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# Rehabilitative management of back pain in children: Protocol for a mixed studies systematic review



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**Title:** Rehabilitative management of back pain in children: Protocol for a mixed studies systematic review

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## ABSTRACT

**Introduction:** Little is known about effective, efficient and acceptable management of back pain in children. A comprehensive and updated evidence synthesis can help to inform clinical practice guidelines.

**Objective:** To inform a clinical practice guideline, we aim to conduct a systematic review of the literature and synthesize the evidence regarding effective, cost-effective and safe rehabilitation interventions for children with back pain to improve their pain, functioning and health outcomes.

**Methods and analysis:** We will search MEDLINE, Embase, PsycINFO, CINAHL, the Index to Chiropractic Literature, the Cochrane Controlled Register of Trials, and EconLit for primary studies published from inception in all languages. We will include quantitative studies (randomized controlled trials, cohort and case-control studies), qualitative studies, mixed methods studies, and full economic evaluations. To augment our search of the bibliographic electronic databases, we will search reference lists of included studies and relevant systematic reviews, Google Scholar, the WHO International Clinical Trials Registry Platform, and consult with content experts. We will assess risk of bias using appropriate critical appraisal tools. We will extract data about study and participant characteristics, intervention type and comparators, context and setting, outcomes, themes and methodological quality assessment. We will use a sequential approach at the review level to integrate data from the quantitative, qualitative and economic evidence syntheses.

**Ethics and dissemination:** Ethics approval is not required. We will disseminate findings through activities including: (1) presentations in national and international conferences; (2) meetings with national and international decision makers; (3) publications in peer-reviewed journals; and (4) posts on organizational websites and social media.

**Systematic review registration number:** PROSPERO CRD42019135009

**Key words:** systematic review, back pain, child, adolescent

## Article Summary

Strengths and limitations of this study

- A systematic review integrating quantitative, qualitative and economic evidence to examine the rehabilitative management of back pain in children.
- Includes studies with a broad range of rehabilitation interventions as described by the World Health Organization (WHO), and outcomes as described by the International Classification of Functioning, Disability and Health (ICF) framework.
- Implements the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols guidelines.
- There is no language restriction in articles.
- Our search strategies, while comprehensive, may miss relevant studies.

**Word count:** 4,160

## INTRODUCTION

### Rationale

A significant proportion of children over 10 years of age suffer from back pain.[1-5] The prevalence of back pain in children ranges between 4% and 74%; the wide range is due to heterogeneous populations studied, and outcome measurements and methodologies used.[6 7] Data from the World Health Organization (WHO) Global Burden of Disease study shows that low back pain is responsible for the 2nd most years lived with disability for children 15-19 years of age.[5] Back pain begins early in life with physical, mental and social consequences (e.g., impact on school-related and sporting activities, general physical activity and well-being) that extend into adulthood.[8-10] Most episodes of spinal pain are brief; however, in a three-year prospective cohort study of 1,465 school children in Denmark, up to 25% of children had three or more episodes over one year, and approximately 13% of children reported episodes lasting five or more weeks.[11]

Two recent systematic reviews assessed the effectiveness of manual therapy to treat a number of conditions including back pain in children, but low-quality evidence precludes drawing conclusions.[12 13] A previous systematic review and meta-analysis which evaluated the effectiveness of conservative interventions for low back pain in children under 18 years of age reported that exercise interventions may be promising for improving pain scores in children compared to no treatment; however, the evidence was very limited and of low-quality.[14] This evidence needs updating. Additionally, to our knowledge, no integrative systematic review – one that incorporates both quantitative and qualitative studies – has been conducted regarding the rehabilitative management of back pain in children. Compared to traditional systematic reviews

of quantitative studies, combining evidence of the effectiveness and efficiency of interventions with qualitative understanding from people's lived experiences can better inform clinical practice guidelines and policy.[15]

This comprehensive knowledge synthesis can inform clinical practice guidelines for decision makers involved with caring for children with back pain including healthcare professionals in a variety of clinical, rehabilitation or community settings (e.g., physicians, nurses, physiotherapists, chiropractors, psychologists, occupational therapists, registered massage therapists). Moreover, the knowledge gaps that we identify can inform future research agendas.

**Objectives**

To inform the development of a clinical practice guideline, we aim to conduct an integrative systematic review of quantitative, qualitative and economic evidence regarding the rehabilitative management of back pain (including mid-back and low back pain) in children aged 19 years and under. Our review will address the following questions:

1) What is the effectiveness and safety of rehabilitation interventions for improving pain, functioning, and health outcomes in children with back pain?
2) What are the patients', caregivers' and providers' experiences, preferences, expectations and valued outcomes regarding rehabilitation interventions for back pain?
3) What is the cost-effectiveness of rehabilitation interventions for improving pain, functioning, and health outcomes in children with back pain?

4) What can be hypothesized from the integration of the quantitative, qualitative and economic evidence about the effectiveness, cost-effectiveness and safety of rehabilitation interventions for low back pain in children?

We are targeting decision makers (clinicians, health managers/administrators, policy makers, patients, and caregivers) involved in implementing, delivering or receiving rehabilitation interventions or programs of care. We aim to provide them with knowledge regarding effective, acceptable and positively experienced interventions for children with back pain and their caregivers.

## METHODS

We developed this systematic review protocol using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Protocols (PRISMA-P)[16] (Additional File 1). We registered our protocol on the International Prospective Register of Systematic Reviews (PROSPERO) (registration # CRD42019135009).[17] We will report our systematic review according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement,[18] or the Synthesis Without Meta-analysis (SWiM) reporting guideline,[19] and the Enhancing Transparency in Reporting the Synthesis of Qualitative Research (ENTREQ) reporting guideline.[20]

### Eligibility criteria

#### *Population*

We will target studies including children (aged 19 years or younger)[21] with non-specific low back or thoracic spine pain. We define LBP as pain and discomfort below the costal margin and

above the inferior gluteal folds, with or without radiculopathy (referred leg pain).[22] Radiculopathy refers to inflammation, injury/dysfunction, or compression of spinal nerve roots that can present as pain, weakness, or altered sensation in a myotomal or dermatomal distribution. Lumbar radiculopathy is commonly attributed to lumbar disc herniation (localized displacement of disc material beyond the normal margins of the intervertebral disc space).[23] We define thoracic spine pain as pain within the region bounded superiorly by the first thoracic spinous process, inferiorly by the last thoracic spinous process, and laterally by the most lateral margins of the erector spinae muscles.[24] We will include studies investigating diagnoses including low back pain, mid-back pain, mechanical back pain, lumbago, lumbar sprain or strain, back sprain or strain, lumbopelvic pain, lumbar radiculopathy, lumbar disc herniation, sacroiliac syndrome, sciatica, musculoskeletal or non-specific chest wall pain (pain referred to the chest wall from the thoracic spine).

We will exclude studies of children with back pain attributed to major structural or systemic pathology (e.g., fracture, infection, tumour, osteoporosis, inflammatory arthritides, cauda equina syndrome, neuromuscular disease, myelopathy, and scoliosis); and (2) studies of children with back pain attributed to a non-spine-related condition that might refer pain to the chest wall (e.g., heart, lung or esophagus conditions).

***Intervention***

We will include studies that investigate the effectiveness and safety of rehabilitation interventions or programs of care for children with back pain, including pharmacological and psychological interventions. The WHO defines rehabilitation as a set of interventions that assist

individuals who experience, or are likely to experience, disability to achieve and maintain optimal functioning when interacting with their environments.[25] Rehabilitation interventions include rehabilitation medicine/therapy, which aims to: 1) improve function through the diagnosis and treatment of health conditions, reducing impairments, preventing or treating complications; and 2) restore and compensate loss of functioning, and prevent or slow deterioration in functioning in every area of a person's life.[25] It may also include assistive devices, which refers to any item, piece of equipment, or product used to increase, maintain, or improve functional capabilities.[25] Various healthcare providers may provide interventions including, but not limited to, general practitioners, nurses, physiotherapists, chiropractors, occupational therapists, psychologists, and registered massage therapists (Table 1). We will exclude studies assessing surgical interventions, and interventions solely conducted at the societal level, such as barrier removal initiatives (e.g., fitting a ramp to a public building).

***Comparison***

The quantitative component of this review will consider comparisons including other interventions, placebo or sham interventions, wait list, standard care, and no intervention.

***Outcomes***

We will include outcomes related to pain, functioning and health as described by the ICF framework domains *body functions and structures* (to describe a child's impairment), and *activities and participation* (to describe a child's functional status and involvement in life situations).[26] We will also include adverse events, cost measures, and qualitative outcomes (Table 2).

***Types of studies***

We will include randomized controlled trials, cohort studies, case-control studies, and mixed-methods studies (quantitative component) for question 1 (effectiveness and safety of interventions); qualitative and mixed-methods studies (qualitative component) for question 2 (users' experiences, preferences, expectations and valued outcomes of interventions); and trial- and model-based full economic evaluations for question 3 (cost-effectiveness of interventions) (Table 2).

We will exclude the following types of studies: cross-sectional studies, pilot studies assessing feasibility, protocol studies, case reports, case series, studies assessing only prevention of back pain and incidence outcomes, systematic reviews (although their reference lists will be searched for potentially relevant studies) and other review papers, clinical practice guidelines, biomechanical studies, laboratory studies, cadaveric or animal studies, conceptual papers, letters, editorials, commentaries, books and book chapters, conference proceedings, meeting abstracts, lectures and addresses, consensus development statements, guideline statements, and studies reviewing solely partial economic evaluations (e.g., cost of illness studies).

***Context and setting***

We will consider rehabilitation interventions/programs of care delivered in any healthcare system within an urban or rural area and in any healthcare setting (e.g., acute care, hospital, primary health care, rehabilitation clinics), or in the community. Community-based rehabilitation is implemented through the combined efforts of individuals with disabilities, their families and

communities, and relevant government and non-government health, education, social and other services (e.g., advocacy programme).[27]

**Information sources**

We will develop the initial search strategy in MEDLINE, in consultation with an experienced health sciences librarian. A second experienced health sciences librarian will review the search strategy assessing its appropriateness and comprehensiveness using the Peer Review of Electronic Search Strategies (PRESS) Checklist.[28 29] We will conduct electronic searches of the following databases from database inception to the present: MEDLINE (Ovid), Embase (Ovid), PsycINFO (Ovid), CINAHL (Cumulative Index to Nursing and Allied Health Literature, EBSCO*host*), the Index to Chiropractic Literature (Chiropractic Library Collaboration), the Cochrane Controlled Register of Trials (Ovid), and EconLit (EBSCO*host*). We will augment our search of the bibliographic electronic databases to identify additional relevant studies, and mitigate the potential impact of publication bias and selective outcome reporting bias.[30] We will search reference lists of included studies from the database searches and relevant systematic reviews; we will search Google Scholar; and we will consult with content experts. We will ask experts to suggest up to three targeted websites that may contain relevant studies and other potentially relevant studies not captured by our search strategy. Lastly, we will search the WHO International Clinical Trials Registry Platform (http://apps.who.int/trialsearch/). For studies only reported in the registry, we will contact first authors by email (with two reminders over one month) to obtain full study reports, or additional study or outcome data. We will include studies in any language and will use professional medical translation services where required.

## Search strategy

The searches will include a combination of subject headings specific to databases (e.g. MeSH in MEDLINE) and free text words to capture the key concepts of rehabilitative management of back pain in children (Additional file 2). We will search Google Scholar using the terms *back pain* AND *children* AND *rehabilitation.*

## Patient and public involvement

Patients were not involved in the design of our study. However, we will seek patient and public consultation during the development of clinical practice guidelines, which will be the next phase of this project.

## Data management

We will download the electronic search results into Endnote X9 reference manager software (Clarivate Analytics, PA, USA). We will remove duplicates and upload the remaining references to the Evidence for Policy and Practice Information and Coordinating (EPPI) Centre Reviewer software for the data extraction stages (EPPI-Reviewer version 4, UCL Institute of Education, University of London, UK). EPPI-Reviewer software stores references, manages and monitors the data extraction process and provides an audit trail for the review.[31]

## Screening for eligibility

Using the inclusion and exclusion criteria, pairs of reviewers will independently screen titles and abstracts, and subsequently the full text of each selected article in order to confirm inclusion into the study. Titles and abstracts will be classified as possibly relevant or irrelevant. With respect to

Google Scholar, for reasons of feasibility, we will perform title and abstract screening for only the first 250 results. Subsequently, full-text articles of abstracts classified as possibly relevant will be retrieved, reviewed and classified as relevant or irrelevant.

We will conduct training exercises prior to initiating the screening process to ensure reliability between reviewers. Reviewers will first screen a random sample of 50 records based on titles and abstracts. Paired reviewers must reach 90% agreement before completing title and abstract screening for the remaining studies.[32] If this threshold is not reached for all review teams, all team members will discuss differences in classification to clarify and potentially modify the eligibility criteria prior to completing title and abstract screening. Next, reviewers will screen a random sample of 25 full-text articles. All paired reviewers must again reach 90% agreement before completing full-text article screening for the remaining studies. If not, all team members will discuss to clarify eligibility criteria and resolve disagreements prior to completing full-text article screening. Upon completing full-text article screening, paired reviewers will discuss disagreements and reach consensus related to the inclusion of any article, involving a third reviewer if necessary.

**Risk of bias in individual studies**

We will assess the quality of studies using the Scottish Intercollegiate Guidelines Network (SIGN) criteria for randomized controlled trials (RCTs), cohort and case-control studies;[33] the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for qualitative studies;[34] the Mixed Methods Appraisal Tool (MMAT) for mixed methods studies;[35] and the Drummond checklist for economic evaluations.[36] The SIGN checklists allow reviewers to assess internal validity by

considering the impact of selection bias, information bias, and confounding on study results. The JBI checklist allows reviewers to assess the possibility of bias in qualitative studies' design, conduct and analysis. The MMAT allows reviewers to assess the interdependent qualitative and quantitative components of the study and criteria to consider, such as justification for mixing evidence, and appropriate ways of integrating the data. The Drummond checklist allows reviewers to identify elements that demonstrate a sound economic evaluation such as the assessment of both costs and effects of interventions, accurate measurements of costs and effects, and allowances made for uncertainty in the estimates of costs and effects. We will categorize the validity or credibility of each study as either low risk of bias, some concerns, or high risk of bias. We will contact the authors of papers to request missing or additional data for clarification where required. Paired reviewers will independently assess the eligible studies for quality. Any disagreements that arise between the reviewers will be resolved through discussion, or with a third reviewer.

**Data items and data extraction process**

Paired reviewers will independently extract the data from all eligible studies. For the quantitative studies, we will extract data on the study and participant characteristics; intervention and comparator intervention characteristics using the Template for Intervention Description and Replication (TIDieR) checklist;[37] outcomes broadly categorized according to the ICF categories (body functions and structures, activities and participation;[38-40] adverse events; key findings; and methodological quality. The TIDieR checklist[37] consists of items to help readers better understand the interventions and how they were delivered (i.e., name of intervention, why, what (materials), what (procedure), who provided, how, where, when and how much, tailoring,

modifications, how well (planned), how well (actual)).[37] We will use the PerSPecTIF question formulation framework to guide data extraction for the qualitative studies regarding the items: perspective, setting, phenomenon of interest, environment, timing, and findings (e.g., themes).[41] We will also extract data describing the qualitative approach used and methodological quality of studies. For both quantitative and qualitative studies, we will extract data on the ICF categories 'environmental factors' (contextual factors that make up the physical, social and attitudinal environment in which people live and conduct their lives) and 'personal factors' (internal contextual factors that influence how disability is experienced by the individual) to add context to the interventions and outcomes.[26] For the economic evaluations, we will use the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement[42] and extract data on the analytic approach (trial- or model-based), evaluation type, the analytic perspective, time horizon adopted for costs, main cost items, setting, key findings, and methodological quality of studies.

Paired reviewers will pretest the data extraction form and revise as needed. We will use EPPI-Reviewer software to manage the data extraction process. Any disagreements that arise between the reviewers will be resolved through discussion, or with a third reviewer. We will contact authors of papers to request missing or additional data, if required.

## DATA SYNTHESIS

We will use a sequential approach at the review level to synthesize and integrate the data.[43] This will involve separate quantitative, economic, and qualitative findings synthesis followed by integration of the resultant quantitative, economic, and qualitative economic evidence. In each synthesis, we will use ICF categories in the evidence table and text to synthesize the relevant

data. Specifically, we will synthesize outcomes as *body functions and structures* (to describe a child's impairment) or *activities and participation* (to describe a child's function and involvement in life situations). We will also synthesize data according to *personal factors* (e.g., participants' expectations regarding the interventions or outcomes, and experiences with the outcomes), and *environmental factors* (e.g., the environment in which people live or receive rehabilitation interventions; or interventions that modify a child's physical, social or attitudinal environment).

***Quantitative synthesis***

We will assess clinical, methodological, and statistical heterogeneity among studies. Differences in populations, interventions, comparators, or outcomes across studies may result in clinical heterogeneity. Methodological and statistical heterogeneity may result from differences in risk of bias and differences in outcomes across studies beyond what could be expected by chance alone. We will assess the methodological heterogeneity across studies using our assessments from the SIGN checklist as either low risk of bias, some concerns, or high risk of bias. We will assess statistical heterogeneity using the $I^2$ statistic, whereby $I^2$ of <25-50% will be considered low to moderate (homogeneous), and ≥ 50% considered high (heterogeneous).[44] If two or more studies are clinically homogeneous (i.e., similar populations, interventions, comparators and outcomes) and statistically homogeneous (i.e., $I^2$ <25-50%), we will perform a random effects meta-analysis using EPPI-Reviewer software using the relative risk (or odds ratio for rare events) effect measure for dichotomous data, mean differences for continuous data, hazard rate ratios for time-to-event data, and rates or rate ratios for count data. We will explore the impact of methodological heterogeneity through sensitivity analyses. We will first analyze all studies (i.e.,

low risk of bias, some concerns, and high risk of bias), then analyze the studies with some concerns and low risk of bias studies separately. We will base our recommendations on studies with low risk of bias and some concerns.[45]

If the studies are heterogeneous (i.e., if there is clinical, methodological, and statistical heterogeneity), we will describe the findings of all eligible studies, stratified by low risk of bias, some concerns, and high risk of bias. We will further stratify findings by study design (i.e., randomized controlled trial, cohort study, case-control study). We will then stratify findings by type of intervention, and finally by type of outcome. If multiple outcome measures are used to assess one construct, we will further stratify our analyses by outcome measure and describe how the results vary. To quantify the effectiveness of interventions, we will use the data provided in the studies to compute effect measures and 95% confidence intervals (i.e., odds ratio or relative risk for dichotomous outcomes, mean differences for continuous outcomes, hazard rate ratios for time-to-event outcomes, and rates or rate ratios for count outcomes).[46] Regarding adverse events, we will report the unit of analysis as reported by the study authors (e.g., proportion of participants that experienced adverse events, or number of adverse event experienced). We will interpret the evidence on the effectiveness of interventions (i.e., whether an intervention was superior, equal or inferior to a comparison intervention) by considering the direction, magnitude, and precision of effect estimates across studies, impact of risk of bias in sensitivity analyses, and the generalizability of findings. We will base our recommendations on studies with low risk of bias and some concerns.[45]

***Economic synthesis***

We will report the main findings of economic studies, first stratified by low risk of bias, some concerns, and high risk of bias. We will further stratify findings by study design (i.e., cost-effectiveness, cost-utility, cost-benefit, or cost-consequences). We will then stratify findings by type of intervention, outcome, and cost measure.

To indicate whether an intervention might be judged favourable (or unfavourably) from an economic perspective,[47] we will use the Dominance Ranking Matrix (DRM) to classify the interventions into one of three options.[48] *Strong dominance* for the intervention will be selected when the incremental cost-effectiveness measure shows the intervention as: (i) more effective and less costly than the comparator; or (ii) effective and less costly; or (iii) equal cost and more effective. In this case, from an efficiency perspective, decision makers should favor the intervention over the comparator (in circumstances similar to those of the evaluations). *Weak dominance* for the intervention will be selected when the measure shows the interventions as: (i) equally costly and effective as the comparator; or (ii) more effective and more costly; or (iii) less effective and less costly. In this case, no conclusion may be drawn about whether the intervention is preferable from an efficiency perspective without further information on the priorities or preferences of decision makers in a particular context. Decision makers must determent whether the cost/benefit trade-offs are worth the implementing an intervention in their particular context. Lastly, *non-dominance* for the intervention will be selected when the measure shows the intervention as: (i) more costly and less effective; or (ii) equally as costly and less effective; or (iii) more costly and as effective. In this case the evidence we will interpret the evidence as suggesting the comparator is favourable from an efficiency perspective (in circumstances similar to those of the evaluations).

***Qualitative synthesis***

We will stratify the qualitative findings similarly to the quantitative and economic findings. We will first stratify the findings by risk of bias (high risk of bias, some concerns, or low risk of bias), then by study approach or design (e.g., qualitative descriptive, ethnography, grounded theory), and by intervention type and outcome.

Additionally, we will stratify findings according to individual perspective (i.e., patient (children), caregivers (parents/guardians), healthcare providers, community service providers, or others involved with the rehabilitation of back pain in children). We will use thematic synthesis to synthesize the qualitative research findings.[49 50] First, we will enter all the text labelled as 'results' or 'findings' of the primary studies verbatim into EPPI-Reviewer. Then, pairs of trained reviewers will independently code each line of text according to its meaning and content, and group codes hierarchically into descriptive themes, including the *a priori* themes (intervention type and outcomes according to the ICF framework). Reviewers will also generate themes *a posteriori* to answer our review question (i.e., experiences, preferences, expectations and valued outcomes regarding rehabilitation interventions for back pain in children). Reviewers will finalize the themes through discussion. We will base our recommendations on studies with low risk of bias and some concerns.[45]

***Integration of quantitative, qualitative and economic evidence***

Various methods can be used to integrate diverse study types including: (1) juxtaposing findings in a matrix, (2) using logic models/conceptual framework, (3) analyzing program theory, (4)

testing hypothesis derived using subgroup analysis, and (5) qualitative comparative analysis.[43] We will integrate the evidence by juxtaposing findings in a matrix to generate hypotheses regarding the effectiveness, cost-effectiveness and safety of rehabilitation interventions for low back pain in children. We selected this methodology because it is suitable for comparing and contrasting the findings across the individual quantitative, qualitative and economic evidence syntheses in our review.[43] The use of a matrix will allow us to explore heterogeneity in the findings of the quantitative studies and may indicate why some interventions may be effective, cost-effective and safe, and some may not.[43] For example, we may list themes from the qualitative synthesis along one side of the matrix, and then plot the interventions evaluated in the quantitative synthesis against the themes as either a match (when the intervention matched a theme) or a mismatch (when the intervention was the opposite of a theme). We will also plot the economic evaluation findings against the corresponding intervention and theme. We will identify gaps in knowledge if a particular theme for an intervention does not match with any of the interventions evaluated in the quantitative studies.

## DISSEMINATION

Knowledge translation activities will include presentations to clinicians and researchers at national and international conferences; meetings with national and international decision makers (clinicians, health managers/administrators, policy makers and patients); publications in peer-reviewed journals; clinician and patient/caregiver resources; posts and lay language summaries on organizations' websites (open access) and other social media platforms.

## DISCUSSION

Findings from this mixed studies review will advance our knowledge of the effectiveness, safety, user experience, and cost-effectiveness of a wide range of rehabilitation interventions for children with back pain. This work will provide the evidentiary basis to develop clinical practice guidelines and care pathways outlining the evidence-based management of back pain in children, which can be adapted for specific settings (e.g., hospitals, rehabilitation clinics, and schools) and geographical regions. Specifically, decision makers should consider interventions that are identified as effective, safe, efficient, and positively experienced by patients and caregivers. Mapping findings to the ICF framework will allow decision makers to use standardized language in the assessment and management of children during their care program. This may further facilitate improvements in functioning and health outcomes in this patient population.

A potential limitation of our review is that our search strategy may miss potentially relevant studies, however, we have mitigated this by expanding our search strategy to include content experts and searching relevant websites. A potential risk is that there may be too little evidence available to answer our review questions.

Findings from this review will guide future research by identifying methodological limitations and knowledge gaps in the available literature. Future studies can be designed to address these limitations and gaps. This novel interpretation of quantitative, qualitative and economic evidence according to the ICF framework serves as a model for how outcomes related to functioning and health can be prioritized in future research.[51]

## ADDITIONAL FILES

Additional file 1: PRISMA-P 2015 Checklist. Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) 2015 statement

Additional file 2: Literature search strategies

## DECLARATIONS

**Ethics approval and consent to participate:** Not applicable

**Consent for publication:** Not applicable

**Availability of data and materials:** Not applicable

**Competing interests:** None declared.

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**Author contributions:**

All authors assisted in developing the research questions and systematic review methodology. CC and JJW drafted the manuscript. All authors reviewed and revised the manuscript, and approved the final manuscript.

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**Table 1: Examples of rehabilitation interventions**

| Intervention | Definition | Examples |
|---|---|---|
| Patient or caregiver education and self-management strategies (structured or unstructured) | Teaching patients skills that they can use to manage their health condition | • Learning disease-specific information<br>• Learning general managing skills (e.g., problem-solving, finding and using community resources, working with healthcare team)<br>• Learning strategies to increase confidence (i.e., self-efficacy) in ability to engage in behaviours that are needed to manage their condition on a daily basis<br>• Adequate peer role models and support networks that facilitate the initiation and maintenance of desired behavioural changes |
| Exercise | A subcategory of physical activity that is planned, structured, repetitive, and purposeful; can be supervised (e.g., by a healthcare professional) or unsupervised | • Stretching<br>• Strengthening<br>• Range of motion exercises<br>• Aerobic (e.g., swimming, cycling, walking, running)<br>• Anaerobic (e.g., jumping, sprinting, weight lifting) |
| Manual therapies | - Manipulation: Techniques incorporating a high-velocity low-amplitude impulse or thrust applied at or near the end of a joint's passive range of motion<br>- Mobilization: Techniques incorporating a low-velocity and small or large amplitude oscillatory movement, within a joint's passive range of motion<br>- Traction: Manual or mechanically assisted application of an intermittent or continuous distractive force<br>- Soft tissue therapy: A mechanical form of therapy where soft-tissue structures are pressed and kneaded, using physical contact with the hand or mechanical device | • Lumbar manipulation, mobilization, or traction<br>• Massage<br>• Muscle energy technique<br>• Strain-counterstrain |
| Passive physical modalities | A form of cold, heat, or light application affecting the body at the skin level or ultrasonic or electromagnetic radiation affecting structures beneath the skin surface: | • Heat application: heat pack, hydrotherapy<br>• Cryotherapy: cold pack, vapocoolant spray |

| | | |
|---|---|---|
| | - Passive assistive devices: Device to encourage immobilization in anatomic positions or actively inhibit or prevent movement | • Low-level laser<br>• Electrical muscle stimulation<br>• Pulsed electromagnetic therapy |
| Acupuncture | Any body-needling, moxibustion, electric acupuncture, laser acupuncture, microsystem acupuncture, and acupressure | • Traditional needling<br>• Dry needling<br>• Burning of specific herbs<br>• Electro-acupuncture<br>• Photo-acupuncture |
| Pharmacological interventions | A substance used in treating disease or relieving pain | • Acetaminophen<br>• Nonsteroidal anti-inflammatory drugs<br>• Muscle relaxants<br>• Antidepressants |
| Psychological interventions | Activities used to modify behaviour, emotional state, or feelings | • Cognitive behavioural therapy<br>• Counselling<br>• Social network and environment-based therapies<br>• Psychoeducational interventions<br>• Mindfulness meditation |
| Modifications to environment | | • Ergonomic interventions at school or work |
| Assistive devices | Any item, piece of equipment or product system, used to increase, maintain, or improve the functional capabilities of people with disabilities | • Walking aids<br>• Orthoses<br>• Braces<br>• Wheelchairs |

**Table 2. Research questions, outcomes and study types**

| Research Question | Outcomes | Study Types |
|---|---|---|
| What is the effectiveness and safety of rehabilitation interventions for improving pain, functioning, and health outcomes in children with back pain? | 1. Outcomes related to *body functions and structures* to describe a child's impairment: e.g., pain intensity, frequency, duration; range of motion; psychological outcomes such as depression and anxiety. Examples of outcome measures: NRS, VAS, Faces Pain Scale - Revised;[52 53] goniometer, Revised Child Anxiety and Depression Scale,[54] State-Trait Anxiety Inventory for Children,[55] PROMIS Pediatric Self Report Scale[56]<br><br>2. Outcomes related to *activities and participation* to describe a child's functional status and involvement in life situations: e.g., disability, communication, mobility, interpersonal interactions, preferences, self-care, learning, applying knowledge, return to activities/school. Examples of outcome measures: Modified Oswestry Low Back Pain Disability Questionnaire,[57] KIDSCREEN-52,[58] Pediatric Quality of Life Inventory[59]<br><br>3. Adverse events: any unfavourable sign, symptom, or disease temporarily associated with the treatment, whether or not caused by the treatment.[60] We will also consider indirect harms, where the use of an intervention delays a diagnosis or treatment, and such delay holds a potential harm.[61] | Randomized controlled trials<br><br>Cohort studies<br><br>Case-control studies<br><br>Mixed methods studies (quantitative component) |
| What are the patients', caregivers' and providers' experiences, preferences, expectations and valued outcomes regarding rehabilitation interventions for back pain? | Experiences, preferences, expectations, valued outcomes | Qualitative studies (e.g., phenomenology, grounded theory, ethnography, action research, descriptive qualitative studies)<br><br>Mixed-methods studies (qualitative component) |

| | | |
|---|---|---|
| What is the cost-effectiveness of rehabilitation interventions for improving pain, functioning, and health outcomes in children with back pain? | Direct costs: resources consumed or saved by an intervention<br><br>Indirect costs: productivity gains or losses (e.g., time consumed or freed by the intervention)<br><br>Economic health outcomes: QALY, ICER, NMB<br><br>Intangible: e.g., pain or suffering saved or brought on by an intervention | Full economic evaluations (trial- and model-based): cost-effectiveness, cost-utility, cost-benefit, cost-consequences |

ICER: incremental cost-effectiveness ratio; NMB: measure of net monetary benefit; NRS: Numerical Rating Scale; PROMIS: Patient-Reported Outcomes Measurement Information System; QALY: quality adjusted life years; VAS: Visual Analogue Scale

**PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol***

| Section and topic | Item No | Checklist item | (Page No.#) |
|---|---|---|---|
| **ADMINISTRATIVE INFORMATION** | | | |
| Title: | | | |
| Identification | 1a | Identify the report as a protocol of a systematic review | 1 |
| Update | 1b | If the protocol is for an update of a previous systematic review, identify as such | N/A |
| Registration | 2 | If registered, provide the name of the registry (such as PROSPERO) and registration number | 4 |
| Authors: | | | |
| Contact | 3a | Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author | 1-2 |
| Contributions | 3b | Describe contributions of protocol authors and identify the guarantor of the review | 22-23 |
| Amendments | 4 | If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments | N/A |
| Support: | | | |
| Sources | 5a | Indicate sources of financial or other support for the review | 22 |
| Sponsor | 5b | Provide name for the review funder and/or sponsor | |
| Role of sponsor or funder | 5c | Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol | |
| **INTRODUCTION** | | | |
| Rationale | 6 | Describe the rationale for the review in the context of what is already known | 5-6 |
| Objectives | 7 | Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO) | 6-7 |
| **METHODS** | | | |
| Eligibility criteria | 8 | Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review | 7-11 |
| Information sources | 9 | Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage | 11 |
| Search strategy | 10 | Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated | Additional File 2 |

| | | | |
|---|---|---|---|
| Study records: | | | |
| Data management | 11a | Describe the mechanism(s) that will be used to manage records and data throughout the review | 12 |
| Selection process | 11b | State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis) | 12, 16-7 |
| Data collection process | 11c | Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators | 14-5 |
| Data items | 12 | List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications | 14-5 |
| Outcomes and prioritization | 13 | List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale | 17 |
| Risk of bias in individual studies | 14 | Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis | 13-4 |
| Data synthesis | 15a | Describe criteria under which study data will be quantitatively synthesised | 16-7 |
| | 15b | If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as $I^2$, Kendall's $\tau$) | |
| | 15c | Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression) | |
| | 15d | If quantitative synthesis is not appropriate, describe the type of summary planned | |
| Meta-bias(es) | 16 | Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies) | 11 |
| Confidence in cumulative evidence | 17 | Describe how the strength of the body of evidence will be assessed (such as GRADE) | 17 |

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

*From: Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart L, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. BMJ. 2015 Jan 2;349(jan02 1):g7647.*

**Appendix 2. Literatures search strategies**

**Ovid MEDLINE:** Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE® Daily and Ovid MEDLINE® 1946-Present

| | |
|---|---|
| 1 | exp Infant/ |
| 2 | Child, Preschool/ |
| 3 | Child/ |
| 4 | Adolescent/ |
| 5 | Pediatrics/ |
| 6 | (baby or babies).ab,ti. |
| 7 | "newborn*".ab,ti. |
| 8 | (infant or infants).ab,ti. |
| 9 | (child or children*).ab,ti. |
| 10 | (adolescent* or adolescence).ab,ti. |
| 11 | (teen or teens or teenager).ab,ti. |
| 12 | (pediatric* or paediatric*).ab,ti. |
| 13 | (young adj3 (person* or people)).ab,ti. |
| 14 | emerging adult*.ab,ti. |
| 15 | "youth*".ab,ti. |
| 16 | or/1-15 [**pediatric population] |
| 17 | exp Back Injuries/ |
| 18 | exp Back Pain/ |
| 19 | Coccyx/in [Injuries] |
| 20 | Intervertebral Disc Degeneration/ |
| 21 | Intervertebral Disc Displacement/ |
| 22 | Lumbar Vertebrae/in [Injuries] |
| 23 | Lumbosacral Region/in [Injuries] |
| 24 | Osteoarthritis, Spine/ |
| 25 | Piriformis Muscle Syndrome/ |
| 26 | Radiculopathy/ |
| 27 | Sciatica/ |
| 28 | Spinal Diseases/ |

| | |
|---|---|
| 29 | Spinal Stenosis/ |
| 30 | Thoracic Injuries/ |
| 31 | Thoracic Vertebrae/ |
| 32 | (back adj3 (ache* or injur* or pain*)).ab,ti. |
| 33 | (backache* adj3 (injur* or pain*)).ab,ti. |
| 34 | (back pain or back-pain).ab,ti. |
| 35 | (lumbar disc* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 36 | (lumbar disk* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 37 | "low* back pain".ab,ti. |
| 38 | (lumbar adj3 (pain or facet or nerve root* or osteoarthritis or radicul* or spinal stenosis or spondylo* or zygapophys*)).ab,ti. |
| 39 | "Piriformis syndrome*".ab,ti. |
| 40 | radiculopathy.ab,ti. |
| 41 | (sacral adj2 pain*).ab,ti. |
| 42 | ((spine or spinal) adj4 (condition* or disable* or disabilit* or disorder* or pain or stenos?s)).ab,ti. |
| 43 | spondylosis.ab,ti. |
| 44 | (thoracic adj4 (injur* or pain or spine or spinal)).ab,ti. |
| 45 | (T-spine or T-spinal).ab,ti. |
| 46 | or/17-45 [**back pain] |
| 47 | Acupressure/ |
| 48 | Acupuncture/ |
| 49 | exp Acupuncture Therapy/ |
| 50 | "Bedding and Linens"/ |
| 51 | Behavior Therapy/ |
| 52 | exp Biofeedback, Psychology/ |
| 53 | exp Cognitive Behavioral Therapy/ |
| 54 | Combined Modality Therapy/ |
| 55 | Community-Based Participatory Research/ |
| 56 | Community Health Services/ |
| 57 | Community Participation/ |
| 58 | Complementary Therapies/ |
| 59 | Cryotherapy/ |

| | |
|---|---|
| 60 | exp Diathermy/ |
| 61 | exp Electric Stimulation Therapy/ |
| 62 | Electroacupuncture/ |
| 63 | Ergonomics/ |
| 64 | exp Exercise/ |
| 65 | exp Exercise Movement Techniques/ |
| 66 | exp Exercise Therapy/ |
| 67 | Fluid Therapy/ |
| 68 | High-Energy Shock Waves/tu [Therapeutic Use] |
| 69 | Immobilization/ |
| 70 | Hot Temperature/tu [Therapeutic Use] |
| 71 | exp Hydrotherapy/ |
| 72 | Laser Therapy, Low-Level/ |
| 73 | Low-Level Light Therapy/ |
| 74 | Magnetic Field Therapy/ |
| 75 | Magnetics/tu [Therapeutic Use] |
| 76 | Massage/ |
| 77 | exp Medicine, Chinese Traditional/ |
| 78 | exp Musculoskeletal Manipulations/ |
| 79 | Patient Education as Topic/ |
| 80 | Physical Therapy Modalities/ |
| 81 | Self Care/ |
| 82 | Self-Help Devices/ |
| 83 | Physical Fitness/ |
| 84 | Restraint, Physical/ |
| 85 | Transcutaneous Electric Nerve Stimulation/ |
| 86 | Vibration/tu [Therapeutic Use] |
| 87 | Wheelchairs/ |
| 88 | acupressure.ab,ti. |
| 89 | "acupunctur*".ab,ti. |
| 90 | (advice or advise or advised).ab,ti. |
| 91 | alexander technique.ab,ti. |

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|---|---|
| 92 | "assistive device*".ab,ti. |
| 93 | "back belt*".ab,ti. |
| 94 | "back school*".ab,ti. |
| 95 | (back adj2 work).ab,ti. |
| 96 | (braces or brace or bracing).ab,ti. |
| 97 | canes.ab,ti. |
| 98 | chiropract*.ab,ti. |
| 99 | "cognitive behavioral therap*".ab,ti. |
| 100 | "cognitive behavioural therap*".ab,ti. |
| 101 | (cold adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |
| 102 | "core stabili*".ab,ti. |
| 103 | (corset or corsets).ab,ti. |
| 104 | crutches.ab,ti. |
| 105 | cryotherap*.ab,ti. |
| 106 | "deep tissue therap*".ab,ti. |
| 107 | diathermy.ab,ti. |
| 108 | (electric* adj3 (stimulation or EMS or heating pad*)).ab,ti. |
| 109 | electro-acupuncture.ab,ti. |
| 110 | (electrogalvanic stimulation or EGS).ab,ti. |
| 111 | (electromagnet* and (radiation or therap*)).ab,ti. |
| 112 | electromodalit*.ab,ti. |
| 113 | electrotherapy.ab,ti. |
| 114 | (exercise or exercises or exercising).ab,ti. |
| 115 | (flexion-distraction or flexion distraction).ab,ti. |
| 116 | fluidotherap*.ab,ti. |
| 117 | galvanic stimulation.ab,ti. |
| 118 | (H-Wave Device Stimulation or HWDS).ab,ti. |
| 119 | ((heat* or hot) adj3 (therap* or pack* or compress or massage or lamp or pad or bath or soak or tub or bottle or superficial or therapeutic)).ab,ti. |
| 120 | (high energy shock wave* or high-energy shock wave* or HESW).ab,ti. |
| 121 | "hydrotherap*".ab,ti. |
| 122 | (ice adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |

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|---|---|
| 123 | "interferential current*".ab,ti. |
| 124 | infrared.ab,ti. |
| 125 | iontophoresis.ab,ti. |
| 126 | electroanalgesia.ab,ti. |
| 127 | ergonomic*.ab,ti. |
| 128 | kinesiotap*.ab,ti. |
| 129 | (laser* adj3 (phototherapy or irradiation or biostimulation or light or therap*)).ab,ti. |
| 130 | "low level laser*".ab,ti. |
| 131 | "lumbar support*".ab,ti. |
| 132 | (magnetic adj3 (necklace* or therap* or bracelet*)).ab,ti. |
| 133 | (manipulat* adj3 (therap* or treatment* or spinal or osteopath*)).ab,ti. |
| 134 | "manual therap*".ab,ti. |
| 135 | Microcurrent Electrical Neuromuscular Stimulation.ab,ti. |
| 136 | microwave*.ab,ti. |
| 137 | ((moblisation or mobilization) adj4 (osteopath* or orthopedic* or orthopaedic* or lumbar or spinal)).ab,ti. |
| 138 | "moist air bath*".ab,ti. |
| 139 | moxibustion.ab,ti. |
| 140 | ((multimodal* or multi-modal* or multi modal*) adj4 (treatment* or approach or care or therap* or procedure* or package* or manage*)).ab,ti. |
| 141 | muscle activation.ab,ti. |
| 142 | "muscle energy technique*".ab,ti. |
| 143 | myofascial release.ab,ti. |
| 144 | (Neuromuscular Electrical Stimulation or NMES).ab,ti. |
| 145 | orthotic*.ab,ti. |
| 146 | "passive modalit*".ab,ti. |
| 147 | (patient* adj3 (educat* or train*)).ab,ti. |
| 148 | "Percutaneous Electric* Nerve Stimulation".ab,ti. |
| 149 | (physical adj therap*).ab,ti. |
| 150 | physiotherap*.ab,ti. |
| 151 | photo-acupuncture.ab,ti. |
| 152 | pillow*.ab,ti. |
| 153 | pilates.ab,ti. |

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|---|---|
| 154 | (postur* adj3 (correct* or educat* or instruct* or train*)).ab,ti. |
| 155 | (pulsed adj3 (electromagnetic or magnetic or radio frequency or energy)).ab,ti. |
| 156 | radiant light.ab,ti. |
| 157 | Russian stimulation.ab,ti. |
| 158 | "seat adj cushion*".ab,ti. |
| 159 | (self-manage* or self manage*).ab,ti. |
| 160 | (short wave* or short-wave*).ab,ti. |
| 161 | ((shockwave* or shock wave* or shock-wave*) adj3 (ultrasonic or therap* or radiation)).ab,ti. |
| 162 | "soft tissue therap*".ab,ti. |
| 163 | "spray and stretch".ab,ti. |
| 164 | strain-counterstrain.ab,ti. |
| 165 | strengthen*.ab,ti. |
| 166 | stretching.ab,ti. |
| 167 | (tape or taping).ab,ti. |
| 168 | thoracolumbosacral orthosis.ab,ti. |
| 169 | traction.ab,ti. |
| 170 | traditional Chinese medicine.ab,ti. |
| 171 | (transcutaneous electrical stimulation or TENS).ab,ti. |
| 172 | ultrasound.ab,ti. |
| 173 | vapocoolant spray.ab,ti. |
| 174 | "vibration therap*".ab,ti. |
| 175 | walkers.ab,ti. |
| 176 | "walking adj3 aid*".ab,ti. |
| 177 | "warm compress*".ab,ti. |
| 178 | whirlpool*.ab,ti. |
| 179 | yoga.ab,ti. |
| 180 | or/47-179 [**interventions] |
| 181 | Case-Control Studies/ |
| 182 | Cohort Studies/ |
| 183 | Controlled Clinical Trials as Topic/ |
| 184 | Epidemiologic Studies/ |
| 185 | Epidemiology/ |

| | |
|---|---|
| 186 | Follow-Up Studies/ |
| 187 | Longitudinal Studies/ |
| 188 | Prospective Studies/ |
| 189 | Retrospective Studies/ |
| 190 | Randomized Controlled Trials as Topic/ |
| 191 | ((case control or case-control) adj3 (stud* or design*)).ab,ti. |
| 192 | (cohort adj3 (stud* or design* or analysis)).ab,ti. |
| 193 | controlled clinical trial.pt. |
| 194 | "epidemiolog*".ab,ti. |
| 195 | ((followup or follow-up) adj3 (stud* or design* or analysis)).ab,ti. |
| 196 | (longitudinal* adj3 (stud* or design* or analysis)).ab,ti. |
| 197 | (prospective adj3 (stud* or design* or analysis)).ab,ti. |
| 198 | (random* and (control* or clinical or allocat*)).ab,ti. |
| 199 | randomized controlled trial.pt. |
| 200 | (retrospective adj3 (stud* or design*)).ab,ti. |
| 201 | or/181-200 [**study designs_effectiveness] |
| 202 | 16 and 46 and 180 and 201 |
| 203 | Anthropology, Cultural/ |
| 204 | Attitude/ |
| 205 | Awareness/ |
| 206 | Behavioral Research/ |
| 207 | Diary as Topic/ |
| 208 | Emotions/ |
| 209 | Ethnology/ |
| 210 | Ethnopsychology/ |
| 211 | Focus Groups/ |
| 212 | Grounded Theory/ |
| 213 | Interview, Psychological/ |
| 214 | Interviews as Topic/ |
| 215 | Mindfulness/ |
| 216 | Motivation/ |
| 217 | Narration/ |

218 Observation/

219 Perception/

220 Personal Narratives as Topic/

221 Personal Satisfaction/

222 Qualitative Research/

223 Self Report/

224 "Surveys and Questionnaires"/

225 Tape Recording/

226 Thinking/

227 Video Recording/ or Videotape Recording/

228 (attitude* or aware* or belief* or believe* or experience* or mindfulness or motivation or opinion* or perception* or perspective*).ab,ti.

229 ((audio adj record*) or audiorecord* or audiotap*).ab,ti.

230 ((behavioral or behavioural) adj2 research).ab,ti.

231 biographical method*.ab,ti.

232 (constant adj2 (comparative or comparison)).ab,ti.

233 ((content or conversation or discourse) adj2 analys*).ab,ti.

234 descriptive research.ab,ti.

235 (diary or diaries).ab,ti.

236 emotions.ab,ti.

237 ethnograph*.ab,ti.

238 ethnology.ab,ti.

239 ethnopsychology.ab,ti.

240 feelings.ab,ti.

