sick leave	Quality of life
	Mean (95% CI or SD)		
Becker et al. 2008	*(Hannover Functional Ability Questionnaire; 0-100%)*	*(Median days)*	*(EuroQoL)*
Implementation group 1	72.956 (70.433-75.479)	6.159 (2.453-9.865)	68.456 (66.724-70.189)
Implementation group 2	74.637 (72.205-77.141)	6.458 (2.488-10.428)	70.375 (68.649-72.100)
Control	71.559 (68.963-74.156)	9.271 (5.248-13.294)	67.652 (65.794-69.510)
Bekkering et al. 2005	*(Quebec Back Pain Disability Scale; 0-100)*	*(Median days/previous 6 weeks)*	Not reported
Implementation	17.0 (4.6-32.0)	9.8 (30)	
Control	13.0 (4.8-29.0)	5.0 (15)	
Rebbeck et al. 2006	*(Functional Rating Index; 0-40)*	*(Days off work/past month)*	*(Core Outcome Measure (Whiplash); 1-5)*
Implementation	11.4 (8.9)	0 (0-0)	2 (1-4)
Control	12 (10.4)	0 (0-1)	2 (1-4)

Effect on cost of care

Three studies performed and separately reported a cost-effectiveness analysis for their implementation strategies [12,15,110]. Two of these cost-effectiveness analyses [12,110] showed that multifaceted implementation yielded lower costs and more effects, although these results were not statistically significant. The third study showed no cost or effect advantages for the intervention group compared to the control group.

DISCUSSION

This review showed that multifaceted strategies for the implementation of neck and/or back pain guidelines in health care do not significantly improve professional behaviour outcomes. Only active treatment was more often advised in the multifaceted implementation groups than in the control groups. No effects on patient outcomes or cost of care could be found. These results are not in line with findings from previous research in other fields that showed that active, multifaceted implementation strategies are effective in changing professional behaviour compared to passive dissemination of guidelines or minimal implementation activities.[63-69] However, the results are in line with a more recent and more elaborate overview of systematic reviews, which suggested that multifaceted implementation strategies are not more effective than other strategies.[11]

Few studies that were found in the electronic database search were included in the current review. Many studies were excluded because their interpretations of 'multifaceted' strategies were not in line with the EPOC definition. For example, several studies indicated having applied a multifaceted approach by organising several workshops on multiple occasions. However, all workshops were part of one element, i.e. educational meetings. As according to the EPOC taxonomy an intervention is multifaceted if it applies two or more elements, these strategies did not meet the criteria for being multifaceted.[12] It seems that either the EPOC taxonomy is not often used or that the definition of multifaceted strategies is open to interpretation. Either way, consensus on the definition of 'multifaceted' and application of the taxonomy could improve insight into the effectiveness of multifaceted implementation strategies.

Only 12 articles were identified and included in this study. These studies were not able to produce high quality evidence for changes on professional or patient outcomes in the current review. Only 3 articles reported cost-effectiveness analyses of original studies. These cost-effectiveness studies were evaluated by a recent review by Jensen et al., who showed that the quality of these economic evaluations was moderate, and that the studies, although similar to one another, showed conflicting results on cost-effectiveness.[70] It is advisable that researchers implementing guidelines also include cost-effectiveness in their analyses. Multifaceted implementation strategies can be costly, especially when they are applied to implement guidelines on a national level. The efforts and resources for applying these strategies are only worthwhile if they are effective in improving patient outcomes or quality of care. If these strategies also lead to changes in specific professional behaviour, e.g. less unnecessary health care utilization referrals or medication prescriptions, and advises to return-to-work, the costs of implementation might be offset by the decrease in costs of care.

Of the included studies, only 3 applied a patient-mediated implementation element. Of these 3 studies, only 1 actually measured patient outcomes (11). Two other studies reported patient outcomes, while they had not applied patient-mediated elements. This might be an

explanation for the lack of effect on patient outcomes. Grol and Wensing identified several patient characteristics as possible factors for implementation success.[7] For example, patient attitude and knowledge might pose a barrier for the uptake of changes by professionals. Therefore, when aiming to improve professional practice, applying elements that are targeted at patient-mediated barriers and facilitators might be essential to guideline implementation. This is underlined by the slightly more positive results in the study of Becker et al. [11] compared to the other studies that reported patient outcomes. However, merely applying patient-mediated interventions does not necessarily address patient barriers. It is advisable that these barriers be taken into account when designing implementation strategies.

