FACET INJECTION STUDY

CONSENSUS CONFERENCE

Facet-joint injections for people with persistent non-specific low back pain (FIS)

27th June 2014

Scarman Conference Centre, University of Warwick

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Welcome

The Facet Injection Study team are delighted that you have agreed to join this consensus conference and would like to welcome you. Your expert contribution to the development of consensus is very important for the success of this research. This document introduces you to the research and the five key areas on which we seek consensus, in addition to the evidence we have collated to support the consensus process. We hope you will have the opportunity to read this document before the conference. You may find it helpful to start by reading the one page summaries of each section.

I will be facilitating the consensus conference. I am a Medical Sociologist with clinical experience in General Medical Practice and has facilitated similar consensus events. I am not a specialist in back pain or clinical trials. If you have any questions about the consensus process please feel free to contact me using the details below.

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2 Introduction

Low back pain is a common and costly disorder. Facet joints are paired structures between spinal vertebrae that allow flexion, and some rotation, of the spine. Facet joint disease can be a cause of low back pain. Although widely used, the available evidence does not support the use of facet joint injections as treatment for low back pain; National Institute for Health and Care Excellence (NICE) advised against their use in 2009. This consensus conference will inform the design of a randomised feasibility study to look at the effectiveness of adding facet joint injections to a 'best usual care' package of physiotherapy treatment developed specifically for this trial.

The study will be conducted in 2 phases.

Phase 1 is an exploratory phase involving systematic reviews and this consensus process, to develop and evaluate agreed criteria

- For identifying people with suspected facet joint pain
- To develop a protocol for the injection of facet joints in an agreed consistent manner
- To develop and evaluate a standardised control treatment deliverable in the NHS and congruent with NICE guidance ('best usual care')
- To develop and test systems for collecting short and long term pain outcomes, including measures required for economic evaluation.

The outcomes of the exploratory phase which affect the conduct of the proposed randomised pilot trial, phase 2, will be addressed via a substantial amendment to the protocol. The phase 2, randomised feasibility trial will run in four NHS Acute Trusts. Patients referred for treatment of low back pain present for at least six months, after failure of conservative treatment, will be considered as potential participants, with a total of 150 participants to be recruited. Participants eligible for the study whom provide written informed consent will be randomised to receive either facet joint injection with 'best usual care' package of physiotherapy treatment, or 'best usual care' package of physiotherapy treatment only. The injection is a mixture of a steroid and a local anaesthetic injected into up to six facet joints. Injections will be performed under X-ray control by a trained clinician. Participants will be included in the study for a period of 12 months. Short term effects on pain will be collected using text messaging (initially daily), paper diary also available, for up to three months, with postal questionnaire follow up at three, six and 12 months.

Previous trials of facet joint injections do not constitute a robust evidence base to inform decisions about the use of facet joint injections. The NIHR HTA Commissioning Board noted the need for such a trial as a high priority to the NHS. The Board called for proposals for a trial to test the use of facet joint injections as treatment for non-specific low back pain, i.e. lower back pain for which no serious medical cause (malignancy, infection, fracture) has been identified, with pain present for at least six months. The National Institute for Health Research Health Technology Assessment (NIHR HTA) Commissioning Board has funded two studies of which this is one. We will explore the feasibility of running a randomised controlled trial to test the hypothesis that, for people with suspected facet joint pain contributing to persistent non-specific low back pain, adding the option of facet joint injections, with local anaesthetic and corticosteroids, to best usual non-invasive care available from the NHS is clinically and cost-effective.

2.1 Aim of the consensus conference

The aim of this conference is to draw on evidence and expertise to reach a consensus on questions that will affect the details of trial design. The consensus results will be written up as a document for use by the trial team and for publication. The names of all those attending the consensus conference will be published with the consensus document. At the end of the consensus conference there will be an opportunity for individuals to write a signed statement detailing any disagreement and this will be published along with the consensus document.

3 NIHR HTA brief

Below is the text of the NIHR HTA brief for the commissioned projects.

1 Intervention / Technology: Facet-joint injections – applicants should indicate, and justify, the procedure to be used and what will be injected.

2 Patient group / Target group: Patients with back pain of at least six months duration that has not improved after treatment in accordance with NICE guidance: the treating clinician would now consider the use of facet joint injection. Applicants should define the patient group to be assessed for inclusion, and describe in detail criteria for entry into the trial (i.e. how will those with facet joint pain be identified).

3 Setting: Secondary care clinics (e.g. pain or orthopaedic), possibly also primary care

4 Control or comparator: (i) Usual care, as defined by NICE guidelines, (ii) sham facet joint injection (method of delivering the sham procedure to be investigated in the feasibility phase)

5 Study Design: A feasibility study to i) assess the ability to recruit both centres and patients, and to deliver the intervention; ii) develop a plausible sham procedure; iii) develop criteria for assessment for, and diagnosis of facet joint pain, iv) decide on most appropriate procedure for facet joint injection; v) develop a proposal for a definitive study. The definitive study should be a three arm trial comparing (i) facet joint injection with injection of active agents, (ii) sham facet joint injection, method of delivering the sham procedure to be investigated in the feasibility phase, and (iii) usual care in accordance with NICE guidance.

6 Important outcomes: Ability to recruit trial centres and patients; agreed sham and active intervention packages, ability to randomise patients; identification of possible subgroups for further investigation in a definitive trial; proposal and protocol for a definitive trial. Applicants should also indicate what outcomes they consider might be used for a definitive study (e.g. pain, mobility, quality of life) and how the feasibility study might further inform their choice.

Two studies were commissioned to assess the clinical- and cost-effectiveness of facet-joint injections in selected patients with non-specific low back pain. The competing project is comparing facet joint injections with local anaesthetic and steroid to a sham procedure in people with positive diagnostic test for facet joint disease. (Competing project reference link http://www.controlled-trials.com/ISRCTN12191542/12191542).

4 Five Key Questions: Reviewing the Evidence

The questions to be considered at this consensus conference are key to trial design and of vital importance for the production of robust evidence on facet joint injection. During the consensus conference we will be considering five questions. In sections 5 to 10 below we set out the evidence available to help us answer these questions. This evidence has been collected and analysed systematically as described in each section. During the consensus conference small groups will consider each of these five questions and reach a consensus using the Nominal Group Technique. In a plenary any discrepancies between the small groups will be discussed to achieve final consensus. This process will be explained at the start of the consensus conference.

For each question we have written a summary of what the evidence suggests and the implications for the study of the answer to the question. Following the summary we present details of the systematic review.

5 Identifying patients with suspected facet joint pain

5.1 Summary

<u>Question:</u> What is the best choice of clinical assessment to identify patients with suspected facet joint pain?

What the evidence suggests

The empirical evidence to date remains limited as to how best to clinically 'diagnose' lumbar facet joints as a source of pain in chronic low back pain patients. Whilst certain signs/symptoms or aggravating factors have been suggested to be indicative of facet joint pain, there use is generally not supported by the research evidence. The one technique/test that may offer some validity in terms of non-invasive diagnosis is a regular compression pattern when testing combined movements. However, the research to date is small scale and provisional.

Implication for the study

The ability to identify patients where the facet joints are a suspected source of pain is important as it is one of the entry criteria for enrolment in the study. Being able to accurately identify a relatively homogenous group of back pain patients with facet joint pain will allow a true evaluation of the potential benefits of facet joint injections.

5.2 Background

Between 5-15% of people with chronic low back pain (LBP) are believed to have disease of one or more facet or zygoapophyseal joints contributing to their pain yet there is considerable uncertainty on how to identify such people. We needed to evaluate and update the evidence-base for non-invasive assessment techniques available to indicate suspected facet joint pain.

Numerous non-invasive tests are available to clinicians to help 'diagnose' pain that may arise from the facet joints. Revel et al (1998)[1] considered facet joint pain to be typified by age >65, pain well relieved by recumbency and an absence of pain exacerbation by coughing, forward flexion, rising from flexion, hyper extension or extension–rotation. Conversely, Wilde et al (2007)[2], reporting expert consensus, advocated exacerbation of pain on extension, lateral side flexion or rotation to the ipsilateral side with including pain unilateral in nature, lacking radicular features, and reduction in local passive movement or stiffness at the suspected site.

A commonly used, well established physiotherapy testing procedure of 'combined movements' purports to load the facet joint.[3, 4] This procedure simply combines different spinal movements to produce either a regular or irregular compression pattern and may offer some utility in directing specific back pain treatment options.[5]

The most recent systematic review evaluating tests to identify the facet joint as a source of low back pain[6], identified no evidence to support any specific test. A subsequent update (to January 2012) identified no additional published evidence.

5.3 Methods

The review updated an existing systematic review and reports the evidence for non-invasive physical examination techniques available to indicate suspected facet joint pain.[6] The evidence synthesis comprises of two components;

1. Systematic review (SR) of the empirical, published evidence (2007 to present)
2. Narrative evidence synthesis from seminal texts of physical therapy

Questions:

1. What is the diagnostic validity/accuracy (sensitivity, specificity, positive predictive values and negative predictive values) of physical examination techniques/tests available to clinicians to identify the facet joint as the source of low back pain?

2. What are the common components utilised in a clinical examination for facet joint pain e.g. pain referral maps or patterns, palpation, observation of posture and range of motion testing?

Selection of studies

Criteria for inclusion of studies;

1. Population
   Participants had low back pain and no known or suspected serious pathology

2. Appropriate reference test
   An appropriate reference test based on those of the International Association for the Study of Pain, (intra-articular blocks or medial branch blocks)

3. Index test
   Evaluate at least one index test available to clinicians e.g. include pain referral patterns or pain maps, active range of motion, palpation (static and active), Passive Physiological Inter-vertebral Movements (PPIVM) and Passive Accessory Inter-vertebral Movements (PAIVM).

4. Diagnostic validity
   Studies should contain a 2x2 contingency table or data enabling the development of one must be present

The outcome of interest for the SR was pain or function with an appropriate reference e.g. intra-articular facet or medial branch blocks.

MEDLINE, EMBASE, CINAHL, Allied and Contemporary Medicine Database (AMED) and BIOSIS were searched in addition to the grey literature databases and citation tracking / hand searching as appropriate.

Search terms

Low back pain OR back pain OR lumbar vertebrae OR spine OR spinal diseases OR facet* OR facet joint* OR zygapophyseal joint* OR lumbar sacral pain. Intervention search terms included orthopaedic OR manual OR physical OR therapeutic exercise OR exercise therapy OR rehabilitation OR physiotherapy

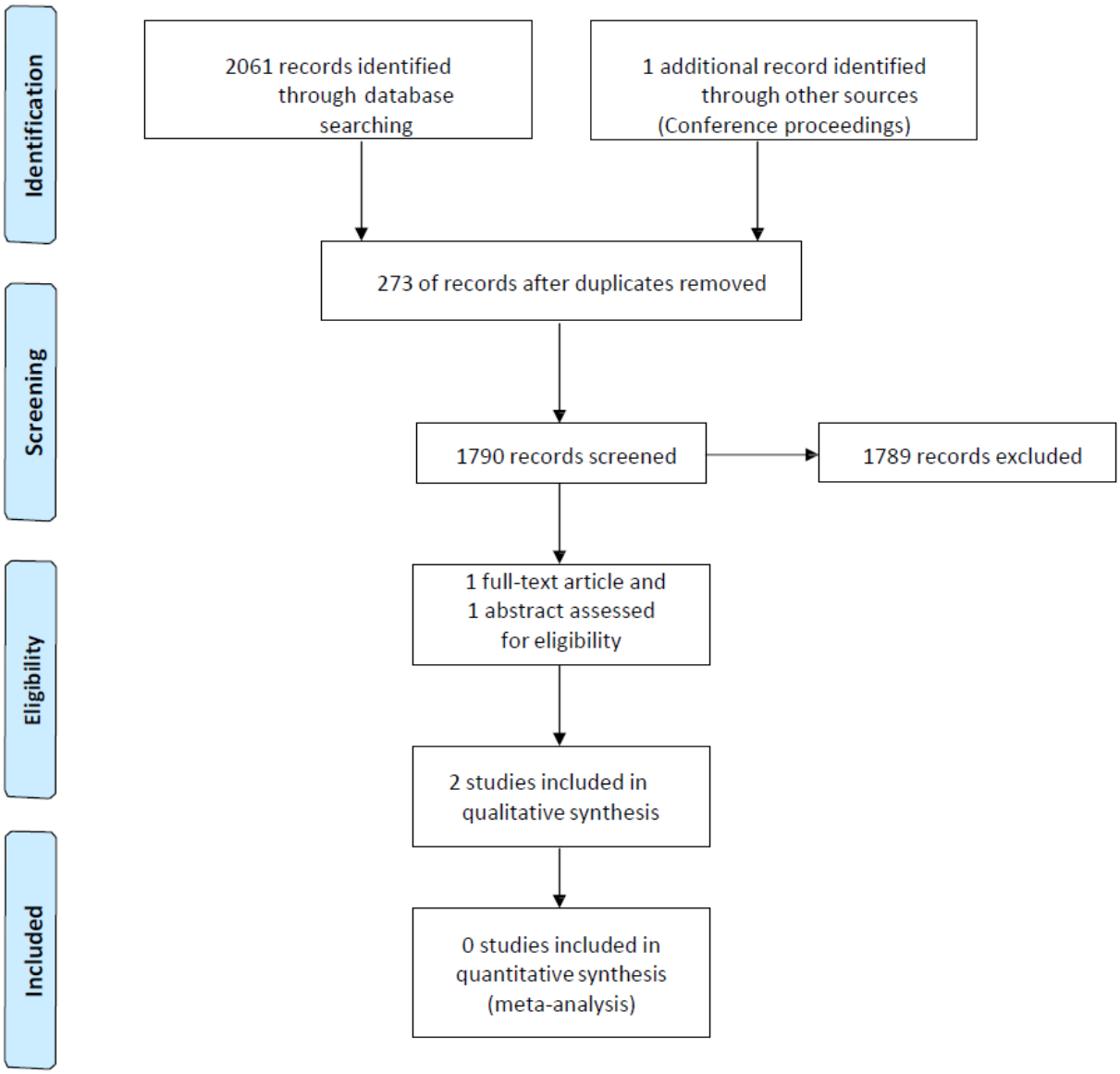
Exclusion or inclusion criteria

Pragmatically, all study types were considered initially then included or excluded in the first stage of selection. Full text article were reviewed and relevant quality assessment undertaken.

5.4 Results

Database searches identified 2061 hits; one of which was relevant to our question.[7] Further hand searching identified one abstract directly related to our question and the author was approached to share initial data with the FIS team and agreed. [8] Key themes from seminal texts in osteopathy and physiotherapy are summarised.

Review Process: Diagnosis



Reference	Setting	Study Population	Diagnostic test	Findings
Challinor, et al 2013[8]	Secondary care Patients undergoing diagnostic lumbar medial branch block (MBB)	N=96 (61 F: 35 M) Median age 63.5 yrs Median LBP 6 yrs (IQR 12)	Combined movement patterns Pain scores Effects of recumbence Effects of prolonged standing Health questionnaires (RMDQ, EQ5D, MYMOP) >50% reduction in VAS post injection was considered a successful response	Regular compression combined movement pattern demonstrated 80% sensitivity (95% CI 71% to 89%) and 50% specificity (28% to 71%) - 74% accurate prediction positive response to MBB Strong correlation between pre and post injection VAS scores (higher pain correlates to greater reduction in pain post MBB) Pain not relieved by flexion/recumbence with a regular compression pattern demonstrated greatest median reduction in post MBB VAS scores No association between MBB response and RMDQ EQ-5D MYMOP Duration of symptoms Standing as pain provoking activity
Wong & Johnson 2012[7]	N/A	Narrative review	Lower quadrant test of lumbar spinal joint motion. Extension with side-bending and rotation to the same side	Ipsilateral axial pain suggests facet joint compression
Physiotherapy texts	Segmental palpation examining relative hyper and hypomobility Passive Physiological Intervertebral Movements (PPIVMs) Passive accessory Intervertebral Movements (PAIVMs) Combined movements patterns Palpation of local tenderness with somatic referral pattern			
Seminal osteopathic texts	Emphasis on palpation Consideration of segmental and general spinal mechanics Palpation of tissue tension/texture Mobility restriction/'end feel' idea of 'low back strain' Palpation of local tenderness Emphasis on 'locking' defined as a 'blocking hypomobility' Emphasis on seated and standing examination based on Fryette spinal mechanics.			

6 Injection of facet joints

6.1 Summary

<u>Question:</u> What is the agreed technique for the injection of facet joints?

Any research project that investigates facet joint injection must define the technique for injection.

