Modelling the Cost Effectiveness of Interventions, Strategies, Programmes and Policies to reduce the number of employees on sickness absence

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Executive Summary

This report aims to assess the cost-effectiveness of a range of interventions to return people to work following long term sickness absence. It accompanies the report of the evidence review of the effectiveness and cost-effectiveness of these interventions. An economic model was required to objectively combine data from a number of different sources and to make projections into the future.

A scope for the economic modelling was developed based on the results of the evidence review of the effectiveness of interventions to help people return to work following long term sickness absence. A state transition model was developed to represent a cohort of 1000 employed men and women that have been on sick leave between 1 week and 6 months over the remaining working lifetime following the long term sickness absence episode. The model was developed to consider employees absent from work due to musculoskeletal disorders due to the limited effectiveness data around other causes of sickness absence identified by the review. The interventions assessed are a workplace intervention, an intervention involving some form of physical activity and education and an intervention involving physical activity, education and a workplace visit. Two additional interventions: the use of an initial assessment and the use of a case worker/ manager/ team, were also assessed within the model after the initial assessment using a threshold analysis. The comparator within the model is usual care for musculoskeletal disorders. The outcomes considered within the model are the incremental cost per QALY gained and the incremental cost per day on sick leave avoided by the interventions in comparison to usual care. The model has been developed in order to estimate the cost-effectiveness of the interventions in comparison to usual care from a National Health Service (NHS) and Personal Social Services perspective (PSS), a societal perspective and an employer perspective.

The economic analysis indicates that, from an NHS and PSS or societal perspective, all of the interventions assessed are likely to be considered to be cost-effective at a willingness-to-pay threshold of £20,000 per QALY gained. The physical activity and education intervention was estimated to result in a cost per QALY gained of around £2,800 in comparison to usual care from both an NHS and PSS perspective and a

societal perspective. The remaining two interventions assessed within the model were estimated to be more effective and less costly than usual care. This can be explained by the low costs of the interventions in comparison to the large reduction in production occasioned by longer sickness absences without intervention. It is estimated that 8 additional employees out of 1000 need to return to work within 6 months for the intervention to be considered cost-effective in comparison to usual care at a threshold of £20,000 per QALY gained (assuming that the intervention costs around £800 per person on sick leave in addition to usual care).

From the employer perspective, interventions which do not require a large cost input from the employer are likely to be cost-saving to the employer. The workplace intervention which is assumed to cost the employer £527 per person on sick leave is estimated to cost the employer **a net** 34 pence per day on sick leave avoided after taking into account lost production and costs such as Occupational Sick Pay. This result is underpinned by the assumption that an employee can be replaced within 10 weeks. If this period was greater, it would be more likely that the workplace intervention would be cost saving to the employer.

The exploratory analysis around the potential cost-effectiveness of the use of an initial assessment and/ or case worker/manager/team with the aim of establishing the most appropriate intervention for each employee suggests that if this results in at least a one percentage point improvement in the return-to work rate and costs less than about £900 per employee, then it is likely to be considered to be cost effective at a threshold of £20,000 per QALY. It is not known whether this result applies to all groups of workers or only to the kind of workers covered by Haldorsen *et al.* (2006). Hence caution is needed in generalising this result.

There is limited data and hence a large amount of uncertainty around the cost-effectiveness of interventions to return people to work. In order to try and address this, the key model assumptions have been tested within a one-way sensitivity analysis for the workplace intervention, the physical activity, education and workplace visit and the physical activity and education intervention. Since many of the costs are incurred within the first six months of sickness absence, the assumptions around the extrapolation of current data into the future have a limited impact upon the model results and therefore the model appears reasonably robust to changes in the key model assumptions. However, caution should be taken when interpreting these results given that the evidence on the costs and effectiveness of the interventions is based on studies carried out in non-UK countries. Differences in insurance schemes, the health care systems and patients' attitudes to work lead to questions around the generalisability of these studies within the UK setting. Thus, this modelling work is intended to be indicative only. Further research around the effectiveness of interventions on return to work is recommended which: (1) Is within the UK setting; (2) Provides follow up data beyond 12 months; (3) Reports comparable return to work outcomes between studies; and (4) Reports quality of life data of the employees who are both at work and on sick leave.

1 Background

1.1 The role of economic evaluation within the NICE process

The original purpose of NICE was to advise the National Health Service (NHS) on the effectiveness and cost-effectiveness of clinical-management strategies and health technologies. Since 2005, this remit has expanded to the wider public sector with respect to public health.