241 (field adj2 (notes or research or study or studies)).ab,ti.

242 (focus adj2 group*).ab,ti.

243 framework analysis.ab,ti.

244 grounded theory.ab,ti.

245 interview*.ab,ti.

246 life world.ab,ti.

247 lived experience.ab,ti.

248 (meaning or meanings).ab,ti.

249 (narrative* or narration*).ab,ti.

250 (observe* or observation*).ab,ti.

251 (open adj ended).ab,ti.

252 phenomenology.ab,ti.

253 purposive sampl*.ab,ti.

254 qualitative.ab,ti.

255 questionnaire*.ab,ti.

256 (realist adj3 (review* or research or synthesis)).ab,ti.

257 satisfaction.ab,ti.

258 self report*.ab,ti.

259 semantic analysis.ab,ti.

260 standpoint*.ab,ti.

261 (story or stories).ab,ti.

262 survey*.ab,ti.

263 (theme* or thematic).ab,ti.

264 (theoretical adj2 (sampl* or saturation)).ab,ti.

265 (thoughts or thinking).ab,ti.

266 ((video adj record*) or videorecord* or videotap*).ab,ti.

267 or/203-266 [**experience/qualitative]

268 "Costs and Cost Analysis"/

269 exp Cost-Benefit Analysis/

270 Quality-Adjusted Life Years/

271 Economics, Medical/

272 (economic* adj4 (evaluat* or stud*)).ab,ti.

273 (health economic* adj4 (evaluat* or stud*)).ab,ti.

274 ((cost-utility or cost utility) adj4 (stud* or analys*)).ab,ti.

275 ((cost-benefit or cost benefit) adj4 (stud* or analys*)).ab,ti.

276 (CEA or CUA or CBA).ab,ti.

277 ((cost-effective* or cost effective*) adj4 (analys* or stud*)).ab,ti.

278 (economic* adj4 (impact or value or factor* or analys*)).ab,ti.

279 (cost* adj4 (health care or analys* or savings or hospital or medical or utilit* or effective* or efficac* or benefit* or consequence* or unit*)).ab,ti.

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|---|---|
| 280 | (decision adj1 (tree* or analy* or model*)).ab,ti. |
| 281 | economics.fs. |
| 282 | (qol or qoly or qolys or hrqol or qaly or qalys or qale or qales).ab,ti. |
| 283 | (sensitivity analys* or "willingness to pay" or quality-adjusted life year* or quality adjusted life year* or quality-adjusted life expectanc* or quality adjusted life expectanc*).ab,ti. |
| 284 | (markov* or monte carlo*).ab,ti. |
| 285 | or/268-284 [**cost effectiveness] |
| 286 | Delivery of Health Care/ |
| 287 | Delivery of Health Care, Integrated/ |
| 288 | Health Planning/ |
| 289 | Health Promotion/ |
| 290 | Health Services Administration/ |
| 291 | Integrative Medicine/ |
| 292 | Interprofessional Relations/ |
| 293 | Patient Care Management/ |
| 294 | (approach* adj3 (collaborative or complementary or comprehensive or innovative or integrated)).ab,ti. |
| 295 | barrier*.ab,ti. |
| 296 | facilitator*.ab,ti. |
| 297 | ((health care or healthcare or health-care) adj3 (clinic or clinics or delivery or implement* or intervention* or model* or plan* or process* or program*or services or strateg* or system* or team*)).ab,ti. |
| 298 | implement*.ab,ti. |
| 299 | (innovate* adj3 (intervention* or model* or plan* or process* or program*or strateg* or system*)).ab,ti. |
| 300 | (model* adj care).ab,ti. |
| 301 | ((integrated or interdisciplinary or interprofessional or multidisciplinary) adj3 (care or clinic or clinics or intervention* or model* or plan* or process* or program*or strateg* or system* or challenge* or benefit* or success* or constrain* or difficult* or enhanc* or influen* or interfer* or motivat* or obstruct* or problem* or promot* or restrain* or restrict* or disincentive* or factor* or capacity or enabler*)).ab,ti. |
| 302 | (pathway* adj3 (clinical or care)).ab,ti. |
| 303 | (program* adj3 (assess* or evaluat*)).ab,ti. |
| 304 | or/286-303 [**implementation] |
| 305 | 16 and 46 and 180 and (201 or 267 or 285 or 304) |
| 306 | 16 and 46 and 180 [**pediatric, back pain, interventions] |

**Embase** Classic+Embase 1947 to 2020

| | |
|---|---|
| 1 | newborn/ |
| 2 | infant/ or infancy/ or baby/ |
| 3 | childhood/ |
| 4 | child/ |
| 5 | adolescent/ or adolescence/ |
| 6 | juvenile/ |
| 7 | (baby or babies).ab,ti. |
| 8 | "newborn*".ab,ti. |
| 9 | (infant or infants).ab,ti. |
| 10 | (child or children*).ab,ti. |
| 11 | (adolescent* or adolescence).ab,ti. |
| 12 | (teen or teens or teenager).ab,ti. |
| 13 | (pediatric* or paediatric*).ab,ti. |
| 14 | (young adj3 (person* or people)).ab,ti. |
| 15 | emerging adult*.ab,ti. |
| 16 | "youth*".ab,ti. |
| 17 | or/1-16 [**pediatric population] |
| 18 | backache/ |
| 19 | low back pain/ |
| 20 | intervertebral disc degeneration/ |
| 21 | intervertebral disk hernia/ |
| 22 | lumbar vertebra/ |
| 23 | lumbosacral region/ |
| 24 | piriformis syndrome/ |
| 25 | radiculopathy/ |
| 26 | sciatica/ |
| 27 | spine disease/ |
| 28 | vertebral canal stenosis/ |
| 29 | spondylosis/ |
| 30 | (back adj3 (ache* or injur* or pain*)).ab,ti. |

| | |
|---|---|
| 31 | (backache* adj3 (injur* or pain*)).ab,ti. |
| 32 | (back pain or back-pain).ab,ti. |
| 33 | (lumbar disc* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 34 | (lumbar disk* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 35 | "low* back pain".ab,ti. |
| 36 | (lumbar adj3 (pain or facet or nerve root* or osteoarthritis or radicul* or spinal stenosis or spondylo* or zygapophys*)).ab,ti. |
| 37 | "Piriformis syndrome*".ab,ti. |
| 38 | radiculopathy.ab,ti. |
| 39 | (sacral adj2 pain*).ab,ti. |
| 40 | ((spine or spinal) adj4 (condition* or disable* or disabilit* or disorder* or pain or stenos?s)).ab,ti. |
| 41 | spondylosis.ab,ti. |
| 42 | (thoracic adj4 (injur* or pain or spine or spinal)).ab,ti. |
| 43 | (T-spine or T-spinal).ab,ti. |
| 44 | or/18-43 [**back injuries] |
| 45 | acupressure/ |
| 46 | acupuncture/ |
| 47 | behavior therapy/ |
| 48 | biofeedback/ |
| 49 | cognitive behavioral therapy/ |
| 50 | participatory research/ |
| 51 | community care/ |
| 52 | community participation/ |
| 53 | alternative medicine/ |
| 54 | cryotherapy/ |
| 55 | diathermy/ |
| 56 | electrostimulation therapy/ |
| 57 | electroacupuncture/ |
| 58 | ergonomics/ |
| 59 | exp exercise/ |
| 60 | exp kinesiotherapy/ |
| 61 | fitness/ |

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|---|---|
| 62 | fluid therapy/ |
| 63 | shock wave/ |
| 64 | immobilization/ |
| 65 | heat/ |
| 66 | exp hydrotherapy/ |
| 67 | low level laser therapy/ |
| 68 | phototherapy/ |
| 69 | exp magnetism/ |
| 70 | magnetotherapy/ |
| 71 | massage/ |
| 72 | Chinese medicine/ |
| 73 | manipulative medicine/ |
| 74 | patient education/ |
| 75 | physiotherapy/ |
| 76 | self care/ |
| 77 | transcutaneous nerve stimulation/ |
| 78 | whole body vibration/ |
| 79 | acupressure.ab,ti. |
| 80 | "acupunctur*".ab,ti. |
| 81 | (advice or advise or advised).ab,ti. |
| 82 | alexander technique.ab,ti. |
| 83 | "assistive device*".ab,ti. |
| 84 | "back belt*".ab,ti. |
| 85 | "back school*".ab,ti. |
| 86 | (back adj2 work).ab,ti. |
| 87 | (braces or brace or bracing).ab,ti. |
| 88 | chiropract*.ab,ti. |
| 89 | "cognitive behavioral therap*".ab,ti. |
| 90 | "cognitive behavioural therap*".ab,ti. |
| 91 | (cold adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |
| 92 | "core stabili*".ab,ti. |
| 93 | (corset or corsets).ab,ti. |

| | |
|---|---|
| 94 | crutches.ab,ti. |
| 95 | cryotherap*.ab,ti. |
| 96 | "deep tissue therap*".ab,ti. |
| 97 | diathermy.ab,ti. |
| 98 | (electric* adj3 (stimulation or EMS or heating pad*)).ab,ti. |
| 99 | electro-acupuncture.ab,ti. |
| 100 | (electrogalvanic stimulation or EGS).ab,ti. |
| 101 | (electromagnet* and (radiation or therap*)).ab,ti. |
| 102 | electromodalit*.ab,ti. |
| 103 | electrotherapy.ab,ti. |
| 104 | (exercise or exercises or exercising).ab,ti. |
| 105 | (flexion-distraction or flexion distraction).ab,ti. |
| 106 | fluidotherap*.ab,ti. |
| 107 | galvanic stimulation.ab,ti. |
| 108 | (H-Wave Device Stimulation or HWDS).ab,ti. |
| 109 | ((heat* or hot) adj3 (therap* or pack* or compress or massage or lamp or pad or bath or soak or tub or bottle or superficial or therapeutic)).ab,ti. |
| 110 | (high energy shock wave* or high-energy shock wave* or HESW).ab,ti. |
| 111 | "hydrotherap*".ab,ti. |
| 112 | (ice adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |
| 113 | "interferential current*".ab,ti. |
| 114 | infrared.ab,ti. |
| 115 | iontophoresis.ab,ti. |
| 116 | electroanalgesia.ab,ti. |
| 117 | ergonomic*.ab,ti. |
| 118 | kinesiotap*.ab,ti. |
| 119 | (laser* adj3 (phototherapy or irradiation or biostimulation or light or therap*)).ab,ti. |
| 120 | "low level laser*".ab,ti. |
| 121 | "lumbar support*".ab,ti. |
| 122 | (magnetic adj3 (necklace* or therap* or bracelet*)).ab,ti. |
| 123 | (manipulat* adj3 (therap* or treatment* or spinal or osteopath*)).ab,ti. |
| 124 | "manual therap*".ab,ti. |

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|---|---|
| 125 | Microcurrent Electrical Neuromuscular Stimulation.ab,ti. |
| 126 | microwave*.ab,ti. |
| 127 | ((moblisation or mobilization) adj4 (osteopath* or orthopedic* or orthopaedic* or lumbar or spinal)).ab,ti. |
| 128 | "moist air bath*".ab,ti. |
| 129 | moxibustion.ab,ti. |
| 130 | ((multimodal* or multi-modal* or multi modal*) adj4 (treatment* or approach or care or therap* or procedure* or package* or manage*)).ab,ti. |
| 131 | muscle activation.ab,ti. |
| 132 | "muscle energy technique*".ab,ti. |
| 133 | myofascial release.ab,ti. |
| 134 | (Neuromuscular Electrical Stimulation or NMES).ab,ti. |
| 135 | orthotic*.ab,ti. |
| 136 | "passive modalit*".ab,ti. |
| 137 | (patient* adj3 (educat* or train*)).ab,ti. |
| 138 | "Percutaneous Electric* Nerve Stimulation".ab,ti. |
| 139 | (physical adj therap*).ab,ti. |
| 140 | physiotherap*.ab,ti. |
| 141 | photo-acupuncture.ab,ti. |
| 142 | pillow*.ab,ti. |
| 143 | pilates.ab,ti. |
| 144 | (postur* adj3 (correct* or educat* or instruct* or train*)).ab,ti. |
| 145 | (pulsed adj3 (electromagnetic or magnetic or radio frequency or energy)).ab,ti. |
| 146 | radiant light.ab,ti. |
| 147 | Russian stimulation.ab,ti. |
| 148 | "seat adj cushion*".ab,ti. |
| 149 | (self-manage* or self manage*).ab,ti. |
| 150 | (short wave* or short-wave*).ab,ti. |
| 151 | ((shockwave* or shock wave* or shock-wave*) adj3 (ultrasonic or therap* or radiation)).ab,ti. |
| 152 | "soft tissue therap*".ab,ti. |
| 153 | "spray and stretch".ab,ti. |
| 154 | strain-counterstrain.ab,ti. |
| 155 | strengthen*.ab,ti. |

156 stretching.ab,ti.

157 (tape or taping).ab,ti.

158 thoracolumbosacral orthosis.ab,ti.

159 traction.ab,ti.

160 traditional Chinese medicine.ab,ti.

161 (transcutaneous electrical stimulation or TENS).ab,ti.

162 ultrasound.ab,ti.

163 vapocoolant spray.ab,ti.

164 "vibration therap*".ab,ti.

165 walkers.ab,ti.

166 "walking adj3 aid*".ab,ti.

167 "warm compress*".ab,ti.

168 whirlpool*.ab,ti.

169 yoga.ab,ti.

170 or/45-169 [**interventions]

171 case control study/

172 cohort analysis/

173 "controlled clinical trial (topic)"/

174 longitudinal study/

175 "randomized controlled trial (topic)"/

176 ((case control or case-control) adj3 (stud* or design*)).ab,ti.

177 (cohort adj3 (stud* or design* or analysis)).ab,ti.

178 "epidemiolog*".ab,ti.

179 ((followup or follow-up) adj3 (stud* or design* or analysis)).ab,ti.

180 (longitudinal* adj3 (stud* or design* or analysis)).ab,ti.

181 (prospective adj3 (stud* or design* or analysis)).ab,ti.

182 (random* and (control* or clinical or allocat* or trial*)).ab,ti.

183 (retrospective adj3 (stud* or design*)).ab,ti.

184 or/171-183 [**effectiveness]

185 attitude to health/

186 patient attitude/

187 awareness/

188 behavioral research/

189 writing/

190 emotion/

191 ethnology/

192 cultural psychology/

193 information processing/

194 grounded theory/

195 interview/

196 mindfulness/

197 motivation/

198 exp verbal communication/

199 observation/ or participant observation/

200 perception/

201 satisfaction/ or patient satisfaction/

202 qualitative research/

203 self report/

204 health survey/

205 questionnaire/

206 exp recording/

207 exp thinking/

208 (attitude* or aware* or belief* or believe* or experience* or mindfulness or motivation or opinion* or perception* or perspective*).ab,ti.

209 ((audio adj record*) or audiorecord* or audiotap*).ab,ti.

210 ((behavioral or behavioural) adj2 research).ab,ti.

211 biographical method*.ab,ti.

212 (constant adj2 (comparative or comparison)).ab,ti.

213 ((content or conversation or discourse) adj2 analys*).ab,ti.

214 descriptive research.ab,ti.

215 (diary or diaries).ab,ti.

216 emotions.ab,ti.

217 ethnograph*.ab,ti.

218 ethnology.ab,ti.

219 ethnopsychology.ab,ti.

220 feelings.ab,ti.

221 (field adj2 (notes or research or study or studies)).ab,ti.

222 (focus adj2 group*).ab,ti.

223 framework analysis.ab,ti.

224 grounded theory.ab,ti.

225 interview*.ab,ti.

226 life world.ab,ti.

227 lived experience.ab,ti.

228 (meaning or meanings).ab,ti.

229 (narrative* or narration*).ab,ti.

230 (observe* or observation*).ab,ti.

231 (open adj ended).ab,ti.

232 phenomenology.ab,ti.

233 purposive sampl*.ab,ti.

234 qualitative.ab,ti.

235 questionnaire*.ab,ti.

236 (realist adj3 (review* or research or synthesis)).ab,ti.

237 satisfaction.ab,ti.

238 self report*.ab,ti.

239 semantic analysis.ab,ti.

240 standpoint*.ab,ti.

241 (story or stories).ab,ti.

242 survey*.ab,ti.

243 (theme* or thematic).ab,ti.

244 (theoretical adj2 (sampl* or saturation)).ab,ti.

245 (thoughts or thinking).ab,ti.

246 ((video adj record*) or videorecord* or videotap*).ab,ti.

247 or/185-246 [**qualitative_experience]

248 "cost effectiveness analysis"/

249 "cost benefit analysis"/

250 quality adjusted life year/

| | |
|---|---|
| 251 | health economics/ |
| 252 | (economic* adj4 (evaluat* or stud*)).ab,ti. |
| 253 | (health economic* adj4 (evaluat* or stud*)).ab,ti. |
| 254 | ((cost-utility or cost utility) adj4 (stud* or analys*)).ab,ti. |
| 255 | ((cost-benefit or cost benefit) adj4 (stud* or analys*)).ab,ti. |
| 256 | (CEA or CUA or CBA).ab,ti. |
| 257 | ((cost-effective* or cost effective*) adj4 (analys* or stud*)).ab,ti. |
| 258 | (economic* adj4 (impact or value or factor* or analys*)).ab,ti. |
| 259 | (cost* adj4 (health care or analys* or savings or hospital or medical or utilit* or effective* or efficac* or benefit* or consequence* or unit*)).ab,ti. |
| 260 | (decision adj1 (tree* or analy* or model*)).ab,ti. |
| 261 | economics.fs. |
| 262 | (qol or qoly or qolys or hrqol or qaly or qalys or qale or qales).ab,ti. |
| 263 | (sensitivity analys* or "willingness to pay" or quality-adjusted life year* or quality adjusted life year* or quality-adjusted life expectanc* or quality adjusted life expectanc*).ab,ti. |
| 264 | (markov* or monte carlo*).ab,ti. |
| 265 | or/248-264 [**cost effectiveness] |
| 266 | health care delivery/ |
| 267 | integrated health care system/ |
| 268 | health care planning/ |
| 269 | health promotion/ |
| 270 | health service/ |
| 271 | integrative medicine/ |
| 272 | case management/ |
| 273 | (approach* adj3 (collaborative or complementary or comprehensive or innovative or integrated)).ab,ti. |
| 274 | barrier*.ab,ti. |
| 275 | facilitator*.ab,ti. |
| 276 | ((health care or healthcare or health-care) adj3 (clinic or clinics or delivery or implement* or intervention* or model* or plan* or process* or program*or services or strateg* or system* or team*)).ab,ti. |
| 277 | implement*.ab,ti. |
| 278 | (innovate* adj3 (intervention* or model* or plan* or process* or program*or strateg* or system*)).ab,ti. |
| 279 | (model* adj care).ab,ti. |

| | |
|---|---|
| 280 | ((integrated or interdisciplinary or interprofessional or multidisciplinary) adj3 (care or clinic or clinics or intervention* or model* or plan* or process* or program*or strateg* or system* or challenge* or benefit* or success* or constrain* or difficult* or enhanc* or influen* or interfer* or motivat* or obstruct* or problem* or promot* or restrain* or restrict* or disincentive* or factor* or capacity or enabler*)).ab,ti. |
| 281 | (pathway* adj3 (clinical or care)).ab,ti. |
| 282 | (program* adj3 (assess* or evaluat*)).ab,ti. |
| 283 | or/266-282 [**implementation] |
| 284 | 17 and 44 and 170 |
| 285 | 284 and (184 or 247 or 265 or 283) |
| 286 | limit 285 to (conference abstract or conference paper or "conference review" or editorial or letter) |
| 287 | 285 not 286 |

**PsycINFO** 1806

| | |
|---|---|
| 1 | (baby or babies).ab,ti. |
| 2 | "newborn*".ab,ti. |
| 3 | (infant or infants).ab,ti. |
| 4 | (child or children*).ab,ti. |
| 5 | (adolescent* or adolescence).ab,ti. |
| 6 | (teen or teens or teenager).ab,ti. |
| 7 | (pediatric* or paediatric*).ab,ti. |
| 8 | (young adj3 (person* or people)).ab,ti. |
| 9 | emerging adult*.ab,ti. |
| 10 | "youth*".ab,ti. |
| 11 | or/1-10 [**pediatric population] |
| 12 | exp Back Pain/ |
| 13 | Lumbar Spinal Cord/ |
| 14 | Spinal Cord Injuries/ |
| 15 | Spinal Column/ |
| 16 | (back adj3 (ache* or injur* or pain*)).ab,ti. |
| 17 | (backache* adj3 (injur* or pain*)).ab,ti. |
| 18 | (back pain or back-pain).ab,ti. |
| 19 | (lumbar disc* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 20 | (lumbar disk* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 21 | "low* back pain".ab,ti. |
| 22 | (lumbar adj3 (pain or facet or nerve root* or osteoarthritis or radicul* or spinal stenosis or spondylo* or zygapophys*)).ab,ti. |
| 23 | "Piriformis syndrome*".ab,ti. |
| 24 | radiculopathy.ab,ti. |
| 25 | (sacral adj2 pain*).ab,ti. |
| 26 | ((spine or spinal) adj4 (condition* or disable* or disabilit* or disorder* or pain or stenos?s)).ab,ti. |
| 27 | spondylosis.ab,ti. |
| 28 | (thoracic adj4 (injur* or pain or spine or spinal)).ab,ti. |
| 29 | (T-spine or T-spinal).ab,ti. |
| 30 | or/12-29 [**back injuries] |

| | |
|---|---|
| 31 | Acupuncture/ |
| 32 | exp Behavior Therapy/ |
| 33 | exp Biofeedback/ |
| 34 | exp Cognitive Behavior Therapy/ |
| 35 | Alternative Medicine/ |
| 36 | Electrical Stimulation/ |
| 37 | Human Factors Engineering/ |
| 38 | exp Exercise/ |
| 39 | Movement Therapy/ |
| 40 | Shock Therapy/ |
| 41 | Heat/ |
| 42 | exp Hydrotherapy/ |
| 43 | Laser Irradiation/ |
| 44 | exp Magnetism/ |
| 45 | Massage/ |
| 46 | Client Education/ |
| 47 | Self-Care Skills/ |
| 48 | Physical Therapy/ |
| 49 | Self-Help Techniques/ |
| 50 | Physical Fitness/ |
| 51 | Vibration/ |
| 52 | acupressure.ab,ti. |
| 53 | "acupunctur*".ab,ti. |
| 54 | (advice or advise or advised).ab,ti. |
| 55 | alexander technique.ab,ti. |
| 56 | "assistive device*".ab,ti. |
| 57 | "back belt*".ab,ti. |
| 58 | "back school*".ab,ti. |
| 59 | (back adj2 work).ab,ti. |
| 60 | (braces or brace or bracing).ab,ti. |
| 61 | canes.ab,ti. |
| 62 | chiropract*.ab,ti. |

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|---|---|
| 63 | "cognitive behavioral therap*".ab,ti. |
| 64 | "cognitive behavioural therap*".ab,ti. |
| 65 | (cold adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |
| 66 | "core stabili*".ab,ti. |
| 67 | (corset or corsets).ab,ti. |
| 68 | crutches.ab,ti. |
| 69 | cryotherap*.ab,ti. |
| 70 | "deep tissue therap*".ab,ti. |
| 71 | diathermy.ab,ti. |
| 72 | (electric* adj3 (stimulation or EMS or heating pad*)).ab,ti. |
| 73 | electro-acupuncture.ab,ti. |
| 74 | (electrogalvanic stimulation or EGS).ab,ti. |
| 75 | (electromagnet* and (radiation or therap*)).ab,ti. |
| 76 | electromodalit*.ab,ti. |
| 77 | electrotherapy.ab,ti. |
| 78 | (exercise or exercises or exercising).ab,ti. |
| 79 | (flexion-distraction or flexion distraction).ab,ti. |
| 80 | fluidotherap*.ab,ti. |
| 81 | galvanic stimulation.ab,ti. |
| 82 | (H-Wave Device Stimulation or HWDS).ab,ti. |
| 83 | ((heat* or hot) adj3 (therap* or pack* or compress or massage or lamp or pad or bath or soak or tub or bottle or superficial or therapeutic)).ab,ti. |
| 84 | (high energy shock wave* or high-energy shock wave* or HESW).ab,ti. |
| 85 | "hydrotherap*".ab,ti. |
| 86 | (ice adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |
| 87 | "interferential current*".ab,ti. |
| 88 | infrared.ab,ti. |
| 89 | iontophoresis.ab,ti. |
| 90 | electroanalgesia.ab,ti. |
| 91 | ergonomic*.ab,ti. |
| 92 | kinesiotap*.ab,ti. |
| 93 | (laser* adj3 (phototherapy or irradiation or biostimulation or light or therap*)).ab,ti. |

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| 94 | "low level laser*".ab,ti. |
| 95 | "lumbar support*".ab,ti. |
| 96 | (magnetic adj3 (necklace* or therap* or bracelet*)).ab,ti. |
| 97 | (manipulat* adj3 (therap* or treatment* or spinal or osteopath*)).ab,ti. |
| 98 | "manual therap*".ab,ti. |
| 99 | Microcurrent Electrical Neuromuscular Stimulation.ab,ti. |
| 100 | microwave*.ab,ti. |
| 101 | ((moblisation or mobilization) adj4 (osteopath* or orthopedic* or orthopaedic* or lumbar or spinal)).ab,ti. |
| 102 | "moist air bath*".ab,ti. |
| 103 | moxibustion.ab,ti. |
| 104 | ((multimodal* or multi-modal* or multi modal*) adj4 (treatment* or approach or care or therap* or procedure* or package* or manage*)).ab,ti. |
| 105 | muscle activation.ab,ti. |
| 106 | "muscle energy technique*".ab,ti. |
| 107 | myofascial release.ab,ti. |
| 108 | (Neuromuscular Electrical Stimulation or NMES).ab,ti. |
| 109 | orthotic*.ab,ti. |
| 110 | "passive modalit*".ab,ti. |
| 111 | (patient* adj3 (educat* or train*)).ab,ti. |
| 112 | "Percutaneous Electric* Nerve Stimulation".ab,ti. |
| 113 | (physical adj therap*).ab,ti. |
| 114 | physiotherap*.ab,ti. |
| 115 | photo-acupuncture.ab,ti. |
| 116 | pillow*.ab,ti. |
| 117 | pilates.ab,ti. |
| 118 | (postur* adj3 (correct* or educat* or instruct* or train*)).ab,ti. |
| 119 | (pulsed adj3 (electromagnetic or magnetic or radio frequency or energy)).ab,ti. |
| 120 | radiant light.ab,ti. |
| 121 | Russian stimulation.ab,ti. |
| 122 | "seat adj cushion*".ab,ti. |
| 123 | (self-manage* or self manage*).ab,ti. |
| 124 | (short wave* or short-wave*).ab,ti. |

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| 125 | ((shockwave* or shock wave* or shock-wave*) adj3 (ultrasonic or therap* or radiation)).ab,ti. |
| 126 | "soft tissue therap*".ab,ti. |
| 127 | "spray and stretch".ab,ti. |
| 128 | strain-counterstrain.ab,ti. |
| 129 | strengthen*.ab,ti. |
| 130 | stretching.ab,ti. |
| 131 | (tape or taping).ab,ti. |
| 132 | thoracolumbosacral orthosis.ab,ti. |
| 133 | traction.ab,ti. |
| 134 | traditional Chinese medicine.ab,ti. |
| 135 | (transcutaneous electrical stimulation or TENS).ab,ti. |
| 136 | ultrasound.ab,ti. |
| 137 | vapocoolant spray.ab,ti. |
| 138 | "vibration therap*".ab,ti. |
| 139 | walkers.ab,ti. |
| 140 | "walking adj3 aid*".ab,ti. |
| 141 | "warm compress*".ab,ti. |
| 142 | whirlpool*.ab,ti. |
| 143 | yoga.ab,ti. |
| 144 | or/31-143 [**interventions] |
| 145 | Cohort Analysis/ |
| 146 | Clinical Trials/ |
| 147 | Longitudinal Studies/ |
| 148 | exp Randomized Controlled Trials/ |
| 149 | ((case control or case-control) adj3 (stud* or design*)).ab,ti. |
| 150 | (cohort adj3 (stud* or design* or analysis)).ab,ti. |
| 151 | controlled clinical trial.pt. |
| 152 | "epidemiolog*".ab,ti. |
| 153 | ((followup or follow-up) adj3 (stud* or design* or analysis)).ab,ti. |
| 154 | (longitudinal* adj3 (stud* or design* or analysis)).ab,ti. |
| 155 | (prospective adj3 (stud* or design* or analysis)).ab,ti. |
| 156 | (random* and (control* or clinical or allocat*)).ab,ti. |

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|---|---|
| 157 | (retrospective adj3 (stud* or design*)).ab,ti. |
| 158 | or/145-157 [**effectiveness] |
| 159 | exp Attitudes/ |
| 160 | Awareness/ |
| 161 | Journal Writing/ |
| 162 | Emotions/ |
| 163 | Ethnology/ |
| 164 | Focus Group/ |
| 165 | Grounded Theory/ |
| 166 | Interviews/ |
| 167 | Mindfulness/ or Mindfulness-Based Interventions/ |
| 168 | Motivation/ |
| 169 | Narratives/ |
| 170 | exp Observation Methods/ |
| 171 | Perception/ |
| 172 | Preferences/ |
| 173 | Satisfaction/ |
| 174 | Qualitative Methods/ |
| 175 | Self-Report/ |
| 176 | Surveys/ or Questionnaires/ |
| 177 | exp Tape Recorders/ |
| 178 | Thinking/ |
| 179 | Digital Video/ |
| 180 | (attitude* or aware* or belief* or believe* or experience* or mindfulness or motivation or opinion* or perception* or perspective*).ab,ti. |
| 181 | ((audio adj record*) or audiorecord* or audiotap*).ab,ti. |
| 182 | ((behavioral or behavioural) adj2 research).ab,ti. |
| 183 | biographical method*.ab,ti. |
| 184 | (constant adj2 (comparative or comparison)).ab,ti. |
| 185 | ((content or conversation or discourse) adj2 analys*).ab,ti. |
| 186 | descriptive research.ab,ti. |
| 187 | (diary or diaries).ab,ti. |

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|---|---|
| 188 | emotions.ab,ti. |
| 189 | ethnograph*.ab,ti. |
| 190 | ethnology.ab,ti. |
| 191 | ethnopsychology.ab,ti. |
| 192 | feelings.ab,ti. |
| 193 | (field adj2 (notes or research or study or studies)).ab,ti. |
| 194 | (focus adj2 group*).ab,ti. |
| 195 | framework analysis.ab,ti. |
| 196 | grounded theory.ab,ti. |
| 197 | interview*.ab,ti. |
| 198 | life world.ab,ti. |
| 199 | lived experience.ab,ti. |
| 200 | (meaning or meanings).ab,ti. |
| 201 | (narrative* or narration*).ab,ti. |
| 202 | (observe* or observation*).ab,ti. |
| 203 | (open adj ended).ab,ti. |
| 204 | phenomenology.ab,ti. |
| 205 | purposive sampl*.ab,ti. |
| 206 | qualitative.ab,ti. |
| 207 | questionnaire*.ab,ti. |
| 208 | (realist adj3 (review* or research or synthesis)).ab,ti. |
| 209 | satisfaction.ab,ti. |
| 210 | self report*.ab,ti. |
| 211 | semantic analysis.ab,ti. |
| 212 | standpoint*.ab,ti. |
| 213 | (story or stories).ab,ti. |
| 214 | survey*.ab,ti. |
| 215 | (theme* or thematic).ab,ti. |
| 216 | (theoretical adj2 (sampl* or saturation)).ab,ti. |
| 217 | (thoughts or thinking).ab,ti. |
| 218 | ((video adj record*) or videorecord* or videotap*).ab,ti. |
| 219 | or/159-218 [** qualitative_experience] |

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|---|---|
| 220 | "Costs and Cost Analysis"/ |
| 221 | Health Care Costs/ |
| 222 | Quality of Life Measures/ |
| 223 | Health Care Economics/ |
| 224 | (economic* adj4 (evaluat* or stud*)).ab,ti. |
| 225 | (health economic* adj4 (evaluat* or stud*)).ab,ti. |
| 226 | ((cost-utility or cost utility) adj4 (stud* or analys*)).ab,ti. |
| 227 | ((cost-benefit or cost benefit) adj4 (stud* or analys*)).ab,ti. |
| 228 | (CEA or CUA or CBA).ab,ti. |
| 229 | ((cost-effective* or cost effective*) adj4 (analys* or stud*)).ab,ti. |
| 230 | (economic* adj4 (impact or value or factor* or analys*)).ab,ti. |
| 231 | (cost* adj4 (health care or analys* or savings or hospital or medical or utilit* or effective* or efficac* or benefit* or consequence* or unit*)).ab,ti. |
| 232 | (decision adj1 (tree* or analy* or model*)).ab,ti. |
| 233 | [economics.fs.] |
| 234 | (qol or qoly or qolys or hrqol or qaly or qalys or qale or qales).ab,ti. |
| 235 | (sensitivity analys* or "willingness to pay" or quality-adjusted life year* or quality adjusted life year* or quality-adjusted life expectanc* or quality adjusted life expectanc*).ab,ti. |
| 236 | (markov* or monte carlo*).ab,ti. |
| 237 | or/220-236 [**cost effectiveness] |
| 238 | Health Care Delivery/ |
| 239 | Health Care Administration/ |
| 240 | Health Promotion/ |
| 241 | Integrated Services/ |
| 242 | Interdisciplinary Treatment Approach/ |
| 243 | Case Management/ |
| 244 | (approach* adj3 (collaborative or complementary or comprehensive or innovative or integrated)).ab,ti. |
| 245 | barrier*.ab,ti. |
| 246 | facilitator*.ab,ti. |
| 247 | ((health care or healthcare or health-care) adj3 (clinic or clinics or delivery or implement* or intervention* or model* or plan* or process* or program*or services or strateg* or system* or team*)).ab,ti. |
| 248 | implement*.ab,ti. |

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|---|---|
| 249 | (innovate* adj3 (intervention* or model* or plan* or process* or program*or strateg* or system*)).ab,ti. |
| 250 | (model* adj care).ab,ti. |
| 251 | ((integrated or interdisciplinary or interprofessional or multidisciplinary) adj3 (care or clinic or clinics or intervention* or model* or plan* or process* or program*or strateg* or system* or challenge* or benefit* or success* or constrain* or difficult* or enhanc* or influen* or interfer* or motivat* or obstruct* or problem* or promot* or restrain* or restrict* or disincentive* or factor* or capacity or enabler*)).ab,ti. |
| 252 | (pathway* adj3 (clinical or care)).ab,ti. |
| 253 | (program* adj3 (assess* or evaluat*)).ab,ti. |
| 254 | or/238-253 [**implementation] |
| 255 | 11 and 30 and 144 |
| 256 | limit 255 to (childhood <birth to 12 years> and (100 childhood <birth to age 12 yrs> or 120 neonatal <birth to age 1 mo> or 140 infancy <2 to 23 mo> or 160 preschool age <age 2 to 5 yrs> or 180 school age <age 6 to 12 yrs> or 200 adolescence <age 13 to 17 yrs>)) |
| 257 | 255 and (158 or 219 or 237 or 254) |
| 258 | limit 257 to (childhood <birth to 12 years> and (100 childhood <birth to age 12 yrs> or 120 neonatal <birth to age 1 mo> or 140 infancy <2 to 23 mo> or 160 preschool age <age 2 to 5 yrs> or 180 school age <age 6 to 12 yrs> or 200 adolescence <age 13 to 17 yrs>)) |

BMJ Open

# Rehabilitative management of back pain in children: Protocol for a mixed studies systematic review

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| | |

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**Title:** Rehabilitative management of back pain in children: Protocol for a mixed studies systematic review

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## ABSTRACT

**Introduction:** Little is known about effective, efficient and acceptable management of back pain in children. A comprehensive and updated evidence synthesis can help to inform clinical practice.

**Objective:** To inform clinical practice, we aim to conduct a systematic review of the literature and synthesize the evidence regarding effective, cost-effective and safe rehabilitation interventions for children with back pain to improve their functioning and other health outcomes.

**Methods and analysis:** We will search MEDLINE, Embase, PsycINFO, CINAHL, the Index to Chiropractic Literature, the Cochrane Controlled Register of Trials, and EconLit for primary studies published from inception in all languages. We will include quantitative studies (randomized controlled trials, cohort and case-control studies), qualitative studies, mixed methods studies, and full economic evaluations. To augment our search of the bibliographic electronic databases, we will search reference lists of included studies and relevant systematic reviews, the WHO International Clinical Trials Registry Platform, and consult with content experts. We will assess risk of bias using appropriate critical appraisal tools. We will extract data about study and participant characteristics, intervention type and comparators, context and setting, outcomes, themes and methodological quality assessment. We will use a sequential approach at the review level to integrate data from the quantitative, qualitative and economic evidence syntheses.

**Ethics and dissemination:** Ethics approval is not required. We will disseminate findings through activities including: (1) presentations in national and international conferences; (2) meetings with national and international decision makers; (3) publications in peer-reviewed journals; and (4) posts on organizational websites and social media.

**Systematic review registration number:** PROSPERO CRD42019135009

**Key words:** systematic review, back pain, child, adolescent

## Article Summary

Strengths and limitations of this study

- A systematic review integrating quantitative, qualitative and economic evidence to examine the rehabilitative management of back pain in children.
- Includes studies with a broad range of rehabilitation interventions as described by the World Health Organization (WHO), and outcomes as described by the International Classification of Functioning, Disability and Health (ICF) framework.
- Implements the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols guidelines.
- There is no language restriction in articles.
- Our search strategies, while comprehensive, may miss relevant studies.

**Word count:** 4,872

## INTRODUCTION

### Rationale

A significant proportion of children over 10 years of age suffer from back pain.[1-5] The prevalence of back pain in children ranges between 4% and 74%; the wide range is due to heterogeneous populations studied, outcome measurements and methodologies used.[6 7] Data from the World Health Organization (WHO) Global Burden of Disease study in 2017 shows that low back pain is the leading cause of global years lived with disability.[8] Back pain begins early in life with physical, mental and social consequences (e.g., impact on school-related and sporting activities, general physical activity and well-being) that extend into adulthood.[9-11] Most episodes of spinal pain are brief; however, in a three-year prospective cohort study of 1,465 school children in Denmark, up to 25% of children had three or more episodes over one year, and approximately 13% of children reported episodes lasting five or more weeks.[12]

Two recent systematic reviews assessed the effectiveness of manual therapy to treat a number of conditions including back pain in children, but low-quality evidence precludes drawing conclusions.[13 14] A previous systematic review and meta-analysis which evaluated the effectiveness of conservative interventions for low back pain in children under 18 years of age reported that exercise interventions may be promising for improving pain scores in children compared to no treatment; however, the evidence was very limited and of low-quality.[15] This evidence also needs updating. Additionally, to our knowledge, no integrative systematic review – one that incorporates both quantitative and qualitative studies – has been conducted regarding the rehabilitative management of back pain in children. Compared to traditional systematic reviews of quantitative studies, combining evidence of the effectiveness and efficiency of interventions

with qualitative understanding from people's lived experiences can better inform clinical practice guidelines and policy.[16]

This comprehensive knowledge synthesis can inform clinical practice for decision makers involved with caring for children with back pain including healthcare professionals in a variety of clinical, rehabilitation or community settings (e.g., physicians, nurses, physiotherapists, chiropractors, psychologists, occupational therapists, registered massage therapists). Moreover, the knowledge gaps that we identify can inform future research agendas.

**Objectives**

To support clinical practice for children with back pain, we aim to conduct an integrative systematic review of quantitative, qualitative and economic evidence regarding the rehabilitative management of back pain (including mid-back and low back pain) in children aged 19 years and under. Our review will address the following questions:

1) What is the effectiveness and safety of rehabilitation interventions for improving functioning and other health outcomes in children with back pain?
2) What are the patients', caregivers' and providers' experiences, preferences, expectations and valued outcomes regarding rehabilitation interventions for back pain?
3) What is the cost-effectiveness of rehabilitation interventions for improving functioning and other health outcomes in children with back pain?
4) What can be hypothesized from the integration of the quantitative, qualitative and economic evidence about the effectiveness, cost-effectiveness and safety of rehabilitation interventions for low back pain in children?

We are targeting decision makers (clinicians, health managers/administrators, policy makers, patients, and caregivers) involved in implementing, delivering or receiving rehabilitation interventions or programs of care. We aim to provide them with knowledge regarding effective, acceptable and positively experienced interventions for children with back pain and their caregivers.

## METHODS

We developed this systematic review protocol using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Protocols (PRISMA-P)[17] (Additional file 1). We registered our protocol on the International Prospective Register of Systematic Reviews (PROSPERO) (registration # CRD42019135009).[18] We will report our systematic review according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement,[19] and the Enhancing Transparency in Reporting the Synthesis of Qualitative Research (ENTREQ) reporting guideline.[20]

### Eligibility criteria

#### *Population*

We will target studies including children (aged 19 years or younger)[21] with non-specific low back or thoracic spine pain of any duration and severity. We define LBP as pain and discomfort below the costal margin and above the inferior gluteal folds, with or without radiculopathy (referred leg pain).[22] Radiculopathy refers to inflammation, injury/dysfunction, or compression of spinal nerve roots that can present as pain, weakness, or altered sensation in a myotomal or dermatomal distribution. Lumbar radiculopathy is commonly attributed to lumbar disc herniation

(localized displacement of disc material beyond the normal margins of the intervertebral disc space).[23] We define thoracic spine pain as pain within the region bounded superiorly by the first thoracic spinous process, inferiorly by the last thoracic spinous process, and laterally by the most lateral margins of the erector spinae muscles.[24] We will include studies investigating diagnoses including low back pain, mid-back pain, mechanical back pain, lumbago, lumbar sprain or strain, back sprain or strain, lumbopelvic pain, lumbar radiculopathy, lumbar disc herniation, sacroiliac syndrome, sciatica, dysplastic or isthmic spondylolisthesis or spondylolysis, musculoskeletal or non-specific chest wall pain (pain referred to the chest wall from the thoracic spine).

We will exclude studies of children with back pain attributed to major structural or systemic pathology (e.g., fracture, acute traumatic or pathological spondylolisthesis or spondylolysis, infection, tumour, osteoporosis, inflammatory arthritides, cauda equina syndrome, neuromuscular disease, myelopathy, and scoliosis); and (2) studies of children with back pain attributed to a non-spine-related condition that might refer pain to the chest wall (e.g., heart, lung or esophagus conditions).

***Intervention***

We will include studies that investigate the effectiveness and safety of rehabilitation interventions or programs of care for children with back pain, including education and self-management strategies, exercise, manual therapies, passive physical modalities, acupuncture, pharmacological interventions, psychological interventions, environmental modifications, assistive devices, and complementary and alternative therapies (CAM). Interventions may be delivered in any manner such as in-person, or remotely using technology such as telehealth. The

WHO defines rehabilitation as a set of interventions that assist individuals who experience, or are likely to experience, disability to achieve and maintain optimal functioning when interacting with their environments.[25] Rehabilitation interventions include rehabilitation medicine/therapy, which aims to: 1) improve function through the diagnosis and treatment of health conditions, reducing impairments, preventing or treating complications; and 2) restore and compensate loss of functioning, and prevent or slow deterioration in functioning in every area of a person's life.[25] It may also include assistive devices, which refers to any item, piece of equipment, or product used to increase, maintain, or improve functional capabilities.[25] Various healthcare providers may provide interventions including, but not limited to, general practitioners, nurses, physiotherapists, chiropractors, occupational therapists, psychologists, and registered massage therapists (Table 1). We will exclude studies assessing surgical interventions, and interventions solely conducted at the societal level, such as barrier removal initiatives (e.g., fitting a ramp to a public building).

***Comparison***

The quantitative component of this review will consider comparisons including other interventions, placebo or sham interventions, wait list, standard care, and no intervention.

***Outcomes***

Our primary outcome of interest is a child's functioning. Secondary health outcomes of interest are pain (e.g., pain intensity, frequency, or duration), psychological outcomes (e.g., anxiety and depression), health-related quality of life, adverse events, qualitative outcomes, and economic outcomes (Table 2). We are interested in both short-term (<3 months) and long-term (≥3 months)

outcomes. We selected these outcomes because they are important to children, their caregivers and decision makers, and they are reflected in the WHO's framework for health and disability (International Classification of Functioning, Disability and Health [ICF]).[26] The ICF provides a standard language and framework for the description of health and health-related states, and organizes information into two components – 'body functions and body structures' and 'activities and participation'.[26] Our primary outcome of interest, functioning, aligns with the 'activities and participation' component of the ICF. Examples of *activities* include walking, running, jumping and lifting. *Participation* refers to involvement in life situations such as with one's family, school and community. Common methods to measure ***functioning*** include the Modified Oswestry Low Back Pain Disability Questionnaire,[27] Roland Morris Disability Questionnaire (RMDQ),[28] return to school, and participation in sports or other recreational activities. Pain and psychological outcomes fit within the 'body functions and body structures' component of the ICF. Common methods to measure ***pain*** include the Visual Analogue Scale (VAS),[29] Numerical Rating Scale (NRS),[30] and Faces Pain Scale – Revised.[31 32] Common methods to measure ***psychological outcomes*** (e.g., anxiety and depression) include Revised Child Anxiety and Depression Scale,[33] and State-Trait Anxiety Inventory for Children.[34] We will also assess ***health-related quality of life***, which is not definable in the ICF framework.[35] It is commonly measured with the KIDSCREEN-52,[36] Pediatric Quality of Life Inventory,[37] and PROMIS Pediatric Self Report Scale.[38] We defined ***adverse events or harms*** as any unfavourable sign, symptom, or disease temporarily associated with the treatment, whether or not caused by the treatment.[39 40] We will consider indirect harms (where the use of an intervention delays a diagnosis or treatment, and such delay holds a potential harm),[41] number of adverse events, severity of adverse events (i.e., mild, moderate or severe), and number of

participant withdrawals from the study due to adverse events. ***Qualitative outcomes*** include the experiences, preferences, expectations, and valued outcomes (of children, caregivers, and providers). Lastly, ***economic outcomes*** include direct costs (e.g., resources saved by an intervention), indirect costs (e.g., time freed by an intervention), economic health outcomes (e.g., quality-adjusted life-year [QALY], incremental cost-effectiveness ratio [ICER], net monetary benefit [NMB]), and intangible outcomes (e.g., pain or suffering saved by an intervention).