What the evidence suggests

Key educational/instructional texts for facet joint injection describe details of each author's technique. A broad methodology emerges that varies in detail within a narrow range of options.

Implications for the study

For this study we need to achieve a single, detailed process for therapeutic injection of lumbar facet joints that is acceptable to the professional community, and can be applied consistently across all participating study centres.

6.2 Background

While many have reported their individual techniques for the therapeutic injection of lumbar facet joints there is little consensus and no guidelines or recommendations for current best practice. The purpose of our review is to: Report the evidence on the techniques, practices and processes recommended and used in current clinical practice to administer fluoroscopically guided therapeutic facet joint injections to patients with facetogenic low back pain.

To help in identifying the important issues and to facilitate the process of seeking consensus, the study team deconstructed the procedure of injection into a number of key topics and these form the basis of the review.

The key topics and the rationale for their inclusion are shown below.

Topic	Rationale
1: Pre-injection consent/risk management procedures	To seek consensus on pre injection consent/risk management procedures.
2: Processes used to select the facet joint(s) to be injected	To seek consensus on the procedures used by clinicians to determine the appropriate facet joint(s) to be injected (location/level, single/multiple joints, unilateral/bilateral injections).
3: Identification and visualisation of the selected joints	To seek consensus on the procedures used by clinicians to ensure the accurate positioning of the needle in the joint cleft.
4: Positioning of patient	To seek consensus on the positioning of the patient to ensure optimal access to the lumbar facet joints.
5: Skin cleansing/sterilisation methods/materials	To seek consensus on the skin cleansing/sterilisation methods and materials used by clinicians, balancing sterilisation, contamination and neurotoxicity issues.
6: Administration of local anaesthetic/composition	To seek consensus on the methods and materials used by clinicians to numb the skin.
7: Gauge/type/length of needle	To seek consensus on the needle gauge, length and point type.
8: Method of approach to the joint	To seek consensus on the procedures used by clinicians in selecting the joint injection site (inferior or superior recess/pole).
9: Methods used to confirm intra-articular positioning of needle	To seek consensus on the procedures used by clinicians to confirm intra-articular positioning of needle (clinician feel, X-ray parallax, use of contrast medium).
10: Dose of radiation used to visualise the joint	To seek consensus on the dose of radiation used to visualise the joint while minimizing X-ray exposure.

11: Optimal type/configuration of X-ray machine/equipment etc.	To seek consensus on the optimal type/configuration of X-ray machine/equipment.
12: Injectate volume	To seek consensus on the injectate volume.
13: Injectate composition	To seek consensus on the composition of the injectate (local anaesthetic/steroid mix).
14: After care advice	To seek consensus on after care advice (in accordance with the current practise of the participating local institution).
15: Other	To seek consensus on other issues not included in other topics.

6.3 Methods

Search strategy: An extensive search of PubMed and EMBASE (January-March 2014) was conducted and a wide ranging search of key instructional texts was undertaken.
The search strategy consisted of the following.

Target condition search terms. (All title and abstract)

- Low back pain
- Back pain
- Spinal pain
- Spinal diseases
- Facet
- Facet joint
- Zygapophysial joint
- Lumbar sacral pain
- Facetogenic pain
- Spinal pain
- Facet syndrome
- Paravertebral facet pain

Intervention search terms. (All title and abstract)

- Intra-articular facet injection(s)
- Image guided injection(s)
- Interventional spinal procedure(s)
- Fluoroscopic/fluoroscopy
- Diagnostic
- Therapeutic
- Injection
- Percutaneous
- Spinal intervention
- Procedure

Publication type search terms. (All title and abstract)

- Conference
- Consensus development
- Clinico-pathological Congress
- Convention
- Guideline(s)
- Recommendation(s)
- Clinical
- Best Practice(s)

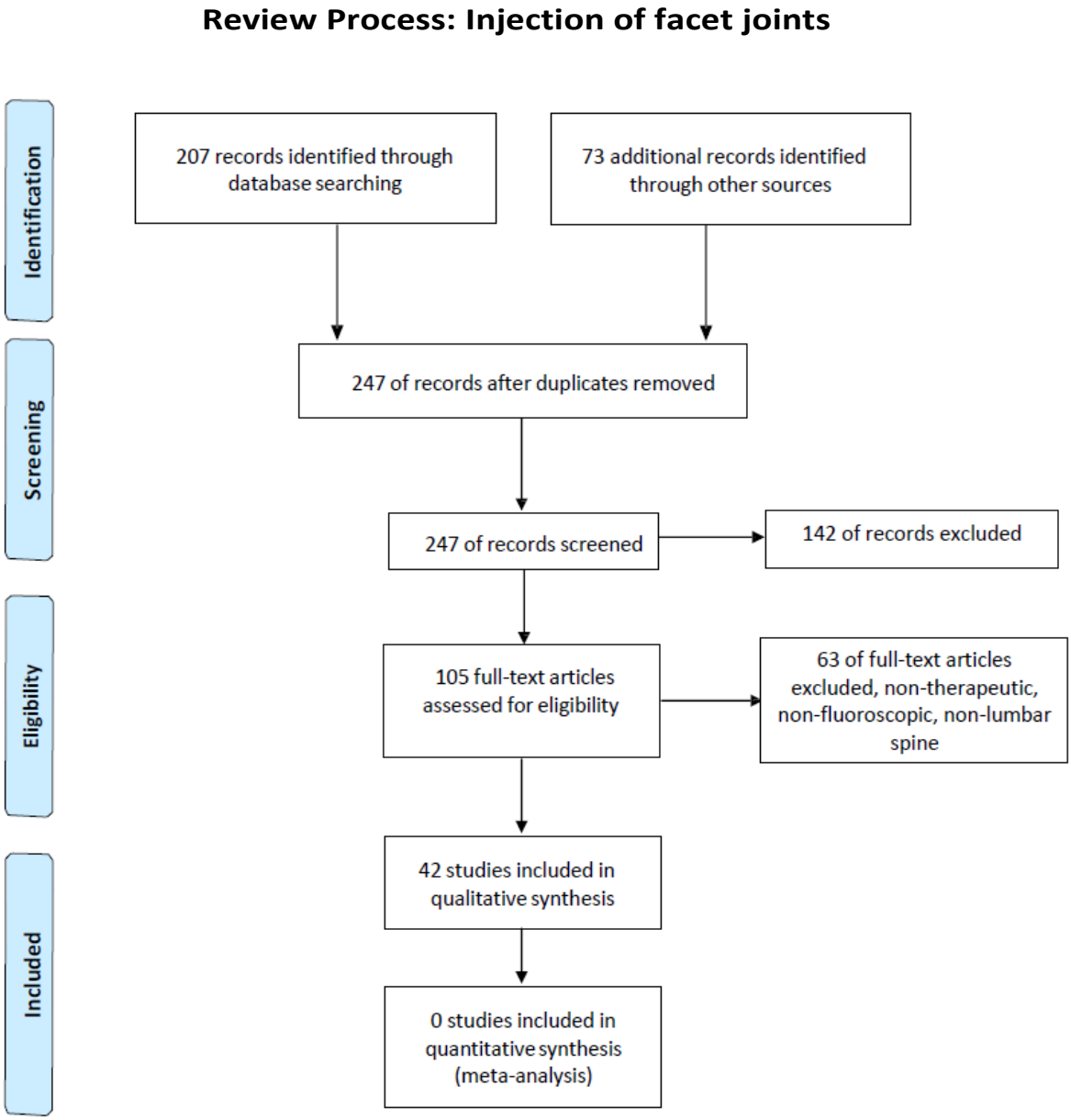
Inclusion criteria:

- Guidelines
- Recommendations
- Therapeutic
- Intra-articular injection
- Lumbar facet joint
- Flouroscopy

Exclusion criteria:

- Diagnostic
- Medial branch block
- Thoracic, cervical facet joint
- Peri-articular
- CT guided
- MRI guided

6.4 Results


Review Process: Injection of facet joints
Identification
Screening
Eligibility
Included
207 records identified through database searching
73 additional records identified through other sources
247 of records after duplicates removed
247 of records screened
142 of records excluded
105 full-text articles assessed for eligibility
63 of full-text articles excluded, non-therapeutic, non-fluoroscopic, non-lumbar spine
42 studies included in qualitative synthesis
0 studies included in quantitative synthesis (meta-analysis)

Topic 1: Pre-injection consent/risk management procedures		
Reference	Data	Comments*
Renfrew DL 2004[9]	Informed consent issues may be divided into 3 topics: description of the procedure/possible drug side effects/delineation of material risks. The patient to be given a precise description of the procedure, warnings about drug side effects and of material risks. Information about alternative procedures is also given. Patients should be warned that injections may recreate or exacerbate their pain. Local anaesthetic may cause numbness. A review of corticosteroid side effects (eg changes in mood/appetite/insomnia /sweating/hot flushes/rash/gastrointestinal upset).	
Deer TD 2004[10]	Contraindications: Absolute: Major hypersensitivity to anaesthetic solutions or glucocorticoids Local infection at site of proposed injection Active infections (glucocorticoids suppression of immunity). Contra indications to glucocorticoids. Informed consent should include awareness of possible: Temporary anaesthesia, regional or referred secondary to anaesthetic effect. Insomnia for ½ nights post procedure. Facial flushing/truncal rash. Low grade fever 1/3 days post procedure Heartburn, stomach pain, nausea for ½ days post procedure Mild to moderate headache secondary to glucocorticoid side effects.	
Dreyfuss PH et al 2003[11]	Contraindications to z-joint injection include bleeding diathesis, those on anticoagulants including antiplatelet agents, local or systemic infection or spinal malignancy. Z-joint injections should not be commonly employed in patients who have new neurological impairment of spinal origin as determined by dermatomal sensory loss, true muscle weakness and definite neural tension signs.	
Ackerman WE et al 2008[12]	The patients continued their medications previously prescribed for medical reasons such as diabetes, hypertension, asthma, etc. throughout this study. Opioids, nonsteroidal anti-inflammatory drugs, and muscle relaxants prescribed by referring physicians were discontinued 14 days before the injection.	

Schutz P et al 2011[13]	Patients fulfilling criteria underwent radiological imaging: all had standard X-rays of lumbar spine in 2 planes, 91.7% had MRI of lumbar spine and 8.3% a CT scan, also.	Refers to intraarticular facet joint block with local anaesthetic as a diagnostic tool to specify indication of lumbar spine surgery
Manchikanti L et al 2009 A	Complications: infection, intraarterial or intravenous injection, spinal anaesthesia, chemical meningitis, neural trauma, spinal cord injury, dural puncture, pneumothorax, radiation exposure, facet capsule rupture, haematoma formation, and steroid side effects.	
Peh WGC 2011[14]	The patient comes fasting for 6 to 8 hours prior to the procedure.	

*comments column in all the tables in section six contains items that the study team considered important to take into account when assessing the data.

Topic 2: Processes used to select the facet joint(s) to be injected		
Reference	Data	Comments
Deer TD 2004[10]	Facet levels to be injected should be correlated to patient completed pain drawings	
Shih C et al 2001[15]	The lumbar zygapophyseal joint was matched to the patient's subjective orientation of symptoms, according to the mapping of pain-referral patterns in symptomatic patients by Mooney and Robertson. Bilateral zygapophyseal joint injections were related to patient self-complaints of pain. If position was ambiguous, the 2 contiguous joints were injected. Plain X-ray films of the lumbar spine were reviewed to determine the exact lumbar level of injections, and to ensure there was no vertebral bone disease.	
Ackerman WE et al 2008[12]	MRI imaging and SPECT scans were used to identify facet joint pathology and positive lumbar facet.	
Destouet JM et al 1982[16]	Only one level injected per study to determine which joint were symptomatic Based primarily on clinical evidence, especially focal tenderness over joint(s).	
Rados I et al 2013[17]	If no localised signs are evident, recommended sites = L4-L5 and L5-S1 facet joints (ipsilateral for unilateral back pain or bilateral for bilateral pain)	
Schutz P et al 2011[13]	Segment which was clinically or radiogically most likely affected was chosen. And if indication not	Refers to intraarticular facet joint block

	possible, the statistically most affected segment L4/5 was tested. 3.3% injected at level L3/4, 46.7% at L4/5, 50% at L5/S1 Bilateral.	with local anaesthetic as a diagnostic tool to specify indication of lumbar spine surgery
Carette S et al 1991[18]	Unilateral/bilateral depending on pain on one/both sides of spine.	
Peh WGC 2011[14]	Pain drawings may be helpful in identifying the specific levels that are associated with the patient's complaints. The patient's medical and imaging records should be carefully reviewed, and the magnetic resonance (MR) images should be compared with radiographs.	

Topic 3: Identification and visualisation of the selected joints.		
Reference	Data	Comments
O'Connor T et al 2003[19]	C-arm fluoroscopy is positioned at an angle of about 30°, tilted towards the side of the joint to be injected and adjusted until the joint is well visualised. A radio-opaque object is positioned over the joint and the skin marked.	
Prithvi Raj P et al 2012[25]	Place the C-arm in a posteroanterior position. Identify the midpoint of the intervertebral space at the target level. Adjust the lower endplate of the target vertebral body to be aligned by moving the C-arm in cephalocaudal direction. Turn the C-arm in the oblique direction approximately 45° from L4-L5 and L5-S2 level, and 30° for upper levels until the facets become visible.	
Rathmell J 2006[26]	C-arm is rotated obliquely 25-35° from the sagittal plane and without caudal angulations.	This angle allows direct visualisation of the facet joint.
Waldman SD 2009[20]	Beam is rotated in a saggital plane from an anterior to posterior position, which allows identification and visualisation of the articular pillars of the respective vertebrae and the adjacent facet joints. Fluoroscopy beam is aimed directly through the introducer needle which is repositioned fluoroscopically until it points to the inferior aspect of the facet joint. Following bony contact, the spinal needle is withdrawn and introducer needle repositioned superiorly, aiming toward the facet joint. The spinal needle is then re-advanced through the introducer needle until it enters the target joint.	An 18-gauge, 1 inch needle serves as an introducer and the 25-gauge is inserted through it.

Schweizer ME 2007[27]	Oblique approach: C-arm is started in the posterior-anterior projection and centred onto the joint of interest. The X-ray tube is rotated towards the lateral direction until the first profile of articular margins is seen. Posterior approach: The X-ray tube is left in a vertical position centred over the level of interest in order to access the inferior recess just below the superior articular process.	The traditional 45° oblique position profiles the anterior aspect of the joint, but observation of the most posterior position of the joint is required to ensure correct targeting. Often the landmarks of the superior articular process are not well visualised.
Fenton DS et al 2003[21]	Beginning from straight AP- C arm is positioned obliquely 10-45° until posterior of facet joint appears 'open'	
Agorastides ID & Kumar N 2001[22]	C-arm is rotated until the facet joint space is first seen. This renders the beam parallel to the posterolateral part of the joint, which is accessible for direct puncture.	
El-Khoury GY et al 1991[23]	The posterior aspect of the joint is profiled fluoroscopically	
Carrera GF et al 1980[24]	Computer Tomography (CT) prior to facet block shows the lumbar facet joint and can provide additional information about facet orientation. When facet joints are relatively straight and lie almost entirely in an oblique plane, they will be seen best with the beam oriented in an oblique plan.	
Destouet JM et al 1982[16]	45° oblique radiograph of the lumbar spine: the anterior portion of the joint space is seen and the posterolateral portion of the joint is accessible to puncture from a posterior approach.	
Rados I et al 2013[17]	Beam is rotated obliquely 10° to 40° to get best image of joint space	
Carette S et al 1991[18]	Patient rotated in the oblique position until facet-joint space visualised	
Peh WGC 2011[14]	The upper lumbar spine may require obliquity of as little as 30°, while the lower lumbar spine may require obliquity of up to 60°.	

