

Effectiveness of strategies for implementing guideline-concordant care in low back pain: a systematic review and meta-analysis of randomised controlled trials



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Summary

Background International low back pain guidelines recommend providing education/advice to patients, discouraging routine imaging use, and encouraging judicious prescribing of analgesics. However, practice variation occurs and the effectiveness of implementation strategies to promote guideline-concordant care is unclear. This review aims to comprehensively evaluate the effectiveness of implementation strategies to promote guideline-concordant care for low back pain.

Methods Five databases (including MEDLINE, Embase, CINAHL, CENTRAL and PEDro) were searched from inception until 22nd August 2024. Randomised controlled trials (RCTs) that evaluated strategies to promote guideline-concordant care (providing education/advice, discouraging routine imaging use, and/or reducing analgesic use) among healthcare professionals or organisations were included. Two reviewers independently conducted screening, data extraction, and risk of bias assessments. The primary outcome was guideline-concordant care in the medium-term (>3 months but <12 months). The taxonomy recommended by the Cochrane Effective Practice and Organisation of Care (EPOC) group was used to categorise implementation strategies. Meta-analysis with a random-effects model was conducted where possible. This systematic review was prospectively registered in PROSPERO (registration number: CRD42023452969).

Findings Twenty-seven RCTs with 32 reports were included. All strategies targeted healthcare professionals (7796 health professionals overseeing 34,890 patients with low back pain), and none targeted organisations. The most commonly used implementation strategies were educational materials (15/27) and educational meetings (14/27), although most studies (24/27) used more than one strategy ('multifaceted strategies'). In the medium-term, compared to no implementation, implementation strategies probably reduced the use of routine imaging (number of studies [N] = 7, odds ratio [OR] = 1.26, 95% confidence interval [CI]: 1.01–1.58, $I^2 = 50%$, moderate certainty evidence), but made no difference in reducing analgesic use (N = 4, OR = 1.05, 95% CI: 0.96–1.14, $I^2 = 0%$, high certainty evidence). Further, implementation strategies may make no difference to improve the rate of providing education/advice (N = 3, OR = 1.83, 95% CI: 0.87–3.87, $I^2 = 95%$, low certainty evidence), but this finding should be interpreted with caution because the sensitivity analysis showed a weak positive finding indicating unstable results that are likely to change with future research (N = 2, OR = 1.18, 95% CI: 1.04–1.35, $I^2 = 0%$, moderate certainty evidence). No difference was found when comparing one implementation strategy to another in the medium-term.

Interpretation Implementing guideline recommendations delivered mixed effects in promoting guideline-concordant care for low back pain management.

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Keywords: Low back pain; Implementation strategy; Guideline-concordant care

Research in context

Evidence before this study

It is unclear to what extent implementation strategies can promote guideline-concordant care in low back pain. Previous systematic reviews have provided conflicting results on the effectiveness of strategies to implement recommendations from low back pain guidelines. The latest systematic review on this topic was published in 2016, synthesising studies published up to 2015.

Added value of this study

This review comprehensively evaluated the effectiveness of implementation strategies for three core guideline recommendations in the management of low back pain: providing education/advice, discouraging routine imaging use

and reducing analgesic use. Twenty-seven randomized controlled trials were included, of which twenty were not featured in the most recent 2016 systematic review on this topic, and twelve were published after its 2015 search. Through a meta-analysis, our findings suggested that implementation strategies discouraged routine imaging use but did not improve the provision of patient education/advice or reduce analgesic use compared to no implementation in the medium-term (between 3 and 12 months).

Implications of all the available evidence

Implementation strategies may improve healthcare professional adherence to some guideline-concordant practices in the management of low back pain.

Introduction

Globally, low back pain is highly prevalent and a leading cause of disability.¹ Clinical practice guidelines serve as important resources to improve the quality of care for low back pain by synthesising and appraising existing evidence, and providing recommendations for evidence-informed management.²⁻⁴ However, a time lag exists in the translation of evidence into practice⁵ and in many cases, the management of low back pain is inconsistent with guideline-concordant care.⁶

International guidelines, such as ones from the World Health Organization, Europe, United States of America and Australia, present similar core recommendations for managing low back pain, including providing education/advice to patients, discouraging routine imaging use, and reducing analgesic use, such as opioids.⁶⁻⁹ Such recommendations are informed by evidence demonstrating that education/advice can provide small, short-term improvements in pain management,¹⁰ and routine imaging does not confer clinical benefits yet can prolong recovery in patients with non-specific low back pain.^{11,12} Further, guidelines are shifting from a focus on analgesic to non-analgesic treatments, due to the limited evidence of efficacy and risk of harm associated with many analgesics.^{6,13-17}

Despite the consistency of recommendations for the management of low back pain across international guidelines, there is variation in the care provided in practice.¹⁸ Guideline implementation involves the use of strategies aimed to facilitate uptake, use or adoption of guideline-concordant care, change healthcare professionals' behaviours and improve patient outcomes.^{3,19-22} Previous research has shown that the use of implementation strategies by guideline developers may increase the uptake of clinical practice guidelines, compared to

passive dissemination.¹⁹ However, for low back pain, current evidence to support the effectiveness of guideline implementation strategies is limited and findings from systematic reviews on this topic are inconsistent.^{4,23-27} Considering that implementation research is a rapidly evolving area, and a number of implementation studies in low back pain have been published^{28,29} since the last systematic review on this topic in 2016,^{4,24} an up-to-date systematic review with meta-analysis is warranted.

