



Public Health  
England

Protecting and improving the nation's health

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

## **Final Report**

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# Executive Summary

## Introduction

Public Health England (PHE) commissioned York Health Economics Consortium (YHEC) to develop an economic tool to compare the return on investment of interventions for the prevention of musculoskeletal (MSK) conditions. The tool 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 aim of the project was to develop an easy-to-use, interactive tool for use by various stakeholders including NHS Clinical Commissioning Groups (CCGs), Local Authorities (LAs) and Sustainability & Transformation Partnerships (STPs), to assess the potential return on investment (ROI) for investing in programmes aimed to prevent and treat individuals with MSK conditions.

This report provides a summary of the methodology, the main findings from the development of the tool and draws some high level conclusions. The detail of the literature review can be found in a separate report: Return on Investment of Interventions for the Prevention and Treatment of Musculoskeletal Conditions - Report of Literature Review, June 2017.

There were two key objectives for the work:

- 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;
- To develop an ROI tool that allows the resource and financial consequences of implementing these cost-effective interventions nationally and at local levels.

## Methodology

Stakeholder engagement and opinion was essential to inform the development of the tool. A Project Steering Group was established, which included national experts in the MSK field and the economics of public health. In order to gain the perspective from potential users of the tool, an MSK ROI User Group was established, to allow those in the MSK field to influence its development. During the course of the project members of the Steering Group and User Group were asked to provide information and comment on the content and design of the tool.

A literature review was undertaken to identify cost-effectiveness evidence for interventions for patients with osteoarthritis, back pain, or neck pain. The Stage One literature search took a pragmatic and iterative approach to identify potentially cost effective interventions, in order to produce a short list of interventions for more detailed review in Stage Two. The extent and quality of evidence for each of the seven interventions was found to be variable and is described in detail, with references, in Section 3 of the Report of Literature Review.

The evidence from the literature review, coupled with the expert knowledge amongst members of the Project Steering Group, informed the decision on which interventions should be included in the tool. A summary of the studies used to underpin the analysis for each of the seven interventions, and any assumptions included in the tool, are included in this report.

The following interventions were agreed to be taken forward to the modelling stage:

- Cognitive Behavioural Therapy (CBT) including exercise, for back pain;
- STarT Back (Stratified Risk Assessment and Care), for back pain;
- 'PhysioDirect - Early telephone assessment and advice';
- Self-referral to physiotherapy, for all MSK conditions;
- ESCAPE-pain, for knee pain;
- *Yoga for Healthy Lower Backs*<sup>1</sup>, for back pain;
- Vocational advice from physiotherapists in primary care, for all MSK conditions.

A protocol setting out the parameters to be included in the tool was drafted and shared with the Steering Group for comments. This described the methodology to be adopted for each element of the tool, including: structure of the tool; perspective; population; cost and resource use; calculations and results.

## Results and Discussion

The results of the modelling for each intervention included in the tool are presented in this report and are summarised below. The sample analysis is based on 1000 patients receiving the interventions per year, excluding optional costs for service evaluation.

The results screen in the tool shows the net cost of the interventions, any gains in quality adjusted life years (QALYs) and days of worked saved. These three values are used to calculate the ROI at three levels: financial ROI (healthcare savings), societal ROI (excluding productivity and societal ROI (including productivity)). If any of these values are not included in the study underpinning the analysis, the value shows in the tool as Not Reported. The ROI values show the estimated value generated for every £1 spent on the intervention. If the ROI value is less than £1 for every £1 spent, this indicates that the cost of the intervention is greater than the value generated in one year, in the population selected.

The estimated ROI ratios for each intervention for the sample analysis using 1000 patients are shown in Table 4.1. This summary indicates that, when taking a healthcare financial perspective, four of the seven interventions produce a positive return on investment when compared with usual care. These are STarT Back, 'PhysioDirect (Early telephone assessment and advice), self-referral to physiotherapy and ESCAPE-pain. CBT with exercise, *Yoga for Healthy Lower Backs* and vocational advice in primary care do not report a positive ROI from a financial perspective.

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<sup>1</sup> *Yoga for Healthy Lower Backs* is the name of a specific intervention.

The interventions that show a financial ROI are contributing to reduced demand on the health and social care system, either by increasing efficiency, achieving similar outcomes with fewer resources, or reducing demand by improving health outcomes. These returns may not yield cash releasing savings, unless capacity of services is reduced in line with the reduced demand. A reduction in demand may however, serve to release capacity to enable waiting time targets to be met, particularly for GP appointments and physiotherapy services.

When a wider societal perspective is adopted and the impact of each intervention on patients' quality of life is quantified, CBT with exercise and *Yoga for Healthy Lower Backs* show a small positive ROI. The ROI's for STarT Back and PhysioDirect increase substantially when including quality of life gains. The tool also shows improved clinical outcomes for ESCAPE-pain, STarT Back and CBT. In cases where the intervention may cost more than usual care, but generates greater levels of benefit (i.e. it is cost effective but not cost saving), it may still be viewed as good value for money. This may be attractive if commissioners are willing and able to pay for quality of life gains or improved clinical outcomes.

There are a number of innovations that bring societal benefits by contributing to improved productivity or preventing loss of productivity. The interventions having the greatest impact on work days saved are STarT Back, *Yoga for Healthy Lower Backs* and vocational advice, which shows a positive ROI when a person's ability to work is included in the outcomes. Productivity gains are likely to be accrued to employers and the payer for the service may not realise the benefits directly. The exception to this could be in the case of public sector employers such as the NHS, where an intervention's potential to prevent lost work days may be seen as an advantage.

It is important to note that for all of the interventions, the evidence used to underpin the analysis does not show confidence intervals for the input costs. The implications of this are that commissioners of the services are not able to assess the chances of the costs being higher or lower than stated.

## Recommendations

The following recommendations are made as a result of the information synthesised during the course of the project work, and in discussion with the Steering Group:

- The usefulness of the MSK ROI tool in practice should be evaluated, with users being invited to give feedback on changes that could be made for future versions of the tool;
- The literature review found a lack of evidence on interventions to prevent neck pain. There was also poor data on the prevalence of neck pain, although this is a common cause of

disability, as reported in the Global Burden of Disease Study<sup>2</sup>. There is scope for future research into the prevention of neck pain which may be of particular relevance to employers;

- The implementation of the interventions in the tool should be evaluated and information shared in order to add to the evidence base on the topic. Experience of local implementation and evaluation of effectiveness in a real world setting would be particularly useful;
- Evidence of the outcomes of the interventions should be collected for a period beyond one year, so that the time horizon of the tool can be extended based on evidence of the duration of effects;
- Following the literature review stage it was concluded that self-management programmes, while being interventions in their own right, currently lack evidence of effectiveness for musculoskeletal conditions. They should, however, be considered to be an integral component of good care and supported as a principle.