Topic 4: Positioning of patient		
Reference	Data	Comments
O'Connor T et al 2003[19]	Prone. Pillow under anterior superior iliac spine.	
Prithvi Raj P et al 2012[25]	Prone with a pillow under the abdomen.	
Rathmell J 2006[26]	Prone with the head turned to one side.	
Renfrew DL 2004[9]	Prone with a bolster under the abdomen to flex lumbar spine	
Waldman SD 2009[20]	Prone position. Pillows placed under the chest to allow the lumbar spine to be moderately flexed. Forehead allowed to rest on a folded blanket.	
Schweizer ME 2007[27]	Prone position with pillows or cushions underneath the abdomen.	This is thought to reduce lumbar lordosis and increase the size of the inferior recess.
Deer TD 2004[10]	Prone or slightly oblique from prone.	
Fenton DS et al 2003[21]	Prone.	
Agorastides ID & Kumar N 2001[22]	Prone on the fluoroscopy table, with a pillow under the abdomen.	
Shih C et al 2001[15]	Prone position with a pillow under the belly.	
El-Khoury GY et al 1991[23]	Most joints can be punctured with the patient either prone or in a shallow anterior oblique position, with the injected side up. The obliquity should be limited to ensure that the most posterior portion of the joint is the part in profile.	
Carrera GF et al 1980[24]	The patient is placed in the prone position. If the joint space cannot be seen, the patient is rotated into an oblique position with the affected side up until a joint space can be identified.	
Rados I et al 2013[17]	Prone with pillow under upper abdomen and legs slightly abducted. Positioned so that an oblique view of lumbar spine is obtained.	
Schutz P et al 2011[13]	Oblique prone position. Optimal obliqueness: • 30^{o} for upper lumbar facet joint • 60^{o} for lower facet joint	Refers to intraarticular facet joint block with local anaesthetic as a diagnostic tool to specify indication of lumbar spine surgery
Carette S et al 1991[18]	Prone	
Peh WGC 2011[14]	Prone pillow may be placed below the abdomen to generate kyphosis	

Topic 5: Skin cleansing/sterilisation methods/materials		
Reference	Data	Comments
O'Connor T et al 2003[19]	The lumbar midline and an area 10cm x 5cm laterally is cleaned with antiseptic solution.	
Prithvi Raj P et al 2012[25]	Area for needle entry is prepared in a sterile fashion.	
Waldman SD 2009[20]	Skin prepared with antiseptic solution	
Fenton DS et al 2003[21]	Providone-Iodine (Betadine) and alcohol scrub	
Agorastides ID & Kumar N 2001[22]	The overlying skin is prepared and the C-arm is rotated until the facet joint space is first seen.	
Shih C et al 2001[15]	Local aseptic and anaesthetic procedures	
Carrera GF et al 1980[24]	Sterile skin preparation was done and after that a fenestrated sterile drape was placed	
Bykowski JL et al. 2012[28]	Skin marked, prepped and draped in usual sterile fashion	

Topic 6: Administration of local anaesthetic/composition etc.		
Reference	Data	Comments
O'Connor T et al 2003[19]	A skin wheal with 1% lidocaine is raised	
Prithvi Raj P et al 2012[25]	1% lidocaine for skin infiltration	
Rathmell J 2006[26]	Skin and subcutaneous tissue overlying the facet joint are anesthetised with 1-2ml of 1% lidocaine.	
Deer TD 2004[10]	Lidocaine 1% plus buffer of 4.2% sodium bicarbonate (2:1 lidocaine/Buffer)	
Fenton DS et al 2003[21]	9.5ml 1% Lidicaine and .5ml 8.4% injectable sodium bicarbonate (1m EQ/ML)	
Agorastides ID & Kumar N 2001[22]	5–10 ml of 1% lignocaine is injected into the skin and subcutaneous tissue (local anaesthetic).	
Shih C et al 2001[15]	Local aseptic and anaesthetic procedures	
Ackerman WE et al 2008[12]	1mL of 1% lidocaine to anaesthetise the skin.	
Carrera GF et al 1980[24]	Local anaesthesia of the skin after cleaning it.	
Destouet JM et al 1982[16]	Skin and subcutaneous tissue infiltrated with 1% lidocaine	
Rados I et al 2013[17]	Infiltrated local anaesthetic into the skin and deeper tissue over the joint	
Schutz P et al 2011[13]	Local anaesthetic (and contrast medium) was avoided to avoid additional irritation.	Refers to intraarticular facet joint block with local anaesthetic as a diagnostic tool to specify indication of lumbar spine surgery

Bykowski JL et al 2012[28]	Skin and subcutaneous tissue anesthetised with lidocaine	
Carette S et al 1991[18]	Skin infiltrated with 1% lidocaine	
Peh WGC 2011[14]	1% Lignocaine is used for skin infiltration The local anaesthetic used here should be preservative- free, so as to prevent flocculation of the steroid.	

Topic 7: Gauge/type/length of needle		
Reference	Data	Comments
O'Connor T et al 2003[19]	25-gauge needle	Details of when each should be used and for what purpose was not found.
Prithvi Raj P et al 2012[25]	25-guage, 1.5 inch needle for skin infiltration	
Rathmell J 2006[26]	22-gauge spinal needle	
Renfrew DL 2004[9]	22-gauge spinal needle for most lumbar injections, 25-gauge for thoracic and cervical injections.	Selection of needle type varies with the operator.
Waldman SD 2009[20]	25-gauge, 2-3.5 inch spinal needle	An 18-gauge, 1 inch needle serves as an introducer and the 25-gauge is inserted through it.
Deer TD 2004[10]	25 gauge (preferred). 22 gauge (largest necessary) 3.5-5.0 inch most common but possibly 6-7inc 22 gauge in large patients.	
Fenton DS et al 2003[21]	22 gauge 3.5 inch Quinke point	
Agorastides ID & Kumar N 2001[22]	21-gauge spinal needle (31/2 or 5 inch)	
Shih C et al 2001[15]	23-gauge spinal needle	
El-Khoury et al 1991[23]	22-gauge spinal needle	
Ackerman WE et al 2008[12]	25-gauge 3.5.-inch spinal needle	
Carrera GF et al 1980[24]	20 gauge spinal needle	
Destouet JM et al 1982[16]	20- or 22-gauge, 3.5 inch spinal needle	
Schutz P et al 2011[13]	22-23-gauge needle, 3.5-5 inches	Refers to intraarticular facet joint block with local anaesthetic as a diagnostic tool to

		specify indication of lumbar spine surgery
Bykowski JL et al 2012[28]	22-gauge, 3.5 inch spinal needle	
Carette S et al 1991[18]	22-gauge, 3.5 inch spinal needle	
Peh WGC 2011[14]	23G spinal needle for entering the facet joint 18G needle for aspirating drugs 24G hypodermic needle for skin infiltration with lignocaine; The paper states: 'In thick patients, a longer spinal needle may be required. In some instances, even co-axial insertion of the spinal needle through an 18 or 20 G stiff metallic needle (with stillete) may be required'.	

Topic 8: Method of approach to the joint		
Reference	Data	Comments
O'Connor T et al 2003[19]	Spinal needle introduced in a vertical direction to the skin, until the needle is observed to enter the joint space.	
Prithvi Raj P et al 2012[25]	Advance the needle under fluoroscopic guidance toward the inferior aspect of the facet joint to pass the inferior subscapular recess.	
Rathmell J 2006[26]	Spinal needle is advanced in the axial plane overlying the facet joint with 25-35^{o} of oblique angulation from the sagittal plane.	
Renfrew DL 2004[9]	The needle is inserted along the course of the X-ray beam far enough so that it is anchored. Adjust and advance until the needle encounters bone, feels as if it has entered the joint, or demonstrates a curve in its distal aspect. Target the inferior aspect of the joint. Posterior approach. If an oblique approach, rather than a posterior approach, is used, it often works well to target the superior or inferior aspect of the joint.	
Waldman SD 2009[20]	Fluoroscopy beam is aimed directly through the introducer needle which is repositioned fluoroscopically until it points to the inferior aspect of the facet joint.	
Schweizer ME 2007[27]	Posterior approach: goal is to access the inferior recess The needle is placed straight down until the bone is encountered.	

	Passage into the joint though the capsule is often perceived as loss of resistance or as a “pop”.	
Deer TD 2004[10]	Postero- lateral approach.	
Fenton DS et al 2003[21]	Target = posterior recess , most easily entered using approach angle of 10-20^{o}from AP, but an angle of 30-45^{o} may be necessary dependent on anatomy/osteoarthritis.	
Agorastides ID & Kumar N 2001[22]	Using the needle tip as a marker, 5–10ml of 1% lignocaine is injected. The syringe is disengaged, leaving the needle to act as a guide. A spinal needle is introduced parallel and close to the hypodermic needle, aiming at the inferior recess of the joint, until a bony end point is reached. In case of difficulty, the superior recess of the joint is the second preferred site for needle insertion.	
Shih C et al 2001[15]	The zygapophyseal joint was approached posteriorly with a 23-gauge spinal needle under fluoroscope.	
El-Khoury GY et al 1991[23]	The needle is advanced vertically into the joint.	
Carrera GF et al 1980[24]	With the beam directed sagitally through the patient, or in a minimal oblique position, the most posterior portion is demonstrated and can be punctured from the back. The needle is advanced until posterior joint opening is contacted. A direct vertical puncture assures that the tip will enter the joint space.	
Destouet JM et al 1982[16]	Spinal needle is directed vertically into the joint space until bone or cartilage is reached.	
Carette S et al 1991[18]	Needle directed vertically into the joint space.	
Peh WGC 2011[14]	Lower pole of the inferior apophyseal process, as this is the expected location of the inferior recess of the facet joint. The inferior recess is preferentially targeted since it is located posteriorly, has no direct relation with neural elements, is relatively capacious and is easy to enter.	

Topic 9: Methods used to confirm intra-articular positioning of needle		
Reference	Data	Comments
O'Connor T et al 2003[19]	Confirmation of intra-articular placement is made by observation of the needle tip remaining on the joint line as the fluoroscope is rotated laterally. Correct placement is indicated by outlining the joint with 0.5ml of non-ionic radio-contrast medium.	
Prithvi Raj P et al 2012[25]	0.2ml contrast material e.g. iohexol. Move the C-arm laterally to reconfirm the depth of the needle.	
Rathmell J 2006[26]	Placing contrast in the joint limits the ability to place local anaesthetic and steroid within the joint. Nonetheless, intra-articular injection of contrast is commonly carried out at the lumbar level.	
Renfrew DL 2004[9]	Visualise the joint with an ipsilateral oblique view to determine if the needle is in the inferior aspect of the joint. 0.1-0.3 ml non-ionic contrast material.	Any extra-articular contrast material injected will quickly obscure the joint margins and prevent completion of the procedure. If the contrast pattern suggests that the injection is intrathecal, it best to stop the procedure as the anaesthetic agent may result in spinal block and steroid may result in arachnoiditis.
Waldman SD 2009[20]	Biplanar fluoroscopy and 1ml contrast medium.	
Schweizer ME 2007[27]	Small amount (0.5 cc) of contrast material.	
Deer TD 2004[10]	Needle insertion is performed with gentle, small incremental advances observing fluoroscopically intermittently.	Possible to use non-ionic water-soluble iodinated contrast agents eg. Iopamidol and Iohexol 180-240mgl/ml
Fenton DS et al 2003[21]	Flouroscope rotated until facet joint appears 'open' (optimal needle trajectory) The 22 guage needle is advanced through the facet joint capsule. 'A release in the needle advancement is usually 'felt' by the operator when the joint capsule has been penetrated.	

Agorastides ID & Kumar N 2001[22]	2 ml of 0.5% Bupivacaine is injected for diagnostic purposes or 1 ml of 0.5% Bupivacaine and 1 ml of Triamcinolone for therapeutic purposes.	
Shih C et al 2001[15]	A test dose of iopamidol (Iopamiro® 370, Bracco, Italy) was injected to confirm intra-articular needle localization.	
Dreyfuss PH et al 2003[11]	Once joint entry is perceived during intra-articular blocks, a small amount (0.2 to 0.3 ml) of contrast medium should be instilled to ensure intra-articular spread.	
El-Khoury et al 1991[23]	Position of the needle is checked by injecting 0.5-1 .0 ml of non-ionic contrast material	
Ackerman WE et al 2008[12]	Each patient received 0.1 ml of radiopaque contrast (isohexol 300) before the local anesthetic steroid injection to confirm correct needle tip placement. Each injection was done using fluoroscopic needle tip guidance.	
Carrera GF et al 1980[24]	The needle is advanced until posterior joint opening is contacted. A direct vertical puncture assures that the tip will enter the joint space. The correct position is confirmed by injecting 0.5 – 1 ml of methylglucamine diatrizoate (Renografin-60, Squibb).	
Destouet JM et al 1982[16]	Needle tip will move with the facet joint when patient is turned into a steep oblique position. 0.5-1.5 ml of contrast material (Conray-60 [iothalamate maglumine])	
Rados I et al 2013[17]	0.3 ml of Radiocontrast to produce a arthrogram and rotate the C-arm in a sagittal plane	
Bykowski JL et al 2012[28]	0.2 ml contrast (iohexol)	
Carette S et al 1991[18]	0.2-0.5 ml contrast (Omnipaque)	
Peh WGC 2011[14]	The spinal needle is then inserted vertically through this point until it reaches the bone. Once it enters the joint, a “giving way” sensation is perceived. Some minor manipulation may be needed to get into the joint space. In the majority of cases, anatomical location of the needle tip on fluoroscopic imaging is sufficient for localisation. The intra-articular location of the needle tip is be confirmed by rotating the patient and observing the needle tip move together with the facet joint. 300 mg% Iohexol as the contrast agent.	

Topic 10: Dose of radiation used to visualise the joint		
Reference	Data	Comments
	No Data	

Topic 11: Optimal type/configuration of X-ray machine etc		
Reference	Data	Comments
	No Data	

Topic 12: Injectate volume		
Reference	Data	Comments
O'Connor T et al 2003[19]	A total volume of more than 1 ml may damage the joint	
Rathmell J 2006[26]	The facet joint holds only limited volume (typically < 1.5 ml).	
Renfrew DL 2004[9]	0.5-1.0 ml of local anaesthetic and 0.5-1.0 ml of steroid	(this volume is described as low).
Waldman SD 2009[20]	Up to 2 ml local anaesthetic with or without steroid	Rapid or forceful injection may rupture the joint capsule
Deer TD 2004[10]	1-2.00 ml	
Fenton DS et al 2003[21]	1-1.5 ml	
Agorastides ID & Kumar N 2001[22]	2 ml of 0.5% Bupivacaine is injected for diagnostic purposes or 1 ml of 0.5% Bupivacaine and 1 ml of Triamcinolone for therapeutic purposes.	
Shih C et al 2001[15]	A 0.8–1.5 mL mixture of lidocaine, betamethasone dipropionate (Diprospan®, Schering-Plough, Heist-op-den-Berg, Belgium) and iopamidol (1:1:0.5) was injected into the joint. The injected volume depended on the pressure sensation of the injected joint.	
Slipman CW et al 2003[29]	Carette (1991)[18]: 1 ml of methylprednisolone acetate (20mg) combined with 1ml of normal saline Lilius (1989)[30]: Three groups. First group 6ml bupivacaine hydrochloride (30mg) and 2ml methylprednisolone (80mg). Second group treated with a pericapsular injection of bupivacaine and methylprednisolone. Third group 8 ml normal saline intraarticularly. Marks (1992)[31]: 0.5 ml of methylprednisolone acetate and 1.5 ml lidocaine1%. Lynch and Taylor (1986)[32]: 60mg of methylprednisolone.	Cited studies:[18,30,31,32] Lilius et al criticised for using excessive volume
Dreyfuss PH et al 2003[11]	Maximum volume injected into the z-joints should be less than 2 ml, and most authors recommend approximately 1.5 ml of total injectate	
El-Khoury GY et al 1991[23]	In as much as the capacity of the lumbar facet joints is only 1 -2 ml, facet joint injections of more than 2 ml	

	result in leakage of local anaesthetic and corticosteroid from the joint.	
Ackerman WE et al 2008[12]	The injectate consisted of 0.5 mL of a local anesthetic-steroid solution (0.5 mL of 1% preservative free lidocaine and 0.2 mL (8 mg) of triamcinolone).	
Carrera GF et al 1980[24]	The facet joint is blocked by injecting 2-3 ml of 1% lidocaine solution and 10 mg of depo-prednisolone acetate suspension.	
Boswell MV et al 2005[33]	Carette et al (1991): 2 ml	Cited study:[18]
Rados I et al 2013[17]	1.5 ml (with contrast) 2 ml (without contrast)	
Schutz P et al 2011[13]	1.5 ml. The joint capacity (1-2ml) must not be exceeded to avoid extravasation.	Refers to intraarticular facet joint block with local anaesthetic as a diagnostic tool to specify indication of lumbar spine surgery
Carette S et al 1991[18]	2 ml	
Peh WGC 2011[14]	The volume of the joint usually does not exceed 1.5 to 2 ml. We usually terminate the injection when resistance is encountered.	