Regarding the effectiveness of more comprehensive strategies compared to strategies that apply fewer elements, the results from the current review are inconclusive. It seems that more does not always mean better, and multifaceted strategies possibly are only more effective when they apply different elements that are targeted at various barriers and facilitators for change.[71] However, this was not confirmed in our review. A recent review by Mesner et al. suggested that the success of implementation interventions does not necessarily depend on the specific type of interventions, but rather might be determined by the increase of frequency and duration of implementation interventions.[72] There is still a lack of use of theory in implementation research and studies on guideline implementation strategies poorly justify the choice of intervention.[72-73] This is in line with the findings of the current review, in which only 4 studies (partly) based their strategies on theories and also reported on the development of their strategy. This could be one possible explanation for the lack of effective results in these studies.[73] However, for many studies it is unknown whether the implementation strategies were conducted as planned, which might be another factor influencing the effectiveness of the implementation strategies. Process evaluations are necessary to gain more insight into this factor, however of the included studies in this review, only one study performed a process evaluation [19], and reported moderato to high levels of fidelity.[74]

Strengths and limitations of this study

When interpreting the results of the current review, some limitations should be taken into account. Firstly, this review did not search for unpublished studies. Also, due to the amount of synonyms for the term 'Implementation' included in the search strategy, it might be possible that some studies were missed during the search phase. Furthermore, all but 2 studies were published before 2007, and the quality of the evidence found in these studies was very low to moderate, according to the GRADE assessment performed in the current review. Another important limitation is the comparability of the studies. Not only did the studies apply various implementation strategies, usual dissemination in the control groups also varied. Besides, there was wide variation in the outcomes that were measured, how they were measured, and how they were reported. In the meta-analyses the statistical heterogeneity was large, and results should therefore be interpreted with caution. For example, one study where the control

group did not receive any implementation strategy was compared with a study in which the control group received a patient-mediated implementation strategy. Other reasons for heterogeneity might be clinical (e.g. due to different settings and patients) or statistical (e.g. different study sizes). No sensitivity analyses were performed due to the small number of studies that could be included in the meta-analyses, and notwithstanding the high statistical heterogeneity found in these analyses as expressed by the I^2 measures, these analyses might give an insight into the effect directions of the included studies.

By following the method guidelines for systematic reviews as posed by the Cochrane Back Review Group, and the Cochrane Handbook for Systematic Reviews of Interventions, the current review pursued the highest methodological quality.[12, 75] By applying a broad and comprehensive search strategy and supplementary hand search of reference lists of included studies, this review ensured that as few as possible eligible studies were missed. To further minimize this chance, no language restrictions were applied during the inclusion and data collection phases.

CONCLUSION

This review showed that multifaceted strategies for the implementation of neck and/or back pain guidelines in health care do not significantly improve professional behaviour outcomes. Only active treatment was more often advised in the multifaceted implementation groups than in the control groups. No effects on patient outcomes or cost of care could be found.

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APPENDICES

Appendix 1. Full electronic database searches

Medline (Pubmed):

1. Neck pain OR back pain

"Neck Pain"[Mesh] OR "Neck Injuries"[Mesh] OR "Back Pain"[Mesh] OR ((neck[mesh] OR neck[tiab] OR cervical*[tiab] OR cervico*[tiab] OR neck[ot] OR cervical*[ot] OR cervico*[ot] OR back[mesh] OR back[tiab] OR vertebr*[tiab] OR intervertebral disk*[tiab] OR back[ot] OR vertebr*[ot] OR "Spine"[Mesh] OR spine[tiab] OR spinal[tiab] OR spine[ot] OR spinal[ot] OR intervertebral disk*[ot]) AND (pain[mesh] OR pain*[tiab] OR complaint*[tiab] OR ache*[tiab] OR disorder*[tiab] OR syndrome*[tiab] OR injury[tiab] OR injuries[tiab] OR pain*[ot] OR complaint*[ot] OR ache*[ot] OR disorder*[ot] OR syndrome*[ot] OR injury[ot] OR injuries[ot])) OR whiplash*[tiab] OR neckache*[tiab] OR mnd[tiab] OR WAD*[tiab] OR backache*[tiab] OR lbp[tiab] OR sciatica[tiab] OR lumbago[tiab] OR whiplash*[ot] OR neckache*[ot] OR mnd[ot] OR WAD*[ot] OR backache*[ot] OR sciatica[ot] OR lumbago[ot]