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<sup>2</sup> GBD 2015 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*. 2016 Oct 8;388(10053):1545-1602

# 1. Introduction

## 1.1 Background

Public Health England (PHE) commissioned York Health Economics Consortium (YHEC) to develop an economic tool to compare the return on investment of interventions for the prevention of musculoskeletal (MSK) conditions. The tool has been developed in response to requests from local commissioners and decision makers, in light of the high financial costs, loss in quality of life and loss of productivity associated with MSK conditions.

The tool 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. The aim of the project was to develop an easy-to-use, interactive tool for use by various stakeholders including NHS Clinical Commissioning Groups (CCGs), Local Authorities (LAs) and Sustainability & Transformation Partnerships (STPs), to assess the potential return on investment (ROI) for investing in programmes aimed to prevent and treat individuals with MSK conditions. Users of the economic tool may 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.

The work was overseen by a Steering Group, led by PHE and comprising experts from across the MSK field. A User Group was also established, to influence the development of the MSK economic tool.

This report provides a summary of the methodology, the main findings from the development of the tool and draws some high level conclusions. The detail of the literature review can be found in a separate report: Return on Investment of Interventions for the Prevention and Treatment of Musculoskeletal Conditions - Report of Literature Review, June 2017.

## 1.2 Objectives

There were two key objectives for the work:

- 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;
- To develop an ROI tool that allows the resource and financial consequences of implementing these cost-effective interventions nationally and at local levels.



### 1.3 Interventions to be Included in the Tool

The evidence from the literature review, coupled with the expert knowledge amongst Steering Group members, informed the decision on which interventions should be included in the tool. The following interventions were agreed to be taken forward to the modelling stage:

- Cognitive Behavioural Therapy (CBT) including exercise, for back pain;
- STarT Back (Stratified Risk Assessment and Care), for back pain;
- Self-referral to physiotherapy for all MSK conditions;
- PhysioDirect (Early telephone assessment and advice);
- ESCAPE-pain, for knee pain;
- *Yoga for Healthy Lower Backs*, for back pain;
- Vocational advice from physiotherapists in primary care, for all MSK conditions.

The description of the interventions below is taken from the study used to underpin the analysis in the tool.

#### Cognitive Behavioural Therapy (CBT) Including Exercise, for back pain

The CBT intervention for the treatment of lower back pain comprised exercise and education using CBT. The intervention was delivered as group sessions by physiotherapists specifically trained in CBT. Eight two-hour sessions delivered over a five week period in groups of four to 10 led by two physiotherapists. An information booklet was also provided.

For further information please see: <https://www.ncbi.nlm.nih.gov/pubmed/17621203>

#### STarT Back (Stratified Risk Assessment and Care), for back pain

STarT Back 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. For patients in the low-risk group, family physicians gave written information on self-management and advice to keep active, prescribed pain medications where appropriate, and reassured patients about their good prognosis. For patients in the medium-risk or high-risk groups, physicians were encouraged to refer patients to physical therapy and address their back-related concerns highlighted by the stratification tool. For patients in the high risk group, psychologically informed physical therapy was provided.

For further information please see: <http://www.wmahsn.org/programmes/view/start-back->

## PhysioDirect (Early telephone assessment and advice)

PhysioDirect involved telephone assessment and advice followed by face-to-face care if required (as opposed to being placed on a waiting list for routine face-to-face treatment). The interview was conducted by a specially trained senior physiotherapist and assisted by computerised templates. Patients were sent leaflets and advice on self-management, with and invitation to call again or make a face-to-face appointment.

For further information please see: <http://www.csp.org.uk/frontline/article/hanging-telephone>

## Self-Referral to Physiotherapy, for all MSK conditions

Patients could either undertake self-referral to a physiotherapist, with or without the suggestion of their GP.

For further information please see: <http://www.csp.org.uk/professional-union/practice/self-referral-key-improving-access-physiotherapy>

## ESCAPE-Pain, for knee pain

ESCAPE-pain is an exercise-based rehabilitation program designed to improve function by integrating exercise, education, and self-management strategies to dispel inappropriate health beliefs, alter behaviour, and encourage regular physical activity. Participants were invited to attend 12 supervised sessions, twice weekly for six weeks. For 15 to 20 minutes of each session, the supervising physiotherapist facilitated a discussion on a specific topic, advising and suggesting simple coping strategies. For 35 to 40 minutes of the session, each participant performed a simple individualised exercise regimen to address their disabilities and progressed this as they improved. After completion, participants were discharged with encouragement to perform home exercises and physical activity, especially walking, but did not receive any additional intervention as part of the program.

For further information please see: <http://www.escape-pain.org/>

## *Yoga for Healthy Lower Backs, for Back Pain*

Participants received a 12-week educational course of specialised gentle yoga (75-minute weekly classes) plus a 4-track relaxations CD, student yoga manual, home practice sheets, hand-outs, yoga mat, the Back Book (education booklet for improving back pain) and usual care.

This mind-body long-term self-management course was designed to help attendees gain improvements in pain reduction, strength, flexibility, mobility, postural awareness, confidence in movement, spinal and back-care education, mental focus, relaxation and breathing techniques, 'psychosocial' / positive mental mood.

For further information please see: <http://www.yogaforbacks.co.uk/>

### Vocational Advice in Primary Care, for all MSK Conditions

A vocational advice service to provide a structured approach to managing work related issues. People with a musculoskeletal problem who required help and support in remaining at or returning to work could be referred to the vocational advice service by their GP or nurse practitioner. Patients were contacted by a vocational advisor, seven days after receipt of the referral who helped the patient to identify and overcome obstacles to remaining at or returning to work. A stepped care model was used, with initial telephone contact and follow-up face-to-face appointment for approximately 20% of patients.

The Flags model of management of the health and work interface was used to structure the vocational advice service, including 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 was facing with respect to managing their musculoskeletal condition in the workplace. There was re-evaluation of the patient's situation regularly until a sustained return-to-work was achieved using a goal oriented approach.