This systematic review aimed to comprehensively evaluate the effectiveness of implementation strategies for improving the uptake of one or more of three guideline recommendations for the management of low back pain: providing education/advice, discouraging routine imaging use, and/or reducing analgesic use. This review hypothesised that implementing low back pain guideline recommendations would promote guideline-concordant care among healthcare professionals and organisations.

Methods

The systematic review was performed in accordance with the Cochrane Handbook for Systematic Reviews of Interventions version 6.3 (updated February 2022)³⁰ and methods proposed by the EPOC group.^{31,32} The results were reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.³³ The review was prospectively registered on PROSPERO (CRD42023452969).³⁴

Information sources and search strategy

A comprehensive literature search was performed by a reviewer (S.Z.) in the following electronic databases

from inception to the 22nd of August 2024: MEDLINE (Via Ovid), Embase (Via Ovid), Cumulative Index to Nursing and Allied Health Literature (CINAHL) (Via EBSCO), Cochrane Central Register of Controlled Trials (CENTRAL) and Physiotherapy Evidence Database (PEDro). A University of Sydney librarian was consulted to develop the search strategy containing three aspects: 1) the search filter of randomised controlled trials published by the Cochrane Collaboration,³⁵ 2) a combination of index terms and phrases on low back pain developed by the Cochrane Back and Neck Group in January 2013,³⁶ 3) and a combination of index terms and phrases on guideline implementation from a Cochrane systematic review.¹⁹ The search strategy was initially constructed in the Medline database, and then modified for other databases ([Appendix 1](#)). In accordance with EPOC guidance,³² grey literature was retrieved through the OpenGrey and the Grey Literature Report. Incomplete or ongoing trials were additionally searched through the International Clinical Trials Registry Platform (ICTRP). Forward and backward citation searching was performed using the SCOPUS database.³⁷ There were no language or publication restrictions.

Eligibility criteria

All randomised controlled trials (RCTs) were considered eligible if they used any implementation strategy to promote uptake of at least one of the three guideline recommendations of interest: providing education/advice, discouraging routine imaging use, and reducing analgesic use. Studies with implementation strategies targeting healthcare professionals or organisations within any healthcare setting were included. Studies that targeted both healthcare professionals and patients (e.g., mixed population) were eligible, while those targeting only on patients, consumers, the general public, or healthcare professional trainees/students were excluded. Studies did not need to exclusively include patients with non-specific low back pain; studies with mixed patient populations were also included if outcomes of the sub-group of patients with non-specific low back pain were reported. The comparator group of eligible RCTs used either: 1) no implementation strategy (no implementation interventions, or 'treatment as usual' defined by each included study), or 2) an alternative implementation strategy (including light touch, single or multifaceted implementation interventions).

Study selection

All retrieved records were imported into Covidence for screening, then duplicates were removed. Each record was screened independently and in duplicate by two of five reviewers (S.Z., A.V.L., M.L., Z.Y., and C.W.C.L.), by title and abstract, then by full text. Disagreements were resolved after discussion between reviewers.

Outcomes

The primary outcome was guideline-concordant care, measured by the rate of patients receiving education/advice, imaging requests (including total imaging requests and requests for X-ray, magnetic resonance imaging (MRI) and computed tomography (CT)), and analgesic use (measured by prescription, dispensing or consumption). Secondary outcomes were healthcare professionals' knowledge and beliefs (measured by knowledge questionnaires or scales on attitudes and belief, e.g., Neurophysiology of Pain Questionnaire (NPQ)), patient-reported pain intensity (measured by self-reported scales, e.g., Numeric Pain Rating Scale (NPRS)), physical function (measured by self-reported scales, e.g., Oswestry Disability Index (ODI)) and adverse events (measured by proportions (%) of patients reporting an adverse event, e.g., presence of adverse events: yes/no). All data was grouped into three time-points: short-term (≤ 3 months), medium-term (>3 months but <12 months), and long-term (≥ 12 months). The medium term was the primary time point of interest. If an included study reported outcomes at multiple time points, we used the time point that was the closest to 3 months and 6 months for short- and medium-term and used the longest available time point for the long-term outcome.

