Public Health England

Protecting and improving the nation's health

Return on Investment of Interventions for the Prevention and Treatment of Musculoskeletal Conditions

Report of Literature Review

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Executive summary

Introduction

Public Health England (PHE) has commissioned York Health Economics Consortium (YHEC) to develop an economic tool to compare the return on investment of interventions and programmes for the prevention of musculoskeletal (MSK) conditions. This is in light of the high, and rising, financial costs, loss in quality of life and loss of productivity associated with MSK conditions. The tool has been developed in response to requests from local commissioners and decision makers. It focuses on high volume MSK conditions in working age adults (osteoarthritis hip and knee, back pain and neck pain) and compares the cost effectiveness of a selected number of interventions.

The objective of the literature review work was to conduct a literature review to identify which interventions are cost-effective in reducing the complications associated with osteoarthritis of the hip or knee, neck pain or back pain.

The findings were used to develop a return on investment (ROI) tool that allows the resource and financial consequences of implementing these cost-effective interventions nationally and at local levels.

Methods

The first stage of the work was an evidence review to identify cost-effective interventions for patients with osteoarthritis, back pain, or neck pain, in order to inform selection of the interventions which could be included in the economic tool. A second stage literature review was then conducted, comprising focused searches to seek further evidence of cost effectiveness for these candidate interventions and to inform the development of a protocol for the economic tool.

Results

The Stage One searches identified 5,336 records (Table 3.1). Following de-duplication, a total of 4,040 records were assessed for relevance. Following screening, 107 relevant records remained, nearly two thirds of which were studies of interventions for back pain.

Table 3.1: Number of relevant records for each condition

Conditions	Number of relevant records
Back pain	65
Neck pain	7
Neck and back pain	6
OA hip/knee	25
All (back, neck, OA)	4
Total	107

The majority of interventions identified were for the secondary prevention of complications of the MSK condition(s) concerned. The few primary prevention interventions identified were all workplace based programmes to prevent MSK problems in high risk jobs.

The results of the stage one searches were discussed at the Steering Group on 15 February 2017. It was agreed that the interventions to be taken forward for more detailed literature review and for inclusion in the ROI tool would be:

- Cognitive and psychological approaches (CBT);
- STarT Back (stratified risk assessment and care);
- Self-referral to physiotherapy;
- ESCAPE-pain (structured community rehabilitation programme);
- Group physical activity classes for back pain;
- Vocational advice in primary care;
- Workplace interventions for neck pain.

The Stage Two targeted searches returned 1,015 records, 705 of which remained after the results were de-duplicated against each other and the results of the initial literature search. Following full text screening and data extraction, 27 studies were found to meet the inclusion criteria.

Discussion and Conclusions

The title and abstract review of potential evidence available in the first stage literature review found good concordance with the interventions included in the recent NICE guidelines for Low Back pain and Osteoarthritis, with the exception of acupuncture, which is not recommended by NICE. The Steering Group was able to use this information to inform the selection of potential interventions for inclusion in the tool, subject to further analysis of evidence in stage two.

The second stage literature review has sought and found evidence of cost effectiveness for the seven interventions selected for potential inclusion in the tool. Following consultation with the Steering and User Groups, the interventions and programmes with sufficient evidence to proceed with inclusion in the tool were:

- Cognitive and psychological approaches (CBT) with exercise;
- STarT Back (stratified risk assessment and care);
- Self-referral to physiotherapy;
- ESCAPE-pain;
- Group physical activity classes for back pain (medical yoga);
- Vocational advice in primary care.

There was insufficient good quality evidence found to include workplace interventions for neck pain. Minor limitations were identified with the conduct of the literature search but these were not judged to have introduced bias into the results.

1. Introduction

1.1 Background

Public Health England (PHE) has commissioned York Health Economics Consortium (YHEC) to develop an economic tool to compare the return on investment of interventions and programmes for the prevention of musculoskeletal (MSK) conditions. This is in light of the high, and rising, financial costs, loss in quality of life and loss of productivity associated with MSK conditions.

The tool has been developed in response to requests from local commissioners and decision makers. It focuses on high volume MSK conditions in working age adults (osteoarthritis hip and knee, back pain and neck pain) and compares the cost effectiveness of a selected number of interventions. Working age adults are defined as 18+, with an upper limit of 75. Users of the economic tool will include those responsible for policy setting, planning, commissioning, delivering and auditing of MSK programmes in local government organisations, health and social care and the voluntary sector.

1.2 Objective

The objective of the literature review work was:

> *To conduct a literature review to identify which interventions are cost-effective in reducing the complications associated with osteoarthritis of the hip or knee, neck pain or back pain. The findings will be used to develop a return on investment (ROI) tool that allows the resource and financial consequences of implementing these cost-effective interventions nationally and at local levels.*

The first stage of the work was an evidence review to identify cost-effective interventions, in order to inform selection of the interventions which could be included in the economic tool. A second stage literature review was then conducted, comprising focused searches to seek further evidence of cost effectiveness for these candidate interventions and to inform the development of a protocol for the economic tool. This report provides a summary of both stages of the literature review.

2. Methods

2.1 Stage One Literature Review

The literature search was designed to identify cost-effectiveness evidence for interventions for patients with osteoarthritis, back pain, or neck pain. A pragmatic, iterative approach was required in order to ensure the volume of records retrieved could be processed within the time and resource constraints of this project. Initial scoping searches demonstrated that an extensive, sensitive search approach would not be feasible; such a strategy returns over 5,000 records in MEDLINE alone.

Eligibility Criteria

The objective of the cost-effectiveness literature review was to identify which interventions are cost-effective in reducing the complications associated with osteoarthritis of the hip or knee, neck pain or back pain. The eligibility criteria outlined in the specification for the project are presented in Table 2.1.

Table 2.1: Eligibility criteria for the review

	Eligible studies	Ineligible studies
Population	Working age people with osteoarthritis of the hip or knee, neck pain or back pain	People outside the ages of 18 to 75
Interventions	Any relevant MSK prevention/intervention programme (can be primary prevention, secondary prevention or not defined)	Studies incorporating multiple interventions (i.e. not only MSK prevention) where the data for MSK prevention interventions are not reported separately.
Comparators	Any MSK prevention/intervention programme No intervention	Studies incorporating multiple interventions (i.e. not only MSK prevention) where the data for MSK prevention interventions are not reported separately.
Outcomes	Cost-effectiveness outcomes e.g. cost per condition prevented, total cost savings, return on investment, cost per QALY, productivity gains Health outcomes e.g. number of complications, number of hospitalisations.	Studies not reporting cost-effectiveness outcomes.
Study design	Economic evaluations (cost-effectiveness studies, cost-utility studies, cost-benefit analyses); Costing reports; Systematic reviews of economic evaluations; Health technology assessments.	Studies with no evidence of cost-effectiveness evaluations being undertaken.
Limits	Evidence in English Evidence available as full text e.g. journal articles, reports, theses	Evidence in languages other than English Evidence in abstract form only e.g. abstracts of conference presentations

Study Features and Design

To be eligible for inclusion in the review studies were:

- Published in English (as per NICE process and methods manual[10]);
- Conducted within an OECD country - in an attempt to improve generalisability to the English setting.

No date restrictions were applied to the search.

Only the following study types were eligible:

- Cost-utility analyses;
- Cost-effectiveness analyses;
- Cost-benefit analyses;
- Cost-minimisation analyses;
- Cost-consequences analyses;
- Randomised controlled trials (RCT) that include economic data in the study designs.

Burden of disease and cost of illness studies were included in the cost-effectiveness review but were filed for background information.

Databases Searched

Relevant economic evaluations were searched for primarily from the NHS Economic Evaluations Database (NHS EED), Health Technology Assessment Database (HTA Database) and Cost Effectiveness Analysis Registry (CEA Registry). These searches were not limited by date. Searching resources which only include economic or HTA evidence was intended to increase precision and limit retrieval of irrelevant records which do not report eligible outcomes. As the last searches to identify studies for inclusion in NHS EED covered up to December 31 2014; these searches were supplemented by searches of MEDLINE (Ovid) and Embase (Ovid) to identify studies with a publication date of January 2015 to current, or studies which were added to the databases after 1st January 2015 regardless of publication date. We acknowledge that this approach is likely to miss relevant studies that are not included in these economic specific resources. We sought to limit this risk by the use of supplementary evidence identification techniques including checking the reference lists of eligible studies and reviews, and seeking both published and unpublished evidence from Public Health England and the Steering Group.

The databases and information sources searched are shown in Table 2.2.

Table 2.2: Databases and information sources searched

Database / information source	Interface / URL
Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) 1946 to Present	OvidSP
Embase	OvidSP
Health Technology Assessment Database	Cochrane Library / Wiley
NHS Economic Evaluation Database	Cochrane Library / Wiley
CEA Registry	http://healtheconomics.tuftsmedicalcenter.org /cear4/Home.aspx

The following search strategy in Figure 2.1 was used to search MEDLINE (OvidSP interface). It was translated appropriately to run in the other databases specified.

The strategy was structured using the following concepts:

- Osteoarthritis OR back pain OR neck pain (search lines 1-37);

AND

- Economic evaluations (search lines 38-57).

Search terms for back pain and neck pain include generic terminology, in addition to specific common diagnoses which may result in this type of pain. Specifically the search included terms to describe:

- Sciatica;
- Whiplash;
- Radiculopathy;
- Displaced or degenerated discs;
- Spondylitis including ankylosing spondylitis;
- Cervical spondylosis;
- Spinal stenosis;
- Brachial plexus neuropathy;
- Torticollis;
- Fibromyalgia;
- Chronic Widespread Pain.

The search terms used for the cost-effectiveness concept comprised the Centre for Reviews and Dissemination (CRD) search filter developed to identify economic evaluations for inclusion in the NHS Economic Evaluations Database (NHS EED). This search filter was supplemented by a search line to identify evidence related to ROI as this outcome is not specifically covered by CRD (search lines 55 and 56).

Animal studies are removed from the MEDLINE strategy using a standard algorithm. The strategy also excludes publication types that are unlikely to yield relevant information; comments, editorial, news, letters and case reports. The MEDLINE search is limited to English language studies only, published or added to the database since 1 January 2015.

Figure 2.1: Search strategy used to identify records in Ovid MEDLINE

1	Osteoarthritis/ or Osteoarthritis, Hip/ or Osteoarthritis, Knee/
2	(osteoarthrit$ or osteo-arthrit$ or osteoarthro$ or osteo-arthro$).ti,ab,kf.
3	(coxarthr$ or gonarthr$).ti,ab,kf.
4	((degenerative or non-inflammatory or noninflammatory) adj3 arthri$).ti,ab,kf.
5	((knee or knees or hip or hips or cox or coxa or coxas or femorotibial) and (arthrosis or arthroses)).ti,ab,kf.
6	degenerative joint disease.ti,ab,kf.
7	exp Back Pain/ or Neck Pain/
8	Sciatica/ or Sciatic Neuropathy/
9	Radiculopathy/
10	exp Neck Injuries/ or Back Injuries/
11	Intervertebral Disc Displacement/ or Intervertebral Disc Degeneration/
12	exp Spondylitis/ or exp Spondylosis/ or Spinal Stenosis/
13	exp Brachial Plexus Neuropathies/
14	Torticollis/
15	chronic pain/ or fibromyalgia/
16	(exp back/ or exp back muscles/ or exp spine/ or exp neck/ or neck muscles/ or hip/ or exp hip joint/ or knee/ or exp knee joint/) and (pain/ or acute pain/ or musculoskeletal pain/ or myalgia/ or arthralgia/ or exp neuralgia/ or exp nociceptive pain/ or pain, intractable/ or pain, referred/ or exp "sprains and strains"/)
17	(backache$ or lumbago or sciatica or sciaticas).ti,ab,kf.
18	(dorsalgia$ or coccydynia$).ti,ab,kf.
19	(cervicalgia$ or cervicodynia$ or neckache$ or brachialgia$).ti,ab,kf.
20	((back or backs or spine$1 or spinal or sacroiliac or vertebrogenic or lumbar or lumbosacral or lumbo-sacral or cervical or coccy$ or tailbone$ or tail bone$ or thoracic or radicular or neck or necks or cervicobrachial or brachial or knee or knees or tibiofibular or patellofemoral or hip or hips or coxa or coxas or acetabulofemoral) adj3 (pain$ or ache or aches or aching or discomfort$ or stiff$ or neuralgia$ or neuralgic$ or neuropath$ or neuriti$ or sprain$1 or strain$1 or injur$ or myalgia$1 or myalgic or arthralgi$ or allodyni$ or hyperalgesi$ or misalign$)).ti,ab,kf.
21	((disc or discs or disk or disks) adj3 (hernia$ or slipped or slip or displac$ or prolapse$ or degenerat$ or degradat$ or bulge$ or bulging or protrud$ or protrusion$)).ti,ab,kf.
22	(whiplash or cervical acceleration deceleration).ti,ab,kf.
23	(torticollis or cervical dystonia$).ti,ab,kf.
24	(nerve root$ adj3 (pain$ or avulsion or compress$ or disorder$ or pinch$ or inflam$ or imping$ or irritat$ or entrap$ or trap$)).ti,ab,kf.
25	(radiculopath$ or radiculitis or radiculitides).ti,ab,kf.
26	(brachial plexopath$ or klumpke paralysis or dejerine-klumpke or klumpke$ pals$).ti,ab,kf.
27	(parsonage-aldren-turner or parsonage-turner).ti,ab,kf.
28	(brachial plexus adj3 (disorder$ or disease$ or paralys$)).ti,ab,kf.
29	(amyotrophic adj3 (neuralgia$ or neuralgic$ or neuropath$ or neuriti$)).ti,ab,kf.
30	(shoulder girdle$ adj3 (neuralgia$ or neuralgic$ or neuropath$ or neuriti$)).ti,ab,kf.
31	(erb adj3 (paraly$ or palsy or palsies)).ti,ab,kf.
32	(ankylosis or spondylitis or spondylitide$ or discitis or discitides or diskitis or diskitides or spondylodisk$ or spondylodisc$ or spondylarthr$ or spondyloarthr$ or spondylos$ or spondylolisthes$).ti,ab,kf.
33	(spinal arthr$ or marie-strumpell or bechterew).ti,ab,kf.
34	(spinal stenoses or spinal stenosis).ti,ab,kf.
35	(chronic widespread pain$ or CWP or CWPS or widespread pain disorder$ or widespread pain syndrome$).ti,ab,kf.
36	(fibromyalgi$ or fibromyositis or fibrositis or fibrositides or muscular rheumatism or myofascial pain syndrome).ti,ab,kf.
37	or/1-36

38	economics/
39	exp "costs and cost analysis"/
40	economics, dental/
41	exp "economics, hospital"/
42	economics, medical/
43	economics, nursing/
44	economics, pharmaceutical/
45	(economic$ or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic$).ti,ab.
46	(expenditure$ not energy).ti,ab.
47	(value adj2 money).ti,ab.
48	budget$.ti,ab.
49	or/38-48
50	((energy or oxygen) adj cost).ti,ab.
51	(metabolic adj cost).ti,ab.
52	((energy or oxygen) adj expenditure).ti,ab.
53	50 or 51 or 52
54	49 not 53
55	((return$ or gain$1) adj3 investment$1).ti,ab,kf.
56	(ROI or ROIs).ti,ab,kf.
57	54 or 55 or 56
58	37 and 57
59	exp animals/ not humans/
60	(news or comment or editorial or letter or case reports).pt. or case report.ti.
61	58 not (59 or 60)
62	limit 61 to (english language and yr="2015 -Current")
63	(2015* or 2016* or 2017*).dc.
64	(2015* or 2016* or 2017*).ed.
65	61 and (63 or 64)
66	62 or 65
67	remove duplicates from 66

The MEDLINE strategy was translated appropriately for other databases. Full strategies (including search dates) for all sources searched are included in Appendix A.

Searching a number of databases produces a degree of duplication in the results. To manage this issue, the titles and abstracts of bibliographic records were downloaded and imported into EndNote bibliographic management software and duplicate records were removed using several algorithms. Where result format did not facilitate loading into EndNote, Word documents or Excel spreadsheets were used as appropriate.

Study Selection

The records were screened on title and abstract by two reviewers, who identified studies meeting the eligibility criteria in the protocol. Records which were not reporting cost effectiveness outcomes, but were thought to be potentially of use in the modelling stage of the work, were identified and filed separately. The two reviewers then reviewed each other's selected records, discussing any areas of variation, in order to ensure consistency of applying the criteria. The resulting list of included records was categorised according to which of the key conditions they related to. The number of records included and removed at each selection stage were recorded according to the PRISMA template (Appendix B).

Evidence from the Steering Group and User Group

As the literature search protocol may have missed relevant studies that are not included within published resources, we also sought to include supplementary evidence, both published and unpublished, from members of the Steering Group and User Group. Steering Group members were invited to share any examples of existing MSK prevention programmes currently in operation and any literature about MSK prevention programmes, either published or in the process of publication. The User Group members were asked to share any intelligence about which MSK prevention interventions are currently being used locally and appropriate grey literature on the evaluation of MSK prevention programmes.

Selection of the Interventions for Consideration by the Steering Group

The information gained from the literature review, Steering Group evidence and the information supplied by the User Group was synthesised to provide an overview of the range of interventions. The information was tabulated and interventions grouped into categories to form a 'long list'. This enabled us to observe concordance between the literature review findings and the information shared by the Steering Group and the User Group.

The resulting categories (e.g. physical activity, integrated programmes) were further analysed according to the condition concerned. For the eight most frequently occurring interventions in the long list, a summary of the extent of cost effectiveness evidence available contained within the abstract was summarised for each category of intervention, for consideration by the Steering Group.

2.2 Stage Two Literature Review

Following the completion of the broader search to identify cost-effectiveness studies patients with osteoarthritis, back pain, or neck pain, we then undertook a series of highly targeted, pragmatic searches using MEDLINE (Ovid) and CINAHL in order to identify evidence specific to the seven shortlisted interventions, to add to those of relevance from the stage one review:

- Cognitive and psychological approaches (CBT);
- STarT Back;
- Self-referral to physiotherapy;
- ESCAPE-pain;
- Group physical activity classes for back pain;
- Vocational advice in primary care;
- Workplace interventions for neck pain.

The purpose of these searches was two-fold: a) to identify any additional cost effectiveness evidence not retrieved by the initial searches b) identify evidence for the efficacy of these interventions which may be required for model inputs. The strategies were highly pragmatic and prioritised sensitivity over precision. The approach was tailored by the intervention; for example searches for the “branded” interventions (ESCAPE-pain, STarT Back, and SWAP) could be fairly broad and did not require date or study design limits due to the specific language used to describe them and the relatively limited size of the literature. In contrast, the literature on CBT for back or neck pain is much larger and more difficult to capture without returning a volume of records beyond that which could be screened within the constraints of this project. For this intervention we identified recently published Cochrane systematic reviews for the effectiveness data and undertook bibliographic database searches only for economic evaluations that may have been missed by the initial searches.

Search strategies were limited to exclude animal studies, non-English language studies, and publication types unlikely to be relevant (letters, editorial, news, comment, case reports). Full details of each search strategy are provided in Appendix D.

Database searches were supplemented by evidence identification techniques including checking the reference lists of eligible studies and reviews, and exploration of further unpublished evidence. We also searched and browsed relevant webpages (e.g. the ESCAPE-pain and STarT Back programme webpages for additional literature.

Assessing the Relevance of Studies to the Review

Results from the first stage searches were re-screened on title and abstract to identify those of relevance to the seven shortlisted interventions. Results from the second stage searches were similarly screened for relevance by the review team, based on title and abstract and using the eligibility criteria set out in Table 2.1. The number of records included and removed at each selection stage was recorded according to the PRISMA template (Appendix B).

The screened results from both stages of the literature searches were categorised according to each intervention. Full texts of these studies were obtained for detailed assessment of relevance to the review's eligibility criteria, data extraction and quality assessment. Studies excluded after assessment of the full document are described in an excluded studies table with the reasons for exclusion Appendix C.

Data Extraction

Data extraction of the full text papers was conducted by three researchers. For each included study the following data were extracted:

- Bibliographic details;
- Study type (e.g. RCT with economic evaluation plus details such as follow-up);
- Setting, country and location;
- Intervention in detail (who, where, when);
- Comparator in detail (who, where, when);
- Number of participants (total number of participants included in the study, the numbers of participants who started and completed the study in each arm);
- Patient characteristics (age, sex, ethnic origin);
- Methods of analysis (type of economic analysis, data sources, time horizon, discount rates, perspective and sensitivity analysis);
- Cost of intervention and timeframe for delivery;
- Outcomes: results for primary and secondary outcomes, resource utilisation outcomes, time at which outcomes were reported;
- Factors found to be critical to the success of the intervention;
- Study quality assessment and applicability.

The full data extraction and evidence tables are available on request.

Assessing the Quality of Studies

The quality of the eligible studies was assessed using the appropriate appraisal checklist (Appendix H of the NICE Process and Methods manual). This includes the following quality assessment questions on applicability and study limitations:

1. Applicability

- Is the study population appropriate for the review question?
- Are the interventions appropriate for the review question?
- Is the system in which the study was conducted sufficiently similar to the current UK context?
- Are the perspectives clearly stated and are they appropriate for the review question?
- Are all direct effects on individuals included, and are all other effects included where they are material?
- Are all future costs and outcomes discounted appropriately?
- Is QALY used as an outcome, and was it derived using NICE's preferred methods? If not, describe rationale and outcomes used in line with analytical perspectives taken;
- Are costs and outcomes from other sectors fully and appropriately measured and valued?
- Overall judgement: Directly applicable/partially applicable/not applicable.

Section 2 of the checklist is not completed if the study is considered 'not applicable'.

2. Study limitations

- Does the model structure adequately reflect the nature of the topic under evaluation?
- Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?
- Are all important and relevant outcomes included?
- Are the estimates of baseline outcomes from the best available source?
- Are the estimates of relative intervention effects from the best available source?
- Are all important and relevant costs included?
- Are the estimates of resource use from the best available source?
- Are the unit costs of resources from the best available source?
- Is an appropriate incremental analysis presented or can it be calculated from the data?
- Are all important parameters whose values are uncertain subjected to appropriate sensitivity analysis?
- Is there any potential conflict of interest?

- Overall assessment: minor limitations/potentially serious limitations/very serious limitations.

Data Synthesis

Following full text review and quality assessment the relevant content from each study was synthesised for each of the seven shortlisted interventions.

3. Results

3.1 Stage One Literature Review

The searches identified 5,336 records (Table 3.1). Following de-duplication, a total of 4,040 records were assessed for relevance.

Table 3.1: Literature search results

Resource	Records identified
Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) 1946 to Present	1,583 + 498
Embase	1,599 + 321
Health Technology Assessment Database	580
NHS Economic Evaluation Database	617
CEA Registry	138
TOTAL	**5,336**
TOTAL after deduplication	**4,040**

Following screening, 107 relevant records remained, nearly two thirds of which were studies of interventions for back pain. The number of studies for each of the conditions is shown in Table 3.2.

Table 3.2: Number of relevant records for each condition

Conditions	Number of relevant records
Back pain	65
Neck pain	7
Neck and back pain	6
OA hip/knee	25
All (back, neck, OA)	4
Total	107

Overview of Interventions

A total of 19 groups of MSK interventions have been identified from the stage one evidence review. The interventions and the number of records from each evidence source are listed in Table 3.3. The majority of interventions identified are for the secondary prevention of complications of the MSK condition(s) concerned. The few primary prevention interventions identified are all workplace based programmes to prevent MSK problems in high risk jobs.

Table 3.3: Number of records from each evidence source for interventions

Intervention	No. of records from literature review					Steering group evidence	User group examples
	Back pain	Neck pain	Back / neck	All	OA hip / knee		
Exercise therapy	4				9	4	4
Integrated/multi-disciplinary programmes	12	2		1	5	3	1
Workplace programmes	9	4		2			5
Self-management / education	1				2	2	
Stratified assessment and care	2					2	1
Cognitive approaches	7			1	1	1	
Physiotherapy	9	6			1		
Acupuncture	9	1			2		
Osteopathy	1						
Chiropractic	6						
Back belts/lumbar supports	2						
Massage (inc Alexander technique)	1						
Brief pain management programme	1						
Health coaching					1		
Mud bath therapy (for OA)					1		
Water based therapy					1		
Yoga	3				1		
Emergency Department pathway (including patient education)	1						
Classification system (Delitto's)	1						

Selection of Interventions for Further Review

The screening of results involved in the first stage of the literature review, indicates eight groups of interventions with significant levels of potential cost-effectiveness evidence. Contributions from the Steering Group and User Group also indicated that these groups of interventions are likely to be highly relevant to the development of the ROI tool. Most also have commonality with interventions recommended in relevant NICE guidelines[1,2], whereas some with little evidence (mud baths, belts and braces, massage, chiropractic and osteopathy) are not recommended by NICE.

[1] NICE Guideline NG59: *Low back pain and sciatica in over 16s: assessment and management.* November 2016
[2] NICE Clinical Guideline CG177: *Osteoarthritis: Care and management in adults*. February 2014.

The eight groups of interventions are categorised as:

- Exercise therapy;
- Integrated/multi-disciplinary programmes;
- Workplace programmes;
- Self-management / education;
- Stratified assessment and care;
- Cognitive approaches;
- Physiotherapy;
- Acupuncture.

A brief summary of the extent of cost-effectiveness evidence, based on abstract only, has been summarised for each category in Appendix C. The information gives some indication of the strength of cost-effectiveness evidence for the eight groups of interventions, for different conditions, based on the abstract screening. There is relatively little evidence for interventions for neck pain, compared to back pain. For OA, there appears to be more evidence relating to OA knee than OA hip.

The results of the stage one searches were discussed at the Steering Group on 15 February 2017. It was agreed that the interventions to be taken forward for more detailed literature review and for inclusion in the ROI tool would be:

- Cognitive and psychological approaches (CBT);
- STarT Back (stratified risk assessment and care);
- Self-referral to physiotherapy (the focus will be on the incremental benefits derived from patients being able to access services more quickly, as opposed to physiotherapy itself which can be considered to be cost-effective per se);
- ESCAPE-pain (structured community rehabilitation programme);
- Group physical activity classes for back pain;
- Vocational advice in primary care;
- Workplace interventions for neck pain.