For further information please see: <https://www.keele.ac.uk/kctu/ourresearch/swap/>

## 2. Methods

### 2.1 Steering Group and User Group

Stakeholder engagement and opinion was essential to inform the development of the tool. The Project Steering Group included national experts in the MSK field and the economics of public health. Members of the Steering Group were consulted via regular Steering Group meetings and provided advice at each stage of the project, commenting on the draft tool before circulating it to a wider audience. The membership of the Steering Group can be found in Appendix A.

In order to gain the perspective from potential users of the tool, an MSK ROI User Group was established, to allow those in the MSK field to influence its development. An invitation to be involved in the User Group was produced by YHEC and circulated by members of the Steering Group to their contacts and via their networks. The Membership of the User Group can be found in Appendix B.

During the course of the project members of the Steering Group and User Group were asked to provide information and comment on the following:

- Intelligence about which MSK prevention interventions are currently being used locally, including resources required for delivery and evaluation plans;
- Appropriate grey literature on the evaluation of MSK prevention programmes;
- Information on any relevant patient and public involvement (PPI) activities for MSK prevention programmes;
- Comment on the first draft of the MSK tool, with particular regard to proposed functionality and how the tool would be used in practice;
- Respond to a short survey to elicit views and comments on the second draft of the tool.

### 2.2 Literature Review

The literature review was designed to identify cost-effectiveness evidence for interventions for patients with osteoarthritis, back pain, or neck pain. As the MSK interventions and programmes to be considered were not specified, the literature search parameters were initially quite broad. Consequently, the literature review was undertaken in two stages.

The Stage One literature search took a pragmatic and iterative approach to identify potentially cost effective interventions, in order to produce a short list of interventions for more detailed review in Stage Two. The searches excluded interventions that did not have a cost-effectiveness analysis. 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.

In Stage Two, a series of highly targeted, pragmatic searches was undertaken, in order to identify evidence specific to the seven shortlisted interventions, to add to those of relevance from the Stage One review. 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.

Following full text review and quality assessment, the relevant content from each study was synthesised for each of the seven shortlisted interventions. These were considered by the Steering Group, before agreeing which interventions should be included in the draft tool.

The full detail of the methods and results from the literature review can be found in a separate report: Cost-Effectiveness and Return on Investment for MSK Prevention - Report of Literature Review, June 2017.

## 2.3 Intervention Effectiveness and Assumptions

The extent and quality of evidence for each of the seven interventions was found to be variable and is described in detail, with references, in Section 3 of the Report of Literature Review. A summary of the studies used to underpin the analysis for each of the seven interventions, and any assumptions included in the tool, are set out below.

It should be noted that the results generated by the tool will not necessarily be replicated in each local authority area if there are differences in implementation costs. It should also be noted that, in the tool, the value of healthcare costs and savings have been adjusted for inflation over time.

### Cognitive and Psychological Approaches (CBT)

*Johnson RE et al; Active exercise, education, and cognitive behavioral therapy for persistent disabling low back pain: a randomized controlled trial. 2007 Spine 32 (15) 1578-1585.*

In a UK randomized controlled trial of active group exercise, education, and cognitive behavioural therapy delivered by physiotherapists, the authors found the intervention to have a mean incremental cost effectiveness ratio of £5,000 per quality adjusted life year (QALY) at 15 months.

#### Assumptions about resources/costs:

- Training cost per physiotherapist (£1,533);
- Cost of an information booklet, (£5);
- Number of sessions for each group, 8;
- Group size (average), 7;
- Number of physiotherapists in each session, 2;
- Length of sessions (hours), 2;
- Grade 6 physio delivering sessions (%), 42.0%;
- Grade 7 physio delivering sessions (%), 55.0%
- Grade 8 physio delivering sessions (%), 3.0%.

#### Assumptions about outcomes:

- None required.

### STarT Back (Stratified Risk Assessment and Care)

*Whitehurst et al. 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.*

The authors 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.

#### Assumptions about costs:

- Training cost for GPs using STarT Back (£2,000).

#### Assumptions about outcomes:

- None required.

### PhysioDirect (Early telephone assessment and advice)

*Salisbury et al. 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.*

The authors found no evidence of a difference in the clinical outcome at six months post intervention, 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.

Assumptions about costs:

- Days of training required for physiotherapist (two);
- Grade of staff and proportion of time spent triaging patient calls (Grade 6, 42%; Grade 7, 55%; Grade 8, 3%);
- Leaflet cost per patient, £0.20.

Assumptions about outcomes:

- None required.

## Self-Referral to Physiotherapy

*Holdsworth et al. What are the costs to NHS Scotland of self-referral to physiotherapy? Results of a national trial. 2007 Physiotherapy 93 (1) 3-11.*

The authors estimated that an average episode of care was £66.31 for a self-referral, £79.50 for a GP-suggested referral and £88.99 for a GP referral, suggesting potential cost savings with self-referral.

Assumptions about costs:

- Training costs for physiotherapists (£1,000);
- Average length of time with GP per patient for back pain 8 (self-referral), 17 (GP referral).

Assumptions about outcomes:

- Cost of NSAIDs (Naproxen 500 twice a day, yearly cost £58.40) and analgesia (Co-codamol 15/500 2 tablets 4 times a day, yearly cost £279.74);
- NSAIDs prescriptions per patient, 0.12 (self-referral), 0.12 (GP referral);
- Analgesia prescriptions per patient, 0.10 (self-referral), 0.16 (GP referral);
- Assume referral rates remain constant over time.

## ESCAPE-pain

*Hurley et al. Long-term outcomes and costs of an integrated rehabilitation program for chronic knee pain: a pragmatic, cluster randomized, controlled trial. 2012 Arthritis Care and Research 64 (2) 238-247.*

The authors identified that the programme is clinically effective and has the potential to be cost effective. 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 therapy was found to be just as effective, but cheaper than individual therapy over 30 months, but authors suggest individual therapy may offer flexibility that cannot be offered in a group setting.

Assumptions about costs:

- Training costs per physiotherapist, £250.00;
- Building costs per session, £25.00;
- Average number of patients in each group, 3;
- Grade of physio delivering sessions, 7;
- Number of one hour sessions, 12.

Assumptions about outcomes:

- None required.