Data extraction

The modified EPOC data extraction form was tailored for data extraction.³¹ Data were independently extracted by two of five reviewers (S.Z., A.V.L., Q.C., M.L., and C.W.C.L.). When extracting data, all reports from the same study were linked. Discussion among reviewers were used to settle any discrepancies. The following information was extracted: 1) study information: study design (e.g., parallel), first author, year of publication, country of origin, and clinical setting. 2) participants characteristics: population description, sample size, the total number of participants randomised, age, and sex. 3) implementation strategy used in the intervention and comparator group: type (grouped by a taxonomy developed by the EPOC group³⁸ or by consensus between reviewers if the EPOC taxonomy was not applicable. Definitions of each strategy described in [Supplementary Table S1](#)), format (e.g., written, electronic or verbal), mode (e.g., internet-based, face-to-face, electronic-based or paper-based), strategy provider and recipient, and duration. 4) outcome data. In addition, data was extracted on how implementation strategies were developed based on feedback from a consumer advisory group. This was added to the protocol after registration.

Risk of bias assessment

Studies were assessed by two independent reviewers (S.Z. and Q.C.) using the Cochrane risk of bias tool.³⁹ Six domains (sequence generation, concealment of

allocation, blinded or objective assessment of main outcome(s), incomplete outcome data, selective outcome reporting and other potential sources of bias) were evaluated, with each domain's overall risk of bias being rated as either high, moderate, or low. Disagreements were solved by discussion among the two reviewers, then, if necessary, arbitration by a third, independent reviewer.

Assessment of the certainty of the evidence

The certainty of the evidence was assessed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach.⁴⁰ Two independent reviewers (S.Z. and Q.C.) rated the certainty of the evidence based on consideration of five domains: risk of bias, inconsistency, indirectness, imprecision and publication bias (Appendix 2). The overall certainty of evidence was assessed for all outcomes and categorised the certainty of evidence as high, moderate, low, very low or no evidence. The assessment was performed using GRADEpro.

Statistics

Characteristics and implementation strategies of included studies were reported descriptively. For outcome data, where possible, we conducted a random-effects meta-analysis using the RevMan 5.4 software. Mantel-Haenszel (M-H) method of meta-analysis was used for dichotomous data and Inverse Variance (IV) method was used for continuous data. Heterogeneity among study findings was assessed using I^2 statistic (ranging from 0 to 100%). Pooled effects were expressed of dichotomous variables as odds ratios (ORs) and 95% confidence intervals (CIs), or continuous variables as mean differences (MDs) and CIs. If the statistical heterogeneity was large ($I^2 > 50\%$), sensitivity analyses were used to examine the sources of heterogeneity by excluding one study at a time in the primary results at the primary time-point.⁴¹ For pain, we converted continuous pain intensity scales to a common 0 to 10 scale,^{42,43} and physical function scales to a 0 to 100 scale.^{44,45}

Studies were categorised based on the guideline recommendation (providing education/advice, discouraging routine imaging use, reducing analgesic use, or a combination of recommendations if more than one was implemented), and time-points (short-term, medium-term, or long-term). For studies implementing strategies to discourage routine imaging use, subgroup analysis was conducted by the type of imaging (X-ray or MRI/CT scan).

In order to answer whether implementing guideline-concordant care was effective, implementation strategies were compared to no implementation strategy, regardless of the type of implementation strategies used. Additionally, one strategy was compared to another in order to assess the comparative effectiveness of the

strategies. In this case, for studies that compared two implementation strategies (either isolated or combinations of them), the group with fewer strategies was designated as the comparator.

Ethics

No ethical approval was required as this review used publicly available data.

Role of funding source

No funding was received for this specific review.

Results

Characteristics of included studies

A total of 10,762 records were identified in our search with 8273 records for screening after removing the duplicates. Following screening, 27 studies (including 32 study reports) with implementation strategies targeting 7796 healthcare professionals (overseeing 34,890 patients with low back pain) were included (Fig. 1).^{28,29,46-75} No study investigated strategies targeted at the organisational level. Studies were conducted in 10 countries, and three different settings (e.g., primary care (including community-based and hospital-based), emergency department, and chiropractic and physiotherapy clinics). Of the 27 studies, 17 studies implemented one guideline recommendation (six on providing education/advice,^{46,48,54,57,62,74} and 11 on discouraging routine imaging use),^{28,52,55,58,60,61,63,66,68,71,73} nine implemented two,^{29,49,50,53,56,65,67,69,72} and one implemented all three recommendations.⁵¹ Twenty-four studies^{29,46,48-58,60,61,63,66-69,71-74} implemented specific guidelines, published between 1990 and 2018, while three^{28,62,65} did not specify the guideline but implemented care that was concordant with the recommendations of interest. Characteristics of the included studies are described in Supplementary Table S2.