3.2 Stage Two Literature Review

The targeted searches returned 1,015 records, 705 of which remained after the results were de-duplicated against each other and the results of the initial literature search. Following full text screening and data extraction, 27 studies were found to meet the inclusion criteria. The numbers of studies for each intervention are listed in Table 3.4.

Table 3.4: Number of included studies for each intervention

Intervention	Number of included studies
Cognitive and psychological approaches (CBT)	6
STarT Back (stratified risk assessment and care)	4
Group physical activity classes for back pain	6
Self-referral to physiotherapy	4
SWAP – vocational advice in primary care	1
ESCAPE-pain	3
Workplace interventions for neck pain	3
Total	27

Overview of the Studies

The summary features of the included studies is presented in Table 3.5.

Table 3.5: Overview of studies

Country setting for the intervention	UK 18; USA 3; Netherlands 3; Sweden 1; Denmark 1; Review including Scandinavian studies and one US study.
Patient characteristics	Age: all adults over 18 years, many with an upper age of 65 years. For those stating mean age this was commonly late 30s/early 40s for interventions aimed at working population and mid-60s for those not specific to a working population.
Delivery setting	The setting varied according to the nature of the intervention. However, for the UK based studies (the majority) the interventions were mostly taking place in primary or community settings. This was to be expected as the interventions were generally for individuals not in an acute setting but requiring assistance with return to work or managing everyday tasks.
Follow-up period	The vast majority of the studies used a final follow-up period of 12 months, with interim results variously reported at 3, 4 or 6 months. A small number of studies reported outcomes at over 12 months.
Summary of quality assessments from checklists	The quality assessment templates showed that all of the included studies were applicable to the review question. This was largely because they had been subject to full text review and data extraction prior to quality assessment. The assessment of study limitations revealed that some studies had potentially serious limitations and these are noted in the content description in the relevant sections below.

3.3 Summary for Evidence for Each Intervention

Cognitive and Psychological Approaches (CBT)

The included studies for CBT approaches all related to back pain. Lamb et al. [1] conducted a randomised controlled trial of a primary-care based cognitive behavioural programme for low back pain: the Back Skills Training (BeST), in the UK. The BEST intervention, for adults with lower back pain for more than six weeks, consisted of six sessions of CBT delivered as group therapy, (including the understanding of pain, benefits of exercise, setting goals and coping with flare ups). The accompanying cost utility analysis found the intervention to be cost effective from a healthcare perspective, with an average QALY gain of 0.099 and a mean cost per patient of attending a cycle of CBT of £187 (2008). This good quality study included full sensitivity analysis on all key parameters and provides data and parameters which could be used in an economic model. In a similar study, Lamb et al. [2] found six sessions of a group cognitive behavioural treatment for moderately troublesome sub-acute or chronic low back pain to be cost effective, with an incremental cost per QALY was £1,786 and the probability of being cost-effective of greater than 90% at a threshold of £3,000 per QALY.

A cost effectiveness study by Manca in 2007 [3] compared physiotherapy with and without CBT, using solution finding approach, for back or neck pain that had been present for more than two weeks. The cost utility evaluation of concluded that physiotherapy-led CBT was no more effective than the physiotherapy without CBT and concluded that traditional physiotherapy was likely to be more cost effective.

Three studies in the USA were less useful. Rogerson et al. [4] compared the cost utility of an interdisciplinary early intervention versus treatment as usual, for patients with high-risk acute low back pain lasting less than 10 weeks (the algorithm to identify high risk was not provided). The intervention of six to nine sessions of both cognitive-behavioural and physical therapy included coping skills training, relaxation, and biofeedback. The cost utility analysis took a societal perspective and found no significant impact on pain or change in QALYs, with a statistically significant difference in work days missed (difference of 12.2 days in the mean for intervention over treatment as usual). Although this study provides additional evidence for the role of CBT in back pain, it was assessed to have potentially serious limitations and is only partly applicable to the UK setting. Newcomer et al. [5] in the USA compared a videotape to change beliefs and behaviours, to a standard informational videotape in acute low back pain. They conducted a simple cost analysis from the perspective of the health insurer and found no difference between intervention and comparator for any measure. Also in the USA, Strong et al. [6] compared two self-care interventions to reduce disability associated with back pain, one of which included two psychologist led sessions focusing on action planning, problem solving techniques, exercises and posture, plus identifying when medical care would be needed. They found that after 12 months, the number of days where patients were satisfied with their level of back pain was reduced by 26.2 days (i.e. low-impact bed days). However, further cost information was not available in the paper which had serious limitations.

STarT Back (Stratified Risk Assessment and Care)

The STarT Back prognostic risk stratification tool is used by clinicians to identify patients at low, medium, and high risk of persistent disabling lower back pain and follow recommendations for matched treatments. In 2011, Hill et al. [7] studied the clinical and cost-effectiveness of stratified primary care compared with non-stratified current best practice. Following an initial 30 minute assessment and treatment appointment according to an agreed protocol in the study, low risk patients were given advice focusing on appropriate levels of activity, including return to work, an educational video and the Back Book. Medium-risk patients were referred for standardised physiotherapy and high-risk patients were referred for psychologically informed physiotherapy. After 12 months, stratified care was associated with a mean increase in generic health benefit (0·039 additional QALYs) and cost savings (£240·01 vs £274·40) compared with current best practice. Although referral rates with stratified management were higher, these health-sector costs were outweighed by savings due to reductions in referral of low-risk patients and overall use of health-care resources during the follow-up. Based on this trial, Whitehurst et al. [8] conducted a cost-utility analysis which found significant between-group differences in Roland Morris Disability Questionnaire adjusted mean change scores for medium-risk patients at four and 12 months, and high-risk patients at four months. Low-risk patients had non-inferior outcomes compared with controls at both time-points. Patients receiving stratified care also reported fewer back pain-related days off work in all three subgroups. The authors concluded the likelihood that stratified care provides a cost-effective use of resources exceeds 90% at willingness-to-pay thresholds of £4,000 per additional QALY for the medium-risk and high-risk groups (2008/09 prices).

In 2015, Whitehurst et al. [9] reported a 'within study cost-utility analysis' of stratified management for low back pain in primary care, for adults over 18 years. At six months post-intervention, mean health care cost savings were found to be £124, with an incremental QALY estimate of 0.023. The stratified care group was also associated with fewer days of work absence compared with usual care, with associated societal cost savings per employed patient of £736 (medium risk) and £652 (high risk). Analysis included healthcare utilisation and sensitivity analyses examined alternative methodological approaches, including a complete case analysis, the incorporation of non back pain related health care use and estimation of societal costs relating to work absence. The authors concluded that stratified care for lower back pain is cost-effective for patients at high risk of persistent disabling lower back pain.

Apeldoorn et al. [10] studied the cost-effectiveness of a modified version of Delitto's classification-based treatment approach compared with usual physical therapy care in patients with sub-acute and chronic lower back pain in the Netherlands between 2008 and 2010. Patients received treatment according to their classification category (direction specific exercises, spinal manipulation, or stabilization exercises) for a minimum of four weeks. After this period, the physical therapist was allowed to change treatment strategy according to the current Dutch guidelines. At 12 months, the cost-utility analysis showed that classification-

based treatment was more costly and slightly more effective than usual physical therapy care. This study has some similarities with the UK evidence but also some study limitations.

Self-Referral to Physiotherapy

Self-referral to physiotherapy enables patients to access physiotherapy treatment without requiring a formal referral from a primary care clinician. Hollinghurst et al. [11] conducted an economic evaluation of the 'PhysioDirect' telephone assessment and advice service for patients with musculoskeletal problems, based on the trial by Salisbury et al. [12]. PhysioDirect involved telephone assessment plus advice, with the aid of previously developed computerised templates, followed by face-to-face care if needed. Lower limb problems were the most prevalent (30%) reason for referral, with 27% patients having a lumbar problem and 23% upper limb problems. Usual care patients were placed on a waiting list for face-to-face care. At six months there was no evidence of a difference in the clinical outcome, suggesting that PhysioDirect led to similar outcomes as usual physiotherapy care. However, QALYs were higher in the PhysioDirect group by 0.009, equating to about 3.3 extra days of full health over a year. The cost-utility analysis found the costs of physiotherapy in the PhysioDirect were higher by £19.30, with a QALY gain of 0.007, giving an incremental cost-effectiveness ratio £2,889. Post trial, it was found that at the service was found to be more efficient when not constrained by trial conditions. Sensitivity analyses were performed for (1) increased productivity of the therapists, (2) removing hospital costs, (3) imputing missing data. This was viewed to be a directly applicable good quality study with potential to inform the economic model.

In a cost minimisation analysis based on a cohort study, Mallett et al. [13] compared waiting times, attendance rates, cost-effectiveness and the patient experience of a self-referral service, compared to GP referral. The most common reason for self-referral was spinal pain. The analysis showed favourable results for waiting times and a higher percentage of self-referral patients being managed without face-to-face contact (34.3%) compared to GP referral (3.4%). An average saving of £36.42 per patient per episode of care was calculated with the self-referral initiated pathway, due to a reduction in initial appointment non-attendance and fewer mean patient contacts. However, the follow-up period was not clear and not all costs were included, making this this a less reliable study.

Holdsworth et al. [14] conducted a national trial to establish the costs to NHS Scotland of differing modes of access to physiotherapy in primary care for adults in Scotland. The main outcome measures were the number of GP and physiotherapy contacts, prescribing of non-steroidal anti-inflammatory drugs and analgesics, and referral for X-ray, magnetic resonance imaging and/or secondary care. Self-referring patients were less likely to be referred for X-ray, prescribed far fewer drugs compared with patients referred at the suggestion of or by their GP, and used less GP time. Efficiencies were gained from lower DNAs and greater completion of treatment, giving an average cost of an episode of care as £66.31 for a self-referral, £79.50 for a GP-suggested referral and £88.99 for a GP referral (2004).

ESCAPE-pain

The ESCAPE-pain programme is a structured community rehabilitation programme integrating exercise, self-management and active coping strategies for chronic knee pain. Hurley et al. [15] conducted a cost effectiveness evaluation alongside a clinical trial of ESCAPE-pain in the UK, delivered in a group and individual setting. The cost analysis from the NHS perspective of found ESCAPE-pain to cost £224 per person for 12 sessions of 45-60 minutes for six weeks (2003/04 prices). At 30 months, no difference was found in total health and social care resource when using unadjusted data used. When missing data were imputed, ESCAPE-pain was found to be cost saving by £1,118. Hurley et al. [16] found group therapy was found to be just as effective but cheaper than individual therapy.

In a limited study, Jessep et al. [17] compared the benefits and costs of an integrated rehabilitation programme compared with outpatient physiotherapy (up to 10 sessions) for chronic knee pain in 2005. Whilst the authors report that the ESCAPE-pain group had lower resource use, the calculation of the p-value suggests there was no statistical difference in costs. Authors stress that it is important that people on the ESCAPE-pain programme hold positive prior beliefs about exercise.

Group Physical Activity Classes for Back Pain

The review found a number of heterogeneous group interventions for back pain. In a randomized controlled study, Aboagye et al. [18] investigated the cost effectiveness of medical yoga, exercise therapy and self-care advice, in Sweden. Medical yoga comprised twice weekly session for six weeks, plus a CD and written information to support participants to carry on practicing medical yoga no less than twice per week. Exercise therapy provided a six week individual standardised strength training programme followed up by physiotherapist groups once every two weeks. Self-care comprised brief advice on staying active and a booklet. The analysis used a societal perspective including costs associated with the intervention and production loss through sickness absence. At 12 months, medical yoga cost 1,519 Euro less than exercise therapy and 2,124 Euro less than self-care, and showed a better quality of life using HrQOL. Medical yoga was found to have an ICER of 4,984 Euro compared to self-care and was concluded to be the most cost-effective of the interventions. This study was viewed to be directly applicable with only minor limitations.

In a UK randomized controlled trial of active group exercise, education, and cognitive behavioural therapy delivered by physiotherapists, Johnson et al. [19] found the intervention to have a mean ICER of £5,000 per QALY at 15 months. This was a good quality study with cost effectiveness results.

Chuang et al. [20] conducted a pragmatic randomized controlled trial of yoga for chronic low back pain from an NHS and societal perspectives. The yoga group received a 12 week course of yoga (75 minute weekly class) plus relaxation CD, student yoga manual, yoga mat, the Back

Book, education booklet for improving back pain and usual care. The control arm received usual care, a copy of Back Book, plus one yoga class after follow up. The yoga arm gained 0.037 QALYs more than the control arm at an increased cost of £506.80 per patient, giving an ICER of £13,606 and a 72% chance of being cost-effective at a £20k willingness to pay threshold. This was a good quality study covering productivity and resource use costs, plus the inclusion of QALYs.

Van der Roer et al. [21] evaluated an intensive group training protocol compared with usual care physiotherapy in patients with chronic low back pain in the Netherlands (2008). Patients received exercise therapy and a back school intervention of 10 individual sessions and 20 group sessions. The analysis (perspective not stated) reported favourable ICERS for EQ-5D, perceived recovery and Roland Morris Disability Questionnaire scores, plus direct/in-direct healthcare costs with sensitivity analysis applied to indirect costs, which could be used within a model.

Wright et al. [22] conducted a cost minimisation analysis of an individual active treatment combined with group exercise for people aged 18-65 with a new episode of simple back pain causing them to be off work or on modified work for less than one year. The intervention group received the back booklet, one session of advice and also a back program (full assessment, one individual treatment, plus exercise classes over one to two weeks). Over a short two months observation period the intervention group returned to work by a median of seven days quicker than the control group, showing potential productivity benefits and potential savings. This study is partially applicable with minor limitations and would need to be supplemented by other studies to inform the model.

The UK BEAM Trial Team [23] reported cost effectiveness of adding spinal manipulation, exercise classes, or manipulation followed by exercise (‘combined treatment) to ‘best care’ in general practice for patients consulting with low back pain (best care comprised practice teams trained in ‘active management’ and providing the Back Book). The exercise programme comprised an initial assessment and up to nine classes in community settings over 12 weeks. The spinal manipulation package comprised eight sessions over 12 weeks of a package of techniques developed by a multidisciplinary group. In combined treatment participants received six weeks of manipulation followed by six weeks of exercise. This 2004 study found the combination of manipulation and exercise to be most cost effective.

Vocational Advice in Primary Care

The review found only one study protocol and abstract for the provision of vocational advice in a primary care setting. In the Study of Work and Pain (SWAP) Wynne-Jones et al. [24] compared the provision of a vocational advisor in primary care for all MSK conditions, but particularly for spinal pain, to usual care. The advisor helped patients to identify and overcome obstacles to remain at, or return to work, using the Flags Model of management. Participants in the intervention arm had significantly fewer days absent over four months (mean 9.3 days)

compared with control (mean 14.4 days). This difference was largely due to fewer GP certified absent days (8.4 days versus 13.5 days). At 12 months the effect of the vocational advice service was significantly greater in those with spinal pain compared to patients with other MSK problems. As this is the only study on this intervention, further detail is required to assess the potential for inclusion in the model.

Workplace Interventions for Neck Pain

The review found no relevant UK evidence on this intervention, with most studies being performed in Scandinavian countries. None of the studies included analysis from a healthcare perspective and included only sickness absence measures.

Aas et al. [25] conducted a review of RCTs into workplace interventions for neck pain in adult workers with neck pain. Workplace interventions, included physical education, mental health education and relaxation, delivered either as single interventions or combining several components. Typically, a 12 month measure was used for 'long term follow up'. Overall, it was concluded that none of the significant results for pain from the workplace interventions were sustained across different follow-up periods. One study had data on sickness absence and provided evidence that a four component workplace intervention was significantly more effective in reducing sick leave in the intermediate term (but not short or long term).

Jorgensen et al. [26] studied the effects on musculoskeletal pain, work ability and sickness absence in a one-year randomised controlled trial among cleaners in Denmark. Physical coordination training, or cognitive behavioural training, were delivered first as an intensive three month phase, and then as a less intensive nine month phase. Only females were included in the analysis due to gender bias in the workers. The control group received a one hour health check, including a pulmonary function test and aerobic capacity test. There was no significant difference in accumulated sickness absence or number of sickness absence spells between groups at baseline or 12 months follow up. Furthermore, no costs were reported.

Spekle et al. [27] studied the cost-effectiveness of the RSI QuickScan intervention programme for computer workers in the Netherlands. Computer workers recruited from seven companies with and without arm, neck or shoulder symptoms received an assessment by RSI QuickScan followed by tailor made advice, with a total of 16 interventions aimed at reducing risk factors available (e.g. eye sight check, work station check). The usual care group received standard, untailored advice. While the intervention group reported improvements in 'work posture and movement' and 'arm, neck and shoulder symptoms', no significant difference was found between groups over 12 months in resource use and costs. The ICER for days of sick leave indicated that investment of 71.31 Euros was associated with an increase in sick leave of one day (an undesired effect) but this effect was non-significant.

4. Discussion and Conclusion

4.1 Discussion Points from Stage One Literature Review

The title and abstract review of potential evidence available in the first stage literature review found good concordance with the interventions included in the recent NICE guidelines for Low Back pain and Osteoarthritis, with the exception of acupuncture, which is not recommended by NICE. The Steering Group was able to use this information to inform the selection of potential interventions for inclusion in the tool, subject to further analysis of evidence in stage two. These interventions are listed in Section 3.1.2.

The following points were also agreed during the discussion:

- Physiotherapy is a profession, not an intervention and should therefore not be included as a separate category. The interventions described in the stage one evidence mainly relate to manual therapy;
- Weight loss will be considered as integral to other approaches and not as an intervention in its own right;
- Acupuncture will not be included as the Guideline NG59 recommends “Do not offer acupuncture for managing low back pain with or without sciatica”. The Steering Group concluded that the evidence review process underpinning the NICE Guideline development is robust and gives a clear position not to recommend acupuncture. The NICE Guideline found that the studies showing clinical and cost effectiveness were thought to result from contextual effects and also some of the studies were of poor quality. Hence including acupuncture in the ROI tool would give a mixed message to commissioners and appear to be disregarding the NICE Guideline;
- Cognitive behavioural approaches should be included provided they are not incorporated into the physical heath/mental health model. It has subsequently been confirmed that this is not the case;
- Self-management interventions in their own right lack evidence, but should be considered to be an integral component of good care and supported as a principle, and form core quality standards of care in NICE guidelines (e.g. OA and LBP);
- When conducting the data extraction at the next stage of literature review, it will be helpful to keep note of the relevant stakeholders for each intervention. The implications for these groups can be considered when the tool is ready for dissemination;
- In the final report and the tool, any information obtained on ‘critical success factors’ should be reported i.e. what needs to be in place to achieve equivalent results to those predicated in the model;

- The final project report should refer to interventions that sound promising but lack evidence of effectiveness at this stage, indicating further research would be useful.

4.2 Findings from Stage Two Literature Review

Full data extraction has taken place from 27 included studies across these interventions. The extent and quality of evidence for each intervention is variable and described in detail in Section 3.3. The main conclusions are summarised below.

Cognitive and Psychological Approaches (CBT)

The included studies for CBT approaches all related to back pain. There was some variation in the CBT interventions and variable evidence on the cost effectiveness of these. The strongest and best quality evidence was for the Back Skills Training (BeST) intervention in the UK, for adults having lower back pain for more than six weeks. The programme is based around six sessions of group therapy and the authors concluded that CBT can be delivered by existing NHS staff (physiotherapists, nurses, psychologists or occupational therapists) with just two days of training. It was found to be cost effective from a healthcare perspective with an incremental cost per QALY was £1,786.

There was less strong evidence from the USA, firstly for the impact of group based CBT interventions on work days missed and for psychologist led sessions on the level of back pain experienced. These studies were of lower applicability to the UK setting however. There was no evidence that a videotape to change beliefs and behaviours was effective or cost effective.

STarT Back (Stratified Risk Assessment and Care)

The risk stratification approach to assessment and treatment for back pain was found to be cost effective in several good quality studies. Although referral rates for some patients were higher with stratified management, these health-related costs were outweighed by savings elsewhere (fewer referrals for low-risk patients and lower follow-up costs). Stratified care was associated with a mean increase in generic health benefit (0·039 additional QALYs) and cost savings compared with current best practice (£240·01 vs £274·40).

Self-Referral to Physiotherapy

Self-referral to physiotherapy, whereby a patient is able to access physiotherapy treatment without a formal referral, is widely available in Scotland and in some areas of England and Wales. The incremental benefits are derived from patients being able to access services more quickly (usually via an initial telephone appointment with a physiotherapist), as opposed to the physiotherapy treatment itself, which can be considered to be cost-effective per se. Although all MSK conditions were eligible for the service, those found to be most commonly presenting in the services studied were spinal or lower limb problems.

The review found good quality evidence for the cost effectiveness of self-referral to physiotherapy. The treatment pathway was found to have equivalent outcomes to physiotherapy via GP referral, but improved quality of life for patients and reduced healthcare use in terms of prescribing, diagnostic tests and further appointments. An incremental cost-effectiveness ratio of £2,889 per QALY was shown, with the suggestion that this could be improved outside of trial conditions.

ESCAPE-pain

The ESCAPE-pain programme is a structured community rehabilitation programme integrating exercise, self-management and active coping strategies for chronic knee pain. The studies identified that the programme is clinically effective and has the potential to be cost effective, although there were some limitations to the evidence available. The analysis showed a difference in total health and social care resource when using imputed values for missing data. The programme has been found to be slightly cost saving when compared with out-patient physiotherapy.

Group Physical Activity Classes for Back Pain

The review found a number of heterogeneous group interventions for back pain. There was good quality evidence from two studies of yoga. 'Medical' yoga (in Sweden) was defined as twice weekly session for six weeks, plus CD and written information to support continued practice and was found to have an ICER of 4,984 Euro compared to self-care. A UK yoga study intervention comprised a 12-week class and produced 0.037 QALYs more than the control at an increased cost of £506.80 per patient (ICER of £13,606).

There was also good quality evidence from a UK study of active group exercise, education, and cognitive behavioural therapy delivered by physiotherapists, with a mean incremental cost effectiveness ratio of £5,000 per QALY at 15 months. The CBT element of this study lends weight to the conclusions on CBT interventions for back pain described in Section 4.2.1.

Vocational Advice in Primary Care

The review found limited evidence for the provision of vocational advice in a primary care setting. The Study of Work and Pain (SWAP) compared the provision of a vocational advisor in primary care for all MSK conditions, but particularly for spinal pain, to usual care. Participants were found to have significantly fewer days absent from work over a four month period. As this is the only study on this intervention, further evidence may be required to assess the potential for inclusion in the tool.

Workplace Interventions for Neck Pain

The review found no relevant UK evidence on this intervention, with most studies being performed in Scandinavian countries. Although the included studies were varied in the interventions they described, none found good evidence for the impact of workplace interventions to reduce neck pain and associated sickness absence.

4.3 Limitations of the Review and Potential Impact on Findings

The review only searched for studies that referred economic evaluations, costing reports, systematic reviews of economic evaluations and health technology assessments. Broadening the search strategy to include studies with evidence of clinical effectiveness only would have resulted in the retrieval of an unacceptably high volume of irrelevant records. Only English language studies were included, so the review could have missed a relevant study in a non-English language journal. Heterogeneity in patients and study types was not controlled for. We also did not check for publication bias.

Sensitivity analyses were performed in some studies, but the methodology used and the presentation of the results were not always clear. A small number of studies were carried out in countries with different health care systems and reimbursement systems, thus caution is required when extrapolating the study findings to other countries.

Despite these limitations we do not judge that they have introduced bias into the results. Rather they are common to all such reviews of economic studies and none seriously challenge the validity of the findings.

The methodological quality of included economic studies has been assessed, with less weight on those studies of poor quality and of little relevance to the research question. No meta-analysis has been conducted whereby the quantitative results of separate, but similar studies, are combined. Hence it has not been possible to provide measure of uncertainty around results.

Other issues include the mean follow-up period of around 12 months (excluding Hurley et al) which may not be sufficiently long to capture benefits to around 24 months, the proposed time horizon for the economic tool.

Economic studies rely on the quality of the underlying clinical study and these have not been evaluated. The better quality studies are in the main those that accompany an RCT which has collected resource use and quality of life data along with the clinical outcomes. This can be addressed partially at the next stage of the process whereby, for the interventions included in the tool, we will go back to the clinical studies to extract the key components of the intervention to inform the resource use in the model. If at that stage we judge a clinical study is badly flawed we shall advise PHE and agree the best way forward.

There is evidence to show that incidence of certain musculoskeletal conditions is higher in lower socioeconomic groups [28]. The review found no specific mention of the ability of the interventions considered to address inequalities in health. However, a focus on this condition may direct services to those with greater health need and the implementation of the MSK ROI tool has the potential to influence investment in these conditions where interventions are shown to be cost effective.