Topic 13: Injectate composition.		
Reference	Data	Comments
O'Connor T et al 2003[19]	Lidocaine 1% 0.5 ml plus corticosteroid e.g. triamcinolone 25 mg	
Rathmell J 2006[26]	A total dose of 80 mg of methylprednisolone acetate or equivalent should be divided over all the joints to be injected but more than 40 mg per joint is probably unnecessary. Using concentrated steroids (40 or 80 mg per ml) allows 1:1 mixture with local anaesthetic (0.5% bupivacaine).	
Renfrew DL 2004[9]	Anaesthetic and steroid agents as desired	
Waldman SD 2009[20]	Up to 2ml local anaesthetic with or without steroid (80mg of depot-steroid added to first block with 40mg added to subsequent blocks)	
Deer TD 2004[10]	Marcaine 0.5% or Lidocaine 2% and glucocorticoids: Celestone Soluspan (6 mg betamethasone per ml-water soluble) Depo-Medrol (most commonly used 40 mg/ml solution)	NB when multiple joint injections total glucocorticoid volumes should be limited to;

		celestone Soluspan: 2.5-3.0ml: depo-medrol 80-120mg
Fenton DS et al 2003[21]	Short term anaesthetic: 3 ml 2% Lidocaine. Long term anaesthetic: 3 ml 5% Bupivacaine Therapeutic; Combination of 2.5ml Bupivacaine (0.5 MPF)/,5ml Betamethasone sodium phosphate and Betamethasone acetate injectable suspension 6 Mg/ml	
Agorastides ID & Kumar N 2001[22]	2 ml of 0.5% Bupivacaine is injected for diagnostic purposes or 1 ml of 0.5% Bupivacaine and 1 ml of Triamcinolone for therapeutic purposes.	
Shih C et al 2001[15]	A 0.8–1.5 mL mixture of lidocaine, betamethasone dipropionate (Diprospan®, Schering-Plough, Heist-op-den-Berg, Belgium) and iopamidol (1:1:0.5) was injected into the joint.	
Slipman CW et al 2003[29]	Carette (1991) [18]: 1 ml of methylprednisolone acetate (20mg) combined with 1ml of normal saline Lilius (1989)[30]: Three groups. First group 6cc bupivacaine hydrochloride (30mg) and 21 cc methylprednisolone (80mg). Second group treated with a pericapsular injection of bupivacaine and methylprednisolone. Third group 8 ml normal saline intraarticularly. Marks (1992)[31]: 0.5 ml of methylprednisolone acetate and 1.5 ml lidocaine1%. Lynch and Taylor (1986)[32]: 60 mg of methylprednisolone.	Cited studies:[18,30,31,32]
Peh WGC 2011[14]	A combination consisting of 1 to 1.5 ml of the steroid and local anaesthetic, in equal parts, is injected. Advisable to follow the recommendation on the upper limit of steroid usage (3 mg/kg of body weight of steroid, or 210 mg per year in an average person and a lifetime dose of 420 mg of steroid, equivalent to methylprednisolone)	
El-Khoury GY et al 1991[23]	3 mg (0.5 ml) of betamethasone and 1 .5 ml of 0.25% bupivacaine.	
Ackerman WE et al 2008[12]	The facet joint is blocked by injecting 2-3 ml of 1% lidocaine solution and 10mg of depo-prednisolone acetate suspension.	
Airaksinen O et al 2006[34]	Lilius et al (1989)[30]: Methylprednisolone and/or bupivacaine Marks et al (1992)[31]: Methylprednisolone and lidocaine	Cited studies: [30,31]
Boswell MV et al 2005[33]	Carette *et al* (1991)[18]: 1 ml 20mg of methylprednisolone mixed with 1/2 ml of isotonic saline	Cited studies:[18, 35,16,32,36]

	Murtagh (1988)[35]: 6 mg betamethasone Destouet et al (1982)[16]: 1 ml 0.25% bupivacaine and 40 mg depot methylprednisolone Lynch and Taylor (1986)[32]: 60 mg methylprednisolone Lippitt (1984)[36]: 1 ml 1% lidocaine and 80 mg depot methylprednisolone	
Destouet JM et al 1982[16]	1 ml 0.25% bupivacaine hydrochloride and 40 mg of methylprednisolone acetate suspension	
Rados I et al 2013[17]	Local anesthetic, lidocain or bupivacaine/levobupivacain and 20-40 mg of methylprednisolone acetate	
Schutz P et al 2011[13]	Verum: 1.5 ml 1% Mepivacaine Jackson et al (1988)[37]: 1 ml of 0.5% bupivacaine and 2mg (0.5ml) of triamcinolone	Refers to intraarticular facet joint block with local anaesthetic as a diagnostic tool to specify indication of lumbar spine surgery
Bykowski JL et al 2012[28]	Combined solution of anaesthetic and long acting steroid (methylprednisolone, triamcionolon or betamethasone).	
Carette S et al 1991[18]	2 ml 1% lidocaine 1ml (20mg) methylprednisolone acetate mixed with 1ml isotonic saline OR 2ml isotonic saline.	
Staal JB et al 2008[38]	Fuchs et al (2005)[39] sodium hyaluronate or corticosteroid injection. Revel et al (1998)[1], lidocaine or saline followed by an injection with corticosteroids (i.e. cortivazol) near the joints.	Citied studies:[39,1]
Boswell MV et al 2007[40]	RCT: Fuchs et al (2005)[39] Carette et al (1991)[18] Observational: Schulte et al. steroid, lidocaine and 5% phenol Murtagh et al (1988)[35] 6 mg Betamethasone Destouet et al (1982)[16]: 1 ml 0.25% bupivacaine and 40 mg depot methylprednisolone Lynch and Taylor (1986)[32]: 60 mg methylprednisolone Lippitt (1984)[36]: 1 ml 1% Lidocaine and 80mg depot methylprednisolone	Cited studies:[39,18,35,16,32,36,41]

	Lau (1985)[41]: Bupivacaine and depot methylprednisolone	
Boswell MV et al 2005[33]	RCT: Carette et al (1991)[18] Observational: Murtagh et al (1988)[35] 6 mg Betamethasone Destouet et al (1982)[16]: 1 ml 0.25% bupivacaine and 40mg depot methylprednisolone Lynch and Taylor (1986)[32]: 60 mg methylprednisolone Lippitt (1984)[36]: 1 ml 1% Lidocaine and 80mg depot methylprednisolone Lau (1985)[41]. Bupivacaine and depot methylprednisolone	Cited studies: 18,35,16,32,36,41
Falco FJ et al 2012[42]	Carette et al (1991)[18] Fuchs et al (2005)[39]: Hyaluronic acid/glucocorticoid Celik et al (2011)[43]: (Prospective cohort) Diclofnac sodium thiocolchicoside ve prilocaine, bupivacaine and methylprednisolone Anand and Butt (2007)[44]:local anaesthetic and steroids Murtagh et al (1988)[35] 6 mg Betamethasone Destouet et al (1982)[16]: 1 ml 0.25% bupivacaine and 40mg depot methylprednisolone Lippitt (1984)[36]: 1 ml 1% Lidocaine and 80mg depot	Cited studies:[18, 39, 43,44,35,16,36]
Peh WGC 2011[14]	40 mg% Triamcinolone (a long- acting steroid depot preparation) and 0.5% Bupivacaine (long-acting local anaesthetic agent). Mixed in equal volumes.	
Henschke 2010[45]	Carette (1991)[18]: (1ml methylprednisolone acetate mixed with 1 ml isotonic saline) Lilius (1989)[30]: (6ml (30mg) bupivacaine hydrochloride mixed with 2 ml (80mg) methylprednisolone.	Cited studies:[18,30]

Topic 14: After care advice		
Reference	Data	Comments
Renfrew DL 2004[9]	Monitor for pain response and record percentage of pain relief at 30 minutes. Release patient when stable and provide with telephone number to call due to incidences of increased pain, numbness or fever, swelling or redness.	
Deer TD 2004[10]	Post procedure care: Wash Iodine scrub from skin, apply band aid over puncture. Explain possible localised anaesthesia at injection site and possible referred pain along course of normal pain. Explain possible glucocorticoid side effects. An information and instruction sheet should be given.	

	Patients to remain 15/20 mins in waiting area and report immediate results before final discharge.	
Fenton DS et al 2003[21]	Recommends pain diary of patient symptoms immediately post procedure and continuing for 5/7 days.	
Ackerman WE et al 2008[12]	Patients were prescribed amitriptyline 25 mg at night and tizanidine 2 to 4 mg every 8 hours as needed for muscle spasms.	
Schutz P et al 2011[13]	Pain level was recorded with 10-point visual analogue scale before injection and time points after injection (30 mins, 60 mins, 2-3 hrs and 6-8 hrs)	Refers to intraarticular facet joint block with local anaesthetic as a diagnostic tool to specify indication of lumbar spine surgery

Topic 15: Other		
Reference	Data	Comments
	No Data	

6.5 Current study protocol for facet joint injection

We describe here, as a starting point for discussion, the protocol for injecting facet joints that we have proposed to the funders and submitted for ethical approval.

When they attend for injection the operator will make a brief clinical assessment to satisfy themselves that facet joint injections are appropriate. Consent for the procedure will be obtained and the current pre-injection risk management procedures of the participating study centres will be adhered to. The operator will then inject the facet joint(s). We anticipate injecting up to six facet joints in each individual (L3/L4, L4/L5; L5/S1) bilaterally. However, where, on clinical assessment, there is unilateral pain, or involvement of only some levels the operator may choose to do unilateral injection, or be selective on levels injected. We anticipate that everyone should receive at least two injections. This pragmatic approach reflects what actually happens in NHS practice. This approach is consistent with that used in trials of other complex interventions for low back pain, e.g. manual therapy or a cognitive behavioural approach, where practitioners choose from a limited range of options based on their clinical assessment of the patient.

Procedure to position the needle:

- We do not anticipate using intravenous sedation.
- Prone position with pillow under abdomen to flatten lumbar lordosis.
- Intravenous access, resuscitation equipment available.

- Skin cleansing with chlorhexidine 0.5% or 2% in alcohol, sterile drapes. (Some clinicians think that 2% chlorhexidine is neurotoxic and like to use 0.5% as skin cleansing before nerve blocks. On the other hand 2% chlorhexidine is recommended by the control-of-infection experts as optimum skin cleansing before intravenous cannulation and may be preferred in some Trusts).
- X-ray imaging (C-arm fluoroscopy) oblique view to visualise joint.
- The dose of radiation used will be adequate to visualise the joint while minimizing X-ray exposure.
- Skin weal at needle entry point: 1% lidocaine via 25G hypodermic needle.
- 22G x 3.5 inch (0.7 x 90 mm) needle with Quincke type point guide to joint cleft.
- Entry to the joint cleft may be indicated by X-ray appearance: observation of the needle tip on the joint line with medial/lateral movement of the X-ray beam to cause parallax shift.
- If entry to the joint has not been achieved after repositioning the needle twice, the needle will be positioned on the joint line without further attempts at capsular puncture.
- Aspiration should be negative for blood or cerebrospinal fluid.
- We do not anticipate using contrast medium because of the restriction of available joint volume and the risk of serious allergic reactions.
- The immediate post injection advice will be in accordance with the current procedures of the participating study centre.

Injection

- Pre-filled syringes containing bupivacaine 7.5mg and methyl prednisolone 20mg in total volume; 2ml will be used for each joint.
- The full volume, 2ml, will be injected through the spinal needle placed into each joint. Some facet joints may not be sufficiently large to take this volume of injectate meaning in practice that the injections will be intra- and peri-articular. This reflects what we believe to be current practice in the UK.
- Resistance to injection may occur due to abutment of the needle bevel to a surface or due to filling of the intra-articular space:
    - Force should not be used.
    - The needle should first be rotated 90° and a further attempt at injection made.
    - If, after two further 90° rotations resistance to injection persists or if, after successful injection of a part volume resistance develops, gentle pressure should be maintained on the plunger and the needle withdrawn gradually until resistance to injection falls.
- After completion of the injection the needle is removed and a sterile dressing applied.

7 Interpreting between group differences in score: what is a 'meaningful difference' between treatment groups at 3-months?

7.1 Summary

Main Question: ***What is the difference in magnitude of response between treatment and control groups that should be considered large enough to establish the scientific or therapeutic importance of the results?***

Further Questions:

1.0 What is the minimal between-group difference in change scores necessary for Facet Joint Injection(s) to be considered worthwhile?

- ***1.1 At 3-months, should we be seeking a mean between-group difference in change scores that is smaller / the same / or larger than that observed for the trials of manual therapy?***
- ***1.2 Informed by the MID-units calculated for the trials of manual therapy (supporting evidence), at 3-months should we be seeking a small (<0.5), medium (0.5-1.0) or large (>1.0) MID-unit as proof of important difference?***

2.0 What magnitude of reduction in pain after the injection constitutes immediate pain relief?

3.0 What proportion of those we inject should obtain immediate pain relief, based on the agreed definition, for us to conclude we have selected a population likely to benefit from facet joint injections?

Score interpretation is essential to understanding the relative importance, meaningfulness or value attributed to differences in scores within or between individuals or groups.[46, 47, 48] Two aspects of score interpretation of relevance to a clinical trial can therefore be described – the first, relates to the evaluation of change over time; the second to discrimination between groups. Whilst guidance for the interpretation of within person change over time exists for chronic low back pain, reported as the minimal important change (MIC) for both the Roland and Morris Disability Questionnaire (RMDQ; score change of 5 or 30% improvement from baseline) and the Pain (NRS; score change of 2 or 30% improvement from baseline)[49], guidance for interpretation of the between-group difference (BGD) does not exist. Interpretation of the relative importance of between-group differences is crucial, especially when these between group differences are likely to be small, and is the focus of this work-stream.

What the evidence suggests

An initial systematic review failed to identify guidance for interpretation of between-group differences in change in chronic low-back pain studies. We therefore conducted two further, complementary work-streams to generate evidence with which to inform interpretation:

1) A meta-analysis of large RCTs of therapist delivered interventions for chronic low back pain from which we reported:

1.1) mean between-group differences at follow-up points; and

1.2) calculated the Minimal Important Difference-units (MID-units: mean between-group difference in score is divided by the known MIC for a measure[50, 51] for individual and the combined trials at 3 and 12-months;

2) A further analysis of data from a large UK-trial (UK BEAM[52]) and reported:

2.1) mean between-groups differences; and

2.2) MID-units for the RMDQ and Pain (NRS) at 4-weeks, 3 and 12-months.

Mean between-groups differences in change in score: As expected, the between-groups differences in change in scores are considerably lower than the MIC for individual change calculated for the RMDQ: ranging 0.8 to 1.87 at 3-months, and 0.8 to 1.30 at 12-months (Table 7.4.2.2). No studies included a Pain (NRS) as a primary (or secondary) outcome measure.

MID-units: Larger MID-units were calculated for the RMDQ when utilising the 30% change from estimated baseline mean as the denominator in comparison to a score change of 5: these were of a moderate size at 3-months (range 0.20 and 0.69; combined 0.49 (0.37 – 0.61)), but smaller at 12-months (range 0.14 to 0.49; combined 0.34 (0.21-0.48)). Interpretation of effect suggests that active treatment may benefit an appreciable number of patients at 3-months, but fewer at 12-months. Small to moderate MID-units for the Pain (NRS) were calculated at 4-weeks (0.21), 3-months (0.40) and 12-months (0.40). Interpretation suggests that few people will achieve important benefits (pain reduction) from treatment at 4-weeks. However, the larger MID-units at both 3 and 12-months suggest that treatment might result in pain reduction in an appreciable number of patients.

***Implications for the study*:**

Understanding the relative value of one intervention against another is important. We are seeking to describe the size of difference between groups that should be considered sufficiently important, and hence have implications for whether we proceed to a main study.

What magnitude of reduction in pain after the injection constitutes immediate pain relief?

An important aspect of interpreting the findings of the feasibility study is knowing whether we have correctly selected people who have facet joint pain. Whilst we cannot, within this study, do a gold standard diagnostic assessment involving placebo and active injections we will be able to assess immediate response to their injections. Immediately prior to the procedure participants will be asked to rate their current pain on an 11 point (0-10) numerical rating scale. We will repeat this 45-60 minutes after injection. Those participants who obtain pain relief at this time will be deemed as having 'confirmed' facet joint pain. This group with 'confirmed' facet joint will include both those who have gained pain relief from the local anaesthetic and placebo responders and exclude those for whom injectate was not injected in, or adjacent, to the facet joints.

For our current purpose we need to decide on what is immediate pain relief from the injection. Do we only accept absence of low back pain, or do we accept any minimal level of pain as pain relief, or might we define responders as those with a substantial percentage improvement (30%, 50%, 70%).

What the evidence suggests

We are not aware of any robust evidence to inform this decision and are seeking consensus on what we should accept as pain relief.