Characteristics of implementation strategies

The most commonly used strategies were educational materials (15/27), educational meetings (14/27) and audit and feedback (9/27). Almost all studies (24/27) used more than one strategy (Table 1). Most (81%) of the included studies used implementation strategies delivered in a written format and 44% used verbal formats. The delivery modes of the implementation strategies in 24 studies (89%) were paper-based and in 16 (59%) were face-to-face. The recipients of the implementation strategy were general practitioners in 17 studies (63%). 56% of included studies described how the implementation strategies were developed, of these, the implementation strategies were developed with low back pain patients in two studies,^{50,58} and healthcare professionals or researchers in 10 studies.^{29,48,50,52,56-58,68,69,72} Seven studies^{29,50,51,55,56,58,69} reported using frameworks or models to inform strategy development. Details of the

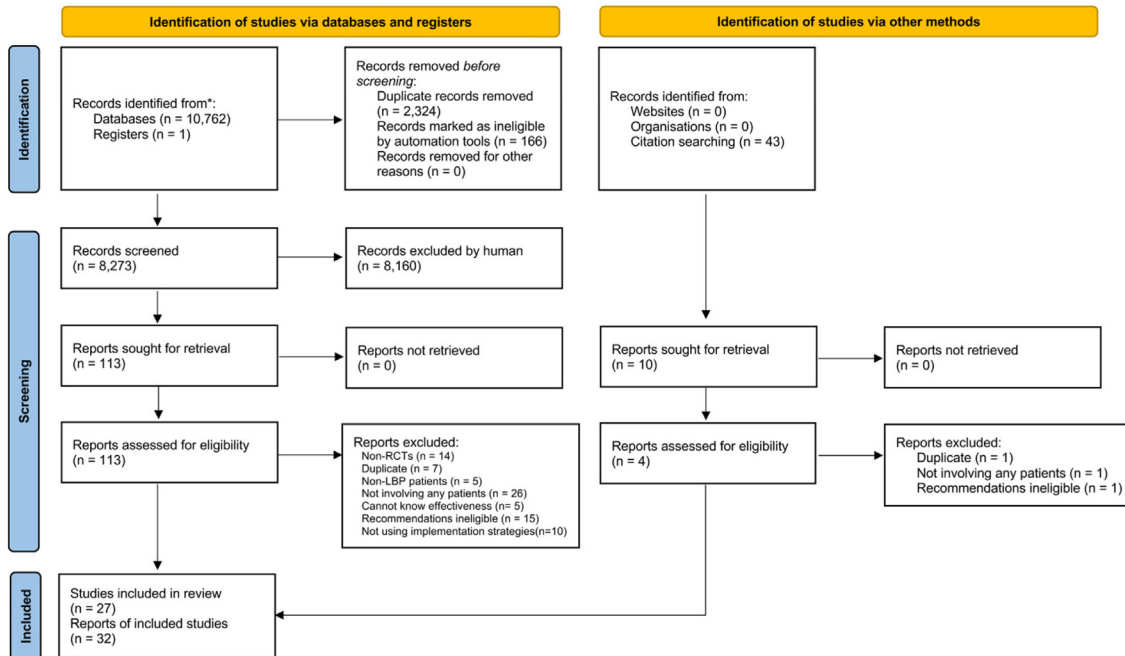


Fig. 1: PRISMA flow chart.

Implementation strategy	Becker 2008 ⁴⁶	Bekkering 2005 ⁴⁷ , 48	Bishop 2006 ⁴⁹	Cooms 2021 & Jones 2023 ⁵⁰ , 59*	Dey 2004 ⁵¹	Eccles 2001 & Ramsay 2003 ⁵² , 64	Engers 2005 ⁵³	Evans 2010 ⁵⁴	Fenton 2016 ⁵⁵	French 2013 ⁵⁶	French 2022 ²⁹	Henrotin 2011 ⁵⁷	Jenkins 2022 ⁵⁸	Kerry 2000 ⁶⁰	Kullgren 2018 ⁶¹	Lane 2022 ⁶²	O'Connor 2022 ²⁸	Oakeshott 1994 ⁶³	Rhon 2021 ⁶⁵	Robing 2002 ⁶⁶ , #	Rossignol 2000 ⁶⁷	Schechtman 2003 ⁶⁸	Schröder 2020 & 2021 & 2022 ⁶⁹ , 70, 75	Simola 2021 ⁷¹	Soon 2018 ⁷²	Suman 2018 ⁷³	van Duijnen 2014 ⁷⁴		
Educational materials	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Educational meetings	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Distributing clinical practice guidelines	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Audit and feedback	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Educational outreach visits, or academic detailing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Patient-mediated interventions	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Reminders	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Tailored interventions	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Monitoring the performance of the delivery of healthcare	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Inter-professional education	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Local opinion leaders	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Routine patient-reported outcome measures	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Communities of practice	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

The definition of each strategy is provided in [Supplementary Table S1](#). [‡]The study included a strategy that cannot be classified by EPOC taxonomy, which was provision of alternatives more easily accessible to healthcare professionals. [#]The study included a strategy that cannot be classified by EPOC taxonomy, which was a facilitation-based approach aimed at optimizing clinical workflows for imaging requests.