## *Yoga for Healthy Lower Backs*

*Chuang et al. A pragmatic multicentered randomized controlled trial of yoga for chronic low back pain: economic evaluation. 2012 Spine 37 (18) 1593-601.*

In a pragmatic randomized controlled trial of yoga for chronic low back pain the yoga arm gained 0.037 QALYs more than the control arm at an increased cost of £506.80 per patient, giving an incremental cost effectiveness ratio of £13,606 and a 72% chance of being cost-effective at a £20k willingness to pay threshold. This is a high level of uncertainty.

Assumptions about costs:

- Fully-resourced group specialised yoga course, including venue costs, teacher support, student resources pack (at £70 each), total of £292.61 per participant;
- Number of participants per class, 15;
- Nil costs for training yoga teachers in this specialised yoga programme (these costs have already been self-financed by the already-qualified registered *Yoga for Healthy Lower Backs* teachers).



Assumptions about outcomes:

- None required.

## Vocational Advice in Primary Care

*Gwynne-Jones et al. 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.*

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.

Assumptions about costs:

- Building cost per participant, (£0);
- Assumed the service is running at full capacity;
- Duration of initial consultation (mins), 13.3;
- Duration of face-to-face consultation (mins), 60;
- Number of face-to-face consultations, 2;
- Percentage having face-to-face consultations, 17.0%;
- Average number of re-evaluation consultations required per person, 2;
- Grade of physio delivering sessions, 8a;
- Days training per physiotherapist, 4.5;
- Grade of staff delivering training, 8a;
- Number of staff delivering training each session, 2;
- Monthly mentoring (hours per month per physiotherapist), 1.5;

Assumptions about outcomes:

- None required.

## 2.4 Developing the Economic Tool

A protocol setting out the parameters to be included in the tool was drafted and shared with the Steering Group for comments. This described the methodology to be adopted for each element of the tool, including: structure of the tool; perspective; population; cost and resource use; calculations and results.

### Population

The tool focuses on interventions which aim to prevent high volume MSK conditions in working age adults. Working age adults are defined as 18+ years, with an upper limit of 75 years.

Using the tool it is possible to assess the return on investment from adopting each intervention within a specific geographical area e.g. an individual local authority, CCG and STP. The tool is pre-populated with relevant English data to allow the user to select the relevant population for their local area, using the dropdown menus provided.

It should be noted that the results generated by the tool will not necessarily be replicated in each local authority area if there are differences in the demographic profile which influence uptake and use of the services provided.

### Approach to the Calculation of ROI

Although the tool has been built from a commissioning perspective, an understanding of the wider societal perspective is desired, whereby the quality of life impacts are included and also the opportunity loss of productivity is measured and reported. The model therefore estimates a series of results, dependent on the values selected for each of the model input parameters.

The ROI is the key outcome measure and is calculated using the formula outlined below:

$$\text{ROI} = \frac{\sum \text{Total discounted benefits}}{\sum \text{Total discounted costs}} \quad (\text{Where } \sum \text{ means 'the sum of'})$$

'Discounted': costs and benefits that are predicted to occur in the future are usually valued less than present costs. It is therefore recommended that a discounting factor is applied to costs and benefits which occur over a time period longer than one year. Please see below for Time Periods and Discounting.

This approach to ROI differs from the approach used by the National Institute of Health and care Excellence (NICE), which uses total net discounted benefits minus total discounted costs, divided by total discounted costs. The approach taken in measuring ROI for this tool

is therefore technically a cost benefit ratio with benefits divided by costs, as opposed to net benefits divided by costs. This approach is consistently used in ROI tools published by PHE.

The ROI values show the estimated value generated for every £1 spent on the intervention. If the ROI value is less than £1 for every £1 spent, this indicates that the cost of the intervention is greater than the value generated.

The ROI is presented as a ratio, with three levels of analysis:

- a) Financial ROI: The healthcare savings to commissioners for every £1 spent by commissioners on the intervention;
- b) Societal ROI (excluding productivity): The healthcare savings to commissioners plus the QALY gain (monetised) for every £1 spent by commissioners on the intervention;
- c) Societal ROI (including productivity): The healthcare savings to commissioners plus the QALY gain (monetised) and the productivity gain for an increase in work days for every £1 spent by commissioners on the intervention.

## QALY

The quality-adjusted life year is a summary outcome measure used to quantify the effectiveness of a particular intervention. QALYs have been designed to combine the impact of gains in quality of life and in quantity of life (i.e. life expectancy) associated with an intervention<sup>3</sup>.

More specifically, QALYs are based on utilities, which are valuations of health-related quality of life measured on a scale where full health is valued as 1 and death as 0. These valuations are then multiplied by the duration of time (in years) that a subject spends in a health state with that particular utility score, and aggregate QALYs are then summed over the subject's projected lifetime (or other time period corresponding to the time horizon of the analysis). For example, if someone experiences a health state with a utility of 0.8 for 10 years and then a health state with a utility of 0.5 for 5 years (and then dies), their aggregate QALYs will be  $(0.8 \times 10) + (0.5 \times 5) = 10.5$  QALYs.

The Department of Health estimates that a QALY has a monetised value of £60,000 per additional QALY<sup>4</sup>. This cost-effectiveness threshold is higher than the value typically applied by NICE for the technology appraisals programme (£20,000 to £30,000) but is relevant for public health interventions such as those considered here.

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<sup>3</sup> Quality-Adjusted Life Year (QALY) [online]. (2016). York; York Health Economics Consortium; 2016. <http://www.yhec.co.uk/glossary/quality-adjusted-life-year-qaly/>

<sup>4</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/216003/dh\\_120108.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/216003/dh_120108.pdf).

## Other Result Metrics

Two outcome measures are included in the results, where these were presented in the literature evidence. These are:

- WOMAC score: Western Ontario and McMaster Universities Osteoarthritis Index - a widely used, proprietary set of standardized questionnaires used by health professionals to evaluate the condition of patients with osteoarthritis of the knee and hip, including pain, stiffness, and physical functioning of the joints. It is also used to assess back pain and other MSK conditions;
- RMDQ score: Roland Morris Disability Questionnaire - a widely used health status measure for low back pain which can be used in research or clinical practice.

## Time Periods and Discounting

The tool makes predictions of the costs and benefits over a specific time period. For this analysis, based upon the evidence available, the time horizon adopted is up to 12 months, with the exception of one intervention (ESCAPE-pain), where the outcome data were available at 30 months post intervention. Therefore, at the end of the 12 month period it is assumed that all potential benefits from the interventions have ended and, as such, no more costs should be incurred.