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Appendix A: Stage One Search Strategies

A.1: Source: Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>

Interface / URL: Ovid SP
Database coverage dates: 1946 to Present. Updated daily.
Search date: 12/01/17
Retrieved records: 2081 from two separate searches
Search strategy:

Database: Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>
Search Strategy:

1	Osteoarthritis/ or Osteoarthritis, Hip/ or Osteoarthritis, Knee/ (61422)
2	(osteoarthrit$ or osteo-arthrit$ or osteoarthro$ or osteo-arthro$).ti,ab,kf. (66032)
3	(coxarthr$ or gonarthr$).ti,ab,kf. (3170)
4	((degenerative or non-inflammatory or noninflammatory) adj3 arthri$).ti,ab,kf. (1867)
5	((knee or knees or hip or hips or cox or coxa or coxas or femorotibial) and (arthrosis or arthroses)).ti,ab,kf. (1946)
6	degenerative joint disease.ti,ab,kf. (2309)
7	exp Back Pain/ or Neck Pain/ (41635)
8	Sciatica/ or Sciatic Neuropathy/ (7324)
9	Radiculopathy/ (4700)
10	exp Neck Injuries/ or Back Injuries/ (9512)
11	Intervertebral Disc Displacement/ or Intervertebral Disc Degeneration/ (22609)
12	exp Spondylitis/ or exp Spondylosis/ or Spinal Stenosis/ (45896)
13	exp Brachial Plexus Neuropathies/ (3630)
14	Torticollis/ (3633)
15	chronic pain/ or fibromyalgia/ (16648)
16	(exp back/ or exp back muscles/ or exp spine/ or exp neck/ or neck muscles/ or hip/ or exp hip joint/ or knee/ or exp knee joint/) and (pain/ or acute pain/ or musculoskeletal pain/ or myalgia/ or arthralgia/ or exp neuralgia/ or exp nociceptive pain/ or pain, intractable/ or pain, referred/ or exp "sprains and strains"/) (14526)
17	(backache$ or lumbago or sciatica or sciaticas).ti,ab,kf. (9313)
18	(dorsalgia$ or coccydynia$).ti,ab,kf. (207)
19	(cervicalgia$ or cervicodynia$ or neckache$ or brachialgia$).ti,ab,kf. (321)
20	((back or backs or spine$1 or spinal or sacroiliac or vertebrogenic or lumbar or lumbosacral or lumbo-sacral or cervical or coccy$ or tailbone$ or tail bone$ or thoracic or radicular or neck or necks or cervicobrachial or brachial or knee or knees or tibiofibular or patellofemoral or hip or hips or coxa or coxas or acetabulofemoral) adj3 (pain$ or ache or aches or aching or discomfort$ or stiff$ or neuralgia$ or neuralgic$ or neuropath$ or neuriti$ or sprain$1 or strain$1 or injur$ or myalgia$1 or myalgic or arthralgi$ or allodyni$ or hyperalgesi$ or misalign$)).ti,ab,kf. (150578)
21	((disc or discs or disk or disks) adj3 (hernia$ or slipped or slip or displac$ or prolapse$ or degenerat$ or degradat$ or bulge$ or bulging or protrud$ or protrusion$)).ti,ab,kf. (22570)
22	(whiplash or cervical acceleration deceleration).ti,ab,kf. (3044)
23	(torticollis or cervical dystonia$).ti,ab,kf. (4323)
24	(nerve root$ adj3 (pain$ or avulsion or compress$ or disorder$ or pinch$ or inflam$ or imping$ or irritat$ or entrap$ or trap$)).ti,ab,kf. (2348)

25 (radiculopath$ or radiculitis or radiculitides).ti,ab,kf. (6362)
26 (brachial plexopath$ or klumpke paralysis or dejerine-klumpke or klumpke$ pals$).ti,ab,kf. (684)
27 (parsonage-aldren-turner or parsonage-turner).ti,ab,kf. (180)
28 (brachial plexus adj3 (disorder$ or disease$ or paralys$)).ti,ab,kf. (466)
29 (amyotrophic adj3 (neuralgia$ or neuralgic$ or neuropath$ or neuriti$)).ti,ab,kf. (160)
30 (shoulder girdle$ adj3 (neuralgia$ or neuralgic$ or neuropath$ or neuriti$)).ti,ab,kf. (8)
31 (erb adj3 (paraly$ or palsy or palsies)).ti,ab,kf. (81)
32 (ankylosis or spondylitis or spondylitide$ or discitis or discitides or diskitis or diskitides or spondylodisk$ or spondylodisc$ or spondylarthr$ or spondyloarthr$ or spondylos$ or spondylolisthes$).ti,ab,kf. (36236)
33 (spinal arthr$ or marie-strumpell or bechterew).ti,ab,kf. (876)
34 (spinal stenoses or spinal stenosis).ti,ab,kf. (4516)
35 (chronic widespread pain$ or CWP or CWPS or widespread pain disorder$ or widespread pain syndrome$).ti,ab,kf. (1299)
36 (fibromyalgi$ or fibromyositis or fibrositis or fibrositides or muscular rheumatism or myofascial pain syndrome).ti,ab,kf. (10223)
37 or/1-36 (358916)
38 economics/ (29847)
39 exp "costs and cost analysis"/ (225286)
40 economics, dental/ (2013)
41 exp "economics, hospital"/ (23671)
42 economics, medical/ (10009)
43 economics, nursing/ (4509)
44 economics, pharmaceutical/ (2840)
45 (economic$ or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic$).ti,ab. (659695)
46 (expenditure$ not energy).ti,ab. (25665)
47 (value adj2 money).ti,ab. (1507)
48 budget$.ti,ab. (25445)
49 or/38-48 (811356)
50 ((energy or oxygen) adj cost).ti,ab. (3731)
51 (metabolic adj cost).ti,ab. (1240)
52 ((energy or oxygen) adj expenditure).ti,ab. (23640)
53 50 or 51 or 52 (27673)
54 49 not 53 (805264)
55 ((return$ or gain$1) adj3 investment$1).ti,ab,kf. (2129)
56 (ROI or ROIs).ti,ab,kf. (12074)
57 54 or 55 or 56 (817405)
58 37 and 57 (11321)
59 exp animals/ not humans/ (4853750)
60 (news or comment or editorial or letter or case reports).pt. or case report.ti. (3693917)
61 58 not (59 or 60) (10581)
62 limit 61 to (english language and yr="2015 -Current") (1894)
63 remove duplicates from 62 (1583)

Database: Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>
Search Strategy:
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1 Osteoarthritis/ or Osteoarthritis, Hip/ or Osteoarthritis, Knee/ (61799)
2 (osteoarthrit$ or osteo-arthrit$ or osteoarthro$ or osteo-arthro$).ti,ab,kf. (66485)
3 (coxarthr$ or gonarthr$).ti,ab,kf. (3176)
4 ((degenerative or non-inflammatory or noninflammatory) adj3 arthri$).ti,ab,kf. (1869)

5 ((knee or knees or hip or hips or cox or coxa or coxas or femorotibial) and (arthrosis or arthroses)).ti,ab,kf. (1946)
6 degenerative joint disease.ti,ab,kf. (2317)
7 exp Back Pain/ or Neck Pain/ (41710)
8 Sciatica/ or Sciatic Neuropathy/ (7336)
9 Radiculopathy/ (4705)
10 exp Neck Injuries/ or Back Injuries/ (9527)
11 Intervertebral Disc Displacement/ or Intervertebral Disc Degeneration/ (22634)
12 exp Spondylitis/ or exp Spondylosis/ or Spinal Stenosis/ (46589)
13 exp Brachial Plexus Neuropathies/ (3634)
14 Torticollis/ (3638)
15 chronic pain/ or fibromyalgia/ (16935)
16 (exp back/ or exp back muscles/ or exp spine/ or exp neck/ or neck muscles/ or hip/ or exp hip joint/ or knee/ or exp knee joint/) and (pain/ or acute pain/ or musculoskeletal pain/ or myalgia/ or arthralgia/ or exp neuralgia/ or exp nociceptive pain/ or pain, intractable/ or pain, referred/ or exp "sprains and strains"/) (14569)
17 (backache$ or lumbago or sciatica or sciaticas).ti,ab,kf. (9316)
18 (dorsalgia$ or coccydynia$).ti,ab,kf. (208)
19 (cervicalgia$ or cervicodynia$ or neckache$ or brachialgia$).ti,ab,kf. (323)
20 ((back or backs or spine$1 or spinal or sacroiliac or vertebrogenic or lumbar or lumbosacral or lumbo-sacral or cervical or coccy$ or tailbone$ or tail bone$ or thoracic or radicular or neck or necks or cervicobrachial or brachial or knee or knees or tibiofibular or patellofemoral or hip or hips or coxa or coxas or acetabulofemoral) adj3 (pain$ or ache or aches or aching or discomfort$ or stiff$ or neuralgia$ or neuralgic$ or neuropath$ or neuriti$ or sprain$1 or strain$1 or injur$ or myalgia$1 or myalgic or arthralgi$ or allodyni$ or hyperalgesi$ or misalign$)).ti,ab,kf. (151035)
21 ((disc or discs or disk or disks) adj3 (hernia$ or slipped or slip or displac$ or prolapse$ or degenerat$ or degradat$ or bulge$ or bulging or protrud$ or protrusion$)).ti,ab,kf. (22628)
22 (whiplash or cervical acceleration deceleration).ti,ab,kf. (3053)
23 (torticollis or cervical dystonia$).ti,ab,kf. (4328)
24 (nerve root$ adj3 (pain$ or avulsion or compress$ or disorder$ or pinch$ or inflam$ or imping$ or irritat$ or entrap$ or trap$)).ti,ab,kf. (2351)
25 (radiculopath$ or radiculitis or radiculitides).ti,ab,kf. (6377)
26 (brachial plexopath$ or klumpke paralysis or dejerine-klumpke or klumpke$ pals$).ti,ab,kf. (687)
27 (parsonage-aldren-turner or parsonage-turner).ti,ab,kf. (180)
28 (brachial plexus adj3 (disorder$ or disease$ or paralys$)).ti,ab,kf. (466)
29 (amyotrophic adj3 (neuralgia$ or neuralgic$ or neuropath$ or neuriti$)).ti,ab,kf. (159)
30 (shoulder girdle$ adj3 (neuralgia$ or neuralgic$ or neuropath$ or neuriti$)).ti,ab,kf. (8)
31 (erb adj3 (paraly$ or palsy or palsies)).ti,ab,kf. (81)
32 (ankylosis or spondylitis or spondylitide$ or discitis or discitides or diskitis or diskitides or spondylodisk$ or spondylodisc$ or spondylarthr$ or spondyloarthr$ or spondylos$ or spondylolisthes$).ti,ab,kf. (36774)
33 (spinal arthr$ or marie-strumpell or bechterew).ti,ab,kf. (876)
34 (spinal stenoses or spinal stenosis).ti,ab,kf. (4524)
35 (chronic pain$ or chronic widespread pain$ or CWP or CWPS).ti,ab,kf. (32963)
36 (fibromyalgi$ or fibromyositis or fibrositis or fibrositides or muscular rheumatism or myofascial pain syndrome).ti,ab,kf. (10467)
37 or/1-36 (381482)
38 economics/ (29855)
39 exp "costs and cost analysis"/ (225772)
40 economics, dental/ (2013)
41 exp "economics, hospital"/ (23712)
42 economics, medical/ (10017)
43 economics, nursing/ (4509)

44 economics, pharmaceutical/ (2855)
45 (economic$ or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic$).ti,ab. (661424)
46 (expenditure$ not energy).ti,ab. (25726)
47 (value adj2 money).ti,ab. (1512)
48 budget$.ti,ab. (25507)
49 or/38-48 (813287)
50 ((energy or oxygen) adj cost).ti,ab. (3732)
51 (metabolic adj cost).ti,ab. (1241)
52 ((energy or oxygen) adj expenditure).ti,ab. (23701)
53 50 or 51 or 52 (27736)
54 49 not 53 (807192)
55 ((return$ or gain$1) adj3 investment$1).ti,ab,kf. (2131)
56 (ROI or ROIs).ti,ab,kf. (12096)
57 54 or 55 or 56 (819355)
58 37 and 57 (12406)
59 exp animals/ not humans/ (4859716)
60 (news or comment or editorial or letter or case reports).pt. or case report.ti. (3700735)
61 58 not (59 or 60) (11613)
62 limit 61 to (english language and yr="2015 -Current") (2099)
63 (2015* or 2016* or 2017*).dc. (2967863)
64 (2015* or 2016* or 2017*).ed. (2628071)
65 61 and (63 or 64) (2811)
66 65 not 62 (712)
67 limit 66 to english language (601)
68 remove duplicates from 67 (498)

A.2: Source: Embase

Interface / URL: Ovid SP
Database coverage dates: 1974 to 11/01/17
Search date: 12/01/17
Retrieved records: 1920 from two separate searches
Search strategy:

Database: Embase <1974 to 2017 January 11>
Search Strategy:
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1 osteoarthritis/ or hip osteoarthritis/ or knee osteoarthritis/ (103447)
2 (osteoarthrit$ or osteo-arthriti$ or osteoarthro$ or osteo-arthro$).ti,ab,kw. (78009)
3 (coxarthr$ or gonarthr$).ti,ab,kw. (3632)
4 ((degenerative or non-inflammatory or noninflammatory) adj3 arthri$).ti,ab,kw. (2010)
5 ((knee or knees or hip or hips or cox or coxa or coxas or femorotibial) and (arthrosis or arthroses)).ti,ab,kw. (2338)
6 degenerative joint disease.ti,ab,kw. (2610)
7 exp backache/ or neck pain/ (105029)
8 sciatic neuropathy/ or sciatica/ (2188)
9 cervicobrachial neuralgia/ (2959)
10 exp radiculopathy/ (31588)
11 neck injury/ or whiplash injury/ or musculoskeletal injury/ (13436)
12 exp intervertebral disk disease/ (31483)
13 spondylitis/ or ankylosing spondylitis/ or spondylarthritis/ (32526)
14 brachial plexus neuropathy/ (1760)
15 torticollis/ (4345)

16 (exp back/ or exp neck/ or hip/ or knee/) and chronic pain/ (3560)
17 fibromyalgia/ (16976)
18 exp spondylosis/ (7410)
19 exp vertebral canal stenosis/ (9962)
20 (exp back/ or exp neck/ or hip/ or knee/) and (pain/ or allodynia/ or intractable pain/ or musculoskeletal pain/ or psychogenic pain/ or myalgia/ or arthralgia/ or neuralgia/ or neuropathic pain/) (45900)
21 (backache$ or lumbago or sciatica or sciaticas).ti,ab,kw. (9032)
22 (dorsalgia$ or coccydynia$).ti,ab,kw. (279)
23 (cervicalgia$ or cervicodynia$ or neckache$ or brachialgia$).ti,ab,kw. (404)
24 ((back or backs or spine$1 or spinal or sacroiliac or vertebrogenic or lumbar or lumbosacral or lumbo-sacral or cervical or coccy$ or tailbone$ or tail bone$ or thoracic or radicular or neck or necks or cervicobrachial or brachial or knee or knees or tibiofibular or patellofemoral or hip or hips or coxa or coxas or acetabulofemoral) adj3 (pain$ or ache or aches or aching or discomfort$ or stiff$ or neuralgia$ or neuralgic$ or neuropath$ or neuriti$ or sprain$1 or strain$1 or injur$ or myalgia$1 or myalgic or arthralgi$ or allodyni$ or hyperalgesi$ or misalign$)).ti,ab,kw. (179068)
25 ((disc or discs or disk or disks) adj3 (hernia$ or slipped or slip or displac$ or prolapse$ or degenerat$ or degradat$ or bulge$ or bulging or protrud$ or protrusion$)).ti,ab,kw. (24498)
26 (whiplash or cervical acceleration deceleration).ti,ab,kw. (3515)
27 (torticollis or cervical dystonia$).ti,ab,kw. (5563)
28 (nerve root$ adj3 (pain$ or avulsion or compress$ or disorder$ or pinch$ or inflam$ or imping$ or irritat$ or entrap$ or trap$)).ti,ab,kw. (2791)
29 (radiculopath$ or radiculitis or radiculitides).ti,ab,kw. (8301)
30 (brachial plexopath$ or klumpke paralysis or dejerine-klumpke or klumpke$ pals$).ti,ab,kw. (908)
31 (parsonage-aldren-turner or parsonage-turner).ti,ab,kw. (255)
32 (brachial plexus adj3 (disorder$ or disease$ or paralys$)).ti,ab,kw. (467)
33 (amyotrophic adj3 (neuralgia$ or neuralgic$ or neuropath$ or neuriti$)).ti,ab,kw. (178)
34 (shoulder girdle$ adj3 (neuralgia$ or neuralgic$ or neuropath$ or neuriti$)).ti,ab,kw. (12)
35 (erb adj3 (paraly$ or palsy or palsies)).ti,ab,kw. (93)
36 (ankylosis or spondylitis or spondylitide$ or discitis or discitides or diskitis or diskitides or spondylodisk$ or spondylodisc$ or spondylarthr$ or spondyloarthr$ or spondylos$ or spondylolisthes$).ti,ab,kw. (44884)
37 (spinal arthr$ or marie-strumpell or bechterew).ti,ab,kw. (904)
38 (spinal stenoses or spinal stenosis).ti,ab,kw. (5616)
39 (chronic widespread pain$ or CWP or CWPS or widespread pain disorder$ or widespread pain syndrome$).ti,ab,kw. (1599)
40 (fibromyalgi$ or fibromyositis or fibrositis or fibrositides or muscular rheumatism or myofascial pain syndrome).ti,ab,kw. (14556)
41 or/1-40 (471988)
42 Health Economics/ (37407)
43 exp Economic Evaluation/ (265289)
44 exp Health Care Cost/ (251751)
45 Pharmacoeconomics/ (7758)
46 (econom$ or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic$).ti,ab. (788532)
47 (expenditure$ not energy).ti,ab. (30590)
48 (value adj2 money).ti,ab. (1863)
49 budget$.ti,ab. (29965)
50 or/42-49 (1023763)
51 (metabolic adj cost).ti,ab. (1138)
52 ((energy or oxygen) adj cost).ti,ab. (3599)
53 ((energy or oxygen) adj expenditure).ti,ab. (25549)
54 51 or 52 or 53 (29365)

55 50 not 54 (1017750)
56 (animal/ or animal experiment/ or animal model/ or animal tissue/ or nonhuman/) not exp human/ (5387400)
57 (letter or editorial or note).pt. (2171217)
58 conference abstract.pt. (2447214)
59 case report/ or case report.ti. (2206655)
60 or/56-59 (11756427)
61 41 and 55 (19624)
62 61 not 60 (13704)
63 limit 62 to (english language and yr="2015 -Current") (1934)
64 remove duplicates from 63 (1599)

Database: Embase <1974 to 2017 January 23>
Search Strategy:
---
1 osteoarthritis/ or hip osteoarthritis/ or knee osteoarthritis/ (103626)
2 (osteoarthrit$ or osteo-arthriti$ or osteoarthro$ or osteo-arthro$).ti,ab,kw. (78141)
3 (coxarthr$ or gonarthr$).ti,ab,kw. (3635)
4 ((degenerative or non-inflammatory or noninflammatory) adj3 arthri$).ti,ab,kw. (2012)
5 ((knee or knees or hip or hips or cox or coxa or coxas or femorotibial) and (arthrosis or arthroses)).ti,ab,kw. (2342)
6 degenerative joint disease.ti,ab,kw. (2614)
7 exp backache/ or neck pain/ (105263)
8 sciatic neuropathy/ or sciatica/ (2196)
9 cervicobrachial neuralgia/ (2966)
10 exp radiculopathy/ (31652)
11 neck injury/ or whiplash injury/ or musculoskeletal injury/ (13453)
12 exp intervertebral disk disease/ (31553)
13 spondylitis/ or ankylosing spondylitis/ or spondylarthritis/ (32582)
14 brachial plexus neuropathy/ (1764)
15 torticollis/ (4347)
16 (exp back/ or exp neck/ or hip/ or knee/) and chronic pain/ (3569)
17 fibromyalgia/ (17002)
18 exp spondylosis/ (7419)
19 exp vertebral canal stenosis/ (9984)
20 (exp back/ or exp neck/ or hip/ or knee/) and (pain/ or allodynia/ or intractable pain/ or musculoskeletal pain/ or psychogenic pain/ or myalgia/ or arthralgia/ or neuralgia/ or neuropathic pain/) (45952)
21 (backache$ or lumbago or sciatica or sciaticas).ti,ab,kw. (9035)
22 (dorsalgia$ or coccydynia$).ti,ab,kw. (280)
23 (cervicalgia$ or cervicodynia$ or neckache$ or brachialgia$).ti,ab,kw. (406)
24 ((back or backs or spine$1 or spinal or sacroiliac or vertebrogenic or lumbar or lumbosacral or lumbo-sacral or cervical or coccy$ or tailbone$ or tail bone$ or thoracic or radicular or neck or necks or cervicobrachial or brachial or knee or knees or tibiofibular or patellofemoral or hip or hips or coxa or coxas or acetabulofemoral) adj3 (pain$ or ache or aches or aching or discomfort$ or stiff$ or neuralgia$ or neuralgic$ or neuropath$ or neuriti$ or sprain$1 or strain$1 or injur$ or myalgia$1 or myalgic or arthralgi$ or allodyni$ or hyperalgesi$ or misalign$)).ti,ab,kw. (179407)
25 ((disc or discs or disk or disks) adj3 (hernia$ or slipped or slip or displac$ or prolapse$ or degenerat$ or degradat$ or bulge$ or bulging or protrud$ or protrusion$)).ti,ab,kw. (24545)
26 (whiplash or cervical acceleration deceleration).ti,ab,kw. (3518)
27 (torticollis or cervical dystonia$).ti,ab,kw. (5568)
28 (nerve root$ adj3 (pain$ or avulsion or compress$ or disorder$ or pinch$ or inflam$ or imping$ or irritat$ or entrap$ or trap$)).ti,ab,kw. (2794)
29 (radiculopath$ or radiculitis or radiculitides).ti,ab,kw. (8319)

30 (brachial plexopath$ or klumpke paralysis or dejerine-klumpke or klumpke$ pals$).ti,ab,kw. (910)
31 (parsonage-aldren-turner or parsonage-turner).ti,ab,kw. (255)
32 (brachial plexus adj3 (disorder$ or disease$ or paralys$)).ti,ab,kw. (467)
33 (amyotrophic adj3 (neuralgia$ or neuralgic$ or neuropath$ or neuriti$)).ti,ab,kw. (180)
34 (shoulder girdle$ adj3 (neuralgia$ or neuralgic$ or neuropath$ or neuriti$)).ti,ab,kw. (12)
35 (erb adj3 (paraly$ or palsy or palsies)).ti,ab,kw. (93)
36 (ankylosis or spondylitis or spondylitide$ or discitis or discitides or diskitis or diskitides or spondylodisk$ or spondylodisc$ or spondylarthr$ or spondyloarthr$ or spondylos$ or spondylolisthes$).ti,ab,kw. (44950)
37 (spinal arthr$ or marie-strumpell or bechterew).ti,ab,kw. (904)
38 (spinal stenoses or spinal stenosis).ti,ab,kw. (5626)
39 (chronic widespread pain$ or CWP or CWPS or widespread pain disorder$ or widespread pain syndrome$).ti,ab,kw. (1603)
40 (fibromyalgi$ or fibromyositis or fibrositis or fibrositides or muscular rheumatism or myofascial pain syndrome).ti,ab,kw. (14568)
41 or/1-40 (472810)
42 Health Economics/ (37437)
43 exp Economic Evaluation/ (265733)
44 exp Health Care Cost/ (252182)
45 Pharmacoeconomics/ (7767)
46 (econom$ or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic$).ti,ab. (790202)
47 (expenditure$ not energy).ti,ab. (30645)
48 (value adj2 money).ti,ab. (1870)
49 budget$.ti,ab. (30028)
50 or/42-49 (1025751)
51 (metabolic adj cost).ti,ab. (1138)
52 ((energy or oxygen) adj cost).ti,ab. (3604)
53 ((energy or oxygen) adj expenditure).ti,ab. (25608)
54 51 or 52 or 53 (29428)
55 50 not 54 (1019733)
56 (animal/ or animal experiment/ or animal model/ or animal tissue/ or nonhuman/) not exp human/ (5393290)
57 (letter or editorial or note).pt. (2174199)
58 conference abstract.pt. (2454102)
59 case report/ or case report.ti. (2209961)
60 or/56-59 (11773534)
61 41 and 55 (19672)
62 61 not 60 (13738)
63 limit 62 to (english language and yr="2015 -Current") (1965)
64 (2015$ or 2016$ or 2017$).dc,dd. (4013555)
65 62 and 64 (2420)
66 65 not 63 (479)
67 limit 66 to english language (365)
68 remove duplicates from 67 (321)

A.3: Source: NHS Economic Evaluation Database (NHS EED)

Interface / URL: Cochrane Library
Database coverage dates: Issue 2 of 4, April 2015
Search date: 12/01/17
Retrieved records: 617
Search strategy:

ID	Search	Hits
#1	[mh ^Osteoarthritis] or [mh ^"Osteoarthritis, Hip"] or [mh ^"Osteoarthritis, Knee"]	4263
#2	osteoarthrit* or osteo-arthrit* or osteoarthro* or osteo-arthro*	9031
#3	coxarthr* or gonarthr*	394
#4	(degenerative or non-inflammatory or noninflammatory) near/3 arthri*	118
#5	(knee or knees or hip or hips or cox or coxa or coxas or femorotibial) and (arthrosis or arthroses)	251
#6	"degenerative joint disease"	133
#7	[mh "Back Pain"] or [mh ^"Neck Pain"]	4069
#8	[mh ^Sciatica] or [mh ^"Sciatic Neuropathy"]	257
#9	[mh ^Radiculopathy]	258
#10	[mh "Neck Injuries"] or [mh ^"Back Injuries"]	280
#11	[mh ^"Intervertebral Disc Displacement"] or [mh ^"Intervertebral Disc Degeneration"]	847
#12	[mh Spondylitis] or [mh Spondylosis] or [mh ^"Spinal Stenosis"]	1324
#13	[mh "Brachial Plexus Neuropathies"]	53
#14	[mh ^Torticollis]	94
#15	[mh ^"chronic pain"] or [mh ^fibromyalgia]	1536
#16	[mh back] or [mh "back muscles"] or [mh spine] or [mh neck] or [mh ^"neck muscles"] or [mh ^hip] or [mh "hip joint"] or [mh ^knee] or [mh "knee joint"]	9690
#17	[mh ^pain] or [mh ^"acute pain"] or [mh ^"musculoskeletal pain"] or [mh ^myalgia] or [mh ^arthralgia] or [mh neuralgia] or [mh "nociceptive pain"] or [mh ^"pain, intractable"] or [mh ^"pain, referred"] or [mh "sprains and strains"]	13564
#18	#16 and #17	838
#19	backache* or lumbago or sciatica or sciaticas	3152
#20	dorsalgia* or coccydynia*	69
#21	cervicalgia* or cervicodynia* or neckache* or brachialgia*	39
#22	(back or backs or spine* or spinal or sacroiliac or vertebrogenic or lumbar or lumbosacral or lumbo-sacral or cervical or coccy* or tailbone* or tail-bone* or thoracic or radicular or neck or necks or cervicobrachial or brachial or knee or knees or tibiofibular or patellofemoral or hip or hips or coxa or coxas or acetabulofemoral) near/3 (pain* or ache or aches or aching or discomfort* or stiff* or neuralgia* or neuralgic* or neuropath* or neuriti* or sprain* or strain* or injur* or myalgia* or myalgic or arthralgi* or allodyni* or hyperalgesi* or misalign*)	19693
#23	(disc or discs or disk or disks) near/3 (hernia* or slipped or slip or displac* or prolapse* or degenerat* or degradat* or bulge* or bulging or protrud* or protrusion*)	2213
#24	whiplash or "cervical acceleration deceleration"	419
#25	torticollis or cervical next dystonia*	253
#26	(nerve next root*) near/3 (pain* or avulsion or compress* or disorder* or pinch* or inflam* or imping* or irritat* or entrap* or trap*)	225
#27	radiculopath* or radiculitis or radiculitides	761
#28	brachial next plexopath* or "klumpke paralysis" or dejerine-klumpke or klumpke* next pals*	24
#29	parsonage-aldren-turner or parsonage-turner	1
#30	"brachial plexus" near/3 (disorder* or disease* or paralys*)	18
#31	amyotrophic near/3 (neuralgia* or neuralgic* or neuropath* or neuriti*)	4
#32	shoulder next girdle* near/3 (neuralgia* or neuralgic* or neuropath* or neuriti*)	0
#33	erb near/3 (paraly* or palsy or palsies)	6