Table 1: Strategies used in the included studies.

implementation strategies of included studies are presented in [Supplementary Table S2](#).

Risk of bias and GRADE

[Supplementary Figure S1](#) presents the risk of bias assessment. In general, studies performed well in attrition bias and selection bias, but nine studies had high, and 14 studies had unclear bias for blinding of participants and personnel. The GRADE assessment and summary of findings are shown in [Supplementary Table S3](#). Publication bias analysis using a funnel plot was not performed due to the low number of studies included for each primary outcome analysis.

Primary outcomes on guideline-concordant care

Providing education/advice

Twelve studies^{29,46–49,51,53,54,56,57,62,69,74} with 2204 healthcare professionals (overseeing 6971 patients and 7161 cases of consultation) were included. Studies used multifaceted (N = 11)^{29,46,48,49,51,53,54,56,62,69,74} or single strategies (N = 1)⁵⁷ compared against no strategy (N = 7)^{49,51,53,54,57,62,69} or another strategy (N = 5).^{29,46,48,56,74}

Implementation strategy versus no strategy. Implementation strategies focused on education (combination of educational materials and educational meetings, etc) did not improve the rate of providing education/advice in the medium-term compared to no implementation strategy (N = 3, OR = 1.83, 95% CI: 0.87–3.87, I² = 95%, low certainty evidence) ([Fig. 2](#), see [Supplementary Table S2](#) for implementation strategies used by each study). In the short-term, similar results of no improvement were seen. No study investigated long-term outcomes ([Supplementary Figure S2](#)).

Implementation strategy versus alternative strategy.

No study compared an implementation strategy to another strategy in the medium-term. Implementation strategy (multifaceted) did not improve the rate of providing education/advice in the short-term compared to single strategy ([Supplementary Figure S2](#)). In the long

term, one study⁵⁶ showed that one implementation strategy (educational meetings and barrier and enabler-based tailored interventions) improved the provision of education/advice compared to an alternate strategy (distributing clinical practice guidelines) (N = 1, OR = 3.71, 95% CI: 2.25–6.13). ([Supplementary Figure S2](#)).

Discouraging routine imaging use

Nineteen studies^{28,29,50–52,55,56,58,60,61,63,65–69,71–73} with 5202 healthcare professionals (overseeing 31,852 patients and 56,312 cases of consultation) were included. Studies used multifaceted (N = 17)^{29,50–52,55,56,58,60,61,65–67,69,71,73,76,77} and/or single strategies (N = 3)^{63,66,72} compared to no strategy (N = 13)^{28,50,51,58,60,61,63,65,67–69,71,73} or another strategy (N = 6).^{29,52,55,56,66,72}

Implementation strategy versus no strategy. Implementation strategies (combination of educational materials and educational meetings, etc) discouraged routine imaging use from healthcare professionals compared to no strategy in the medium-term. (N = 7, OR = 1.26, 95% CI: 1.01 to 1.58, I² = 50%, moderate certainty evidence) ([Fig. 3](#), see [Supplementary Table S2](#) for implementation strategies used by each study). Similar results were seen in the short-term, but not in the long-term ([Supplementary Figure S3](#)).

Implementation strategy versus alternative strategy. No between-group difference was found when one implementation strategy (combination of audit and feedback, educational materials and educational meetings, etc) was compared to another strategy (combination of educational materials, distributing clinical practice guidelines and reminders) at any time-point ([Fig. 3](#), and [Supplementary Figure S3](#)).

Subgroup analysis by the type of imaging. In a pre-specified subgroup analysis, implementation strategies did not reduce the routine use of X-rays (N = 3, OR = 0.97, 95% CI: 0.57–1.66, I² = 0%, moderate certainty evidence) or MRI/CT scans (N = 4, OR = 1.03, 95% CI: 0.60–1.76, I² = 42%, moderate certainty

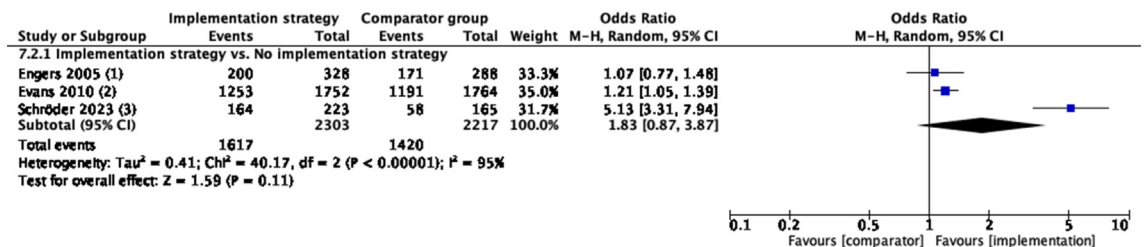


Fig. 2: Guideline-concordant care on providing education/advice in medium-term, compared with no implementation strategy. Implementation strategy of included studies: (1): educational materials, educational meetings, distributing clinical practice guidelines, barrier and enabler-based tailored interventions and inter-professional education; (2): educational materials and distributing clinical practice guidelines; (3): educational materials, educational meetings, educational outreach visits, or academic detailing, communities of practice and local opinion leaders. For explanation and details of each implementation strategy, refer to [Supplementary Table S2](#).