Where the time horizon is greater than one year, all costs and outcomes are usually discounted at a rate of 3.5% for costs and 1.5% for benefits. For the intervention where this is relevant (ESCAPE-pain), a temporal distribution of costs was not available in order to be able to discount the costs and the benefits. It is not anticipated that the results would be substantially affected by this over the time period of only 30 months.

The value of healthcare costs and savings have been adjusted for inflation over time. Therefore the values in the tool may not be exactly as stated in the studies used.

## Sensitivity Analysis and Confidence Intervals

Deterministic sensitivity analysis is used in economic models to examine the uncertainty associated with model input parameters. Due to the methods of reporting and nature of the studies used to underpin the analyses, the effectiveness values used in the MSK tool are largely composite outcome measures (i.e. a 'cost saving'). These largely cannot be disaggregated to perform sensitivity analysis on specific elements of the input costs or outcomes that are uncertain. In addition, many of the parameters were reported with certainty, (for example, the number of hours training required).

For a few interventions, however, single parameters could be disaggregated. Sensitivity analysis has been used to test the impact on the ROI value of uncertainty in these parameters. In addition, the value of a QALY and average wage per day are also candidates for sensitivity analysis. The parameters included in the sensitivity analysis are therefore:

- Value of a QALY;
- Average wage per day;
- Proportion of participants in employment (STarT Back only);
- Number of days each physiotherapist works in the service (Vocational Advice in Primary care only).

Where confidence intervals for cost savings, QALY gains or productivity gains were available in the evidence, these have been used to apply appropriate ranges to the costs and outcomes for each intervention. This enables the user to observe a range of results within which the true ROI values may lie.

## Evaluation Costs

The tool includes the option to include costs for the evaluation of the interventions in practice. These have been included at a base value of 5%, following guidelines from OECD, which recommend that around 3-5% of a project budget should be spent on evaluation.<sup>5</sup> The value can be changed by the user of the tool.

## Using the Tool in Practice

The tool has an Information Section. This sets out a model guide and the different steps the user of the tool should follow to generate results for the intervention and area of interest. The Information Section also includes a worked example.

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<sup>5</sup> Austrian Development Agency. *Guidelines for Project and Programme Evaluations*. July 2009.

### 3. Results

The results of the modelling for each intervention included in the tool are presented individually below. For the purposes of this sample analysis, a specific geographical area has been selected, in order to present the results for a whole population. The results are based on an analysis of 1,000 patients receiving the intervention. All other parameters are based upon the inputs in the literature, (as opposed to user defined). Evaluation costs of 5% have not been included in the estimates. These costs can be varied by the user of the tool.

The results screen in the tool shows the net cost of the interventions, any gains in quality adjusted life years (QALYs) and days of worked saved. These three values are used to calculate the ROI at three levels: financial ROI (healthcare savings), societal ROI (excluding productivity) and societal ROI (including productivity). If any of these values are not included in the study underpinning the analysis, the value shows as 'Not reported'.

#### 3.1 Cognitive and Psychological Approaches (CBT) including Exercise

The results of the analysis for CBT are shown in Table 3.1. There is an estimated net cost of £216.03 per patient to implement the intervention and a small estimated gain in quality of life of 0.03 QALYs per patient. There was no evidence of productivity gains via days of work saved. It should be noted that there are no data available to calculate the confidence intervals for the cost of the intervention.

**Table 3.1: Results for CBT including exercise**

	Costs per patient	Population costs	95% CI for population	
			Lower bound	Upper bound
Cost of intervention delivery	£243.03	£243,030	Not reported	Not reported
Health care savings	£27.00	£27,000	-£159,000	£213,000
Net cost of intervention	£216.03	£216,030	£402,030	£30,030
QALY gains	0.0300	30.00	-40.00	90.00
Value of QALY gains	£1,800	£1,800,000	-£2,400,000	£5,400,000
Days of work saved	Not reported	Not reported	Not reported	Not reported
Value of days of work saved	Not reported	Not reported	Not reported	Not reported

The ROI values for CBT are shown in Table 3.2. These show that from a healthcare financial perspective there is not a positive ROI, as the ratio of input cost to outcome value is less than £1:£1. When QALY gains are included, there is an estimated ROI of £7.52 for every £1 spent on the intervention.

**Table 3.2: Return on investment for CBT including exercise**

	Mean	95% CI	
		Lower bound	Upper bound
Financial ROI	£1:£0.11	£1:£-0.65	£1:£0.88
Societal ROI (excluding productivity)	£1:£7.52	£1:£-9	£1:£21.57
Societal ROI (including productivity)	£1:£7.52	Not reported	Not reported

### 3.2 STarT Back (Stratified Risk Assessment and Care)

The results of the analysis for STarT Back are shown in Table 3.3. There is an estimated net saving of £21.07 per patient when implementing the intervention and a small estimated gain in quality of life of 0.0029 per patient. There is also evidence of productivity gains via days of work saved. It should be noted that there are no data available to calculate the confidence intervals for the values shown and therefore the results should be viewed with caution.

**Table 3.3: Results for STarT Back**

	Costs per patient	Population costs	95% CI for population	
			Lower bound	Upper bound
Cost of intervention delivery	£2.20	£2,200	Not reported	Not reported
Health care savings	£23.27	£23,275	Not reported	Not reported
Net cost of intervention	-£21.07	-£21,075	Not reported	Not reported
QALY gains	0.0029	2.95	Not reported	Not reported
Value of QALY gains	£177	£176,746	Not reported	Not reported
Days of work saved	2.42	2420	Not reported	Not reported
Value of days of work saved	£298	£297,679	Not reported	Not reported

The ROI values for STarT Back are shown in Table 3.4. These show that there is a positive ROI from a healthcare financial perspective of £10.58 for every £1 spent on the intervention. When QALY gains are included, this increases to an estimated return of £90.92 for every £1 spent and when days of work saved are also included, this increases to an estimated £226.23 for every £1 spent.

**Table 3.4: Return on investment for STarT Back**

	Mean	95% CI	
		Lower bound	Upper bound
Financial ROI	£1:£10.58	Not reported	Not reported
Societal ROI (excluding productivity)	£1:£90.92	Not reported	Not reported
Societal ROI (including productivity)	£1:£226.23	Not reported	Not reported

### 3.3 PhysioDirect (Early telephone assessment and advice)

The results of the analysis for PhysioDirect are shown in Table 3.5. This shows that there is an estimated net saving of £10.02 per patient when implementing the intervention and a small estimated gain in quality of life of 0.007 QALYs per patient. There was no evidence of productivity gains via days of work saved. It should be noted that there are no data available to calculate the confidence intervals for the cost of the intervention and therefore the results should be viewed with caution.