***Types of studies***

We will include randomized controlled trials of any type (e.g., superiority, non-inferiority and equivalence), cohort studies, case-control studies, and mixed-methods studies (quantitative component) including any secondary analyses of eligible studies for question 1 (effectiveness and safety of interventions); qualitative and mixed-methods studies (qualitative component) for question 2 (users' experiences, preferences, expectations and valued outcomes of interventions); and trial- and model-based full economic evaluations for question 3 (cost-effectiveness of interventions) (Table 2).

We will exclude the following types of studies: cross-sectional studies, pilot studies assessing feasibility, protocol studies, case reports, case series, studies assessing only prevention of back pain and incidence outcomes, systematic reviews (although their reference lists will be searched for potentially relevant studies) and other review papers, clinical practice guidelines, biomechanical studies, laboratory studies, cadaveric or animal studies, conceptual papers, letters, editorials, commentaries, books and book chapters, conference proceedings, meeting abstracts,

lectures and addresses, consensus development statements, guideline statements, and studies reviewing solely partial economic evaluations (e.g., cost of illness studies).

***Context and setting***

We will consider rehabilitation interventions/programs of care delivered in any healthcare system within an urban or rural area and in any healthcare setting (e.g., acute care, hospital, primary health care, rehabilitation clinics), or in the community. Community-based rehabilitation is implemented through the combined efforts of individuals with disabilities, their families and communities, and relevant government and non-government health, education, social and other services (e.g., advocacy programme).[42]

**Information sources**

We will develop the initial search strategy in MEDLINE, in consultation with an experienced health sciences librarian. A second experienced health sciences librarian will review the search strategy assessing its appropriateness and comprehensiveness using the Peer Review of Electronic Search Strategies (PRESS) Checklist.[43 44] We will conduct electronic searches of the following databases from database inception to the present: MEDLINE (Ovid), Embase (Ovid), PsycINFO (Ovid), CINAHL (Cumulative Index to Nursing and Allied Health Literature, EBSCO*host*), the Index to Chiropractic Literature (Chiropractic Library Collaboration), the Cochrane Controlled Register of Trials (Ovid), and EconLit (EBSCO*host*). We will augment our search of the bibliographic electronic databases to identify additional relevant studies, and mitigate the potential impact of publication bias and selective outcome reporting bias.[45] We will search reference lists of included studies from the database searches and relevant systematic

reviews; and we will consult with content experts. We will ask experts to suggest up to three targeted websites that may contain relevant studies and other potentially relevant studies not captured by our search strategy. Lastly, we will search the WHO International Clinical Trials Registry Platform (http://apps.who.int/trialsearch/). For studies only reported in the registry, we will contact first authors by email (with two reminders over one month) to obtain full study reports, or additional study or outcome data. We will include studies in any language and will use professional medical translation services where required. If 12 or more months elapse between the search date and submission for publication, we will update the search.

**Search strategy**

The searches will include a combination of subject headings specific to databases (e.g. MeSH in MEDLINE) and free text words to capture the key concepts of rehabilitative management of back pain in children (Additional file 2).

**Patient and public involvement**

Patients were not involved in the design of our study. However, we will seek patient and public consultation during the development of clinical practice guidelines, which will be the next phase of this project.

**Data management**

We will download the electronic search results into Endnote X9 reference manager software (Clarivate Analytics, PA, USA). We will remove duplicates and upload the remaining references to the Evidence for Policy and Practice Information and Coordinating (EPPI) Centre Reviewer

software for the data extraction stages (EPPI-Reviewer version 4, UCL Institute of Education, University of London, UK). EPPI-Reviewer software stores references, manages and monitors the data extraction process and provides an audit trail for the review.[46]

**Screening for eligibility**

Using the inclusion and exclusion criteria, pairs of reviewers will independently screen titles and abstracts, and subsequently the full text of each selected article in order to confirm inclusion into the study. Titles and abstracts will be classified as possibly relevant or irrelevant. Subsequently, full-text articles of abstracts classified as possibly relevant will be retrieved, reviewed and classified as relevant or irrelevant.

We will conduct training exercises prior to initiating the screening process to ensure reliability between reviewers. Reviewers will first screen a random sample of 50 records based on titles and abstracts. Paired reviewers must reach 90% agreement before completing title and abstract screening for the remaining studies.[47] If this threshold is not reached for all review teams, all team members will discuss differences in classification to clarify and potentially modify the eligibility criteria prior to completing title and abstract screening. Next, reviewers will screen a random sample of 25 full-text articles. All paired reviewers must again reach 90% agreement before completing full-text article screening for the remaining studies. If not, all team members will discuss to clarify eligibility criteria and resolve disagreements prior to completing full-text article screening. Upon completing full-text article screening, paired reviewers will discuss disagreements and reach consensus related to the inclusion of any article, involving a third reviewer if necessary.

**Risk of bias in individual studies**

We will critically appraise studies according to study design using appropriate checklists (Additional file 3). We will assess the quality of studies using the Scottish Intercollegiate Guidelines Network (SIGN) criteria for randomized controlled trials (RCTs), cohort and case-control studies;[48] the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for qualitative studies;[49] the Mixed Methods Appraisal Tool (MMAT) for mixed methods studies;[50] and the Drummond checklist for economic evaluations.[51] The SIGN checklists allow reviewers to assess internal validity by considering the impact of selection bias, information bias, and confounding on study results. The JBI checklist allows reviewers to assess the possibility of bias in qualitative studies' design, conduct and analysis. The MMAT allows reviewers to assess the interdependent qualitative and quantitative components of the study and criteria to consider, such as justification for mixing evidence, and appropriate ways of integrating the data. The Drummond checklist allows reviewers to identify elements that demonstrate a sound economic evaluation such as the assessment of both costs and effects of interventions, accurate measurements of costs and effects, and allowances made for uncertainty in the estimates of costs and effects. We will contact the authors of papers to request missing or additional data for clarification where required. Paired reviewers will independently assess the eligible studies for quality. Any disagreements that arise between the reviewers will be resolved through discussion, or with a third reviewer. Since some of the reviewers have published within this area, the review coordinator will ensure that reviewers will not be assigned their own studies for risk of bias assessment. Additionally, reviewers will recluse themselves from any discussion and decision-making that involves their paper. We will clearly describe this in our final systematic review report.

Using these established checklists and notes to guide our assessment, we will categorize the validity or credibility of each study as either high, low, or unclear risk of bias. We will not use a quantitative cut-off score to determine study quality and will not pre-define weights for the checklist items. Rather, we will make an overall quality judgement by considering the impact of selection bias, information bias and confounding on study results throughout the conduct of each study.[52] We will report detailed results of the critical appraisal in a narrative form and in a 'risk of bias' table. All studies, regardless of their methodological quality, will be extracted and synthesized (where possible). The overall methodological quality of relevant studies will be considered in the individual synthesis of quantitative, qualitative and economic data and the integration of these findings. The results of the risk of bias assessment will be used in a sensitivity analysis to ensure that studies judged to be at 'high risk of bias' do not affect the robustness of our results.

**Data items and data extraction process**

Paired reviewers will independently extract the data from all eligible studies. For the quantitative studies, we will extract data on the study and participant characteristics; intervention and comparator intervention characteristics using the Template for Intervention Description and Replication (TIDieR) checklist;[53] all pre-determined outcomes including multiple measures if used;; key findings; and methodological quality. The TIDieR checklist[53] consists of items to help readers better understand the interventions and how they were delivered (i.e., name of intervention, why, what (materials), what (procedure), who provided, how, where, when and how much, tailoring, modifications, how well (planned), how well (actual)).[53] We will use the

PerSPecTIF question formulation framework to guide data extraction for the qualitative studies regarding the items: perspective, setting, phenomenon of interest, environment, timing, and findings (e.g., themes).[54] We will also extract data describing the qualitative approach used and methodological quality of studies. For both quantitative and qualitative studies, we will extract data on the ICF categories 'environmental factors' (contextual factors that make up the physical, social and attitudinal environment in which people live and conduct their lives) and 'personal factors' (internal contextual factors that influence how disability is experienced by the individual) to add context to the interventions and outcomes.[26] For the economic evaluations, we will use the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement[55] and extract data on the analytic approach (trial- or model-based), evaluation type, the analytic perspective, time horizon adopted for costs, main cost items, setting, key findings, and methodological quality of studies.

Paired reviewers will pretest the data extraction form and revise as needed. We will use EPPI-Reviewer software to manage the data extraction process. Any disagreements that arise between the reviewers will be resolved through discussion, or with a third reviewer. We will contact authors of papers to request missing or additional data, if required.

## DATA SYNTHESIS

We will use a sequential approach at the review level to synthesize and integrate the data.[56] This will involve separate quantitative, economic, and qualitative findings synthesis followed by integration of the resultant quantitative, economic, and qualitative evidence.

***Quantitative synthesis***

We will group studies by: 1) class of intervention (i.e., education and self-management strategies, exercise, manual therapies, passive physical modalities, acupuncture, pharmacological interventions, psychological interventions, environmental modifications, assistive devices, and CAM); 2) comparator type, either inactive comparator (e.g., placebo, no treatment, standard care, or waiting list control) or active comparator (e.g., different type of therapy); 3) outcome domain (i.e., functioning, pain, psychological outcomes, health-related quality of life, and adverse events) as well as subdomain (e.g., functioning could be further stratified into return to school outcomes and participation in sports; psychological outcomes into depressive or anxiety outcomes; pain outcomes into pain intensity or duration); and 4) methodological quality assessment (i.e., high/low/unclear risk of bias). We may conduct further subgroup analyses according to study design (i.e., RCT, cohort or case-control study); age group (e.g., youth, adolescent); sex; back pain type (e.g., non-specific low back pain, disc herniation); specific intervention within each intervention class outlined in Table 1 (e.g., type of exercise such as aerobic or stretching); mode of intervention delivery (e.g., provider type, in-person or remotely); specific measurements used in each outcome domain (e.g., VAS or Faces Pain Scale – Revised for the pain domain); and time points of outcome measurement (short- or long-term). We will use established minimal clinically important differences (MCID) to determine the clinical importance of effect sizes when possible.

We will assess clinical, methodological, and statistical heterogeneity among studies. Differences in populations, interventions, comparators, or outcomes across studies may result in clinical heterogeneity. Methodological and statistical heterogeneity may result from differences in risk of

bias and differences in outcomes across studies beyond what could be expected by chance alone. We will assess the methodological heterogeneity across studies using our assessments from the SIGN checklist as either high, low, or unclear risk of bias. We will assess statistical heterogeneity using the $I^2$ statistic, whereby $I^2$ of <25-50% will be considered low to moderate (homogeneous), and ≥ 50% considered high (heterogeneous).[57] If two or more studies are clinically homogeneous (i.e., similar populations, interventions, comparators and outcomes) and statistically homogeneous (i.e., $I^2$ <25-50%), we will perform a random effects meta-analysis using EPPI-Reviewer software using the relative risk (or odds ratio for rare events) effect measure for dichotomous data, mean differences for continuous data, hazard rate ratios for time-to-event data, and rates or rate ratios for count data. For studies that used multiple measures to assess the same outcome and at multiple time points, we will select the most prevalent measure and time point used across the studies to maximize comparability of the findings. For our primary analysis, we will analyze the studies with low and unclear risk of bias. We will then explore the impact of methodological heterogeneity through sensitivity analysis by analyzing all studies together, including those with a high risk of bias, and comparing our primary analysis with our sensitivity analysis. If the results of the primary and sensitivity analyses differ, we will give precedence to the primary analysis because high risk of bias studies are known to be at risk of overestimating effect sizes.[58]

If the studies are heterogeneous (i.e., if there is clinical, methodological, and statistical heterogeneity), we will narratively summarize the characteristics and findings of all eligible studies according to or the Synthesis Without Meta-analysis (SWiM) reporting guideline.[59] To quantify the effectiveness of interventions, we will use the data provided in the studies to

compute effect measures and 95% confidence intervals (i.e., odds ratio or relative risk for dichotomous outcomes, mean differences for continuous outcomes, hazard rate ratios for time-to-event outcomes, and rates or rate ratios for count outcomes).[60] We will interpret the evidence on the effectiveness of interventions (i.e., whether an intervention was superior, equal or inferior to a comparison intervention) by considering the direction, magnitude, and precision of effect estimates across studies, impact of risk of bias in sensitivity analyses, and the generalizability of findings. Similar to any meta-analysis we may conduct, we will give precedence to the primary analysis consisting of studies with low and unclear risk of bias.

***Economic synthesis***

We will report the main findings of economic studies, first stratified by high, low or unclear risk of bias. We will further stratify findings by study design (i.e., cost-effectiveness, cost-utility, cost-benefit, or cost-consequences). We will then stratify findings by type of intervention, outcome, and cost measure.

To indicate whether an intervention might be judged favourably (or unfavourably) from an economic perspective,[61] we will use the Dominance Ranking Matrix (DRM) to classify the interventions into one of three options.[62] *Strong dominance* for the intervention will be selected when the incremental cost-effectiveness measure shows the intervention as: (i) more effective and less costly than the comparator; or (ii) effective and less costly; or (iii) equal cost and more effective. In this case, from an efficiency perspective, decision makers should favor the intervention over the comparator (in circumstances similar to those of the evaluations). *Weak dominance* for the intervention will be selected when the measure shows the interventions as: (i)

equally costly and effective as the comparator; or (ii) more effective and more costly; or (iii) less effective and less costly. In this case, no conclusion may be drawn about whether the intervention is preferable from an efficiency perspective without further information on the priorities or preferences of decision makers in a particular context. Decision makers must determine whether the cost/benefit trade-offs are worth the implementing an intervention in their particular context. Lastly, *non-dominance* for the intervention will be selected when the measure shows the intervention as: (i) more costly and less effective; or (ii) equally as costly and less effective; or (iii) more costly and as effective. In this case the evidence we will interpret the evidence as suggesting the comparator is favourable from an efficiency perspective (in circumstances similar to those of the evaluations).

***Qualitative synthesis***

We will stratify the qualitative findings similarly to the quantitative and economic findings. We will first stratify the findings by risk of bias (i.e., high/low/unclear), then by study approach or design (e.g., qualitative descriptive, ethnography, grounded theory), and by intervention type and outcome.

Additionally, we will stratify findings according to individual perspective (i.e., patient (children), caregivers (parents/guardians), healthcare providers, community service providers, or others involved with the rehabilitation of back pain in children). We will use thematic synthesis to synthesize the qualitative research findings.[63 64] First, we will enter all the text labelled as 'results' or 'findings' of the primary studies verbatim into EPPI-Reviewer. Then, pairs of trained reviewers will independently code each line of text according to its meaning and content, and

group codes hierarchically into descriptive themes, including the *a priori* themes (intervention type and outcomes). Reviewers will also generate themes *a posteriori* to answer our review question (i.e., experiences, preferences, expectations and valued outcomes regarding rehabilitation interventions for back pain in children). Reviewers will finalize the themes through discussion. We will give precedence to studies with low or unclear risk of bias.[65]

***Integration of quantitative, qualitative and economic evidence***

Various methods can be used to integrate diverse study types including: (1) juxtaposing findings in a matrix, (2) using logic models/conceptual framework, (3) analyzing program theory, (4) testing hypothesis derived using subgroup analysis, and (5) qualitative comparative analysis.[56] We will integrate the evidence by juxtaposing findings in a matrix to generate hypotheses regarding the effectiveness, cost-effectiveness and safety of rehabilitation interventions for back pain in children. We selected this methodology because it is suitable for comparing and contrasting the findings across the individual quantitative, qualitative and economic evidence syntheses in our review.[56] The use of a matrix will allow us to explore heterogeneity in the findings of the quantitative studies and may indicate why some interventions may be effective, cost-effective and safe, and some may not.[56] For example, we may list themes from the qualitative synthesis along one side of the matrix, and then plot the interventions evaluated in the quantitative synthesis against the themes as either a match (when the intervention matched a theme) or a mismatch (when the intervention was the opposite of a theme). We will also plot the economic evaluation findings against the corresponding intervention and theme. We will identify gaps in knowledge if a particular theme for an intervention does not match with any of the interventions evaluated in the quantitative studies.

## DISSEMINATION

Knowledge translation activities will include presentations to clinicians and researchers at national and international conferences; meetings with national and international decision makers (clinicians, health managers/administrators, policy makers and patients); publications in peer-reviewed journals; clinician and patient/caregiver resources; posts and lay language summaries on organizations' websites (open access) and other social media platforms.

## DISCUSSION

Findings from this mixed studies review will advance our knowledge of the effectiveness, safety, user experience, and cost-effectiveness of a wide range of rehabilitation interventions for children with back pain. This work will provide the evidentiary basis to develop clinical practice guidelines and care pathways outlining the evidence-based management of back pain in children, which can be adapted for specific settings (e.g., hospitals, rehabilitation clinics, and schools) and geographical regions. Specifically, decision makers should consider interventions that are identified as effective, safe, efficient, and positively experienced by patients and caregivers. Mapping findings to the ICF framework will allow decision makers to use standardized language in the assessment and management of children during their care program. This may further facilitate improvements in functioning and health outcomes in this patient population.

A potential limitation of our review is that our search strategy may miss potentially relevant studies, however, we have mitigated this by expanding our search strategy to include content experts and searching relevant websites. A potential risk is that there may be too little evidence

available to answer our review questions. Another limitation is that we will not assess the potential for publication bias in our review.

Findings from this review will guide future research by identifying methodological limitations and knowledge gaps in the available literature. Future studies can be designed to address these limitations and gaps. This novel interpretation of quantitative, qualitative and economic evidence according to the ICF framework serves as a model for how outcomes related to functioning and health can be prioritized in future research.

## ADDITIONAL FILES

Additional file 1: PRISMA-P 2015 Checklist. Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) 2015 statement

Additional file 2: Literature search strategies

Additional file 3: Risk of bias assessment

## DECLARATIONS

**Ethics approval and consent to participate:** Not applicable

**Consent for publication:** Not applicable

**Availability of data and materials:** Not applicable

**Competing interests:** None declared.

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**Author contributions:**

All authors (CC, JJW, HY, SM, GB, HMS, DR, LH, EP, CC, MS, GC, LV, ATV, PC) assisted in designing and planning the study, developing the research questions and systematic review methodology. CC and JJW drafted the manuscript. All authors reviewed and revised the manuscript, and approved the final manuscript.

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791 **Table 1: Examples of rehabilitation interventions**

| Intervention | Definition | Examples |
|---|---|---|
| Patient or caregiver education and self-management strategies (structured or unstructured) | Teaching patients skills that they can use to manage their health condition | • Learning disease-specific information<br>• Learning general managing skills (e.g., problem-solving, finding and using community resources, working with healthcare team)<br>• Learning strategies to increase confidence (i.e., self-efficacy) in ability to engage in behaviours that are needed to manage their condition on a daily basis<br>• Adequate peer role models and support networks that facilitate the initiation and maintenance of desired behavioural changes |
| Exercise | A subcategory of physical activity that is planned, structured, repetitive, and purposeful; can be supervised (e.g., by a healthcare professional) or unsupervised | • Stretching<br>• Strengthening<br>• Range of motion exercises<br>• Aerobic (e.g., swimming, cycling, walking, running)<br>• Anaerobic (e.g., jumping, sprinting, weight lifting)<br>• Yoga, Qigong |
| Manual therapies | - Manipulation: Techniques incorporating a high-velocity low-amplitude impulse or thrust applied at or near the end of a joint's passive range of motion<br>- Mobilization: Techniques incorporating a low-velocity and small or large amplitude oscillatory movement, within a joint's passive range of motion<br>- Traction: Manual or mechanically assisted application of an intermittent or continuous distractive force<br>- Soft tissue therapy: A mechanical form of therapy where soft-tissue structures are pressed and kneaded, using physical contact with the hand or mechanical device | • Lumbar manipulation, mobilization, or traction<br>• Massage<br>• Muscle energy technique<br>• Strain-counterstrain |
| Passive physical modalities | A form of cold, heat, or light application affecting the body at the skin level or ultrasonic | • Heat application: heat pack, hydrotherapy |

| | | |
|---|---|---|
| | or electromagnetic radiation affecting structures beneath the skin surface:<br>- Passive assistive devices: Device to encourage immobilization in anatomic positions or actively inhibit or prevent movement | • Cryotherapy: cold pack, vapocoolant spray<br>• Low-level laser<br>• Electrical muscle stimulation<br>• Pulsed electromagnetic therapy |
| Acupuncture | Any body-needling, moxibustion, electric acupuncture, laser acupuncture, microsystem acupuncture, and acupressure | • Traditional needling<br>• Dry needling<br>• Burning of specific herbs<br>• Electro-acupuncture<br>• Photo-acupuncture |
| Pharmacological interventions | A substance used in treating disease or relieving pain | • Acetaminophen<br>• Nonsteroidal anti-inflammatory drugs<br>• Muscle relaxants<br>• Antidepressants |
| Psychological interventions | Activities used to modify behaviour, emotional state, or feelings | • Cognitive behavioural therapy<br>• Counselling<br>• Social network and environment-based therapies<br>• Psychoeducational interventions<br>• Mindfulness meditation |
| Modifications to environment | | • Ergonomic interventions at school or work |
| Assistive devices | Any item, piece of equipment or product system, used to increase, maintain, or improve the functional capabilities of people with disabilities | • Walking aids<br>• Orthoses<br>• Braces<br>• Wheelchairs |
| Complementary and alternative therapies (CAM) | Medical products and practices that are not part of standard medical care | • Homeopathy<br>• Traditional Chinese Medicine<br>• Naturopathy<br>• Products (e.g., herbs, dietary supplements, probiotics) |

794 **Table 2. Research questions, outcomes and study types**

| Research Question | Outcomes | Study Types |
|---|---|---|
| What is the effectiveness and safety of rehabilitation interventions for improving functioning and other health outcomes in children with back pain? | *Primary:*<br>1. **Functioning**: e.g., Modified Oswestry Low Back Pain Disability Questionnaire, Roland Morris Disability Questionnaire, return to school, participation in sports/other recreational activities<br>*Secondary:*<br>2. **Pain** (including pain intensity, frequency, duration): e.g., VAS, NRS, Faces Pain Scale - Revised<br>3. **Psychological outcomes** (including anxiety and depression): e.g., Revised Child Anxiety and Depression Scale, State-Trait Anxiety Inventory for Children<br>4. **Health-related quality of life**: e.g., KIDSCREEN-52, Pediatric Quality of Life Inventory, PROMIS Pediatric Self Report Scale<br>5. **Adverse events**: any unfavorable sign, symptom, or disease temporarily associated with treatment, indirect harms (e.g., delayed diagnosis/treatment), number of adverse events, severity of adverse events (i.e., mild, moderate, severe), number of participant withdrawals from study due to adverse events. | Randomized controlled trials<br><br>Cohort studies<br><br>Case-control studies<br><br>Mixed methods studies (quantitative component) |
| What are the patients', caregivers' and providers' experiences, preferences, expectations and valued outcomes regarding rehabilitation interventions for back pain? | 6. **Qualitative outcomes**: experiences, preferences, expectations, valued outcomes | Qualitative studies (e.g., phenomenology, grounded theory, ethnography, action research, descriptive qualitative studies)<br><br>Mixed-methods studies (qualitative component) |
| What is the cost-effectiveness of rehabilitation interventions for improving functioning and other health outcomes in children with back pain? | 7. **Economic outcomes**:<br>Direct costs: resources consumed or saved by an intervention<br>Indirect costs: productivity gains or losses (e.g., time consumed or freed by the intervention)<br>Economic health outcomes: QALY, ICER, NMB | Full economic evaluations (trial- and model-based): cost-effectiveness, cost-utility, cost-benefit, cost-consequences |

| | | |
|---|---|---|
| | Intangible: e.g., pain or suffering saved or brought on by an intervention | |

ICER: incremental cost-effectiveness ratio; NMB: measure of net monetary benefit; NRS: Numerical Rating Scale; PROMIS: Patient-Reported Outcomes Measurement Information System; QALY: quality adjusted life years; VAS: Visual Analogue Scale

**PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol***

| Section and topic | Item No | Checklist item | (Page No.#) |
|---|---|---|---|
| **ADMINISTRATIVE INFORMATION** | | | |
| Title: | | | |
| Identification | 1a | Identify the report as a protocol of a systematic review | 1 |
| Update | 1b | If the protocol is for an update of a previous systematic review, identify as such | N/A |
| Registration | 2 | If registered, provide the name of the registry (such as PROSPERO) and registration number | 4 |
| Authors: | | | |
| Contact | 3a | Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author | 1-2 |
| Contributions | 3b | Describe contributions of protocol authors and identify the guarantor of the review | 25 |
| Amendments | 4 | If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments | N/A |
| Support: | | | |
| Sources | 5a | Indicate sources of financial or other support for the review | 25 |
| Sponsor | 5b | Provide name for the review funder and/or sponsor | |
| Role of sponsor or funder | 5c | Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol | |
| **INTRODUCTION** | | | |
| Rationale | 6 | Describe the rationale for the review in the context of what is already known | 5-6 |
| Objectives | 7 | Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO) | 6 |
| **METHODS** | | | |
| Eligibility criteria | 8 | Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review | 7-11 |
| Information sources | 9 | Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage | 12-13 |
| 3Search strategy | 10 | Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated | Additional File 2 |

| | | | |
|---|---|---|---|
| Study records: | | | |
| Data management | 11a | Describe the mechanism(s) that will be used to manage records and data throughout the review | 13 |
| Selection process | 11b | State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis) | 14, 18-20 |
| Data collection process | 11c | Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators | 16-7 |
| Data items | 12 | List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications | 16-7 |
| Outcomes and prioritization | 13 | List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale | 9-11 |
| Risk of bias in individual studies | 14 | Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis | 15-6 |
| Data synthesis | 15a | Describe criteria under which study data will be quantitatively synthesised | 17-22 |
| | 15b | If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as $I^2$, Kendall's $\tau$) | |
| | 15c | Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression) | |
| | 15d | If quantitative synthesis is not appropriate, describe the type of summary planned | |
| Meta-bias(es) | 16 | Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies) | 15 |
| Confidence in cumulative evidence | 17 | Describe how the strength of the body of evidence will be assessed (such as GRADE) | 20 |

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

*From: Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart L, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. BMJ. 2015 Jan 2;349(jan02 1):g7647.*

**Additional file 2. Literatures search strategies**

**Ovid MEDLINE:** Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE® Daily and Ovid MEDLINE® 1946-Present

| | |
|---|---|
| 1 | exp Infant/ |
| 2 | Child, Preschool/ |
| 3 | Child/ |
| 4 | Adolescent/ |
| 5 | Pediatrics/ |
| 6 | (baby or babies).ab,ti. |
| 7 | "newborn*".ab,ti. |
| 8 | (infant or infants).ab,ti. |
| 9 | (child or children*).ab,ti. |
| 10 | (adolescent* or adolescence).ab,ti. |
| 11 | (teen or teens or teenager).ab,ti. |
| 12 | (pediatric* or paediatric*).ab,ti. |
| 13 | (young adj3 (person* or people)).ab,ti. |
| 14 | emerging adult*.ab,ti. |
| 15 | "youth*".ab,ti. |
| 16 | or/1-15 [**pediatric population] |
| 17 | exp Back Injuries/ |
| 18 | exp Back Pain/ |
| 19 | Coccyx/in [Injuries] |
| 20 | Intervertebral Disc Degeneration/ |
| 21 | Intervertebral Disc Displacement/ |
| 22 | Lumbar Vertebrae/in [Injuries] |
| 23 | Lumbosacral Region/in [Injuries] |
| 24 | Osteoarthritis, Spine/ |
| 25 | Piriformis Muscle Syndrome/ |
| 26 | Radiculopathy/ |
| 27 | Sciatica/ |
| 28 | Spinal Diseases/ |

| | |
|---|---|
| 29 | Spinal Stenosis/ |
| 30 | Thoracic Injuries/ |
| 31 | Thoracic Vertebrae/ |
| 32 | (back adj3 (ache* or injur* or pain*)).ab,ti. |
| 33 | (backache* adj3 (injur* or pain*)).ab,ti. |
| 34 | (back pain or back-pain).ab,ti. |
| 35 | (lumbar disc* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 36 | (lumbar disk* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 37 | "low* back pain".ab,ti. |
| 38 | (lumbar adj3 (pain or facet or nerve root* or osteoarthritis or radicul* or spinal stenosis or spondylo* or zygapophys*)).ab,ti. |
| 39 | "Piriformis syndrome*".ab,ti. |
| 40 | radiculopathy.ab,ti. |
| 41 | (sacral adj2 pain*).ab,ti. |
| 42 | ((spine or spinal) adj4 (condition* or disable* or disabilit* or disorder* or pain or stenos?s)).ab,ti. |
| 43 | spondylosis.ab,ti. |
| 44 | (thoracic adj4 (injur* or pain or spine or spinal)).ab,ti. |
| 45 | (T-spine or T-spinal).ab,ti. |
| 46 | or/17-45 [**back pain] |
| 47 | Acupressure/ |
| 48 | Acupuncture/ |
| 49 | exp Acupuncture Therapy/ |
| 50 | "Bedding and Linens"/ |
| 51 | Behavior Therapy/ |
| 52 | exp Biofeedback, Psychology/ |
| 53 | exp Cognitive Behavioral Therapy/ |
| 54 | Combined Modality Therapy/ |
| 55 | Community-Based Participatory Research/ |
| 56 | Community Health Services/ |
| 57 | Community Participation/ |
| 58 | Complementary Therapies/ |
| 59 | Cryotherapy/ |

| | |
|---|---|
| 60 | exp Diathermy/ |
| 61 | exp Electric Stimulation Therapy/ |
| 62 | Electroacupuncture/ |
| 63 | Ergonomics/ |
| 64 | exp Exercise/ |
| 65 | exp Exercise Movement Techniques/ |
| 66 | exp Exercise Therapy/ |
| 67 | Fluid Therapy/ |
| 68 | High-Energy Shock Waves/tu [Therapeutic Use] |
| 69 | Immobilization/ |
| 70 | Hot Temperature/tu [Therapeutic Use] |
| 71 | exp Hydrotherapy/ |
| 72 | Laser Therapy, Low-Level/ |
| 73 | Low-Level Light Therapy/ |
| 74 | Magnetic Field Therapy/ |
| 75 | Magnetics/tu [Therapeutic Use] |
| 76 | Massage/ |
| 77 | exp Medicine, Chinese Traditional/ |
| 78 | exp Musculoskeletal Manipulations/ |
| 79 | Patient Education as Topic/ |
| 80 | Physical Therapy Modalities/ |
| 81 | Self Care/ |
| 82 | Self-Help Devices/ |
| 83 | Physical Fitness/ |
| 84 | Restraint, Physical/ |
| 85 | Transcutaneous Electric Nerve Stimulation/ |
| 86 | Vibration/tu [Therapeutic Use] |
| 87 | Wheelchairs/ |
| 88 | acupressure.ab,ti. |
| 89 | "acupunctur*".ab,ti. |
| 90 | (advice or advise or advised).ab,ti. |
| 91 | alexander technique.ab,ti. |

| | |
|---|---|
| 92 | "assistive device*".ab,ti. |
| 93 | "back belt*".ab,ti. |
| 94 | "back school*".ab,ti. |
| 95 | (back adj2 work).ab,ti. |
| 96 | (braces or brace or bracing).ab,ti. |
| 97 | canes.ab,ti. |
| 98 | chiropract*.ab,ti. |
| 99 | "cognitive behavioral therap*".ab,ti. |
| 100 | "cognitive behavioural therap*".ab,ti. |
| 101 | (cold adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |
| 102 | "core stabili*".ab,ti. |
| 103 | (corset or corsets).ab,ti. |
| 104 | crutches.ab,ti. |
| 105 | cryotherap*.ab,ti. |
| 106 | "deep tissue therap*".ab,ti. |
| 107 | diathermy.ab,ti. |
| 108 | (electric* adj3 (stimulation or EMS or heating pad*)).ab,ti. |
| 109 | electro-acupuncture.ab,ti. |
| 110 | (electrogalvanic stimulation or EGS).ab,ti. |
| 111 | (electromagnet* and (radiation or therap*)).ab,ti. |
| 112 | electromodalit*.ab,ti. |
| 113 | electrotherapy.ab,ti. |
| 114 | (exercise or exercises or exercising).ab,ti. |
| 115 | (flexion-distraction or flexion distraction).ab,ti. |
| 116 | fluidotherap*.ab,ti. |
| 117 | galvanic stimulation.ab,ti. |
| 118 | (H-Wave Device Stimulation or HWDS).ab,ti. |
| 119 | ((heat* or hot) adj3 (therap* or pack* or compress or massage or lamp or pad or bath or soak or tub or bottle or superficial or therapeutic)).ab,ti. |
| 120 | (high energy shock wave* or high-energy shock wave* or HESW).ab,ti. |
| 121 | "hydrotherap*".ab,ti. |
| 122 | (ice adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |

| | |
|---|---|
| 123 | "interferential current*".ab,ti. |
| 124 | infrared.ab,ti. |
| 125 | iontophoresis.ab,ti. |
| 126 | electroanalgesia.ab,ti. |
| 127 | ergonomic*.ab,ti. |
| 128 | kinesiotap*.ab,ti. |
| 129 | (laser* adj3 (phototherapy or irradiation or biostimulation or light or therap*)).ab,ti. |
| 130 | "low level laser*".ab,ti. |
| 131 | "lumbar support*".ab,ti. |
| 132 | (magnetic adj3 (necklace* or therap* or bracelet*)).ab,ti. |
| 133 | (manipulat* adj3 (therap* or treatment* or spinal or osteopath*)).ab,ti. |
| 134 | "manual therap*".ab,ti. |
| 135 | Microcurrent Electrical Neuromuscular Stimulation.ab,ti. |
| 136 | microwave*.ab,ti. |
| 137 | ((moblisation or mobilization) adj4 (osteopath* or orthopedic* or orthopaedic* or lumbar or spinal)).ab,ti. |
| 138 | "moist air bath*".ab,ti. |
| 139 | moxibustion.ab,ti. |
| 140 | ((multimodal* or multi-modal* or multi modal*) adj4 (treatment* or approach or care or therap* or procedure* or package* or manage*)).ab,ti. |
| 141 | muscle activation.ab,ti. |
| 142 | "muscle energy technique*".ab,ti. |
| 143 | myofascial release.ab,ti. |
| 144 | (Neuromuscular Electrical Stimulation or NMES).ab,ti. |
| 145 | orthotic*.ab,ti. |
| 146 | "passive modalit*".ab,ti. |
| 147 | (patient* adj3 (educat* or train*)).ab,ti. |
| 148 | "Percutaneous Electric* Nerve Stimulation".ab,ti. |
| 149 | (physical adj therap*).ab,ti. |
| 150 | physiotherap*.ab,ti. |
| 151 | photo-acupuncture.ab,ti. |
| 152 | pillow*.ab,ti. |
| 153 | pilates.ab,ti. |

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|---|---|
| 154 | (postur* adj3 (correct* or educat* or instruct* or train*)).ab,ti. |
| 155 | (pulsed adj3 (electromagnetic or magnetic or radio frequency or energy)).ab,ti. |
| 156 | radiant light.ab,ti. |
| 157 | Russian stimulation.ab,ti. |
| 158 | "seat adj cushion*".ab,ti. |
| 159 | (self-manage* or self manage*).ab,ti. |
| 160 | (short wave* or short-wave*).ab,ti. |
| 161 | ((shockwave* or shock wave* or shock-wave*) adj3 (ultrasonic or therap* or radiation)).ab,ti. |
| 162 | "soft tissue therap*".ab,ti. |
| 163 | "spray and stretch".ab,ti. |
| 164 | strain-counterstrain.ab,ti. |
| 165 | strengthen*.ab,ti. |
| 166 | stretching.ab,ti. |
| 167 | (tape or taping).ab,ti. |
| 168 | thoracolumbosacral orthosis.ab,ti. |
| 169 | traction.ab,ti. |
| 170 | traditional Chinese medicine.ab,ti. |
| 171 | (transcutaneous electrical stimulation or TENS).ab,ti. |
| 172 | ultrasound.ab,ti. |
| 173 | vapocoolant spray.ab,ti. |
| 174 | "vibration therap*".ab,ti. |
| 175 | walkers.ab,ti. |
| 176 | "walking adj3 aid*".ab,ti. |
| 177 | "warm compress*".ab,ti. |
| 178 | whirlpool*.ab,ti. |
| 179 | yoga.ab,ti. |
| 180 | or/47-179 [**interventions] |
| 181 | Case-Control Studies/ |
| 182 | Cohort Studies/ |
| 183 | Controlled Clinical Trials as Topic/ |
| 184 | Epidemiologic Studies/ |
| 185 | Epidemiology/ |

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|---|---|
| 186 | Follow-Up Studies/ |
| 187 | Longitudinal Studies/ |
| 188 | Prospective Studies/ |
| 189 | Retrospective Studies/ |
| 190 | Randomized Controlled Trials as Topic/ |
| 191 | ((case control or case-control) adj3 (stud* or design*)).ab,ti. |
| 192 | (cohort adj3 (stud* or design* or analysis)).ab,ti. |
| 193 | controlled clinical trial.pt. |
| 194 | "epidemiolog*".ab,ti. |
| 195 | ((followup or follow-up) adj3 (stud* or design* or analysis)).ab,ti. |
| 196 | (longitudinal* adj3 (stud* or design* or analysis)).ab,ti. |
| 197 | (prospective adj3 (stud* or design* or analysis)).ab,ti. |
| 198 | (random* and (control* or clinical or allocat*)).ab,ti. |
| 199 | randomized controlled trial.pt. |
| 200 | (retrospective adj3 (stud* or design*)).ab,ti. |
| 201 | or/181-200 [**study designs_effectiveness] |
| 202 | 16 and 46 and 180 and 201 |
| 203 | Anthropology, Cultural/ |
| 204 | Attitude/ |
| 205 | Awareness/ |
| 206 | Behavioral Research/ |
| 207 | Diary as Topic/ |
| 208 | Emotions/ |
| 209 | Ethnology/ |
| 210 | Ethnopsychology/ |
| 211 | Focus Groups/ |
| 212 | Grounded Theory/ |
| 213 | Interview, Psychological/ |
| 214 | Interviews as Topic/ |
| 215 | Mindfulness/ |
| 216 | Motivation/ |
| 217 | Narration/ |

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|---|---|
| 218 | Observation/ |
| 219 | Perception/ |
| 220 | Personal Narratives as Topic/ |
| 221 | Personal Satisfaction/ |
| 222 | Qualitative Research/ |
| 223 | Self Report/ |
| 224 | "Surveys and Questionnaires"/ |
| 225 | Tape Recording/ |
| 226 | Thinking/ |
| 227 | Video Recording/ or Videotape Recording/ |
| 228 | (attitude* or aware* or belief* or believe* or experience* or mindfulness or motivation or opinion* or perception* or perspective*).ab,ti. |
| 229 | ((audio adj record*) or audiorecord* or audiotap*).ab,ti. |
| 230 | ((behavioral or behavioural) adj2 research).ab,ti. |
| 231 | biographical method*.ab,ti. |
| 232 | (constant adj2 (comparative or comparison)).ab,ti. |
| 233 | ((content or conversation or discourse) adj2 analys*).ab,ti. |
| 234 | descriptive research.ab,ti. |
| 235 | (diary or diaries).ab,ti. |
| 236 | emotions.ab,ti. |
| 237 | ethnograph*.ab,ti. |
| 238 | ethnology.ab,ti. |
| 239 | ethnopsychology.ab,ti. |
| 240 | feelings.ab,ti. |
| 241 | (field adj2 (notes or research or study or studies)).ab,ti. |
| 242 | (focus adj2 group*).ab,ti. |
| 243 | framework analysis.ab,ti. |
| 244 | grounded theory.ab,ti. |
| 245 | interview*.ab,ti. |
| 246 | life world.ab,ti. |
| 247 | lived experience.ab,ti. |
| 248 | (meaning or meanings).ab,ti. |

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| 249 | (narrative* or narration*).ab,ti. |
| 250 | (observe* or observation*).ab,ti. |
| 251 | (open adj ended).ab,ti. |
| 252 | phenomenology.ab,ti. |
| 253 | purposive sampl*.ab,ti. |
| 254 | qualitative.ab,ti. |
| 255 | questionnaire*.ab,ti. |
| 256 | (realist adj3 (review* or research or synthesis)).ab,ti. |
| 257 | satisfaction.ab,ti. |
| 258 | self report*.ab,ti. |
| 259 | semantic analysis.ab,ti. |
| 260 | standpoint*.ab,ti. |
| 261 | (story or stories).ab,ti. |
| 262 | survey*.ab,ti. |
| 263 | (theme* or thematic).ab,ti. |
| 264 | (theoretical adj2 (sampl* or saturation)).ab,ti. |
| 265 | (thoughts or thinking).ab,ti. |
| 266 | ((video adj record*) or videorecord* or videotap*).ab,ti. |
| 267 | or/203-266 [**experience/qualitative] |
| 268 | "Costs and Cost Analysis"/ |
| 269 | exp Cost-Benefit Analysis/ |
| 270 | Quality-Adjusted Life Years/ |
| 271 | Economics, Medical/ |
| 272 | (economic* adj4 (evaluat* or stud*)).ab,ti. |
| 273 | (health economic* adj4 (evaluat* or stud*)).ab,ti. |
| 274 | ((cost-utility or cost utility) adj4 (stud* or analys*)).ab,ti. |
| 275 | ((cost-benefit or cost benefit) adj4 (stud* or analys*)).ab,ti. |
| 276 | (CEA or CUA or CBA).ab,ti. |
| 277 | ((cost-effective* or cost effective*) adj4 (analys* or stud*)).ab,ti. |
| 278 | (economic* adj4 (impact or value or factor* or analys*)).ab,ti. |
| 279 | (cost* adj4 (health care or analys* or savings or hospital or medical or utilit* or effective* or efficac* or benefit* or consequence* or unit*)).ab,ti. |

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|---|---|
| 280 | (decision adj1 (tree* or analy* or model*)).ab,ti. |
| 281 | economics.fs. |
| 282 | (qol or qoly or qolys or hrqol or qaly or qalys or qale or qales).ab,ti. |
| 283 | (sensitivity analys* or "willingness to pay" or quality-adjusted life year* or quality adjusted life year* or quality-adjusted life expectanc* or quality adjusted life expectanc*).ab,ti. |
| 284 | (markov* or monte carlo*).ab,ti. |
| 285 | or/268-284 [**cost effectiveness] |
| 286 | Delivery of Health Care/ |
| 287 | Delivery of Health Care, Integrated/ |
| 288 | Health Planning/ |
| 289 | Health Promotion/ |
| 290 | Health Services Administration/ |
| 291 | Integrative Medicine/ |
| 292 | Interprofessional Relations/ |
| 293 | Patient Care Management/ |
| 294 | (approach* adj3 (collaborative or complementary or comprehensive or innovative or integrated)).ab,ti. |
| 295 | barrier*.ab,ti. |
| 296 | facilitator*.ab,ti. |
| 297 | ((health care or healthcare or health-care) adj3 (clinic or clinics or delivery or implement* or intervention* or model* or plan* or process* or program*or services or strateg* or system* or team*)).ab,ti. |
| 298 | implement*.ab,ti. |
| 299 | (innovate* adj3 (intervention* or model* or plan* or process* or program*or strateg* or system*)).ab,ti. |
| 300 | (model* adj care).ab,ti. |
| 301 | ((integrated or interdisciplinary or interprofessional or multidisciplinary) adj3 (care or clinic or clinics or intervention* or model* or plan* or process* or program*or strateg* or system* or challenge* or benefit* or success* or constrain* or difficult* or enhanc* or influen* or interfer* or motivat* or obstruct* or problem* or promot* or restrain* or restrict* or disincentive* or factor* or capacity or enabler*)).ab,ti. |
| 302 | (pathway* adj3 (clinical or care)).ab,ti. |
| 303 | (program* adj3 (assess* or evaluat*)).ab,ti. |
| 304 | or/286-303 [**implementation] |
| 305 | 16 and 46 and 180 and (201 or 267 or 285 or 304) |
| 306 | 16 and 46 and 180 [**pediatric, back pain, interventions] |