#34 ankylosis or spondylitis or spondylitide* or discitis or discitides or diskitis or diskitides or spondylodisk* or spondylodisc* or spondylarthr* or spondyloarthr* or spondylos* or spondylolisthes* 2314
#35 spinal next arthr* or marie-strumpell or bechterew 135
#36 "spinal stenoses" or "spinal stenosis" 614
#37 "chronic widespread" next pain* or CWP or CWPS or "widespread pain" next disorder* or "widespread pain" next syndrome* 108
#38 fibromyalgi* or fibromyositis or fibrositis or fibrositides or "muscular rheumatism" or "myofascial pain syndrome" 2002
#39 {or #1-#15} 16645
#40 {or #18-#38} 26824
#41 #39 or #40 33637
#42 #41 in Economic Evaluations 617

A.4: Source: HTA Database

Interface / URL: Cochrane Library
Database coverage dates: Issue 4 of 4, October 2016
Search date: 12/01/17
Retrieved records: 580
Search strategy:

ID Search Hits
#1 [mh ^Osteoarthritis] or [mh ^"Osteoarthritis, Hip"] or [mh ^"Osteoarthritis, Knee"] 4263
#2 osteoarthrit* or osteo-arthrit* or osteoarthro* or osteo-arthro* 9031
#3 coxarthr* or gonarthr* 394
#4 (degenerative or non-inflammatory or noninflammatory) near/3 arthri* 118
#5 (knee or knees or hip or hips or cox or coxa or coxas or femorotibial) and (arthrosis or arthroses) 251
#6 "degenerative joint disease" 133
#7 [mh "Back Pain"] or [mh ^"Neck Pain"] 4069
#8 [mh ^Sciatica] or [mh ^"Sciatic Neuropathy"] 257
#9 [mh ^Radiculopathy] 258
#10 [mh "Neck Injuries"] or [mh ^"Back Injuries"] 280
#11 [mh ^"Intervertebral Disc Displacement"] or [mh ^"Intervertebral Disc Degeneration"] 847
#12 [mh Spondylitis] or [mh Spondylosis] or [mh ^"Spinal Stenosis"] 1324
#13 [mh "Brachial Plexus Neuropathies"] 53
#14 [mh ^Torticollis] 94
#15 [mh ^"chronic pain"] or [mh ^fibromyalgia] 1536
#16 [mh back] or [mh "back muscles"] or [mh spine] or [mh neck] or [mh ^"neck muscles"] or [mh ^hip] or [mh "hip joint"] or [mh ^knee] or [mh "knee joint"] 9690
#17 [mh ^pain] or [mh ^"acute pain"] or [mh ^"musculoskeletal pain"] or [mh ^myalgia] or [mh ^arthralgia] or [mh neuralgia] or [mh "nociceptive pain"] or [mh ^"pain, intractable"] or [mh ^"pain, referred"] or [mh "sprains and strains"] 13564
#18 #16 and #17 838
#19 backache* or lumbago or sciatica or sciaticas 3152
#20 dorsalgia* or coccydynia* 69
#21 cervicalgia* or cervicodynia* or neckache* or brachialgia* 39
#22 (back or backs or spine* or spinal or sacroiliac or vertebrogenic or lumbar or lumbosacral or lumbo-sacral or cervical or coccy* or tailbone* or tail-bone* or thoracic or radicular or neck or necks or cervicobrachial or brachial or knee or knees or tibiofibular or patellofemoral or hip or hips or coxa or coxas or acetabulofemoral) near/3 (pain* or ache or aches or aching or discomfort* or stiff* or neuralgia* or neuralgic* or neuropath* or neuriti* or sprain* or strain* or injur* or myalgia* or myalgic or arthralgi* or allodyni* or hyperalgesi* or misalign*) 19693

#23 (disc or discs or disk or disks) near/3 (hernia* or slipped or slip or displac* or prolapse* or degenerat* or degradat* or bulge* or bulging or protrud* or protrusion*) 2213
#24 whiplash or "cervical acceleration deceleration" 419
#25 torticollis or cervical next dystonia* 253
#26 (nerve next root*) near/3 (pain* or avulsion or compress* or disorder* or pinch* or inflam* or imping* or irritat* or entrap* or trap*) 225
#27 radiculopath* or radiculitis or radiculitides 761
#28 brachial next plexopath* or "klumpke paralysis" or dejerine-klumpke or klumpke* next pals* 24
#29 parsonage-aldren-turner or parsonage-turner 1
#30 "brachial plexus" near/3 (disorder* or disease* or paralys*) 18
#31 amyotrophic near/3 (neuralgia* or neuralgic* or neuropath* or neuriti*) 4
#32 shoulder next girdle* near/3 (neuralgia* or neuralgic* or neuropath* or neuriti*) 0
#33 erb near/3 (paraly* or palsy or palsies) 6
#34 ankylosis or spondylitis or spondylitide* or discitis or discitides or diskitis or diskitides or spondylodisk* or spondylodisc* or spondylarthr* or spondyloarthr* or spondylos* or spondylolisthes* 2314
#35 spinal next arthr* or marie-strumpell or bechterew 135
#36 "spinal stenoses" or "spinal stenosis" 614
#37 "chronic widespread" next pain* or CWP or CWPS or "widespread pain" next disorder* or "widespread pain" next syndrome* 108
#38 fibromyalgi* or fibromyositis or fibrositis or fibrositides or "muscular rheumatism" or "myofascial pain syndrome" 2002
#39 {or #1-#15} 16645
#40 {or #18-#38} 26824
#41 #39 or #40 33637
#42 #41 in Technology Assessments 580

A.5: Source: CEA Registry

Interface / URL: http://healtheconomics.tuftsmedicalcenter.org/cear4/Home.aspx
Database coverage dates: Not provided
Search date: 12/01/17
Retrieved records: 138
Search strategy:

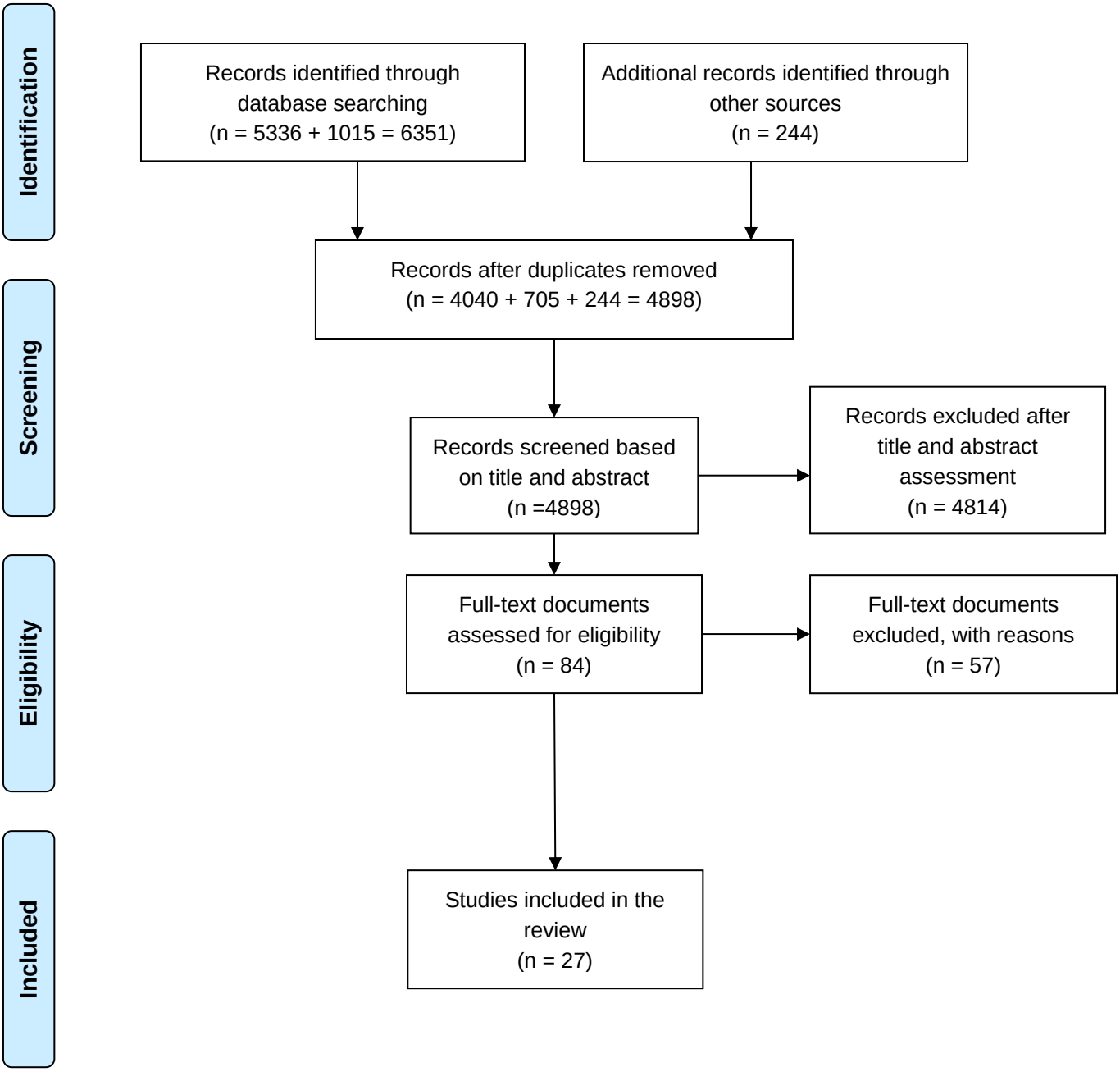
Only basic search functionality available. Boolean operators, multiple search strings etc. are not supported. The following phrases were searched individually

Osteoarthritis
Neck pain
Back pain

138 records returned in total.

Appendix B: PRISMA Flow Diagram

Figure B.1: PRISMA Flow Diagram



Appendix C: Excluded Studies Table

Excluded Studies Table

Full bibliographic reference	Reasons for exclusion
Werner EL, Storheim K, Lochting I, et al. Cognitive Patient Education for Low Back Pain in Primary Care: A Cluster Randomized Controlled Trial and Cost-Effectiveness Analysis. Spine. 2016;41(6):455-62.	Not available
Norton G, McDonough CM, Cabral H, et al. Cost-utility of cognitive behavioral therapy for low back pain from the commercial payer perspective. Spine. 2015;40(10):725-33.	No useable cost information.
Hurley MV, Carter A. ESCAPE-into the community - A community-based rehabilitation programme for elderly people with chronic joint pain. Perspectives in Public Health. 2016;136(2):67-69.	Not an economic evaluation
Linton SJ, Nordin E. A 5-year follow-up evaluation of the health and economic consequences of an early cognitive behavioral intervention for back pain: a randomized, controlled trial (Structured abstract). Spine. 2006;31(8):853-58.	Not available
Schweikert B, Jacobi E, Seitz R, et al. Effectiveness and cost-effectiveness of adding a cognitive behavioral treatment to the rehabilitation of chronic low back pain (Structured abstract). J Rheumatol. 2006;33(12):2519-26.	Not relevant to UK setting
Driessen M, Bosmans J, Proper K, et al. The economic evaluation of a Participatory Ergonomics programme to prevent low back and neck pain (Provisional abstract). Work. 2012;41(2):2315-20.	Reports results from multiple interventions
Jensen IB, Busch H, Bodin L, et al. Cost effectiveness of two rehabilitation programmes for neck and back pain patients: a seven year follow-up (Provisional abstract). Pain. 2009;142(3):202-08.	Not relevant to UK setting.
Moffett JK, Torgerson D, Bell-Syer SB, et al. Randomised controlled trial of exercise for low back pain: clinical outcomes, costs, and preferences (Structured abstract). BMJ. 1999;319(7205):279-83.	Pre-2000
Chuang LH, Soares MO, Tilbrook H, et al. A pragmatic multicentered randomized controlled trial of yoga for chronic low back pain: economic evaluation (Structured abstract). Spine. 2012;37(18):1593-601.	Study protocol - see 5047 for details of economic evaluation
Henchoz Y, Pinget C, Wasserfallen JB, et al. Cost-utility analysis of a three-month exercise programme vs usual care following multidisciplinary rehabilitation for chronic low back pain (Provisional abstract). J Rehabil Med. 2010;42(9):846-52.	Not relevant to UK setting
Lamb SE, Hansen Z, Lall R, et al. Group cognitive behavioural treatment for low-back pain in primary care: a randomised controlled trial and cost-effectiveness analysis (Structured abstract). Lancet. 2010;375(9718):916-23.	Briefer report of another included record
Bernaards CM, Bosmans JE, Hildebrandt VH, et al. The cost-effectiveness of a lifestyle physical activity intervention in addition to a work style intervention on recovery from neck and upper limb symptoms and pain reduction in computer workers (Provisional abstract). Occup Environ Med. 2011;68(4):265-72.	Reports results from multiple interventions
McCarthy CJ, Mills PM, Pullen R, et al. Supplementation of a home-based exercise programme with a class-based programme for people with osteoarthritis of the knees: a randomised controlled trial and health economic analysis (Provisional abstract). Health Technol Assess. 2004;8(46):iii-iv.	Not relevant intervention
Richardson G, Hawkins N, McCarthy CJ, et al. Cost-effectiveness of a supplementary class-based exercise program in the treatment of knee osteoarthritis (Structured abstract). Int J Technol Assess Health Care. 2006;22(1):84-89.	Not relevant intervention
Johnston V, O'Leary S, Comans T, et al. A workplace exercise versus health promotion intervention to prevent and reduce the economic and personal burden of non-specific neck pain in office personnel: protocol of a cluster-randomised controlled	Study Protocol only

Full bibliographic reference	Reasons for exclusion
trial. Journal of Physiotherapy. 2014;60(4):233; discussion 33.	
Foster NE, Mullis R, Hill JC, et al. Effect of stratified care for low back pain in family practice (IMPaCT Back): a prospective population-based sequential comparison. Ann Fam Med. 2014;12(2):102-11.	Duplicate record
Murphy SE, Blake C, Power CK, et al. The effectiveness of a stratified group intervention using the STarTBack screening tool in patients with LBP--a non randomised controlled trial. BMC Musculoskelet Disord. 2013;14:342.	Planned study, not yet reported
del Pozo-Cruz B, Parraca JA, del Pozo-Cruz J, et al. An occupational, internet-based intervention to prevent chronicity in subacute lower back pain: a randomised controlled trial. J Rehabil Med. 2012;44(7):581-7.	No cost information included
Whitehurst DGT, Bryan S, Lewis M, et al. Exploring the cost-utility of stratified primary care management for low back pain compared with current best practice within risk-defined subgroups. Ann Rheum Dis. 2012;71(11):1796-802.	Duplicate record
Hill JC, Whitehurst DGT, Lewis M, et al. Comparison of stratified primary care management for low back pain with current best practice (STarT Back): a randomised controlled trial. Lancet. 2011;378(9802):1560-71.	Duplicate record
ESCAPE - PAIN MANAGEMENT. Podiatry Now. 2015;18(6):8-8.	Not available
Gurden M, Morelli M, Sharp G, et al. Evaluation of a general practitioner referral service for manual treatment of back and neck pain. Primary Health Care Research & Development. 2012;13(3):204-10.	Not available
Mitchell JM, de Lissovoy G. A comparison of resource use and cost in direct access versus physician referral episodes of physical therapy. Phys Ther. 1997;77(1):10-8.	Pre-2000
Ojha HA, Brandi JA, Finn KM, et al. Cost Efficiency of Direct Access Physical Therapy for Temple University Employees with Musculoskeletal Injuries. Orthopaedic Physical Therapy Practice. 2015;27(4):228-33.	Not available
ten Hove R. Self-referral could save NHS millions. Frontline (20454910). 2015;21(9):20-21.	Editorial only
Hutting N, Staal JB, Engels JA, et al. Effect evaluation of a self-management programme for employees with complaints of the arm, neck or shoulder: a randomised controlled trial. Occupational & Environmental Medicine. 2015;72(12):852-61.	No cost information included
Myhre K, Marchand GH, Leivseth G, et al. The effect of work-focused rehabilitation among patients with neck and back pain: a randomized controlled trial. Spine. 2014;39(24):1999-2006.	No cost information included
Schaafsma FG, Whelan K, van der Beek AJ, et al. Physical conditioning as part of a return to work strategy to reduce sickness absence for workers with back pain. Cochrane Database Syst Rev. 2013(8):CD001822.	Not relevant intervention
Driessen M, Bosmans J, Proper K, et al. The economic evaluation of a participatory ergonomics programme to prevent low back and neck pain. Work. 2012;41 Suppl 1:2315-20.	Duplicate record
Bernaards CM, Bosmans JE, Hildebrandt VH, et al. The cost-effectiveness of a lifestyle physical activity intervention in addition to a work style intervention on recovery from neck and upper limb symptoms and pain reduction in computer workers. Occupational & Environmental Medicine. 2011;68(4):265-72.	Duplicate record
Schaafsma F, Schonstein E, Whelan KM, et al. Physical conditioning programs for improving work outcomes in workers with back pain. Cochrane Database Syst Rev. 2010(1):CD001822.	Not relevant intervention No costs information included
Larsen MK, Samani A, Madeleine P, et al. Short-term effects of implemented high intensity shoulder elevation during computer work. BMC Musculoskelet Disord. 2009;10:101.	No cost information included
Elfving B, Asell M, Ropponen A, et al. What factors predict full or partial return to work among sickness absentees with spinal pain participating in rehabilitation? Disability & Rehabilitation. 2009;31(16):1318-27.	No cost information included
Hall A, Richmond H, Copsey B, et al. Physiotherapist-delivered cognitive-behavioural interventions are effective for low back pain, but can they be replicated in clinical practice? A systematic review. Disabil Rehabil. 2016:1-9.	Not an economic evaluation
Lin C-WC, Haas M, Maher CG, et al. Cost-effectiveness of guideline-endorsed treatments for low back pain: a systematic	Not an economic evaluation

Full bibliographic reference	Reasons for exclusion
review. Eur Spine J. 2011;20(7):1024-38.	
Coupe VMH, Veenhof C, van Tulder MW, et al. The cost effectiveness of behavioural graded activity in patients with osteoarthritis of hip and/or knee. Ann Rheum Dis. 2007;66(2):215-21.	Not comparable intervention
Steenstra IA, Anema JR, van Tulder MW, et al. Economic evaluation of a multi-stage return to work program for workers on sick-leave due to low back pain. Journal of Occupational Rehabilitation. 2006;16(4):557-78.	Not relevant intervention
Jensen IB, Bergstrom G, Ljungquist T, et al. A 3-year follow-up of a multidisciplinary rehabilitation programme for back and neck pain. Pain. 2005;115(3):273-83.	Limited data included
Heymans MW, de Vet HCW, Bongers PM, et al. Back schools in occupational health care: design of a randomized controlled trial and cost-effectiveness study. Journal of Manipulative & Physiological Therapeutics. 2004;27(7):457-65.	Trial protocol
Jensen I, Nygren A, Gamberale F, et al. The role of the psychologist in multidisciplinary treatments for chronic neck and shoulder pain: a controlled cost-effectiveness study. Scand J Rehabil Med. 1995;27(1):19-26.	Pre-2000
Standaert CJ, Friedly J, Erwin MW, et al. Comparative effectiveness of exercise, acupuncture, and spinal manipulation for low back pain. Spine. 2011;36(21 Suppl):S120-30.	No cost information included
Henchoz Y, Pinget C, Wasserfallen J-B, et al. Cost-utility analysis of a three-month exercise programme vs usual care following multidisciplinary rehabilitation for chronic low back pain. J Rehabil Med. 2010;42(9):846-52.	Duplicate record
Groessl EJ, Weingart KR, Aschbacher K, et al. Yoga for veterans with chronic low-back pain. J Altern Complement Med. 2008;14(9):1123-9.	No cost information included
Carr JL, Klaber Moffett JA, Howarth E, et al. A randomized trial comparing a group exercise programme for back pain patients with individual physiotherapy in a severely deprived area. Disability & Rehabilitation. 2005;27(16):929-37.	Not an economic evaluation
Molde Hagen E, Grasdal A, Eriksen HR. Does early intervention with a light mobilization program reduce long-term sick leave for low back pain: a 3-year follow-up study. Spine. 2003;28(20):2309-15; discussion 16.	Not relevant intervention
Niemisto L, Lahtinen-Suopanki T, Rissanen P, et al. A randomized trial of combined manipulation, stabilizing exercises, and physician consultation compared to physician consultation alone for chronic low back pain. Spine. 2003;28(19):2185-91.	Does not appear to be a group activity
Hagen EM, Eriksen HR, Ursin H. Does early intervention with a light mobilization program reduce long-term sick leave for low back pain? Spine. 2000;25(15):1973-6.	Not available and more updated paper available (record 5086)
Moffett JK, Torgerson D, Bell-Syer S, et al. Randomised controlled trial of exercise for low back pain: clinical outcomes, costs, and preferences. BMJ. 1999;319(7205):279-83.	Pre-2000
Leggett S, Mooney V, Matheson LN, et al. Restorative exercise for clinical low back pain. A prospective two-center study with 1-year follow-up. Spine. 1999;24(9):889-98.	Pre-2000
Torstensen TA, Ljunggren AE, Meen HD, et al. Efficiency and costs of medical exercise therapy, conventional physiotherapy, and self-exercise in patients with chronic low back pain. A pragmatic, randomized, single-blinded, controlled trial with 1-year follow-up. Spine. 1998;23(23):2616-24.	Pre-2000
Malmivaara A, Hakkinen U, Aro T, et al. The treatment of acute low back pain--bed rest, exercises, or ordinary activity? N Engl J Med. 1995;332(6):351-5.	Pre-2000
Gundewall B, Liljeqvist M, Hansson T. Primary prevention of back symptoms and absence from work. A prospective randomized study among hospital employees. Spine. 1993;18(5):587-94.	Pre-2000
Versloot JM, Rozeman A, van Son AM, et al. The cost-effectiveness of a back school program in industry. A longitudinal controlled field study. Spine. 1992;17(1):22-7.	Pre-2000

Full bibliographic reference	Reasons for exclusion
Brown KC, Sirles AT, Hilyer JC, et al. Cost-effectiveness of a back school intervention for municipal employees. Spine. 1992;17(10):1224-8.	Pre-2000
Matsudaira K, Hiroe M, Kikkawa M, et al. Can standing back extension exercise improve or prevent low back pain in Japanese care workers? J Man Manip Ther. 2015;23(4):205-9.	No costs information included
Groessl EJ, Weingart KR, Johnson N, et al. The benefits of yoga for women veterans with chronic low back pain. J Altern Complement Med. 2012;18(9):832-8.	No costs information included
Dufour N, Thamsborg G, Oefeldt A, et al. Treatment of chronic low back pain: a randomized, clinical trial comparing group-based multidisciplinary biopsychosocial rehabilitation and intensive individual therapist-assisted back muscle strengthening exercises. Spine. 2010;35(5):469-76.	No costs information included

Appendix D: Summary Evidence Findings for Key Interventions in Stage One

Intervention	Evidence
Exercise therapy	Back pain: some evidence of cost-effectiveness of class based sessions, supported by a systematic review. OA: based mostly on a mix of class based exercise, supplemented by home based exercise, this therapy is may be cost saving, but the evidence is mixed as to whether the cost of the class is offset by reduced need for healthcare. There is evidence of improvements in knee pain especially when combined with diet/weight management, but not good evidence for hip pain. Some of the evidence refers to 'seniors' so may be less relevant to the working age group. No cost-effectiveness evidence was found for the CHAIN knee programme.
Integrated / multi-disciplinary programmes	There is some variation in the models of care but the general principle of a multi-disciplinary approach incorporating patient education, exercise and various professional inputs runs through the literature. OA: studies show good evidence that the ESCAPE-pain programme is cost-effective. It has small cost implications, but was more likely to be cost-effective in improving function than usual primary care. The use of group rehabilitation is found to reduce costs without compromising clinical effectiveness, therefore contributing to cost-effectiveness. Back pain: a systematic review concluded that the evidence is inadequate to determine cost-effectiveness due to the variability of the interventions, comparators and outcomes. However, several single studies show positive cost-effectiveness, including the 'back book', patient education and exercises, relaxation and some also including cognitive approaches.
Workplace programmes	Primary prevention: pre-work screening for employees hired into physically laborious jobs shows evidence of reduced medical cost and reduced work days lost. Corporate wellness programmes showed mixed results for back pain and were not cost-effective for neck pain or OA. Secondary prevention: there is some evidence that self-referral to workplace physiotherapy is cost-effective across conditions. For neck pain, a programme targeting computer workers with neck symptoms showed cost-effectiveness for pain reduction. For back pain, programmes including mixed approaches (information leaflet, psychosocial education, staff training, and ergonomic controls) had the potential to be cost-effective.
Self-management / education	OA: two studies showed conflicting evidence, so this is inconclusive. Back pain: interventions with lay and psychologist input showed modest improvements in outcomes but at higher costs than usual care.
STarT Back	Back pain: RCT evidence shows that the STarT Back stratified primary care management approach for back pain, using prognostic

Intervention	Evidence
(Stratified risk assessment and care)	screening and matched pathways, leads to improved outcomes and increased quality of life. Economic analysis found stratified care to be a highly cost-effective use of resources across all risk groups.
Cognitive approaches	With the exception of one study, on an internet based cognitive behavioural intervention for chronic pain (not specified), all of the studies were on back pain. One was inconclusive but the rest all concluded that CBT based approaches were cost-effective, either alone or in conjunction with other treatments. Behavioural graded activity (physical activity programme, underpinned by cognitive approaches) was not shown to be cost-effective for either OA or back pain.
Physiotherapy	Neck pain: the cost-effectiveness evidence does not appear to be strong for neck pain. There is some suggestion that a brief physiotherapy intervention is as effective as the usual course of physiotherapy treatment. One study showed spinal mobilisation to be more effective and less costly than physiotherapy. Back pain: different physiotherapy regimens were found to improve disability and physiotherapy led pain management classes offer an alternative to usual outpatient physiotherapy care. Evidence shows that physiotherapy is in general cost effective for back pain but not more so than GP care alone. There is some evidence for brief intervention and advice being more cost-effective than the usual care model for physiotherapy.
Acupuncture	The majority of studies were for back pain. Evidence from these studies suggests that acupuncture is cost effective, producing modest health gains at minor additional cost. The evidence is for acupuncture alone and in conjunction with routine care, suggesting both are cost-effective, particularly where improvements in depression are included as an outcome.