2. Implementation

"Health Plan Implementation"[Mesh] OR implement*[tiab] OR implement*[ot]

Embase:

1. Neck pain OR back pain

'neck pain'/exp OR 'neck injury'/exp OR 'backache'/exp OR whiplash*:ab,ti OR neckache*:ab,ti OR mnd:ab,ti OR WAD*:ab,ti OR backache*:ab,ti OR lbp:ab,ti OR sciatica:ab,ti OR lumbago:ab,ti OR (('neck'/exp OR neck:ab,ti OR cervical*:ab,ti OR cervico*:ab,ti OR 'back'/exp OR back:ab,ti OR vertebr*:ab,ti OR (intervertebral NEAR/3 disk*):ab,ti OR 'spine'/exp OR spine:ab,ti OR spinal:ab,ti) AND ('pain'/exp OR pain*:ab,ti OR complaint*:ab,ti OR ache*:ab,ti OR disorder*:ab,ti OR syndrome*:ab,ti OR injury:ab,ti OR injuries:ab,ti))

2. Implementation

'health care planning'/exp OR implement*:ti,ab

PsycINFO:

1. Neck/back pain

DE "Back Pain" OR DE "Whiplash"

OR

TI (whiplash* OR neckache* OR mnd OR WAD* OR backache* OR lbp OR sciatica OR lumbago) OR AB (whiplash* OR neckache* OR mnd OR WAD* OR backache* OR lbp OR sciatica OR lumbago)

OR

(DE "Neck (Anatomy)" OR DE "Back (Anatomy)" OR DE "Spinal Column") OR TI ((neck OR cervical* OR cervico* OR back OR vertebr* OR spine OR spinal OR "intervertebral disk" OR "intervertebral disks") OR AB ((neck OR cervical* OR cervico* OR back OR vertebr* OR spine OR spinal)

AND

(DE "Pain" OR DE "Aphagia" OR DE "Back Pain" OR DE "Chronic Pain" OR DE "Neuralgia" OR DE "Neuropathic Pain" OR DE "Somatoform Pain Disorder") OR TI (pain* OR complaint* OR ache* OR disorder* OR syndrome* OR injury OR injuries) OR AB (pain* OR complaint* OR ache* OR disorder* OR syndrome* OR injury OR injuries)

2. Implementation

TI implement* OR AB implement*

Continued Appendix 1. Full electronic database searches

Cochrane Library
1. Neck pain OR back pain
whiplash* OR neckache* OR mnd OR WAD* OR backache* OR lbp OR sciatica OR lumbago OR ((neck OR cervical* OR cervico* OR back OR vertebr* OR "intervertebral disk" OR "intervertebral disks" OR Spine OR spinal) AND (pain* OR complaint* OR ache* OR disorder* OR syndrome* OR injury OR injuries))
2. Implementation
implement*

Cinahl (Ebsco)
1. Neck/back pain
((MH "Back Pain+") OR (MH "Neck Pain") OR (MH "Whiplash Injuries")) OR TI ((whiplash* OR neckache* OR mnd OR WAD* OR backache* OR lbp OR sciatica OR lumbago) OR AB ((whiplash* OR neckache* OR mnd OR WAD* OR backache* OR lbp OR sciatica OR lumbago)
OR
((MH "Neck") OR (MH "Back")) OR TI (neck OR cervical* OR cervico* OR back OR vertebr* OR spine OR spinal OR "intervertebral disk" OR "intervertebral disks) OR AB (neck OR cervical* OR cervico* OR back OR vertebr* OR spine OR spinal OR "intervertebral disk" OR "intervertebral disks) AND
(MH "Pain") OR TI (pain* OR complaint* OR ache* OR disorder* OR syndrome* OR injury OR injuries) OR AB (pain* OR complaint* OR ache* OR disorder* OR syndrome* OR injury OR injuries)
2. Implementation
(MH "Program Implementation") OR TI implement* OR AB implement*