What proportion of those we inject should obtain immediate pain relief, based on the agreed definition, for us to conclude we have selected a population likely to benefit from facet joint injections?

This would ideally be 100%; however, the best comparable study of which we are aware achieved relief of pain in 62% of subjects. For a pragmatic study of this nature an immediate response rate well below 100% would be acceptable and is partly dependent on how effective and safe we consider the injections to be. If, a substantial beneficial effect is expected in selected cases and adverse events are minimal then quite a low rate of immediate response could still translate into a worthwhile effect across the whole population.

What the evidence suggests

We are not aware of any robust evidence to inform this decision and are seeking consensus on what we should accept as pain relief.

7.2 Background

Patient-reported outcome measures (PROMs) are self-completed questionnaires which support patients in communicating how they feel, what they can do and how well they live their lives as a consequence of their health and associated healthcare. Informed by consensus recommendations[46], two PROMs have been selected as the primary outcome measures for the FIS trial:

Roland and Morris Disability Questionnaire (RMDQ) [53] **:** a 24-item self-completed questionnaire about the impact of back pain on activities of daily life. A binary response is utilised in which patients affirm ('check') items that have relevance to them 'today'. 'Checked' items receive a score of 1; checked items are summed, producing a score range 0-24, where higher scores equate to worse functional ability (see appendix 11.1 for copy).

Pain – Numerical Rating Scale (Pain-NRS): a single item, 11-point scale on which captures pain severity using a 0-10 numerical response scale. Score 0-10 where higher scores equate to most severe pain (see appendix 11.2 for copy).

Interpretation of change in PROM score is essential to understanding the relative importance, meaningfulness or value attributed to differences in scores within or between individuals or groups. [46, 47, 48] Two aspects of score interpretation of relevance to a clinical trial can therefore be described – the first, relates to the evaluation of change over time; the second to discrimination between groups:

1. ***Minimal important change (MIC)***: defined as the smallest difference in score that represents an important change within individuals or groups over time. If we are interested in evaluation of change, we need to interpret the differences in scores within individuals or groups over time which is meaningful. [46, 48] Guidance for interpretation of the MIC for both the RMDQ and Pain (NRS) following completion by patients with chronic low back pain exists[49]:

   RMDQ: 5 (or 30% improvement from baseline)
   Pain NRS: 2 (or 30% improvement from baseline)

2. ***Between-group difference (BGD):*** defined as the difference in magnitude of response between treatment and control groups that should be considered large enough to establish the scientific or therapeutic importance of the results. [48] Interpretation of the relative importance of between group differences is crucial, especially when these between group differences are likely to be small. However, guidance for interpretation of the between-group difference (BGD) in chronic low back pain studies does not exist.

Of note, criteria for the MIC in individuals over time cannot be extrapolated to the interpretation of between-group differences. For example, although a 5-point reduction on the RMDQ can be considered a minimally important change for an individual patient, it should not be concluded that a 5-point difference in mean improvement in functional ability between treatment groups is necessary for a treatment benefit to be considered important. Moreover, guidance from the FDA (PRO) suggests that meaningful change at an individual level is generally 'larger than the minimal important difference for application to group mean comparisons'. [54]

Minimal Important Difference units (MID-units): Where differences between groups are statistically significant, interpretation of the magnitude of effect is important. [55] In the context of pooling results

from systematic reviews or meta-analyses of randomised controlled trials, a complementary approach to calculation of the standardised mean difference (SMD) has been proposed – the Minimal Important Difference unit (MID-unit). [51, 55] The MID-unit is calculated as the mean difference between groups divided by the MIC associated with the specific outcome variable. Suggested MID-units interpretation: if the pooled estimate is greater than 1 MID-unit, many patients are likely to gain important benefits from the treatment; an estimate of effect between 0.5 and 1.0 would suggest that the treatment may benefit an appreciable number of patients; an estimate less than 0.5 MID units suggests that it is increasingly less likely that an appreciable number of patients will achieve important benefits from treatment. [55]

Aim:

To provide guidance to support interpretation of between-group differences (as defined above) for the RMDQ and Pain (NRS) in the chronic low back pain population.

Main question:

What is the difference in magnitude of response between treatment and control groups that should be considered large enough to establish the scientific or therapeutic importance of the results?

Further Questions:

Should we be seeking a smaller or larger MID-unit as proof of important difference?
What magnitude of reduction in pain after the injection constitutes immediate pain relief?

7.3 Methods

7.3.1 Systematic review of evidence in support of the between-group difference on the RMDQ and Pain (NRS) in the chronic low back pain population.

Search strategy 1 (see appendix 11.3): An extensive search of PubMED and EMBASE (2006-March 2014) was conducted. The search strategy consisted of the following strings:

- #1 Instrument search: a) All terms for RMDQ; b) All terms for Pain (NRS).
- #2 Population search: all terms for low back pain (two separate searches: a or b).
- #3 Measurement terms of relevance to 'between-group difference'.[56]
- #4 Exclusion filter
- Searches were: #1 (a or b) AND #2 (a or b) AND #3 NOT #4.

Search strategy 2: An author specific search was also conducted.

Inclusion criteria:
Article:

- Specific evaluation of the NRS (Pain) and/or the RMDQ for evidence of 'between-group difference'*.
- Specific to non-inflammatory LBP population only.
- Anglicised / English translation of the measures only.

- Completion by Adults (18years and above).
- Self-completion only (not proxy).

Measures (PROMs):

- RMDQ (all variations of reporting).
- Pain (NRS) (all variations of reporting).

Exclusion criteria:

Article:

- Not specific to the evaluation of the NRS (Pain) and/or the RMDQ for evidence of 'between-group difference'*.
- Not specific to non-inflammatory LBP population.
- Non-Anglicised / non-English publication.
- Completion by children (18 years and below).
- Proxy-completion.

7.3.2 Structured review and meta-analysis of data from large trials of physical interventions in chronic low back pain to:

- Identify mean between-group differences (raw data) reported for the RMDQ and Pain (NRS).[48, 57]
- Support calculation of the Minimal Important Difference Units (MID-units) for the RMDQ and Pain (NRS). [51, 55]

Inclusion criteria:

- Large randomised controlled trials (RCTs) of therapist delivered interventions for low back pain (>300 patients included in the analysis) identified from the 'Repository Database' (housed by Warwick CTU).
- RMDQ and/or Pain (NRS) included as primary or secondary outcome measures.

Data extraction:

- Mean (SD) between-group difference in scores at i) baseline; and ii) all follow-up points.
- MIC if calculated.

Data analysis:

- Report the range of mean between-group differences of change across treatment interventions and at time-points.
- Compare to known MIC for RMDQ and Pain-NRS for chronic low back pain.
- Conduct meta-analysis of data extracted.
- Calculate MID-units.

7.3.3 Review of raw between-group differences and calculation of MID-units from large UK-trial (BEAM trial data[52]).[51, 55]

Responder analysis of data from a large UK trial of chronic low back pain (the BEAM trial[52]). [48]

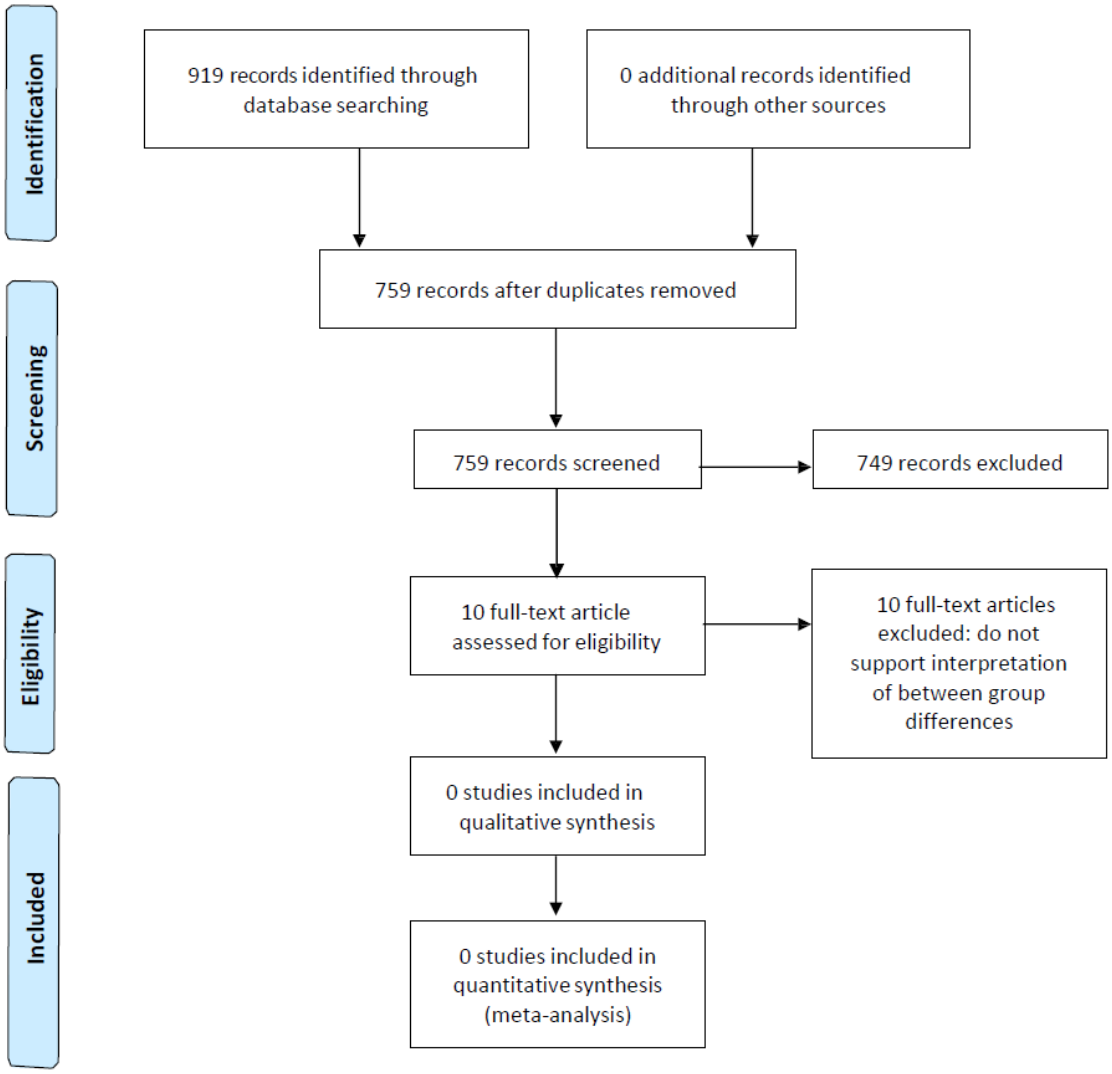
- Calculation of mean between-group differences for RMDQ and Pain (NRS) with responder analysis.[48]
- Calculation of MID-units for the RMDQ and Pain (NRS). [51, 55]

7.4 Results

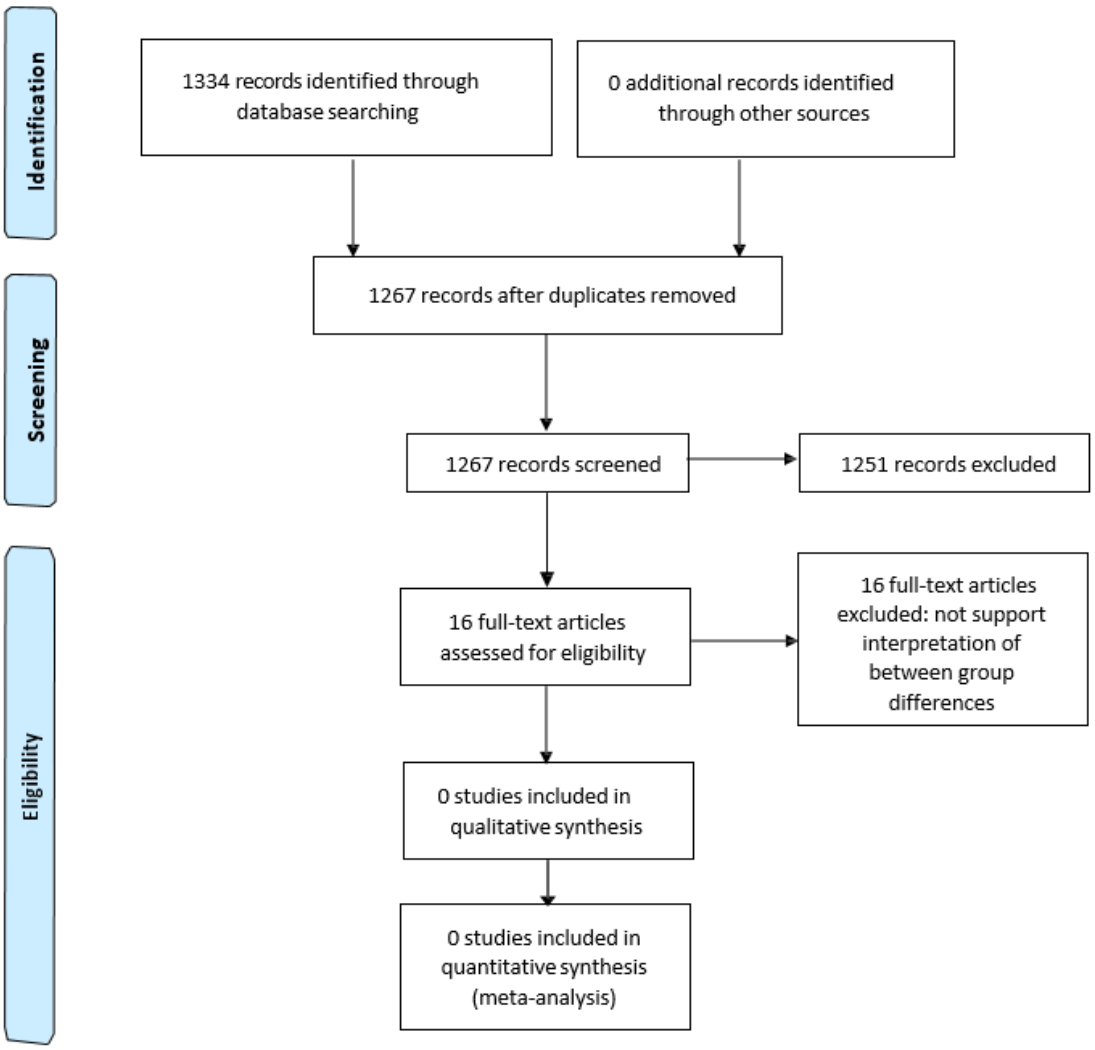
7.4.1 Systematic review of evidence in support of the between-group difference on the RMDQ and Pain (NRS) in the chronic low back pain population.

Despite the extensive search, no studies were identified that provided guidance regarding interpretation of the between-group difference in magnitude of response (PRISMA flowchart[58] – figure 7.4 A (Pain-NRS) and 7.4 B (RMDQ).

7.4 A) Review Process: Between-group difference in scores; Numerical Rating Scale (NRS)



7.4 B) Review Process: FIS MIC/MID Roland Morris Disability Questionnaire (RMDQ)



However, several discussion [46, 47, 48] and methodological [51, 55] papers were identified which suggested that alternative strategies could be explored to provide further guidance for interpretation of the BGD in this population. Hence, meta-analysis and re-analysis of data to calculate MID-unit in the current synthesis.

7.4.2 Structured review and meta-analysis of data from large trials of physical interventions in chronic low back pain.

7.4.2.1 Mean between-group differences (raw data) reported for the RMDQ and Pain (NRS)

Included studies: Warwick RCT 'Repository' is a database of individual patient data from RCTs of therapist delivered interventions for back pain. The repository includes data from 19 clinical trials totalling 9328 participants. Following application of our inclusion criteria, three out of five short-listed large trials (>n=300 patients included in the analysis) of physical therapy interventions in patients with chronic low back pain which included the RMDQ and/or Pain (NRS) as primary outcome measures were included in the analysis (Table 7.4.2.1).