**Embase** Classic+Embase 1947 to 2020

| | |
|---|---|
| 1 | newborn/ |
| 2 | infant/ or infancy/ or baby/ |
| 3 | childhood/ |
| 4 | child/ |
| 5 | adolescent/ or adolescence/ |
| 6 | juvenile/ |
| 7 | (baby or babies).ab,ti. |
| 8 | "newborn*".ab,ti. |
| 9 | (infant or infants).ab,ti. |
| 10 | (child or children*).ab,ti. |
| 11 | (adolescent* or adolescence).ab,ti. |
| 12 | (teen or teens or teenager).ab,ti. |
| 13 | (pediatric* or paediatric*).ab,ti. |
| 14 | (young adj3 (person* or people)).ab,ti. |
| 15 | emerging adult*.ab,ti. |
| 16 | "youth*".ab,ti. |
| 17 | or/1-16 [**pediatric population] |
| 18 | backache/ |
| 19 | low back pain/ |
| 20 | intervertebral disc degeneration/ |
| 21 | intervertebral disk hernia/ |
| 22 | lumbar vertebra/ |
| 23 | lumbosacral region/ |
| 24 | piriformis syndrome/ |
| 25 | radiculopathy/ |
| 26 | sciatica/ |
| 27 | spine disease/ |
| 28 | vertebral canal stenosis/ |
| 29 | spondylosis/ |
| 30 | (back adj3 (ache* or injur* or pain*)).ab,ti. |

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|---|---|
| 31 | (backache* adj3 (injur* or pain*)).ab,ti. |
| 32 | (back pain or back-pain).ab,ti. |
| 33 | (lumbar disc* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 34 | (lumbar disk* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 35 | "low* back pain".ab,ti. |
| 36 | (lumbar adj3 (pain or facet or nerve root* or osteoarthritis or radicul* or spinal stenosis or spondylo* or zygapophys*)).ab,ti. |
| 37 | "Piriformis syndrome*".ab,ti. |
| 38 | radiculopathy.ab,ti. |
| 39 | (sacral adj2 pain*).ab,ti. |
| 40 | ((spine or spinal) adj4 (condition* or disable* or disabilit* or disorder* or pain or stenos?s)).ab,ti. |
| 41 | spondylosis.ab,ti. |
| 42 | (thoracic adj4 (injur* or pain or spine or spinal)).ab,ti. |
| 43 | (T-spine or T-spinal).ab,ti. |
| 44 | or/18-43 [**back injuries] |
| 45 | acupressure/ |
| 46 | acupuncture/ |
| 47 | behavior therapy/ |
| 48 | biofeedback/ |
| 49 | cognitive behavioral therapy/ |
| 50 | participatory research/ |
| 51 | community care/ |
| 52 | community participation/ |
| 53 | alternative medicine/ |
| 54 | cryotherapy/ |
| 55 | diathermy/ |
| 56 | electrostimulation therapy/ |
| 57 | electroacupuncture/ |
| 58 | ergonomics/ |
| 59 | exp exercise/ |
| 60 | exp kinesiotherapy/ |
| 61 | fitness/ |

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|---|---|
| 62 | fluid therapy/ |
| 63 | shock wave/ |
| 64 | immobilization/ |
| 65 | heat/ |
| 66 | exp hydrotherapy/ |
| 67 | low level laser therapy/ |
| 68 | phototherapy/ |
| 69 | exp magnetism/ |
| 70 | magnetotherapy/ |
| 71 | massage/ |
| 72 | Chinese medicine/ |
| 73 | manipulative medicine/ |
| 74 | patient education/ |
| 75 | physiotherapy/ |
| 76 | self care/ |
| 77 | transcutaneous nerve stimulation/ |
| 78 | whole body vibration/ |
| 79 | acupressure.ab,ti. |
| 80 | "acupunctur*".ab,ti. |
| 81 | (advice or advise or advised).ab,ti. |
| 82 | alexander technique.ab,ti. |
| 83 | "assistive device*".ab,ti. |
| 84 | "back belt*".ab,ti. |
| 85 | "back school*".ab,ti. |
| 86 | (back adj2 work).ab,ti. |
| 87 | (braces or brace or bracing).ab,ti. |
| 88 | chiropract*.ab,ti. |
| 89 | "cognitive behavioral therap*".ab,ti. |
| 90 | "cognitive behavioural therap*".ab,ti. |
| 91 | (cold adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |
| 92 | "core stabili*".ab,ti. |
| 93 | (corset or corsets).ab,ti. |

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|---|---|
| 94 | crutches.ab,ti. |
| 95 | cryotherap*.ab,ti. |
| 96 | "deep tissue therap*".ab,ti. |
| 97 | diathermy.ab,ti. |
| 98 | (electric* adj3 (stimulation or EMS or heating pad*)).ab,ti. |
| 99 | electro-acupuncture.ab,ti. |
| 100 | (electrogalvanic stimulation or EGS).ab,ti. |
| 101 | (electromagnet* and (radiation or therap*)).ab,ti. |
| 102 | electromodalit*.ab,ti. |
| 103 | electrotherapy.ab,ti. |
| 104 | (exercise or exercises or exercising).ab,ti. |
| 105 | (flexion-distraction or flexion distraction).ab,ti. |
| 106 | fluidotherap*.ab,ti. |
| 107 | galvanic stimulation.ab,ti. |
| 108 | (H-Wave Device Stimulation or HWDS).ab,ti. |
| 109 | ((heat* or hot) adj3 (therap* or pack* or compress or massage or lamp or pad or bath or soak or tub or bottle or superficial or therapeutic)).ab,ti. |
| 110 | (high energy shock wave* or high-energy shock wave* or HESW).ab,ti. |
| 111 | "hydrotherap*".ab,ti. |
| 112 | (ice adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |
| 113 | "interferential current*".ab,ti. |
| 114 | infrared.ab,ti. |
| 115 | iontophoresis.ab,ti. |
| 116 | electroanalgesia.ab,ti. |
| 117 | ergonomic*.ab,ti. |
| 118 | kinesiotap*.ab,ti. |
| 119 | (laser* adj3 (phototherapy or irradiation or biostimulation or light or therap*)).ab,ti. |
| 120 | "low level laser*".ab,ti. |
| 121 | "lumbar support*".ab,ti. |
| 122 | (magnetic adj3 (necklace* or therap* or bracelet*)).ab,ti. |
| 123 | (manipulat* adj3 (therap* or treatment* or spinal or osteopath*)).ab,ti. |
| 124 | "manual therap*".ab,ti. |

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| 125 | Microcurrent Electrical Neuromuscular Stimulation.ab,ti. |
| 126 | microwave*.ab,ti. |
| 127 | ((moblisation or mobilization) adj4 (osteopath* or orthopedic* or orthopaedic* or lumbar or spinal)).ab,ti. |
| 128 | "moist air bath*".ab,ti. |
| 129 | moxibustion.ab,ti. |
| 130 | ((multimodal* or multi-modal* or multi modal*) adj4 (treatment* or approach or care or therap* or procedure* or package* or manage*)).ab,ti. |
| 131 | muscle activation.ab,ti. |
| 132 | "muscle energy technique*".ab,ti. |
| 133 | myofascial release.ab,ti. |
| 134 | (Neuromuscular Electrical Stimulation or NMES).ab,ti. |
| 135 | orthotic*.ab,ti. |
| 136 | "passive modalit*".ab,ti. |
| 137 | (patient* adj3 (educat* or train*)).ab,ti. |
| 138 | "Percutaneous Electric* Nerve Stimulation".ab,ti. |
| 139 | (physical adj therap*).ab,ti. |
| 140 | physiotherap*.ab,ti. |
| 141 | photo-acupuncture.ab,ti. |
| 142 | pillow*.ab,ti. |
| 143 | pilates.ab,ti. |
| 144 | (postur* adj3 (correct* or educat* or instruct* or train*)).ab,ti. |
| 145 | (pulsed adj3 (electromagnetic or magnetic or radio frequency or energy)).ab,ti. |
| 146 | radiant light.ab,ti. |
| 147 | Russian stimulation.ab,ti. |
| 148 | "seat adj cushion*".ab,ti. |
| 149 | (self-manage* or self manage*).ab,ti. |
| 150 | (short wave* or short-wave*).ab,ti. |
| 151 | ((shockwave* or shock wave* or shock-wave*) adj3 (ultrasonic or therap* or radiation)).ab,ti. |
| 152 | "soft tissue therap*".ab,ti. |
| 153 | "spray and stretch".ab,ti. |
| 154 | strain-counterstrain.ab,ti. |
| 155 | strengthen*.ab,ti. |

156 stretching.ab,ti.

157 (tape or taping).ab,ti.

158 thoracolumbosacral orthosis.ab,ti.

159 traction.ab,ti.

160 traditional Chinese medicine.ab,ti.

161 (transcutaneous electrical stimulation or TENS).ab,ti.

162 ultrasound.ab,ti.

163 vapocoolant spray.ab,ti.

164 "vibration therap*".ab,ti.

165 walkers.ab,ti.

166 "walking adj3 aid*".ab,ti.

167 "warm compress*".ab,ti.

168 whirlpool*.ab,ti.

169 yoga.ab,ti.

170 or/45-169 [**interventions]

171 case control study/

172 cohort analysis/

173 "controlled clinical trial (topic)"/

174 longitudinal study/

175 "randomized controlled trial (topic)"/

176 ((case control or case-control) adj3 (stud* or design*)).ab,ti.

177 (cohort adj3 (stud* or design* or analysis)).ab,ti.

178 "epidemiolog*".ab,ti.

179 ((followup or follow-up) adj3 (stud* or design* or analysis)).ab,ti.

180 (longitudinal* adj3 (stud* or design* or analysis)).ab,ti.

181 (prospective adj3 (stud* or design* or analysis)).ab,ti.

182 (random* and (control* or clinical or allocat* or trial*)).ab,ti.

183 (retrospective adj3 (stud* or design*)).ab,ti.

184 or/171-183 [**effectiveness]

185 attitude to health/

186 patient attitude/

187 awareness/

| | |
|---|---|
| 188 | behavioral research/ |
| 189 | writing/ |
| 190 | emotion/ |
| 191 | ethnology/ |
| 192 | cultural psychology/ |
| 193 | information processing/ |
| 194 | grounded theory/ |
| 195 | interview/ |
| 196 | mindfulness/ |
| 197 | motivation/ |
| 198 | exp verbal communication/ |
| 199 | observation/ or participant observation/ |
| 200 | perception/ |
| 201 | satisfaction/ or patient satisfaction/ |
| 202 | qualitative research/ |
| 203 | self report/ |
| 204 | health survey/ |
| 205 | questionnaire/ |
| 206 | exp recording/ |
| 207 | exp thinking/ |
| 208 | (attitude* or aware* or belief* or believe* or experience* or mindfulness or motivation or opinion* or perception* or perspective*).ab,ti. |
| 209 | ((audio adj record*) or audiorecord* or audiotap*).ab,ti. |
| 210 | ((behavioral or behavioural) adj2 research).ab,ti. |
| 211 | biographical method*.ab,ti. |
| 212 | (constant adj2 (comparative or comparison)).ab,ti. |
| 213 | ((content or conversation or discourse) adj2 analys*).ab,ti. |
| 214 | descriptive research.ab,ti. |
| 215 | (diary or diaries).ab,ti. |
| 216 | emotions.ab,ti. |
| 217 | ethnograph*.ab,ti. |
| 218 | ethnology.ab,ti. |

219 ethnopsychology.ab,ti.

220 feelings.ab,ti.

221 (field adj2 (notes or research or study or studies)).ab,ti.

222 (focus adj2 group*).ab,ti.

223 framework analysis.ab,ti.

224 grounded theory.ab,ti.

225 interview*.ab,ti.

226 life world.ab,ti.

227 lived experience.ab,ti.

228 (meaning or meanings).ab,ti.

229 (narrative* or narration*).ab,ti.

230 (observe* or observation*).ab,ti.

231 (open adj ended).ab,ti.

232 phenomenology.ab,ti.

233 purposive sampl*.ab,ti.

234 qualitative.ab,ti.

235 questionnaire*.ab,ti.

236 (realist adj3 (review* or research or synthesis)).ab,ti.

237 satisfaction.ab,ti.

238 self report*.ab,ti.

239 semantic analysis.ab,ti.

240 standpoint*.ab,ti.

241 (story or stories).ab,ti.

242 survey*.ab,ti.

243 (theme* or thematic).ab,ti.

244 (theoretical adj2 (sampl* or saturation)).ab,ti.

245 (thoughts or thinking).ab,ti.

246 ((video adj record*) or videorecord* or videotap*).ab,ti.

247 or/185-246 [**qualitative_experience]

248 "cost effectiveness analysis"/

249 "cost benefit analysis"/

250 quality adjusted life year/

| | |
|---|---|
| 251 | health economics/ |
| 252 | (economic* adj4 (evaluat* or stud*)).ab,ti. |
| 253 | (health economic* adj4 (evaluat* or stud*)).ab,ti. |
| 254 | ((cost-utility or cost utility) adj4 (stud* or analys*)).ab,ti. |
| 255 | ((cost-benefit or cost benefit) adj4 (stud* or analys*)).ab,ti. |
| 256 | (CEA or CUA or CBA).ab,ti. |
| 257 | ((cost-effective* or cost effective*) adj4 (analys* or stud*)).ab,ti. |
| 258 | (economic* adj4 (impact or value or factor* or analys*)).ab,ti. |
| 259 | (cost* adj4 (health care or analys* or savings or hospital or medical or utilit* or effective* or efficac* or benefit* or consequence* or unit*)).ab,ti. |
| 260 | (decision adj1 (tree* or analy* or model*)).ab,ti. |
| 261 | economics.fs. |
| 262 | (qol or qoly or qolys or hrqol or qaly or qalys or qale or qales).ab,ti. |
| 263 | (sensitivity analys* or "willingness to pay" or quality-adjusted life year* or quality adjusted life year* or quality-adjusted life expectanc* or quality adjusted life expectanc*).ab,ti. |
| 264 | (markov* or monte carlo*).ab,ti. |
| 265 | or/248-264 [**cost effectiveness] |
| 266 | health care delivery/ |
| 267 | integrated health care system/ |
| 268 | health care planning/ |
| 269 | health promotion/ |
| 270 | health service/ |
| 271 | integrative medicine/ |
| 272 | case management/ |
| 273 | (approach* adj3 (collaborative or complementary or comprehensive or innovative or integrated)).ab,ti. |
| 274 | barrier*.ab,ti. |
| 275 | facilitator*.ab,ti. |
| 276 | ((health care or healthcare or health-care) adj3 (clinic or clinics or delivery or implement* or intervention* or model* or plan* or process* or program*or services or strateg* or system* or team*)).ab,ti. |
| 277 | implement*.ab,ti. |
| 278 | (innovate* adj3 (intervention* or model* or plan* or process* or program*or strateg* or system*)).ab,ti. |
| 279 | (model* adj care).ab,ti. |

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| 280 | ((integrated or interdisciplinary or interprofessional or multidisciplinary) adj3 (care or clinic or clinics or intervention* or model* or plan* or process* or program*or strateg* or system* or challenge* or benefit* or success* or constrain* or difficult* or enhanc* or influen* or interfer* or motivat* or obstruct* or problem* or promot* or restrain* or restrict* or disincentive* or factor* or capacity or enabler*)).ab,ti. |
| 281 | (pathway* adj3 (clinical or care)).ab,ti. |
| 282 | (program* adj3 (assess* or evaluat*)).ab,ti. |
| 283 | or/266-282 [**implementation] |
| 284 | 17 and 44 and 170 |
| 285 | 284 and (184 or 247 or 265 or 283) |
| 286 | limit 285 to (conference abstract or conference paper or "conference review" or editorial or letter) |
| 287 | 285 not 286 |

**PsycINFO** 1806

| | |
|---|---|
| 1 | (baby or babies).ab,ti. |
| 2 | "newborn*".ab,ti. |
| 3 | (infant or infants).ab,ti. |
| 4 | (child or children*).ab,ti. |
| 5 | (adolescent* or adolescence).ab,ti. |
| 6 | (teen or teens or teenager).ab,ti. |
| 7 | (pediatric* or paediatric*).ab,ti. |
| 8 | (young adj3 (person* or people)).ab,ti. |
| 9 | emerging adult*.ab,ti. |
| 10 | "youth*".ab,ti. |
| 11 | or/1-10 [**pediatric population] |
| 12 | exp Back Pain/ |
| 13 | Lumbar Spinal Cord/ |
| 14 | Spinal Cord Injuries/ |
| 15 | Spinal Column/ |
| 16 | (back adj3 (ache* or injur* or pain*)).ab,ti. |
| 17 | (backache* adj3 (injur* or pain*)).ab,ti. |
| 18 | (back pain or back-pain).ab,ti. |
| 19 | (lumbar disc* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 20 | (lumbar disk* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 21 | "low* back pain".ab,ti. |
| 22 | (lumbar adj3 (pain or facet or nerve root* or osteoarthritis or radicul* or spinal stenosis or spondylo* or zygapophys*)).ab,ti. |
| 23 | "Piriformis syndrome*".ab,ti. |
| 24 | radiculopathy.ab,ti. |
| 25 | (sacral adj2 pain*).ab,ti. |
| 26 | ((spine or spinal) adj4 (condition* or disable* or disabilit* or disorder* or pain or stenos?s)).ab,ti. |
| 27 | spondylosis.ab,ti. |
| 28 | (thoracic adj4 (injur* or pain or spine or spinal)).ab,ti. |
| 29 | (T-spine or T-spinal).ab,ti. |
| 30 | or/12-29 [**back injuries] |

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|---|---|
| 31 | Acupuncture/ |
| 32 | exp Behavior Therapy/ |
| 33 | exp Biofeedback/ |
| 34 | exp Cognitive Behavior Therapy/ |
| 35 | Alternative Medicine/ |
| 36 | Electrical Stimulation/ |
| 37 | Human Factors Engineering/ |
| 38 | exp Exercise/ |
| 39 | Movement Therapy/ |
| 40 | Shock Therapy/ |
| 41 | Heat/ |
| 42 | exp Hydrotherapy/ |
| 43 | Laser Irradiation/ |
| 44 | exp Magnetism/ |
| 45 | Massage/ |
| 46 | Client Education/ |
| 47 | Self-Care Skills/ |
| 48 | Physical Therapy/ |
| 49 | Self-Help Techniques/ |
| 50 | Physical Fitness/ |
| 51 | Vibration/ |
| 52 | acupressure.ab,ti. |
| 53 | "acupunctur*".ab,ti. |
| 54 | (advice or advise or advised).ab,ti. |
| 55 | alexander technique.ab,ti. |
| 56 | "assistive device*".ab,ti. |
| 57 | "back belt*".ab,ti. |
| 58 | "back school*".ab,ti. |
| 59 | (back adj2 work).ab,ti. |
| 60 | (braces or brace or bracing).ab,ti. |
| 61 | canes.ab,ti. |
| 62 | chiropract*.ab,ti. |

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|---|---|
| 63 | "cognitive behavioral therap*".ab,ti. |
| 64 | "cognitive behavioural therap*".ab,ti. |
| 65 | (cold adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |
| 66 | "core stabili*".ab,ti. |
| 67 | (corset or corsets).ab,ti. |
| 68 | crutches.ab,ti. |
| 69 | cryotherap*.ab,ti. |
| 70 | "deep tissue therap*".ab,ti. |
| 71 | diathermy.ab,ti. |
| 72 | (electric* adj3 (stimulation or EMS or heating pad*)).ab,ti. |
| 73 | electro-acupuncture.ab,ti. |
| 74 | (electrogalvanic stimulation or EGS).ab,ti. |
| 75 | (electromagnet* and (radiation or therap*)).ab,ti. |
| 76 | electromodalit*.ab,ti. |
| 77 | electrotherapy.ab,ti. |
| 78 | (exercise or exercises or exercising).ab,ti. |
| 79 | (flexion-distraction or flexion distraction).ab,ti. |
| 80 | fluidotherap*.ab,ti. |
| 81 | galvanic stimulation.ab,ti. |
| 82 | (H-Wave Device Stimulation or HWDS).ab,ti. |
| 83 | ((heat* or hot) adj3 (therap* or pack* or compress or massage or lamp or pad or bath or soak or tub or bottle or superficial or therapeutic)).ab,ti. |
| 84 | (high energy shock wave* or high-energy shock wave* or HESW).ab,ti. |
| 85 | "hydrotherap*".ab,ti. |
| 86 | (ice adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |
| 87 | "interferential current*".ab,ti. |
| 88 | infrared.ab,ti. |
| 89 | iontophoresis.ab,ti. |
| 90 | electroanalgesia.ab,ti. |
| 91 | ergonomic*.ab,ti. |
| 92 | kinesiotap*.ab,ti. |
| 93 | (laser* adj3 (phototherapy or irradiation or biostimulation or light or therap*)).ab,ti. |

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|---|---|
| 94 | "low level laser*".ab,ti. |
| 95 | "lumbar support*".ab,ti. |
| 96 | (magnetic adj3 (necklace* or therap* or bracelet*)).ab,ti. |
| 97 | (manipulat* adj3 (therap* or treatment* or spinal or osteopath*)).ab,ti. |
| 98 | "manual therap*".ab,ti. |
| 99 | Microcurrent Electrical Neuromuscular Stimulation.ab,ti. |
| 100 | microwave*.ab,ti. |
| 101 | ((moblisation or mobilization) adj4 (osteopath* or orthopedic* or orthopaedic* or lumbar or spinal)).ab,ti. |
| 102 | "moist air bath*".ab,ti. |
| 103 | moxibustion.ab,ti. |
| 104 | ((multimodal* or multi-modal* or multi modal*) adj4 (treatment* or approach or care or therap* or procedure* or package* or manage*)).ab,ti. |
| 105 | muscle activation.ab,ti. |
| 106 | "muscle energy technique*".ab,ti. |
| 107 | myofascial release.ab,ti. |
| 108 | (Neuromuscular Electrical Stimulation or NMES).ab,ti. |
| 109 | orthotic*.ab,ti. |
| 110 | "passive modalit*".ab,ti. |
| 111 | (patient* adj3 (educat* or train*)).ab,ti. |
| 112 | "Percutaneous Electric* Nerve Stimulation".ab,ti. |
| 113 | (physical adj therap*).ab,ti. |
| 114 | physiotherap*.ab,ti. |
| 115 | photo-acupuncture.ab,ti. |
| 116 | pillow*.ab,ti. |
| 117 | pilates.ab,ti. |
| 118 | (postur* adj3 (correct* or educat* or instruct* or train*)).ab,ti. |
| 119 | (pulsed adj3 (electromagnetic or magnetic or radio frequency or energy)).ab,ti. |
| 120 | radiant light.ab,ti. |
| 121 | Russian stimulation.ab,ti. |
| 122 | "seat adj cushion*".ab,ti. |
| 123 | (self-manage* or self manage*).ab,ti. |
| 124 | (short wave* or short-wave*).ab,ti. |

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| 125 | ((shockwave* or shock wave* or shock-wave*) adj3 (ultrasonic or therap* or radiation)).ab,ti. |
| 126 | "soft tissue therap*".ab,ti. |
| 127 | "spray and stretch".ab,ti. |
| 128 | strain-counterstrain.ab,ti. |
| 129 | strengthen*.ab,ti. |
| 130 | stretching.ab,ti. |
| 131 | (tape or taping).ab,ti. |
| 132 | thoracolumbosacral orthosis.ab,ti. |
| 133 | traction.ab,ti. |
| 134 | traditional Chinese medicine.ab,ti. |
| 135 | (transcutaneous electrical stimulation or TENS).ab,ti. |
| 136 | ultrasound.ab,ti. |
| 137 | vapocoolant spray.ab,ti. |
| 138 | "vibration therap*".ab,ti. |
| 139 | walkers.ab,ti. |
| 140 | "walking adj3 aid*".ab,ti. |
| 141 | "warm compress*".ab,ti. |
| 142 | whirlpool*.ab,ti. |
| 143 | yoga.ab,ti. |
| 144 | or/31-143 [**interventions] |
| 145 | Cohort Analysis/ |
| 146 | Clinical Trials/ |
| 147 | Longitudinal Studies/ |
| 148 | exp Randomized Controlled Trials/ |
| 149 | ((case control or case-control) adj3 (stud* or design*)).ab,ti. |
| 150 | (cohort adj3 (stud* or design* or analysis)).ab,ti. |
| 151 | controlled clinical trial.pt. |
| 152 | "epidemiolog*".ab,ti. |
| 153 | ((followup or follow-up) adj3 (stud* or design* or analysis)).ab,ti. |
| 154 | (longitudinal* adj3 (stud* or design* or analysis)).ab,ti. |
| 155 | (prospective adj3 (stud* or design* or analysis)).ab,ti. |
| 156 | (random* and (control* or clinical or allocat*)).ab,ti. |

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|---|---|
| 157 | (retrospective adj3 (stud* or design*)).ab,ti. |
| 158 | or/145-157 [**effectiveness] |
| 159 | exp Attitudes/ |
| 160 | Awareness/ |
| 161 | Journal Writing/ |
| 162 | Emotions/ |
| 163 | Ethnology/ |
| 164 | Focus Group/ |
| 165 | Grounded Theory/ |
| 166 | Interviews/ |
| 167 | Mindfulness/ or Mindfulness-Based Interventions/ |
| 168 | Motivation/ |
| 169 | Narratives/ |
| 170 | exp Observation Methods/ |
| 171 | Perception/ |
| 172 | Preferences/ |
| 173 | Satisfaction/ |
| 174 | Qualitative Methods/ |
| 175 | Self-Report/ |
| 176 | Surveys/ or Questionnaires/ |
| 177 | exp Tape Recorders/ |
| 178 | Thinking/ |
| 179 | Digital Video/ |
| 180 | (attitude* or aware* or belief* or believe* or experience* or mindfulness or motivation or opinion* or perception* or perspective*).ab,ti. |
| 181 | ((audio adj record*) or audiorecord* or audiotap*).ab,ti. |
| 182 | ((behavioral or behavioural) adj2 research).ab,ti. |
| 183 | biographical method*.ab,ti. |
| 184 | (constant adj2 (comparative or comparison)).ab,ti. |
| 185 | ((content or conversation or discourse) adj2 analys*).ab,ti. |
| 186 | descriptive research.ab,ti. |
| 187 | (diary or diaries).ab,ti. |

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| 188 | emotions.ab,ti. |
| 189 | ethnograph*.ab,ti. |
| 190 | ethnology.ab,ti. |
| 191 | ethnopsychology.ab,ti. |
| 192 | feelings.ab,ti. |
| 193 | (field adj2 (notes or research or study or studies)).ab,ti. |
| 194 | (focus adj2 group*).ab,ti. |
| 195 | framework analysis.ab,ti. |
| 196 | grounded theory.ab,ti. |
| 197 | interview*.ab,ti. |
| 198 | life world.ab,ti. |
| 199 | lived experience.ab,ti. |
| 200 | (meaning or meanings).ab,ti. |
| 201 | (narrative* or narration*).ab,ti. |
| 202 | (observe* or observation*).ab,ti. |
| 203 | (open adj ended).ab,ti. |
| 204 | phenomenology.ab,ti. |
| 205 | purposive sampl*.ab,ti. |
| 206 | qualitative.ab,ti. |
| 207 | questionnaire*.ab,ti. |
| 208 | (realist adj3 (review* or research or synthesis)).ab,ti. |
| 209 | satisfaction.ab,ti. |
| 210 | self report*.ab,ti. |
| 211 | semantic analysis.ab,ti. |
| 212 | standpoint*.ab,ti. |
| 213 | (story or stories).ab,ti. |
| 214 | survey*.ab,ti. |
| 215 | (theme* or thematic).ab,ti. |
| 216 | (theoretical adj2 (sampl* or saturation)).ab,ti. |
| 217 | (thoughts or thinking).ab,ti. |
| 218 | ((video adj record*) or videorecord* or videotap*).ab,ti. |
| 219 | or/159-218 [** qualitative_experience] |

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| 220 | "Costs and Cost Analysis"/ |
| 221 | Health Care Costs/ |
| 222 | Quality of Life Measures/ |
| 223 | Health Care Economics/ |
| 224 | (economic* adj4 (evaluat* or stud*)).ab,ti. |
| 225 | (health economic* adj4 (evaluat* or stud*)).ab,ti. |
| 226 | ((cost-utility or cost utility) adj4 (stud* or analys*)).ab,ti. |
| 227 | ((cost-benefit or cost benefit) adj4 (stud* or analys*)).ab,ti. |
| 228 | (CEA or CUA or CBA).ab,ti. |
| 229 | ((cost-effective* or cost effective*) adj4 (analys* or stud*)).ab,ti. |
| 230 | (economic* adj4 (impact or value or factor* or analys*)).ab,ti. |
| 231 | (cost* adj4 (health care or analys* or savings or hospital or medical or utilit* or effective* or efficac* or benefit* or consequence* or unit*)).ab,ti. |
| 232 | (decision adj1 (tree* or analy* or model*)).ab,ti. |
| 233 | [economics.fs.] |
| 234 | (qol or qoly or qolys or hrqol or qaly or qalys or qale or qales).ab,ti. |
| 235 | (sensitivity analys* or "willingness to pay" or quality-adjusted life year* or quality adjusted life year* or quality-adjusted life expectanc* or quality adjusted life expectanc*).ab,ti. |
| 236 | (markov* or monte carlo*).ab,ti. |
| 237 | or/220-236 [**cost effectiveness] |
| 238 | Health Care Delivery/ |
| 239 | Health Care Administration/ |
| 240 | Health Promotion/ |
| 241 | Integrated Services/ |
| 242 | Interdisciplinary Treatment Approach/ |
| 243 | Case Management/ |
| 244 | (approach* adj3 (collaborative or complementary or comprehensive or innovative or integrated)).ab,ti. |
| 245 | barrier*.ab,ti. |
| 246 | facilitator*.ab,ti. |
| 247 | ((health care or healthcare or health-care) adj3 (clinic or clinics or delivery or implement* or intervention* or model* or plan* or process* or program*or services or strateg* or system* or team*)).ab,ti. |
| 248 | implement*.ab,ti. |

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| 249 | (innovate* adj3 (intervention* or model* or plan* or process* or program*or strateg* or system*)).ab,ti. |
| 250 | (model* adj care).ab,ti. |
| 251 | ((integrated or interdisciplinary or interprofessional or multidisciplinary) adj3 (care or clinic or clinics or intervention* or model* or plan* or process* or program*or strateg* or system* or challenge* or benefit* or success* or constrain* or difficult* or enhanc* or influen* or interfer* or motivat* or obstruct* or problem* or promot* or restrain* or restrict* or disincentive* or factor* or capacity or enabler*)).ab,ti. |
| 252 | (pathway* adj3 (clinical or care)).ab,ti. |
| 253 | (program* adj3 (assess* or evaluat*)).ab,ti. |
| 254 | or/238-253 [**implementation] |
| 255 | 11 and 30 and 144 |
| 256 | limit 255 to (childhood <birth to 12 years> and (100 childhood <birth to age 12 yrs> or 120 neonatal <birth to age 1 mo> or 140 infancy <2 to 23 mo> or 160 preschool age <age 2 to 5 yrs> or 180 school age <age 6 to 12 yrs> or 200 adolescence <age 13 to 17 yrs>)) |
| 257 | 255 and (158 or 219 or 237 or 254) |
| 258 | limit 257 to (childhood <birth to 12 years> and (100 childhood <birth to age 12 yrs> or 120 neonatal <birth to age 1 mo> or 140 infancy <2 to 23 mo> or 160 preschool age <age 2 to 5 yrs> or 180 school age <age 6 to 12 yrs> or 200 adolescence <age 13 to 17 yrs>)) |

Additional file 3: Risk of bias assessment according to study design

| Quantitative studies (SIGN checklists) | | |
|---|---|---|
| **Randomized controlled trials** | **Cohort studies** | **Case-control studies** |
| 1. The study addresses an appropriate and clearly focused question. | 1. The study addresses an appropriate and clearly focused question. | 1. The study addresses an appropriate and clearly focused question. |
| 2 .The assignment of subjects to treatment groups is randomised. | 2. The two groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation. | 2. The cases and controls are taken from comparable populations. |
| 3. An adequate concealment method is used. | 3. The study indicates how many of the people asked to take part did so, in each of the groups being studied. | 3. The same exclusion criteria are used for both cases and controls. |
| 4. The design keeps subjects and investigators 'blind' about treatment allocation. | 4. The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis. | 4. What percentage of each group (cases and controls) participated in the study? |
| 5. The treatment and control groups are similar at the start of the trial. | 5. What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed. | 5. Comparison is made between participants and non-participants to establish their similarities or differences. |
| 6. The only difference between groups is the treatment under investigation. | 6. Comparison is made between full participants and those lost to follow up, by exposure status. | 6. Cases are clearly defined and differentiated from controls. |
| 7. All relevant outcomes are measured in a standard, valid and reliable way. | 7. The outcomes are clearly defined. | 7. It is clearly established that controls are non-cases |
| 8. What percentage of the individuals or clusters recruited into each treatment arm of the study dropped out before the study was completed? | 8. The assessment of outcome is made blind to exposure status. If the study is retrospective this may not be applicable. | 8. Measures will have been taken to prevent knowledge of primary exposure influencing case ascertainment |
| 9. All the subjects are analysed in the groups to which they were randomly allocated (often referred to as intention to treat analysis). | 9. Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome. | 9. Exposure status is measured in a standard, valid and reliable way |
| 10. Where the study is carried out at more than one site, results are comparable for all sites. | 10. The method of assessment of exposure is reliable. | 10. The main potential confounders are identified and taken into account in the design and analysis |
| | 11. Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable. | 11. Confidence intervals are provided |
| | 12. Exposure level or prognostic factor is assessed more than once. | |
| | 13. The main potential confounders are identified and taken into account in the design and analysis. | |

| | | |
|---|---|---|
| | 14. Have confidence intervals been provided? | |

| **Mixed methods studies (MMAT)** |
|---|
| **Qualitative:**<br>1. Is the qualitative approach appropriate to answer the research question?<br>2. Are the qualitative data collection methods adequate to address the research question?<br>3. Are the findings adequately derived from the data?<br>4. Is the interpretation of results sufficiently substantiated by data?<br>5. Is there coherence between qualitative data sources, collection, analysis and interpretation? |
| **Quantitative randomized controlled trials:**<br>1. Is randomization appropriately performed?<br>2. Are the groups comparable at baseline?<br>3. Are there complete outcome data?<br>4. Are outcome assessors blinded to the intervention provided?<br>5. Did the participants adhere to the assigned intervention? |
| **Quantitative non-randomized:**<br>1. Are the participants representative of the target population?<br>2. Are measurements appropriate regarding both the outcome and intervention (or exposure)?<br>3. Are there complete outcome data?<br>4. Are the confounders accounted for in the design and analysis?<br>5. During the study period, is the intervention administered (or exposure occurred) as intended? |
| **Quantitative descriptive**:<br>1. Is the sampling strategy relevant to address the research question?<br>2. Is the sample representative of the target population?<br>3. Are the measurements appropriate?<br>4. Is the risk of nonresponse bias low?<br>5. Is the statistical analysis appropriate to answer the research question? |
| **Mixed methods:**<br>1. Is there adequate rationale for using a mixed methods design to address the research question?<br>2. Are the different components of the study effectively integrated to answer the research question?<br>3. Are the outputs of the integration of qualitative and quantitative components adequately interpreted?<br>4. Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?<br>5 .Do the different components of the study adhere to the quality criteria of each tradition of the methods involved? |
| **Qualitative studies (JBI)** |
| 1 .Is there congruity between the stated philosophical perspective and the research methodology?<br>2 .Is there congruity between the research methodology and the research question or objectives?<br>3 .Is there congruity between the research methodology and the methods used to collect data?<br>4 .Is there congruity between the research methodology and the representation and analysis of data?<br>5. Is there congruity between the research methodology and the interpretation of results?<br>6 .Is there a statement locating the researcher culturally or theoretically?<br>7. Is the influence of the researcher on the research, and vice-versa, addressed?<br>8. Are participants, and their voices, adequately represented?<br>9. Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?<br>10. Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data? |
| **Economic evaluations (Drummond checklist)** |
| 1. Was a well-defined question posed in an answerable form?<br>2. Was a comprehensive description of the competing alternatives given?<br>3. Was the effectiveness of the programmes or services established?<br>4. Were all the important and relevant costs and consequences for each alternative identified?<br>5. Were cost and effects measured accurately in appropriate physical units (e.g., QALYs)?<br>6 .Were costs and effects valued credibly?<br>7. Were cost and effects adjusted for differential timing?<br>8. Was an incremental analysis of cost and effects of alternatives performed? |

9. Were allowances made for uncertainty in the estimates of cost and effects?
10. Did the presentation and discussion of study results include all issues of concern to users?

**Drummond checklist:** (Drummond M et al. Methods for the economic evaluation of health care programmes. Oxford: Oxford University Press, 2015). **JBI checklist:** Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Qualitative Research (JBI Manual for Evidence Synthesis. Appendix 2.1: https://wiki.joannabriggs.org/display/MANUAL/Appendix+2.1%3A+JBI+Critical+Appraisal+Checklist+for+Qualitative+Research). **MMAT:** Mixed Methods Appraisal Tool, version 18 (Hong QN, Pluye P, Fàbreques S, Bartlett G, Boardman F, Cargo M, Dagenais P, Gagnon M-P, Griffiths F, Nicolau B, O'Cathain A, Rousseau M-C, Vedel I. Mixed Methods Appraisal Tool (MMAT), version 2018. Registration of Copyright (#1148552, Canadian Intellectual Property Office, Industry Canada). **SIGN checklists:** Scottish Intercollegiate Guidelines Network checklists https://www.sign.ac.uk/checklists-and-notes

BMJ Open

# Rehabilitative management of back pain in children: Protocol for a mixed studies systematic review

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|---|---|
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| | |

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**Title:** Rehabilitative management of back pain in children: Protocol for a mixed studies systematic review

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## ABSTRACT

**Introduction:** Little is known about effective, efficient and acceptable management of back pain in children. A comprehensive and updated evidence synthesis can help to inform clinical practice.

**Objective:** To inform clinical practice, we aim to conduct a systematic review of the literature and synthesize the evidence regarding effective, cost-effective and safe rehabilitation interventions for children with back pain to improve their functioning and other health outcomes.

**Methods and analysis:** We will search MEDLINE, Embase, PsycINFO, CINAHL, the Index to Chiropractic Literature, the Cochrane Controlled Register of Trials, and EconLit for primary studies published from inception in all languages. We will include quantitative studies (randomized controlled trials, cohort and case-control studies), qualitative studies, mixed methods studies, and full economic evaluations. To augment our search of the bibliographic electronic databases, we will search reference lists of included studies and relevant systematic reviews, the WHO International Clinical Trials Registry Platform, and consult with content experts. We will assess risk of bias using appropriate critical appraisal tools. We will extract data about study and participant characteristics, intervention type and comparators, context and setting, outcomes, themes and methodological quality assessment. We will use a sequential approach at the review level to integrate data from the quantitative, qualitative and economic evidence syntheses.

**Ethics and dissemination:** Ethics approval is not required. We will disseminate findings through activities including: (1) presentations in national and international conferences; (2) meetings with national and international decision makers; (3) publications in peer-reviewed journals; and (4) posts on organizational websites and social media.

**Systematic review registration number:** PROSPERO CRD42019135009

**Key words:** systematic review, back pain, child, adolescent

## Article Summary

Strengths and limitations of this study

- A systematic review integrating quantitative, qualitative and economic evidence to examine the rehabilitative management of back pain in children.
- Includes studies with a broad range of rehabilitation interventions as described by the World Health Organization (WHO), and outcomes as described by the International Classification of Functioning, Disability and Health (ICF) framework.
- Implements the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols guidelines.
- There is no language restriction in articles.
- Our search strategies, while comprehensive, may miss relevant studies.

**Word count:** 4,872

## INTRODUCTION

### Rationale

A significant proportion of children over 10 years of age suffer from back pain.[1-5] The prevalence of back pain in children ranges between 4% and 74%; the wide range is due to heterogeneous populations studied, outcome measurements and methodologies used.[6 7] Data from the World Health Organization (WHO) Global Burden of Disease study in 2017 shows that low back pain is the leading cause of global years lived with disability.[8] Back pain begins early in life with physical, mental and social consequences (e.g., impact on school-related and sporting activities, general physical activity and well-being) that extend into adulthood.[9-11] Most episodes of spinal pain are brief; however, in a three-year prospective cohort study of 1,465 school children in Denmark, up to 25% of children had three or more episodes over one year, and approximately 13% of children reported episodes lasting five or more weeks.[12]

Two recent systematic reviews assessed the effectiveness of manual therapy to treat a number of conditions including back pain in children, but low-quality evidence precludes drawing conclusions.[13 14] A previous systematic review and meta-analysis which evaluated the effectiveness of conservative interventions for low back pain in children under 18 years of age reported that exercise interventions may be promising for improving pain scores in children compared to no treatment; however, the evidence was very limited and of low-quality.[15] This evidence also needs updating. Additionally, to our knowledge, no integrative systematic review – one that incorporates both quantitative and qualitative studies – has been conducted regarding the rehabilitative management of back pain in children. Compared to traditional systematic reviews of quantitative studies, combining evidence of the effectiveness and efficiency of interventions

with qualitative understanding from people's lived experiences can better inform clinical practice guidelines and policy.[16]

This comprehensive knowledge synthesis can inform clinical practice for decision makers involved with caring for children with back pain including healthcare professionals in a variety of clinical, rehabilitation or community settings (e.g., physicians, nurses, physiotherapists, chiropractors, psychologists, occupational therapists, registered massage therapists). Moreover, the knowledge gaps that we identify can inform future research agendas.

**Objectives**

To support clinical practice for children with back pain, we aim to conduct an integrative systematic review of quantitative, qualitative and economic evidence regarding the rehabilitative management of back pain (including mid-back and low back pain) in children aged 19 years and under. Our review will address the following questions:

1) What is the effectiveness and safety of rehabilitation interventions for improving functioning and other health outcomes in children with back pain?
2) What are the patients', caregivers' and providers' experiences, preferences, expectations and valued outcomes regarding rehabilitation interventions for back pain?
3) What is the cost-effectiveness of rehabilitation interventions for improving functioning and other health outcomes in children with back pain?
4) What can be hypothesized from the integration of the quantitative, qualitative and economic evidence about the effectiveness, cost-effectiveness and safety of rehabilitation interventions for low back pain in children?

We are targeting decision makers (clinicians, health managers/administrators, policy makers, patients, and caregivers) involved in implementing, delivering or receiving rehabilitation interventions or programs of care. We aim to provide them with knowledge regarding effective, acceptable and positively experienced interventions for children with back pain and their caregivers.

## METHODS

We developed this systematic review protocol using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Protocols (PRISMA-P)[17] (Additional file 1). We registered our protocol on the International Prospective Register of Systematic Reviews (PROSPERO) (registration # CRD42019135009).[18] We will report our systematic review according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement,[19] and the Enhancing Transparency in Reporting the Synthesis of Qualitative Research (ENTREQ) reporting guideline.[20]

### Eligibility criteria

#### *Population*

We will target studies including children (aged 19 years or younger)[21] with non-specific low back or thoracic spine pain of any duration and severity. We define LBP as pain and discomfort below the costal margin and above the inferior gluteal folds, with or without radiculopathy (referred leg pain).[22] Radiculopathy refers to inflammation, injury/dysfunction, or compression of spinal nerve roots that can present as pain, weakness, or altered sensation in a myotomal or dermatomal distribution. Lumbar radiculopathy is commonly attributed to lumbar disc herniation

(localized displacement of disc material beyond the normal margins of the intervertebral disc space).[23] We define thoracic spine pain as pain within the region bounded superiorly by the first thoracic spinous process, inferiorly by the last thoracic spinous process, and laterally by the most lateral margins of the erector spinae muscles.[24] We will include studies investigating diagnoses including low back pain, mid-back pain, mechanical back pain, lumbago, lumbar sprain or strain, back sprain or strain, lumbopelvic pain, lumbar radiculopathy, lumbar disc herniation, sacroiliac syndrome, sciatica, dysplastic or isthmic spondylolisthesis or spondylolysis, musculoskeletal or non-specific chest wall pain (pain referred to the chest wall from the thoracic spine).

We will exclude studies of children with back pain attributed to major structural or systemic pathology (e.g., fracture, acute traumatic or pathological spondylolisthesis or spondylolysis, infection, tumour, osteoporosis, inflammatory arthritides, cauda equina syndrome, neuromuscular disease, myelopathy, and scoliosis); (2) studies of children with back pain attributed to a non-spine-related condition that might refer pain to the chest wall (e.g., heart, lung or esophagus conditions); and (3) studies that target asymptomatic children at baseline and assess interventions that aim to prevent the incidence of back pain.

***Intervention***

We will include studies that investigate the effectiveness and safety of rehabilitation interventions or programs of care for children with back pain, including education and self-management strategies, exercise, manual therapies, passive physical modalities, acupuncture, pharmacological interventions, psychological interventions, environmental modifications, assistive devices, and complementary and alternative therapies (CAM). Interventions may be

delivered in any manner such as in-person, or remotely using technology such as telehealth. The WHO defines rehabilitation as a set of interventions that assist individuals who experience, or are likely to experience, disability to achieve and maintain optimal functioning when interacting with their environments.[25] Rehabilitation interventions include rehabilitation medicine/therapy, which aims to: 1) improve function through the diagnosis and treatment of health conditions, reducing impairments, preventing or treating complications; and 2) restore and compensate loss of functioning, and prevent or slow deterioration in functioning in every area of a person's life.[25] It may also include assistive devices, which refers to any item, piece of equipment, or product used to increase, maintain, or improve functional capabilities.[25] Various healthcare providers may provide interventions including, but not limited to, general practitioners, nurses, physiotherapists, chiropractors, occupational therapists, psychologists, and registered massage therapists (Table 1). We will exclude studies assessing surgical interventions, and interventions solely conducted at the societal level, such as barrier removal initiatives (e.g., fitting a ramp to a public building).

***Comparison***

The quantitative component of this review will consider comparisons including other interventions, placebo or sham interventions, wait list, standard care, and no intervention.