**Table 3.5: Results for PhysioDirect**

	Costs per patient	Population costs	95% CI for population	
			Lower bound	Upper bound
Cost of intervention delivery	£9.28	£9,284	Not reported	Not reported
Health care savings	£19.30	£19,300	-£37,600	£76,190
Net cost of intervention	-£10.02	-£10,016	£46,884	-£66,906
QALY gains	0.0070	7.00	-3.00	16.00
Value of QALY gains	£420	£420,000	-£180,000	£960,000
Days of work saved	Not reported	Not reported	Not reported	Not reported
Value of days of work saved	Not reported	Not reported	Not reported	Not reported

The ROI values for PhysioDirect are shown in Table 3.6. These show that there is a small but positive ROI from a healthcare financial perspective of £2.08 for every £1 spent on the intervention. When QALY gains are included, there is an estimated ROI of £47.32 for every £1 spent.



**Table 3.6: Return on investment for PhysioDirect**

	Mean	95% CI	
		Lower bound	Upper bound
Financial ROI	£1:£2.08	£1:£-4.05	£1:£8.21
Societal ROI (excluding productivity)	£1:£47.32	£1:£-11.18	£1:£99.35
Societal ROI (including productivity)	£1:£47.32	Not reported	Not reported

### 3.4 Self-Referral to Physiotherapy

The results of the analysis for self-referral to physiotherapy are shown in Table 3.7. There is an estimated net saving of £195.08 per patient when implementing the intervention. There was no evidence of quality of life gains or productivity gains via days of work saved. It should be noted that there are no data available to calculate the confidence intervals for the costs of the intervention and therefore the results should be viewed with caution.

**Table 3.7: Results for self-referral to physiotherapy**

	Costs per patient	Population costs	95% CI for population	
			Lower bound	Upper bound
Cost of intervention delivery	£2.00	£2,000	Not reported	Not reported
Health care savings	£197.08	£197,082	Not reported	Not reported
Net cost of intervention	-£195.08	-£195,082	Not reported	Not reported
QALY gains	Not reported	Not reported	Not reported	Not reported
Value of QALY gains	Not reported	Not reported	Not reported	Not reported
Days of work saved	Not reported	Not reported	Not reported	Not reported
Value of days of work saved	Not reported	Not reported	Not reported	Not reported

The ROI values for self-referral to physiotherapy are shown in Table 3.8. These show that there is an estimated ROI from a healthcare financial perspective of £98.54 for every £1 spent on the intervention.

**Table 3.8: Return on investment for self-referral to physiotherapy**

	Mean	95% CI	
		Lower bound	Upper bound
Financial ROI	£1:£98.54	Not reported	Not reported
Societal ROI (excluding productivity)	£1:£98.54	Not reported	Not reported
Societal ROI (including productivity)	£1:£98.54	Not reported	Not reported

### 3.5 *Yoga for Healthy Lower Backs*

The results of the analysis for *Yoga for Healthy Lower Backs* are shown in Table 3.9. The study reports that the healthcare costs are £232.30 higher for those who partake in the intervention compared to those who do not. When adjusted to current values, there is therefore an estimated net cost to implement the intervention of £578.34 per patient. There is an estimated gain in quality of life of 0.037 QALYs per patient and an estimated 8.46 days of work saved per patient.

**Table 3.9: Results for *Yoga for Healthy Lower Backs***

	Costs per patient	Population costs	95% CI for population	
			Lower bound	Upper bound
Cost of intervention delivery	£292.61	£29,610	Not reported	Not reported
Health care savings	-£285.73	-£285,729	-£742,853	£278,253
Net cost of intervention	£578.34	£578,339	£1,035,463	£14,357
QALY gains	0.0370	37.00	6.00	69.00
Value of QALY gains	£2,220	£2,220,000	£360,000	£4,140,000
Days of work saved	8.46	8460	Not reported	Not reported
Value of days of work saved	£1,041	£1,040,580	Not reported	Not reported

The ROI values for *Yoga for Healthy Lower Backs* are shown in Table 3.10. These show that from a healthcare financial perspective there is a negative ROI as there is a healthcare spending loss rather than a healthcare spending saving as a result of the intervention. When QALY gains are included, there is an estimated ROI of £6.61 for every £1 spent on the intervention and when days of work saved are also included, this increases to an estimated £10.17 for every £1 spent.

**Table 3.10: Return on investment for Yoga for Healthy Lower Backs**

	Mean	95% CI	
		Lower bound	Upper bound
Financial ROI	£1:£-0.98	£1:£-2.54	£1:£0.95
Societal ROI (excluding productivity)	£1:£6.61	£1:£2.18	£1:£11.61
Societal ROI (including productivity)	£1:£10.17	Not reported	Not reported

### 3.6 ESCAPE-pain

The results of the analysis for ESCAPE-pain are shown in Table 3.11. There is an estimated net saving of £1309.78 per patient when implementing the intervention. There was no evidence of quality of life gains or productivity gains via days of work saved. It should be noted that there are no data available to calculate the confidence intervals for the costs of the intervention. There was a mean reduction (i.e. improvement) in WOMAC<sup>6</sup> score of 3.17 points.

**Table 3.11: Results for ESCAPE-pain**

	Costs per patient	Population costs	95% CI for population	
			Lower bound	Upper bound
Cost of intervention delivery	£312.22	£312,217	Not reported	Not reported
Health care savings	£1,622.00	£1,622,000	£321,000	£3,723,000
Net cost of intervention	-£1,309.78	-£1,309,783	-£8,783	-£3,410,783
QALY gains	Not reported	Not reported	Not reported	Not reported
Value of QALY gains	Not reported	Not reported	Not reported	Not reported
Days of work saved	Not reported	Not reported	Not reported	Not reported
Value of days of work saved	Not reported	Not reported	Not reported	Not reported

The ROI values for ESCAPE-pain are shown in Table 3.12. These show that there is a positive ROI from a healthcare financial perspective of £5.20 for every £1 spent on the intervention.

<sup>6</sup> WOMAC score: The Western Ontario and McMaster Universities Osteoarthritis Index. A higher score indicates worse pain, stiffness and functional limitation.