Table 7.4.2.1 Study characteristics (number of trials n= 3/5 included)

Author	Total trial population (baseline)	Mean age (SD)		Sex (Female)		Primary outcomes	
		Treatment	Control	Treatment	Control	RMDQ	Pain (NRS)
Lamb et al (2010) (BeST),[59, 60]	701	53 (14.6)	54 (14.9)	278 (59%)	142 (61%)	Yes	No (von Korff)
UK Beam (2004)[52]	1334	Total pop: 43.0 (11.0)		Total pop: 56% female		Yes	No (von Korff)
Hay et al (2005)[61]	402	PT – Rx: 40.9 (11.6)	Pain Mgt: 40.4 (12.0)	110 (55%)	100 (50%)	Yes	No (VAS)

Raw data: The raw data suggests that differences in mean functional ability (RMDQ scores) between control or 'best care' groups and a range of physical modalities – CBT with advice, exercise, manipulation, manipulation followed by exercise, physical therapy – following 3 months of treatment / follow-up range between 0.8[61]and 1.87 [52](Table 7.4.2.2)

Following 12-months of follow-up the mean between-group difference in RMDQ scores range 0.8 [61] to 1.30 [52, 59, 60](Table 7.4.2.2)

These between-group score differences are considerably lower than the MIC for individual change calculated for the RMDQ (score change of 5 or 30% change from baseline).

No studies included a Pain (NRS) as a primary (or secondary) outcome measure.

7.4.2.2 Meta-analysis and calculation of the MID-units for the RMDQ.

For all included studies, MID-units were calculated using 1) the recommended MIC of 5 points; and 2) the recommended MIC of 30% improvement in score from baseline. MID-units were calculated per trial and as an overall score (combined) at 3 and 12-months (Table 7.4.2.3).

When calculated using the score change of 5-points, smaller MID-units were calculated for the RMDQ at all follow-up points when compared to MID-units calculated using the 30% improvement from baseline as denominator. Using the change in score of 5-points, MID-units for the RMDQ at 3-months range between 0.16 and 0.37; the combined MID-unit is 0.28 (0.21 – 0.35). MID-units at 12-months are smaller, ranging 0.08 to 0.26; the combined MID-units is 0.20 (0.13 – 0.27). However, when using the 30% change in score from baseline, MID-units at 3-months range between 0.20 and 0.69; the combined MID-unit is 0.49 (0.37 – 0.61). At 12-months, the MID-units are smaller, ranging 0.14 to 0.49; the combined MID-unit is 0.34 (0.21-0.48).

Adopting the interpretation recommended by Johnston et al [51, 55], an estimate of less than 0.5 MID-units suggests that it is increasingly less likely than an appreciable number of patients will achieve important benefits in functional ability from treatment. However, an estimate of effect between 0.5 and 1.0 suggests that treatment may benefit an appreciable number of patients. Larger MID-units were reported when the 30% change from baseline score was utilised as the denominator, providing more promising results in support of the effectiveness of interventions at improving functional ability at 3-months. Smaller MID-units were reported at 12-months.

Table 7.4.2.2 Characteristics of included trials of 'physical treatment' for b) functional disability (RMDQ) in patients with chronic low back pain

First author	Intervention	'Rx' (n)	'Ctrl' (n)	Mean baseline RMDQ (SD)	Mean score Rx group at follow-up	Mean change Rx group (95% CI)	Mean score Control group at follow-up	Mean change Control (95% CI)	Mean between-group difference in change score (95% CI)	Outcome assessment time-points (months)
Lamb et al (2010)[59,60]	Advise plus CBT vs 'best practice'	355	190	9.0 (SD 4.7-5.0)		2.0 (1.58 – 2.43)		1.1 (0.35 – 1.54)	1.1 (0.38 – 1.71)	3
		393	189			2.5 (1.96 – 3.03)		1.0 (0.40 – 1.67)	1.5 (0.70 – 2.22)	6
		399	199			2.4 (1.89 – 2.84)		1.1 (0.39 – 1.72)	1.3 (0.56 – 2.06)	12
UKBeam (2004)[52]	'Best care' in GP vs Exercise vs Manip vs Manip followed by exercise	225 287 258	256 ('best care')	Total: 9.0 (4.0)	(Mean(SE)) Exercise: 5.47 (0.29) Manip: 5.09 (0.28) Manip+Ex: 4.84 (0.28)	*3.5* *3.9* *4.1*	6.83 (0.28) 6.66 (0.30) 6.71 (0.28)	*2.1* *2.3* *2.3*	Exercise: 1.36 (0.63–2.10) Manip: 1.57 (0.82–2.32) Manip+Ex: 1.87 (1.15–2.60)	3
		216 273 257	248 ('best care')		(Mean(SE)) Exercise: 5.74 (0.31) Manip: 5.15 (0.29) Manip+Ex: 4.72 (0.29)	*3.2* *3.8* *4.2*	6.13 (0.30) 6.16 (0.31) 6.02 (0.30)	*2.8* *2.8* *2.9*	Exercise: 0.39(-0.41–1.19) Manip: 1.01 (0.22–1.81) Manip+Ex: 1.30 (0.54–2.07)	12
Hay et al (2005)[61]	Physical Rx (PT - Rx) vs pain mgt prog (control)	162	157	Rx 13.3 (4.9); Ct 13.8 (4.8)	PT – Rx: 5.1 (5.8)	PT – Rx: 8.1 (6.0)	Pn Mgt: 6.0 (5.9)	Pn Mgt: 7.8 (6.6)	0.8 (-0.5 – 2.1)	3
		165	164		PT – Rx: 4.4 (5.5)	PT – Rx: 8.8 (6.1)	Pn Mgt: 5.2 (5.7)	Pn Mgt: 8.8 (6.4)	0.8 (-0.5 – 2.0)	12

Table 7.4.2.3 Results of the meta-analysis (workstream 2) and data analysis from the BeST trial data (workstream 3): mean between-group difference in change score and MID-units for the RMDQ and Pain (NRS).

	Mean between-group difference in change score (95% CI)			**MID units (95% CI) (mean change / MIC of 5 points)**			**MID units (95% CI) (mean change / MIC 30% change from baseline)**		
	4-weeks	3-mths	12-mths	4-weeks	3-mths	12-mths	4-wks	3-mths	12-mths
RMDQ									
Lamb (2010)[59,60]	-	1.1 (0.38 – 1.71)	1.3 (0.56 – 2.06)	-	0.22 (0.09-0.35)	0.26 (0.11 – 0.41)	-	0.42 (0.16 – 0.67)	0.49 (0.21 – 0.78)
UKBeam (2004)[52]	-	Exercise: 1.36 (0.63–2.10) Manip: 1.57 (0.82–2.32) Manip+Ex: 1.87 (1.15–2.60)	Exercise: 0.39 (-0.41–1.19) Manip: 1.01 (0.22–1.81) Manip+Ex: 1.30 (0.54–2.07)	-	Exercise: 0.27 (0.13 – 0.42) Manip: 0.31 (0.16 – 0.46) Manip+Ex: 0.37 (0.23 – 0.52)	Exercise: 0.08 (-0.08 – 0.24) Manip: 0.20 (0.04 – 0.36) Manip+Ex: 0.26 (0.11 – 0.41)	-	Exercise: 0.50 (0.23 – 0.77) Manip: 0.58 (0.31 – 0.86) Manip+Ex: 0.69 (0.42 – 0.96)	Exercise: 0.14 (-0.15 – 0.44) Manip: 0.38 (0.08 – 0.67) Manip+Ex: 0.48 (0.20 – 0.76)
Hay et al (2005)[61]	-	0.8 (-0.5 – 2.1)	0.8 (-0.5 – 2.0)	-	0.16 (-0.10 – 0.42)	0.16 (-0.09 – 0.41)	-	0.20 (-0.12 – 0.52)	0.20 (-0.11 – 0.50)
Meta-analysis (combined)	-	-	-	-	0.28 (0.21-0.35)	0.20 (0.13 - 0.27)	-	0.49 (0.37 – 0.61)	0.34 (0.21 - 0.48)
Raw data (BeST) (n= 1169)	1.0 (0.45 – 1.50)	1.5 (0.94 – 2.15)	1.0 (0.31 – 1.62)	0.20 (0.09 – 0.30)	0.31 (0.12 – 0.43)	0.25 (0.08 -0.41)	0.42 (0.20, 0.64)	0.68 (0.43, 0.93)	0.48 (0.20, 0.75)
Pain (NRS)									
Raw data (BeST) (n= 1126)	0.43 (0.12, 0.74)	0.81 (0.45,1.17)	0.50 (0.12, 0.87)	0.22 (0.06, 0.37)	0.41 (0.22, 0.59)	0.25 (0.06, 0.43)	0.13 (-0.15, 0.42)	0.54 (0.22, 0.86)	0.41 (0.06, 0.75)

7.4.3 Between-group differences of change and calculation of MID-units from large UK-trial

A responder analysis of raw data from a large UK trial (n= 1169) (the UK BEAM tria[52]) was conducted. Scores for the RMDQ and Pain (NRS) were adjusted for sex, age and scores at baseline (Table 7.4.2.3).

7.4.3.1 Mean between-group differences of change in RMDQ and Pain (NRS) scores (Table 7.4.2.3):

MID-units were calculated for using the MIC change in score (7.4.3.2) and MIC % improvement in score from baseline (7.4.3.3).

7.4.3.2 The Minimal Important Difference units (MID-units) were calculated for the RMDQ (using a recommended MIC of 5) and the Pain (NRS) (using a recommended MIC of 2).

RMDQ: Small MID-units were calculated for the RMDQ at 4-weeks, 3-months and 12-months from a further analysis of raw data generated from the UK BEAM trial: ranging from 0.20 (0.09, 0.30) at 4-weeks to 0.31 (0.12, 0.43) at 3-months (interpretation as above).
Pain (NRS): Small to moderate MID-units for the Pain (NRS) were calculated at 4-weeks (0.21), 3-months (0.40) and 12-months (0.40). Interpretation of the MID-units suggests that few people will achieve important benefits (reductions in pain) from treatment at 4-weeks. However, larger MID-units are reported at both 3 and 12-months, suggesting that treatment might result in a reduction in pain in an appreciable number of patients at these time-points.

7.4.3.3 The Minimal Important Difference units (MID-units) were calculated for the RMDQ (using a recommended MIC of 30% improvement from baseline) and the Pain (NRS) (using a recommended MIC of 30% improvement from baseline).

RMDQ: Use of the alternative (30% improvement in score) denominator produced larger MID-units for the RMDQ at all time-points: the MID-units were moderate (0.42 (0.20, 0.64) at 4-weeks) and 0.48 (0.20, 0.75) at 1-year, and large at 3-months (0.68 (0.43, 0.93)).

Pain (NRS): Use of the 30% improvement in score produced small to moderate MID-units for the Pain (NRS); ranging 0.13 (-0.15, 0.42) at 4-weeks to 0.54 (0.22, 0.86) at 3-months.

Use of the MIC - 30% improvement in score from baseline as a denominator produced consistently larger MID-units when compared to use of the MIC raw score change. Utilising the MIC (30% improvement), the largest MID-unit was produced at 3-months follow-up: interpretation would suggest that treatment might result in an improvement in functional ability (RMDQ) and reduction in pain (Pain NRS) in an appreciable number of patients at 3-months, and to a lesser extent at 12-months. However, fewer people will achieve important benefits from treatment at 4-weeks.

8 'Best usual care' package

8.1 Summary

<u>Question:</u> What is the optimal conservative management/ rehabilitation for patients with low back pain where facet joints have been identified as a contributing source of symptoms?

The review process comprises of three components;

1. Systematic review (SRs) for physical therapy for facet joint pain
2. Systematic review for psychological or cognitive behavioural approaches for patients with low back pain delivered by non-psychologists
3. Narrative evidence synthesis from seminal texts of physical therapy

This review utilised two search strategies in order to narrow down physical therapy management, concentrating specifically on treatment/management directed at pain arising from the facet joint and a second strategy utilising a broader search terms with psychological components to management of back pain in general.

What the evidence suggests:
Rehabilitation of low back pain has been extensively researched over the last few decades and it is now widely accepted that this should comprise of both physical and psychological components.

However evidence for specific rehabilitation where facet joints are suspected or known to be the source of pain has received little attention. Whilst seminal texts within the physical therapy suggest techniques or methods of treatment that may be of help, at this time there is no agreement regarding what constitutes the best physical therapy management in this patient group.

A greater degree of agreement has emerged regarding the need to integrate psychological components and techniques within all back pain management. There is evidence that some form of cognitive behavioural approach aiming to address unhelpful beliefs and barriers to recovery has a positive, added effect to physical rehabilitation in isolation. In light of a paucity of empirical evidence supporting any specific physical therapy approach in this patient group, an option is to provide a toolkit of techniques based on the available evidence for therapists to use on an individual basis.

Implication for the study:
Providing the best, bespoke rehabilitation for both arms of the study is important in order to provide a credible treatment for all patients and provide any added value of facet joint injections.

8.2 Background

Whilst low back pain (LBP) has a high prevalence rate, the cause or source of pain is often unclear or unknown. However, the suspected source of pain, along with clinical reasoning[62,63], will often direct both medical and conservative management strategies.[5] Pain originating from the facet joints is thought to be common. However, despite numerous clinical opinion and texts indicating how LBP arising from different sources may be managed, at present there is no systematic review identifying what evidence based components should be included within the conservative management/rehabilitation for patients with LBP where facet joints have been identified as a contributing source of symptoms.

It is known that musculoskeletal pain and disability, particularly chronic LBP, is often associated with psychological distress[64, 65], negative beliefs and fear-avoidance behaviour [66, 67, 68, 69]. Correspondingly, there is a growing evidence base indicating that that the integration of psychological treatment, particularly those based upon cognitive behavioural principles can be efficacious in the management of chronic pain. In planning this review it was therefore deemed important to include both the physical and psychological management in order to achieve a comprehensive evidence synthesis.

8.3 Methods

Search terms

Two separate search strategies were used;

=1 physical therapy components

=2 psychological components

The full combination of searches for the two separate search strategies are shown in Table 8.3.1 and 8.3.2

Table 8.3.1: Search term combinations (Physical therapy)

1	**Problem of interest**	**Low back pain OR back pain OR lumbar vertebrae OR spine OR spinal diseases OR facet* OR facet joint* OR zygapophyseal joint* OR lumbar sacral pain**
2	Outcome	Pain OR function
3		#1 AND #2
4	Intervention	orthopaedic OR manual OR physical OR therapeutic exercise OR exercise therapy OR rehabilitation OR physiotherapy
5		#3 AND #4
	Limitations	English language, humans
*** wild card/truncation (search term that begin with the letters preceding the asterisk)**		

Table 8.3.2: Search term combinations (psychological interventions)

1	**Problem of interest**	**Low back pain OR back pain OR lumbar vertebrae OR spine OR spinal diseases OR facet* OR facet joint* OR zygapophyseal joint* OR lumbar sacral pain**
2	Outcome	Pain OR Function
3		#1 AND #2
4	Intervention	cognitive behavioural approach* OR cognitive behavioural principle* OR psychological approach* OR psychological principle* OR self-management OR self help
5		#3 AND #4
	Limitations	English language, humans
*** wild card/truncation (search term that begin with the letters preceding the asterisk)**		

Databases searched

MEDLINE, CINAHL and Allied and contemporary medicine database (AMED). Citation tracking of eligible studies. Hand searching as appropriate

Inclusion criteria

Type of study

All study types were considered initially then included or excluded in the first stage of selection as appropriate. At the second stage of selection, the full text articles were reviewed to determine

whether the study utilised physical therapy or psychological techniques to manage 'facet joint pain', in relation to physical therapy or back or chronic pain in relation to psychological techniques.

In the interest in being as broad as possible with respect to this evidence synthesis it was decided that appropriate systematic reviews, identified by the search strategies, could be included.

Selection of studies

To be included in the review articles/studies needed to include;

1. Population
   People with low back pain where facet joints have been identified as a contributing source of symptoms and no known or suspected serious pathology for the 'physical therapy' review.
2. Intervention
   Any physical therapy management or cognitive behavioural therapy (CBT) type intervention/approaches/techniques (delivered by non-psychologists) used as part of the management of patients with low back pain where facet joints have been identified as a contributing source of symptoms
3. Setting
   Any; either primary, secondary or community setting was considered again in order to as broad as possible in terms of the literature identified.

In order to supplement the systematic review, hand searching of seminal texts for physical therapy (as defined by NICE, 2009) was undertaken. Key texts in the area of physiotherapy and osteopathy were identified through personal experience, consultation with relevant experts and correspondence with the relevant governing bodies. No texts in chiropractic were identified. A summary of guidance is presented in Table 8.4.1.