Appendix E: Stage Two Search Strategies

E.1: ESCAPE-pain, STarT Back, SWAP

Database: Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>
Date run: 02/03/17
Database coverage: 1946 to current
Records returned: 90

Search Strategy:
---

1 Osteoarthritis/ or Osteoarthritis, Hip/ or Osteoarthritis, Knee/ (52266)
2 (osteoarthrit$ or osteo-arthrit$ or osteoarthro$ or osteo-arthro$).ti,ab,kf. (57177)
3 (coxarthr$ or gonarthr$).ti,ab,kf. (2787)
4 ((degenerative or non-inflammatory or noninflammatory) adj3 arthri$).ti,ab,kf. (1569)
5 ((knee or knees or hip or hips or cox or coxa or coxas or femorotibial) and (arthrosis or arthroses)).ti,ab,kf. (1725)
6 degenerative joint disease.ti,ab,kf. (2007)
7 exp Back Pain/ or Neck Pain/ or exp Musculoskeletal pain/ (40668)
8 Sciatica/ or Sciatic Neuropathy/ (6485)
9 Radiculopathy/ (4355)
10 exp Neck Injuries/ or Back Injuries/ (8709)
11 Intervertebral Disc Displacement/ or Intervertebral Disc Degeneration/ (19521)
12 exp Spondylitis/ or exp Spondylosis/ or Spinal Stenosis/ (41218)
13 exp Brachial Plexus Neuropathies/ (3283)
14 Torticollis/ (3292)
15 chronic pain/ or fibromyalgia/ (15109)
16 (exp back/ or exp back muscles/ or exp spine/ or exp neck/ or neck muscles/ or hip/ or exp hip joint/ or knee/ or exp knee joint/) and (pain/ or acute pain/ or musculoskeletal pain/ or myalgia/ or arthralgia/ or exp neuralgia/ or exp nociceptive pain/ or pain, intractable/ or pain, referred/ or exp "sprains and strains"/) (12519)
17 (backache$ or lumbago or sciatica or sciaticas).ti,ab,kf. (8583)
18 (dorsalgia$ or coccydynia$).ti,ab,kf. (185)
19 (cervicalgia$ or cervicodynia$ or neckache$ or brachialgia$).ti,ab,kf. (303)
20 ((back or backs or spine$1 or spinal or sacroiliac or vertebrogenic or lumbar or lumbosacral or lumbo-sacral or cervical or coccy$ or tailbone$ or tail bone$ or thoracic or radicular or neck or necks or cervicobrachial or brachial or knee or knees or tibiofibular or patellofemoral or hip or hips or coxa or coxas or acetabulofemoral) adj3 (pain$ or ache or aches or aching or discomfort$ or stiff$ or neuralgia$ or neuralgic$ or neuropath$ or neuriti$ or sprain$1 or strain$1 or injur$ or myalgia$1 or myalgic or arthralgi$ or allodyni$ or hyperalgesi$ or misalign$)).ti,ab,kf. (136845)
21 (musculoskeletal adj3 (pain$ or ache or aches or aching or discomfort$ or stiff$ or sprain$1 or strain$1 or injur$)).ti,ab,kf. (8544)
22 ((disc or discs or disk or disks) adj3 (hernia$ or slipped or slip or displac$ or prolapse$ or degenerat$ or degradat$ or bulge$ or bulging or protrud$ or protrusion$)).ti,ab,kf. (20229)
23 (whiplash or cervical acceleration deceleration).ti,ab,kf. (2856)
24 (torticollis or cervical dystonia$).ti,ab,kf. (4002)
25 (nerve root$ adj3 (pain$ or avulsion or compress$ or disorder$ or pinch$ or inflam$ or imping$ or irritat$ or entrap$ or trap$)).ti,ab,kf. (2137)
26 (radiculopath$ or radiculitis or radiculitides).ti,ab,kf. (5937)

27 (brachial plexopath$ or klumpke paralysis or dejerine-klumpke or klumpke$ pals$).ti,ab,kf. (620)
28 (parsonage-aldren-turner or parsonage-turner).ti,ab,kf. (173)
29 (brachial plexus adj3 (disorder$ or disease$ or paralys$)).ti,ab,kf. (425)
30 (amyotrophic adj3 (neuralgia$ or neuralgic$ or neuropath$ or neuriti$)).ti,ab,kf. (137)
31 (shoulder girdle$ adj3 (neuralgia$ or neuralgic$ or neuropath$ or neuriti$)).ti,ab,kf. (8)
32 (erb adj3 (paraly$ or palsy or palsies)).ti,ab,kf. (74)
33 (ankylosis or spondylitis or spondylitide$ or discitis or discitides or diskitis or diskitides or spondylodisk$ or spondylodisc$ or spondylarthr$ or spondyloarthr$ or spondylos$ or spondylolisthes$).ti,ab,kf. (33060)
34 (spinal arthr$ or marie-strumpell or bechterew).ti,ab,kf. (752)
35 (spinal stenoses or spinal stenosis).ti,ab,kf. (4037)
36 (chronic widespread pain$ or CWP or CWPS or widespread pain disorder$ or widespread pain syndrome$).ti,ab,kf. (1141)
37 (fibromyalgi$ or fibromyositis or fibrositis or fibrositides or muscular rheumatism or myofascial pain syndrome).ti,ab,kf. (9681)
38 or/1-37 (328947)
39 (escape pain or escape knee pain).ti,ab,kf. (12)
40 (Good Life with osteoArthritis in Denmark or (gla adj d)).ti,ab,kf. (7)
41 (STarT Back or IMPaCT Back or ISRCTN37113406 or ISRCTN55174281).ti,ab,kf. (81)
42 (stratified adj3 management).ti,ab,kf. (112)
43 (swap or vocational advice or vocational adviser$ or workplace advice or ISRCTN52269669).ti,ab,kf. (1676)
44 or/39-43 (1886)
45 38 and 44 (100)
46 exp animals/ not humans/ (4326005)
47 (news or comment or editorial or letter or case reports).pt. or case report.ti. (3404399)
48 45 not (46 or 47) (94)
49 limit 48 to english language (93)
50 remove duplicates from 49 (90)

Database: CINAHL (EBSCO Host)
Date run: 02/03/17
Database coverage: 1937 to current
Records returned: 96

S15 S1 OR S2 OR S3 OR S4 OR S14 Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search
Database - CINAHL Plus 96
S14 S10 AND S13 Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search
Database - CINAHL Plus 15
S13 S11 OR S12 Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search
Database - CINAHL Plus 404
S12 TX swap or "vocational advice" or "vocational adviser*" or ISRCTN52269669) Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search
Database - CINAHL Plus 369
S11 TX stratified N3 management Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search

Database - CINAHL Plus 35
S10 S5 OR S6 OR S7 OR S8 OR S9 Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search
Database - CINAHL Plus 104,757
S9 TX (back or backs or spine* or spinal or sacroiliac or vertebrogenic or lumbar or lumbosacral or lumbo-sacral or cervical or coccy* or tailbone* or tail bone* or thoracic or radicular or neck or necks or cervicobrachial or brachial or knee or knees or tibiofibular or patellofemoral or hip or hips or coxa or coxas or acetabulofemoral) N3 (pain* or ache or aches or aching or discomfort* or stiff* or neuralgia* or neuralgic* or neuropath* or neuriti* or sprain* or strain* or injur* or myalgia* or myalgic or arthralgi* or allodyni* or hyperalgesi* or misalign*) Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search
Database - CINAHL Plus 79,554
S8 TX musculoskeletal N3 (pain* or ache or aches or aching or discomfort* or stiff* or sprain* or strain* or injur*) Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search
Database - CINAHL Plus 5,975
S7 (MH "Back Pain+") OR (MH "Neck Pain") OR (MH "Muscle Pain") Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search
Database - CINAHL Plus 27,559
S6 (MH "Back Injuries+") OR (MH "Neck Injuries+") Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search
Database - CINAHL Plus 9,791
S5 (MH "Osteoarthritis+") Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search
Database - CINAHL Plus 19,371
S4 TX "STarT Back" or "IMPaCT Back" or ISRCTN37113406 or ISRCTN55174281 Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search
Database - CINAHL Plus 77
S3 TX gla W1 d Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search
Database - CINAHL Plus 1
S2 TX "Good Life with osteoArthritis in Denmark" Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search
Database - CINAHL Plus 2
S1 TX "escape pain" or "escape knee pain" Search modes - Boolean/Phrase Interface - EBSCOhost Research Databases
Search Screen - Advanced Search
Database - CINAHL Plus 5

E.2: Self-referral to physiotherapy

Database: Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>
Date run: 02/03/17
Database coverage: 1946 to current
Records returned: 115

Search Strategy:

---

1 Osteoarthritis/ or Osteoarthritis, Hip/ or Osteoarthritis, Knee/ (52266)
2 (osteoarthrit$ or osteo-arthrit$ or osteoarthro$ or osteo-arthro$).ti,ab,kf. (57177)
3 (coxarthr$ or gonarthr$).ti,ab,kf. (2787)
4 ((degenerative or non-inflammatory or noninflammatory) adj3 arthri$).ti,ab,kf. (1569)
5 ((knee or knees or hip or hips or cox or coxa or coxas or femorotibial) and (arthrosis or arthroses)).ti,ab,kf. (1725)
6 degenerative joint disease.ti,ab,kf. (2007)
7 exp Back Pain/ or Neck Pain/ or exp Musculoskeletal pain/ or Musculoskeletal Diseases/ (50613)
8 Sciatica/ or Sciatic Neuropathy/ (6485)
9 Radiculopathy/ (4355)
10 exp Neck Injuries/ or Back Injuries/ (8709)
11 Intervertebral Disc Displacement/ or Intervertebral Disc Degeneration/ (19521)
12 exp Spondylitis/ or exp Spondylosis/ or Spinal Stenosis/ (41218)
13 exp Brachial Plexus Neuropathies/ (3283)
14 Torticollis/ (3292)
15 chronic pain/ or fibromyalgia/ (15109)
16 (exp back/ or exp back muscles/ or exp spine/ or exp neck/ or neck muscles/ or hip/ or exp hip joint/ or knee/ or exp knee joint/) and (pain/ or acute pain/ or musculoskeletal pain/ or myalgia/ or arthralgia/ or exp neuralgia/ or exp nociceptive pain/ or pain, intractable/ or pain, referred/ or exp "sprains and strains"/) (12519)
17 (backache$ or lumbago or sciatica or sciaticas).ti,ab,kf. (8583)
18 (dorsalgia$ or coccydynia$).ti,ab,kf. (185)
19 (cervicalgia$ or cervicodynia$ or neckache$ or brachialgia$).ti,ab,kf. (303)
20 ((back or backs or spine$1 or spinal or sacroiliac or vertebrogenic or lumbar or lumbosacral or lumbo-sacral or cervical or coccy$ or tailbone$ or tail bone$ or thoracic or radicular or neck or necks or cervicobrachial or brachial or knee or knees or tibiofibular or patellofemoral or hip or hips or coxa or coxas or acetabulofemoral) adj3 (pain$ or ache or aches or aching or discomfort$ or stiff$ or neuralgia$ or neuralgic$ or neuropath$ or neuriti$ or sprain$1 or strain$1 or injur$ or myalgia$1 or myalgic or arthralgi$ or allodyni$ or hyperalgesi$ or misalign$)).ti,ab,kf. (136845)
21 (musculoskeletal adj3 (pain$ or ache or aches or aching or discomfort$ or stiff$ or sprain$1 or strain$1 or injur$ or disease$1 or disorder$1 or problem$)).ti,ab,kf. (16832)
22 ((disc or discs or disk or disks) adj3 (hernia$ or slipped or slip or displac$ or prolapse$ or degenerat$ or degradat$ or bulge$ or bulging or protrud$ or protrusion$)).ti,ab,kf. (20229)
23 (whiplash or cervical acceleration deceleration).ti,ab,kf. (2856)
24 (torticollis or cervical dystonia$).ti,ab,kf. (4002)
25 (nerve root$ adj3 (pain$ or avulsion or compress$ or disorder$ or pinch$ or inflam$ or imping$ or irritat$ or entrap$ or trap$)).ti,ab,kf. (2137)
26 (radiculopath$ or radiculitis or radiculitides).ti,ab,kf. (5937)
27 (brachial plexopath$ or klumpke paralysis or dejerine-klumpke or klumpke$ pals$).ti,ab,kf. (620)
28 (parsonage-aldren-turner or parsonage-turner).ti,ab,kf. (173)
29 (brachial plexus adj3 (disorder$ or disease$ or paralys$)).ti,ab,kf. (425)
30 (amyotrophic adj3 (neuralgia$ or neuralgic$ or neuropath$ or neuriti$)).ti,ab,kf. (137)

31 (shoulder girdle$ adj3 (neuralgia$ or neuralgic$ or neuropath$ or neuriti$)).ti,ab,kf. (8)
32 (erb adj3 (paraly$ or palsy or palsies)).ti,ab,kf. (74)
33 (ankylosis or spondylitis or spondylitide$ or discitis or discitides or diskitis or diskitides or spondylodisk$ or spondylodisc$ or spondylarthr$ or spondyloarthr$ or spondylos$ or spondylolisthes$).ti,ab,kf. (33060)
34 (spinal arthr$ or marie-strumpell or bechterew).ti,ab,kf. (752)
35 (spinal stenoses or spinal stenosis).ti,ab,kf. (4037)
36 (chronic widespread pain$ or CWP or CWPS or widespread pain disorder$ or widespread pain syndrome$).ti,ab,kf. (1141)
37 (fibromyalgi$ or fibromyositis or fibrositis or fibrositides or muscular rheumatism or myofascial pain syndrome).ti,ab,kf. (9681)
38 or/1-37 (340610)
39 exp Physical Therapy Modalities/ (128978)
40 Physical Therapy Specialty/ (2463)
41 Physical Therapy Department, Hospital/ (319)
42 physiotherap$.ti,ab,kf. (20186)
43 ((physical or manual or manipulative) adj therap$).ti,ab,kf. (22086)
44 or/39-43 (151910)
45 *"Referral and Consultation"/ (22477)
46 (self-refer$ or direct$ access$ or patient led referral$ or patient directed referral$).ti,ab,kf. (7423)
47 45 or 46 (29519)
48 44 and 47 (467)
49 38 and 48 (148)
50 physiodirect$.ti,ab,kf. (11)
51 49 or 50 (155)
52 exp animals/ not humans/ (4326005)
53 (news or comment or editorial or letter or case reports).pt. or case report.ti. (3404399)
54 51 not (52 or 53) (125)
55 limit 54 to english language (118)
56 remove duplicates from 55 (115)

Database: CINAHL (EBSCO Host)
Date run: 02/03/17
Database coverage: 1937 to current
Records returned: 149

S24
s21 not (s22 or s23)
Search modes - Boolean/Phrase
View Results (149) View Details Edit
S23
(MH "Animal Studies")
Search modes - Boolean/Phrase
View Results (75,975) View Details Edit
S22
PT(editorial or letter or commentary)
Search modes - Boolean/Phrase
View Results (532,189) View Details Edit
S21
S19 OR S20
Search modes - Boolean/Phrase
View Results (210) View Details Edit
S20
physiodirect*

Search modes - Boolean/Phrase
View Results (12) View Details Edit
S19
S17 AND S18
Search modes - Boolean/Phrase
View Results (200) View Details Edit
S18
(s1 or s2) and s9
Search modes - Boolean/Phrase
View Results (2,597) View Details Edit
S17
S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16
Search modes - Boolean/Phrase
View Results (115,321) View Details Edit
S16
TX osteoarthri*
Search modes - Boolean/Phrase
View Results (26,310) View Details Edit
S15
TX (back or backs or spine* or spinal or sacroiliac or vertebrogenic or lumbar or lumbosacral or lumbo-sacral or cervical or coccy* or tailbone* or tail bone* or thoracic or radicular or neck or necks or cervicobrachial or brachial or knee or knees or tibiofibular or patellofemoral or hip or hips or coxa or coxas or acetabulofemoral) N3 (pain* or ache or aches or aching or discomfort* or stiff* or neuralgia* or neuralgic* or neuropath* or neuriti* or sprain* or strain* or injur* or myalgia* or m ...
Search modes - Boolean/Phrase
View Results (79,594) View Details Edit
S14
TX musculoskeletal N3 (pain* or ache or aches or aching or discomfort* or stiff* or sprain* or strain* or injur* or problem* or disease* of disorder*)
Search modes - Boolean/Phrase
View Results (6,684) View Details Edit
S13
(MH "Musculoskeletal Diseases")
Search modes - Boolean/Phrase
View Results (6,528) View Details Edit
S12
(MH "Back Pain+") OR (MH "Neck Pain") OR (MH "Muscle Pain")
Search modes - Boolean/Phrase
View Results (27,569) View Details Edit
S11
(MH "Back Injuries+") OR (MH "Neck Injuries+")
Search modes - Boolean/Phrase
View Results (9,794) View Details Edit
S10
(MH "Osteoarthritis") OR (MH "Osteoarthritis, Hip") OR (MH "Osteoarthritis, Knee")
Search modes - Boolean/Phrase
View Results (19,156) View Details Edit
S9
S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8
Search modes - Boolean/Phrase
View Results (234,789) View Details Edit
S8
TX (physical or manual or manipulative) N1 therap*
Search modes - Boolean/Phrase
View Results (164,770) View Details Edit

S7
TX physiotherap*
Search modes - Boolean/Phrase
View Results (42,464) View Details Edit
S6
(MH "Physical Therapy Assessment")
Search modes - Boolean/Phrase
View Results (2,011) View Details Edit
S5
(MH "Physical Therapy Service")
Search modes - Boolean/Phrase
View Results (838) View Details Edit
S4
(MH "Physical Therapists")
Search modes - Boolean/Phrase
View Results (7,900) View Details Edit
S3
(MH "Physical Therapy+")
Search modes - Boolean/Phrase
View Results (101,275) View Details Edit
S2
TX "self-refer*" or "direct* access*" or "patient led referral*" or "patient directed referral*"
Search modes - Boolean/Phrase
View Results (2,161) View Details Edit
S1
(MM "Referral and Consultation")
Search modes - Boolean/Phrase

E.3: Group physical activity classes for back pain

Database: Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>
Date run: 07/03/17
Database coverage: 1946 to current
Records returned: 135 and 131 (2 strategies used – one for economic evaluations and one more focused search not limited by study design to find trials published in the last 10 years).

Search Strategy:

1	exp Back Pain/ or Sciatica/ or Sciatic Neuropathy/ (38485)
2	Back Injuries/ (1461)
3	Intervertebral Disc Displacement/ or Intervertebral Disc Degeneration/ (19528)
4	exp Spondylitis/ or exp Spondylosis/ or Spinal Stenosis/ (41229)
5	(exp back/ or exp back muscles/ or exp spine/) and (pain/ or acute pain/ or musculoskeletal pain/ or myalgia/ or arthralgia/ or exp neuralgia/ or exp nociceptive pain/ or pain, intractable/ or pain, referred/ or exp "sprains and strains"/) (5948)
6	(backache$ or lumbago or sciatica or sciaticas).ti,ab,kf. (8593)
7	(dorsalgia$ or coccydynia$).ti,ab,kf. (185)

8 ((back or backs or spine$1 or spinal or sacroiliac or vertebrogenic or lumbar or lumbosacral or lumbo-sacral or coccy$ or tailbone$ or tail bone$ or thoracic or radicular) adj3 (pain$ or ache or aches or aching or discomfort$ or stiff$ or neuralgia$ or neuralgic$ or neuropath$ or neuriti$ or sprain$1 or strain$1 or injur$ or myalgia$1 or myalgic or arthralgi$ or allodyni$ or hyperalgesi$ or misalign$)).ti,ab,kf. (97110)
9 ((disc or discs or disk or disks) adj3 (hernia$ or slipped or slip or displac$ or prolapse$ or degenerat$ or degradat$ or bulge$ or bulging or protrud$ or protrusion$)).ti,ab,kf. (20276)
10 (ankylosis or spondylitis or spondylitide$ or discitis or discitides or diskitis or diskitides or spondylodisk$ or spondylodisc$ or spondylarthr$ or spondyloarthr$ or spondylos$ or spondylolisthes$).ti,ab,kf. (33125)
11 (spinal stenoses or spinal stenosis or spinal arthr$).ti,ab,kf. (4578)
12 or/1-11 (182802)
13 exp Exercise/ (150545)
14 exp Exercise Therapy/ (39360)
15 exp Exercise Movement Techniques/ (6514)
16 ((group or groups or group based) adj4 (exercis$ or fitness$ or physical activit$ or program$ or training)).ti,ab,kf. (40294)
17 ((exercis$ or fitness or sport$ or activity) adj4 (class or classes or class based)).ti,ab,kf. (5359)
18 (aerobics or yoga or pilates or tai ji or tai chi or taichi or taiji or taijiquan).ti,ab,kf. (5238)
19 or/13-18 (215275)
20 exp "Costs and Cost Analysis"/ (205716)
21 (economic or cost or costs).ti. (118600)
22 (economic evaluation$ or economic appraisal or economic assessment$ or cost effectiv$ or cost utility or cost benefit or cost consequence or costing study or cost assessment).ti,ab. (116128)
23 *Economics/ (10528)
24 or/20-23 (325875)
25 12 and 19 and 24 (158)
26 exp animals/ not humans/ (4327457)
27 (news or comment or editorial or letter or case reports).pt. or case report.ti. (3406726)
28 25 not (26 or 27) (149)
29 limit 28 to english language (141)
30 remove duplicates from 29 (135)

1 exp Back Pain/ or Sciatica/ or Sciatic Neuropathy/ (38485)
2 Back Injuries/ (1461)
3 Intervertebral Disc Displacement/ or Intervertebral Disc Degeneration/ (19528)
4 exp Spondylitis/ or exp Spondylosis/ or Spinal Stenosis/ (41229)
5 (exp back/ or exp back muscles/ or exp spine/) and (pain/ or acute pain/ or musculoskeletal pain/ or myalgia/ or arthralgia/ or exp neuralgia/ or exp nociceptive pain/ or pain, intractable/ or pain, referred/ or exp "sprains and strains"/) (5948)
6 (backache$ or lumbago or sciatica or sciaticas).ti,ab,kf. (8593)
7 (dorsalgia$ or coccydynia$).ti,ab,kf. (185)
8 ((back or backs or spine$1 or spinal or sacroiliac or vertebrogenic or lumbar or lumbosacral or lumbo-sacral or coccy$ or tailbone$ or tail bone$ or thoracic or radicular) adj3 (pain$ or ache or aches or aching or discomfort$ or stiff$ or neuralgia$ or neuralgic$ or neuropath$ or neuriti$ or sprain$1 or strain$1 or injur$ or myalgia$1 or myalgic or arthralgi$ or allodyni$ or hyperalgesi$ or misalign$)).ti,ab,kf. (97110)
9 ((disc or discs or disk or disks) adj3 (hernia$ or slipped or slip or displac$ or prolapse$ or degenerat$ or degradat$ or bulge$ or bulging or protrud$ or protrusion$)).ti,ab,kf. (20276)
10 (ankylosis or spondylitis or spondylitide$ or discitis or discitides or diskitis or diskitides or spondylodisk$ or spondylodisc$ or spondylarthr$ or spondyloarthr$ or spondylos$ or spondylolisthes$).ti,ab,kf. (33125)
11 (spinal stenoses or spinal stenosis or spinal arthr$).ti,ab,kf. (4578)
12 or/1-11 (182802)

13 (exp Exercise Therapy/ or exp Exercise/) and (group or groups or class or classes).ti. (1570)
14 ((group or groups or group based) adj (exercis$ or fitness$ or physical activit$ or program$ or training)).ti,ab,kf. (3740)
15 ((exercis$ or fitness or sport$ or activity) adj (class or classes or class based)).ti,ab,kf. (864)
16 ((aerobic$ or yoga or pilates or tai chi) adj (group or groups or group based or class or classes)).ti,ab,kf. (820)
17 or/13-16 (6610)
18 12 and 17 (241)
19 exp animals/ not humans/ (4327457)
20 (news or comment or editorial or letter or case reports).pt. or case report.ti. (3406726)
21 18 not (19 or 20) (238)
22 limit 21 to english language (223)
23 remove duplicates from 22 (214)
24 limit 23 to yr="2007 -Current" (151)

E.4: Cognitive and psychological approaches (CBT)

Database: Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>
Date run: 07/03/17
Database coverage: 1946 to current
Records returned: 112

Searched only for economic evidence as recent Cochrane Systematic Reviews provide effectiveness evidence