Appendix 2. Data sources and calculations for meta-analyses

Referral for X-ray:
- Dey et al. 2004; Table 3: Number of x-ray referrals in intervention and control group;
- French et al. 2013; Table 7: Number of x-ray referrals in intervention and control group;
- Schectman et al. 2003; Table 2: Number of not guideline consistent x-ray referrals in intervention year for intervention group (= group 'clinician intervention only' + group 'patient/clinician intervention': n patients in study year only) and control group (= group 'control group'+ group 'patient intervention only': n patients in study year only): Intervention: 8.1*828/100=67 / Control: 8.6*1218/100=105.

Referral for CT/MRI scan:
- French et al. 2013; Table 7: Number of CT referrals in intervention and control group;
- Schectman et al. 2003; Table 2: Number of CT or MRI referrals in intervention year for intervention group (= group 'clinician intervention only' + group 'patient/clinician intervention': n patients in study year only) and control group (= group 'control group'+ group 'patient intervention only': n patients in study year only): Intervention: 3.5*828/100=29 / Control: 5.4*1218/100=66.

Referral for PT:
- Dey et al. 2004; Table 3: Number of PT/educational programme referrals in intervention and control group. Reported as number referred, for analysis converted to number not reffered: Intervention: 1049-273=776 / Control: 1138-157=981;
- Engers et al. 2005; Table 3: Number of therapist referrals in intervention group and control group for All consultations. Reported as number referred, for analysis converted to number not reffered: Intervention: 328-75=253 / Control: 288-79=209;
- Schectman et al. 2003; Table 2: Number of PT referrals not consistent with guideline in intervention year for intervention group (= group 'clinician intervention only' + group 'patient/clinician intervention': n patients in study year only) and control group (= group 'control group'+ group 'patient intervention only': n patients in study year only): Intervention: 9.2*828/100=76 / Control: 12*1218/100=146.

Referral for specialty/secondary care:
- Dey et al. 2004; Table 3: Number of secondary care referrals in intervention and control group (Table 3). Reported as number referred, for analysis converted to number not referred: Intervention: 1049-273=776 / Control: 1138-157=981;
- Schectman et al. 2003; Table 2: Number of specialty referrals not consistent with guideline in intervention year for intervention group (= group 'clinician intervention only' + group 'patient/clinician intervention': n patients in study year only) and control group (= group 'control group'+ group 'patient intervention only': n patients in study year only):
Intervention: 7.1*828/100=59 / Control: 5.6*1218/100=68.

Provision of adequate patient information (i.e. reassuring & explaining)
- Bekkering et al. 2005(a); Table 3: Number of patients to whom adequate information is given in intervention and control group. Reported as number adequate, for analysis converted to number inadequate: Intervention: 247-229=18 / Control: 253-221=32.
- Bishop et al. 2006(1); Figure 2A: Percentage guideline concordant education & reassurance for intervention group 2 (implementation arm 1) and control group. Reported as guideline concordant, for analysis converted to guideline disconcordant: Intervention: 90*162/100=146 / Control: 93*149/100=139.

Continued Appendix 2. Data sources and calculations for meta-analyses

- Bishop et al. 2006 (2); Figure 2A: Percentage guideline concordant education & reassurance for intervention group 3 (implementation arm 2) and control group. Reported as guideline concordant, for analysis converted to guideline disconcordant: Intervention: 94*151/100=142 / Control: 93*149/100=139.
- Engers et al. 2005; Table 4: Percentages of submeasures (explained no specific cause, explained pain will ease, explained no harm, explained to accept pain) of general information provided for intervention and control group for All consultations. Mean of submeasure patient numbers calculated for analysis. Reported as number of patients to whom it is provided, for analysis converted to number of patients to whom it is not provided: Intervention: 214+274+270+209=927, 927/4=242, 328-242=86 / Control: 238+246+212+180=876, 876/4=219, 288-219=69

Medication prescription
- Bishop et al. 2006(1); Figure 2A: Percentage guideline concordant appropriate medication for intervention group 2 (implementation arm 1) and control group. Reported as guideline concordant, for analysis converted to guideline disconcordant: Intervention: 15*162/100=24 / Control: 23*149/100=34.
- Bishop et al. 2006 (2); Figure 2A: Percentage guideline concordant appropriate medication for intervention group 3 (implementation arm 2) and control group. Reported as guideline concordant, for analysis converted to guideline disconcordant: Intervention: 19*151/100=29 / Control: 23*149/100=34.
- Dey et al. 2004; Table 3: Percentage prescribed opioids or muscle relaxants for intervention and control groups.
- Engers et al. 2005; Table 3: Prescription of pain medication (general) for intervention and control groups for All consultations.