***Outcomes***

Our primary outcome of interest is a child's functioning. Secondary health outcomes of interest are pain (e.g., pain intensity, frequency, or duration), psychological outcomes (e.g., anxiety and depression), health-related quality of life, adverse events, qualitative outcomes, and economic

outcomes (Table 2). We are interested in both short-term (<3 months) and long-term (≥3 months) outcomes. We selected these outcomes because they are important to children, their caregivers and decision makers, and they are reflected in the WHO's framework for health and disability (International Classification of Functioning, Disability and Health [ICF]).[26] The ICF provides a standard language and framework for the description of health and health-related states, and organizes information into two components – 'body functions and body structures' and 'activities and participation'.[26] Our primary outcome of interest, functioning, aligns with the 'activities and participation' component of the ICF. Examples of *activities* include walking, running, jumping and lifting. *Participation* refers to involvement in life situations such as with one's family, school and community. Common methods to measure ***functioning*** include the Modified Oswestry Low Back Pain Disability Questionnaire,[27] Roland Morris Disability Questionnaire (RMDQ),[28] return to school, and participation in sports or other recreational activities. Pain and psychological outcomes fit within the 'body functions and body structures' component of the ICF. Common methods to measure ***pain*** include the Visual Analogue Scale (VAS),[29] Numerical Rating Scale (NRS),[30] and Faces Pain Scale – Revised.[31 32] Common methods to measure ***psychological outcomes*** (e.g., anxiety and depression) include Revised Child Anxiety and Depression Scale,[33] and State-Trait Anxiety Inventory for Children.[34] We will also assess ***health-related quality of life***, which is not definable in the ICF framework.[35] It is commonly measured with the KIDSCREEN-52,[36] Pediatric Quality of Life Inventory,[37] and PROMIS Pediatric Self Report Scale.[38] We defined ***adverse events or harms*** as any unfavourable sign, symptom, or disease temporarily associated with the treatment, whether or not caused by the treatment.[39 40] We will consider indirect harms (where the use of an intervention delays a diagnosis or treatment, and such delay holds a potential harm),[41] number of

adverse events, severity of adverse events (i.e., mild, moderate or severe), and number of participant withdrawals from the study due to adverse events. ***Qualitative outcomes*** include the experiences, preferences, expectations, and valued outcomes (of children, caregivers, and providers). Lastly, ***economic outcomes*** include direct costs (e.g., resources saved by an intervention), indirect costs (e.g., time freed by an intervention), economic health outcomes (e.g., quality-adjusted life-year [QALY], incremental cost-effectiveness ratio [ICER], net monetary benefit [NMB]), and intangible outcomes (e.g., pain or suffering saved by an intervention).

***Types of studies***

We will include randomized controlled trials of any type (e.g., superiority, non-inferiority and equivalence), cohort studies, case-control studies, and mixed-methods studies (quantitative component) including any secondary analyses of eligible studies for question 1 (effectiveness and safety of interventions); qualitative and mixed-methods studies (qualitative component) for question 2 (users' experiences, preferences, expectations and valued outcomes of interventions); and trial- and model-based full economic evaluations for question 3 (cost-effectiveness of interventions) (Table 2).

We will exclude the following types of studies: cross-sectional studies, pilot studies assessing feasibility, protocol studies, case reports, case series, studies assessing only prevention of back pain and incidence outcomes, systematic reviews (although their reference lists will be searched for potentially relevant studies) and other review papers, clinical practice guidelines, biomechanical studies, laboratory studies, cadaveric or animal studies, conceptual papers, letters, editorials, commentaries, books and book chapters, conference proceedings, meeting abstracts,

lectures and addresses, consensus development statements, guideline statements, and studies reviewing solely partial economic evaluations (e.g., cost of illness studies).

***Context and setting***

We will consider rehabilitation interventions/programs of care delivered in any healthcare system within an urban or rural area and in any healthcare setting (e.g., acute care, hospital, primary health care, rehabilitation clinics), or in the community. Community-based rehabilitation is implemented through the combined efforts of individuals with disabilities, their families and communities, and relevant government and non-government health, education, social and other services (e.g., advocacy programme).[42]

**Information sources**

We will develop the initial search strategy in MEDLINE, in consultation with an experienced health sciences librarian. A second experienced health sciences librarian will review the search strategy assessing its appropriateness and comprehensiveness using the Peer Review of Electronic Search Strategies (PRESS) Checklist.[43 44] We will conduct electronic searches of the following databases from database inception to the present: MEDLINE (Ovid), Embase (Ovid), PsycINFO (Ovid), CINAHL (Cumulative Index to Nursing and Allied Health Literature, EBSCO*host*), the Index to Chiropractic Literature (Chiropractic Library Collaboration), the Cochrane Controlled Register of Trials (Ovid), and EconLit (EBSCO*host*). We will augment our search of the bibliographic electronic databases to identify additional relevant studies, and mitigate the potential impact of publication bias and selective outcome reporting bias.[45] We will search reference lists of included studies from the database searches and relevant systematic

reviews; and we will consult with content experts. We will ask experts to suggest up to three targeted websites that may contain relevant studies and other potentially relevant studies not captured by our search strategy. Lastly, we will search the WHO International Clinical Trials Registry Platform (http://apps.who.int/trialsearch/). For studies only reported in the registry, we will contact first authors by email (with two reminders over one month) to obtain full study reports, or additional study or outcome data. We will include studies in any language and will use professional medical translation services where required. If 12 or more months elapse between the search date and submission for publication, we will update the search.

**Search strategy**

The searches will include a combination of subject headings specific to databases (e.g. MeSH in MEDLINE) and free text words to capture the key concepts of rehabilitative management of back pain in children (Additional file 2).

**Patient and public involvement**

Patients were not involved in the design of our study. However, we will seek patient and public consultation during the development of clinical practice guidelines, which will be the next phase of this project.

**Data management**

We will download the electronic search results into Endnote X9 reference manager software (Clarivate Analytics, PA, USA). We will remove duplicates and upload the remaining references to the Evidence for Policy and Practice Information and Coordinating (EPPI) Centre Reviewer

software for the data extraction stages (EPPI-Reviewer version 4, UCL Institute of Education, University of London, UK). EPPI-Reviewer software stores references, manages and monitors the data extraction process and provides an audit trail for the review.[46]

**Screening for eligibility**

Using the inclusion and exclusion criteria, pairs of reviewers will independently screen titles and abstracts, and subsequently the full text of each selected article in order to confirm inclusion into the study. Titles and abstracts will be classified as possibly relevant or irrelevant. Subsequently, full-text articles of abstracts classified as possibly relevant will be retrieved, reviewed and classified as relevant or irrelevant.

We will conduct training exercises prior to initiating the screening process to ensure reliability between reviewers. Reviewers will first screen a random sample of 50 records based on titles and abstracts. Paired reviewers must reach 90% agreement before completing title and abstract screening for the remaining studies.[47] If this threshold is not reached for all review teams, all team members will discuss differences in classification to clarify and potentially modify the eligibility criteria prior to completing title and abstract screening. Next, reviewers will screen a random sample of 25 full-text articles. All paired reviewers must again reach 90% agreement before completing full-text article screening for the remaining studies. If not, all team members will discuss to clarify eligibility criteria and resolve disagreements prior to completing full-text article screening. Upon completing full-text article screening, paired reviewers will discuss disagreements and reach consensus related to the inclusion of any article, involving a third reviewer if necessary.

**Risk of bias in individual studies**

We will critically appraise studies according to study design using appropriate checklists (Additional file 3). We will assess the quality of studies using the Scottish Intercollegiate Guidelines Network (SIGN) criteria for randomized controlled trials (RCTs), cohort and case-control studies;[48] the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for qualitative studies;[49] the Mixed Methods Appraisal Tool (MMAT) for mixed methods studies;[50] and the Drummond checklist for economic evaluations.[51] The SIGN checklists allow reviewers to assess internal validity by considering the impact of selection bias, information bias, and confounding on study results. The JBI checklist allows reviewers to assess the possibility of bias in qualitative studies' design, conduct and analysis. The MMAT allows reviewers to assess the interdependent qualitative and quantitative components of the study and criteria to consider, such as justification for mixing evidence, and appropriate ways of integrating the data. The Drummond checklist allows reviewers to identify elements that demonstrate a sound economic evaluation such as the assessment of both costs and effects of interventions, accurate measurements of costs and effects, and allowances made for uncertainty in the estimates of costs and effects. We will contact the authors of papers to request missing or additional data for clarification where required. Paired reviewers will independently assess the eligible studies for quality. Any disagreements that arise between the reviewers will be resolved through discussion, or with a third reviewer. Since some of the reviewers have published within this area, the review coordinator will ensure that reviewers will not be assigned their own studies for risk of bias assessment. Additionally, reviewers will recluse themselves from any discussion and decision-making that involves their paper. We will clearly describe this in our final systematic review report.

Using these established checklists and notes to guide our assessment, we will categorize the validity or credibility of each study as either high, low, or unclear risk of bias. We will not use a quantitative cut-off score to determine study quality and will not pre-define weights for the checklist items. Rather, we will make an overall quality judgement by considering the impact of selection bias, information bias and confounding on study results throughout the conduct of each study.[52] We will report detailed results of the critical appraisal in a narrative form and in a 'risk of bias' table. All studies, regardless of their methodological quality, will be extracted and synthesized (where possible). The overall methodological quality of relevant studies will be considered in the individual synthesis of quantitative, qualitative and economic data and the integration of these findings. The results of the risk of bias assessment will be used in a sensitivity analysis to ensure that studies judged to be at 'high risk of bias' do not affect the robustness of our results.

**Data items and data extraction process**

Paired reviewers will independently extract the data from all eligible studies. For the quantitative studies, we will extract data on the study and participant characteristics; intervention and comparator intervention characteristics using the Template for Intervention Description and Replication (TIDieR) checklist;[53] all pre-determined outcomes including multiple measures if used;; key findings; and methodological quality. The TIDieR checklist[53] consists of items to help readers better understand the interventions and how they were delivered (i.e., name of intervention, why, what (materials), what (procedure), who provided, how, where, when and how much, tailoring, modifications, how well (planned), how well (actual)).[53] We will use the

PerSPecTIF question formulation framework to guide data extraction for the qualitative studies regarding the items: perspective, setting, phenomenon of interest, environment, timing, and findings (e.g., themes).[54] We will also extract data describing the qualitative approach used and methodological quality of studies. For both quantitative and qualitative studies, we will extract data on the ICF categories 'environmental factors' (contextual factors that make up the physical, social and attitudinal environment in which people live and conduct their lives) and 'personal factors' (internal contextual factors that influence how disability is experienced by the individual) to add context to the interventions and outcomes.[26] For the economic evaluations, we will use the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement[55] and extract data on the analytic approach (trial- or model-based), evaluation type, the analytic perspective, time horizon adopted for costs, main cost items, setting, key findings, and methodological quality of studies.

Paired reviewers will pretest the data extraction form and revise as needed. We will use EPPI-Reviewer software to manage the data extraction process. Any disagreements that arise between the reviewers will be resolved through discussion, or with a third reviewer. We will contact authors of papers to request missing or additional data, if required.

## DATA SYNTHESIS

We will use a sequential approach at the review level to synthesize and integrate the data.[56] This will involve separate quantitative, economic, and qualitative findings synthesis followed by integration of the resultant quantitative, economic, and qualitative evidence.

***Quantitative synthesis***

We will stratify the study results by: 1) population, 2) intervention, 3) comparator type, 4) outcomes, 5) study design, and 6) methodological quality (Table 3). More specifically, regarding ***population***, we will stratify the results by age range (i.e., infants [aged < 1 year], children [aged 1-9 years], or adolescents [aged 10-19 years]);[21] type of back pain (i.e., thoracic spine pain with/without radiculopathy, low back pain with/without radiculopathy, musculoskeletal chest wall pain, or spondylolisthesis/spondylolysis); duration of pain (i.e., acute/subacute [<12 weeks' duration], or persistent [≥12 weeks' duration]); and severity of pain (i.e., mild, moderate, or severe as classified according to the outcome measures used). For example, scores and categories of pain for the Faces Pain Scale-Revised (FPS-R) are no pain (0 and 2), mild pain (4), moderate pain (6) and severe pain (8 and 10). For the Color Analogue Scale (CAS), these are no pain (0 to 1), mild pain (1.25 to 2.75), moderate pain (3 to 5.75), and severe pain (6 to 10).[57] We will stratify the results by ***intervention type*** (i.e., education and self-management strategies, exercise, manual therapies, passive physical modalities, acupuncture, pharmacological interventions, psychological interventions, multimodal care, environmental modifications, assistive devices, and CAM). We will conduct subgroup analyses by stratifying the interventions further such as type of exercise (e.g., stretching vs. aerobic) and manual therapy (e.g., mobilization vs. soft tissue therapy), and mode of intervention delivery (e.g., provider type, in-person or remotely). We will stratify the results by ***comparator type*** (i.e., active vs. inactive comparator), and conduct subgroup analyses by stratifying the comparators further such as type of inactive comparator (e.g., placebo/sham intervention, wait list, standard or usual care, or no intervention). We will stratify ***outcome*** results by type (i.e., functioning, pain, psychological, health-related quality of life, or adverse events); and effect estimate (i.e., mean difference, relative risk, odds ratio, or

hazard ratio). We will conduct subgroup analyses by stratifying the outcome types further such as type of outcome measure used (e.g., Oswestry Disabiltiy Index [ODI] vs. return to school to measure functioning; and depressive vs. anxiety outcomes to measure psychological outcomes), and time points of outcome measurement (short- or long-term). We will stratify results by ***study design*** (i.e., RCTs, cohort or case-control studies) and conduct subgroup analyses by stratifying the study designs further (e.g., superiority, non-inferiority, and equivalence RCTs). Finally, we will stratify results by ***methodological quality assessment*** (i.e., high/low/unclear risk of bias) to aid in our subsequent meta-analysis and narrative synthesis of results.

We will use established minimal clinically important differences (MCID) to determine the clinical importance of effect sizes when possible.

We will assess clinical, methodological, and statistical heterogeneity among studies. Differences in populations, interventions, comparators, or outcomes across studies may result in clinical heterogeneity. Methodological and statistical heterogeneity may result from differences in risk of bias and differences in outcomes across studies beyond what could be expected by chance alone. We will assess the methodological heterogeneity across studies using our assessments from the SIGN checklist as either high, low, or unclear risk of bias. We will assess statistical heterogeneity using the $I^2$ statistic, whereby $I^2$ of <25-50% will be considered low to moderate (homogeneous), and ≥ 50% considered high (heterogeneous).[58] If two or more studies are clinically homogeneous (i.e., similar populations, interventions, comparators and outcomes) and statistically homogeneous (i.e., $I^2$ <25-50%), we will perform a random effects meta-analysis using EPPI-Reviewer software using the relative risk (or odds ratio for rare events) effect

measure for dichotomous data, mean differences for continuous data, hazard rate ratios for time-to-event data, and rates or rate ratios for count data. For studies that used multiple measures to assess the same outcome and at multiple time points, we will select the most prevalent measure and time point used across the studies to maximize comparability of the findings. We will attempt to summarize the results in a similar way if possible. We will contact study investigators to obtain the data if it is not reported. If the data are unavailable, we will summarize the data in three ways: by entering the means as continuous outcomes, the counts as dichotomous outcomes and by entering all of the data in text form as 'other data' outcomes.[59] We may also use statistical approaches to re-express odds ratios as standardized mean differences (and vice versa), allowing us to combine dichotomous and continuous data.[59] For our primary analysis, we will analyze the studies with low and unclear risk of bias. We will then explore the impact of methodological heterogeneity through sensitivity analysis by analyzing all studies together, including those with a high risk of bias, and comparing our primary analysis with our sensitivity analysis. If the results of the primary and sensitivity analyses differ, we will give precedence to the primary analysis because high risk of bias studies are known to be at risk of overestimating effect sizes.[60]

If the studies are heterogeneous (i.e., if there is clinical, methodological, and statistical heterogeneity), we will narratively summarize the characteristics and findings of all eligible studies according to or the Synthesis Without Meta-analysis (SWiM) reporting guideline.[61] To quantify the effectiveness of interventions, we will use the data provided in the studies to compute effect measures and 95% confidence intervals (i.e., odds ratio or relative risk for dichotomous outcomes, mean differences for continuous outcomes, hazard rate ratios for time-to-event outcomes, and rates or rate ratios for count outcomes).[62]

We will assess the potential impact of reporting biases on the results of our review or meta-analysis by attempting to identify study protocols through the trials registry (WHO International Clinical Trials Registry Platform http://apps.who.int/trialsearch/), and through the use of funnel plots. After results are stratified (Table 3), outcomes that are reported in at least 10 studies will be assessed for publication bias by visually inspecting funnel plots for asymmetry.[63 64]

We will interpret the evidence on the effectiveness of interventions (i.e., whether an intervention was superior, equal or inferior to a comparison intervention) by considering the direction, magnitude, and precision of effect estimates across studies, impact of risk of bias in sensitivity analyses, potential for publication bias, and the generalizability of findings. Similar to any meta-analysis we may conduct, we will give precedence to the primary analysis consisting of studies with low and unclear risk of bias.

***Economic synthesis***

We will report the main findings of economic studies, first stratified by high, low or unclear risk of bias. We will further stratify findings by study design (i.e., cost-effectiveness, cost-utility, cost-benefit, or cost-consequences). We will then stratify findings by type of intervention, outcome, and cost measure.

To indicate whether an intervention might be judged favourably (or unfavourably) from an economic perspective,[65] we will use the Dominance Ranking Matrix (DRM) to classify the interventions into one of three options.[66] *Strong dominance* for the intervention will be selected

when the incremental cost-effectiveness measure shows the intervention as: (i) more effective and less costly than the comparator; or (ii) effective and less costly; or (iii) equal cost and more effective. In this case, from an efficiency perspective, decision makers should favor the intervention over the comparator (in circumstances similar to those of the evaluations). *Weak dominance* for the intervention will be selected when the measure shows the interventions as: (i) equally costly and effective as the comparator; or (ii) more effective and more costly; or (iii) less effective and less costly. In this case, no conclusion may be drawn about whether the intervention is preferable from an efficiency perspective without further information on the priorities or preferences of decision makers in a particular context. Decision makers must determine whether the cost/benefit trade-offs are worth the implementing an intervention in their particular context. Lastly, *non-dominance* for the intervention will be selected when the measure shows the intervention as: (i) more costly and less effective; or (ii) equally as costly and less effective; or (iii) more costly and as effective. In this case the evidence we will interpret the evidence as suggesting the comparator is favourable from an efficiency perspective (in circumstances similar to those of the evaluations).

***Qualitative synthesis***

We will stratify the qualitative findings similarly to the quantitative and economic findings. We will first stratify the findings by risk of bias (i.e., high/low/unclear), then by study approach or design (e.g., qualitative descriptive, ethnography, grounded theory), and by intervention type and outcome.

Additionally, we will stratify findings according to individual perspective (i.e., patient (children), caregivers (parents/guardians), healthcare providers, community service providers, or others involved with the rehabilitation of back pain in children). We will use thematic synthesis to synthesize the qualitative research findings.[67 68] First, we will enter all the text labelled as 'results' or 'findings' of the primary studies verbatim into EPPI-Reviewer. Then, pairs of trained reviewers will independently code each line of text according to its meaning and content, and group codes hierarchically into descriptive themes, including the *a priori* themes (intervention type and outcomes). Reviewers will also generate themes *a posteriori* to answer our review question (i.e., experiences, preferences, expectations and valued outcomes regarding rehabilitation interventions for back pain in children). Reviewers will finalize the themes through discussion. We will give precedence to studies with low or unclear risk of bias.[69]

***Integration of quantitative, qualitative and economic evidence***

Various methods can be used to integrate diverse study types including: (1) juxtaposing findings in a matrix, (2) using logic models/conceptual framework, (3) analyzing program theory, (4) testing hypothesis derived using subgroup analysis, and (5) qualitative comparative analysis.[56] We will integrate the evidence by juxtaposing findings in a matrix to generate hypotheses regarding the effectiveness, cost-effectiveness and safety of rehabilitation interventions for back pain in children. We selected this methodology because it is suitable for comparing and contrasting the findings across the individual quantitative, qualitative and economic evidence syntheses in our review.[56] The use of a matrix will allow us to explore heterogeneity in the findings of the quantitative studies and may indicate why some interventions may be effective, cost-effective and safe, and some may not.[56] For example, we may list themes from the

qualitative synthesis along one side of the matrix, and then plot the interventions evaluated in the quantitative synthesis against the themes as either a match (when the intervention matched a theme) or a mismatch (when the intervention was the opposite of a theme). We will also plot the economic evaluation findings against the corresponding intervention and theme. We will identify gaps in knowledge if a particular theme for an intervention does not match with any of the interventions evaluated in the quantitative studies.

## DISSEMINATION

Knowledge translation activities will include presentations to clinicians and researchers at national and international conferences; meetings with national and international decision makers (clinicians, health managers/administrators, policy makers and patients); publications in peer-reviewed journals; clinician and patient/caregiver resources; posts and lay language summaries on organizations' websites (open access) and other social media platforms.

## DISCUSSION

Findings from this mixed studies review will advance our knowledge of the effectiveness, safety, user experience, and cost-effectiveness of a wide range of rehabilitation interventions for children with back pain. This work will provide the evidentiary basis to develop clinical practice guidelines and care pathways outlining the evidence-based management of back pain in children, which can be adapted for specific settings (e.g., hospitals, rehabilitation clinics, and schools) and geographical regions. Specifically, decision makers should consider interventions that are identified as effective, safe, efficient, and positively experienced by patients and caregivers. Mapping findings to the ICF framework will allow decision makers to use standardized language

in the assessment and management of children during their care program. This may further facilitate improvements in functioning and health outcomes in this patient population.

A potential limitation of our review is that our search strategy may miss potentially relevant studies, however, we have mitigated this by expanding our search strategy to include content experts and searching relevant websites. A potential risk is that there may be too little evidence available to answer our review questions.

Findings from this review will guide future research by identifying methodological limitations and knowledge gaps in the available literature. Future studies can be designed to address these limitations and gaps. This novel interpretation of quantitative, qualitative and economic evidence according to the ICF framework serves as a model for how outcomes related to functioning and health can be prioritized in future research.

## ADDITIONAL FILES

Additional file 1: PRISMA-P 2015 Checklist. Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) 2015 statement

Additional file 2: Literature search strategies

Additional file 3: Risk of bias assessment

## DECLARATIONS

**Ethics approval and consent to participate:** Not applicable

**Consent for publication:** Not applicable

**Availability of data and materials:** Not applicable

**Competing interests:** None declared.

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**Author contributions:**

All authors (CC, JJW, HY, SM, GB, HMS, DR, LH, EP, CC, MS, GC, LV, ATV, PC) assisted in designing and planning the study, developing the research questions and systematic review methodology. CC and JJW drafted the manuscript. All authors reviewed and revised the manuscript, and approved the final manuscript.

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832 **Table 1: Examples of rehabilitation interventions**

| Intervention | Definition | Examples |
|---|---|---|
| Patient or caregiver education and self-management strategies (structured or unstructured) | Teaching patients skills that they can use to manage their health condition | • Learning disease-specific information<br>• Learning general managing skills (e.g., problem-solving, finding and using community resources, working with healthcare team)<br>• Learning strategies to increase confidence (i.e., self-efficacy) in ability to engage in behaviours that are needed to manage their condition on a daily basis<br>• Adequate peer role models and support networks that facilitate the initiation and maintenance of desired behavioural changes |
| Exercise | A subcategory of physical activity that is planned, structured, repetitive, and purposeful; can be supervised (e.g., by a healthcare professional) or unsupervised | • Stretching<br>• Strengthening<br>• Range of motion exercises<br>• Aerobic (e.g., swimming, cycling, walking, running)<br>• Anaerobic (e.g., jumping, sprinting, weight lifting)<br>• Yoga, Qigong |
| Manual therapies | - Manipulation: Techniques incorporating a high-velocity low-amplitude impulse or thrust applied at or near the end of a joint's passive range of motion<br>- Mobilization: Techniques incorporating a low-velocity and small or large amplitude oscillatory movement, within a joint's passive range of motion<br>- Traction: Manual or mechanically assisted application of an intermittent or continuous distractive force<br>- Soft tissue therapy: A mechanical form of therapy where soft-tissue structures are pressed and kneaded, using physical contact with the hand or mechanical device | • Lumbar manipulation, mobilization, or traction<br>• Massage<br>• Muscle energy technique<br>• Strain-counterstrain |
| Passive physical modalities | A form of cold, heat, or light application affecting the body at the skin level or ultrasonic | • Heat application: heat pack, hydrotherapy |

| | | |
|---|---|---|
| | or electromagnetic radiation affecting structures beneath the skin surface:<br>- Passive assistive devices: Device to encourage immobilization in anatomic positions or actively inhibit or prevent movement | • Cryotherapy: cold pack, vapocoolant spray<br>• Low-level laser<br>• Electrical muscle stimulation<br>• Pulsed electromagnetic therapy |
| Acupuncture | Any body-needling, moxibustion, electric acupuncture, laser acupuncture, microsystem acupuncture, and acupressure | • Traditional needling<br>• Dry needling<br>• Burning of specific herbs<br>• Electro-acupuncture<br>• Photo-acupuncture |
| Pharmacological interventions | A substance used in treating disease or relieving pain | • Acetaminophen<br>• Nonsteroidal anti-inflammatory drugs<br>• Muscle relaxants<br>• Antidepressants |
| Psychological interventions | Activities used to modify behaviour, emotional state, or feelings | • Cognitive behavioural therapy<br>• Counselling<br>• Social network and environment-based therapies<br>• Psychoeducational interventions<br>• Mindfulness meditation |
| Modifications to environment | | • Ergonomic interventions at school or work |
| Assistive devices | Any item, piece of equipment or product system, used to increase, maintain, or improve the functional capabilities of people with disabilities | • Walking aids<br>• Orthoses<br>• Braces<br>• Wheelchairs |
| Complementary and alternative therapies (CAM) | Medical products and practices that are not part of standard medical care | • Homeopathy<br>• Traditional Chinese Medicine<br>• Naturopathy<br>• Products (e.g., herbs, dietary supplements, probiotics) |

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**Table 2. Research questions, outcomes and study types**

| Research Question | Outcomes | Study Types |
|---|---|---|
| What is the effectiveness and safety of rehabilitation interventions for improving functioning and other health outcomes in children with back pain? | *Primary:*<br>1. **Functioning**: e.g., Modified Oswestry Low Back Pain Disability Questionnaire, Roland Morris Disability Questionnaire, return to school, participation in sports/other recreational activities<br>*Secondary:*<br>2. **Pain** (including pain intensity, frequency, duration): e.g., VAS, NRS, Faces Pain Scale - Revised<br>3. **Psychological outcomes** (including anxiety and depression): e.g., Revised Child Anxiety and Depression Scale, State-Trait Anxiety Inventory for Children<br>4. **Health-related quality of life**: e.g., KIDSCREEN-52, Pediatric Quality of Life Inventory, PROMIS Pediatric Self Report Scale<br>5. **Adverse events**: any unfavorable sign, symptom, or disease temporarily associated with treatment, indirect harms (e.g., delayed diagnosis/treatment), number of adverse events, severity of adverse events (i.e., mild, moderate, severe), number of participant withdrawals from study due to adverse events. | Randomized controlled trials<br><br>Cohort studies<br><br>Case-control studies<br><br>Mixed methods studies (quantitative component) |
| What are the patients', caregivers' and providers' experiences, preferences, expectations and valued outcomes regarding rehabilitation interventions for back pain? | 6. **Qualitative outcomes**: experiences, preferences, expectations, valued outcomes | Qualitative studies (e.g., phenomenology, grounded theory, ethnography, action research, descriptive qualitative studies)<br><br>Mixed-methods studies (qualitative component) |
| What is the cost-effectiveness of rehabilitation interventions for improving functioning and other health outcomes in children with back pain? | 7. **Economic outcomes**:<br>Direct costs: resources consumed or saved by an intervention<br>Indirect costs: productivity gains or losses (e.g., time consumed or freed by the intervention)<br>Economic health outcomes: QALY, ICER, NMB | Full economic evaluations (trial- and model-based): cost-effectiveness, cost-utility, cost-benefit, cost-consequences |

| | | |
|---|---|---|
| | Intangible: e.g., pain or suffering saved or brought on by an intervention | |

ICER: incremental cost-effectiveness ratio; NMB: measure of net monetary benefit; NRS: Numerical Rating Scale; PROMIS: Patient-Reported Outcomes Measurement Information System; QALY: quality adjusted life years; VAS: Visual Analogue Scale

**Table 3. Categories to guide the assessment of homogeneity and stratification of results**

| Category | Description* |
|---|---|
| 1A | Population: age range<br>- Infants (aged <1 year)<br>- Children (aged 1-9 years)<br>- Adolescents (aged 10-19 years) |
| 1B | Population: type of back pain<br>- Thoracic spine pain without radiculopathy<br>- Thoracic spine pain with radiculopathy<br>- Low back pain without radiculopathy<br>- Low back pain with radiculopathy<br>- Musculoskeletal chest wall pain<br>- Spondylolisthesis/spondylolysis |
| 1C | Population: duration of pain<br>- Acute/subacute (<12 weeks' duration)<br>- Persistent (≥12 weeks' duration) |
| 1D | Population: severity of pain<br>– Mild<br>– Moderate<br>– Severe |
| 2 | Intervention: type<br>- Education and self-management strategies<br>- Exercise<br>- Manual therapy: manipulation, mobilization, traction, soft tissue therapy<br>- Passive physical modalities<br>- Acupuncture<br>- Pharmacological intervention<br>- Psychological intervention<br>- Multimodal care<br>- Environmental modifications<br>- Assistive devices<br>- Complementary and alternative medicine (CAM) |
| 3 | Comparator: type<br>Active:<br>- Other intervention<br>Inactive:<br>- Placebo/sham intervention<br>- Wait list<br>- Standard or usual care<br>- No intervention |
| 4A | Outcome: type<br>- Functioning<br>- Pain |

| | |
|---|---|
| | - Psychological<br>- Health-related quality of life<br>- Adverse events |
| 4B | Outcome: effect estimate**<br>- Mean difference<br>- Relative risk<br>- Odds ratio<br>- Hazard ratio |
| 5 | Study design: type<br>- Randomized trials<br>- Cohort studies<br>- Case-control studies |
| 6 | Methodological quality assessment:<br>– Low risk of bias<br>– High risk of bias<br>– Unclear risk of bias |

*Describes how study results will be stratified by the listed categories to guide the assessment of homogeneity (e.g., results would be reported separately for studies targeting 1) adolescents with persistent low back pain without radiculopathy as the population; 2) education as the intervention; 3) no intervention as the comparator; 4) mean difference of pain intensity as the outcome; 5) randomized trial as the study design)

**Unadjusted estimates will be analyzed separately from adjusted estimates

**PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol***

| Section and topic | Item No | Checklist item | (Page No.#) |
|---|---|---|---|
| **ADMINISTRATIVE INFORMATION** | | | |
| Title: | | | |
| Identification | 1a | Identify the report as a protocol of a systematic review | 1 |
| Update | 1b | If the protocol is for an update of a previous systematic review, identify as such | N/A |
| Registration | 2 | If registered, provide the name of the registry (such as PROSPERO) and registration number | 4 |
| Authors: | | | |
| Contact | 3a | Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author | 1-2 |
| Contributions | 3b | Describe contributions of protocol authors and identify the guarantor of the review | 25 |
| Amendments | 4 | If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments | N/A |
| Support: | | | |
| Sources | 5a | Indicate sources of financial or other support for the review | 25 |
| Sponsor | 5b | Provide name for the review funder and/or sponsor | |
| Role of sponsor or funder | 5c | Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol | |
| **INTRODUCTION** | | | |
| Rationale | 6 | Describe the rationale for the review in the context of what is already known | 5-6 |
| Objectives | 7 | Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO) | 6 |
| **METHODS** | | | |
| Eligibility criteria | 8 | Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review | 7-11 |
| Information sources | 9 | Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage | 12-13 |
| 3Search strategy | 10 | Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated | Additional File 2 |

| | | | |
|---|---|---|---|
| Study records: | | | |
| Data management | 11a | Describe the mechanism(s) that will be used to manage records and data throughout the review | 13 |
| Selection process | 11b | State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis) | 14, 18-20 |
| Data collection process | 11c | Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators | 16-7 |
| Data items | 12 | List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications | 16-7 |
| Outcomes and prioritization | 13 | List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale | 9-11 |
| Risk of bias in individual studies | 14 | Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis | 15-6 |
| Data synthesis | 15a | Describe criteria under which study data will be quantitatively synthesised | 17-22 |
| | 15b | If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as $I^2$, Kendall's $\tau$) | |
| | 15c | Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression) | |
| | 15d | If quantitative synthesis is not appropriate, describe the type of summary planned | |
| Meta-bias(es) | 16 | Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies) | 15 |
| Confidence in cumulative evidence | 17 | Describe how the strength of the body of evidence will be assessed (such as GRADE) | 20 |

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

*From: Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart L, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. BMJ. 2015 Jan 2;349(jan02 1):g7647.*

**Additional file 2. Literatures search strategies**

**Ovid MEDLINE:** Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE® Daily and Ovid MEDLINE® 1946-Present

| | |
|---|---|
| 1 | exp Infant/ |
| 2 | Child, Preschool/ |
| 3 | Child/ |
| 4 | Adolescent/ |
| 5 | Pediatrics/ |
| 6 | (baby or babies).ab,ti. |
| 7 | "newborn*".ab,ti. |
| 8 | (infant or infants).ab,ti. |
| 9 | (child or children*).ab,ti. |
| 10 | (adolescent* or adolescence).ab,ti. |
| 11 | (teen or teens or teenager).ab,ti. |
| 12 | (pediatric* or paediatric*).ab,ti. |
| 13 | (young adj3 (person* or people)).ab,ti. |
| 14 | emerging adult*.ab,ti. |
| 15 | "youth*".ab,ti. |
| 16 | or/1-15 [**pediatric population] |
| 17 | exp Back Injuries/ |
| 18 | exp Back Pain/ |
| 19 | Coccyx/in [Injuries] |
| 20 | Intervertebral Disc Degeneration/ |
| 21 | Intervertebral Disc Displacement/ |
| 22 | Lumbar Vertebrae/in [Injuries] |
| 23 | Lumbosacral Region/in [Injuries] |
| 24 | Osteoarthritis, Spine/ |
| 25 | Piriformis Muscle Syndrome/ |
| 26 | Radiculopathy/ |
| 27 | Sciatica/ |
| 28 | Spinal Diseases/ |

| | |
|---|---|
| 29 | Spinal Stenosis/ |
| 30 | Thoracic Injuries/ |
| 31 | Thoracic Vertebrae/ |
| 32 | (back adj3 (ache* or injur* or pain*)).ab,ti. |
| 33 | (backache* adj3 (injur* or pain*)).ab,ti. |
| 34 | (back pain or back-pain).ab,ti. |
| 35 | (lumbar disc* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 36 | (lumbar disk* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 37 | "low* back pain".ab,ti. |
| 38 | (lumbar adj3 (pain or facet or nerve root* or osteoarthritis or radicul* or spinal stenosis or spondylo* or zygapophys*)).ab,ti. |
| 39 | "Piriformis syndrome*".ab,ti. |
| 40 | radiculopathy.ab,ti. |
| 41 | (sacral adj2 pain*).ab,ti. |
| 42 | ((spine or spinal) adj4 (condition* or disable* or disabilit* or disorder* or pain or stenos?s)).ab,ti. |
| 43 | spondylosis.ab,ti. |
| 44 | (thoracic adj4 (injur* or pain or spine or spinal)).ab,ti. |
| 45 | (T-spine or T-spinal).ab,ti. |
| 46 | or/17-45 [**back pain] |
| 47 | Acupressure/ |
| 48 | Acupuncture/ |
| 49 | exp Acupuncture Therapy/ |
| 50 | "Bedding and Linens"/ |
| 51 | Behavior Therapy/ |
| 52 | exp Biofeedback, Psychology/ |
| 53 | exp Cognitive Behavioral Therapy/ |
| 54 | Combined Modality Therapy/ |
| 55 | Community-Based Participatory Research/ |
| 56 | Community Health Services/ |
| 57 | Community Participation/ |
| 58 | Complementary Therapies/ |
| 59 | Cryotherapy/ |

| | |
|---|---|
| 60 | exp Diathermy/ |
| 61 | exp Electric Stimulation Therapy/ |
| 62 | Electroacupuncture/ |
| 63 | Ergonomics/ |
| 64 | exp Exercise/ |
| 65 | exp Exercise Movement Techniques/ |
| 66 | exp Exercise Therapy/ |
| 67 | Fluid Therapy/ |
| 68 | High-Energy Shock Waves/tu [Therapeutic Use] |
| 69 | Immobilization/ |
| 70 | Hot Temperature/tu [Therapeutic Use] |
| 71 | exp Hydrotherapy/ |
| 72 | Laser Therapy, Low-Level/ |
| 73 | Low-Level Light Therapy/ |
| 74 | Magnetic Field Therapy/ |
| 75 | Magnetics/tu [Therapeutic Use] |
| 76 | Massage/ |
| 77 | exp Medicine, Chinese Traditional/ |
| 78 | exp Musculoskeletal Manipulations/ |
| 79 | Patient Education as Topic/ |
| 80 | Physical Therapy Modalities/ |
| 81 | Self Care/ |
| 82 | Self-Help Devices/ |
| 83 | Physical Fitness/ |
| 84 | Restraint, Physical/ |
| 85 | Transcutaneous Electric Nerve Stimulation/ |
| 86 | Vibration/tu [Therapeutic Use] |
| 87 | Wheelchairs/ |
| 88 | acupressure.ab,ti. |
| 89 | "acupunctur*".ab,ti. |
| 90 | (advice or advise or advised).ab,ti. |
| 91 | alexander technique.ab,ti. |

| | |
|---|---|
| 92 | "assistive device*".ab,ti. |
| 93 | "back belt*".ab,ti. |
| 94 | "back school*".ab,ti. |
| 95 | (back adj2 work).ab,ti. |
| 96 | (braces or brace or bracing).ab,ti. |
| 97 | canes.ab,ti. |
| 98 | chiropract*.ab,ti. |
| 99 | "cognitive behavioral therap*".ab,ti. |
| 100 | "cognitive behavioural therap*".ab,ti. |
| 101 | (cold adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |
| 102 | "core stabili*".ab,ti. |
| 103 | (corset or corsets).ab,ti. |
| 104 | crutches.ab,ti. |
| 105 | cryotherap*.ab,ti. |
| 106 | "deep tissue therap*".ab,ti. |
| 107 | diathermy.ab,ti. |
| 108 | (electric* adj3 (stimulation or EMS or heating pad*)).ab,ti. |
| 109 | electro-acupuncture.ab,ti. |
| 110 | (electrogalvanic stimulation or EGS).ab,ti. |
| 111 | (electromagnet* and (radiation or therap*)).ab,ti. |
| 112 | electromodalit*.ab,ti. |
| 113 | electrotherapy.ab,ti. |
| 114 | (exercise or exercises or exercising).ab,ti. |
| 115 | (flexion-distraction or flexion distraction).ab,ti. |
| 116 | fluidotherap*.ab,ti. |
| 117 | galvanic stimulation.ab,ti. |
| 118 | (H-Wave Device Stimulation or HWDS).ab,ti. |
| 119 | ((heat* or hot) adj3 (therap* or pack* or compress or massage or lamp or pad or bath or soak or tub or bottle or superficial or therapeutic)).ab,ti. |
| 120 | (high energy shock wave* or high-energy shock wave* or HESW).ab,ti. |
| 121 | "hydrotherap*".ab,ti. |
| 122 | (ice adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |

| | |
|---|---|
| 123 | "interferential current*".ab,ti. |
| 124 | infrared.ab,ti. |
| 125 | iontophoresis.ab,ti. |
| 126 | electroanalgesia.ab,ti. |
| 127 | ergonomic*.ab,ti. |
| 128 | kinesiotap*.ab,ti. |
| 129 | (laser* adj3 (phototherapy or irradiation or biostimulation or light or therap*)).ab,ti. |
| 130 | "low level laser*".ab,ti. |
| 131 | "lumbar support*".ab,ti. |
| 132 | (magnetic adj3 (necklace* or therap* or bracelet*)).ab,ti. |
| 133 | (manipulat* adj3 (therap* or treatment* or spinal or osteopath*)).ab,ti. |
| 134 | "manual therap*".ab,ti. |
| 135 | Microcurrent Electrical Neuromuscular Stimulation.ab,ti. |
| 136 | microwave*.ab,ti. |
| 137 | ((moblisation or mobilization) adj4 (osteopath* or orthopedic* or orthopaedic* or lumbar or spinal)).ab,ti. |
| 138 | "moist air bath*".ab,ti. |
| 139 | moxibustion.ab,ti. |
| 140 | ((multimodal* or multi-modal* or multi modal*) adj4 (treatment* or approach or care or therap* or procedure* or package* or manage*)).ab,ti. |
| 141 | muscle activation.ab,ti. |
| 142 | "muscle energy technique*".ab,ti. |
| 143 | myofascial release.ab,ti. |
| 144 | (Neuromuscular Electrical Stimulation or NMES).ab,ti. |
| 145 | orthotic*.ab,ti. |
| 146 | "passive modalit*".ab,ti. |
| 147 | (patient* adj3 (educat* or train*)).ab,ti. |
| 148 | "Percutaneous Electric* Nerve Stimulation".ab,ti. |
| 149 | (physical adj therap*).ab,ti. |
| 150 | physiotherap*.ab,ti. |
| 151 | photo-acupuncture.ab,ti. |
| 152 | pillow*.ab,ti. |
| 153 | pilates.ab,ti. |

| | |
|---|---|
| 154 | (postur* adj3 (correct* or educat* or instruct* or train*)).ab,ti. |
| 155 | (pulsed adj3 (electromagnetic or magnetic or radio frequency or energy)).ab,ti. |
| 156 | radiant light.ab,ti. |
| 157 | Russian stimulation.ab,ti. |
| 158 | "seat adj cushion*".ab,ti. |
| 159 | (self-manage* or self manage*).ab,ti. |
| 160 | (short wave* or short-wave*).ab,ti. |
| 161 | ((shockwave* or shock wave* or shock-wave*) adj3 (ultrasonic or therap* or radiation)).ab,ti. |
| 162 | "soft tissue therap*".ab,ti. |
| 163 | "spray and stretch".ab,ti. |
| 164 | strain-counterstrain.ab,ti. |
| 165 | strengthen*.ab,ti. |
| 166 | stretching.ab,ti. |
| 167 | (tape or taping).ab,ti. |
| 168 | thoracolumbosacral orthosis.ab,ti. |
| 169 | traction.ab,ti. |
| 170 | traditional Chinese medicine.ab,ti. |
| 171 | (transcutaneous electrical stimulation or TENS).ab,ti. |
| 172 | ultrasound.ab,ti. |
| 173 | vapocoolant spray.ab,ti. |
| 174 | "vibration therap*".ab,ti. |
| 175 | walkers.ab,ti. |
| 176 | "walking adj3 aid*".ab,ti. |
| 177 | "warm compress*".ab,ti. |
| 178 | whirlpool*.ab,ti. |
| 179 | yoga.ab,ti. |
| 180 | or/47-179 [**interventions] |
| 181 | Case-Control Studies/ |
| 182 | Cohort Studies/ |
| 183 | Controlled Clinical Trials as Topic/ |
| 184 | Epidemiologic Studies/ |
| 185 | Epidemiology/ |

| | |
|---|---|
| 186 | Follow-Up Studies/ |
| 187 | Longitudinal Studies/ |
| 188 | Prospective Studies/ |
| 189 | Retrospective Studies/ |
| 190 | Randomized Controlled Trials as Topic/ |
| 191 | ((case control or case-control) adj3 (stud* or design*)).ab,ti. |
| 192 | (cohort adj3 (stud* or design* or analysis)).ab,ti. |
| 193 | controlled clinical trial.pt. |
| 194 | "epidemiolog*".ab,ti. |
| 195 | ((followup or follow-up) adj3 (stud* or design* or analysis)).ab,ti. |
| 196 | (longitudinal* adj3 (stud* or design* or analysis)).ab,ti. |
| 197 | (prospective adj3 (stud* or design* or analysis)).ab,ti. |
| 198 | (random* and (control* or clinical or allocat*)).ab,ti. |
| 199 | randomized controlled trial.pt. |
| 200 | (retrospective adj3 (stud* or design*)).ab,ti. |
| 201 | or/181-200 [**study designs_effectiveness] |
| 202 | 16 and 46 and 180 and 201 |
| 203 | Anthropology, Cultural/ |
| 204 | Attitude/ |
| 205 | Awareness/ |
| 206 | Behavioral Research/ |
| 207 | Diary as Topic/ |
| 208 | Emotions/ |
| 209 | Ethnology/ |
| 210 | Ethnopsychology/ |
| 211 | Focus Groups/ |
| 212 | Grounded Theory/ |
| 213 | Interview, Psychological/ |
| 214 | Interviews as Topic/ |
| 215 | Mindfulness/ |
| 216 | Motivation/ |
| 217 | Narration/ |

218 Observation/

219 Perception/

220 Personal Narratives as Topic/

221 Personal Satisfaction/

222 Qualitative Research/

223 Self Report/

224 "Surveys and Questionnaires"/

225 Tape Recording/

226 Thinking/

227 Video Recording/ or Videotape Recording/

228 (attitude* or aware* or belief* or believe* or experience* or mindfulness or motivation or opinion* or perception* or perspective*).ab,ti.

229 ((audio adj record*) or audiorecord* or audiotap*).ab,ti.

230 ((behavioral or behavioural) adj2 research).ab,ti.

231 biographical method*.ab,ti.