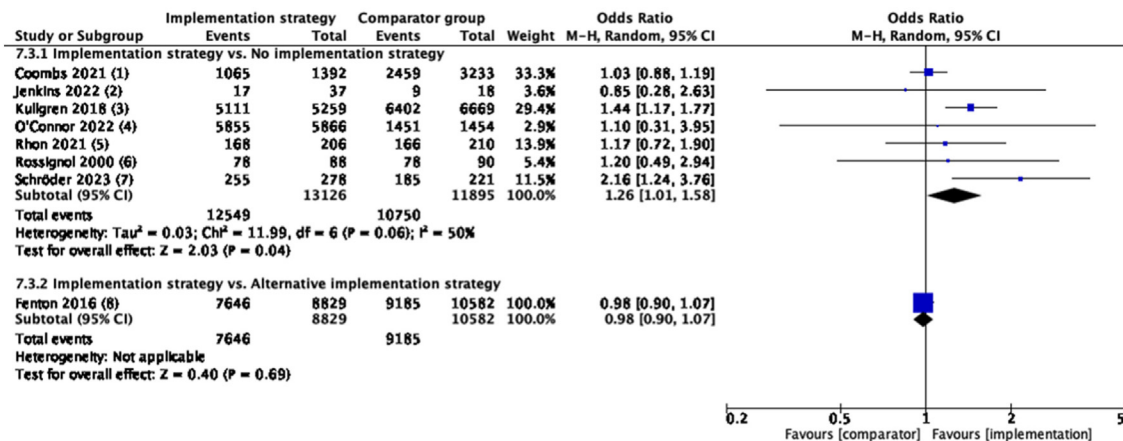


Fig. 3: Guideline-concordant care on discouraging routine imaging use in medium-term, compared with no implementation strategy or another implementation strategy. Implementation strategy of included studies: (1): educational materials, educational meetings, distributing clinical practice guidelines, audit and feedback, educational outreach visits, or academic detailing and patient-mediated interventions; (2): educational materials and educational meetings; (3): educational materials and reminders; (4): educational materials, audit and feedback, reminders and monitoring the performance of the delivery of healthcare; (5): educational materials and patient-mediated interventions; (6): patient-mediated interventions (established a plan of action with the low back pain patients), tailored interventions and routine patient-reported outcome measures; (7): educational materials, educational meetings, educational outreach visits, or academic detailing, communities of practice and local opinion leaders; (8): audit and feedback and patient-mediated interventions (standardized patients). Comparator group for 7.3.2: (8) distributing clinical practice guidelines, and patient-mediated interventions (standardized patients). For explanation and details of each implementation strategy, refer to [Supplementary Table S2](#).

evidence) compared to no implementation strategies in the medium-term ([Supplementary Figures S4 and S5](#)). Results in the short- or long-term, and when one implementation strategy was compared to another were presented in [Supplementary Figures S4 and S5](#).

Reducing analgesic use

Seven studies^{49–51,53,65,67,72} with a total of 161 healthcare professionals (overseeing 7972 patients and 13,875 cases of consultations) were included. Studies used multifaceted ($N = 6$)^{45–47,58,60,68} strategies or ‘reminders’ as a single strategy ($N = 1$)⁷² compared to no strategy ($N = 6$)^{49–51,53,65,67} or another strategy ($N = 1$).⁷²

Implementation strategy versus no strategy. Implementation strategies (combination of educational materials and educational meetings, etc) were not effective in reducing analgesic use in medium-term ($N = 4$, OR = 1.05, 95% CI: 0.96–1.14, $I^2 = 0\%$, high certainty evidence) compared to no strategy ([Fig. 4](#), see [Supplementary Table S2](#) for implementation strategies used by each study). Similar results were seen in the short-term ([Supplementary Figure S6](#)). However, in the long-term, low certainty evidence from one study⁵⁰ showed that ‘multifaceted strategies’ might reduce analgesic use compared to no strategy ($N = 1$, OR = 1.69, 95% CI: 1.08–2.63) ([Supplementary Figure S6](#)).

Implementation strategy versus alternative strategy. No between-group difference was found in the short-term (analysis of other time points was not feasible due to

insufficient data) when one strategy was compared to another strategy ([Supplementary Figure S6](#)).