Advising active treatment
- Bekkering et al. 2005; Table 3: Number used mainly active interventions for intervention and control group. Reported as number adequate, for analysis converted to number inadequate: Intervention: 247-183= 64 / Control: 253-154=99.
- Bishop et al. 2006(1); Figure 2A: Percentage guideline concordant exercise for intervention group 2 (implementation arm 1) and control group. Reported as guideline concordant, for analysis converted to guideline disconcordant: Intervention: 62*162/100=100 / Control: 57*149/100=85.
- Bishop et al. 2006 (2); Figure 2A: Percentage guideline concordant exercise for intervention group 3 (implementation arm 2) and control group. Reported as guideline concordant, for analysis converted to guideline disconcordant: Intervention: 47*151/100=71 / Control: 57*149/100=85.
- Engers et al. 2005; Table 4: Percentages of submeasures (advised to stay active, advise to gradually increase activity) of activating information provided for intervention and control group for All consultations. Mean of submeasure patient numbers calculated for analysis. Reported as number of patients to whom it is provided, for analysis converted to number of patients to whom it is not provided: Intervention: 312+256=568, 568/2=284, 328-284=44 / Control: 257+188=445, 445/2=223, 288-223=65.

Appendix 3. List of excluded studies and reasons for exclusion

Study ID	Excluded study	Reason for exclusion
E1	Ammendolia et al. 2004	Not RCT
E2	Bussières et al. 2010	Not non-specific LBP/NP
E3	Bekkering et al. 2005	Duplicate publication: Dutch summary of published results (results included in this review)
E4	Cherkin et al. 1991	Not multifaceted
E5	Cunningham et al. 2008	Not RCT; Not guideline implementation in health care setting
E6	Taramona Espinoza et al. 2012	Not RCT; Not guideline implementation in health care setting; abstract
E7	Evans et al. 2005	Not multifaceted; study protocol
E8	Fleuren et al. 2010	Not non-specific LBP/NP; Not RCT
E9	Jensen et al. 2014	Study protocol of economic evaluation
E10	Lang et al. 2002	Not RCT
E11	McKenzie et al. 2008	Not multifaceted; study protocol
E12	McKenzie et al. 2010	Study protocol
E13	Mortimer et al. 2008	Not multifaceted; study protocol for economic evaluation of study E11
E14	Rasmussen 2002	Not RCT; Not non-specific LBP/NP; Not guideline implementation in health care setting
E15	Rebbeck et al. 2006	Not guideline implementation in health care setting; Not RCT, Not multifaceted
E16	Rebbeck et al. 2011	Not RCT; Not guideline implementation in health care setting; abstract
E17	Rebbeck et al. 2013	Not RCT
E18	Rebbeck et al. 2013	Not RCT; Not multifaceted
E19	Richings et al. 2011	Not multifaceted, Not RCT; Not guideline implementation in health care setting; abstract
E20	Riis et al. 2013	Study protocol
E21	Rossignol et al. 2000	Not guideline implementation in health care setting
E22	Rutten et al. 2011	Not RCT; Not multifaceted; poster
E23	Rutten et al. 2014	Not RCT; Not guideline implementation in health care setting
E24	Sandner-Kiesling et al. 2009	Not multifaceted; abstract
E25	Shenoy 2013	Not peer-reviewed (dissertation)
E26	Slater et al. 2014	Not RCT
E27	Stiell et al. 2009	Not guideline implementation in health care setting
E28	Suman et al. 2015	Study protocol
E29	Tracey et al. 1994	Not RCT; Not multifaceted
E30	Twomey e2003	Not RCT; Not non-specific LBP/NP
E31	Van Dulmen et al. 2014	Not multifaceted