232 (constant adj2 (comparative or comparison)).ab,ti.

233 ((content or conversation or discourse) adj2 analys*).ab,ti.

234 descriptive research.ab,ti.

235 (diary or diaries).ab,ti.

236 emotions.ab,ti.

237 ethnograph*.ab,ti.

238 ethnology.ab,ti.

239 ethnopsychology.ab,ti.

240 feelings.ab,ti.

241 (field adj2 (notes or research or study or studies)).ab,ti.

242 (focus adj2 group*).ab,ti.

243 framework analysis.ab,ti.

244 grounded theory.ab,ti.

245 interview*.ab,ti.

246 life world.ab,ti.

247 lived experience.ab,ti.

248 (meaning or meanings).ab,ti.

249 (narrative* or narration*).ab,ti.

250 (observe* or observation*).ab,ti.

251 (open adj ended).ab,ti.

252 phenomenology.ab,ti.

253 purposive sampl*.ab,ti.

254 qualitative.ab,ti.

255 questionnaire*.ab,ti.

256 (realist adj3 (review* or research or synthesis)).ab,ti.

257 satisfaction.ab,ti.

258 self report*.ab,ti.

259 semantic analysis.ab,ti.

260 standpoint*.ab,ti.

261 (story or stories).ab,ti.

262 survey*.ab,ti.

263 (theme* or thematic).ab,ti.

264 (theoretical adj2 (sampl* or saturation)).ab,ti.

265 (thoughts or thinking).ab,ti.

266 ((video adj record*) or videorecord* or videotap*).ab,ti.

267 or/203-266 [**experience/qualitative]

268 "Costs and Cost Analysis"/

269 exp Cost-Benefit Analysis/

270 Quality-Adjusted Life Years/

271 Economics, Medical/

272 (economic* adj4 (evaluat* or stud*)).ab,ti.

273 (health economic* adj4 (evaluat* or stud*)).ab,ti.

274 ((cost-utility or cost utility) adj4 (stud* or analys*)).ab,ti.

275 ((cost-benefit or cost benefit) adj4 (stud* or analys*)).ab,ti.

276 (CEA or CUA or CBA).ab,ti.

277 ((cost-effective* or cost effective*) adj4 (analys* or stud*)).ab,ti.

278 (economic* adj4 (impact or value or factor* or analys*)).ab,ti.

279 (cost* adj4 (health care or analys* or savings or hospital or medical or utilit* or effective* or efficac* or benefit* or consequence* or unit*)).ab,ti.

| | |
|---|---|
| 280 | (decision adj1 (tree* or analy* or model*)).ab,ti. |
| 281 | economics.fs. |
| 282 | (qol or qoly or qolys or hrqol or qaly or qalys or qale or qales).ab,ti. |
| 283 | (sensitivity analys* or "willingness to pay" or quality-adjusted life year* or quality adjusted life year* or quality-adjusted life expectanc* or quality adjusted life expectanc*).ab,ti. |
| 284 | (markov* or monte carlo*).ab,ti. |
| 285 | or/268-284 [**cost effectiveness] |
| 286 | Delivery of Health Care/ |
| 287 | Delivery of Health Care, Integrated/ |
| 288 | Health Planning/ |
| 289 | Health Promotion/ |
| 290 | Health Services Administration/ |
| 291 | Integrative Medicine/ |
| 292 | Interprofessional Relations/ |
| 293 | Patient Care Management/ |
| 294 | (approach* adj3 (collaborative or complementary or comprehensive or innovative or integrated)).ab,ti. |
| 295 | barrier*.ab,ti. |
| 296 | facilitator*.ab,ti. |
| 297 | ((health care or healthcare or health-care) adj3 (clinic or clinics or delivery or implement* or intervention* or model* or plan* or process* or program*or services or strateg* or system* or team*)).ab,ti. |
| 298 | implement*.ab,ti. |
| 299 | (innovate* adj3 (intervention* or model* or plan* or process* or program*or strateg* or system*)).ab,ti. |
| 300 | (model* adj care).ab,ti. |
| 301 | ((integrated or interdisciplinary or interprofessional or multidisciplinary) adj3 (care or clinic or clinics or intervention* or model* or plan* or process* or program*or strateg* or system* or challenge* or benefit* or success* or constrain* or difficult* or enhanc* or influen* or interfer* or motivat* or obstruct* or problem* or promot* or restrain* or restrict* or disincentive* or factor* or capacity or enabler*)).ab,ti. |
| 302 | (pathway* adj3 (clinical or care)).ab,ti. |
| 303 | (program* adj3 (assess* or evaluat*)).ab,ti. |
| 304 | or/286-303 [**implementation] |
| 305 | 16 and 46 and 180 and (201 or 267 or 285 or 304) |
| 306 | 16 and 46 and 180 [**pediatric, back pain, interventions] |

**Embase** Classic+Embase 1947 to 2020

| | |
|---|---|
| 1 | newborn/ |
| 2 | infant/ or infancy/ or baby/ |
| 3 | childhood/ |
| 4 | child/ |
| 5 | adolescent/ or adolescence/ |
| 6 | juvenile/ |
| 7 | (baby or babies).ab,ti. |
| 8 | "newborn*".ab,ti. |
| 9 | (infant or infants).ab,ti. |
| 10 | (child or children*).ab,ti. |
| 11 | (adolescent* or adolescence).ab,ti. |
| 12 | (teen or teens or teenager).ab,ti. |
| 13 | (pediatric* or paediatric*).ab,ti. |
| 14 | (young adj3 (person* or people)).ab,ti. |
| 15 | emerging adult*.ab,ti. |
| 16 | "youth*".ab,ti. |
| 17 | or/1-16 [**pediatric population] |
| 18 | backache/ |
| 19 | low back pain/ |
| 20 | intervertebral disc degeneration/ |
| 21 | intervertebral disk hernia/ |
| 22 | lumbar vertebra/ |
| 23 | lumbosacral region/ |
| 24 | piriformis syndrome/ |
| 25 | radiculopathy/ |
| 26 | sciatica/ |
| 27 | spine disease/ |
| 28 | vertebral canal stenosis/ |
| 29 | spondylosis/ |
| 30 | (back adj3 (ache* or injur* or pain*)).ab,ti. |

| | |
|---|---|
| 31 | (backache* adj3 (injur* or pain*)).ab,ti. |
| 32 | (back pain or back-pain).ab,ti. |
| 33 | (lumbar disc* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 34 | (lumbar disk* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 35 | "low* back pain".ab,ti. |
| 36 | (lumbar adj3 (pain or facet or nerve root* or osteoarthritis or radicul* or spinal stenosis or spondylo* or zygapophys*)).ab,ti. |
| 37 | "Piriformis syndrome*".ab,ti. |
| 38 | radiculopathy.ab,ti. |
| 39 | (sacral adj2 pain*).ab,ti. |
| 40 | ((spine or spinal) adj4 (condition* or disable* or disabilit* or disorder* or pain or stenos?s)).ab,ti. |
| 41 | spondylosis.ab,ti. |
| 42 | (thoracic adj4 (injur* or pain or spine or spinal)).ab,ti. |
| 43 | (T-spine or T-spinal).ab,ti. |
| 44 | or/18-43 [**back injuries] |
| 45 | acupressure/ |
| 46 | acupuncture/ |
| 47 | behavior therapy/ |
| 48 | biofeedback/ |
| 49 | cognitive behavioral therapy/ |
| 50 | participatory research/ |
| 51 | community care/ |
| 52 | community participation/ |
| 53 | alternative medicine/ |
| 54 | cryotherapy/ |
| 55 | diathermy/ |
| 56 | electrostimulation therapy/ |
| 57 | electroacupuncture/ |
| 58 | ergonomics/ |
| 59 | exp exercise/ |
| 60 | exp kinesiotherapy/ |
| 61 | fitness/ |

| | |
|---|---|
| 62 | fluid therapy/ |
| 63 | shock wave/ |
| 64 | immobilization/ |
| 65 | heat/ |
| 66 | exp hydrotherapy/ |
| 67 | low level laser therapy/ |
| 68 | phototherapy/ |
| 69 | exp magnetism/ |
| 70 | magnetotherapy/ |
| 71 | massage/ |
| 72 | Chinese medicine/ |
| 73 | manipulative medicine/ |
| 74 | patient education/ |
| 75 | physiotherapy/ |
| 76 | self care/ |
| 77 | transcutaneous nerve stimulation/ |
| 78 | whole body vibration/ |
| 79 | acupressure.ab,ti. |
| 80 | "acupunctur*".ab,ti. |
| 81 | (advice or advise or advised).ab,ti. |
| 82 | alexander technique.ab,ti. |
| 83 | "assistive device*".ab,ti. |
| 84 | "back belt*".ab,ti. |
| 85 | "back school*".ab,ti. |
| 86 | (back adj2 work).ab,ti. |
| 87 | (braces or brace or bracing).ab,ti. |
| 88 | chiropract*.ab,ti. |
| 89 | "cognitive behavioral therap*".ab,ti. |
| 90 | "cognitive behavioural therap*".ab,ti. |
| 91 | (cold adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |
| 92 | "core stabili*".ab,ti. |
| 93 | (corset or corsets).ab,ti. |

| | |
|---|---|
| 94 | crutches.ab,ti. |
| 95 | cryotherap*.ab,ti. |
| 96 | "deep tissue therap*".ab,ti. |
| 97 | diathermy.ab,ti. |
| 98 | (electric* adj3 (stimulation or EMS or heating pad*)).ab,ti. |
| 99 | electro-acupuncture.ab,ti. |
| 100 | (electrogalvanic stimulation or EGS).ab,ti. |
| 101 | (electromagnet* and (radiation or therap*)).ab,ti. |
| 102 | electromodalit*.ab,ti. |
| 103 | electrotherapy.ab,ti. |
| 104 | (exercise or exercises or exercising).ab,ti. |
| 105 | (flexion-distraction or flexion distraction).ab,ti. |
| 106 | fluidotherap*.ab,ti. |
| 107 | galvanic stimulation.ab,ti. |
| 108 | (H-Wave Device Stimulation or HWDS).ab,ti. |
| 109 | ((heat* or hot) adj3 (therap* or pack* or compress or massage or lamp or pad or bath or soak or tub or bottle or superficial or therapeutic)).ab,ti. |
| 110 | (high energy shock wave* or high-energy shock wave* or HESW).ab,ti. |
| 111 | "hydrotherap*".ab,ti. |
| 112 | (ice adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |
| 113 | "interferential current*".ab,ti. |
| 114 | infrared.ab,ti. |
| 115 | iontophoresis.ab,ti. |
| 116 | electroanalgesia.ab,ti. |
| 117 | ergonomic*.ab,ti. |
| 118 | kinesiotap*.ab,ti. |
| 119 | (laser* adj3 (phototherapy or irradiation or biostimulation or light or therap*)).ab,ti. |
| 120 | "low level laser*".ab,ti. |
| 121 | "lumbar support*".ab,ti. |
| 122 | (magnetic adj3 (necklace* or therap* or bracelet*)).ab,ti. |
| 123 | (manipulat* adj3 (therap* or treatment* or spinal or osteopath*)).ab,ti. |
| 124 | "manual therap*".ab,ti. |

| | |
|---|---|
| 125 | Microcurrent Electrical Neuromuscular Stimulation.ab,ti. |
| 126 | microwave*.ab,ti. |
| 127 | ((moblisation or mobilization) adj4 (osteopath* or orthopedic* or orthopaedic* or lumbar or spinal)).ab,ti. |
| 128 | "moist air bath*".ab,ti. |
| 129 | moxibustion.ab,ti. |
| 130 | ((multimodal* or multi-modal* or multi modal*) adj4 (treatment* or approach or care or therap* or procedure* or package* or manage*)).ab,ti. |
| 131 | muscle activation.ab,ti. |
| 132 | "muscle energy technique*".ab,ti. |
| 133 | myofascial release.ab,ti. |
| 134 | (Neuromuscular Electrical Stimulation or NMES).ab,ti. |
| 135 | orthotic*.ab,ti. |
| 136 | "passive modalit*".ab,ti. |
| 137 | (patient* adj3 (educat* or train*)).ab,ti. |
| 138 | "Percutaneous Electric* Nerve Stimulation".ab,ti. |
| 139 | (physical adj therap*).ab,ti. |
| 140 | physiotherap*.ab,ti. |
| 141 | photo-acupuncture.ab,ti. |
| 142 | pillow*.ab,ti. |
| 143 | pilates.ab,ti. |
| 144 | (postur* adj3 (correct* or educat* or instruct* or train*)).ab,ti. |
| 145 | (pulsed adj3 (electromagnetic or magnetic or radio frequency or energy)).ab,ti. |
| 146 | radiant light.ab,ti. |
| 147 | Russian stimulation.ab,ti. |
| 148 | "seat adj cushion*".ab,ti. |
| 149 | (self-manage* or self manage*).ab,ti. |
| 150 | (short wave* or short-wave*).ab,ti. |
| 151 | ((shockwave* or shock wave* or shock-wave*) adj3 (ultrasonic or therap* or radiation)).ab,ti. |
| 152 | "soft tissue therap*".ab,ti. |
| 153 | "spray and stretch".ab,ti. |
| 154 | strain-counterstrain.ab,ti. |
| 155 | strengthen*.ab,ti. |

156 stretching.ab,ti.

157 (tape or taping).ab,ti.

158 thoracolumbosacral orthosis.ab,ti.

159 traction.ab,ti.

160 traditional Chinese medicine.ab,ti.

161 (transcutaneous electrical stimulation or TENS).ab,ti.

162 ultrasound.ab,ti.

163 vapocoolant spray.ab,ti.

164 "vibration therap*".ab,ti.

165 walkers.ab,ti.

166 "walking adj3 aid*".ab,ti.

167 "warm compress*".ab,ti.

168 whirlpool*.ab,ti.

169 yoga.ab,ti.

170 or/45-169 [**interventions]

171 case control study/

172 cohort analysis/

173 "controlled clinical trial (topic)"/

174 longitudinal study/

175 "randomized controlled trial (topic)"/

176 ((case control or case-control) adj3 (stud* or design*)).ab,ti.

177 (cohort adj3 (stud* or design* or analysis)).ab,ti.

178 "epidemiolog*".ab,ti.

179 ((followup or follow-up) adj3 (stud* or design* or analysis)).ab,ti.

180 (longitudinal* adj3 (stud* or design* or analysis)).ab,ti.

181 (prospective adj3 (stud* or design* or analysis)).ab,ti.

182 (random* and (control* or clinical or allocat* or trial*)).ab,ti.

183 (retrospective adj3 (stud* or design*)).ab,ti.

184 or/171-183 [**effectiveness]

185 attitude to health/

186 patient attitude/

187 awareness/

188 behavioral research/

189 writing/

190 emotion/

191 ethnology/

192 cultural psychology/

193 information processing/

194 grounded theory/

195 interview/

196 mindfulness/

197 motivation/

198 exp verbal communication/

199 observation/ or participant observation/

200 perception/

201 satisfaction/ or patient satisfaction/

202 qualitative research/

203 self report/

204 health survey/

205 questionnaire/

206 exp recording/

207 exp thinking/

208 (attitude* or aware* or belief* or believe* or experience* or mindfulness or motivation or opinion* or perception* or perspective*).ab,ti.

209 ((audio adj record*) or audiorecord* or audiotap*).ab,ti.

210 ((behavioral or behavioural) adj2 research).ab,ti.

211 biographical method*.ab,ti.

212 (constant adj2 (comparative or comparison)).ab,ti.

213 ((content or conversation or discourse) adj2 analys*).ab,ti.

214 descriptive research.ab,ti.

215 (diary or diaries).ab,ti.

216 emotions.ab,ti.

217 ethnograph*.ab,ti.

218 ethnology.ab,ti.

219 ethnopsychology.ab,ti.

220 feelings.ab,ti.

221 (field adj2 (notes or research or study or studies)).ab,ti.

222 (focus adj2 group*).ab,ti.

223 framework analysis.ab,ti.

224 grounded theory.ab,ti.

225 interview*.ab,ti.

226 life world.ab,ti.

227 lived experience.ab,ti.

228 (meaning or meanings).ab,ti.

229 (narrative* or narration*).ab,ti.

230 (observe* or observation*).ab,ti.

231 (open adj ended).ab,ti.

232 phenomenology.ab,ti.

233 purposive sampl*.ab,ti.

234 qualitative.ab,ti.

235 questionnaire*.ab,ti.

236 (realist adj3 (review* or research or synthesis)).ab,ti.

237 satisfaction.ab,ti.

238 self report*.ab,ti.

239 semantic analysis.ab,ti.

240 standpoint*.ab,ti.

241 (story or stories).ab,ti.

242 survey*.ab,ti.

243 (theme* or thematic).ab,ti.

244 (theoretical adj2 (sampl* or saturation)).ab,ti.

245 (thoughts or thinking).ab,ti.

246 ((video adj record*) or videorecord* or videotap*).ab,ti.

247 or/185-246 [**qualitative_experience]

248 "cost effectiveness analysis"/

249 "cost benefit analysis"/

250 quality adjusted life year/

| | |
|---|---|
| 251 | health economics/ |
| 252 | (economic* adj4 (evaluat* or stud*)).ab,ti. |
| 253 | (health economic* adj4 (evaluat* or stud*)).ab,ti. |
| 254 | ((cost-utility or cost utility) adj4 (stud* or analys*)).ab,ti. |
| 255 | ((cost-benefit or cost benefit) adj4 (stud* or analys*)).ab,ti. |
| 256 | (CEA or CUA or CBA).ab,ti. |
| 257 | ((cost-effective* or cost effective*) adj4 (analys* or stud*)).ab,ti. |
| 258 | (economic* adj4 (impact or value or factor* or analys*)).ab,ti. |
| 259 | (cost* adj4 (health care or analys* or savings or hospital or medical or utilit* or effective* or efficac* or benefit* or consequence* or unit*)).ab,ti. |
| 260 | (decision adj1 (tree* or analy* or model*)).ab,ti. |
| 261 | economics.fs. |
| 262 | (qol or qoly or qolys or hrqol or qaly or qalys or qale or qales).ab,ti. |
| 263 | (sensitivity analys* or "willingness to pay" or quality-adjusted life year* or quality adjusted life year* or quality-adjusted life expectanc* or quality adjusted life expectanc*).ab,ti. |
| 264 | (markov* or monte carlo*).ab,ti. |
| 265 | or/248-264 [**cost effectiveness] |
| 266 | health care delivery/ |
| 267 | integrated health care system/ |
| 268 | health care planning/ |
| 269 | health promotion/ |
| 270 | health service/ |
| 271 | integrative medicine/ |
| 272 | case management/ |
| 273 | (approach* adj3 (collaborative or complementary or comprehensive or innovative or integrated)).ab,ti. |
| 274 | barrier*.ab,ti. |
| 275 | facilitator*.ab,ti. |
| 276 | ((health care or healthcare or health-care) adj3 (clinic or clinics or delivery or implement* or intervention* or model* or plan* or process* or program*or services or strateg* or system* or team*)).ab,ti. |
| 277 | implement*.ab,ti. |
| 278 | (innovate* adj3 (intervention* or model* or plan* or process* or program*or strateg* or system*)).ab,ti. |
| 279 | (model* adj care).ab,ti. |

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|---|---|
| 280 | ((integrated or interdisciplinary or interprofessional or multidisciplinary) adj3 (care or clinic or clinics or intervention* or model* or plan* or process* or program*or strateg* or system* or challenge* or benefit* or success* or constrain* or difficult* or enhanc* or influen* or interfer* or motivat* or obstruct* or problem* or promot* or restrain* or restrict* or disincentive* or factor* or capacity or enabler*)).ab,ti. |
| 281 | (pathway* adj3 (clinical or care)).ab,ti. |
| 282 | (program* adj3 (assess* or evaluat*)).ab,ti. |
| 283 | or/266-282 [**implementation] |
| 284 | 17 and 44 and 170 |
| 285 | 284 and (184 or 247 or 265 or 283) |
| 286 | limit 285 to (conference abstract or conference paper or "conference review" or editorial or letter) |
| 287 | 285 not 286 |

**PsycINFO** 1806

| | |
|---|---|
| 1 | (baby or babies).ab,ti. |
| 2 | "newborn*".ab,ti. |
| 3 | (infant or infants).ab,ti. |
| 4 | (child or children*).ab,ti. |
| 5 | (adolescent* or adolescence).ab,ti. |
| 6 | (teen or teens or teenager).ab,ti. |
| 7 | (pediatric* or paediatric*).ab,ti. |
| 8 | (young adj3 (person* or people)).ab,ti. |
| 9 | emerging adult*.ab,ti. |
| 10 | "youth*".ab,ti. |
| 11 | or/1-10 [**pediatric population] |
| 12 | exp Back Pain/ |
| 13 | Lumbar Spinal Cord/ |
| 14 | Spinal Cord Injuries/ |
| 15 | Spinal Column/ |
| 16 | (back adj3 (ache* or injur* or pain*)).ab,ti. |
| 17 | (backache* adj3 (injur* or pain*)).ab,ti. |
| 18 | (back pain or back-pain).ab,ti. |
| 19 | (lumbar disc* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 20 | (lumbar disk* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 21 | "low* back pain".ab,ti. |
| 22 | (lumbar adj3 (pain or facet or nerve root* or osteoarthritis or radicul* or spinal stenosis or spondylo* or zygapophys*)).ab,ti. |
| 23 | "Piriformis syndrome*".ab,ti. |
| 24 | radiculopathy.ab,ti. |
| 25 | (sacral adj2 pain*).ab,ti. |
| 26 | ((spine or spinal) adj4 (condition* or disable* or disabilit* or disorder* or pain or stenos?s)).ab,ti. |
| 27 | spondylosis.ab,ti. |
| 28 | (thoracic adj4 (injur* or pain or spine or spinal)).ab,ti. |
| 29 | (T-spine or T-spinal).ab,ti. |
| 30 | or/12-29 [**back injuries] |

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|---|---|
| 31 | Acupuncture/ |
| 32 | exp Behavior Therapy/ |
| 33 | exp Biofeedback/ |
| 34 | exp Cognitive Behavior Therapy/ |
| 35 | Alternative Medicine/ |
| 36 | Electrical Stimulation/ |
| 37 | Human Factors Engineering/ |
| 38 | exp Exercise/ |
| 39 | Movement Therapy/ |
| 40 | Shock Therapy/ |
| 41 | Heat/ |
| 42 | exp Hydrotherapy/ |
| 43 | Laser Irradiation/ |
| 44 | exp Magnetism/ |
| 45 | Massage/ |
| 46 | Client Education/ |
| 47 | Self-Care Skills/ |
| 48 | Physical Therapy/ |
| 49 | Self-Help Techniques/ |
| 50 | Physical Fitness/ |
| 51 | Vibration/ |
| 52 | acupressure.ab,ti. |
| 53 | "acupunctur*".ab,ti. |
| 54 | (advice or advise or advised).ab,ti. |
| 55 | alexander technique.ab,ti. |
| 56 | "assistive device*".ab,ti. |
| 57 | "back belt*".ab,ti. |
| 58 | "back school*".ab,ti. |
| 59 | (back adj2 work).ab,ti. |
| 60 | (braces or brace or bracing).ab,ti. |
| 61 | canes.ab,ti. |
| 62 | chiropract*.ab,ti. |

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|---|---|
| 63 | "cognitive behavioral therap*".ab,ti. |
| 64 | "cognitive behavioural therap*".ab,ti. |
| 65 | (cold adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |
| 66 | "core stabili*".ab,ti. |
| 67 | (corset or corsets).ab,ti. |
| 68 | crutches.ab,ti. |
| 69 | cryotherap*.ab,ti. |
| 70 | "deep tissue therap*".ab,ti. |
| 71 | diathermy.ab,ti. |
| 72 | (electric* adj3 (stimulation or EMS or heating pad*)).ab,ti. |
| 73 | electro-acupuncture.ab,ti. |
| 74 | (electrogalvanic stimulation or EGS).ab,ti. |
| 75 | (electromagnet* and (radiation or therap*)).ab,ti. |
| 76 | electromodalit*.ab,ti. |
| 77 | electrotherapy.ab,ti. |
| 78 | (exercise or exercises or exercising).ab,ti. |
| 79 | (flexion-distraction or flexion distraction).ab,ti. |
| 80 | fluidotherap*.ab,ti. |
| 81 | galvanic stimulation.ab,ti. |
| 82 | (H-Wave Device Stimulation or HWDS).ab,ti. |
| 83 | ((heat* or hot) adj3 (therap* or pack* or compress or massage or lamp or pad or bath or soak or tub or bottle or superficial or therapeutic)).ab,ti. |
| 84 | (high energy shock wave* or high-energy shock wave* or HESW).ab,ti. |
| 85 | "hydrotherap*".ab,ti. |
| 86 | (ice adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |
| 87 | "interferential current*".ab,ti. |
| 88 | infrared.ab,ti. |
| 89 | iontophoresis.ab,ti. |
| 90 | electroanalgesia.ab,ti. |
| 91 | ergonomic*.ab,ti. |
| 92 | kinesiotap*.ab,ti. |
| 93 | (laser* adj3 (phototherapy or irradiation or biostimulation or light or therap*)).ab,ti. |

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|---|---|
| 94 | "low level laser*".ab,ti. |
| 95 | "lumbar support*".ab,ti. |
| 96 | (magnetic adj3 (necklace* or therap* or bracelet*)).ab,ti. |
| 97 | (manipulat* adj3 (therap* or treatment* or spinal or osteopath*)).ab,ti. |
| 98 | "manual therap*".ab,ti. |
| 99 | Microcurrent Electrical Neuromuscular Stimulation.ab,ti. |
| 100 | microwave*.ab,ti. |
| 101 | ((moblisation or mobilization) adj4 (osteopath* or orthopedic* or orthopaedic* or lumbar or spinal)).ab,ti. |
| 102 | "moist air bath*".ab,ti. |
| 103 | moxibustion.ab,ti. |
| 104 | ((multimodal* or multi-modal* or multi modal*) adj4 (treatment* or approach or care or therap* or procedure* or package* or manage*)).ab,ti. |
| 105 | muscle activation.ab,ti. |
| 106 | "muscle energy technique*".ab,ti. |
| 107 | myofascial release.ab,ti. |
| 108 | (Neuromuscular Electrical Stimulation or NMES).ab,ti. |
| 109 | orthotic*.ab,ti. |
| 110 | "passive modalit*".ab,ti. |
| 111 | (patient* adj3 (educat* or train*)).ab,ti. |
| 112 | "Percutaneous Electric* Nerve Stimulation".ab,ti. |
| 113 | (physical adj therap*).ab,ti. |
| 114 | physiotherap*.ab,ti. |
| 115 | photo-acupuncture.ab,ti. |
| 116 | pillow*.ab,ti. |
| 117 | pilates.ab,ti. |
| 118 | (postur* adj3 (correct* or educat* or instruct* or train*)).ab,ti. |
| 119 | (pulsed adj3 (electromagnetic or magnetic or radio frequency or energy)).ab,ti. |
| 120 | radiant light.ab,ti. |
| 121 | Russian stimulation.ab,ti. |
| 122 | "seat adj cushion*".ab,ti. |
| 123 | (self-manage* or self manage*).ab,ti. |
| 124 | (short wave* or short-wave*).ab,ti. |

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|---|---|
| 125 | ((shockwave* or shock wave* or shock-wave*) adj3 (ultrasonic or therap* or radiation)).ab,ti. |
| 126 | "soft tissue therap*".ab,ti. |
| 127 | "spray and stretch".ab,ti. |
| 128 | strain-counterstrain.ab,ti. |
| 129 | strengthen*.ab,ti. |
| 130 | stretching.ab,ti. |
| 131 | (tape or taping).ab,ti. |
| 132 | thoracolumbosacral orthosis.ab,ti. |
| 133 | traction.ab,ti. |
| 134 | traditional Chinese medicine.ab,ti. |
| 135 | (transcutaneous electrical stimulation or TENS).ab,ti. |
| 136 | ultrasound.ab,ti. |
| 137 | vapocoolant spray.ab,ti. |
| 138 | "vibration therap*".ab,ti. |
| 139 | walkers.ab,ti. |
| 140 | "walking adj3 aid*".ab,ti. |
| 141 | "warm compress*".ab,ti. |
| 142 | whirlpool*.ab,ti. |
| 143 | yoga.ab,ti. |
| 144 | or/31-143 [**interventions] |
| 145 | Cohort Analysis/ |
| 146 | Clinical Trials/ |
| 147 | Longitudinal Studies/ |
| 148 | exp Randomized Controlled Trials/ |
| 149 | ((case control or case-control) adj3 (stud* or design*)).ab,ti. |
| 150 | (cohort adj3 (stud* or design* or analysis)).ab,ti. |
| 151 | controlled clinical trial.pt. |
| 152 | "epidemiolog*".ab,ti. |
| 153 | ((followup or follow-up) adj3 (stud* or design* or analysis)).ab,ti. |
| 154 | (longitudinal* adj3 (stud* or design* or analysis)).ab,ti. |
| 155 | (prospective adj3 (stud* or design* or analysis)).ab,ti. |
| 156 | (random* and (control* or clinical or allocat*)).ab,ti. |

| | |
|---|---|
| 157 | (retrospective adj3 (stud* or design*)).ab,ti. |
| 158 | or/145-157 [**effectiveness] |
| 159 | exp Attitudes/ |
| 160 | Awareness/ |
| 161 | Journal Writing/ |
| 162 | Emotions/ |
| 163 | Ethnology/ |
| 164 | Focus Group/ |
| 165 | Grounded Theory/ |
| 166 | Interviews/ |
| 167 | Mindfulness/ or Mindfulness-Based Interventions/ |
| 168 | Motivation/ |
| 169 | Narratives/ |
| 170 | exp Observation Methods/ |
| 171 | Perception/ |
| 172 | Preferences/ |
| 173 | Satisfaction/ |
| 174 | Qualitative Methods/ |
| 175 | Self-Report/ |
| 176 | Surveys/ or Questionnaires/ |
| 177 | exp Tape Recorders/ |
| 178 | Thinking/ |
| 179 | Digital Video/ |
| 180 | (attitude* or aware* or belief* or believe* or experience* or mindfulness or motivation or opinion* or perception* or perspective*).ab,ti. |
| 181 | ((audio adj record*) or audiorecord* or audiotap*).ab,ti. |
| 182 | ((behavioral or behavioural) adj2 research).ab,ti. |
| 183 | biographical method*.ab,ti. |
| 184 | (constant adj2 (comparative or comparison)).ab,ti. |
| 185 | ((content or conversation or discourse) adj2 analys*).ab,ti. |
| 186 | descriptive research.ab,ti. |
| 187 | (diary or diaries).ab,ti. |

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|---|---|
| 188 | emotions.ab,ti. |
| 189 | ethnograph*.ab,ti. |
| 190 | ethnology.ab,ti. |
| 191 | ethnopsychology.ab,ti. |
| 192 | feelings.ab,ti. |
| 193 | (field adj2 (notes or research or study or studies)).ab,ti. |
| 194 | (focus adj2 group*).ab,ti. |
| 195 | framework analysis.ab,ti. |
| 196 | grounded theory.ab,ti. |
| 197 | interview*.ab,ti. |
| 198 | life world.ab,ti. |
| 199 | lived experience.ab,ti. |
| 200 | (meaning or meanings).ab,ti. |
| 201 | (narrative* or narration*).ab,ti. |
| 202 | (observe* or observation*).ab,ti. |
| 203 | (open adj ended).ab,ti. |
| 204 | phenomenology.ab,ti. |
| 205 | purposive sampl*.ab,ti. |
| 206 | qualitative.ab,ti. |
| 207 | questionnaire*.ab,ti. |
| 208 | (realist adj3 (review* or research or synthesis)).ab,ti. |
| 209 | satisfaction.ab,ti. |
| 210 | self report*.ab,ti. |
| 211 | semantic analysis.ab,ti. |
| 212 | standpoint*.ab,ti. |
| 213 | (story or stories).ab,ti. |
| 214 | survey*.ab,ti. |
| 215 | (theme* or thematic).ab,ti. |
| 216 | (theoretical adj2 (sampl* or saturation)).ab,ti. |
| 217 | (thoughts or thinking).ab,ti. |
| 218 | ((video adj record*) or videorecord* or videotap*).ab,ti. |
| 219 | or/159-218 [** qualitative_experience] |

| | |
|---|---|
| 220 | "Costs and Cost Analysis"/ |
| 221 | Health Care Costs/ |
| 222 | Quality of Life Measures/ |
| 223 | Health Care Economics/ |
| 224 | (economic* adj4 (evaluat* or stud*)).ab,ti. |
| 225 | (health economic* adj4 (evaluat* or stud*)).ab,ti. |
| 226 | ((cost-utility or cost utility) adj4 (stud* or analys*)).ab,ti. |
| 227 | ((cost-benefit or cost benefit) adj4 (stud* or analys*)).ab,ti. |
| 228 | (CEA or CUA or CBA).ab,ti. |
| 229 | ((cost-effective* or cost effective*) adj4 (analys* or stud*)).ab,ti. |
| 230 | (economic* adj4 (impact or value or factor* or analys*)).ab,ti. |
| 231 | (cost* adj4 (health care or analys* or savings or hospital or medical or utilit* or effective* or efficac* or benefit* or consequence* or unit*)).ab,ti. |
| 232 | (decision adj1 (tree* or analy* or model*)).ab,ti. |
| 233 | [economics.fs.] |
| 234 | (qol or qoly or qolys or hrqol or qaly or qalys or qale or qales).ab,ti. |
| 235 | (sensitivity analys* or "willingness to pay" or quality-adjusted life year* or quality adjusted life year* or quality-adjusted life expectanc* or quality adjusted life expectanc*).ab,ti. |
| 236 | (markov* or monte carlo*).ab,ti. |
| 237 | or/220-236 [**cost effectiveness] |
| 238 | Health Care Delivery/ |
| 239 | Health Care Administration/ |
| 240 | Health Promotion/ |
| 241 | Integrated Services/ |
| 242 | Interdisciplinary Treatment Approach/ |
| 243 | Case Management/ |
| 244 | (approach* adj3 (collaborative or complementary or comprehensive or innovative or integrated)).ab,ti. |
| 245 | barrier*.ab,ti. |
| 246 | facilitator*.ab,ti. |
| 247 | ((health care or healthcare or health-care) adj3 (clinic or clinics or delivery or implement* or intervention* or model* or plan* or process* or program*or services or strateg* or system* or team*)).ab,ti. |
| 248 | implement*.ab,ti. |

| | |
|---|---|
| 249 | (innovate* adj3 (intervention* or model* or plan* or process* or program*or strateg* or system*)).ab,ti. |
| 250 | (model* adj care).ab,ti. |
| 251 | ((integrated or interdisciplinary or interprofessional or multidisciplinary) adj3 (care or clinic or clinics or intervention* or model* or plan* or process* or program*or strateg* or system* or challenge* or benefit* or success* or constrain* or difficult* or enhanc* or influen* or interfer* or motivat* or obstruct* or problem* or promot* or restrain* or restrict* or disincentive* or factor* or capacity or enabler*)).ab,ti. |
| 252 | (pathway* adj3 (clinical or care)).ab,ti. |
| 253 | (program* adj3 (assess* or evaluat*)).ab,ti. |
| 254 | or/238-253 [**implementation] |
| 255 | 11 and 30 and 144 |
| 256 | limit 255 to (childhood <birth to 12 years> and (100 childhood <birth to age 12 yrs> or 120 neonatal <birth to age 1 mo> or 140 infancy <2 to 23 mo> or 160 preschool age <age 2 to 5 yrs> or 180 school age <age 6 to 12 yrs> or 200 adolescence <age 13 to 17 yrs>)) |
| 257 | 255 and (158 or 219 or 237 or 254) |
| 258 | limit 257 to (childhood <birth to 12 years> and (100 childhood <birth to age 12 yrs> or 120 neonatal <birth to age 1 mo> or 140 infancy <2 to 23 mo> or 160 preschool age <age 2 to 5 yrs> or 180 school age <age 6 to 12 yrs> or 200 adolescence <age 13 to 17 yrs>)) |

Additional file 3: Risk of bias assessment according to study design

| Quantitative studies (SIGN checklists) | | |
|---|---|---|
| **Randomized controlled trials** | **Cohort studies** | **Case-control studies** |
| 1. The study addresses an appropriate and clearly focused question. | 1. The study addresses an appropriate and clearly focused question. | 1. The study addresses an appropriate and clearly focused question. |
| 2 .The assignment of subjects to treatment groups is randomised. | 2. The two groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation. | 2. The cases and controls are taken from comparable populations. |
| 3. An adequate concealment method is used. | 3. The study indicates how many of the people asked to take part did so, in each of the groups being studied. | 3. The same exclusion criteria are used for both cases and controls. |
| 4. The design keeps subjects and investigators 'blind' about treatment allocation. | 4. The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis. | 4. What percentage of each group (cases and controls) participated in the study? |
| 5. The treatment and control groups are similar at the start of the trial. | 5. What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed. | 5. Comparison is made between participants and non-participants to establish their similarities or differences. |
| 6. The only difference between groups is the treatment under investigation. | 6. Comparison is made between full participants and those lost to follow up, by exposure status. | 6. Cases are clearly defined and differentiated from controls. |
| 7. All relevant outcomes are measured in a standard, valid and reliable way. | 7. The outcomes are clearly defined. | 7. It is clearly established that controls are non-cases |
| 8. What percentage of the individuals or clusters recruited into each treatment arm of the study dropped out before the study was completed? | 8. The assessment of outcome is made blind to exposure status. If the study is retrospective this may not be applicable. | 8. Measures will have been taken to prevent knowledge of primary exposure influencing case ascertainment |
| 9. All the subjects are analysed in the groups to which they were randomly allocated (often referred to as intention to treat analysis). | 9. Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome. | 9. Exposure status is measured in a standard, valid and reliable way |
| 10. Where the study is carried out at more than one site, results are comparable for all sites. | 10. The method of assessment of exposure is reliable. | 10. The main potential confounders are identified and taken into account in the design and analysis |
| | 11. Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable. | 11. Confidence intervals are provided |
| | 12. Exposure level or prognostic factor is assessed more than once. | |
| | 13. The main potential confounders are identified and taken into account in the design and analysis. | |

| | | |
|---|---|---|
| | 14. Have confidence intervals been provided? | |

| **Mixed methods studies (MMAT)** |
|---|
| **Qualitative:**<br>1. Is the qualitative approach appropriate to answer the research question?<br>2. Are the qualitative data collection methods adequate to address the research question?<br>3. Are the findings adequately derived from the data?<br>4. Is the interpretation of results sufficiently substantiated by data?<br>5. Is there coherence between qualitative data sources, collection, analysis and interpretation? |
| **Quantitative randomized controlled trials:**<br>1. Is randomization appropriately performed?<br>2. Are the groups comparable at baseline?<br>3. Are there complete outcome data?<br>4. Are outcome assessors blinded to the intervention provided?<br>5. Did the participants adhere to the assigned intervention? |
| **Quantitative non-randomized:**<br>1. Are the participants representative of the target population?<br>2. Are measurements appropriate regarding both the outcome and intervention (or exposure)?<br>3. Are there complete outcome data?<br>4. Are the confounders accounted for in the design and analysis?<br>5. During the study period, is the intervention administered (or exposure occurred) as intended? |
| **Quantitative descriptive**:<br>1. Is the sampling strategy relevant to address the research question?<br>2. Is the sample representative of the target population?<br>3. Are the measurements appropriate?<br>4. Is the risk of nonresponse bias low?<br>5. Is the statistical analysis appropriate to answer the research question? |
| **Mixed methods:**<br>1. Is there adequate rationale for using a mixed methods design to address the research question?<br>2. Are the different components of the study effectively integrated to answer the research question?<br>3. Are the outputs of the integration of qualitative and quantitative components adequately interpreted?<br>4. Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?<br>5 .Do the different components of the study adhere to the quality criteria of each tradition of the methods involved? |
| **Qualitative studies (JBI)** |
| 1 .Is there congruity between the stated philosophical perspective and the research methodology?<br>2 .Is there congruity between the research methodology and the research question or objectives?<br>3 .Is there congruity between the research methodology and the methods used to collect data?<br>4 .Is there congruity between the research methodology and the representation and analysis of data?<br>5. Is there congruity between the research methodology and the interpretation of results?<br>6 .Is there a statement locating the researcher culturally or theoretically?<br>7. Is the influence of the researcher on the research, and vice-versa, addressed?<br>8. Are participants, and their voices, adequately represented?<br>9. Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?<br>10. Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data? |
| **Economic evaluations (Drummond checklist)** |
| 1. Was a well-defined question posed in an answerable form?<br>2. Was a comprehensive description of the competing alternatives given?<br>3. Was the effectiveness of the programmes or services established?<br>4. Were all the important and relevant costs and consequences for each alternative identified?<br>5. Were cost and effects measured accurately in appropriate physical units (e.g., QALYs)?<br>6 .Were costs and effects valued credibly?<br>7. Were cost and effects adjusted for differential timing?<br>8. Was an incremental analysis of cost and effects of alternatives performed? |

9. Were allowances made for uncertainty in the estimates of cost and effects?
10. Did the presentation and discussion of study results include all issues of concern to users?

**Drummond checklist:** (Drummond M et al. Methods for the economic evaluation of health care programmes. Oxford: Oxford University Press, 2015). **JBI checklist:** Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Qualitative Research (JBI Manual for Evidence Synthesis. Appendix 2.1: https://wiki.joannabriggs.org/display/MANUAL/Appendix+2.1%3A+JBI+Critical+Appraisal+Checklist+for+Qualitative+Research). **MMAT:** Mixed Methods Appraisal Tool, version 18 (Hong QN, Pluye P, Fàbreques S, Bartlett G, Boardman F, Cargo M, Dagenais P, Gagnon M-P, Griffiths F, Nicolau B, O'Cathain A, Rousseau M-C, Vedel I. Mixed Methods Appraisal Tool (MMAT), version 2018. Registration of Copyright (#1148552, Canadian Intellectual Property Office, Industry Canada). **SIGN checklists:** Scottish Intercollegiate Guidelines Network checklists https://www.sign.ac.uk/checklists-and-notes

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# Rehabilitative management of back pain in children: Protocol for a mixed studies systematic review

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**Title:** Rehabilitative management of back pain in children: Protocol for a mixed studies systematic review

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## ABSTRACT

**Introduction:** Little is known about effective, efficient and acceptable management of back pain in children. A comprehensive and updated evidence synthesis can help to inform clinical practice.

**Objective:** To inform clinical practice, we aim to conduct a systematic review of the literature and synthesize the evidence regarding effective, cost-effective and safe rehabilitation interventions for children with back pain to improve their functioning and other health outcomes.

**Methods and analysis:** We will search MEDLINE, Embase, PsycINFO, CINAHL, the Index to Chiropractic Literature, the Cochrane Controlled Register of Trials, and EconLit for primary studies published from inception in all languages. We will include quantitative studies (randomized controlled trials, cohort and case-control studies), qualitative studies, mixed methods studies, and full economic evaluations. To augment our search of the bibliographic electronic databases, we will search reference lists of included studies and relevant systematic reviews, the WHO International Clinical Trials Registry Platform, and consult with content experts. We will assess risk of bias using appropriate critical appraisal tools. We will extract data about study and participant characteristics, intervention type and comparators, context and setting, outcomes, themes and methodological quality assessment. We will use a sequential approach at the review level to integrate data from the quantitative, qualitative and economic evidence syntheses.

**Ethics and dissemination:** Ethics approval is not required. We will disseminate findings through activities including: (1) presentations in national and international conferences; (2) meetings with national and international decision makers; (3) publications in peer-reviewed journals; and (4) posts on organizational websites and social media.

**Systematic review registration number:** PROSPERO CRD42019135009

**Key words:** systematic review, back pain, child, adolescent

## Article Summary

Strengths and limitations of this study

- A systematic review integrating quantitative, qualitative and economic evidence to examine the rehabilitative management of back pain in children.
- Includes studies with a broad range of rehabilitation interventions as described by the World Health Organization (WHO), and outcomes as described by the International Classification of Functioning, Disability and Health (ICF) framework.
- Implements the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols guidelines.
- There is no language restriction in articles.
- Our search strategies, while comprehensive, may miss relevant studies.

**Word count:** 4,973

## INTRODUCTION

### Rationale

A significant proportion of children over 10 years of age suffer from back pain.[1-5] The prevalence of back pain in children ranges between 4% and 74%; the wide range is due to heterogeneous populations studied, outcome measurements and methodologies used.[6 7] Data from the World Health Organization (WHO) Global Burden of Disease study in 2017 shows that low back pain is the leading cause of global years lived with disability.[8] Back pain begins early in life with physical, mental and social consequences (e.g., impact on school-related and sporting activities, general physical activity and well-being) that extend into adulthood.[9-11] Most episodes of spinal pain are brief; however, in a three-year prospective cohort study of 1,465 school children in Denmark, up to 25% of children had three or more episodes over one year, and approximately 13% of children reported episodes lasting five or more weeks.[12]

Two recent systematic reviews assessed the effectiveness of manual therapy to treat a number of conditions including back pain in children, but low-quality evidence precludes drawing conclusions.[13 14] A previous systematic review and meta-analysis which evaluated the effectiveness of conservative interventions for low back pain in children under 18 years of age reported that exercise interventions may be promising for improving pain scores in children compared to no treatment; however, the evidence was very limited and of low-quality.[15] This evidence also needs updating. Additionally, to our knowledge, no integrative systematic review – one that incorporates both quantitative and qualitative studies – has been conducted regarding the rehabilitative management of back pain in children. Compared to traditional systematic reviews of quantitative studies, combining evidence of the effectiveness and efficiency of interventions

with qualitative understanding from people's lived experiences can better inform clinical practice guidelines and policy.[16]

This comprehensive knowledge synthesis can inform clinical practice for decision makers involved with caring for children with back pain including healthcare professionals in a variety of clinical, rehabilitation or community settings (e.g., physicians, nurses, physiotherapists, chiropractors, psychologists, occupational therapists, registered massage therapists). Moreover, the knowledge gaps that we identify can inform future research agendas.