The NHS, and more generally the public sector, has limited resources yet demands are essentially unlimited. Where money is spent on a new intervention, existing interventions will be displaced. Therefore, a rational and coherent framework is required to help to inform decisions about which interventions are considered to be economically attractive to society. Within a cost-effectiveness analysis, the additional costs and benefits of a new intervention are compared against those of the current standard intervention over a sufficient period to capture these differences. A new intervention can be considered cost-effective if it generates more health gain to patients than it displaces as a result of any additional costs imposed on the system.

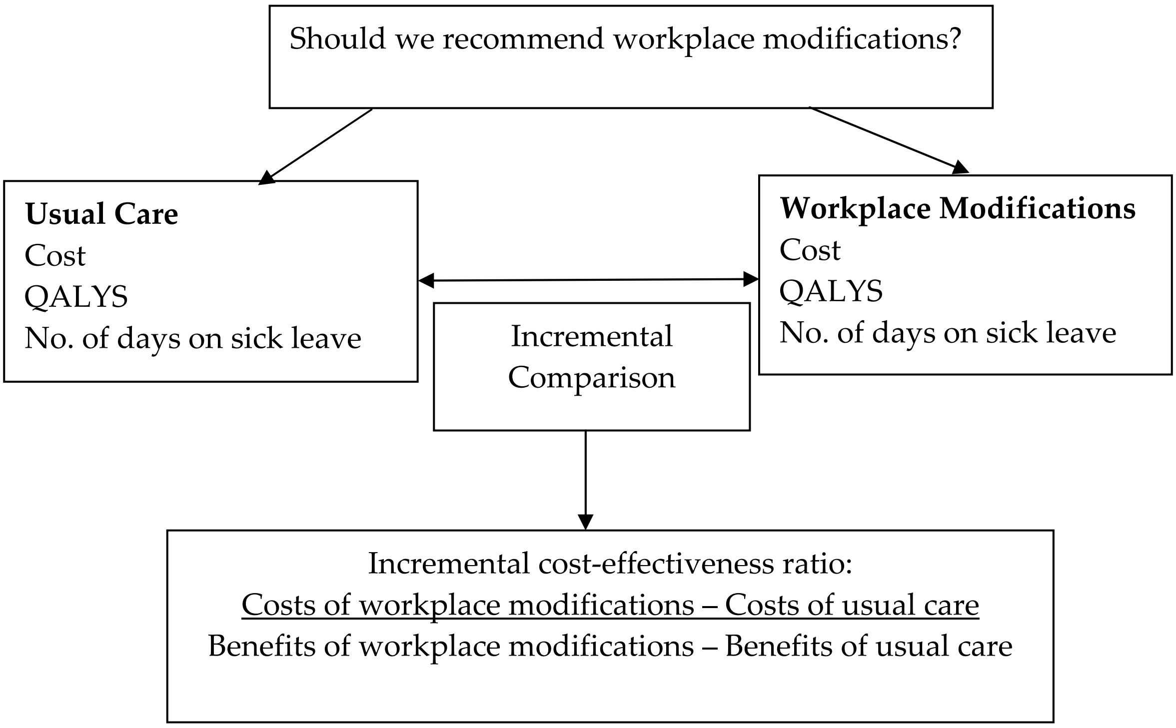
An economic model is required to objectively combine data from a number of different sources and to make projections into the future. If all of the data required to make a decision were readily available, then a model would not be necessary. Thus, by definition, if a model is required, all of the data required to make a decision is not readily available. This means that, inevitably within models, assumptions are required which simplify reality. For example, assumptions are required to be able to estimate future costs and benefits using current data. There will always be some uncertainty associated with the model structure and the model parameters and, therefore, around the model results as a consequence of the assumptions required to develop the model. The strength of the available evidence and the uncertainties around the relationship between costs and outcomes in the present and costs and outcomes in the future will impact upon the model results.

In order to assess the impact of the key assumptions within the model upon the model results, a sensitivity analysis is required. A sensitivity analysis involves varying model assumptions to assess the impact of a different assumption to that made within the base case (the main results presented) upon the model results. If varying an assumption in some sensible way has a large impact upon the model results, then more information may be required around that parameter or structural assumption in order for the model to be able to inform the decision. However, if varying a parameter or assumption has a limited impact upon the model results, then the model results can be considered to be reasonably robust to that assumption. If all of the key assumptions are tested within a sensitivity analysis and they all have a limited impact upon the model results, then there is more certainty that the model results are illustrative of the truth.