Secondary outcomes

Knowledge and belief

Eight studies^{29,51,54,56,62,72,74,75} with 2317 healthcare professionals (overseeing 6802 patients and 861 cases of consultation) were included. Studies used multifaceted ($N = 7$)^{29,51,54,56,62,74,75} strategies or ‘reminders’ as a single strategy ($N = 1$)⁷² compared against no strategy ($N = 4$)^{50,54,62,75} or another strategy ($N = 4$).^{29,56,72,74} Three studies targeted implementation of one recommendation (providing education/advice)^{54,62,74} and five studies targeted implementation of two recommendations (providing education/advice and discouraging routine imaging use,^{29,56,75} or discouraging routine imaging use and reducing analgesic use).^{50,72} None of the comparisons demonstrated a between-group difference at any time point, except very low certainty evidence from one study⁵⁶ showing that in the long-term, educational meetings and barrier and enabler-based tailored interventions improved knowledge and beliefs, compared to distribution of clinical practice guidelines for providing education/advice and discouraging routine imaging use ($N = 1$, MD = 0.4, 95% CI: 0.1–0.7, $I^2 = 0\%$, low certainty evidence) ([Supplementary Figure S7](#)).

Pain intensity and physical function

Nine studies^{29,46,48,50,62,65,67,69,71} involving 883 healthcare professionals (overseeing 9191 patients and 7250 cases

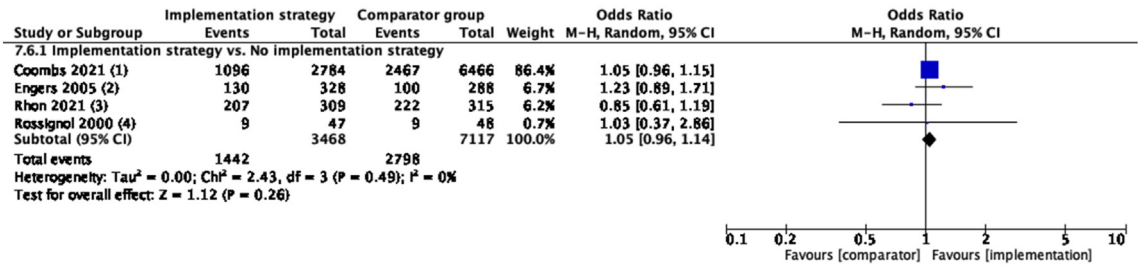


Fig. 4: Guideline-concordant care on reducing analgesic use in medium-term, compared with no implementation strategy. Implementation strategy of included studies: (1): educational materials, educational meetings, distributing clinical practice guidelines, audit and feedback, educational outreach visits, or academic detailing and patient-mediated interventions; (2): educational materials, educational meetings, distributing clinical practice guidelines, tailored interventions and inter-professional education; (3): educational materials and patient-mediated interventions; (4): patient-mediated interventions, tailored interventions and routine patient-reported outcome measures. For explanation and details of each implementation strategy, refer to [Supplementary Table S2](#).

of consultation) assessed patients’ pain intensity and/or physical function. All studies used multifaceted strategies compared against no strategy (N = 6)^{50,62,65,67,69,71} or another strategy (N = 3).^{29,46,48} Four studies targeted implementation of one recommendation (providing education/advice^{46,48,62} or discouraging routine imaging use,⁷¹ separately). Five studies targeted implementation of two recommendations (providing education/advice and discouraging routine imaging use,^{29,69} or discouraging routine imaging use and reducing analgesic use).^{50,65,67} No comparison found that an implementation strategy was effective, except that, compared to no strategy, multifaceted implementation strategies reduced pain intensity in the short-term when implementing all three recommendations (N = 4, MD = -0.19, 95% CI: -0.33 to -0.06, I² = 0%, moderate certainty evidence) ([Supplementary Figures S8 and S9](#)).

Adverse events

No adverse events were reported in any of the included studies.

Sensitivity analysis

In the meta-analysis of the outcome of providing education/advice in the medium-term, high heterogeneity (I² = 95%) was observed. Excluding Schröder et al., 2023⁶⁹ in the sensitivity analysis reduced heterogeneity to 0% and demonstrated that implementation strategies were effective in improving the rate of providing education/advice compared to no strategy (N = 2, OR = 1.18, 95% CI: 1.04–1.35, I² = 0%, moderate certainty evidence) ([Supplementary Figure S10](#)), in contrast to the primary finding of no effect ([Fig. 2](#)). This discrepancy indicated that the primary finding should be interpreted with caution.