**Objectives**

To support clinical practice for children with back pain, we aim to conduct an integrative systematic review of quantitative, qualitative and economic evidence regarding the rehabilitative management of back pain (including mid-back and low back pain) in children aged 19 years and under. Our review will address the following questions:

1) What is the effectiveness and safety of rehabilitation interventions for improving functioning and other health outcomes in children with back pain?
2) What are the patients', caregivers' and providers' experiences, preferences, expectations and valued outcomes regarding rehabilitation interventions for back pain?
3) What is the cost-effectiveness of rehabilitation interventions for improving functioning and other health outcomes in children with back pain?
4) What can be hypothesized from the integration of the quantitative, qualitative and economic evidence about the effectiveness, cost-effectiveness and safety of rehabilitation interventions for low back pain in children?

We are targeting decision makers (clinicians, health managers/administrators, policy makers, patients, and caregivers) involved in implementing, delivering or receiving rehabilitation interventions or programs of care. We aim to provide them with knowledge regarding effective, acceptable and positively experienced interventions for children with back pain and their caregivers.

## METHODS

We developed this systematic review protocol using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Protocols (PRISMA-P)[17] (Additional file 1) and using methods already reported in detail elsewhere.[18] We registered our protocol on the International Prospective Register of Systematic Reviews (PROSPERO) (registration # CRD42019135009).[19] We will report our systematic review according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement,[20] and the Enhancing Transparency in Reporting the Synthesis of Qualitative Research (ENTREQ) reporting guideline.[21]

### Eligibility criteria

#### *Population*

We will target studies including children (aged 19 years or younger)[22] with non-specific low back or thoracic spine pain of any duration and severity. We define LBP as pain and discomfort below the costal margin and above the inferior gluteal folds, with or without radiculopathy (referred leg pain).[23] Radiculopathy refers to inflammation, injury/dysfunction, or compression of spinal nerve roots that can present as pain, weakness, or altered sensation in a myotomal or

dermatomal distribution. Lumbar radiculopathy is commonly attributed to lumbar disc herniation (localized displacement of disc material beyond the normal margins of the intervertebral disc space).[24] We define thoracic spine pain as pain within the region bounded superiorly by the first thoracic spinous process, inferiorly by the last thoracic spinous process, and laterally by the most lateral margins of the erector spinae muscles.[25] We will include studies investigating diagnoses including low back pain, mid-back pain, mechanical back pain, lumbago, lumbar sprain or strain, back sprain or strain, lumbopelvic pain, lumbar radiculopathy, lumbar disc herniation, sacroiliac syndrome, sciatica, dysplastic or isthmic spondylolisthesis or spondylolysis, musculoskeletal or non-specific chest wall pain (pain referred to the chest wall from the thoracic spine).

We will exclude studies of children with back pain attributed to major structural or systemic pathology (e.g., fracture, acute traumatic or pathological spondylolisthesis or spondylolysis, infection, tumour, osteoporosis, inflammatory arthritides, cauda equina syndrome, neuromuscular disease, myelopathy, and scoliosis); (2) studies of children with back pain attributed to a non-spine-related condition that might refer pain to the chest wall (e.g., heart, lung or esophagus conditions); and (3) studies that target asymptomatic children at baseline and assess interventions that aim to prevent the incidence of back pain.

***Intervention***

We will include studies that investigate the effectiveness and safety of rehabilitation interventions or programs of care for children with back pain, including education and self-management strategies, exercise, manual therapies, passive physical modalities, acupuncture, pharmacological interventions, psychological interventions, environmental modifications,

assistive devices, and complementary and alternative therapies (CAM). Interventions may be delivered in any manner such as in-person, or remotely using technology such as telehealth. The WHO defines rehabilitation as a set of interventions that assist individuals who experience, or are likely to experience, disability to achieve and maintain optimal functioning when interacting with their environments (as described in detail previously).[18 26] Rehabilitation interventions include rehabilitation medicine/therapy, which aims to: 1) improve function through the diagnosis and treatment of health conditions, reducing impairments, preventing or treating complications; and 2) restore and compensate loss of functioning, and prevent or slow deterioration in functioning in every area of a person's life.[26] It may also include assistive devices, which refers to any item, piece of equipment, or product used to increase, maintain, or improve functional capabilities.[26] Various healthcare providers may provide interventions including, but not limited to, general practitioners, nurses, physiotherapists, chiropractors, occupational therapists, psychologists, and registered massage therapists (Table 1).[18] We will exclude studies assessing surgical interventions, and interventions solely conducted at the societal level, such as barrier removal initiatives (e.g., fitting a ramp to a public building).

***Comparison***

The quantitative component of this review will consider comparisons including other interventions, placebo or sham interventions, wait list, standard care, and no intervention.

***Outcomes***

Our primary outcome of interest is a child's functioning. Secondary health outcomes of interest are pain (e.g., pain intensity, frequency, or duration), psychological outcomes (e.g., anxiety and

depression), health-related quality of life, adverse events, qualitative outcomes, and economic outcomes (Table 2). We are interested in both short-term (<3 months) and long-term (≥3 months) outcomes. We selected these outcomes because they are important to children, their caregivers and decision makers, and they are reflected in the WHO's framework for health and disability (International Classification of Functioning, Disability and Health [ICF]) (as described in detail previously).[18 27] The ICF provides a standard language and framework for the description of health and health-related states, and organizes information into two components – 'body functions and body structures' and 'activities and participation'.[27] Our primary outcome of interest, functioning, aligns with the 'activities and participation' component of the ICF. Examples of *activities* include walking, running, jumping and lifting. *Participation* refers to involvement in life situations such as with one's family, school and community. Common methods to measure ***functioning*** include the Modified Oswestry Low Back Pain Disability Questionnaire,[28] Roland Morris Disability Questionnaire (RMDQ),[29] return to school, and participation in sports or other recreational activities. Pain and psychological outcomes fit within the 'body functions and body structures' component of the ICF. Common methods to measure ***pain*** include the Visual Analogue Scale (VAS),[30] Numerical Rating Scale (NRS),[31] and Faces Pain Scale – Revised.[32 33] Common methods to measure ***psychological outcomes*** (e.g., anxiety and depression) include Revised Child Anxiety and Depression Scale,[34] and State-Trait Anxiety Inventory for Children.[35] We will also assess ***health-related quality of life***, which is not definable in the ICF framework.[36] It is commonly measured with the KIDSCREEN-52,[37] Pediatric Quality of Life Inventory,[38] and PROMIS Pediatric Self Report Scale.[39] We defined ***adverse events or harms*** as any unfavourable sign, symptom, or disease temporarily associated with the treatment, whether or not caused by the treatment.[40 41] We will consider indirect harms

(where the use of an intervention delays a diagnosis or treatment, and such delay holds a potential harm),[42] number of adverse events, severity of adverse events (i.e., mild, moderate or severe), and number of participant withdrawals from the study due to adverse events. ***Qualitative outcomes*** include the experiences, preferences, expectations, and valued outcomes (of children, caregivers, and providers). Lastly, ***economic outcomes*** include direct costs (e.g., resources saved by an intervention), indirect costs (e.g., time freed by an intervention), economic health outcomes (e.g., quality-adjusted life-year [QALY], incremental cost-effectiveness ratio [ICER], net monetary benefit [NMB]), and intangible outcomes (e.g., pain or suffering saved by an intervention).

***Types of studies***

We will include randomized controlled trials of any type (e.g., superiority, non-inferiority and equivalence), cohort studies, case-control studies, and mixed-methods studies (quantitative component) including any secondary analyses of eligible studies for question 1 (effectiveness and safety of interventions); qualitative and mixed-methods studies (qualitative component) for question 2 (users' experiences, preferences, expectations and valued outcomes of interventions); and trial- and model-based full economic evaluations for question 3 (cost-effectiveness of interventions) (Table 2).

We will exclude the following types of studies: cross-sectional studies, pilot studies assessing feasibility, protocol studies, case reports, case series, studies assessing only prevention of back pain and incidence outcomes, systematic reviews (although their reference lists will be searched for potentially relevant studies) and other review papers, clinical practice guidelines,

biomechanical studies, laboratory studies, cadaveric or animal studies, conceptual papers, letters, editorials, commentaries, books and book chapters, conference proceedings, meeting abstracts, lectures and addresses, consensus development statements, guideline statements, and studies reviewing solely partial economic evaluations (e.g., cost of illness studies).

***Context and setting***

We will consider rehabilitation interventions/programs of care delivered in any healthcare system within an urban or rural area and in any healthcare setting (e.g., acute care, hospital, primary health care, rehabilitation clinics), or in the community (as described in detail previously).[18] Community-based rehabilitation is implemented through the combined efforts of individuals with disabilities, their families and communities, and relevant government and non-government health, education, social and other services (e.g., advocacy programme).[43]

**Information sources**

We will develop the initial search strategy in MEDLINE, in consultation with an experienced health sciences librarian. A second experienced health sciences librarian will review the search strategy assessing its appropriateness and comprehensiveness using the Peer Review of Electronic Search Strategies (PRESS) Checklist.[44 45] We will conduct electronic searches of the following databases from database inception to the present: MEDLINE (Ovid), Embase (Ovid), PsycINFO (Ovid), CINAHL (Cumulative Index to Nursing and Allied Health Literature, EBSCO*host*), the Index to Chiropractic Literature (Chiropractic Library Collaboration), the Cochrane Controlled Register of Trials (Ovid), and EconLit (EBSCO*host*). We will augment our search of the bibliographic electronic databases to identify additional relevant studies, and

mitigate the potential impact of publication bias and selective outcome reporting bias.[46] We will search reference lists of included studies from the database searches and relevant systematic reviews; and we will consult with content experts. We will ask experts to suggest up to three targeted websites that may contain relevant studies and other potentially relevant studies not captured by our search strategy. Lastly, we will search the WHO International Clinical Trials Registry Platform (http://apps.who.int/trialsearch/). For studies only reported in the registry, we will contact first authors by email (with two reminders over one month) to obtain full study reports, or additional study or outcome data. We will include studies in any language and will use professional medical translation services where required. If 12 or more months elapse between the search date and submission for publication, we will update the search.

**Search strategy**

The searches will include a combination of subject headings specific to databases (e.g. MeSH in MEDLINE) and free text words to capture the key concepts of rehabilitative management of back pain in children (Additional file 2).

**Patient and public involvement**

Patients were not involved in the design of our study. However, we will seek patient and public consultation during the development of clinical practice guidelines, which will be the next phase of this project.

**Data management**

We will download the electronic search results into Endnote X9 reference manager software (Clarivate Analytics, PA, USA). We will remove duplicates and upload the remaining references to the Evidence for Policy and Practice Information and Coordinating (EPPI) Centre Reviewer software for the data extraction stages (EPPI-Reviewer version 4, UCL Institute of Education, University of London, UK). EPPI-Reviewer software stores references, manages and monitors the data extraction process and provides an audit trail for the review.[47]

**Screening for eligibility**

Using the inclusion and exclusion criteria, pairs of reviewers will independently screen titles and abstracts, and subsequently the full text of each selected article in order to confirm inclusion into the study (as described in detail previously).[18] Titles and abstracts will be classified as possibly relevant or irrelevant. Subsequently, full-text articles of abstracts classified as possibly relevant will be retrieved, reviewed and classified as relevant or irrelevant.

We will conduct training exercises prior to initiating the screening process to ensure reliability between reviewers. Reviewers will first screen a random sample of 50 records based on titles and abstracts. Paired reviewers must reach 90% agreement before completing title and abstract screening for the remaining studies.[48] If this threshold is not reached for all review teams, all team members will discuss differences in classification to clarify and potentially modify the eligibility criteria prior to completing title and abstract screening. Next, reviewers will screen a random sample of 25 full-text articles. All paired reviewers must again reach 90% agreement before completing full-text article screening for the remaining studies. If not, all team members will discuss to clarify eligibility criteria and resolve disagreements prior to completing full-text

article screening. Upon completing full-text article screening, paired reviewers will discuss disagreements and reach consensus related to the inclusion of any article, involving a third reviewer if necessary.

**Risk of bias in individual studies**

We will critically appraise studies according to study design using appropriate checklists (Additional file 3) (as described in detail previously).[18] We will assess the quality of studies using the Scottish Intercollegiate Guidelines Network (SIGN) criteria for randomized controlled trials (RCTs), cohort and case-control studies;[49] the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for qualitative studies;[50] the Mixed Methods Appraisal Tool (MMAT) for mixed methods studies;[51] and the Drummond checklist for economic evaluations.[52] The SIGN checklists allow reviewers to assess internal validity by considering the impact of selection bias, information bias, and confounding on study results. The JBI checklist allows reviewers to assess the possibility of bias in qualitative studies' design, conduct and analysis. The MMAT allows reviewers to assess the interdependent qualitative and quantitative components of the study and criteria to consider, such as justification for mixing evidence, and appropriate ways of integrating the data. The Drummond checklist allows reviewers to identify elements that demonstrate a sound economic evaluation such as the assessment of both costs and effects of interventions, accurate measurements of costs and effects, and allowances made for uncertainty in the estimates of costs and effects. We will contact the authors of papers to request missing or additional data for clarification where required. Paired reviewers will independently assess the eligible studies for quality. Any disagreements that arise between the reviewers will be resolved through discussion, or with a third reviewer. Since some of the reviewers have published within this area,

the review coordinator will ensure that reviewers will not be assigned their own studies for risk of bias assessment. Additionally, reviewers will recluse themselves from any discussion and decision-making that involves their paper. We will clearly describe this in our final systematic review report.

Using these established checklists and notes to guide our assessment, we will categorize the validity or credibility of each study as either high, low, or unclear risk of bias. We will not use a quantitative cut-off score to determine study quality and will not pre-define weights for the checklist items. Rather, we will make an overall quality judgement by considering the impact of selection bias, information bias and confounding on study results throughout the conduct of each study.[53] We will report detailed results of the critical appraisal in a narrative form and in a 'risk of bias' table. All studies, regardless of their methodological quality, will be extracted and synthesized (where possible). The overall methodological quality of relevant studies will be considered in the individual synthesis of quantitative, qualitative and economic data and the integration of these findings. The results of the risk of bias assessment will be used in a sensitivity analysis to ensure that studies judged to be at 'high risk of bias' do not affect the robustness of our results.

**Data items and data extraction process**

Paired reviewers will independently extract the data from all eligible studies. For the quantitative studies, we will extract data on the study and participant characteristics; intervention and comparator intervention characteristics using the Template for Intervention Description and Replication (TIDieR) checklist;[54] all pre-determined outcomes including multiple measures if

used; key findings; and methodological quality. The TIDieR checklist[54] consists of items to help readers better understand the interventions and how they were delivered (i.e., name of intervention, why, what (materials), what (procedure), who provided, how, where, when and how much, tailoring, modifications, how well (planned), how well (actual)).[54] We will use the PerSPecTIF question formulation framework to guide data extraction for the qualitative studies regarding the items: perspective, setting, phenomenon of interest, environment, timing, and findings (e.g., themes).[55] We will also extract data describing the qualitative approach used and methodological quality of studies. For both quantitative and qualitative studies, we will extract data on the ICF categories 'environmental factors' (contextual factors that make up the physical, social and attitudinal environment in which people live and conduct their lives) and 'personal factors' (internal contextual factors that influence how disability is experienced by the individual) to add context to the interventions and outcomes.[27] For the economic evaluations, we will use the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement[56] and extract data on the analytic approach (trial- or model-based), evaluation type, the analytic perspective, time horizon adopted for costs, main cost items, setting, key findings, and methodological quality of studies.

Paired reviewers will pretest the data extraction form and revise as needed. We will use EPPI-Reviewer software to manage the data extraction process. Any disagreements that arise between the reviewers will be resolved through discussion, or with a third reviewer. We will contact authors of papers to request missing or additional data, if required.

## DATA SYNTHESIS

We will use a sequential approach at the review level to synthesize and integrate the data (as described in detail previously).[57 18]This will involve separate quantitative, economic, and qualitative findings synthesis followed by integration of the resultant quantitative, economic, and qualitative evidence.

***Quantitative synthesis***

We will stratify studies to conduct separate comparisons according to study design, population, intervention, comparison, outcome, and methodological quality, and further conduct subgroup analyses within categories (Table 3). Specifically, we will stratify results to conduct separate comparisons between RCTs versus non-RCTs targeting, for example, children with acute low back pain without radiculopathy, treated with a specific intervention (e.g., manual therapy) compared to an active comparison, and assessed by the mean difference in functioning score (e.g., ODI score) at 3 months.

We will assess clinical, methodological, and statistical heterogeneity among studies (as described in detail previously).[18] Differences in populations, interventions, comparators, or outcomes across studies may result in clinical heterogeneity. Methodological and statistical heterogeneity may result from differences in risk of bias and differences in outcomes across studies beyond what could be expected by chance alone. We will assess the methodological heterogeneity across studies using our assessments from the SIGN checklist as either high, low, or unclear risk of bias. We will assess statistical heterogeneity using the $I^2$ statistic, whereby $I^2$ of <25-50% will be considered low to moderate (homogeneous), and ≥ 50% considered high (heterogeneous).[58] If two or more studies are clinically homogeneous (i.e., similar populations, interventions,

comparators and outcomes) and statistically homogeneous (i.e., $I^2$ <25-50%), we will perform a random effects meta-analysis using EPPI-Reviewer software using the relative risk (or odds ratio for rare events) effect measure for dichotomous data, mean differences for continuous data, hazard rate ratios for time-to-event data, and rates or rate ratios for count data. For studies that used multiple measures to assess the same outcome and at multiple time points, we will select the most prevalent measure and time point used across the studies to maximize comparability of the findings. We will attempt to summarize the results in a similar way if possible. We will contact study investigators to obtain the data if it is not reported. If the data are unavailable, we will summarize the data in three ways: by entering the means as continuous outcomes, the counts as dichotomous outcomes and by entering all of the data in text form as 'other data' outcomes.[59] We may also use statistical approaches to re-express odds ratios as standardized mean differences (and vice versa), allowing us to combine dichotomous and continuous data.[59] For our primary analysis, we will analyze the studies with low and unclear risk of bias. We will then explore the impact of methodological heterogeneity through sensitivity analysis by analyzing all studies together, including those with a high risk of bias, and comparing our primary analysis with our sensitivity analysis. If the results of the primary and sensitivity analyses differ, we will give precedence to the primary analysis because high risk of bias studies are known to be at risk of overestimating effect sizes.[60]

If the studies are heterogeneous (i.e., if there is clinical, methodological, and statistical heterogeneity), we will narratively summarize the characteristics and findings of all eligible studies according to the Synthesis Without Meta-analysis (SWiM) reporting guideline.[61] To quantify the effectiveness of interventions, we will use the data provided in the studies to

compute effect measures and 95% confidence intervals (i.e., odds ratio or relative risk for dichotomous outcomes, mean differences for continuous outcomes, hazard rate ratios for time-to-event outcomes, and rates or rate ratios for count outcomes).[62]

We will assess the potential impact of reporting biases on the results of our review or meta-analysis by attempting to identify study protocols through the trials registry (WHO International Clinical Trials Registry Platform http://apps.who.int/trialsearch/), and through the use of funnel plots. After studies are stratified (Table 3), outcomes that are reported in at least 10 studies will be assessed for publication bias by visually inspecting funnel plots for asymmetry.[63 64]

We will interpret the quality of the evidence for each outcome according to GRADE.[65] The quality of evidence ratings are *very low* (i.e., the true effect is probably markedly different from the estimated effect), *low* (i.e., the true effect might be markedly different from the estimated effect), *moderate* (i.e., the true effect is probably close to the estimated effect), and *high* (highly confident that the true effect is similar to the estimated effect). Assessment of the quality of the evidence is determined by considering the risk of bias, inconsistency, indirectness, imprecision and publication bias.. We will use established minimal clinically important differences (MCID) to determine the clinical importance of effect sizes when possible. Similar to any meta-analysis we may conduct, we will give precedence to the primary analysis consisting of studies with low and unclear risk of bias.

***Economic synthesis***

We will report the main findings of economic studies, first stratified by high, low or unclear risk of bias. We will further stratify findings by study design (i.e., cost-effectiveness, cost-utility, cost-benefit, or cost-consequences). We will then stratify findings by type of intervention, outcome, and cost measure.

To indicate whether an intervention might be judged favourably (or unfavourably) from an economic perspective,[66] we will use the Dominance Ranking Matrix (DRM) to classify the interventions into one of three options.[67] *Strong dominance* for the intervention will be selected when the incremental cost-effectiveness measure shows the intervention as: (i) more effective and less costly than the comparator; or (ii) effective and less costly; or (iii) equal cost and more effective. In this case, from an efficiency perspective, decision makers should favor the intervention over the comparator (in circumstances similar to those of the evaluations). *Weak dominance* for the intervention will be selected when the measure shows the interventions as: (i) equally costly and effective as the comparator; or (ii) more effective and more costly; or (iii) less effective and less costly. In this case, no conclusion may be drawn about whether the intervention is preferable from an efficiency perspective without further information on the priorities or preferences of decision makers in a particular context. Decision makers must determine whether the cost/benefit trade-offs are worth the implementing an intervention in their particular context. Lastly, *non-dominance* for the intervention will be selected when the measure shows the intervention as: (i) more costly and less effective; or (ii) equally as costly and less effective; or (iii) more costly and as effective. In this case the evidence we will interpret the evidence as suggesting the comparator is favourable from an efficiency perspective (in circumstances similar to those of the evaluations).

***Qualitative synthesis***

We will stratify the qualitative findings similarly to the quantitative and economic findings. We will first stratify the findings by risk of bias (i.e., high/low/unclear), then by study approach or design (e.g., qualitative descriptive, ethnography, grounded theory), and by intervention type and outcome.

Additionally, we will stratify findings according to individual perspective (i.e., patient (children), caregivers (parents/guardians), healthcare providers, community service providers, or others involved with the rehabilitation of back pain in children). We will use thematic synthesis to synthesize the qualitative research findings.[68 69] First, we will enter all the text labelled as 'results' or 'findings' of the primary studies verbatim into EPPI-Reviewer. Then, pairs of trained reviewers will independently code each line of text according to its meaning and content, and group codes hierarchically into descriptive themes, including the *a priori* themes (intervention type and outcomes). Reviewers will also generate themes *a posteriori* to answer our review question (i.e., experiences, preferences, expectations and valued outcomes regarding rehabilitation interventions for back pain in children). Reviewers will finalize the themes through discussion. We will give precedence to studies with low or unclear risk of bias.[70]

***Integration of quantitative, qualitative and economic evidence***

Various methods can be used to integrate diverse study types including: (1) juxtaposing findings in a matrix, (2) using logic models/conceptual framework, (3) analyzing program theory, (4) testing hypothesis derived using subgroup analysis, and (5) qualitative comparative analysis.[57]

We will integrate the evidence by juxtaposing findings in a matrix to generate hypotheses regarding the effectiveness, cost-effectiveness and safety of rehabilitation interventions for back pain in children. We selected this methodology because it is suitable for comparing and contrasting the findings across the individual quantitative, qualitative and economic evidence syntheses in our review.[57] The use of a matrix will allow us to explore heterogeneity in the findings of the quantitative studies and may indicate why some interventions may be effective, cost-effective and safe, and some may not.[57] For example, we may list themes from the qualitative synthesis along one side of the matrix, and then plot the interventions evaluated in the quantitative synthesis against the themes as either a match (when the intervention matched a theme) or a mismatch (when the intervention was the opposite of a theme) (as described in detail previously).[18] We will also plot the economic evaluation findings against the corresponding intervention and theme. We will identify gaps in knowledge if a particular theme for an intervention does not match with any of the interventions evaluated in the quantitative studies.

## ETHICS AND DISSEMINATION

Ethics approval is not required for this mixed studies review. Knowledge translation activities will include presentations to clinicians and researchers at national and international conferences; meetings with national and international decision makers (clinicians, health managers/administrators, policy makers and patients); publications in peer-reviewed journals; clinician and patient/caregiver resources; posts and lay language summaries on organizations' websites (open access) and other social media platforms.

## DISCUSSION

Findings from this mixed studies review will advance our knowledge of the effectiveness, safety, user experience, and cost-effectiveness of a wide range of rehabilitation interventions for children with back pain. This work will provide the evidentiary basis to develop clinical practice guidelines and care pathways outlining the evidence-based management of back pain in children, which can be adapted for specific settings (e.g., hospitals, rehabilitation clinics, and schools) and geographical regions. Specifically, decision makers should consider interventions that are identified as effective, safe, efficient, and positively experienced by patients and caregivers. Mapping findings to the ICF framework will allow decision makers to use standardized language in the assessment and management of children during their care program. This may further facilitate improvements in functioning and health outcomes in this patient population.

A potential limitation of our review is that our search strategy may miss potentially relevant studies, however, we have mitigated this by expanding our search strategy to include content experts and searching relevant websites. A potential risk is that there may be too little evidence available to answer our review questions.

Findings from this review will guide future research by identifying methodological limitations and knowledge gaps in the available literature. Future studies can be designed to address these limitations and gaps. This novel interpretation of quantitative, qualitative and economic evidence according to the ICF framework serves as a model for how outcomes related to functioning and health can be prioritized in future research.

## ADDITIONAL FILES

Additional file 1: PRISMA-P 2015 Checklist. Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) 2015 statement

Additional file 2: Literature search strategies

Additional file 3: Risk of bias assessment

## DECLARATIONS

**Ethics approval and consent to participate:** Not applicable

**Consent for publication:** Not applicable

**Availability of data and materials:** Not applicable

**Competing interests:** None declared.

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**Author contributions:**

All authors (CC, JJW, HY, SM, GB, HMS, DR, LH, EP, CC, MS, GC, LV, ATV, PC) assisted in designing and planning the study, developing the research questions and systematic review

methodology. CC and JJW drafted the manuscript. All authors reviewed and revised the manuscript, and approved the final manuscript.

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820 **Table 1: Examples of rehabilitation interventions**

| Intervention | Definition | Examples |
|---|---|---|
| Patient or caregiver education and self-management strategies (structured or unstructured) | Teaching patients skills that they can use to manage their health condition | • Learning disease-specific information<br>• Learning general managing skills (e.g., problem-solving, finding and using community resources, working with healthcare team)<br>• Learning strategies to increase confidence (i.e., self-efficacy) in ability to engage in behaviours that are needed to manage their condition on a daily basis<br>• Adequate peer role models and support networks that facilitate the initiation and maintenance of desired behavioural changes |
| Exercise | A subcategory of physical activity that is planned, structured, repetitive, and purposeful; can be supervised (e.g., by a healthcare professional) or unsupervised | • Stretching<br>• Strengthening<br>• Range of motion exercises<br>• Aerobic (e.g., swimming, cycling, walking, running)<br>• Anaerobic (e.g., jumping, sprinting, weight lifting)<br>• Yoga, Qigong |
| Manual therapies | - Manipulation: Techniques incorporating a high-velocity low-amplitude impulse or thrust applied at or near the end of a joint's passive range of motion<br>- Mobilization: Techniques incorporating a low-velocity and small or large amplitude oscillatory movement, within a joint's passive range of motion<br>- Traction: Manual or mechanically assisted application of an intermittent or continuous distractive force<br>- Soft tissue therapy: A mechanical form of therapy where soft-tissue structures are pressed and kneaded, using physical contact with the hand or mechanical device | • Lumbar manipulation, mobilization, or traction<br>• Massage<br>• Muscle energy technique<br>• Strain-counterstrain |
| Passive physical modalities | A form of cold, heat, or light application affecting the body at the skin level or ultrasonic | • Heat application: heat pack, hydrotherapy |

| | | |
|---|---|---|
| | or electromagnetic radiation affecting structures beneath the skin surface:<br>- Passive assistive devices: Device to encourage immobilization in anatomic positions or actively inhibit or prevent movement | • Cryotherapy: cold pack, vapocoolant spray<br>• Low-level laser<br>• Electrical muscle stimulation<br>• Pulsed electromagnetic therapy |
| Acupuncture | Any body-needling, moxibustion, electric acupuncture, laser acupuncture, microsystem acupuncture, and acupressure | • Traditional needling<br>• Dry needling<br>• Burning of specific herbs<br>• Electro-acupuncture<br>• Photo-acupuncture |
| Pharmacological interventions | A substance used in treating disease or relieving pain | • Acetaminophen<br>• Nonsteroidal anti-inflammatory drugs<br>• Muscle relaxants<br>• Antidepressants |
| Psychological interventions | Activities used to modify behaviour, emotional state, or feelings | • Cognitive behavioural therapy<br>• Counselling<br>• Social network and environment-based therapies<br>• Psychoeducational interventions<br>• Mindfulness meditation |
| Modifications to environment | | • Ergonomic interventions at school or work |
| Assistive devices | Any item, piece of equipment or product system, used to increase, maintain, or improve the functional capabilities of people with disabilities | • Walking aids<br>• Orthoses<br>• Braces<br>• Wheelchairs |
| Complementary and alternative therapies (CAM) | Medical products and practices that are not part of standard medical care | • Homeopathy<br>• Traditional Chinese Medicine<br>• Naturopathy<br>• Products (e.g., herbs, dietary supplements, probiotics) |

**Table 2. Research questions, outcomes and study types**

| Research Question | Outcomes | Study Types |
|---|---|---|
| What is the effectiveness and safety of rehabilitation interventions for improving functioning and other health outcomes in children with back pain? | *Primary:*<br>1. **Functioning**: e.g., Modified Oswestry Low Back Pain Disability Questionnaire, Roland Morris Disability Questionnaire, return to school, participation in sports/other recreational activities<br>*Secondary:*<br>2. **Pain** (including pain intensity, frequency, duration): e.g., VAS, NRS, Faces Pain Scale - Revised<br>3. **Psychological outcomes** (including anxiety and depression): e.g., Revised Child Anxiety and Depression Scale, State-Trait Anxiety Inventory for Children<br>4. **Health-related quality of life**: e.g., KIDSCREEN-52, Pediatric Quality of Life Inventory, PROMIS Pediatric Self Report Scale<br>5. **Adverse events**: any unfavorable sign, symptom, or disease temporarily associated with treatment, indirect harms (e.g., delayed diagnosis/treatment), number of adverse events, severity of adverse events (i.e., mild, moderate, severe), number of participant withdrawals from study due to adverse events. | Randomized controlled trials<br><br>Cohort studies<br><br>Case-control studies<br><br>Mixed methods studies (quantitative component) |
| What are the patients', caregivers' and providers' experiences, preferences, expectations and valued outcomes regarding rehabilitation interventions for back pain? | 6. **Qualitative outcomes**: experiences, preferences, expectations, valued outcomes | Qualitative studies (e.g., phenomenology, grounded theory, ethnography, action research, descriptive qualitative studies)<br><br>Mixed-methods studies (qualitative component) |
| What is the cost-effectiveness of rehabilitation interventions for improving functioning and other health outcomes in children with back pain? | 7. **Economic outcomes**:<br>Direct costs: resources consumed or saved by an intervention<br>Indirect costs: productivity gains or losses (e.g., time consumed or freed by the intervention)<br>Economic health outcomes: QALY, ICER, NMB | Full economic evaluations (trial- and model-based): cost-effectiveness, cost-utility, cost-benefit, cost-consequences |

| | | |
|---|---|---|
| | Intangible: e.g., pain or suffering saved or brought on by an intervention | |

ICER: incremental cost-effectiveness ratio; NMB: measure of net monetary benefit; NRS: Numerical Rating Scale; PROMIS: Patient-Reported Outcomes Measurement Information System; QALY: quality adjusted life years; VAS: Visual Analogue Scale

**Table 3. Categories to guide the analysis (meta-analysis or qualitative synthesis)**

| | |
|---|---|
| **Study Design** | ***Primary Synthesis:***<br>• *Design:* RCTs vs. Non-RCTs (i.e., cohort, case-control)<br>***Subgroup analysis:***<br>– *Specific RCT:* e.g., superiority, non-inferiority, or equivalence |
| **Population** | ***Primary Synthesis:***<br>• *Pain duration:* acute/subacute pain (i.e., <12 weeks' duration) vs. persistent pain (≥12 weeks' duration)<br>• *Age range:* infants (aged <1 year), children (aged 1-9 years), or adolescents (aged 10-19 years)<br>• *Type of back pain:* thoracic spine pain with/without radiculopathy, low back pain with/without radiculopathy, musculoskeletal chest wall pain, spondylolisthesis/spondylolysis<br>***Subgroup analysis:***<br>– *Pain severity:* mild, moderate, or severe |
| **Intervention** | ***Primary Synthesis:***<br>• *Intervention type:* education/self-management strategies, manual therapy, passive physical modalities, acupuncture, pharmacological intervention, psychological intervention, multimodal care, environmental modifications, assistive devices, complementary and alternative medicine (CAM)<br>***Subgroup analysis:***<br>– *Specific intervention type:* e.g., type of exercise (e.g., stretching vs. aerobic) and type of manual therapy (e.g., mobilization, manipulation, traction, soft tissue therapy) |
| **Comparison** | ***Primary Synthesis:***<br>• *Comparator type:* active (other intervention) vs. inactive (e.g., placebo/sham intervention, wait list, standard or usual care, or no intervention) |
| **Outcome** | ***Primary Synthesis:***<br>• *Outcome type:* functioning (e.g., ODI, RMDQ), pain (e.g., VAS, NRS), psychological (e.g., Revised Child Anxiety and Depression Scale), health-related quality of life (e.g., KIDSCREEN-52), or adverse events (e.g., number, severity)<br>• *Time of outcome assessment:* short- (<3 months) or long-term (≥ 3 months)<br>• *Type of effect estimate:** e.g., mean difference, relative risk, odds ratio, or hazard ratio |
| **Methodological Quality** | ***Primary Synthesis:***<br>*Methodological quality assessment:* low or unclear risk of bias<br>***Sensitivity analysis:*** low, unclear and high risk of bias |

*If data are unavailable to re-express effect estimates into a common effect estimate (if applicable)

**PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol***

| Section and topic | Item No | Checklist item | (Page No.#) |
|---|---|---|---|
| **ADMINISTRATIVE INFORMATION** | | | |
| Title: | | | |
| Identification | 1a | Identify the report as a protocol of a systematic review | 1 |
| Update | 1b | If the protocol is for an update of a previous systematic review, identify as such | N/A |
| Registration | 2 | If registered, provide the name of the registry (such as PROSPERO) and registration number | 4 |
| Authors: | | | |
| Contact | 3a | Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author | 1-2 |
| Contributions | 3b | Describe contributions of protocol authors and identify the guarantor of the review | 25 |
| Amendments | 4 | If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments | N/A |
| Support: | | | |
| Sources | 5a | Indicate sources of financial or other support for the review | 25 |
| Sponsor | 5b | Provide name for the review funder and/or sponsor | |
| Role of sponsor or funder | 5c | Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol | |
| **INTRODUCTION** | | | |
| Rationale | 6 | Describe the rationale for the review in the context of what is already known | 5-6 |
| Objectives | 7 | Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO) | 6 |
| **METHODS** | | | |
| Eligibility criteria | 8 | Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review | 7-11 |
| Information sources | 9 | Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage | 12-13 |
| 3Search strategy | 10 | Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated | Additional File 2 |

| | | | |
|---|---|---|---|
| Study records: | | | |
| Data management | 11a | Describe the mechanism(s) that will be used to manage records and data throughout the review | 13 |
| Selection process | 11b | State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis) | 14, 18-20 |
| Data collection process | 11c | Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators | 16-7 |
| Data items | 12 | List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications | 16-7 |
| Outcomes and prioritization | 13 | List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale | 9-11 |
| Risk of bias in individual studies | 14 | Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis | 15-6 |
| Data synthesis | 15a | Describe criteria under which study data will be quantitatively synthesised | 17-22 |
| | 15b | If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as $I^2$, Kendall's $\tau$) | |
| | 15c | Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression) | |
| | 15d | If quantitative synthesis is not appropriate, describe the type of summary planned | |
| Meta-bias(es) | 16 | Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies) | 15 |
| Confidence in cumulative evidence | 17 | Describe how the strength of the body of evidence will be assessed (such as GRADE) | 20 |

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

*From: Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart L, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. BMJ. 2015 Jan 2;349(jan02 1):g7647.*

**Additional file 2. Literatures search strategies**

**Ovid MEDLINE:** Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE® Daily and Ovid MEDLINE® 1946-Present

| | |
|---|---|
| 1 | exp Infant/ |
| 2 | Child, Preschool/ |
| 3 | Child/ |
| 4 | Adolescent/ |
| 5 | Pediatrics/ |
| 6 | (baby or babies).ab,ti. |
| 7 | "newborn*".ab,ti. |
| 8 | (infant or infants).ab,ti. |
| 9 | (child or children*).ab,ti. |
| 10 | (adolescent* or adolescence).ab,ti. |
| 11 | (teen or teens or teenager).ab,ti. |
| 12 | (pediatric* or paediatric*).ab,ti. |
| 13 | (young adj3 (person* or people)).ab,ti. |
| 14 | emerging adult*.ab,ti. |
| 15 | "youth*".ab,ti. |
| 16 | or/1-15 [**pediatric population] |
| 17 | exp Back Injuries/ |
| 18 | exp Back Pain/ |
| 19 | Coccyx/in [Injuries] |
| 20 | Intervertebral Disc Degeneration/ |
| 21 | Intervertebral Disc Displacement/ |
| 22 | Lumbar Vertebrae/in [Injuries] |
| 23 | Lumbosacral Region/in [Injuries] |
| 24 | Osteoarthritis, Spine/ |
| 25 | Piriformis Muscle Syndrome/ |
| 26 | Radiculopathy/ |
| 27 | Sciatica/ |
| 28 | Spinal Diseases/ |

| | |
|---|---|
| 29 | Spinal Stenosis/ |
| 30 | Thoracic Injuries/ |
| 31 | Thoracic Vertebrae/ |
| 32 | (back adj3 (ache* or injur* or pain*)).ab,ti. |
| 33 | (backache* adj3 (injur* or pain*)).ab,ti. |
| 34 | (back pain or back-pain).ab,ti. |
| 35 | (lumbar disc* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 36 | (lumbar disk* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 37 | "low* back pain".ab,ti. |
| 38 | (lumbar adj3 (pain or facet or nerve root* or osteoarthritis or radicul* or spinal stenosis or spondylo* or zygapophys*)).ab,ti. |
| 39 | "Piriformis syndrome*".ab,ti. |
| 40 | radiculopathy.ab,ti. |
| 41 | (sacral adj2 pain*).ab,ti. |
| 42 | ((spine or spinal) adj4 (condition* or disable* or disabilit* or disorder* or pain or stenos?s)).ab,ti. |
| 43 | spondylosis.ab,ti. |
| 44 | (thoracic adj4 (injur* or pain or spine or spinal)).ab,ti. |
| 45 | (T-spine or T-spinal).ab,ti. |
| 46 | or/17-45 [**back pain] |
| 47 | Acupressure/ |
| 48 | Acupuncture/ |
| 49 | exp Acupuncture Therapy/ |
| 50 | "Bedding and Linens"/ |
| 51 | Behavior Therapy/ |
| 52 | exp Biofeedback, Psychology/ |
| 53 | exp Cognitive Behavioral Therapy/ |
| 54 | Combined Modality Therapy/ |
| 55 | Community-Based Participatory Research/ |
| 56 | Community Health Services/ |
| 57 | Community Participation/ |
| 58 | Complementary Therapies/ |
| 59 | Cryotherapy/ |

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|---|---|
| 60 | exp Diathermy/ |
| 61 | exp Electric Stimulation Therapy/ |
| 62 | Electroacupuncture/ |
| 63 | Ergonomics/ |
| 64 | exp Exercise/ |
| 65 | exp Exercise Movement Techniques/ |
| 66 | exp Exercise Therapy/ |
| 67 | Fluid Therapy/ |
| 68 | High-Energy Shock Waves/tu [Therapeutic Use] |
| 69 | Immobilization/ |
| 70 | Hot Temperature/tu [Therapeutic Use] |
| 71 | exp Hydrotherapy/ |
| 72 | Laser Therapy, Low-Level/ |
| 73 | Low-Level Light Therapy/ |
| 74 | Magnetic Field Therapy/ |
| 75 | Magnetics/tu [Therapeutic Use] |
| 76 | Massage/ |
| 77 | exp Medicine, Chinese Traditional/ |
| 78 | exp Musculoskeletal Manipulations/ |
| 79 | Patient Education as Topic/ |
| 80 | Physical Therapy Modalities/ |
| 81 | Self Care/ |
| 82 | Self-Help Devices/ |
| 83 | Physical Fitness/ |
| 84 | Restraint, Physical/ |
| 85 | Transcutaneous Electric Nerve Stimulation/ |
| 86 | Vibration/tu [Therapeutic Use] |
| 87 | Wheelchairs/ |
| 88 | acupressure.ab,ti. |
| 89 | "acupunctur*".ab,ti. |
| 90 | (advice or advise or advised).ab,ti. |
| 91 | alexander technique.ab,ti. |

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|---|---|
| 92 | "assistive device*".ab,ti. |
| 93 | "back belt*".ab,ti. |
| 94 | "back school*".ab,ti. |
| 95 | (back adj2 work).ab,ti. |
| 96 | (braces or brace or bracing).ab,ti. |
| 97 | canes.ab,ti. |
| 98 | chiropract*.ab,ti. |
| 99 | "cognitive behavioral therap*".ab,ti. |
| 100 | "cognitive behavioural therap*".ab,ti. |
| 101 | (cold adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |
| 102 | "core stabili*".ab,ti. |
| 103 | (corset or corsets).ab,ti. |
| 104 | crutches.ab,ti. |
| 105 | cryotherap*.ab,ti. |
| 106 | "deep tissue therap*".ab,ti. |
| 107 | diathermy.ab,ti. |
| 108 | (electric* adj3 (stimulation or EMS or heating pad*)).ab,ti. |
| 109 | electro-acupuncture.ab,ti. |
| 110 | (electrogalvanic stimulation or EGS).ab,ti. |
| 111 | (electromagnet* and (radiation or therap*)).ab,ti. |
| 112 | electromodalit*.ab,ti. |
| 113 | electrotherapy.ab,ti. |
| 114 | (exercise or exercises or exercising).ab,ti. |
| 115 | (flexion-distraction or flexion distraction).ab,ti. |
| 116 | fluidotherap*.ab,ti. |
| 117 | galvanic stimulation.ab,ti. |
| 118 | (H-Wave Device Stimulation or HWDS).ab,ti. |
| 119 | ((heat* or hot) adj3 (therap* or pack* or compress or massage or lamp or pad or bath or soak or tub or bottle or superficial or therapeutic)).ab,ti. |
| 120 | (high energy shock wave* or high-energy shock wave* or HESW).ab,ti. |
| 121 | "hydrotherap*".ab,ti. |
| 122 | (ice adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |

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|---|---|
| 123 | "interferential current*".ab,ti. |
| 124 | infrared.ab,ti. |
| 125 | iontophoresis.ab,ti. |
| 126 | electroanalgesia.ab,ti. |
| 127 | ergonomic*.ab,ti. |
| 128 | kinesiotap*.ab,ti. |
| 129 | (laser* adj3 (phototherapy or irradiation or biostimulation or light or therap*)).ab,ti. |
| 130 | "low level laser*".ab,ti. |
| 131 | "lumbar support*".ab,ti. |
| 132 | (magnetic adj3 (necklace* or therap* or bracelet*)).ab,ti. |
| 133 | (manipulat* adj3 (therap* or treatment* or spinal or osteopath*)).ab,ti. |
| 134 | "manual therap*".ab,ti. |
| 135 | Microcurrent Electrical Neuromuscular Stimulation.ab,ti. |
| 136 | microwave*.ab,ti. |
| 137 | ((moblisation or mobilization) adj4 (osteopath* or orthopedic* or orthopaedic* or lumbar or spinal)).ab,ti. |
| 138 | "moist air bath*".ab,ti. |
| 139 | moxibustion.ab,ti. |
| 140 | ((multimodal* or multi-modal* or multi modal*) adj4 (treatment* or approach or care or therap* or procedure* or package* or manage*)).ab,ti. |
| 141 | muscle activation.ab,ti. |
| 142 | "muscle energy technique*".ab,ti. |
| 143 | myofascial release.ab,ti. |
| 144 | (Neuromuscular Electrical Stimulation or NMES).ab,ti. |
| 145 | orthotic*.ab,ti. |
| 146 | "passive modalit*".ab,ti. |
| 147 | (patient* adj3 (educat* or train*)).ab,ti. |
| 148 | "Percutaneous Electric* Nerve Stimulation".ab,ti. |
| 149 | (physical adj therap*).ab,ti. |
| 150 | physiotherap*.ab,ti. |
| 151 | photo-acupuncture.ab,ti. |
| 152 | pillow*.ab,ti. |
| 153 | pilates.ab,ti. |

154 (postur* adj3 (correct* or educat* or instruct* or train*)).ab,ti.

155 (pulsed adj3 (electromagnetic or magnetic or radio frequency or energy)).ab,ti.

156 radiant light.ab,ti.

157 Russian stimulation.ab,ti.

158 "seat adj cushion*".ab,ti.

159 (self-manage* or self manage*).ab,ti.

160 (short wave* or short-wave*).ab,ti.

161 ((shockwave* or shock wave* or shock-wave*) adj3 (ultrasonic or therap* or radiation)).ab,ti.

162 "soft tissue therap*".ab,ti.