**Table 3.12: Return on investment for ESCAPE-pain**

	Mean	95% CI	
		Lower bound	Upper bound
Financial ROI	£1:£5.20	£1:£1.03	£1:£11.92
Societal ROI (excluding productivity)	£1:£5.20	Not reported	Not reported
Societal ROI (including productivity)	£1:£5.20	Not reported	Not reported

### 3.7 Vocational Advice in Primary Care

The results of the analysis for vocational advice in primary care are shown in Table 3.13. As healthcare savings were not reported in the study, there is an estimated net cost to implement the intervention of £44.17. There were no data available on gains in quality of life and there was an estimated gain in productivity of four days of work saved per patient. It should be noted that there are no data available to calculate the confidence intervals for the values shown and therefore the results should be viewed with caution.

**Table 3.13: Results for vocational advice**

	Costs per patient	Population costs	95% CI for population	
			Lower bound	Upper bound
Cost of intervention delivery	£44.17	£44,172	Not reported	Not reported
Health care savings	Not reported	Not reported	Not reported	Not reported
Net cost of intervention	£44.17	£44,172	Not reported	Not reported
QALY gains	Not reported	Not reported	Not reported	Not reported
Value of QALY gains	Not reported	Not reported	Not reported	Not reported
Days of work saved	4.00	4000	Not reported	Not reported
Value of days of work saved	£492	£492,000	Not reported	Not reported

The ROI values for vocational advice in primary care are shown in Table 3.14. These show that there is not a positive ROI from a healthcare financial perspective. When days of work saved are included, there is an estimated ROI from a societal/productivity perspective of £11.14 for every £1 spent on the intervention.

**Table 3.14: Return on investment for vocational advice**

	Mean	95% CI	
		Lower bound	Upper bound
Financial ROI	Not reported	Not reported	Not reported
Societal ROI (excluding productivity)	Not reported	Not reported	Not reported
Societal ROI (including productivity)	£1:£11.14	Not reported	Not reported

## 4. Discussion and Conclusion

### 4.1 Implications of the Economic Modelling

The MSK ROI tool has been developed to enable the user to observe the potential return on investment if they were to implement the chosen intervention(s) in their local population, be this a CCG, local authority or Sustainability and Transformation Plan (STP) area. The ROI values show the estimated value generated for every £1 spent on the intervention. If the ROI value is less than £1 for every £1 spent, this indicates that the cost of the intervention is greater than the value generated in one year, in the population selected.

Three levels of return on investment analysis have been presented, in recognition of the different perspectives that will be relevant to stakeholders considering commissioning (or decommissioning) a musculoskeletal prevention service. The financial ROI shows the healthcare savings to commissioners of the intervention. The societal ROI (excluding productivity) also includes the quality of life years gained and the societal ROI (including productivity) additionally includes the potential productivity gained by avoided days off work. Users of the tool will wish to consider their local perspective and the relative priority of generating a ROI from a healthcare financial perspective or societal perspective.

The estimated ROI ratios for each intervention for the sample analysis using 1000 patients are shown in Table 4.1. This summary indicates that, when taking a healthcare financial perspective, four of the seven interventions produce a positive return on investment when compared with usual care. These are STarT Back, PhysioDirect (Early telephone assessment and advice), self-referral to physiotherapy and ESCAPE-pain. CBT with exercise, *Yoga for Healthy Lower Backs* and vocational advice in primary care do not report a positive ROI from a financial perspective.

The interventions that show a financial ROI are contributing to reduced demand on the health and social care system, either by increasing efficiency, achieving similar outcomes with fewer resources, or reducing demand by improving health outcomes. These returns may not yield cash releasing savings, unless capacity of services is reduced in line with the reduced demand. A reduction in demand may however, serve to release capacity to enable waiting time targets to be met, particularly for GP appointments and physiotherapy services.

When a wider societal perspective is adopted and the impact of each intervention on patients' quality of life is quantified, CBT with exercise and *Yoga for Healthy Lower Backs* show a small positive ROI. The ROI's for STarT Back and PhysioDirect also increase substantially when including quality of life gains. The tool also shows improved clinical outcomes for ESCAPE-pain, STarT Back, *Yoga for Healthy Lower Backs* and CBT. In cases where the intervention may cost more than usual care, but generates greater levels of benefit (i.e. it is cost effective but not cost saving), it may still be viewed as good value for money. This may be attractive if commissioners are willing and able to pay for quality of life gains or improved clinical outcomes.

There are a number of innovations that bring societal benefits by contributing to improved productivity or preventing loss of productivity. The interventions having the greatest impact on work days saved are STarT Back, *Yoga for Healthy Lower Backs* and vocational advice, which shows a positive ROI when a person's ability to work is included in the outcomes. Productivity gains are likely to be accrued to employers and the payer for the service may not realise the benefits directly. The exception to this could be in the case of public sector employers such as the NHS, where an intervention's potential to prevent lost work days may be seen as an advantage.

It is important to note that for all of the interventions, the evidence used to underpin the analysis does not show confidence intervals for the input costs. The implications of this are that commissioners of the services are not able to assess the chances of the costs being higher or lower than stated. Moreover, there are three interventions where it is not possible to calculate confidence intervals for the estimated ROI values presented. Again, this means that commissioners may have less confidence that the interventions will achieve the value for money presented in the tool. An assessment of the evidence available for the interventions is summarised in Table 4.2.

## 4.2 Recommendations

The following recommendations are made as a result of the information synthesised during the course of the project work, and in discussion with the Steering Group:

- The usefulness of the MSK ROI tool in practice should be evaluated, with users being invited to give feedback on changes that could be made for future versions of the tool;
- The literature review found a lack of evidence on interventions to prevent neck pain. There was also poor data on the prevalence of neck pain, although this is a common cause of disability, as reported in the Global Burden of Disease Study.<sup>7</sup> There is scope for future research into the prevention of neck pain which may be of particular relevance to employers;

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<sup>7</sup> GBD 2015 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*. 2016 Oct 8;388(10053):1545-1602

- The implementation of the interventions in the tool should be evaluated and information shared in order to add to the evidence base on the topic. Experience of local implementation and evaluation of effectiveness in a real world setting would be particularly useful;
- Evidence of the outcomes of the interventions should be collected for a period beyond one year, so that the time horizon of the tool can be extended based on evidence of the duration of effects;
- Following the literature review stage it was concluded that self-management programmes, while being interventions in their own right, currently lack evidence of effectiveness for musculoskeletal conditions. They should, however, be considered to be an integral component of good care and supported as a principle.