The benefits of a new intervention can be measured in terms of disease-specific/ topic specific outcomes. In addition, in order to be able to compare the cost-effectiveness of interventions over different disease areas and populations, NICE uses the cost per quality-adjusted life year (QALY) gained of the new intervention compared with the current standard practice. In order to calculate the cost per QALY, a health utility score (where 0 is a notional health state equivalent to being dead and 1 is a notional health state equivalent to full health) is estimated for each of the states within the economic model. The total utility scores of each person are weighted over the time frame of the model according to time in each state to produce the total QALYs gained for the new intervention compared with the current standard intervention.

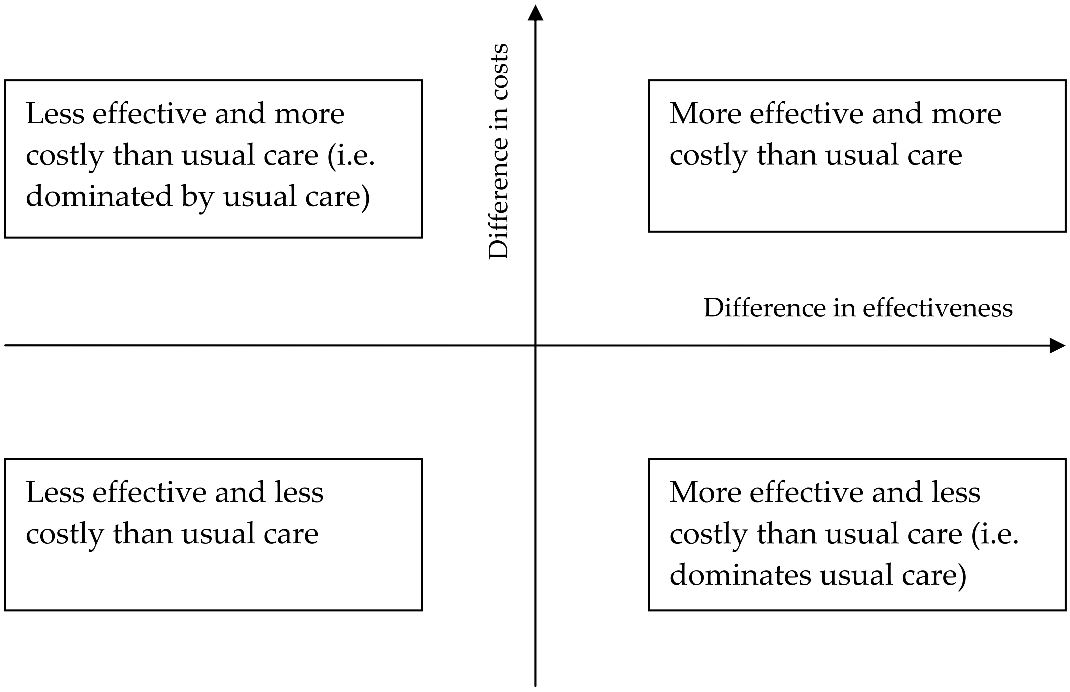
A diagram of the calculation of cost-effectiveness of an example intervention such as workplace modifications compared with usual care is shown in Figure 1 below.

Figure 1: Economic Evaluation



The resulting Cost Effectiveness Ratio (ICER) may be presented in terms of a Cost-Effectiveness Plane as shown in Figure 2 below. Within this figure the cost and effectiveness of usual care is denoted by the origin. The additional benefits and costs generated as a result of each of the interventions assessed are then plotted on the x- and y-axis respectively.

Figure 2: Cost Effectiveness Plane



Interventions which fall into the north-west quadrant of the plane would not be considered as cost-effective in comparison to usual care. Conversely, interventions which fall into the south-east quadrant of the plane would be considered to be economically attractive in comparison to usual care as they are estimated to be more effective and cost saving in comparison to usual care. The cost-effectiveness of interventions which fall into the north-east or south-west quadrant of the plane are less clear as they are more effective and more costly or less effective and less costly than usual care respectively. Most interventions considered would be more likely to fall into the former of these. For these interventions, we allow for an opportunity cost of other interventions displaced by the new intervention which is assumed to be around £20,000 - £30,000 per QALY gained per person by NICE. Interventions which are more effective than usual care and are estimated to have a cost per QALY gained of less than £20,000 - £30,000 are therefore considered to be economically attractive in England and Wales.