163 "spray and stretch".ab,ti.

164 strain-counterstrain.ab,ti.

165 strengthen*.ab,ti.

166 stretching.ab,ti.

167 (tape or taping).ab,ti.

168 thoracolumbosacral orthosis.ab,ti.

169 traction.ab,ti.

170 traditional Chinese medicine.ab,ti.

171 (transcutaneous electrical stimulation or TENS).ab,ti.

172 ultrasound.ab,ti.

173 vapocoolant spray.ab,ti.

174 "vibration therap*".ab,ti.

175 walkers.ab,ti.

176 "walking adj3 aid*".ab,ti.

177 "warm compress*".ab,ti.

178 whirlpool*.ab,ti.

179 yoga.ab,ti.

180 or/47-179 [**interventions]

181 Case-Control Studies/

182 Cohort Studies/

183 Controlled Clinical Trials as Topic/

184 Epidemiologic Studies/

185 Epidemiology/

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|---|---|
| 186 | Follow-Up Studies/ |
| 187 | Longitudinal Studies/ |
| 188 | Prospective Studies/ |
| 189 | Retrospective Studies/ |
| 190 | Randomized Controlled Trials as Topic/ |
| 191 | ((case control or case-control) adj3 (stud* or design*)).ab,ti. |
| 192 | (cohort adj3 (stud* or design* or analysis)).ab,ti. |
| 193 | controlled clinical trial.pt. |
| 194 | "epidemiolog*".ab,ti. |
| 195 | ((followup or follow-up) adj3 (stud* or design* or analysis)).ab,ti. |
| 196 | (longitudinal* adj3 (stud* or design* or analysis)).ab,ti. |
| 197 | (prospective adj3 (stud* or design* or analysis)).ab,ti. |
| 198 | (random* and (control* or clinical or allocat*)).ab,ti. |
| 199 | randomized controlled trial.pt. |
| 200 | (retrospective adj3 (stud* or design*)).ab,ti. |
| 201 | or/181-200 [**study designs_effectiveness] |
| 202 | 16 and 46 and 180 and 201 |
| 203 | Anthropology, Cultural/ |
| 204 | Attitude/ |
| 205 | Awareness/ |
| 206 | Behavioral Research/ |
| 207 | Diary as Topic/ |
| 208 | Emotions/ |
| 209 | Ethnology/ |
| 210 | Ethnopsychology/ |
| 211 | Focus Groups/ |
| 212 | Grounded Theory/ |
| 213 | Interview, Psychological/ |
| 214 | Interviews as Topic/ |
| 215 | Mindfulness/ |
| 216 | Motivation/ |
| 217 | Narration/ |

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|---|---|
| 218 | Observation/ |
| 219 | Perception/ |
| 220 | Personal Narratives as Topic/ |
| 221 | Personal Satisfaction/ |
| 222 | Qualitative Research/ |
| 223 | Self Report/ |
| 224 | "Surveys and Questionnaires"/ |
| 225 | Tape Recording/ |
| 226 | Thinking/ |
| 227 | Video Recording/ or Videotape Recording/ |
| 228 | (attitude* or aware* or belief* or believe* or experience* or mindfulness or motivation or opinion* or perception* or perspective*).ab,ti. |
| 229 | ((audio adj record*) or audiorecord* or audiotap*).ab,ti. |
| 230 | ((behavioral or behavioural) adj2 research).ab,ti. |
| 231 | biographical method*.ab,ti. |
| 232 | (constant adj2 (comparative or comparison)).ab,ti. |
| 233 | ((content or conversation or discourse) adj2 analys*).ab,ti. |
| 234 | descriptive research.ab,ti. |
| 235 | (diary or diaries).ab,ti. |
| 236 | emotions.ab,ti. |
| 237 | ethnograph*.ab,ti. |
| 238 | ethnology.ab,ti. |
| 239 | ethnopsychology.ab,ti. |
| 240 | feelings.ab,ti. |
| 241 | (field adj2 (notes or research or study or studies)).ab,ti. |
| 242 | (focus adj2 group*).ab,ti. |
| 243 | framework analysis.ab,ti. |
| 244 | grounded theory.ab,ti. |
| 245 | interview*.ab,ti. |
| 246 | life world.ab,ti. |
| 247 | lived experience.ab,ti. |
| 248 | (meaning or meanings).ab,ti. |

| | |
|---|---|
| 249 | (narrative* or narration*).ab,ti. |
| 250 | (observe* or observation*).ab,ti. |
| 251 | (open adj ended).ab,ti. |
| 252 | phenomenology.ab,ti. |
| 253 | purposive sampl*.ab,ti. |
| 254 | qualitative.ab,ti. |
| 255 | questionnaire*.ab,ti. |
| 256 | (realist adj3 (review* or research or synthesis)).ab,ti. |
| 257 | satisfaction.ab,ti. |
| 258 | self report*.ab,ti. |
| 259 | semantic analysis.ab,ti. |
| 260 | standpoint*.ab,ti. |
| 261 | (story or stories).ab,ti. |
| 262 | survey*.ab,ti. |
| 263 | (theme* or thematic).ab,ti. |
| 264 | (theoretical adj2 (sampl* or saturation)).ab,ti. |
| 265 | (thoughts or thinking).ab,ti. |
| 266 | ((video adj record*) or videorecord* or videotap*).ab,ti. |
| 267 | or/203-266 [**experience/qualitative] |
| 268 | "Costs and Cost Analysis"/ |
| 269 | exp Cost-Benefit Analysis/ |
| 270 | Quality-Adjusted Life Years/ |
| 271 | Economics, Medical/ |
| 272 | (economic* adj4 (evaluat* or stud*)).ab,ti. |
| 273 | (health economic* adj4 (evaluat* or stud*)).ab,ti. |
| 274 | ((cost-utility or cost utility) adj4 (stud* or analys*)).ab,ti. |
| 275 | ((cost-benefit or cost benefit) adj4 (stud* or analys*)).ab,ti. |
| 276 | (CEA or CUA or CBA).ab,ti. |
| 277 | ((cost-effective* or cost effective*) adj4 (analys* or stud*)).ab,ti. |
| 278 | (economic* adj4 (impact or value or factor* or analys*)).ab,ti. |
| 279 | (cost* adj4 (health care or analys* or savings or hospital or medical or utilit* or effective* or efficac* or benefit* or consequence* or unit*)).ab,ti. |

| | |
|---|---|
| 280 | (decision adj1 (tree* or analy* or model*)).ab,ti. |
| 281 | economics.fs. |
| 282 | (qol or qoly or qolys or hrqol or qaly or qalys or qale or qales).ab,ti. |
| 283 | (sensitivity analys* or "willingness to pay" or quality-adjusted life year* or quality adjusted life year* or quality-adjusted life expectanc* or quality adjusted life expectanc*).ab,ti. |
| 284 | (markov* or monte carlo*).ab,ti. |
| 285 | or/268-284 [**cost effectiveness] |
| 286 | Delivery of Health Care/ |
| 287 | Delivery of Health Care, Integrated/ |
| 288 | Health Planning/ |
| 289 | Health Promotion/ |
| 290 | Health Services Administration/ |
| 291 | Integrative Medicine/ |
| 292 | Interprofessional Relations/ |
| 293 | Patient Care Management/ |
| 294 | (approach* adj3 (collaborative or complementary or comprehensive or innovative or integrated)).ab,ti. |
| 295 | barrier*.ab,ti. |
| 296 | facilitator*.ab,ti. |
| 297 | ((health care or healthcare or health-care) adj3 (clinic or clinics or delivery or implement* or intervention* or model* or plan* or process* or program*or services or strateg* or system* or team*)).ab,ti. |
| 298 | implement*.ab,ti. |
| 299 | (innovate* adj3 (intervention* or model* or plan* or process* or program*or strateg* or system*)).ab,ti. |
| 300 | (model* adj care).ab,ti. |
| 301 | ((integrated or interdisciplinary or interprofessional or multidisciplinary) adj3 (care or clinic or clinics or intervention* or model* or plan* or process* or program*or strateg* or system* or challenge* or benefit* or success* or constrain* or difficult* or enhanc* or influen* or interfer* or motivat* or obstruct* or problem* or promot* or restrain* or restrict* or disincentive* or factor* or capacity or enabler*)).ab,ti. |
| 302 | (pathway* adj3 (clinical or care)).ab,ti. |
| 303 | (program* adj3 (assess* or evaluat*)).ab,ti. |
| 304 | or/286-303 [**implementation] |
| 305 | 16 and 46 and 180 and (201 or 267 or 285 or 304) |
| 306 | 16 and 46 and 180 [**pediatric, back pain, interventions] |

**Embase** Classic+Embase 1947 to 2020

| | |
|---|---|
| 1 | newborn/ |
| 2 | infant/ or infancy/ or baby/ |
| 3 | childhood/ |
| 4 | child/ |
| 5 | adolescent/ or adolescence/ |
| 6 | juvenile/ |
| 7 | (baby or babies).ab,ti. |
| 8 | "newborn*".ab,ti. |
| 9 | (infant or infants).ab,ti. |
| 10 | (child or children*).ab,ti. |
| 11 | (adolescent* or adolescence).ab,ti. |
| 12 | (teen or teens or teenager).ab,ti. |
| 13 | (pediatric* or paediatric*).ab,ti. |
| 14 | (young adj3 (person* or people)).ab,ti. |
| 15 | emerging adult*.ab,ti. |
| 16 | "youth*".ab,ti. |
| 17 | or/1-16 [**pediatric population] |
| 18 | backache/ |
| 19 | low back pain/ |
| 20 | intervertebral disc degeneration/ |
| 21 | intervertebral disk hernia/ |
| 22 | lumbar vertebra/ |
| 23 | lumbosacral region/ |
| 24 | piriformis syndrome/ |
| 25 | radiculopathy/ |
| 26 | sciatica/ |
| 27 | spine disease/ |
| 28 | vertebral canal stenosis/ |
| 29 | spondylosis/ |
| 30 | (back adj3 (ache* or injur* or pain*)).ab,ti. |

| | |
|---|---|
| 31 | (backache* adj3 (injur* or pain*)).ab,ti. |
| 32 | (back pain or back-pain).ab,ti. |
| 33 | (lumbar disc* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 34 | (lumbar disk* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 35 | "low* back pain".ab,ti. |
| 36 | (lumbar adj3 (pain or facet or nerve root* or osteoarthritis or radicul* or spinal stenosis or spondylo* or zygapophys*)).ab,ti. |
| 37 | "Piriformis syndrome*".ab,ti. |
| 38 | radiculopathy.ab,ti. |
| 39 | (sacral adj2 pain*).ab,ti. |
| 40 | ((spine or spinal) adj4 (condition* or disable* or disabilit* or disorder* or pain or stenos?s)).ab,ti. |
| 41 | spondylosis.ab,ti. |
| 42 | (thoracic adj4 (injur* or pain or spine or spinal)).ab,ti. |
| 43 | (T-spine or T-spinal).ab,ti. |
| 44 | or/18-43 [**back injuries] |
| 45 | acupressure/ |
| 46 | acupuncture/ |
| 47 | behavior therapy/ |
| 48 | biofeedback/ |
| 49 | cognitive behavioral therapy/ |
| 50 | participatory research/ |
| 51 | community care/ |
| 52 | community participation/ |
| 53 | alternative medicine/ |
| 54 | cryotherapy/ |
| 55 | diathermy/ |
| 56 | electrostimulation therapy/ |
| 57 | electroacupuncture/ |
| 58 | ergonomics/ |
| 59 | exp exercise/ |
| 60 | exp kinesiotherapy/ |
| 61 | fitness/ |

| | |
|---|---|
| 62 | fluid therapy/ |
| 63 | shock wave/ |
| 64 | immobilization/ |
| 65 | heat/ |
| 66 | exp hydrotherapy/ |
| 67 | low level laser therapy/ |
| 68 | phototherapy/ |
| 69 | exp magnetism/ |
| 70 | magnetotherapy/ |
| 71 | massage/ |
| 72 | Chinese medicine/ |
| 73 | manipulative medicine/ |
| 74 | patient education/ |
| 75 | physiotherapy/ |
| 76 | self care/ |
| 77 | transcutaneous nerve stimulation/ |
| 78 | whole body vibration/ |
| 79 | acupressure.ab,ti. |
| 80 | "acupunctur*".ab,ti. |
| 81 | (advice or advise or advised).ab,ti. |
| 82 | alexander technique.ab,ti. |
| 83 | "assistive device*".ab,ti. |
| 84 | "back belt*".ab,ti. |
| 85 | "back school*".ab,ti. |
| 86 | (back adj2 work).ab,ti. |
| 87 | (braces or brace or bracing).ab,ti. |
| 88 | chiropract*.ab,ti. |
| 89 | "cognitive behavioral therap*".ab,ti. |
| 90 | "cognitive behavioural therap*".ab,ti. |
| 91 | (cold adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |
| 92 | "core stabili*".ab,ti. |
| 93 | (corset or corsets).ab,ti. |

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|---|---|
| 94 | crutches.ab,ti. |
| 95 | cryotherap*.ab,ti. |
| 96 | "deep tissue therap*".ab,ti. |
| 97 | diathermy.ab,ti. |
| 98 | (electric* adj3 (stimulation or EMS or heating pad*)).ab,ti. |
| 99 | electro-acupuncture.ab,ti. |
| 100 | (electrogalvanic stimulation or EGS).ab,ti. |
| 101 | (electromagnet* and (radiation or therap*)).ab,ti. |
| 102 | electromodalit*.ab,ti. |
| 103 | electrotherapy.ab,ti. |
| 104 | (exercise or exercises or exercising).ab,ti. |
| 105 | (flexion-distraction or flexion distraction).ab,ti. |
| 106 | fluidotherap*.ab,ti. |
| 107 | galvanic stimulation.ab,ti. |
| 108 | (H-Wave Device Stimulation or HWDS).ab,ti. |
| 109 | ((heat* or hot) adj3 (therap* or pack* or compress or massage or lamp or pad or bath or soak or tub or bottle or superficial or therapeutic)).ab,ti. |
| 110 | (high energy shock wave* or high-energy shock wave* or HESW).ab,ti. |
| 111 | "hydrotherap*".ab,ti. |
| 112 | (ice adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |
| 113 | "interferential current*".ab,ti. |
| 114 | infrared.ab,ti. |
| 115 | iontophoresis.ab,ti. |
| 116 | electroanalgesia.ab,ti. |
| 117 | ergonomic*.ab,ti. |
| 118 | kinesiotap*.ab,ti. |
| 119 | (laser* adj3 (phototherapy or irradiation or biostimulation or light or therap*)).ab,ti. |
| 120 | "low level laser*".ab,ti. |
| 121 | "lumbar support*".ab,ti. |
| 122 | (magnetic adj3 (necklace* or therap* or bracelet*)).ab,ti. |
| 123 | (manipulat* adj3 (therap* or treatment* or spinal or osteopath*)).ab,ti. |
| 124 | "manual therap*".ab,ti. |

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|---|---|
| 125 | Microcurrent Electrical Neuromuscular Stimulation.ab,ti. |
| 126 | microwave*.ab,ti. |
| 127 | ((moblisation or mobilization) adj4 (osteopath* or orthopedic* or orthopaedic* or lumbar or spinal)).ab,ti. |
| 128 | "moist air bath*".ab,ti. |
| 129 | moxibustion.ab,ti. |
| 130 | ((multimodal* or multi-modal* or multi modal*) adj4 (treatment* or approach or care or therap* or procedure* or package* or manage*)).ab,ti. |
| 131 | muscle activation.ab,ti. |
| 132 | "muscle energy technique*".ab,ti. |
| 133 | myofascial release.ab,ti. |
| 134 | (Neuromuscular Electrical Stimulation or NMES).ab,ti. |
| 135 | orthotic*.ab,ti. |
| 136 | "passive modalit*".ab,ti. |
| 137 | (patient* adj3 (educat* or train*)).ab,ti. |
| 138 | "Percutaneous Electric* Nerve Stimulation".ab,ti. |
| 139 | (physical adj therap*).ab,ti. |
| 140 | physiotherap*.ab,ti. |
| 141 | photo-acupuncture.ab,ti. |
| 142 | pillow*.ab,ti. |
| 143 | pilates.ab,ti. |
| 144 | (postur* adj3 (correct* or educat* or instruct* or train*)).ab,ti. |
| 145 | (pulsed adj3 (electromagnetic or magnetic or radio frequency or energy)).ab,ti. |
| 146 | radiant light.ab,ti. |
| 147 | Russian stimulation.ab,ti. |
| 148 | "seat adj cushion*".ab,ti. |
| 149 | (self-manage* or self manage*).ab,ti. |
| 150 | (short wave* or short-wave*).ab,ti. |
| 151 | ((shockwave* or shock wave* or shock-wave*) adj3 (ultrasonic or therap* or radiation)).ab,ti. |
| 152 | "soft tissue therap*".ab,ti. |
| 153 | "spray and stretch".ab,ti. |
| 154 | strain-counterstrain.ab,ti. |
| 155 | strengthen*.ab,ti. |

156 stretching.ab,ti.

157 (tape or taping).ab,ti.

158 thoracolumbosacral orthosis.ab,ti.

159 traction.ab,ti.

160 traditional Chinese medicine.ab,ti.

161 (transcutaneous electrical stimulation or TENS).ab,ti.

162 ultrasound.ab,ti.

163 vapocoolant spray.ab,ti.

164 "vibration therap*".ab,ti.

165 walkers.ab,ti.

166 "walking adj3 aid*".ab,ti.

167 "warm compress*".ab,ti.

168 whirlpool*.ab,ti.

169 yoga.ab,ti.

170 or/45-169 [**interventions]

171 case control study/

172 cohort analysis/

173 "controlled clinical trial (topic)"/

174 longitudinal study/

175 "randomized controlled trial (topic)"/

176 ((case control or case-control) adj3 (stud* or design*)).ab,ti.

177 (cohort adj3 (stud* or design* or analysis)).ab,ti.

178 "epidemiolog*".ab,ti.

179 ((followup or follow-up) adj3 (stud* or design* or analysis)).ab,ti.

180 (longitudinal* adj3 (stud* or design* or analysis)).ab,ti.

181 (prospective adj3 (stud* or design* or analysis)).ab,ti.

182 (random* and (control* or clinical or allocat* or trial*)).ab,ti.

183 (retrospective adj3 (stud* or design*)).ab,ti.

184 or/171-183 [**effectiveness]

185 attitude to health/

186 patient attitude/

187 awareness/

188 behavioral research/

189 writing/

190 emotion/

191 ethnology/

192 cultural psychology/

193 information processing/

194 grounded theory/

195 interview/

196 mindfulness/

197 motivation/

198 exp verbal communication/

199 observation/ or participant observation/

200 perception/

201 satisfaction/ or patient satisfaction/

202 qualitative research/

203 self report/

204 health survey/

205 questionnaire/

206 exp recording/

207 exp thinking/

208 (attitude* or aware* or belief* or believe* or experience* or mindfulness or motivation or opinion* or perception* or perspective*).ab,ti.

209 ((audio adj record*) or audiorecord* or audiotap*).ab,ti.

210 ((behavioral or behavioural) adj2 research).ab,ti.

211 biographical method*.ab,ti.

212 (constant adj2 (comparative or comparison)).ab,ti.

213 ((content or conversation or discourse) adj2 analys*).ab,ti.

214 descriptive research.ab,ti.

215 (diary or diaries).ab,ti.

216 emotions.ab,ti.

217 ethnograph*.ab,ti.

218 ethnology.ab,ti.

219 ethnopsychology.ab,ti.

220 feelings.ab,ti.

221 (field adj2 (notes or research or study or studies)).ab,ti.

222 (focus adj2 group*).ab,ti.

223 framework analysis.ab,ti.

224 grounded theory.ab,ti.

225 interview*.ab,ti.

226 life world.ab,ti.

227 lived experience.ab,ti.

228 (meaning or meanings).ab,ti.

229 (narrative* or narration*).ab,ti.

230 (observe* or observation*).ab,ti.

231 (open adj ended).ab,ti.

232 phenomenology.ab,ti.

233 purposive sampl*.ab,ti.

234 qualitative.ab,ti.

235 questionnaire*.ab,ti.

236 (realist adj3 (review* or research or synthesis)).ab,ti.

237 satisfaction.ab,ti.

238 self report*.ab,ti.

239 semantic analysis.ab,ti.

240 standpoint*.ab,ti.

241 (story or stories).ab,ti.

242 survey*.ab,ti.

243 (theme* or thematic).ab,ti.

244 (theoretical adj2 (sampl* or saturation)).ab,ti.

245 (thoughts or thinking).ab,ti.

246 ((video adj record*) or videorecord* or videotap*).ab,ti.

247 or/185-246 [**qualitative_experience]

248 "cost effectiveness analysis"/

249 "cost benefit analysis"/

250 quality adjusted life year/

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|---|---|
| 251 | health economics/ |
| 252 | (economic* adj4 (evaluat* or stud*)).ab,ti. |
| 253 | (health economic* adj4 (evaluat* or stud*)).ab,ti. |
| 254 | ((cost-utility or cost utility) adj4 (stud* or analys*)).ab,ti. |
| 255 | ((cost-benefit or cost benefit) adj4 (stud* or analys*)).ab,ti. |
| 256 | (CEA or CUA or CBA).ab,ti. |
| 257 | ((cost-effective* or cost effective*) adj4 (analys* or stud*)).ab,ti. |
| 258 | (economic* adj4 (impact or value or factor* or analys*)).ab,ti. |
| 259 | (cost* adj4 (health care or analys* or savings or hospital or medical or utilit* or effective* or efficac* or benefit* or consequence* or unit*)).ab,ti. |
| 260 | (decision adj1 (tree* or analy* or model*)).ab,ti. |
| 261 | economics.fs. |
| 262 | (qol or qoly or qolys or hrqol or qaly or qalys or qale or qales).ab,ti. |
| 263 | (sensitivity analys* or "willingness to pay" or quality-adjusted life year* or quality adjusted life year* or quality-adjusted life expectanc* or quality adjusted life expectanc*).ab,ti. |
| 264 | (markov* or monte carlo*).ab,ti. |
| 265 | or/248-264 [**cost effectiveness] |
| 266 | health care delivery/ |
| 267 | integrated health care system/ |
| 268 | health care planning/ |
| 269 | health promotion/ |
| 270 | health service/ |
| 271 | integrative medicine/ |
| 272 | case management/ |
| 273 | (approach* adj3 (collaborative or complementary or comprehensive or innovative or integrated)).ab,ti. |
| 274 | barrier*.ab,ti. |
| 275 | facilitator*.ab,ti. |
| 276 | ((health care or healthcare or health-care) adj3 (clinic or clinics or delivery or implement* or intervention* or model* or plan* or process* or program*or services or strateg* or system* or team*)).ab,ti. |
| 277 | implement*.ab,ti. |
| 278 | (innovate* adj3 (intervention* or model* or plan* or process* or program*or strateg* or system*)).ab,ti. |
| 279 | (model* adj care).ab,ti. |

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| 280 | ((integrated or interdisciplinary or interprofessional or multidisciplinary) adj3 (care or clinic or clinics or intervention* or model* or plan* or process* or program*or strateg* or system* or challenge* or benefit* or success* or constrain* or difficult* or enhanc* or influen* or interfer* or motivat* or obstruct* or problem* or promot* or restrain* or restrict* or disincentive* or factor* or capacity or enabler*)).ab,ti. |
| 281 | (pathway* adj3 (clinical or care)).ab,ti. |
| 282 | (program* adj3 (assess* or evaluat*)).ab,ti. |
| 283 | or/266-282 [**implementation] |
| 284 | 17 and 44 and 170 |
| 285 | 284 and (184 or 247 or 265 or 283) |
| 286 | limit 285 to (conference abstract or conference paper or "conference review" or editorial or letter) |
| 287 | 285 not 286 |

**PsycINFO** 1806

| | |
|---|---|
| 1 | (baby or babies).ab,ti. |
| 2 | "newborn*".ab,ti. |
| 3 | (infant or infants).ab,ti. |
| 4 | (child or children*).ab,ti. |
| 5 | (adolescent* or adolescence).ab,ti. |
| 6 | (teen or teens or teenager).ab,ti. |
| 7 | (pediatric* or paediatric*).ab,ti. |
| 8 | (young adj3 (person* or people)).ab,ti. |
| 9 | emerging adult*.ab,ti. |
| 10 | "youth*".ab,ti. |
| 11 | or/1-10 [**pediatric population] |
| 12 | exp Back Pain/ |
| 13 | Lumbar Spinal Cord/ |
| 14 | Spinal Cord Injuries/ |
| 15 | Spinal Column/ |
| 16 | (back adj3 (ache* or injur* or pain*)).ab,ti. |
| 17 | (backache* adj3 (injur* or pain*)).ab,ti. |
| 18 | (back pain or back-pain).ab,ti. |
| 19 | (lumbar disc* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 20 | (lumbar disk* adj3 (extruded or degenerat* or herniat* or prolapse* or sequestered or slipped)).ab,ti. |
| 21 | "low* back pain".ab,ti. |
| 22 | (lumbar adj3 (pain or facet or nerve root* or osteoarthritis or radicul* or spinal stenosis or spondylo* or zygapophys*)).ab,ti. |
| 23 | "Piriformis syndrome*".ab,ti. |
| 24 | radiculopathy.ab,ti. |
| 25 | (sacral adj2 pain*).ab,ti. |
| 26 | ((spine or spinal) adj4 (condition* or disable* or disabilit* or disorder* or pain or stenos?s)).ab,ti. |
| 27 | spondylosis.ab,ti. |
| 28 | (thoracic adj4 (injur* or pain or spine or spinal)).ab,ti. |
| 29 | (T-spine or T-spinal).ab,ti. |
| 30 | or/12-29 [**back injuries] |

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|---|---|
| 31 | Acupuncture/ |
| 32 | exp Behavior Therapy/ |
| 33 | exp Biofeedback/ |
| 34 | exp Cognitive Behavior Therapy/ |
| 35 | Alternative Medicine/ |
| 36 | Electrical Stimulation/ |
| 37 | Human Factors Engineering/ |
| 38 | exp Exercise/ |
| 39 | Movement Therapy/ |
| 40 | Shock Therapy/ |
| 41 | Heat/ |
| 42 | exp Hydrotherapy/ |
| 43 | Laser Irradiation/ |
| 44 | exp Magnetism/ |
| 45 | Massage/ |
| 46 | Client Education/ |
| 47 | Self-Care Skills/ |
| 48 | Physical Therapy/ |
| 49 | Self-Help Techniques/ |
| 50 | Physical Fitness/ |
| 51 | Vibration/ |
| 52 | acupressure.ab,ti. |
| 53 | "acupunctur*".ab,ti. |
| 54 | (advice or advise or advised).ab,ti. |
| 55 | alexander technique.ab,ti. |
| 56 | "assistive device*".ab,ti. |
| 57 | "back belt*".ab,ti. |
| 58 | "back school*".ab,ti. |
| 59 | (back adj2 work).ab,ti. |
| 60 | (braces or brace or bracing).ab,ti. |
| 61 | canes.ab,ti. |
| 62 | chiropract*.ab,ti. |

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| 63 | "cognitive behavioral therap*".ab,ti. |
| 64 | "cognitive behavioural therap*".ab,ti. |
| 65 | (cold adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |
| 66 | "core stabili*".ab,ti. |
| 67 | (corset or corsets).ab,ti. |
| 68 | crutches.ab,ti. |
| 69 | cryotherap*.ab,ti. |
| 70 | "deep tissue therap*".ab,ti. |
| 71 | diathermy.ab,ti. |
| 72 | (electric* adj3 (stimulation or EMS or heating pad*)).ab,ti. |
| 73 | electro-acupuncture.ab,ti. |
| 74 | (electrogalvanic stimulation or EGS).ab,ti. |
| 75 | (electromagnet* and (radiation or therap*)).ab,ti. |
| 76 | electromodalit*.ab,ti. |
| 77 | electrotherapy.ab,ti. |
| 78 | (exercise or exercises or exercising).ab,ti. |
| 79 | (flexion-distraction or flexion distraction).ab,ti. |
| 80 | fluidotherap*.ab,ti. |
| 81 | galvanic stimulation.ab,ti. |
| 82 | (H-Wave Device Stimulation or HWDS).ab,ti. |
| 83 | ((heat* or hot) adj3 (therap* or pack* or compress or massage or lamp or pad or bath or soak or tub or bottle or superficial or therapeutic)).ab,ti. |
| 84 | (high energy shock wave* or high-energy shock wave* or HESW).ab,ti. |
| 85 | "hydrotherap*".ab,ti. |
| 86 | (ice adj3 (therap* or pack* or compress or massage or immersion or soak or treatment or therap*)).ab,ti. |
| 87 | "interferential current*".ab,ti. |
| 88 | infrared.ab,ti. |
| 89 | iontophoresis.ab,ti. |
| 90 | electroanalgesia.ab,ti. |
| 91 | ergonomic*.ab,ti. |
| 92 | kinesiotap*.ab,ti. |
| 93 | (laser* adj3 (phototherapy or irradiation or biostimulation or light or therap*)).ab,ti. |

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| 94 | "low level laser*".ab,ti. |
| 95 | "lumbar support*".ab,ti. |
| 96 | (magnetic adj3 (necklace* or therap* or bracelet*)).ab,ti. |
| 97 | (manipulat* adj3 (therap* or treatment* or spinal or osteopath*)).ab,ti. |
| 98 | "manual therap*".ab,ti. |
| 99 | Microcurrent Electrical Neuromuscular Stimulation.ab,ti. |
| 100 | microwave*.ab,ti. |
| 101 | ((moblisation or mobilization) adj4 (osteopath* or orthopedic* or orthopaedic* or lumbar or spinal)).ab,ti. |
| 102 | "moist air bath*".ab,ti. |
| 103 | moxibustion.ab,ti. |
| 104 | ((multimodal* or multi-modal* or multi modal*) adj4 (treatment* or approach or care or therap* or procedure* or package* or manage*)).ab,ti. |
| 105 | muscle activation.ab,ti. |
| 106 | "muscle energy technique*".ab,ti. |
| 107 | myofascial release.ab,ti. |
| 108 | (Neuromuscular Electrical Stimulation or NMES).ab,ti. |
| 109 | orthotic*.ab,ti. |
| 110 | "passive modalit*".ab,ti. |
| 111 | (patient* adj3 (educat* or train*)).ab,ti. |
| 112 | "Percutaneous Electric* Nerve Stimulation".ab,ti. |
| 113 | (physical adj therap*).ab,ti. |
| 114 | physiotherap*.ab,ti. |
| 115 | photo-acupuncture.ab,ti. |
| 116 | pillow*.ab,ti. |
| 117 | pilates.ab,ti. |
| 118 | (postur* adj3 (correct* or educat* or instruct* or train*)).ab,ti. |
| 119 | (pulsed adj3 (electromagnetic or magnetic or radio frequency or energy)).ab,ti. |
| 120 | radiant light.ab,ti. |
| 121 | Russian stimulation.ab,ti. |
| 122 | "seat adj cushion*".ab,ti. |
| 123 | (self-manage* or self manage*).ab,ti. |
| 124 | (short wave* or short-wave*).ab,ti. |

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| 125 | ((shockwave* or shock wave* or shock-wave*) adj3 (ultrasonic or therap* or radiation)).ab,ti. |
| 126 | "soft tissue therap*".ab,ti. |
| 127 | "spray and stretch".ab,ti. |
| 128 | strain-counterstrain.ab,ti. |
| 129 | strengthen*.ab,ti. |
| 130 | stretching.ab,ti. |
| 131 | (tape or taping).ab,ti. |
| 132 | thoracolumbosacral orthosis.ab,ti. |
| 133 | traction.ab,ti. |
| 134 | traditional Chinese medicine.ab,ti. |
| 135 | (transcutaneous electrical stimulation or TENS).ab,ti. |
| 136 | ultrasound.ab,ti. |
| 137 | vapocoolant spray.ab,ti. |
| 138 | "vibration therap*".ab,ti. |
| 139 | walkers.ab,ti. |
| 140 | "walking adj3 aid*".ab,ti. |
| 141 | "warm compress*".ab,ti. |
| 142 | whirlpool*.ab,ti. |
| 143 | yoga.ab,ti. |
| 144 | or/31-143 [**interventions] |
| 145 | Cohort Analysis/ |
| 146 | Clinical Trials/ |
| 147 | Longitudinal Studies/ |
| 148 | exp Randomized Controlled Trials/ |
| 149 | ((case control or case-control) adj3 (stud* or design*)).ab,ti. |
| 150 | (cohort adj3 (stud* or design* or analysis)).ab,ti. |
| 151 | controlled clinical trial.pt. |
| 152 | "epidemiolog*".ab,ti. |
| 153 | ((followup or follow-up) adj3 (stud* or design* or analysis)).ab,ti. |
| 154 | (longitudinal* adj3 (stud* or design* or analysis)).ab,ti. |
| 155 | (prospective adj3 (stud* or design* or analysis)).ab,ti. |
| 156 | (random* and (control* or clinical or allocat*)).ab,ti. |

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| 157 | (retrospective adj3 (stud* or design*)).ab,ti. |
| 158 | or/145-157 [**effectiveness] |
| 159 | exp Attitudes/ |
| 160 | Awareness/ |
| 161 | Journal Writing/ |
| 162 | Emotions/ |
| 163 | Ethnology/ |
| 164 | Focus Group/ |
| 165 | Grounded Theory/ |
| 166 | Interviews/ |
| 167 | Mindfulness/ or Mindfulness-Based Interventions/ |
| 168 | Motivation/ |
| 169 | Narratives/ |
| 170 | exp Observation Methods/ |
| 171 | Perception/ |
| 172 | Preferences/ |
| 173 | Satisfaction/ |
| 174 | Qualitative Methods/ |
| 175 | Self-Report/ |
| 176 | Surveys/ or Questionnaires/ |
| 177 | exp Tape Recorders/ |
| 178 | Thinking/ |
| 179 | Digital Video/ |
| 180 | (attitude* or aware* or belief* or believe* or experience* or mindfulness or motivation or opinion* or perception* or perspective*).ab,ti. |
| 181 | ((audio adj record*) or audiorecord* or audiotap*).ab,ti. |
| 182 | ((behavioral or behavioural) adj2 research).ab,ti. |
| 183 | biographical method*.ab,ti. |
| 184 | (constant adj2 (comparative or comparison)).ab,ti. |
| 185 | ((content or conversation or discourse) adj2 analys*).ab,ti. |
| 186 | descriptive research.ab,ti. |
| 187 | (diary or diaries).ab,ti. |

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|---|---|
| 188 | emotions.ab,ti. |
| 189 | ethnograph*.ab,ti. |
| 190 | ethnology.ab,ti. |
| 191 | ethnopsychology.ab,ti. |
| 192 | feelings.ab,ti. |
| 193 | (field adj2 (notes or research or study or studies)).ab,ti. |
| 194 | (focus adj2 group*).ab,ti. |
| 195 | framework analysis.ab,ti. |
| 196 | grounded theory.ab,ti. |
| 197 | interview*.ab,ti. |
| 198 | life world.ab,ti. |
| 199 | lived experience.ab,ti. |
| 200 | (meaning or meanings).ab,ti. |
| 201 | (narrative* or narration*).ab,ti. |
| 202 | (observe* or observation*).ab,ti. |
| 203 | (open adj ended).ab,ti. |
| 204 | phenomenology.ab,ti. |
| 205 | purposive sampl*.ab,ti. |
| 206 | qualitative.ab,ti. |
| 207 | questionnaire*.ab,ti. |
| 208 | (realist adj3 (review* or research or synthesis)).ab,ti. |
| 209 | satisfaction.ab,ti. |
| 210 | self report*.ab,ti. |
| 211 | semantic analysis.ab,ti. |
| 212 | standpoint*.ab,ti. |
| 213 | (story or stories).ab,ti. |
| 214 | survey*.ab,ti. |
| 215 | (theme* or thematic).ab,ti. |
| 216 | (theoretical adj2 (sampl* or saturation)).ab,ti. |
| 217 | (thoughts or thinking).ab,ti. |
| 218 | ((video adj record*) or videorecord* or videotap*).ab,ti. |
| 219 | or/159-218 [** qualitative_experience] |

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|---|---|
| 220 | "Costs and Cost Analysis"/ |
| 221 | Health Care Costs/ |
| 222 | Quality of Life Measures/ |
| 223 | Health Care Economics/ |
| 224 | (economic* adj4 (evaluat* or stud*)).ab,ti. |
| 225 | (health economic* adj4 (evaluat* or stud*)).ab,ti. |
| 226 | ((cost-utility or cost utility) adj4 (stud* or analys*)).ab,ti. |
| 227 | ((cost-benefit or cost benefit) adj4 (stud* or analys*)).ab,ti. |
| 228 | (CEA or CUA or CBA).ab,ti. |
| 229 | ((cost-effective* or cost effective*) adj4 (analys* or stud*)).ab,ti. |
| 230 | (economic* adj4 (impact or value or factor* or analys*)).ab,ti. |
| 231 | (cost* adj4 (health care or analys* or savings or hospital or medical or utilit* or effective* or efficac* or benefit* or consequence* or unit*)).ab,ti. |
| 232 | (decision adj1 (tree* or analy* or model*)).ab,ti. |
| 233 | [economics.fs.] |
| 234 | (qol or qoly or qolys or hrqol or qaly or qalys or qale or qales).ab,ti. |
| 235 | (sensitivity analys* or "willingness to pay" or quality-adjusted life year* or quality adjusted life year* or quality-adjusted life expectanc* or quality adjusted life expectanc*).ab,ti. |
| 236 | (markov* or monte carlo*).ab,ti. |
| 237 | or/220-236 [**cost effectiveness] |
| 238 | Health Care Delivery/ |
| 239 | Health Care Administration/ |
| 240 | Health Promotion/ |
| 241 | Integrated Services/ |
| 242 | Interdisciplinary Treatment Approach/ |
| 243 | Case Management/ |
| 244 | (approach* adj3 (collaborative or complementary or comprehensive or innovative or integrated)).ab,ti. |
| 245 | barrier*.ab,ti. |
| 246 | facilitator*.ab,ti. |
| 247 | ((health care or healthcare or health-care) adj3 (clinic or clinics or delivery or implement* or intervention* or model* or plan* or process* or program*or services or strateg* or system* or team*)).ab,ti. |
| 248 | implement*.ab,ti. |

| | |
|---|---|
| 249 | (innovate* adj3 (intervention* or model* or plan* or process* or program*or strateg* or system*)).ab,ti. |
| 250 | (model* adj care).ab,ti. |
| 251 | ((integrated or interdisciplinary or interprofessional or multidisciplinary) adj3 (care or clinic or clinics or intervention* or model* or plan* or process* or program*or strateg* or system* or challenge* or benefit* or success* or constrain* or difficult* or enhanc* or influen* or interfer* or motivat* or obstruct* or problem* or promot* or restrain* or restrict* or disincentive* or factor* or capacity or enabler*)).ab,ti. |
| 252 | (pathway* adj3 (clinical or care)).ab,ti. |
| 253 | (program* adj3 (assess* or evaluat*)).ab,ti. |
| 254 | or/238-253 [**implementation] |
| 255 | 11 and 30 and 144 |
| 256 | limit 255 to (childhood <birth to 12 years> and (100 childhood <birth to age 12 yrs> or 120 neonatal <birth to age 1 mo> or 140 infancy <2 to 23 mo> or 160 preschool age <age 2 to 5 yrs> or 180 school age <age 6 to 12 yrs> or 200 adolescence <age 13 to 17 yrs>)) |
| 257 | 255 and (158 or 219 or 237 or 254) |
| 258 | limit 257 to (childhood <birth to 12 years> and (100 childhood <birth to age 12 yrs> or 120 neonatal <birth to age 1 mo> or 140 infancy <2 to 23 mo> or 160 preschool age <age 2 to 5 yrs> or 180 school age <age 6 to 12 yrs> or 200 adolescence <age 13 to 17 yrs>)) |

Additional file 3: Risk of bias assessment according to study design

| Quantitative studies (SIGN checklists) | | |
|---|---|---|
| **Randomized controlled trials** | **Cohort studies** | **Case-control studies** |
| 1. The study addresses an appropriate and clearly focused question. | 1. The study addresses an appropriate and clearly focused question. | 1. The study addresses an appropriate and clearly focused question. |
| 2 .The assignment of subjects to treatment groups is randomised. | 2. The two groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation. | 2. The cases and controls are taken from comparable populations. |
| 3. An adequate concealment method is used. | 3. The study indicates how many of the people asked to take part did so, in each of the groups being studied. | 3. The same exclusion criteria are used for both cases and controls. |
| 4. The design keeps subjects and investigators 'blind' about treatment allocation. | 4. The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis. | 4. What percentage of each group (cases and controls) participated in the study? |
| 5. The treatment and control groups are similar at the start of the trial. | 5. What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed. | 5. Comparison is made between participants and non-participants to establish their similarities or differences. |
| 6. The only difference between groups is the treatment under investigation. | 6. Comparison is made between full participants and those lost to follow up, by exposure status. | 6. Cases are clearly defined and differentiated from controls. |
| 7. All relevant outcomes are measured in a standard, valid and reliable way. | 7. The outcomes are clearly defined. | 7. It is clearly established that controls are non-cases |
| 8. What percentage of the individuals or clusters recruited into each treatment arm of the study dropped out before the study was completed? | 8. The assessment of outcome is made blind to exposure status. If the study is retrospective this may not be applicable. | 8. Measures will have been taken to prevent knowledge of primary exposure influencing case ascertainment |
| 9. All the subjects are analysed in the groups to which they were randomly allocated (often referred to as intention to treat analysis). | 9. Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome. | 9. Exposure status is measured in a standard, valid and reliable way |
| 10. Where the study is carried out at more than one site, results are comparable for all sites. | 10. The method of assessment of exposure is reliable. | 10. The main potential confounders are identified and taken into account in the design and analysis |
| | 11. Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable. | 11. Confidence intervals are provided |
| | 12. Exposure level or prognostic factor is assessed more than once. | |
| | 13. The main potential confounders are identified and taken into account in the design and analysis. | |

| | | |
|---|---|---|
| | 14. Have confidence intervals been provided? | |

## Mixed methods studies (MMAT)

**Qualitative:**
1. Is the qualitative approach appropriate to answer the research question?
2. Are the qualitative data collection methods adequate to address the research question?
3. Are the findings adequately derived from the data?
4. Is the interpretation of results sufficiently substantiated by data?
5. Is there coherence between qualitative data sources, collection, analysis and interpretation?

**Quantitative randomized controlled trials:**
1. Is randomization appropriately performed?
2. Are the groups comparable at baseline?
3. Are there complete outcome data?
4. Are outcome assessors blinded to the intervention provided?
5. Did the participants adhere to the assigned intervention?

**Quantitative non-randomized:**
1. Are the participants representative of the target population?
2. Are measurements appropriate regarding both the outcome and intervention (or exposure)?
3. Are there complete outcome data?
4. Are the confounders accounted for in the design and analysis?
5. During the study period, is the intervention administered (or exposure occurred) as intended?

**Quantitative descriptive**:
1. Is the sampling strategy relevant to address the research question?
2. Is the sample representative of the target population?
3. Are the measurements appropriate?
4. Is the risk of nonresponse bias low?
5. Is the statistical analysis appropriate to answer the research question?

**Mixed methods:**
1. Is there adequate rationale for using a mixed methods design to address the research question?
2. Are the different components of the study effectively integrated to answer the research question?
3. Are the outputs of the integration of qualitative and quantitative components adequately interpreted?
4. Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?
5 .Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?

## Qualitative studies (JBI)

1 .Is there congruity between the stated philosophical perspective and the research methodology?
2 .Is there congruity between the research methodology and the research question or objectives?
3 .Is there congruity between the research methodology and the methods used to collect data?
4 .Is there congruity between the research methodology and the representation and analysis of data?
5. Is there congruity between the research methodology and the interpretation of results?
6 .Is there a statement locating the researcher culturally or theoretically?
7. Is the influence of the researcher on the research, and vice-versa, addressed?
8. Are participants, and their voices, adequately represented?
9. Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?
10. Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?

## Economic evaluations (Drummond checklist)

1. Was a well-defined question posed in an answerable form?
2. Was a comprehensive description of the competing alternatives given?
3. Was the effectiveness of the programmes or services established?
4. Were all the important and relevant costs and consequences for each alternative identified?
5. Were cost and effects measured accurately in appropriate physical units (e.g., QALYs)?
6 .Were costs and effects valued credibly?
7. Were cost and effects adjusted for differential timing?
8. Was an incremental analysis of cost and effects of alternatives performed?

9. Were allowances made for uncertainty in the estimates of cost and effects?
10. Did the presentation and discussion of study results include all issues of concern to users?

**Drummond checklist:** (Drummond M et al. Methods for the economic evaluation of health care programmes. Oxford: Oxford University Press, 2015). **JBI checklist:** Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Qualitative Research (JBI Manual for Evidence Synthesis. Appendix 2.1: https://wiki.joannabriggs.org/display/MANUAL/Appendix+2.1%3A+JBI+Critical+Appraisal+Checklist+for+Qualitative+Research). **MMAT:** Mixed Methods Appraisal Tool, version 18 (Hong QN, Pluye P, Fàbreques S, Bartlett G, Boardman F, Cargo M, Dagenais P, Gagnon M-P, Griffiths F, Nicolau B, O'Cathain A, Rousseau M-C, Vedel I. Mixed Methods Appraisal Tool (MMAT), version 2018. Registration of Copyright (#1148552, Canadian Intellectual Property Office, Industry Canada). **SIGN checklists:** Scottish Intercollegiate Guidelines Network checklists https://www.sign.ac.uk/checklists-and-notes