**Table 4.1: Estimated ROI ratios for each intervention for 1000 patients**

The table shows the ratio of input costs to the value of outcomes. For example, a ratio of £1:£2 indicates that for every £1 invested, there is £2 of outcome value obtained (including the £1 invested). The values shown do not include costs for service evaluation.

The ROI values are shown cumulatively i.e. the financial ROI shows the healthcare savings to commissioners of the intervention. The societal ROI (excluding productivity) also includes the quality of life years gained and the societal ROI (including productivity) additionally includes the potential productivity gained by avoided days off work.

	<b>CBT</b>	<b>STarT Back</b>	<b>PhysioDirect</b>	<b>Self-referral to physio</b>	<b>ESCAPE-pain</b>	<b>Yoga for Healthy Lower Backs</b>	<b>Vocational advice</b>
Financial ROI	£1:£0.11	£1:£10.58	£1:£2.08	£1:£98.54	£1:£5.20	£1:£-0.98	Not reported
Societal ROI (excluding productivity)	£1:£7.52	£1:£90.92	£1:£47.32	£1:£98.54	£1:£5.20	£1:£6.61	Not reported
Societal ROI (including productivity)	£1:£7.52	£1:£226.23	£1:£47.32	£1:£98.54	£1:£5.20	£1:£10.17	£1:£11.14

**Table 4.2: Strength of evidence available for ROIs for each intervention**

	<b>CBT</b>	<b>STarT Back</b>	<b>PhysioDirect</b>	<b>Self-referral to physio</b>	<b>ESCAPE-pain</b>	<b>Yoga for Healthy Lower Backs</b>	<b>Vocational advice</b>
Financial ROI	XX	√	√	√	√√	X	NR
Societal ROI (excluding productivity)	√	√	√	NR	NR	√√	NR
Societal ROI (including productivity)	NR	√	NR	NR	NR	√√	√

**Key:**

√√ Evidence exists for a positive ROI, with statistically significant values

√ Evidence exists for a positive ROI, statistical significance for the result is unknown (i.e. no confidence intervals available or confidence interval crosses ratio of £1:£1),

XX Evidence exists for a negative ROI, with statistically significant values

X Evidence exists for a negative ROI, statistical significance for the result is unknown

NR No evidence was reported for this component



### 4.3 Limitations of the Analysis

There are a number of potential limitations to the methodology used, which are acknowledged in detail in the literature review. For example, the review searched only for studies that referred to economic evaluations, costing reports, systematic reviews of economic evaluations and health technology assessments. This would have therefore excluded effective interventions that did not have a cost-effectiveness analysis. Despite these limitations it is not judged 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. Other issues include the mean follow-up period of around 12 months (excluding Hurley et al), which are not sufficiently long to capture benefits over a longer time horizon.

It should be noted that the results generated by the tool will not necessarily be replicated in each local authority/CCG area if there are differences in implementation costs. Costs may differ across the country due to different staff costs required. The results may also be affected by differences in the demographic profile which influence uptake and use of the services provided. The robustness of the tool relies on interventions being implemented as closely as possible to those reported in the studies used to underpin the analysis in the tool. Where this is not possible, the actual effectiveness of the intervention may be different, which may in turn lead to a different return on investment.

## Appendix A: Members of the Steering Group

<b>Name</b>	<b>Organisation</b>
Panos Zerdevas	Public Health England
Leoni Belsman	Public Health England
Ginder Narle	Public Health England
Rebecca Worboys	Public Health England
Annalisa Belloni	Public Health England
Nuzhat Ali	Public Health England
Simran Sandhu	Public Health England
Matt Hennessey	Public Health England
Beelin Baxter	Department of Health
Stephen Atkinson	Department of Health
Jeremy Knox	Department of Health
Benjamin Ellis	Arthritis Research UK and Imperial College Healthcare NHS Trust
Krysia Dziedzic	Keele University
Philip Conaghan	University of Leeds
Sarah Marsh	NHS England
Shabana Janjua	NHS England
Shelagh Morris	NHS England
Rebekah Pennington	National Institute for Health and Care Excellence
Bhash Naidoo	National Institute for Health and Care Excellence
Tony Wolfe	Arthritis and Musculoskeletal Alliance (ARMA)
Adiba Enwonwu	Department of Health Work & Health Unit
Stewart Palma	Chartered Society of Physiotherapists
Rohima Begum	Chartered Society of Physiotherapists
Priya Dasoju	Chartered Society of Physiotherapists
Nick Hex	York Health Economics Consortium (YHEC)
Jo Hanlon	York Health Economics Consortium (YHEC)
Dianne Wright	York Health Economics Consortium (YHEC)

# Appendix B: Membership of the MSK ROI Tool User Group

## Membership of MSK ROI User Group, January 2017

Name	Role	Organisation
Patricia Acton	Clinical Lead physiotherapy - Musgrove Park Hospital	Taunton and Somerset NHS Trust
Tim Allison	Director of Public Health	East Riding of Yorkshire Council
Ian Bernstein		NHS Ealing CCG
Peter Davis	Physiotherapist - Staff Service	Northern Devon Healthcare NHS Trust
Helen Duffy	NHS Partnerships & Engagement Manager	Arthritis Research UK Primary Care Centre
Rachel Faulkner		Cornwall Council
John Harrison		Devon and Cornwall Police
Giles Hazan	GP with Special Interest (MSK)	
Mark Holmes	Trust Manual Handling & Ergonomics Advisor	University Hospitals Bristol NHS Foundation Trust
Kathryn Millard	Consultant in Public Health	Public Health Warwickshire, Communities Group
Julie Scrivens	Head of Planned Care and Mental Health	NHS Hammersmith & Fulham CCG
Ruth Sephton	Assistant Clinical Director	5 Boroughs Partnership Foundation Trust, Warrington
Maria Stone	Occupational Health Contract Manager	Torbay and South Devon NHS Foundation Trust
Chris Tomlinson	Clinical Advisor for MSK Services	Shropshire CCG
Nicola Walsh	Professor of Knowledge Mobilisation & Musculoskeletal Health	Avon Primary Care Research Collaborative
Nina White	Head of Transformation for MSK services	Shropshire Community Health NHS Trust
Susie Williams	MSK Lead for Occupational Health	University Hospitals Bristol NHS Foundation Trust
Gwenllian Wynne-Jones	NIHR Research Fellow	Arthritis Research UK Primary Care Centre