The cost-effectiveness ratio may differ according to the perspective from which costs and benefits are incurred. The reference perspective for NICE is that of the National Health Service (NHS) and Personal Social Services (PSS). This means that only costs and benefits associated with the NHS or PSS should be included within the model. Within public health, it is also often useful to consider the societal perspective. This involves considering everyone affected by the intervention and includes all significant health outcomes and costs resulting from it, independent of who incurs the outcomes or costs.

1.2 Long-term sickness absence and incapacity programme

A series of three effectiveness and cost effectiveness evidence reviews covering four primary research questions was commissioned by NICE. The following questions were proposed within the scope of the Long Term Sickness Absence and Incapacity programme.

- Which interventions, programmes, policies or strategies are effective and cost-effective in helping:
  - (Research question 1) to prevent and/or reduce the number of employees who move from short to long-term sickness absence?
  - (Research question 2) employees on long-term sick leave to return to work?
  - (Research question 3) to reduce the number of employees who take short or long- term sickness absence on a recurring basis?
  - (Research question 4) those in receipt of incapacity benefit to return to full or part-time work?

No economic evaluations were identified in the initial evidence reviews covering research questions 1 and 4. Eleven studies were identified for research question 2, three of which were also identified for question 3 (Hillage et al, 2008a; Rick et al, 2008; Hayday et al, 2008). An additional economic evaluation (Adam *et al.*, 2008) was submitted as part of the evidence consultation process for research question 4 (Hillage *et al.*, 2008b).

The general findings of the evidence reviews of economic evaluations were:

- All of the economic evaluations, like the majority of the effectiveness evidence, were based in non-UK countries apart from the cost-benefit analysis by Adam *et al.*;
- Cost benefit analyses tend to have been carried out rather than cost-effectiveness analyses. Only one study used a cost utility approach[1];
- All of the economic evaluations were based on one study (generally an RCT), where the cost-effectiveness analysis was carried out as a smaller, secondary piece of work. The models were generally very basic and no extrapolation of the results from the studies was carried out to assess the longer term impacts of the interventions.

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[1] Cost-effectiveness analysis assesses the costs and effects of a health intervention or strategy. Effects are measured in units of outcomes experienced such as life years gained or cases of disease prevented. Cost-benefit analysis differs from cost-effectiveness analysis in that both costs and health benefits are measured in monetary terms. Cost-utility analysis is a form of cost-effectiveness analysis using the quality-adjusted life year (QALY) as an outcome measure.

- Few studies have carried out any sensitivity analyses to assess the impact of different assumptions upon the results.

In the absence of the very limited cost effectiveness evidence for the interventions covered by the evidence reviews it is necessary to produce an economic model to derive estimates of the cost-effectiveness of interventions to return people back to work following sickness absence.

Given the limited publicly available evidence resulting from the evidence reviews of research questions 1, 3 and 4 (Hillage *et al*, 2008; Rick *et al*, 2008; Hayday *et al,* 2008), the modelling work focuses on research question 2 above. The interventions outlined within the Pathways to Work report (Bewley *et al.*, 2008) and the corresponding cost-benefit analysis (Adam *et al.*, 2008) identified within the review of question 4 have not been taken forward in terms of the modelling work because the Programme Development Group felt that the study did not sufficiently demonstrate adequate efficacy of the intervention.

1.2.1 Purpose of this report

This report aims to assess the cost-effectiveness of a range of interventions to return people to work following long term sickness absence (research question 2). It accompanies the report of the evidence review of the effectiveness and cost-effectiveness of these interventions (Hillage *et al*, 2008).

2 Methods

2.1 Economic model scope

A scope for the economic modelling was developed based on the results of the evidence review of the effectiveness of interventions to help people return to work following sickness absence (research question 2) (Hillage *et al.*, 2008). 45 studies, covering a wide range of interventions, were identified in this evidence review. Interventions for which there were reasonable data on effectiveness (quality grading of '+' or greater using a criteria set by NICE) were considered for possible inclusion in the economic model (n = 18)[2]. All studies (n = 27) with a quality grading of '-' were excluded from use in the economic model since the results of these studies were likely to bias the intervention effectiveness parameters. It should be noted, however, that collectively the studies with a quality grading of '-' did not produce substantially different results to those studies with a quality grading of '+'.