Search Strategy:
---
1 Osteoarthritis/ or Osteoarthritis, Hip/ or Osteoarthritis, Knee/ (52291)
2 (osteoarthrit$ or osteo-arthrit$ or osteoarthro$ or osteo-arthro$).ti,ab,kf. (57289)
3 (coxarthr$ or gonarthr$).ti,ab,kf. (2791)
4 ((degenerative or non-inflammatory or noninflammatory) adj3 arthri$).ti,ab,kf. (1570)
5 ((knee or knees or hip or hips or cox or coxa or coxas or femorotibial) and (arthrosis or arthroses)).ti,ab,kf. (1727)
6 degenerative joint disease.ti,ab,kf. (2010)
7 exp Back Pain/ or Neck Pain/ or exp Musculoskeletal pain/ (40685)
8 Sciatica/ or Sciatic Neuropathy/ (6487)
9 Radiculopathy/ (4355)
10 exp Neck Injuries/ or Back Injuries/ (8712)
11 Intervertebral Disc Displacement/ or Intervertebral Disc Degeneration/ (19528)
12 exp Spondylitis/ or exp Spondylosis/ or Spinal Stenosis/ (41229)
13 exp Brachial Plexus Neuropathies/ (3283)
14 Torticollis/ (3293)
15 chronic pain/ or fibromyalgia/ (15140)
16 (exp back/ or exp back muscles/ or exp spine/ or exp neck/ or neck muscles/ or hip/ or exp hip joint/ or knee/ or exp knee joint/) and (pain/ or acute pain/ or musculoskeletal pain/ or myalgia/ or arthralgia/ or exp neuralgia/ or exp nociceptive pain/ or pain, intractable/ or pain, referred/ or exp "sprains and strains"/) (12525)
17 (backache$ or lumbago or sciatica or sciaticas).ti,ab,kf. (8593)
18 (dorsalgia$ or coccydynia$).ti,ab,kf. (185)
19 (cervicalgia$ or cervicodynia$ or neckache$ or brachialgia$).ti,ab,kf. (304)

20 ((back or backs or spine$1 or spinal or sacroiliac or vertebrogenic or lumbar or lumbosacral or lumbo-sacral or cervical or coccy$ or tailbone$ or tail bone$ or thoracic or radicular or neck or necks or cervicobrachial or brachial or knee or knees or tibiofibular or patellofemoral or hip or hips or coxa or coxas or acetabulofemoral) adj3 (pain$ or ache or aches or aching or discomfort$ or stiff$ or neuralgia$ or neuralgic$ or neuropath$ or neuriti$ or sprain$1 or strain$1 or injur$ or myalgia$1 or myalgic or arthralgi$ or allodyni$ or hyperalgesi$ or misalign$)).ti,ab,kf. (137099)
21 (musculoskeletal adj3 (pain$ or ache or aches or aching or discomfort$ or stiff$ or sprain$1 or strain$1 or injur$)).ti,ab,kf. (8557)
22 ((disc or discs or disk or disks) adj3 (hernia$ or slipped or slip or displac$ or prolapse$ or degenerat$ or degradat$ or bulge$ or bulging or protrud$ or protrusion$)).ti,ab,kf. (20276)
23 (whiplash or cervical acceleration deceleration).ti,ab,kf. (2860)
24 (torticollis or cervical dystonia$).ti,ab,kf. (4005)
25 (nerve root$ adj3 (pain$ or avulsion or compress$ or disorder$ or pinch$ or inflam$ or imping$ or irritat$ or entrap$ or trap$)).ti,ab,kf. (2138)
26 (radiculopath$ or radiculitis or radiculitides).ti,ab,kf. (5949)
27 (brachial plexopath$ or klumpke paralysis or dejerine-klumpke or klumpke$ pals$).ti,ab,kf. (621)
28 (parsonage-aldren-turner or parsonage-turner).ti,ab,kf. (174)
29 (brachial plexus adj3 (disorder$ or disease$ or paralys$)).ti,ab,kf. (425)
30 (amyotrophic adj3 (neuralgia$ or neuralgic$ or neuropath$ or neuriti$)).ti,ab,kf. (137)
31 (shoulder girdle$ adj3 (neuralgia$ or neuralgic$ or neuropath$ or neuriti$)).ti,ab,kf. (8)
32 (erb adj3 (paraly$ or palsy or palsies)).ti,ab,kf. (74)
33 (ankylosis or spondylitis or spondylitide$ or discitis or discitides or diskitis or diskitides or spondylodisk$ or spondylodisc$ or spondylarthr$ or spondyloarthr$ or spondylos$ or spondylolisthes$).ti,ab,kf. (33125)
34 (spinal arthr$ or marie-strumpell or bechterew).ti,ab,kf. (753)
35 (spinal stenoses or spinal stenosis).ti,ab,kf. (4041)
36 (chronic widespread pain$ or CWP or CWPS or widespread pain disorder$ or widespread pain syndrome$).ti,ab,kf. (1150)
37 (fibromyalgi$ or fibromyositis or fibrositis or fibrositides or muscular rheumatism or myofascial pain syndrome).ti,ab,kf. (9693)
38 or/1-37 (329470)
39 Conditioning, Operant/ (18763)
40 Reality Therapy/ (264)
41 psychotherapy/ or exp behavior therapy/ or psychotherapy, rational-emotive/ (110012)
42 ((cognitive or cognition or metacognit$ or behavior$ or behaviour$) adj3 (treatment$ or therap$ or psychotherap$)).ti,ab,kf. (42425)
43 (cbt or cbasp or iapt).ti,ab,kf. (8119)
44 ((cognitive or cognition or metacognit$ or behavior$ or behaviour$) adj3 (treatment$ or therap$ or psychotherap$ or analysis)).ti,ab,kf. (52914)
45 (talking therap$ or mindfulness).ti,ab,kf. (4147)
46 ((cognitive or cognition) adj3 educat$).ti,ab,kf. (1732)
47 (operant adj3 (therap$ or treatment$ or conditioning)).ti,ab,kf. (2089)
48 functional analytic psychotherapy.ti,ab,kf. (33)
49 or/39-48 (166615)
50 49 and 38 (2977)
51 exp "Costs and Cost Analysis"/ (205716)
52 (economic or cost or costs).ti. (118600)
53 (economic evaluation$ or economic appraisal or economic assessment$ or cost effectiv$ or cost utility or cost benefit or cost consequence or costing study or cost assessment).ti,ab. (116128)
54 *Economics/ (10528)
55 51 or 52 or 53 or 54 (325875)
56 50 and 55 (129)

57 exp animals/ not humans/ (4327457)
58 (news or comment or editorial or letter or case reports).pt. or case report.ti. (3406726)
59 56 not (57 or 58) (124)
60 limit 59 to english language (119)
61 remove duplicates from 60 (112)

E.5: Workplace interventions for back pain

Database: Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>
Date run: 02/03/17
Database coverage: 1946 to current
Records returned: 220
Search limited to 2009 to current to reflect date a Cochrane Systematic Review in this topic was carried out.

1 Neck Pain/ or exp Neck Injuries/ (12330)
2 Torticollis/ (3292)
3 (exp neck/ or neck muscles/) and (pain/ or acute pain/ or musculoskeletal pain/ or myalgia/ or arthralgia/ or exp neuralgia/ or exp nociceptive pain/ or pain, intractable/ or pain, referred/ or exp "sprains and strains"/) (1086)
4 (cervicalgia$ or cervicodynia$ or neckache$ or brachialgia$).ti,ab,kf. (303)
5 ((neck or necks or cervical or cervicobrachial or brachial) adj3 (pain$ or ache or aches or aching or discomfort$ or stiff$ or neuralgia$ or neuralgic$ or neuropath$ or neuriti$ or sprain$1 or strain$1 or injur$ or myalgia$1 or myalgic or arthralgi$ or allodyni$ or hyperalgesi$ or misalign$)).ti,ab,kf. (25233)
6 (whiplash or cervical acceleration deceleration).ti,ab,kf. (2856)
7 (torticollis or cervical dystonia$).ti,ab,kf. (4002)
8 or/1-7 (37290)
9 Workplace/ (17326)
10 Occupational Diseases/pc (16230)
11 (work$ based or work place based or work$ led or work place led or work$ focused or work place focused or employer-based or employer-led or employer focused or work$ communit$ or work place communit$).ti,ab,kf. (5124)
12 ((occupational or employee$ or work or working or worker or workers or workplace$ or work-place$ or worksite$ or work-site$ or jobsite$ or job-site$) adj3 (intervention$ or therap$ or program$ or session$ or class$ or train$ or exercis$ or educat$ or rehab$)).ti,ab,kf. (57032)
13 or/9-12 (90904)
14 8 and 13 (490)
15 exp animals/ not humans/ (4326005)
16 (news or comment or editorial or letter or case reports).pt. or case report.ti. (3404399)
17 14 not (15 or 16) (471)
18 limit 17 to (english language and yr="2009 -Current") (236)
19 remove duplicates from 18 (220)

Appendix F: Data Extraction for Included Studies for Included Interventions

Table F.1: Bibliographic details and descriptions of included studies

Study	Description of the study/report	Which of the 7 interventions is it most relevant to	Country of study and setting	Participant characteristics if stated (age, sex, ethnic origin, condition status and comorbidity)	Comparator details (who, where when)	Sample size (intervention and comparator, numbers starting and finishing)	Methods of analysis (type of economic analysis, data sources, time horizon, discount rates, perspective and measures of uncertainty)
M. V. Hurley, N. E. Walsh, H. Mitchell, J. Nicholas and A. Patel. Long-term outcomes and costs of an integrated rehabilitation program for chronic knee pain: a pragmatic, cluster randomized, controlled trial (Structured abstract). 2012 Arthritis Care and Research 64 (2) 238-247	Cost effectiveness evaluation alongside a clinical trial of ESCAPE-knee pain	ESCAPE-PAIN	UK primary care	Mean age 66 (had to be over 50) reporting knee pain for at least six months (mean WOMAC function 27.2). Patients had to have had no physio in previous 12 months and not be wheelchair bound	Usual care. ESCAPE was delivered in a group and individual setting. Results presented for both group and individual ESCAPE combined	140 in usual care, 146 in individual ESCAPE and 132 in Group ESCAPE. Numbers finishing were not provided	Cost analysis from perspective of UK NHS (2003/04 prices). Thirty month time horizon. Costs were sourced from Client Services Receipt Inventory covering health and voluntary resources, use of rehabilitation facilities, patient costs, time off work, benefits and informal care. Costs of delivering the intervention were calculated from the bottom up. Costs were discounted at 3.5%pa
S. A. Jessep, N. E. Walsh, J. Ratcliffe and M. V. Hurley. Long-term clinical benefits and costs of an integrated rehabilitation programme compared with outpatient physiotherapy for chronic knee pain (Structured abstract).	Cost effectiveness evaluation alongside a clinical trial of ESCAPE-knee pain	ESCAPE-PAIN	UK primary and secondary care	Average age 67 for comparator and 66 for ESCAPE. Patients had to be over 50 and had knee pain for six months that would be diagnosed as osteoarthritis. No prior clinical treatment for the pain in the prior six months (twelve months for physio)	Outpatient physiotherapy up to a maximum of 10 sessions in line with what the physio saw as the appropriate care package for the patient	35 patients for outpatient physio and 29 for ESCAPE. Of these 8 (25%) in each arm withdraw from the trial before completion	Cost utility analysis with twelve month time horizon with NHS perspective (2005 prices). Costs were sourced from Client Services Receipt Inventory only related to treatment for knee pain and national reference costs were applied to the resource use. No Sensitivity analysis was undertaken

Study	Description of the study/report	Which of the 7 interventions is it most relevant to	Country of study and setting	Participant characteristics if stated (age, sex, ethnic origin, condition status and comorbidity)	Comparator details (who, where when)	Sample size (intervention and comparator, numbers starting and finishing)	Methods of analysis (type of economic analysis, data sources, time horizon, discount rates, perspective and measures of uncertainty)
2009 Physiotherapy 95 (2) 94-102				was allowed.			
M. V. Hurley, N. E. Walsh, H. L. Mitchell, T. J. Pimm, E. Williamson, R. H. Jones, B. C. Reeves, P. A. Dieppe and A. Patel . Economic evaluation of a rehabilitation program integrating exercise, self-management, and active coping strategies for chronic knee pain (Structured abstract). 2007 Arthritis and Rheumatism (Arthritis Care and Research) 57 (7) 1220-1229	Cost utility and cost effectiveness evaluation alongside a clinical trial of ESCAPE-knee pain	ESCAPE-PAIN	UK primary care	Mean age 66 (had to be over 50) reporting knee pain for at least six months (mean WOMAC function 27.2). Patients had to have had no physio in previous 12 months and not be wheelchair bound	Usual care. ESCAPE was delivered in a group and individual setting	140 in usual care, 146 in individual ESCAPE and 132 in Group ESCAPE. Numbers finishing were not provided	Cost utility analysis from perspective of UK NHS (2003/04 prices). Six month time horizon. Costs were sourced from Client Services Receipt Inventory covering health and voluntary resources, use of rehabilitation facilities, patient costs, time off work, benefits and informal care. Costs of delivering the intervention were calculated from the bottom up. Sensitivity analysis was undertaken around key model assumptions and PSA was also performed.
E. Aboagye, M. L. Karlsson, J. Hagberg and I. Jensen. Cost-effectiveness of early interventions for non-specific low back pain: a randomized controlled study investigating medical yoga, exercise therapy and self-care advice. 2015 Journal of Rehabilitation Medicine 47 (2) 167-73	RCT with cost-effectiveness analysis comparing HrQOL for medical yoga, exercise therapy and self-care advice.	Group physical activity classes for back pain	Sweden, primary care	159 participants randomised into medical yoga (MY) group (52); exercise therapy (ET) group (52); or self-care advice (SC) group (55). Gender female: MY: 72%; ET: 62%; SC: 80% Age: MY: 47; ET: 46; SC: 44	MY twice a week for 6 weeks with participants continuing afterwards. ET 6 week individual standardised strength training programme. SC brief advice on staying active.	See cell I	HRQL measured using regression analysis. Cost-effectiveness calculated as ICER estimated using mean incremental cost and adjusted mean incremental QALY. Societal perspective including costs associated with the intervention and production loss through sickness absence. Also employers perspective ignoring production costs. Willingness to pay assumed to be at 11,500 Euro (Swedish National Board of Health).Sensitivity analysis focused on productivity

Study	Description of the study/report	Which of the 7 interventions is it most relevant to	Country of study and setting	Participant characteristics if stated (age, sex, ethnic origin, condition status and comorbidity)	Comparator details (who, where when)	Sample size (intervention and comparator, numbers starting and finishing)	Methods of analysis (type of economic analysis, data sources, time horizon, discount rates, perspective and measures of uncertainty)
							losses. 12 month time horizon so no discounting.
R. E. Johnson, G. T. Jones, N. J. Wiles, C. Chaddock, R. G. Potter, C. Roberts, D. P. Symmons, P. J. Watson, D. J. Torgerson and G. J. Macfarlane . Active exercise, education, and cognitive behavioral therapy for persistent disabling low back pain: a randomized controlled trial (Structured abstract). 2007 Spine 32 (15) 1578-1585	RCT of active exercise, education and CBT for LBP	Group physical activity classes for back pain	UK, primary care	Patients aged 18 to 65 years old, who consulted their GP with persistent disabling LBP and who did not have any 'red flag' symptoms. Persistent disabling LBP was defined as 20mm pain or more on a VAS and five points or more on the RMDQ.	Both groups received an educational pack, The comparison arm received usual care and the intervention arm received 8 2 hour sessions over 6 weeks from 2 physios in groups of 4-10 patients. This included 4 days training in CBT.	234 patients were eligible for the study and 116 were randomised to the intervention arm. Intervention arm: age 47; 61% female. Comparison arm: age 48; 58% female.	Cost utility analysis. Based on data collected from a single clinical study over 15 months, Time horizon for the economic evaluation was 12 months. No study perspective stated.
D. G. T. Whitehurst, S. Bryan, M. Lewis, E. M. Hay, R. Mullis and N. E. Foster . Implementing stratified primary care management for low back pain: cost-utility analysis alongside a prospective, population-based, sequential comparison study. 2015 Spine 40 (6) 405-14	A within study cost-utility analysis (implementation study)	STarT Back (stratified risk assessment and care)	UK, primary care	Adults over 18 years. Risk-defined patient subgroups i.e. patients at low, medium, and high risk of persistent disabling lower back pain	Usual care, with 6 month patient recruitment period	A total of 922 participants were recruited: Phase 1 (control) = 368; Phase 3 (intervention) = 554 Healthcare cost per patient based on those providing resource use data (n=547)- control low risk n=81, med risk n=104, high risk n= 48, intervention low risk n=110, med	Cost utility analysis. Health care perspective, incorporating NHS and private LBP-related health care resources used during the 6-month follow-up. Secondary analysis calculated self-reported days of work absence. No discounting of costs and health benefits was applied. Uncertainty was explored with cost-utility planes and acceptability curves. Sensitivity analyses examined alternative methodological approaches,

Study	Description of the study/report	Which of the 7 interventions is it most relevant to	Country of study and setting	Participant characteristics if stated (age, sex, ethnic origin, condition status and comorbidity)	Comparator details (who, where when)	Sample size (intervention and comparator, numbers starting and finishing)	Methods of analysis (type of economic analysis, data sources, time horizon, discount rates, perspective and measures of uncertainty)
						risk 61, high risk n=143	including a complete case analysis, the incorporation of non–back pain-related health care use and estimation of societal costs relating to work absence.
J. C. Hill, D. G. Whitehurst, M. Lewis, S. Bryan, K. M. Dunn, N. E. Foster, K. Konstantinou, C. J. Main, E. Mason, S. Somerville, G. Sowden, K. Vohora and E. M. Hay . Comparison of stratified primary care management for low back pain with current best practice (STarT Back): a randomised controlled trial (Provisional abstract). 2011 Lancet 378 (9802) 1560-1571	Clinical effectiveness and cost-effectiveness study of stratified primary care (intervention) compared with non-stratified current best practice (control).	STarT Back (stratified risk assessment and care)	UK, primary care, North Staffs	Adults aged ≥18 years with back pain of any duration, with or without associated radiculopathy.	non-stratified current best practice	Intervention (n=568) and control groups (n=283)	Cost effectiveness, healthcare and societal perspective. Sensitivity analyses were done by use of complete-case analysis (i.e., non-imputed dataset) and further adjustment for therapist's effects with random-effects modelling of main therapist.
D. G. Whitehurst, S. Bryan, M. Lewis, J. Hill and E. M. Hay . Exploring the cost-utility of stratified primary care management for low back pain compared with current best practice within risk-defined subgroups (Structured abstract). 2012 Annals of the Rheumatic Diseases	A within-trial study to determine the economic implications of providing stratified management for low back pain according to patients' prognosis and matched care pathways,	STarT Back (stratified risk assessment and care)	UK, North Staff, primary care	Adults aged 18 years and over with low back pain of any episode duration	non-stratified current best practice	Intervention (n=568) and control groups (n=283)	Cost–utility analysis. Base-case analysis estimated the incremental healthcare cost per additional quality-adjusted life year (QALY), using the EQ-5D to enerate QALYs, for each risk-defined subgroup. Uncertainty was explored with cost–utility planes and acceptability curves. Sensitivity analyses: 1) analysis of healthcare resources funded by the NHS only; (2) the

Study	Description of the study/report	Which of the 7 interventions is it most relevant to	Country of study and setting	Participant characteristics if stated (age, sex, ethnic origin, condition status and comorbidity)	Comparator details (who, where when)	Sample size (intervention and comparator, numbers starting and finishing)	Methods of analysis (type of economic analysis, data sources, time horizon, discount rates, perspective and measures of uncertainty)
71 (11) 1796-1802	compared with nonstratified current best practice, within specific risk-defined subgroups (low-risk, medium-risk and high-risk).						incorporation of non-back pain-related consultations with healthcare professionals; (3) a complete case analysis, where inclusion required a valid EQ-5D response at each data collection stage and complete healthcare resource use data at 12-month follow-up; and (4) consideration of variation in the unit cost of private healthcare; (5) simultaneously multiplying the unit costs of private healthcare by a price premium ranging from one (private costs equal NHS costs) to three (private costs are three times the unit cost of the NHS equivalent). No discounting was necessary.
G Wynne-Jones, M Artus, A Bishop, SA Lawton, M Lewis, C Main, G Sowden, S Wathall, AK Burton, D van der Windt, EM Hay, NE Foster . Does a vocational advice service located in primary care improve work outcomes in patients with musculoskeletal pain? The SWAP (Study of Work and Pain) cluster	Paper presents summary of the study, plus the study protocol	SWAP - vocational advice in primary care	UK, South Staffordshire, GP practices	Patients were ≥18 years, absent from work ≤6 months or struggling at work due to MSK pain.	Best current care	338 participants (158 intervention, 180 control) were recruited with 79% followed-up at 4 months.	A cost-consequence analysis will initially be reported, describing all the important results relating to costs and consequences (across the full range of clinical outcomes). Subsequently, two methods of economic evaluation will be used. A cost-effectiveness analysis will be undertaken from a healthcare perspective to determine the cost per additional day of work

Study	Description of the study/report	Which of the 7 interventions is it most relevant to	Country of study and setting	Participant characteristics if stated (age, sex, ethnic origin, condition status and comorbidity)	Comparator details (who, where when)	Sample size (intervention and comparator, numbers starting and finishing)	Methods of analysis (type of economic analysis, data sources, time horizon, discount rates, perspective and measures of uncertainty)
randomised trial. Rheumatology 2016; 55 (suppl_1): i50							absence avoided. A cost-benefit analysis will also be undertaken from a broader societal perspective to calculate the net societal benefit of the vocational advice service, by subtracting the difference in direct health care costs (costs) between the groups from the difference in indirect productivity costs (benefits) between the trial arms.
S. Hollinghurst, J. Coast, J. Busby, A. Bishop, N. E. Foster, A. Franchini, S. Grove, J. Hall, C. Hopper, S. Kaur, A. A. Montgomery and C. Salisbury . A pragmatic randomised controlled trial of 'PhysioDirect' telephone assessment and advice services for patients with musculoskeletal problems: economic evaluation. 2013 BMJ Open 3 (10) e003406	Economic analysis as part of an RCT comparing the cost effectiveness of PhysioDirect with usual care for patients with MSK problems	Self-referral to physiotherapy	UK Bristol, Somerset, Stoke-on-Trent and Cheshire	Adults 18+ referred by their general practitioner or self-referred for physiotherapy. Mean age was 60, with slightly more women than men (60% vs 40%); they were overwhelmingly white (97%), just over half (60%) were employed and all but a few were referred for physiotherapy by their GP.	Usual care patients were placed on a waiting list for face-to-face care.	2249 patients took part (1506 PhysioDirect; 743 usual care). Had complete NHS cost and QALY data for 840 (56%) PhysioDirect and 432 (58%) usual care participants.	Cost consequences approach, comparing cost from all three perspectives (healthcare provider, patients and carers, lost productivity) with a range of clinical outcomes. Also performed a cost-utility analysis comparing cost to the NHS with Quality-Adjusted Life Years (QALYs). Sensitivity analysis performed for (1) increased productivity of the PTs, (2) removing hospital costs, (3) imputing missing data, and combination of 1 and 3.
C. Salisbury, N. E. Foster, C. Hopper, A. Bishop, S. Hollinghurst, J. Coast, S. Kaur, J. Pearson, A. Franchini, J. Hall, S. Grove, M. Calnan, J. Busby and A. A.	A pragmatic randomised controlled trial of 'PhysioDirect' telephone assessment and advice services for	Self-referral to physiotherapy	UK Bristol, Somerset, Stoke-on-Trent and Cheshire	Adults 18+ referred by their general practitioner or self-referred for physiotherapy. Mean age was 60, with slightly more women than men (60% vs	Usual care patients were placed on a waiting list for face-to-face care.	2249 patients took part (1506 PhysioDirect; 743 usual care). Had complete NHS cost and QALY data for 840 (56%) PhysioDirect and	Cost consequences approach, comparing cost from all three perspectives (healthcare provider, patients and carers, lost productivity) with a range of clinical outcomes. Also performed a cost-utility

Study	Description of the study/report	Which of the 7 interventions is it most relevant to	Country of study and setting	Participant characteristics if stated (age, sex, ethnic origin, condition status and comorbidity)	Comparator details (who, where when)	Sample size (intervention and comparator, numbers starting and finishing)	Methods of analysis (type of economic analysis, data sources, time horizon, discount rates, perspective and measures of uncertainty)
Montgomery . A pragmatic randomised controlled trial of the effectiveness and cost-effectiveness of 'PhysioDirect' telephone assessment and advice services for physiotherapy. 2013 Health Technology Assessment (Winchester, England) 17 (2) 1-157, v-vi	physiotherapy			40%); they were overwhelmingly white (97%), just over half (60%) were employed and all but a few were referred for physiotherapy by their GP.		432 (58%) usual care participants.	analysis comparing cost to the NHS with Quality-Adjusted Life Years (QALYs). Sensitivity analysis performed for (1) increased productivity of the PTs, (2) removing hospital costs, (3) imputing missing data, and combination of 1 and 3.
L. K. Holdsworth, V. S. Webster and A. K. McFadyen. What are the costs to NHS Scotland of self-referral to physiotherapy? Results of a national trial. 2007 Physiotherapy 93 (1) 3-11	Report of a national trial to establish the costs to National Health Service (NHS) Scotland of differing modes of access to physiotherapy in primary care.	Self-referral to physiotherapy	Scotland	Adults	GP referral to physio	1770 60.9% GP referrals, 17.3% GP-suggested referrals and 21.8% self-referrals	Cost-minimisation analysis, multi-centred national trial. NHS perspective
L.-H. Chuang, M. O. Soares, H. Tilbrook, H. Cox, C. E. Hewitt, J. Aplin, A. Semlyen, A. Trewhela, I. Watt and D. J. Torgerson . A pragmatic multicentered randomized controlled trial of yoga for chronic low back pain: economic evaluation. 2012 Spine 37 (18) 1593-601	Multicentred RCTwith QOL and resource use for yoga for chronic back pain.	Group physical activity classes for back pain	UK (Cornwall, N & W London, Manchester, York); primary and community care.	Patients aged 18-65 who had consulted GP about LBP in previous 18 months.	Yoga arm received 12 week course of yoga (75 min weekly class) + educational material and usual care. Control arm received usual care pus 1 yoga class after follow up.	313 participants: 156 in yoga arm and 157 in usual care arm.	Cost effectiveness analysis with 12 month time horizon from NHS and societal perspectives. No discounting needed.