Exclusion criteria

The exclusion filters used for PubMed are shown in Appendix 11.4. Exclusions for other databases were;

- Non-human
- Non-English language
- Radiography
- Cervical

8.4 Results

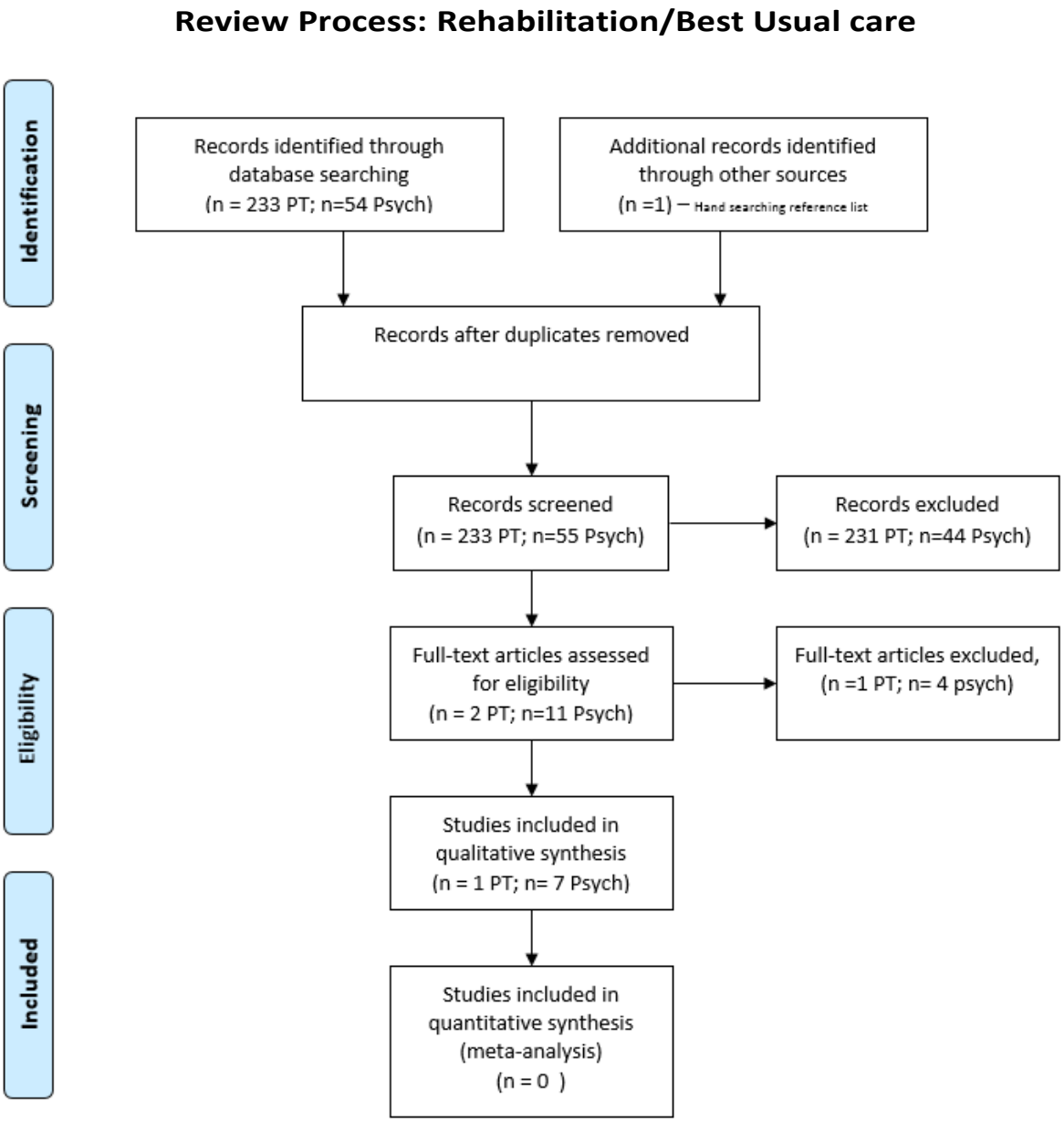

Review Process: Rehabilitation/Best Usual care
Identification
Screening
Eligibility
Included
Records identified through database searching (n = 233 PT; n=54 Psych)
Additional records identified through other sources (n =1) – Hand searching reference list
Records after duplicates removed
Records screened (n = 233 PT; n=55 Psych)
Records excluded (n = 231 PT; n=44 Psych)
Full-text articles assessed for eligibility (n = 2 PT; n=11 Psych)
Full-text articles excluded, (n =1 PT; n= 4 psych)
Studies included in qualitative synthesis (n = 1 PT; n= 7 Psych)
Studies included in quantitative synthesis (meta-analysis) (n = 0)

Table 8.4.1 Data extraction

Reference	Setting	Type of study and outcome (OC) measures	Study Population	Intervention	Findings
BEST (Lamb et al, 2007 and 2010)[70,60]	Primary care	Multi-centred RCT **Primary OC** RMQ MVK	N=701 participants N=233 to active management (AM) N= 468 to AM+CBA	Group delivery of 6–8 patients Six weekly sessions of 90 minutes Cognitive behavioural approach (CBA) included: (i) education to counter unhelpful beliefs about LBP and to highlight the importance of appropriate levels of activity; (ii) use of cognitive re-structuring techniques to counter unhelpful beliefs; (iii) training on goal setting, baseline setting, and pacing for incrementally increasing activities; (iv) specific focus on fear avoidance and attentional effects on pain; (v) techniques for self-management of pain especially in flare-ups.	Mean additional improvement in the CBA arm over AM = 1.1 [95% confidence interval(CI) 0.4 to 1.7], 1.4 (95% CI 0.7 to 2.1) and 1.3 (95% CI 0.6 to 2.1) change points in the RMQ at 3, 6 and 12 months
IMPACT (Sowden et al 2012)[71]	Primary care	Quality improvement study of subgrouping for targeted treatment (STartBack Tool)	High risk group (4/5 psychological risk factors for chronicity) and any back-related physical risk factors	Evidence based physical therapy management in combination with a cognitive-behavioural Approach with a specific focus on communication skills, careful attention to language and collaborative goal setting. Exploration of the impact of LBP using structured identification of potential obstacles to recovery using stem and leaf questions.	Trial currently in progress

Reference	Setting	Type of study and outcome (OC) measures	Study Population	Intervention	Findings
Manca et al (2007)[72] (Klaber Moffett JA, Jackson DA et al. 2006 – *identified through hand searching*)[73]	Secondary care	Economic evaluation conducted alongside RCT **Primary OC** TSK at 6 weeks, 6 and 12 months	Neck pain (NP) and LBP Pain of more than 2 week duration (70% + LBP chronic) Total n=315 (n=219 LBP/96 NP) **MA with/out The Back Book** 44.84 (16.17)/45.15 (14.93) yrs **SFA with/out The Back Book** 43.15 (14.40)/43.05 (14.33) yrs	**The Solution Finding Approach (SFA);** A brief physiotherapy intervention based on cognitive–behavioural principles. Patient-centred and aims to help patients identify reasons for their pain and to provide solutions and long-term management strategies **McKenzie approach (MA):** Classification spinal condition and the prescription of specific therapeutic exercises Both groups subsequently randomised to either receive *The Back Book* or *The Neck Book* or not receive it	Over a 12-month period SFA lower per patient cost of £-24.4 (95% CI £-49.6 to £0.789). The mean difference in QALYs between the two groups: -0.020 (95% CI-0.057 to 0.017); favouring those receiving McKenzie. Clinically important improvement in RMDQ but no statistically significant differences except: - SFA plus Booklet group reported less reliance on health professionals (MHLC-Powerful others) at all time points. - At 6 months MA group showed greater improvements in TSK scores

Reference	Setting	Type of study and outcome (OC) measures	Study Population	Intervention	Findings
Moffett et al (1999)[74]	Community	RCT **Primary OC** RMDQ at 6 and 12 months Aberdeen Pain Scale EuroQoL EQ5D FABQ	N= 187 patients (1860 years) LBP between 4 weeks to 6 months' duration. Exercise and CBA 42.6 (8.62) yrs Usual care 41.1 (9.21) yrs	Exercise classes including strengthening and stretching exercises, relaxation session, and brief education on back care using a CBA. Compared to usual primary care management Eight, one hour sessions over four weeks Upto 10 participants in each class.	Exercise class more clinically effective and cost effective. 6 and 12 months exercise class showed significantly greater improvement in the disability questionnaire score (mean difference in changes 1.35, 95% CI 0.13 to 2.57).
STartBack (Hill et al, 2011)[75] (Main et al, 2012)[76]	Primary care	RCT Clinical & cost-effectiveness of stratified with non-stratified current best practice **Primary OC** RMDQ at 12 months	N=851 patients Intervention n=568 (IG) Control groups n=283 (CG)	CG; 30 minute physiotherapy assessment treatment including advice and exercises Option of onward referral to further physiotherapy IV group all assessed with advice, 15-min educational video (Get Back Active) and given the Back Book. Allocated to three risk-defined groups according to the STarT Tool - low -medium - high **Low:** clinic session only **Medium**: standardised physiotherapy **High**: psychologically informed physiotherapy to address physical symptoms and function, and psychosocial obstacles to recovery	Mean changes in RMDQ significantly higher in the IV than CG at 12 months (4·3 [6·4] vs 3·3 [6·2] At 12 months stratified care mean increase in generic health benefit (0.039 additional QALYs) and cost savings (£240.01 vs £274.40) compared with the control group

Reference	Setting	Type of study and outcome (OC) measures	Study Population	Intervention	Findings
Woods & Asmundson (2008)[77]	Secondary	RCT **Primary OC:** PDI **Secondary:** SF-MPQ HADS TSK FABQ PASS-20 PCS	N=44 chronic LBP patients **Age: Mean (SD)** GA 47.23(12.0) GiVE 46.13(11.9) WLC 46.12 12.5) Total 46.45 (11.9)	**Graded activity (GA):** Graded activity, based upon principles of operant conditioning. Shaping of healthy behaviours through positive reinforcement of predefined activity quotas All exercises derived from existing physiotherapy treatments for LBP Graded activity program individualized **Graded in vivo exposure (GivE):** educating patients about the cognitive-behavioural perspective on fear avoidance followed by graded activity (GA) **Weighting list control (WLC)** GA & GiVE = Eight 45 minute sessions conducted twice-weekly for four weeks	GivE statistically significantly greater improvement on: TSK, FABQ, PASS-20, PCS, HADS, SF-MPQ) compared to WLC GivE statistically significantly greater improvement on: TSK, FABQ, PASS-20, and PSEQ) compared to GA ITT analyses: GivE resulted in significant improvements on the TSK and PCS compared to WLC
Summary of seminal/key texts					
Physiotherapy	Gapping techniques e.g. rotations, transverse mobilisations aimed at increasing IV foraminal space and relieving pressure on z joints Passive Physiological Intervertebral Movements (PPIVMs) into flexion? progressing into low loading extension Mulligan techniques: NAGS, SNAGS and MWMs designed to 'normalise' facet joint function Postural re-education designed to reduce strain on lumbosacral junction Passive accessory Intervertebral Movements (PAIVMs) and combined movements as progression Trigger point release and soft tissue/fascia release				
Osteopathic	Techniques for the lumbar area including generalised non facet specific soft tissue, fascial, harmonic/oscillatory, functional, articulatory and HVLA thrust techniques.				

	Whole body/global treatment emphasis rather than tissue/symptom specific Specific techniques: e.g. kneading/articulation/springing HVT, low velocity techniques Soft tissue, articulatory and specific techniques Non-specific, treatment of spinal lesion aimed at 'normalisation' Osteopathic Treatment. Including HVLT, MET, Myofascial Release, Cranial, Strain-counter strain, Soft tissue/articulatory, Lymphatic techniques,

Key:
RMDQ: Roland and Morris Disability Questionnaire
MVK: Modified Von Korff
PDI: Pain Disability Index
SF-MPQ: McGill Pain Questionnaire – Short Form
HADS: Hospital Anxiety and Depression Scale
TSK: Tampa Scale for Kinesiophobia
FABQ: Fear Avoidance Belief Questionnaire
PASS-20: Short-form of the Pain Anxiety Symptoms Scale
PCS: The Pain Catastrophising Scale
MHLC: Multidimensional Health Locus of Control

The one physical therapy article identified within the search strategy could not be sourced (Dreyer et al, 1999)[78]

8.5 Outline of control intervention: a starting point for discussion

Treatment follows guidance from NICE but tailored to individual patients, to ensure that optimal treatment is given and maximise treatment benefit. Patients initially undergo a thorough physical assessment based on the principles of Maitland manual therapy.[62] Symptomatic levels are identified and the severity and nature of the symptoms recorded and used to direct treatment. The physical aspects of the programme targets facet joints.

To facilitate early treatment and synchronisation of intervention and control treatments individual rather than group treatment are used.

There is evidence that manual therapy has effects on descending inhibition and can produce rapid analgesic effects in the short term.[79,80,81] There is also small scale work indicating that manual therapy followed by specific active exercise in chronic non-specific low back pain produces favourable results when compared with de-tuned ultrasound followed by specific active exercises.[82] Therefore treatment is tailored and an adequate dose is given. The specific level and technique chosen is based on Maitland selection of technique principle.

Assessment of motor control can include assessment in all three planes, sagittal, transverse and coronal. Individualised home exercise regime can be provided based on the patient presentation and their specific motor control strategies/dysfunctions. Treatment focuses on improving the motor control/core stability which is automatic in nature as opposed to volitionally controlled. The treatment may be based on a bio-psychosocial model, integrating with the manual therapy a cognitive behavioural approach (CB) which is effective in improving quality of life in patients with non-specific low back pain (NSLBP).[83] This could include basic principles of cognitive restructuring such as identifying Negative Automatic Thoughts (NATs) in relation to physical activity and chronic pain and challenging these with adaptive thoughts. Cognitive behavioural approaches include working with the patient to understand that NATs are negative appraisals of situations that occur that can then influence mood and behaviour. [84] Patients with NSLBP may have reduced physical activity due to fear and thought patterns associated with being physically disabled which can lead to general de-conditioning. A graded, progressive approach to activity is suggested with home exercises prescribed to ensure an optimal level of activity for each patient.

The treatment could be delivered in a patient centred manner, where patients have the opportunity to express concerns and expectations and be actively involved in the sessions. The sessions could include motivational interviewing to identify barriers and challenges to engaging in activity, as well as assessment of self-efficacy and readiness to change. The therapeutic relationship can be an important component of the treatment, creating the right environment to integrate psychological, manual and exercise components of this treatment.

Outline of content and structure of control intervention – for discussion

Initial assessment

Initial assessment of 60 minutes. Assessment includes discussion of expectations, fear avoidance and self-efficacy to assess any perceived challenges and barriers that patients feel may be preventing them from engaging in self-management of chronic pain and to allow subsequent treatment sessions to be tailed to individual need. For the intervention group, the facet joint injections are given in the period between this first assessment and the first follow-up appointment.

Individual sessions

Five further sessions each of 30-minutes incorporating elements of manual therapy, pacing, motor control retraining, therapeutic exercise, soft tissue stretches/release, postural and general advice, goal setting and challenging negative thoughts associated with physical activity and chronic low back pain as appropriate.

Manual therapy (MT) intervention may include:

- Passive accessory intervertebral movements; either central, unilateral applied to either the symptomatic level or the level adjacent depending on the severity and irritability.[62]
- Soft tissue release/trigger point release/muscle energy techniques as indicated in order to facilitate motor control retraining and effectiveness of manual therapy [85]
- Manipulation treatment as indicated.[86, 87, 88]
- Active exercise to increase mobility, improved motor control and core stability, improve overall strength and stretch any tight muscle groups.
- Mobility techniques such as flexion in lying, pelvic tilt, side glides in standing and gym ball exercises.
- Motor control retraining exercises (depending on individual assessments). This may include all muscles involved in core stabilising of the spine and also reducing activity in more superficial muscles that have been shown to become over active in the presence of LBP. Treatment focuses on retraining the 'co-activation' pattern of stabilising muscles such as transversus abdominus and lumbar multifidus (LM). This includes retraining of lumbar multifidus as it is innervated by the medial branch and becomes inhibited ipsilateral to the pain in chronic back pain conditions.[89,90] There is also evidence that specific retraining of 'core muscles' can improve pain and disability in some back pain patients. [91, 92, 93, 94]
- Passive stretches. Muscle groups identified during assessment as tight or overactive may be stretched within the therapy sessions in order to allow for improved spinal mobility and facilitate motor control retraining. Stretches taught as part of the home exercise regime.

Home exercises and advice may include

- Bespoke exercise programme to compliment face to face sessions. Prescription to include frequency, dose, repetitions and progressions.
- Advice on positions of ease, strategies to use in event of a 'flare-up', and strategies to reduce increasing pain e.g. use of pelvic tilt prior to standing after prolonged sitting.