In order to provide a measure of effectiveness of each of the interventions, a meta-analysis was carried out for each of the interventions using the studies which:

1. were rated as '+' or higher within the quality assessment;
2. reported outcomes that were appropriate for use within the meta-analysis; and
3. had a comparator of usual care

A meta-analysis is a statistical method of combining the results from each of the similar identified studies. In order to combine the results of studies within a meta-analysis, ideally the population, outcomes, interventions and comparators should be similar. The limitations of carrying out a meta-analysis given the heterogeneity

[2] Please note that these numbers were correct at the time of the analysis. The number of studies graded '+' and '-' was revised slightly during the finalisation of the effectiveness review so that 19 were graded as '+' and 26 were graded as '-'.

between the studies identified by the review are considered within the discussion section of this report.

The majority (n = 15) of the 18 studies considered for inclusion in the economic model because of a quality grading of '+' or higher were based on patients with low back pain or other musculoskeletal disorders. Two papers described studies of the effectiveness of interventions for minor mental disorders. Between these two studies there was considerable heterogeneity in terms of study design, geographical location and study population, one looking at Cognitive Behaviour Therapy (CBT) for fatigue (Huibers *et al*., 2004), the other at CBT for minor adjustment disorders (Van der Klink *et al*., 2002). The first of these studies showed that CBT was less effective in improving return to work outcomes compared with usual care. The second of these studies suggested that the probability of return to work at 6 months was 100% in the intervention arm and around 97% in the usual care arm. All employees had returned to work within 12 months independent of treatment. Given the different conclusions from the two studies of CBT for minor mental disorders, this has not been modelled due to insufficient data around the efficacy of the intervention.

The remaining paper not considering an intervention for low back pain or other musculoskeletal disorder (Mortelmans et al., 2006) rated '+' was based on enhanced information exchange between social insurance physicians and occupational physicians for people who were on non-specific sick leave which was shown to be ineffective in helping people return to work following sickness absence. Given the additional costs incurred by the training, a model is not required to suggest that this intervention would not be considered economically attractive in comparison to usual communication between these health professionals. The three papers covering minor mental disorders and non-specific sick leave were therefore not included within the economic model. Thus, because of the evidence identified by the evidence review, the economic model was developed to consider interventions aiming to return people who are suffering from musculoskeletal disorders back to work following sickness absence.

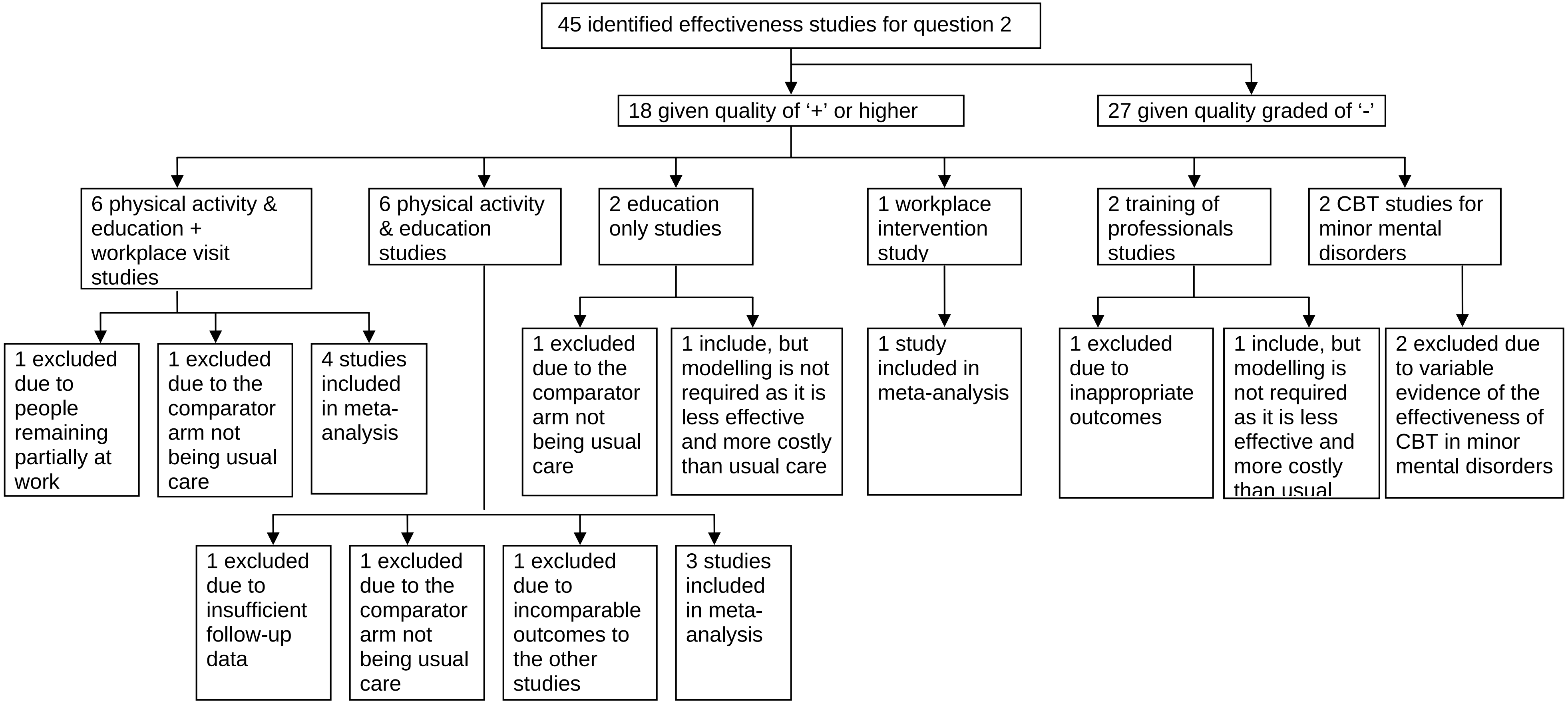
One of the 15 studies assessing the effectiveness of interventions for people with musculoskeletal disorders (Steenstra *et al*, 2005) considered the effectiveness of a workplace intervention which involved a workplace assessment and work modifications based on participative ergonomics involving all important stakeholders. This was identified as one intervention to be considered within the model (See figure 2 below).