Table F.2: Included studies Interventions

Study	Overview of intervention (who, where, when)	MSK condition of relevance	Programme/ intervention costs (if reported)	Timeframe: over which intervention delivered
M. V. Hurley, N. E. Walsh, H. Mitchell, J. Nicholas and A. Patel. Long-term outcomes and costs of an integrated rehabilitation program for chronic knee pain: a pragmatic, cluster randomized, controlled trial (Structured abstract). 2012 Arthritis Care and Research 64 (2) 238-247	ESCAPE-knee pain group and individually delivered	Chronic knee pain	Costs for ESCAPE were £224 per person. (£2003/04)	12 sessions of 45-60 mins for 6 weeks
S. A. Jessep, N. E. Walsh, J. Ratcliffe and M. V. Hurley . Long-term clinical benefits and costs of an integrated rehabilitation programme compared with outpatient physiotherapy for chronic knee pain (Structured abstract). 2009 Physiotherapy 95 (2) 94-102	ESCAPE-knee pain reduced to 10 sessions over five weeks with classes in a group setting	Knee pain (osteoarthritis)	£68.62 per patient	Five weeks (10 sessions)
M. V. Hurley, N. E. Walsh, H. L. Mitchell, T. J. Pimm, E. Williamson, R. H. Jones, B. C. Reeves, P. A. Dieppe and A. Patel . Economic evaluation of a rehabilitation program integrating exercise, self-management, and active coping strategies for chronic knee pain (Structured abstract). 2007 Arthritis and Rheumatism (Arthritis Care and Research) 57 (7) 1220-1229	ESCAPE-knee pain group and individually delivered	Chronic knee pain	Rehabilitation costs in individual ESCAPE was £314 per person. For group ESCAPE the cost was £125 per person. (£2003/04)	12 sessions of 45-60 mins for 6 weeks
E. Aboagye, M. L. Karlsson, J. Hagberg and I. Jensen . Cost-effectiveness of early interventions for non-specific low back pain: a randomized controlled study investigating medical yoga, exercise therapy and self-care advice. 2015 Journal of Rehabilitation Medicine 47 (2) 167-73	MY was a kundalini-based standardized programme performed in groups, twice a week for 6 weeks and led by an experienced medical yoga instructor. Participants received a cd with instructions, and written information about the programme, and were encouraged to perform the programme as often as possible between the medical yoga sessions. After 6 weeks, the participants were to carry on practicing medical yoga no less twice per week. ET was a 6-week individual, standardized strength training programme followed up by an experienced physiotherapist in groups once every second week. In the first week of intervention start, the participants and the	LBP	Mean direct cost: MY: 255 Euro; ET: 461 Euro; SC: 106 Euro Mean societal cost: MY 1,882 Euro; ET: 3,401 Euro; SC: 4,006 Euro	Direct interventions lasted 6 weeks but participants were encouraged to continue beyond that time and were followed up after a year.

Study	Overview of intervention (who, where, when)	MSK condition of relevance	Programme/ intervention costs (if reported)	Timeframe: over which intervention delivered
	physiotherapist met twice in order to individually design the training programme. Participants were followed-up after 2, 4 and 6 weeks. Subsequently, participants were to continue practicing the ET programme at least twice per week. In the SC group, individuals received brief oral recommendation from a back specialist to stay active and a booklet containing self-care advice.			
R. E. Johnson, G. T. Jones, N. J. Wiles, C. Chaddock, R. G. Potter, C. Roberts, D. P. Symmons, P. J. Watson, D. J. Torgerson and G. J. Macfarlane . Active exercise, education, and cognitive behavioral therapy for persistent disabling low back pain: a randomized controlled trial (Structured abstract). 2007 Spine 32 (15) 1578-1585	Intervention for the treatment of LBP which comprised exercise and education using CBT, compared with standard GP care plus educational material. Groups sessions delivered by physios specifically trained in CBT.	LBP	Detail lacking but intervention arm cost £27 more than comparison arm (95% CI -159 to 213)	6 weeks with follow up after 15 months.
D. G. T. Whitehurst, S. Bryan, M. Lewis, E. M. Hay, R. Mullis and N. E. Foster . Implementing stratified primary care management for low back pain: cost-utility analysis alongside a prospective, population-based, sequential comparison study. 2015 Spine 40 (6) 405-14	Prognostic risk stratification tool (the STarT Back tool) was used to identify patients at low, medium, and high risk of persistent disabling LBP that were subsequently matched to targeted treatments. GPs followed screening tool recommendations for matched treatment.	LBP	Not reported	Not clear
J. C. Hill, D. G. Whitehurst, M. Lewis, S. Bryan, K. M. Dunn, N. E. Foster, K. Konstantinou, C. J. Main, E. Mason, S. Somerville, G. Sowden, K. Vohora and E. M. Hay . Comparison of stratified primary care management for low back pain with current best practice (STarT Back): a randomised controlled trial (Provisional abstract). 2011 Lancet 378 (9802) 1560-1571	Primary care stratification of the management of LBP according to the patient's prognosis (low, medium, or high risk). Uses a validated, simple-to-use prognostic screening method (the Keele STarT Back Screening Tool),to allocate patients into one of three risk-defined groups—low, medium, and high . Three treatment pathways were matched to these risk groups. Assessment was by nurses and treatment by physiotherapists. In the intervention group, during the baseline clinical assessment and treatment session, decisions about referral were made by use of the STarT Back Screening Tool classification. The 30-min assessment and initial treatment were delivered according to an agreed protocol, with	LBP	Not reported but training costs for physiotherapists involved in the intervention are reported.	Not reported

Study	Overview of intervention (who, where, when)	MSK condition of relevance	Programme/ intervention costs (if reported)	Timeframe: over which intervention delivered
	advice focusing on promotion of appropriate levels of activity, including return to work, and a pamphlet about local exercise venues and self-help groups. Participants were shown a 15-min educational video entitled Get Back Active20 and given the Back Book. Low-risk patients were only given this clinic session; medium-risk patients were referred for standardised physiotherapy to address symptoms and function. High-risk patients were referred for psychologically informed physiotherapy to address physical symptoms and function, and also psychosocial obstacles to recovery.			
D. G. Whitehurst, S. Bryan, M. Lewis, J. Hill and E. M. Hay . Exploring the cost-utility of stratified primary care management for low back pain compared with current best practice within risk-defined subgroups (Structured abstract). 2012 Annals of the Rheumatic Diseases 71 (11) 1796-1802	Stratified management for low back pain according to patients' prognosis and matched care pathways (as in 2551)	LBP	Not reported	Not reported
G Wynne-Jones, M Artus, A Bishop, SA Lawton, M Lewis, C Main, G Sowden, S Wathall, AK Burton, D van der Windt, EM Hay, NE Foster . Does a vocational advice service located in primary care improve work outcomes in patients with musculoskeletal pain? The SWAP (Study of Work and Pain) cluster randomised trial. Rheumatology 2016; 55 (suppl_1): i50	Vocational advice (VA) service to provide a structured approach to managing work related issues. Patients who require help and support in remaining at or returning to work may be referred to the vocational advice service by their GP or NP. Referred patients will be contacted by a vocational advisor, seven days after receipt of the referral who will help the patient to identify and overcome obstacles to remaining at or returning to work. The Flags model of management of the health and work interface will be used to structure the vocational advice service - identification of obstacles to working with health conditions, development of a plan to manage health and work, taking action to address the issues each individual patient is facing with respect to managing their musculoskeletal condition in the workplace and re-evaluating the patient's situation regularly until a sustained return to work is achieved - a goal oriented approach	MSK but particularly spinal pain	In order to obtain the cost of the vocational advice service, information on the type and number of contacts with the vocational advisor (telephone calls or visits) will be obtained and unit costs applied to calculate overall cost of the intervention.	Not reported
S. Hollinghurst, J. Coast, J. Busby, A.	PhysioDirect involved telephone assessment	Service is open to	Unit costs provided in the	Not reported

Study	Overview of intervention (who, where, when)	MSK condition of relevance	Programme/ intervention costs (if reported)	Timeframe: over which intervention delivered
Bishop, N. E. Foster, A. Franchini, S. Grove, J. Hall, C. Hopper, S. Kaur, A. A. Montgomery and C. Salisbury . A pragmatic randomised controlled trial of 'PhysioDirect' telephone assessment and advice services for patients with musculoskeletal problems: economic evaluation. 2013 BMJ Open 3 (10) e003406	plus advice, with the aid of previously developed computerised templates, followed by face-to-face care if needed.	all MSK conditions. Found Lower limb problems were the most prevalent (30%) reason for referral, 27% patients had a lumbar problem and 23% upper limb problems.	paper. Direct costs to the healthcare provider included: cost of initial and follow-up physiotherapy consultations; primary and community consultations; hospital care and prescribed medication. Patient and carer costs included: telephone calls to the PhysioDirect service; travel; over-the-counter medication; prescription costs; private therapy and purchase of equipment; extra domestic help and loss of earnings.	
C. Salisbury, N. E. Foster, C. Hopper, A. Bishop, S. Hollinghurst, J. Coast, S. Kaur, J. Pearson, A. Franchini, J. Hall, S. Grove, M. Calnan, J. Busby and A. A. Montgomery . A pragmatic randomised controlled trial of the effectiveness and cost-effectiveness of 'PhysioDirect' telephone assessment and advice services for physiotherapy. 2013 Health Technology Assessment (Winchester, England) 17 (2) 1-157, v-vi	PhysioDirect involved telephone assessment plus advice, with the aid of previously developed computerised templates, followed by face-to-face care if needed.	Service is open to all MSK conditions. Found Lower limb problems were the most prevalent (30%) reason for referral, 27% patients had a lumbar problem and 23% upper limb problems.	Unit costs provided in the paper. Direct costs to the healthcare provider included: cost of initial and follow-up physiotherapy consultations; primary and community consultations; hospital care and prescribed medication. Patient and carer costs included: telephone calls to the PhysioDirect service; travel; over-the-counter medication; prescription costs; private therapy and purchase of equipment; extra domestic help and loss of earnings.	Not reported
L. K. Holdsworth, V. S. Webster and A. K. McFadyen . What are the costs to NHS Scotland of self-referral to physiotherapy? Results of a national trial. 2007 Physiotherapy 93 (1) 3-11	Self-referral to physiotherapy	Not specified	not reported	Not reported
L.-H. Chuang, M. O. Soares, H. Tilbrook, H. Cox, C. E. Hewitt, J. Aplin, A. Semlyen, A. Trewhela, I. Watt and D. J.	Yoga arm received 12 week course of yoga (75 min weekly class) + relaxation CD, student yoga manual, yoga mat, the Back Book,	LBP	Costs of yoga intervention (cost of teaching and cost of equipment) estimated at	12 weeks.

Study	Overview of intervention (who, where, when)	MSK condition of relevance	Programme/ intervention costs (if reported)	Timeframe: over which intervention delivered
Torgerson . A pragmatic multicentered randomized controlled trial of yoga for chronic low back pain: economic evaluation. 2012 Spine 37 (18) 1593-601	education booklet for improving back pain and usual care. Control arm received usual care, copy of Back Book, plus 1 yoga class after follow up. 16 classes offered in trial with max 15 per class. Follow up at 3, 6, and 12 months.		£41,941 + £3,706. Cost per participant in yoga arm = £292.61.	

Table F.3: Outcomes of Included studies

Study	Primary outcome measure relating to MSK condition (description)	Other outcome measures relating to MSK condition (description)	Outcome data (values, including effect size, CIs etc)	Time at which outcomes are reported	Resource utilisation outcomes	Factors found to be critical to the success of the intervention
M. V. Hurley, N. E. Walsh, H. Mitchell, J. Nicholas and A. Patel . Long-term outcomes and costs of an integrated rehabilitation program for chronic knee pain: a pragmatic, cluster randomized, controlled trial (Structured abstract). 2012 Arthritis Care and Research 64 (2) 238-247	WOMAC function	NA	Between group difference in WOMAC function was -2.78 (-5.32, -0.23) in favour of ESCAPE	Thirty months	No difference in total health and social care resource use at 30 months if unadjusted data used. If missing data is imputed then ESCAPE is cost saving by £1118 (£221, £2566)	Group therapy was found to be just as effective but cheaper than individual therapy, but authors suggest individual therapy may offer flexibility that cannot be offered in a group setting.
S. A. Jessep, N. E. Walsh, J. Ratcliffe and M. V. Hurley . Long-term clinical benefits and costs of an integrated rehabilitation programme compared with outpatient physiotherapy for chronic knee pain (Structured abstract). 2009 Physiotherapy 95 (2) 94-102	QALY and WOMAC function	NA	No difference in WOMAC between groups. No difference in EQ5D	12 months	Whilst the authors report that the ESCAPE pain group had lower resource use they did not report the statistical significance of this difference. Calculation of the p-value suggests there was no statistical difference in costs	Authors stress that it is important that people on ESCAPE hold positive prior beliefs about exercise and also a review session some months after ESCAPE can be beneficial
M. V. Hurley, N. E. Walsh, H. L. Mitchell, T. J. Pimm, E. Williamson, R. H. Jones, B. C. Reeves, P. A. Dieppe and A. Patel . Economic evaluation of a rehabilitation program integrating exercise, self-management, and active coping strategies for chronic knee pain (Structured abstract). 2007 Arthritis and Rheumatism (Arthritis Care and Research) 57 (7) 1220-1229	QALY and WOMAC function	NA	No difference in QALYs between groups or in any resource use category, time off work or benefits claimed. Proportion of patients with clinically meaningful improvement in functioning was greater in ESCAPE group (112 of 226 compared to 47 of 113 in usual care)	Six months	No difference in any of the resource utilisation outcomes - health, social care or informal care	Group therapy was found to be just as effective but cheaper than individual therapy, but authors suggest individual therapy may offer flexibility that cannot be offered in a group setting.
E. Aboagye, M. L. Karlsson,	QALY	HrQOL measured	From employers	Twelve	See cells Q and U	Needs to be 6

Study	Primary outcome measure relating to MSK condition (description)	Other outcome measures relating to MSK condition (description)	Outcome data (values, including effect size, CIs etc)	Time at which outcomes are reported	Resource utilisation outcomes	Factors found to be critical to the success of the intervention
J. Hagberg and I. Jensen. Cost-effectiveness of early interventions for non-specific low back pain: a randomized controlled study investigating medical yoga, exercise therapy and self-care advice. 2015 Journal of Rehabilitation Medicine 47 (2) 167-73		using EQ-5D	perspective: MY has an ICER of 4,984 Euro compared to SC. MY cost 206 Euro less than ET and HrQOL was not significantly better so MY is cost effective as it is cheaper. From societal perspective: MY cost 1,519 Euro less than ET and 2,124 Euro less than SC and has better HrQOL so it is dominant.	months.		weeks on uninterrupted medical yoga therapy using Kundalini-based standardised programme.
R. E. Johnson, G. T. Jones, N. J. Wiles, C. Chaddock, R. G. Potter, C. Roberts, D. P. Symmons, P. J. Watson, D. J. Torgerson and G. J. Macfarlane . Active exercise, education, and cognitive behavioral therapy for persistent disabling low back pain: a randomized controlled trial (Structured abstract). 2007 Spine 32 (15) 1578-1585	QALY	Pain (VAS) Disability (RMDQ) General health (EQ-5D)	Mean ICER £5,000 per QALY. 90% probability that intervention would be cost effective at £30,000 per QALY. Pain - 5.49 (CI -12.43 to 1.44) Disability -0.93 (CI -2.30 to 0.45) General health 0.03 (-0.04 to 0.09)	15 months follow up.	Not stated.	Provision of programme by CBT trained physio.
D. G. T. Whitehurst, S. Bryan, M. Lewis, E. M. Hay, R. Mullis and N. E. Foster. Implementing stratified primary care management for low back pain: cost-utility analysis alongside a prospective, population-based, sequential comparison study. 2015 Spine 40 (6) 405-14	Incremental LBP-related health care cost per additional quality-adjusted life year (QALY) by risk subgroup.	3-level EQ-5D Roland Morris Disability Questionnaire STarT Back score	Mean health care cost savings of £124 and an incremental QALY estimate of 0.023. Approximately, 6 fewer days of work absence were reported in the stratified care group compared with usual care for those patients in the medium (a 55%	6 months follow-up period	Primary care consultations (GPs and practice nurses), consultations with other health care professionals (e.g., hospital consultants and physiotherapists), hospital-based procedures (diagnostic tests, epidural injections, and inpatient episodes), prescribed medication, and out-of-pocket expenditures on treatments and/or aids.	Not stated

Study	Primary outcome measure relating to MSK condition (description)	Other outcome measures relating to MSK condition (description)	Outcome data (values, including effect size, CIs etc)	Time at which outcomes are reported	Resource utilisation outcomes	Factors found to be critical to the success of the intervention
			reduction) and high-risk (a 39% reduction) subgroups, with associated societal cost savings per employed patient of £736 and £652, respectively.		At the observed level of adherence to screening tool recommendations for matched treatments, stratified care for LBP is cost-effective for patients at high risk of persistent disabling LBP only. Base case results for patients in the low- and medium-risk subgroups show negligible incremental cost and QALY estimates. Costs relating to periods of work absence were analysed separately, without incorporation into the incremental ratio.	
J. C. Hill, D. G. Whitehurst, M. Lewis, S. Bryan, K. M. Dunn, N. E. Foster, K. Konstantinou, C. J. Main, E. Mason, S. Somerville, G. Sowden, K. Vohora and E. M. Hay . Comparison of stratified primary care management for low back pain with current best practice (STarT Back): a randomised controlled trial (Provisional abstract). 2011 Lancet 378 (9802) 1560-1571	Roland Morris Disability Questionnaire (RMDQ) score. Economic evaluation focused on estimating incremental quality-adjusted life years (QALYs) and health-care costs related to back pain.	Secondary outcome measures were referral for further physiotherapy, back pain intensity, the Pain Catastrophizing Scale (measures the extent to which someone has a pessimistic outlook of back pain), fearavoidance beliefs (Tampa Scale of Kinesiophobia24), Hospital Anxiety and Depression Scale, health-related quality of life (EuroQol EQ-5D; Short Form 12 physical and mental component scores),	Adjusted mean changes in RMDQ scores were significantly higher in the intervention group than in the control group at 4 months (4·7 [SD 5·9] vs 3·0 [5·9], between-group difference 1·81 [95% CI 1·06–2·57]) and at 12 months (4·3 [6·4] vs 3·3 [6·2], 1·06 [0·25–1·86]), equating to effect sizes of 0·32 (0·19–0·45) and 0·19 (0·04–0·33), respectively. At 12 months, stratified care was associated with a mean increase in generic health benefit (0·039 additional QALYs) and cost	Roland Morris Disability Questionnaire at 12 months Demographic data and clinical outcomes were gathered before randomisation and 4 months and 12 months later	Number of physiotherapy treatment sessions, attendance at initial physiotherapy treatment, adverse events, health-care resource use and costs over 12 months, number of days off work because of back pain. Although referral rates with stratified management were higher, these health-sector costs were outweighed by savings due to reductions in referral of low-risk patients and overall use of health-care resources during the follow-up.	Not reported

Study	Primary outcome measure relating to MSK condition (description)	Other outcome measures relating to MSK condition (description)	Outcome data (values, including effect size, CIs etc)	Time at which outcomes are reported	Resource utilisation outcomes	Factors found to be critical to the success of the intervention
		STarT Back Screening Tool risk-subgroup reduction, perception of overall change in back pain (global change).	savings (£240·01 vs £274·40) compared with the control group.			
D. G. Whitehurst, S. Bryan, M. Lewis, J. Hill and E. M. Hay. Exploring the cost-utility of stratified primary care management for low back pain compared with current best practice within risk-defined subgroups (Structured abstract). 2012 Annals of the Rheumatic Diseases 71 (11) 1796-1802	The primary unit of outcome was the incremental cost per-QALY	Health outcomes using EQ-5D. Self-reported details of participants' employment status were collected at baseline and 12 months.	Incremental cost to utility ratio of £463 (£26.41/0.057 QALYs) in the high-risk group. For the medium-risk group, a dominant position was observed for the stratified management intervention, i.e. greater mean health benefit (0.044 additional QALYs). For low risk group, with a lower mean healthcare cost (−£64.29) and a lower mean health benefit (−0.001 QALYs). The incremental cost to utility ratio of £48707 (−£64.29/−0.001 QALYs (QALY estimate to three decimal places)) indicates that the cost savings of the low risk intervention are worth the negligible decrement in health or, alternatively, the incremental cost required to achieve the small health benefit associated	One year EQ-5D at baseline, 4 months and 12 months.	Stratified management approach was a cost-effective treatment strategy compared with current best practice within each risk-defined subgroup, for medium-risk patients and acceptable incremental cost to utility ratios for low-risk and high-risk patients. The likelihood that stratified care provides a cost-effective use of resources exceeds 90% at willingness-to-pay thresholds of £4000 (≈ 4500; $6500) per additional QALY for the medium-risk and high-risk groups. Patients receiving stratified care also reported fewer back pain-related days off work in all three subgroups. Expressed as UK averages in 2008/09 prices	

Study	Primary outcome measure relating to MSK condition (description)	Other outcome measures relating to MSK condition (description)	Outcome data (values, including effect size, CIs etc)	Time at which outcomes are reported	Resource utilisation outcomes	Factors found to be critical to the success of the intervention
			with the control group is too expensive. Overall reductions in back pain disability (RMDQ) at 4 and 12 months using the stratified management approach compared with current best practice. Significant between-group differences in RMDQ adjusted mean change scores for medium-risk patients at 4 and 12 months, and high-risk patients at 4 months. Low-risk patients had non-inferior outcomes compared with controls at both time-points.			
G Wynne-Jones, M Artus, A Bishop, SA Lawton, M Lewis, C Main, G Sowden, S Wathall, AK Burton, D van der Windt, EM Hay, NE Foster . Does a vocational advice service located in primary care improve work outcomes in patients with musculoskeletal pain? The SWAP (Study of Work and Pain) cluster randomised trial. Rheumatology 2016; 55 (suppl_1): i50	Number of days off work over 4 months from entry into the trial	Self-reported time off work (in binary form (yes/no)) will be a secondary outcome - medical record review based sick certification periods over 12 months follow-up. Also, Self efficacy to Return to Work Questionnaire [34], pain intensity (0–10 rating scales), bothersomeness (1–5 rating scale), global assessment of change and work	Participants in the intervention arm had significantly fewer days absent over 4 months (mean 9.3 days, SD 21.7) compared with control (mean 14.4 days, SD 27.7); adjusted incidence rate ratio (IRR) 0.51 (0.26, 0.99), p=0.048. This difference was largely due to fewer GP certified absent days (8.4 days versus 13.5 days). At 12 months the effect of the VA	4 and 12 months	Not reported in abstract	

Study	Primary outcome measure relating to MSK condition (description)	Other outcome measures relating to MSK condition (description)	Outcome data (values, including effect size, CIs etc)	Time at which outcomes are reported	Resource utilisation outcomes	Factors found to be critical to the success of the intervention
		performance (SPS6).	service was significantly greater in those with spinal pain compared to patients with other MSK problems (IRR interaction: 0.25 (95% Confidence Interval 0.10, 0.62) (p interaction=0.003).			
S. Hollinghurst, J. Coast, J. Busby, A. Bishop, N. E. Foster, A. Franchini, S. Grove, J. Hall, C. Hopper, S. Kaur, A. A. Montgomery and C. Salisbury . A pragmatic randomised controlled trial of 'PhysioDirect' telephone assessment and advice services for patients with musculoskeletal problems: economic evaluation. 2013 BMJ Open 3 (10) e003406	Primary clinical outcome: physical component summary from the SF-36v2 at 6 months. Outcome for the cost-utility analysis: QALYs used the EQ-5D-3L28 valued using the UK tariff.	Also included in the cost consequences: Measure Yourself Medical Outcomes Profile; a Global Improvement Score; response to treatment; patient satisfaction; waiting time.	No evidence of a difference in the primary clinical outcome (the SF36v2 PCS) between the groups, suggesting that PhysioDirect led to similar outcomes as usual physiotherapy care. QALYs were higher in the PhysioDirect group by 0.009, which equates to about 3.3 extra days of full health over a year. Lost productivity was estimated separately in relation to time off work to attend physiotherapy appointments and time off because of the musculoskeletal condition itself.	6 months	Cost-utility analysis based on complete cases (n=1272) - tTotal NHS costs, including the cost of physiotherapy were higher in the PhysioDirect group by £19.30 (95% CI −£37.60 to £76.19) and there was a QALY gain of 0.007 (95% CI −0.003 to 0.016). The incremental cost-effectiveness ratio was £2889 and the net monetary benefit at λ=£20 000 was £117 (95% CI −£86 to £310).	Efficient operation of the PT service - staffing profile was constrained by trial conditions and was found to be more efficient after trial finished.
C. Salisbury, N. E. Foster, C. Hopper, A. Bishop, S. Hollinghurst, J. Coast, S. Kaur, J. Pearson, A. Franchini, J. Hall, S. Grove, M. Calnan, J. Busby and A.	Primary clinical outcome: physical component summary from the SF-36v2 at 6 months. Outcome	Also included in the cost consequences: Measure Yourself Medical Outcomes Profile; a Global Improvement Score;	No evidence of a difference in the primary clinical outcome (the SF36v2 PCS) between the groups, suggesting	6 months	NHS costs (physiotherapy plus other relevant NHS costs) per patient were similar in the two arms [PhysioDirect £198.98 vs usual care £179.68, difference in means £19.30 (95% CI –	Efficient operation of the PT service - staffing profile was constrained by trial conditions and was found to be more

Study	Primary outcome measure relating to MSK condition (description)	Other outcome measures relating to MSK condition (description)	Outcome data (values, including effect size, CIs etc)	Time at which outcomes are reported	Resource utilisation outcomes	Factors found to be critical to the success of the intervention
A. Montgomery . A pragmatic randomised controlled trial of the effectiveness and cost-effectiveness of 'PhysioDirect' telephone assessment and advice services for physiotherapy. 2013 Health Technology Assessment (Winchester, England) 17 (2) 1-157, v-vi	for the cost-utility analysis: QALYs used the EQ-5D-3L28 valued using the UK tariff.	response to treatment; patient satisfaction; waiting time.	that PhysioDirect led to similar outcomes as usual physiotherapy care. QALYs were higher in the PhysioDirect group by 0.009, which equates to about 3.3 extra days of full health over a year. Lost productivity was estimated separately in relation to time off work to attend physiotherapy appointments and time off because of the musculoskeletal condition itself.		£37.60 to £76.19)], while QALYs gained were also similar [difference in means 0.007 (95% CI –0.003 to 0.016)]. Incremental cost per QALY gained was £2889.	efficient after trial finished.
L. K. Holdsworth, V. S. Webster and A. K. McFadyen . What are the costs to NHS Scotland of self-referral to physiotherapy? Results of a national trial. 2007 Physiotherapy 93 (1) 3-11	Main outcome measures were the number of GP and physiotherapy contacts, prescribing of non-steroidal anti-inflammatory drugs and analgesics, and referral for X-ray, magnetic resonance imaging and/or secondary care	Patient reported measure of how severely problem was affecting them	Self-referring patients were much less likely to be referred for X-ray (7.3% versus 13.6%) or to secondary care than patients referred by their GP (3.1% versus 1.4%). Self-referring patients were prescribed far fewer drugs compared with patients referred at the suggestion of or by their GP (32.2%, 42.7% and 44.1%, respectively). Although similar proportions were only prescribed NSAIDs, fewer self-referring patients were	12 months	The average cost of an episode of care was established as £66.31 for a self-referral, £79.50 for a GP-suggested referral and £88.99 for a GP referral (2004). Efficiences are gained from lower DNAs and greater completion of treatment.	