Cognitive approaches may include:

- Pacing including discussion of what is meant by pacing, relevance of pacing and methods to incorporate pacing into daily activities such as pacing by time, pacing by numbers or pacing by grading activities.
- Goal setting, including discussion of setting mutually agreed goals related to functional activities as well general daily goals and long term goals. Goals agreed between the physiotherapist and patient participant. In line with a CB approach, goals may be based on SMART principles; Specific, Measurable, Achievable, Realistic and have a Time frame (a date for competition). [84]
- Challenging negative automatic thoughts (cognitive restructuring) including, working with patients to identify particular negative thoughts they may have in relation to physical activity and fear avoidance, and helping patients challenge their thoughts and adapt positive coping strategies.
- Homework tasks between each session tailored to each individual and what is discussed during the session. For example, using pacing on a particular activity identified by the patient, keeping a diary of negative automatic thoughts that may trigger anxieties about movement or exercise and pain.

9 Priori sub-group analyses

9.1 Summary

<u>Question:</u> Which variable(s) should be used for a priori sub-group analyses in the main trial?

For any analysis of sub-groups to be robust the factors that might predict response to treatment need to be pre-defined based either on previous empirical data or grounded in the theory. For a future main trial we would wish to select small number of variables to use in a pre-specified sub-group analysis.

9.2 Background

The identification of sub-groups of individuals who are likely to gain the greatest benefit from different approaches to the treatment of low back pain is an important research priority internationally. This study is predicated on their being a group of people who are likely to benefit from facet joint injections. Part of this consensus meeting is focussed on how this phenotypically defined sub-group might be identified. Neither this feasibility study nor any subsequent main study are set up to identify and confirm the validity of the entry criteria by including people for whom facet joint pain is considered clinically unlikely. Such a study might be difficult to justify ethically.

Nevertheless we might anticipate that the effect of facet joint injections may not be homogeneous across the entire patient population included in the study. We would like to use the data collected in the main study to explore such heterogeneity. We are interested here in factors that affect the effectiveness of the treatment (moderators) we are not interested in factors that predict outcome irrespective of treatment used. These are factors measured before randomisation. Thus, whether obtaining immediate pain relief following injection predicts long term benefit is not part of a moderator analysis; rather it is a mediator analysis.

To maintain scientific rigour, we wish to define a small number of a priori factors that may be associated with moderation of the effect of facet joint injections so that we can specify sub-group in advance of a main trial. Whilst we could select a long list of candidate variables that might moderate the effect of facet joint injections, this presents a hazard of getting a false positive result as a consequence of multiple comparisons. For this reason, and to ensure practicality of data collection, we need to identify a small number of variables that are of the greatest interest to include in this confirmatory analysis. We may also be able to do exploratory analyses on a wider range of factors.

In order to ensure the feasibility of collecting the required baseline data and to allow us to make an initial exploration of heterogeneity in treatment effect we will collect data on factors identified in the feasibility study.

9.3 Methods

We are not aware of any studies that have explored treatment moderation in randomised controlled trials of facet joint injections. In a review of low back pain studies that reported effect moderation we identified candidate variables that might be considered significant at the 20% level. A 20% level was chosen rather than a conventional 5% level to ensure we identified all plausible moderators. Broadly speaking these were severity, age, sex, anxiety/depression, treatment expectation, self-efficacy, quality of life, back beliefs, educational attainment, heavier work (Tables 9.3.1 – 9.3.4). Whilst derived from studies of other interventions these might be worth considering. There may well be other moderators that should be considered that are specific to this population. Such potential moderators could be grounded in clinical reasoning or clinical experience. In this context these may include aspects of pain distribution, pain duration, or aspects of the physical examination.

Overall, we are therefore looking for the consensus group to select a small numbers of factors that we should consider for MODERATOR analyses (not analysis of predictors).

The tables below summarise the findings on statistical significance from secondary analyses of four large trials who tested for how baseline factors might moderate treatment effects. Where P-value was greater than 0.2 we have, for simplicity reported as not significant.

Table 9.3.1. Underwood 2011[95], secondary analysis of BEST dataset; trial of a cognitive behavioural approach. Outcomes reported - RMDQ (Roland Morris Disability Questionnaire); MVK (Modified Von Korff) equivalent to a Numerical Rating Scale (NRS)

Study ID	Variables	Significant interaction with intervention (p-value given or no significant interaction seen (NSI))
Underwood 2011[95] Cognitive behavioural approach	Troublesomeness (Very/Extremely – Moderately)	p= 0.190 {(95%CI: -1.01 (-2.52, 0.50)}-RMDQ; p=0.184 {(95%CI: -5.04 (-12.47, 2.40)}-MVK pain
	Age (≥54 years – <54 years)	p=0.035 {(95%CI: -1.58 (-3.05, -0.12)}-RMDQ
	Female – Male	p=0.102 {(95%CI: -1.27 (-2.79, 0.25)}-RMDQ
	Left Full Time Education (>16 years of age – ≤16 years of age)	p=0.098 {(95%CI: 1.29 (-0.24, 2.82)}-RMDQ
	Employed – Not Employed	p=0.011 {(95%CI: 1.89 (0.43, 3.35)}-RMDQ; p=0.181 {(95%CI: 5.01 (-2.33, 12.34)}-MVK pain
	HADS – Anxiety (≥11 – <11)	p=0.195 {(95%CI: -1.12 (-2.83, 0.58)}-RMDQ
	HADS – Depression (≥11 – <11)	p=0.135 {(95% CI: -2.07 (-4.79, 0.65)}-RMDQ; p=0.051 {(95%CI: -14.58 (-29.19, 0.03)}-MVK disability

Table 9.3.2. Witt 2006.[96] Trial of acupuncture. Significance of interactions reported in main paper. Outcome measured using Hannover Functional Ability Questionnaire

Witt 2006[96] Acupuncture	Worse initial back function Younger >10 years of schooling	p<0.001 Back function and pain improvement at 3 months with acupuncture treatment p<0.001 p=0.01

Table 9.3.3. Underwood 2007.[97] Secondary analysis of UK BEAM dataset. Tested manual therapy, group exercise of manual therapy followed by exercise (combined treatment. Outcome report Roland Morris Disability Questionnaire

Study ID	Variables	Significant interaction with intervention (p-value given or no significant interaction seen (NSI))	
Underwood 2007[97] Manual therapy or manual therapy plus exercise		3 months for RMDQ	12 months for RMDQ
		<u>Combined treatment</u>	
	Quality of life	p=0.174 {(95%CI: -0.1 (-0.26, 1.43)}	NSI
	<u>Treatment</u>		
	Helpful	p= 0.073 {(95%CI: -3.2 (-6.74, 0.30)}	p=0.038 {(95%CI: -3.8 (-7.39, -0.20)}
	Very helpful	p=0.192 {(95%CI: -2.2 (-5.49, 1.11)}	p=0.019 {(95%CI: -4.0 (-7.38, -0.67)}
		<u>Manipulation</u>	
	Beliefs	p=0.07 {(95%CI: -0.8 (-1.62, 0.06)}	NSI
	Quality of life	p=0.118 {(95%CI: 1.4 (-0.35, 3.07)}	NSI
	Pain/Disability	p=0.176 {(95%CI: -1.9 (-4.61, 0.85)}	p=0.143 {(95%CI: -2.2 (-5.16, 0.75)}
	<u>Treatment</u>		
	Helpful	NSI	p=0.083 {(95%CI: -0.1 (-0.16,0.01)}
	Very helpful	p=0.113 {(95%CI 1.6 (-0.38, 3.60)}	NSI

Table 9.3.4. Sherman 2009.[98] Secondary analysis of Cherkin acupuncture trials, compared two acupuncture regimens and a sham procedure with usual care
Outcome reported Roland Morris disability Questionnaire

Study ID	**Variables**	**Significant interaction with treatment for back related dysfunction (Roland score) (p-value given or No significant interaction seen (NSI))**					
Sherman 2009[98] Acupuncture		8 weeks			52 weeks		
		Individualised acupuncture	Standardised acupuncture	Simulated acupuncture	Individualised acupuncture	Standardised acupuncture	Simulated acupuncture
	Age	NSI	p=0.08	NSI	NSI	p=0.15	NSI
	Self-efficacy	p=0.04	NSI	NSI	NSI	NSI	NSI
	Baseline Roland score	p<.0001	p=0.004	p=0.001	p=0.07	p=0.07	NSI
	Baseline bothersomeness score	NSI	p=0.10	NSI	NSI	NSI	NSI
	Heavy lifting	p=0.03	p=0.13	p=0.18	p=0.01	p=0.15	p=0.04
	Sedentary	NSI	NSI	NSI	p=0.12	p=0.15	NSI
	Use of narcotic medication	NSI	p=0.04	p=0.19	NSI	p=0.04	p=0.19
	Acupuncture expectation (top tertile)	NSI	p=0.17	p=0.03	NSI	p=0.17	p=0.03
		Significant interaction with treatment symptom bothersomeness score (p-value given or No significant interaction seen (NSI))					
	Age	NSI	p=0.09	p=0.07	NSI	p=0.15	p=0.08
	Self-efficacy	p=0.14	NSI	NSI	NSI	NSI	NSI

	Baseline Roland score	p=0.01	NSI	p=0.0005	p=0.16	NSI	NSI
	Heavy lifting	p=0.05	NSI	NSI	p=0.02	NSI	NSI
	Light/medium lifting	NSI	P=0.12	NSI	p=0.12	NSI	NSI
	Sedentary	NSI	NSI	NSI	p=0.19	NSI	NSI
	Acupuncture expectation (top tertile)	p=0.1	NSI	NSI	p=0.051	NSI	p=0.06

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11 Appendix

11.1 Roland and Morris Disability Questionnaire (RMDQ)

This section is about your back pain <u>today</u>. When your back hurts, you may find it difficult to do some of the things you normally do. This list contains some sentences that people have used to describe themselves when they have back pain. When you read them, you may find that some stand out because they describe you <u>today.</u> As you read the list, think of yourself **<u>today</u>**. When you read a sentence that describes you today, **<u>place a cross in the box beside it</u>**. If the sentence does not describe you, then leave the box blank and go on to the next one. Remember, only place a cross if you are sure that it describes you **<u>today</u>.**

1. I stay at home most of the time because of my back. ☐
2. I change positions frequently to try and get my back comfortable. ☐
3. I walk more slowly than usual because of my back. ☐
4. Because of my back, I am not doing any of the jobs that I usually do around the house. ☐
5. Because of my back, I use a handrail to get upstairs ☐
6. Because of my back, I lie down to rest more often. ☐
7. Because of my back, I have to hold on to something to get out of an easy chair. ☐
8. Because of my back, I try to get other people to do things for me. ☐
9. I get dressed more slowly than usual because of my back. ☐
10. I only stand up for short periods of time because of my back. ☐
11. Because of my back, I try not to bend or kneel down. ☐
12. I find it difficult to get out of a chair because of my back. ☐
13. My back is painful almost all the time. ☐
14. I find it difficult to turn over in bed because of my back. ☐
15. My appetite is not very good because of my back pain. ☐
16. I have trouble putting on my socks (or stockings) because of the pain in my back. ☐
17. I only walk short distances because of my back pain. ☐
18. I sleep less well because of my back. ☐
19. Because of my back pain, I get dressed with help from someone else. ☐
20. I sit down for most of the day because of my back. ☐
21. I avoid heavy jobs around the house because of my back. ☐
22. Because of my back pain, I am more irritable and bad tempered with people than usual. ☐
23. Because of my back, I go upstairs more slowly than usual. ☐
24. I stay in bed most of the time because of my back. ☐

11.2 Pain – Numerical Rating Scale (Pain-NRS)

Question: “Please rate on a 0 to 10 scale (0 = no pain, 10 = worst pain) average pain over last 24 hours.”[99]

11.3 Search string for between-group difference in scores – RMDQ and Pain (NRS): Start Date 2006-present

EMBASE PubMED

NRS:

#1(a) Instrument search: All Title and abstract

“numerical rating scale” OR “NRS” OR “numerical pain intensity scale” OR “numerical pain rating scale” OR “analogue rating scale”

#2 Population search: (ie string A OR B)

STRING A All Title and abstract

"low back pain"OR"back pain"OR"lumbar vertebrae"OR"spine"OR"spinal diseases"OR"facet"OR"facet joint"OR"zygapophyseal joint"OR "zygapophysial joint"OR "lumbar sacral pain"

STRING B

Mesh: Low back pain Generic pop: **(a la Hancock Mindy C)**

Back Pain, Low OR Back Pains, Low OR Low Back Pains OR Pain, Low Back OR Pains Low Back OR Lumbago OR Lower Back Pain OR Back Pain, Lower OR Back Pains, Lower OR Lower Back Pains OR Pain, Lower Back OR Pains, Lower Back OR Low Back Ache OR Ache, Low back OR Aches, Low Back OR Back Ache, Low OR Back Aches, Low OR Low Back Aches OR Low Backache OR Backache, Low OR Backaches Low OR Low Backaches OR Low Back Pain, Recurrent OR Recurrent Low Back pain OR Low Back Pain, Postural OR Postural Low Back Pain OR Low Back Pain, Mechanical OR Mechanical Low Back Pain Or Low Back Pain, Posterior Compartment

#3 MIC related measurement terms: instrumentation[sh] OR methods[sh] OR Validation Studies[pt] OR Comparative Study[pt] OR psychometrics[MeSH] OR psychometr*[tiab] OR clinimetr*[tw] OR clinometr*[tw] OR “outcome assessment (health care) [MeSH] OR outcome assessment[tiab] OR outcome measure*[tw] OR observer variation[MeSH] OR observer variation[tiab] OR Health Status Indicators[Mesh] OR (uncertainty[tiab] AND (measurement[tiab] OR measuring[tiab])) OR “standard error of measure-ment”[tiab] OR sensitiv*[tiab] OR responsive*[tiab] OR ((minimal[tiab] OR minimally[tiab] OR clinical[tiab] OR clinically[tiab]) AND (important[tiab] OR significant[tiab] OR detectable[tiab]) AND

(change[tiab] OR difference[tiab])) OR (small*[tiab] AND (real[tiab] OR detectable[tiab]) AND (change[tiab] OR difference[tiab])) OR meaningful change [tiab]

#4 Exclusion filter: ("addresses"[Publication Type] OR "biography"[Publica-tion Type] OR "case reports"[Publication Type] OR "comment"[Publication Type] OR "directory"[Publication Type] OR "editorial"[Publication Type] OR "fest-schrift"[Publication Type] OR "interview"[Publication Type] OR "lectures"[Publication Type] OR "legal cases"[Publication Type] OR legislation"[Publication Type] OR "letter"[Publication Type] OR "news"[Publi-cation Type] OR "newspaper article"[Publication Type] OR "patient education handout"[Publication Type] OR "popular works"[Publication Type] OR "congresses"[Publication Type] OR "consensus development conference"[Publication Type] OR "consensus development conference, nih"[Publication Type] OR "practice guide-line"[Publication Type]) NOT ("animals"[MeSH Terms] NOT "humans"[MeSH Terms])

Searches were:#1 (a) AND #2 (string A OR string B) AND #3 NOT #4

RMDQ:
All as NRS except instrument search was for RMDQ (#1b) shown below.

RMDQ

#1 (b) Instrument search

"Roland and Morris Disability Questionnaire" OR "R M D Q" OR "R M Q" OR "Roland Morris Disability Questionnaire" OR "Roland Morris Disability Scale" OR "Roland & Morris Disability Questionnaire" OR "Roland Morris Questionnaire" OR "Roland-Morris Disability Questionnaire" OR "Roland-Morris Questionnaire" OR "Roland-Morris" OR " Roland Morris 18 item Disability Questionnaire" OR "Roland-Morris Disability" OR "Roland and Morris"

Searches were:#1 (b) AND #2 (string A OR string B) AND #3 NOT #4

11.4 Exclusion filter for PubMed used in search strategy for 'Best usual care'

("addresses"[Publication Type] OR "biography"[Publication Type] OR "case reports"[Publication Type] OR "comment"[Publication Type] OR "directory"[Publication Type] OR "editorial"[Publication Type] OR "fest-schrift"[Publication Type] OR "interview"[Publication Type] OR "lectures"[Publication Type] OR "legal cases"[Publication Type] OR "legislation"[Publication Type] OR "letter"[Publication Type] OR "news"[Publication Type] OR "newspaper article"[Publication Type] OR "patient education handout"[Publication Type] OR "popular works"[Publication Type] OR "congresses"[Publication Type] OR "consensus development conference"[Publication Type] OR "consensus development conference, nih"[Publication Type] OR "practice guide-line"[Publication Type]) NOT ("animals"[MeSH Terms] NOT "humans"[MeSH Terms])

11.5 The Facet Injection Study Team

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