Discussion

This systematic review and meta-analysis included 27 studies investigating the effects of implementation

strategies for low back pain guideline recommendations, targeting 7796 healthcare professionals overseeing 34,890 patients. Multifaceted strategies were most commonly evaluated, primarily targeting primary care professionals. Across studies, implementation strategies discouraged routine imaging use but did not improve the provision of patient education/advice or reduce analgesic use compared to no implementation strategy at the primary time point (low to moderate certainty evidence). Moreover, no evidence demonstrated that implementation strategies improved healthcare professionals’ knowledge and beliefs, decreased patients’ pain, or improved function at the primary time point.

This review found that implementation strategies were not consistently effective across recommendations and time points. This may reflect the range of barriers that healthcare professionals face when attempting to implement guideline recommendations for low back pain.⁷⁸ Such barriers (e.g., lack of funding support to access to guideline-recommended treatment alternatives) are multiple and varied, arising from various sources, including patients and healthcare systems.^{78–80} Additionally, most included studies targeted strategies at healthcare professionals only, and did not address patients or health systems, likely affecting the success of the strategies. For example, previous literature has identified that patient’s demands are a key barrier to reducing routine imaging use for low back pain.^{81,82} Although strategies did not target patients or their behaviours, it is possible that the implementation strategies supported healthcare professionals to educate patients about the potential harms of imaging, subsequently decreasing inappropriate imaging.⁸³ But for other recommendations like reducing analgesic use, barriers may be more complicated, including a lack of alternative treatment options to manage patient’s pain and workload pressures that prevent healthcare professionals from being able to engage in comprehensive conversations about deprescribing.⁸⁴ As such,

even if strategies intend to change healthcare professional's behaviour, without adequate support from healthcare systems, or buy-in from patients, guideline concordant care may not be able to be enacted.⁸⁰ This may explain why the effectiveness of strategies was not observed in the medium-term.

This review focused on the effectiveness of implementation strategies; one limitation was that studies using different implementation strategies (either in isolation or in combination) were lumped together, so the review is unable to answer whether a specific implementation strategy (e.g., audit and feedback) is effective compared to no implementation. The diversity, multifaceted, and combined nature of strategies makes it difficult to identify which components of the strategy may have led to the desired outcomes. Some of the pooled data exhibited high heterogeneity. For instance, the sensitivity analysis indicated that the study by Schröder et al., 2023⁶⁹ contributed to the heterogeneity observed in the medium-term outcome of providing education/advice. This variation may stem from differences in the intensity of interventions, as Schröder et al.⁶⁹ delivered a 13-h educational workshop for healthcare professionals, while the other two studies included in this analysis delivered workshops lasting less than 2 h.^{53,54} Implementation strategies for specific guideline recommendations should be tailored to the needs of end-users (e.g., healthcare professionals and patients) and the contexts in which they are implemented, taking into account the interaction between the recommendation itself, implementation strategies, and healthcare settings.^{85–87} Additionally, we found that there was significant variability in how strategies were developed and implemented. Most strategies were developed by healthcare professionals or researchers, with no patient/public input, and were rarely informed by a theoretical model or guiding framework. Poor theoretical underpinning and insufficient consultation with key stakeholders might diminish the likelihood of implementation success.^{78,87,88} Some implementation frameworks identify key determinants (e.g., influential contextual barriers) that need to be considered during implementation.⁸⁹ But the lack of consideration for those matching determinants during development might lead to the failure of the implementation strategy in practice.⁹⁰ For example, in primary care settings, using a framework to select potential components of strategies to overcome prominent barriers (barrier-strategy matching process) may increase the uptake of the recommendation.⁹¹

This review provided some different findings compared to other previous studies. Unlike previous reviews that found implementation strategies to be effective in enhancing healthcare professionals' knowledge and beliefs,²⁶ our study did not observe such effects. This may be due to many healthcare professionals already being familiar with guideline

recommendations for low back pain,⁹² preventing the implementation strategies from conferring significantly greater improvements in care. This highlights that the multifaceted barriers faced by healthcare professionals hinder the promotion of guideline-consistent care, even when they possess sufficient knowledge and beliefs. Thus, future research should focus on comprehensive implementation strategies addressing patients' and healthcare professionals' behaviours and knowledge.⁹³ Additionally, none of the included studies reported adverse events related to the implementation strategies, an outcome that has not been examined in previous reviews on this topic.²⁴ The absence of adverse effects was likely due to a lack of data collection for this outcome in primary studies, therefore uncertainty about their occurrence remains.

In summary, with low to moderate certainty evidence, the review showed that implementation strategies discouraged routine imaging use but did not improve the provision of patient education/advice or reduce analgesic use compared to no implementation strategy between 3 and 12 months. Systematically developed implementation strategies addressing multifaceted barriers are needed for achieving and sustaining effectiveness of strategies to improve guideline-concordant care for low back pain.

Contributors

Siya Zhao had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. All authors have read and approved the final version of the manuscript.

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Data sharing statement

The data analysed during the current systematic review and meta-analysis are available from the corresponding author on reasonable request.

Declaration of interests

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.eclinm.2024.102916>.

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