Study	Primary outcome measure relating to MSK condition (description)	Other outcome measures relating to MSK condition (description)	Outcome data (values, including effect size, CIs etc)	Time at which outcomes are reported	Resource utilisation outcomes	Factors found to be critical to the success of the intervention
			prescribed analgesics compared with patients referred at the suggestion of or by their GP (9.7%, 13.5% and 15.8%, respectively), or both NSAIDs and analgesia (9.7%, 14.8% and 15.6%, respectively). Only 18% of self-referring patients visited their GP on more than one occasion, compared with 38% and 39% of patients referred at the suggestion of or by their GP, respectively. Identified that self-referring patients were utilising less GP time (8 minutes versus 17 minutes; P < 0.001).			
L.-H. Chuang, M. O. Soares, H. Tilbrook, H. Cox, C. E. Hewitt, J. Aplin, A. Semlyen, A. Trewhela, I. Watt and D. J. Torgerson . A pragmatic multicentered randomized controlled trial of yoga for chronic low back pain: economic evaluation. 2012 Spine 37 (18) 1593-601	QALY. NHS perspective only used resources in NHS setting. Societal perspective also included personal expenses such as private treatments and equipment, as well as productivity losses.	EQ-5D scores	NHS perspective: Yoga arm gained 0.037 QALYs more than control arm at increased cost of £506.8 per patient = ICER £13,606. 72% chance of cost-effectiveness at £20k WTP. Societal perspective: Yoga arm gained 0.037 QALYs and was £213.9 lower cost so	12 months	NHS costs: yoga arm £762.0; control arm £529.7 Private health costs: yoga arm £331.3; control arm £439.3 Private equipment costs: yoga arm £59.9; control arm £129.0 Productivity loss: yoga arm 3.83 (days off work due to LBP) (SD 11.68); control arm 12.39 days (SD 26.07) (+days off for unpaid activity) Lost of productivity cost: yoga arm £374.2; control arm £1,201.8	Provision of yoga classes.

Study	Primary outcome measure relating to MSK condition (description)	Other outcome measures relating to MSK condition (description)	Outcome data (values, including effect size, CIs etc)	Time at which outcomes are reported	Resource utilisation outcomes	Factors found to be critical to the success of the intervention
			dominant.		Mean societal cost in control arm £2,319.2, £817 more than yoga arm	

Table F.4: Quality Assessment (Applicability and study limitations) of included studies

Hurley 2012

M. V. Hurley, N. E. Walsh, H. Mitchell, J. Nicholas and A. Patel. Long-term outcomes and costs of an integrated rehabilitation program for chronic knee pain: a pragmatic, cluster randomized, controlled trial (Structured abstract). 2012 Arthritis Care and Research 64 (2) 238-247		
Applicability (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Is the study population appropriate for the review question?	Yes
	Are the interventions appropriate for the review question?	Yes
	Is the system in which the study was conducted sufficiently similar to the current UK context?	Yes
	Are the perspectives clearly stated and are they appropriate for the review question?	Yes
	Are all direct effects on individuals included, and are all other effects included where they are material?	Yes
	Are all future costs and outcomes discounted appropriately?	Yes
	Is QALY used as an outcome, and was it derived using NICE's preferred methods? If not, describe rationale and outcomes used in line with analytical perspectives taken (item 1.4 above).	Yes
	Are costs and outcomes from other sectors fully and appropriately measured and valued?	Yes
	Overall judgement: Directly applicable/partially applicable/not applicable	Directly applicable
Study limitations (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Does the model structure adequately reflect the nature of the topic under evaluation?	NA
	Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Yes
	Are all important and relevant outcomes included?	Yes
	Are the estimates of baseline outcomes from the best available source?	Yes
	Are the estimates of relative intervention effects from the best available source?	Yes
	Are all important and relevant costs included?	Yes
	Are the estimates of resource use from the best available source?	Yes
	Are the unit costs of resources from the best available source?	Yes
	Is an appropriate incremental analysis presented or can it be calculated from the data?	NA
	Are all important parameters whose values are uncertain subjected to appropriate sensitivity analysis?	Yes
	Is there any potential conflict of interest?	No
	Overall assessment: Minor limitations/potentially serious limitations/very serious limitations	Minor limitations

Jessep 2009

S. A. Jessep, N. E. Walsh, J. Ratcliffe and M. V. Hurley. Long-term clinical benefits and costs of an integrated rehabilitation programme compared with outpatient physiotherapy for chronic knee pain (Structured abstract). 2009 Physiotherapy 95 (2) 94-102		
Applicability (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Is the study population appropriate for the review question?	Yes
	Are the interventions appropriate for the review question?	Yes
	Is the system in which the study was conducted sufficiently similar to the current UK context?	Yes
	Are the perspectives clearly stated and are they appropriate for the review question?	Yes
	Are all direct effects on individuals included, and are all other effects included where they are material?	Yes
	Are all future costs and outcomes discounted appropriately?	NA
	Is QALY used as an outcome, and was it derived using NICE's preferred methods? If not, describe rationale and outcomes used in line with analytical perspectives taken (item 1.4 above).	Yes
	Are costs and outcomes from other sectors fully and appropriately measured and valued?	No
	Overall judgement: Directly applicable/partially applicable/not applicable	Directly applicable
Study limitations (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Does the model structure adequately reflect the nature of the topic under evaluation?	NA
	Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	No
	Are all important and relevant outcomes included?	Yes
	Are the estimates of baseline outcomes from the best available source?	Yes
	Are the estimates of relative intervention effects from the best available source?	Yes
	Are all important and relevant costs included?	No
	Are the estimates of resource use from the best available source?	Yes
	Are the unit costs of resources from the best available source?	Yes
	Is an appropriate incremental analysis presented or can it be calculated from the data?	NA
	Are all important parameters whose values are uncertain subjected to appropriate sensitivity analysis?	No
	Is there any potential conflict of interest?	No
	Overall assessment: Minor limitations/potentially serious limitations/very serious limitations	Potentially serious limitations

Hurley 2007

M. V. Hurley, N. E. Walsh, H. L. Mitchell, T. J. Pimm, E. Williamson, R. H. Jones, B. C. Reeves, P. A. Dieppe and A. Patel . Economic evaluation of a rehabilitation program integrating exercise, self-management, and active coping strategies for chronic knee pain (Structured abstract). 2007 Arthritis and Rheumatism (Arthritis Care and Research) 57 (7) 1220-1229		
Applicability (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Is the study population appropriate for the review question?	Yes
	Are the interventions appropriate for the review question?	Yes
	Is the system in which the study was conducted sufficiently similar to the current UK context?	Yes
	Are the perspectives clearly stated and are they appropriate for the review question?	Yes
	Are all direct effects on individuals included, and are all other effects included where they are material?	Yes
	Are all future costs and outcomes discounted appropriately?	NA
	Is QALY used as an outcome, and was it derived using NICE's preferred methods? If not, describe rationale and outcomes used in line with analytical perspectives taken (item 1.4 above).	Yes
	Are costs and outcomes from other sectors fully and appropriately measured and valued?	Yes
	Overall judgement: Directly applicable/partially applicable/not applicable	Directly applicable
Study limitations (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Does the model structure adequately reflect the nature of the topic under evaluation?	NA
	Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	No - only six months
	Are all important and relevant outcomes included?	Yes
	Are the estimates of baseline outcomes from the best available source?	Yes
	Are the estimates of relative intervention effects from the best available source?	Yes
	Are all important and relevant costs included?	Yes
	Are the estimates of resource use from the best available source?	Yes
	Are the unit costs of resources from the best available source?	Yes
	Is an appropriate incremental analysis presented or can it be calculated from the data?	NA
	Are all important parameters whose values are uncertain subjected to appropriate sensitivity analysis?	Yes
	Is there any potential conflict of interest?	No
	Overall assessment: Minor limitations/potentially serious limitations/very serious limitations	Minor limitations

Aboagye 2015

E. Aboagye, M. L. Karlsson, J. Hagberg and I. Jensen. Cost-effectiveness of early interventions for non-specific low back pain: a randomized controlled study investigating medical yoga, exercise therapy and self-care advice. 2015 Journal of Rehabilitation Medicine 47 (2) 167-73		
Applicability (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Is the study population appropriate for the review question?	Yes
	Are the interventions appropriate for the review question?	Yes
	Is the system in which the study was conducted sufficiently similar to the current UK context?	Unclear
	Are the perspectives clearly stated and are they appropriate for the review question?	Yes
	Are all direct effects on individuals included, and are all other effects included where they are material?	Yes
	Are all future costs and outcomes discounted appropriately?	NA
	Is QALY used as an outcome, and was it derived using NICE's preferred methods? If not, describe rationale and outcomes used in line with analytical perspectives taken (item 1.4 above).	Yes
	Are costs and outcomes from other sectors fully and appropriately measured and valued?	Yes
	Overall judgement: Directly applicable/partially applicable/not applicable	Directly applicable
Study limitations (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Does the model structure adequately reflect the nature of the topic under evaluation?	Yes
	Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Unclear
	Are all important and relevant outcomes included?	Partly
	Are the estimates of baseline outcomes from the best available source?	Yes
	Are the estimates of relative intervention effects from the best available source?	Yes
	Are all important and relevant costs included?	Yes
	Are the estimates of resource use from the best available source?	Yes
	Are the unit costs of resources from the best available source?	Yes
	Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes
	Are all important parameters whose values are uncertain subjected to appropriate sensitivity analysis?	Unclear
	Is there any potential conflict of interest?	No
	Overall assessment: Minor limitations/potentially serious limitations/very serious limitations	Minor limitations

Johnson 2007

R. E. Johnson, G. T. Jones, N. J. Wiles, C. Chaddock, R. G. Potter, C. Roberts, D. P. Symmons, P. J. Watson, D. J. Torgerson and G. J. Macfarlane . Active exercise, education, and cognitive behavioral therapy for persistent disabling low back pain: a randomized controlled trial (Structured abstract). 2007 Spine 32 (15) 1578-1585		
Applicability (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Is the study population appropriate for the review question?	Yes
	Are the interventions appropriate for the review question?	Yes
	Is the system in which the study was conducted sufficiently similar to the current UK context?	Yes
	Are the perspectives clearly stated and are they appropriate for the review question?	Yes
	Are all direct effects on individuals included, and are all other effects included where they are material?	Yes
	Are all future costs and outcomes discounted appropriately?	NA
	Is QALY used as an outcome, and was it derived using NICE's preferred methods? If not, describe rationale and outcomes used in line with analytical perspectives taken (item 1.4 above).	Yes
	Are costs and outcomes from other sectors fully and appropriately measured and valued?	Yes
	Overall judgement: Directly applicable/partially applicable/not applicable	Directly applicable
Study limitations (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Does the model structure adequately reflect the nature of the topic under evaluation?	Yes
	Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Partly
	Are all important and relevant outcomes included?	Yes
	Are the estimates of baseline outcomes from the best available source?	Yes
	Are the estimates of relative intervention effects from the best available source?	Partly
	Are all important and relevant costs included?	Yes
	Are the estimates of resource use from the best available source?	Yes
	Are the unit costs of resources from the best available source?	Yes
	Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes
	Are all important parameters whose values are uncertain subjected to appropriate sensitivity analysis?	Yes
	Is there any potential conflict of interest?	No
	Overall assessment: Minor limitations/potentially serious limitations/very serious limitations	Minor limitations

Whitehurst 2015

D. G. T. Whitehurst, S. Bryan, M. Lewis, E. M. Hay, R. Mullis and N. E. Foster. Implementing stratified primary care management for low back pain: cost-utility analysis alongside a prospective, population-based, sequential comparison study. 2015 Spine 40 (6) 405-14		
Applicability (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Is the study population appropriate for the review question?	Yes
	Are the interventions appropriate for the review question?	Yes
	Is the system in which the study was conducted sufficiently similar to the current UK context?	Yes
	Are the perspectives clearly stated and are they appropriate for the review question?	Yes
	Are all direct effects on individuals included, and are all other effects included where they are material?	Yes
	Are all future costs and outcomes discounted appropriately?	NA
	Is QALY used as an outcome, and was it derived using NICE's preferred methods? If not, describe rationale and outcomes used in line with analytical perspectives taken (item 1.4 above).	Yes
	Are costs and outcomes from other sectors fully and appropriately measured and valued?	Yes
	Overall judgement: Directly applicable/partially applicable/not applicable	Directly applicable
Study limitations (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Does the model structure adequately reflect the nature of the topic under evaluation?	Yes
	Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	No
	Are all important and relevant outcomes included?	Yes
	Are the estimates of baseline outcomes from the best available source?	Yes
	Are the estimates of relative intervention effects from the best available source?	Yes
	Are all important and relevant costs included?	Partly
	Are the estimates of resource use from the best available source?	Yes
	Are the unit costs of resources from the best available source?	Yes
	Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes
	Are all important parameters whose values are uncertain subjected to appropriate sensitivity analysis?	Partly
	Is there any potential conflict of interest?	Unclear
	Overall assessment: Minor limitations/potentially serious limitations/very serious limitations	Minor limitations

Hill 2011

J. C. Hill, D. G. Whitehurst, M. Lewis, S. Bryan, K. M. Dunn, N. E. Foster, K. Konstantinou, C. J. Main, E. Mason, S. Somerville, G. Sowden, K. Vohora and E. M. Hay . Comparison of stratified primary care management for low back pain with current best practice (STarT Back): a randomised controlled trial (Provisional abstract). 2011 Lancet 378 (9802) 1560-1571		
Applicability (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Is the study population appropriate for the review question?	Yes
	Are the interventions appropriate for the review question?	Yes
	Is the system in which the study was conducted sufficiently similar to the current UK context?	Yes
	Are the perspectives clearly stated and are they appropriate for the review question?	Yes
	Are all direct effects on individuals included, and are all other effects included where they are material?	Yes
	Are all future costs and outcomes discounted appropriately?	NA
	Is QALY used as an outcome, and was it derived using NICE's preferred methods? If not, describe rationale and outcomes used in line with analytical perspectives taken (item 1.4 above).	Yes
	Are costs and outcomes from other sectors fully and appropriately measured and valued?	Partly
	Overall judgement: Directly applicable/partially applicable/not applicable	Directly applicable
Study limitations (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Does the model structure adequately reflect the nature of the topic under evaluation?	NA
	Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Partly
	Are all important and relevant outcomes included?	Yes
	Are the estimates of baseline outcomes from the best available source?	Yes
	Are the estimates of relative intervention effects from the best available source?	Yes
	Are all important and relevant costs included?	Yes
	Are the estimates of resource use from the best available source?	Yes
	Are the unit costs of resources from the best available source?	Yes
	Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes
	Are all important parameters whose values are uncertain subjected to appropriate sensitivity analysis?	Yes
	Is there any potential conflict of interest?	Unclear
	Overall assessment: Minor limitations/potentially serious limitations/very serious limitations	Minor limitations

Whitehurst 2012

D. G. Whitehurst, S. Bryan, M. Lewis, J. Hill and E. M. Hay . Exploring the cost-utility of stratified primary care management for low back pain compared with current best practice within risk-defined subgroups (Structured abstract). 2012 Annals of the Rheumatic Diseases 71 (11) 1796-1802		
Applicability (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Is the study population appropriate for the review question?	Yes
	Are the interventions appropriate for the review question?	Yes
	Is the system in which the study was conducted sufficiently similar to the current UK context?	Yes
	Are the perspectives clearly stated and are they appropriate for the review question?	Yes
	Are all direct effects on individuals included, and are all other effects included where they are material?	Yes
	Are all future costs and outcomes discounted appropriately?	NA
	Is QALY used as an outcome, and was it derived using NICE's preferred methods? If not, describe rationale and outcomes used in line with analytical perspectives taken (item 1.4 above).	Yes
	Are costs and outcomes from other sectors fully and appropriately measured and valued?	Yes
	Overall judgement: Directly applicable/partially applicable/not applicable	Directly applicable
Study limitations (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Does the model structure adequately reflect the nature of the topic under evaluation?	NA
	Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Partly
	Are all important and relevant outcomes included?	Yes
	Are the estimates of baseline outcomes from the best available source?	Yes
	Are the estimates of relative intervention effects from the best available source?	Yes
	Are all important and relevant costs included?	Yes
	Are the estimates of resource use from the best available source?	Yes
	Are the unit costs of resources from the best available source?	Yes
	Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes
	Are all important parameters whose values are uncertain subjected to appropriate sensitivity analysis?	Yes
	Is there any potential conflict of interest?	Unclear
	Overall assessment: Minor limitations/potentially serious limitations/very serious limitations	Minor limitations

Wynne-Jones 2016

G Wynne-Jones, M Artus, A Bishop, SA Lawton, M Lewis, C Main, G Sowden, S Wathall, AK Burton, D van der Windt, EM Hay, NE Foster . Does a vocational advice service located in primary care improve work outcomes in patients with musculoskeletal pain? The SWAP (Study of Work and Pain) cluster randomised trial. Rheumatology 2016; 55 (suppl_1): i50		
Applicability (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Is the study population appropriate for the review question?	Yes
	Are the interventions appropriate for the review question?	Yes
	Is the system in which the study was conducted sufficiently similar to the current UK context?	Yes
	Are the perspectives clearly stated and are they appropriate for the review question?	Yes
	Are all direct effects on individuals included, and are all other effects included where they are material?	Yes
	Are all future costs and outcomes discounted appropriately?	NA
	Is QALY used as an outcome, and was it derived using NICE's preferred methods? If not, describe rationale and outcomes used in line with analytical perspectives taken (item 1.4 above).	No
	Are costs and outcomes from other sectors fully and appropriately measured and valued?	Unclear
	Overall judgement: Directly applicable/partially applicable/not applicable	Directly applicable
Study limitations (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Does the model structure adequately reflect the nature of the topic under evaluation?	Unclear
	Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Partly
	Are all important and relevant outcomes included?	Partly
	Are the estimates of baseline outcomes from the best available source?	Yes
	Are the estimates of relative intervention effects from the best available source?	Yes
	Are all important and relevant costs included?	Unclear
	Are the estimates of resource use from the best available source?	Unclear
	Are the unit costs of resources from the best available source?	Unclear
	Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes
	Are all important parameters whose values are uncertain subjected to appropriate sensitivity analysis?	Yes
	Is there any potential conflict of interest?	No
	Overall assessment: Minor limitations/potentially serious limitations/very serious limitations	Minor limitations

Hollinghurst 2013

S. Hollinghurst, J. Coast, J. Busby, A. Bishop, N. E. Foster, A. Franchini, S. Grove, J. Hall, C. Hopper, S. Kaur, A. A. Montgomery and C. Salisbury . A pragmatic randomised controlled trial of 'PhysioDirect' telephone assessment and advice services for patients with musculoskeletal problems: economic evaluation. 2013 BMJ Open 3 (10) e003406		
Applicability (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Is the study population appropriate for the review question?	Yes
	Are the interventions appropriate for the review question?	Yes
	Is the system in which the study was conducted sufficiently similar to the current UK context?	Yes
	Are the perspectives clearly stated and are they appropriate for the review question?	Yes
	Are all direct effects on individuals included, and are all other effects included where they are material?	Yes
	Are all future costs and outcomes discounted appropriately?	Yes
	Is QALY used as an outcome, and was it derived using NICE's preferred methods? If not, describe rationale and outcomes used in line with analytical perspectives taken (item 1.4 above).	Yes
	Are costs and outcomes from other sectors fully and appropriately measured and valued?	Yes
	Overall judgement: Directly applicable/partially applicable/not applicable	Directly applicable
Study limitations (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Does the model structure adequately reflect the nature of the topic under evaluation?	Yes
	Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	No
	Are all important and relevant outcomes included?	Yes
	Are the estimates of baseline outcomes from the best available source?	Yes
	Are the estimates of relative intervention effects from the best available source?	Yes
	Are all important and relevant costs included?	Yes
	Are the estimates of resource use from the best available source?	Yes
	Are the unit costs of resources from the best available source?	Yes
	Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes
	Are all important parameters whose values are uncertain subjected to appropriate sensitivity analysis?	Partly
	Is there any potential conflict of interest?	Unclear
	Overall assessment: Minor limitations/potentially serious limitations/very serious limitations	Minor limitations

Salisbury 2013

C. Salisbury, N. E. Foster, C. Hopper, A. Bishop, S. Hollinghurst, J. Coast, S. Kaur, J. Pearson, A. Franchini, J. Hall, S. Grove, M. Calnan, J. Busby and A. A. Montgomery . A pragmatic randomised controlled trial of the effectiveness and cost-effectiveness of 'PhysioDirect' telephone assessment and advice services for physiotherapy. 2013 Health Technology Assessment (Winchester, England) 17 (2) 1-157, v-vi		
Applicability (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Is the study population appropriate for the review question?	Yes
	Are the interventions appropriate for the review question?	Yes
	Is the system in which the study was conducted sufficiently similar to the current UK context?	Yes
	Are the perspectives clearly stated and are they appropriate for the review question?	Yes
	Are all direct effects on individuals included, and are all other effects included where they are material?	Yes
	Are all future costs and outcomes discounted appropriately?	Yes
	Is QALY used as an outcome, and was it derived using NICE's preferred methods? If not, describe rationale and outcomes used in line with analytical perspectives taken (item 1.4 above).	Yes
	Are costs and outcomes from other sectors fully and appropriately measured and valued?	Yes
	Overall judgement: Directly applicable/partially applicable/not applicable	Directly applicable
Study limitations (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Does the model structure adequately reflect the nature of the topic under evaluation?	Yes
	Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	No
	Are all important and relevant outcomes included?	Yes
	Are the estimates of baseline outcomes from the best available source?	Yes
	Are the estimates of relative intervention effects from the best available source?	Yes
	Are all important and relevant costs included?	Yes
	Are the estimates of resource use from the best available source?	Yes
	Are the unit costs of resources from the best available source?	Yes
	Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes
	Are all important parameters whose values are uncertain subjected to appropriate sensitivity analysis?	Partly
	Is there any potential conflict of interest?	Unclear
	Overall assessment: Minor limitations/potentially serious limitations/very serious limitations	Minor limitations

Holdsworth 2007

L. K. Holdsworth, V. S. Webster and A. K. McFadyen. What are the costs to NHS Scotland of self-referral to physiotherapy? Results of a national trial. 2007 Physiotherapy 93 (1) 3-11		
Applicability (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Is the study population appropriate for the review question?	Yes
	Are the interventions appropriate for the review question?	Yes
	Is the system in which the study was conducted sufficiently similar to the current UK context?	Partly
	Are the perspectives clearly stated and are they appropriate for the review question?	Yes
	Are all direct effects on individuals included, and are all other effects included where they are material?	Yes
	Are all future costs and outcomes discounted appropriately?	Unclear
	Is QALY used as an outcome, and was it derived using NICE's preferred methods? If not, describe rationale and outcomes used in line with analytical perspectives taken (item 1.4 above).	No
	Are costs and outcomes from other sectors fully and appropriately measured and valued?	Partly
	Overall judgement: Directly applicable/partially applicable/not applicable	Partially applicable
Study limitations (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Does the model structure adequately reflect the nature of the topic under evaluation?	NA
	Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Partly
	Are all important and relevant outcomes included?	Partly
	Are the estimates of baseline outcomes from the best available source?	Yes
	Are the estimates of relative intervention effects from the best available source?	Yes
	Are all important and relevant costs included?	Partly
	Are the estimates of resource use from the best available source?	Yes
	Are the unit costs of resources from the best available source?	Yes
	Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes
	Are all important parameters whose values are uncertain subjected to appropriate sensitivity analysis?	No
	Is there any potential conflict of interest?	Unclear
	Overall assessment: Minor limitations/potentially serious limitations/very serious limitations	Potentially serious limitations

Chuang 2012

L.-H. Chuang, M. O. Soares, H. Tilbrook, H. Cox, C. E. Hewitt, J. Aplin, A. Semlyen, A. Trewhela, I. Watt and D. J. Torgerson . A pragmatic multicentered randomized controlled trial of yoga for chronic low back pain: economic evaluation. 2012 Spine 37 (18) 1593-601		
Applicability (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Is the study population appropriate for the review question?	Yes
	Are the interventions appropriate for the review question?	Yes
	Is the system in which the study was conducted sufficiently similar to the current UK context?	Yes
	Are the perspectives clearly stated and are they appropriate for the review question?	Yes
	Are all direct effects on individuals included, and are all other effects included where they are material?	Yes
	Are all future costs and outcomes discounted appropriately?	NA
	Is QALY used as an outcome, and was it derived using NICE's preferred methods? If not, describe rationale and outcomes used in line with analytical perspectives taken (item 1.4 above).	Yes
	Are costs and outcomes from other sectors fully and appropriately measured and valued?	Yes
	Overall judgement: Directly applicable/partially applicable/not applicable	Directly applicable
Study limitations (Yes / partly / no / unclear / NA) - add comments into last cell if appropriate	Does the model structure adequately reflect the nature of the topic under evaluation?	Yes
	Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Partly
	Are all important and relevant outcomes included?	Yes
	Are the estimates of baseline outcomes from the best available source?	Yes
	Are the estimates of relative intervention effects from the best available source?	Yes
	Are all important and relevant costs included?	Yes
	Are the estimates of resource use from the best available source?	Yes
	Are the unit costs of resources from the best available source?	Yes
	Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes
	Are all important parameters whose values are uncertain subjected to appropriate sensitivity analysis?	Yes
	Is there any potential conflict of interest?	No
	Overall assessment: Minor limitations/potentially serious limitations/very serious limitations	Minor limitations