Six of the remaining studies were based around some form of physical activity, education of how to deal with pain and body mechanics and a form of workplace visit; hence these were grouped together as one broad intervention identified within this report as 'physical activity, education and workplace visit' to be selected for economic analysis. The workplace visit involved within these studies was usually one short visit and meeting with the employer, and was not as comprehensive as the workplace intervention described above. The education element could include CBT, information, education on body mechanics, education around re-injury prevention or discussion of coping strategies. The physical activity element could include any form of physical activity from graded activity or physiotherapy to daily walks. One of these studies was excluded from the meta-analysis of the evidence on this intervention due to people remaining partially at work (Meijer *et al.,* 2006) and another study was excluded because the comparator within the study was not usual care (Van den Hout et al., 2003). The remaining four physical activity, education and workplace visit studies were included within a meta-analysis (Burke *et al.,* 1994; Haldorsen *et al.*, 1998; Lindstrom *et al.*, 1992; Skouen and Kvale, 2006). Three of these studies (all except Burke *et al*.) include CBT as part of the intervention evaluated.

Six of the studies with a quality grading of '+' or higher considered physical activity and education of how to deal with pain and body mechanics only (without the workplace visit) and these were grouped together as another broad intervention called 'physical activity and education'. One study assessing the effectiveness of physical activity and education was excluded from the meta analysis as the outcomes reported were mean number of days on sick leave with insufficient data provided regarding variability in this parameter to enable the derivation of the proportion of employees returning to work within 6 months (Torstensen *et al*., 1998). One study was excluded from the meta-analysis due to the follow up of the study being less than 6 months (Sullivan *et al*., 2006) and one study was excluded due to the comparator within the study not being usual care (Jensen *et al.,* 1997). The remaining three studies of physical activity and education were included within a meta-analysis (Molde Hagen *et al*., 2003; Jensen *et al*., 2005; Sinclair *et al*., 1997). Jensen *et al.* includes CBT as part of the intervention evaluated; however psychological interventions alone were not assessed within the model since none of the studies considered this intervention in isolation. The meta-analyses are shown in Appendix A.

Two studies were based on exercise-based interventions alone. One of these studies could not be included for use to describe the efficacy of this intervention because it did not have a comparator of 'usual care' (Aure *et al*., 2003). The other study on exercise-based interventions (Marhold *et al.*, 2001) suggested that the intervention was less effective in increasing return to work than usual care. Given that the intervention is more expensive than usual care, a model is not required to suggest that exercise-based interventions alone would not be economically attractive based on the evidence identified. The studies included and excluded for use within the economic evaluation, with reasons for exclusions, are shown in Figure 3.

Figure 3: Included and excluded studies used in economic evaluation[3]



[3] Please note all studies are based on musculoskeletal disorders unless stated otherwise

The following scope was therefore defined for the economic modelling:

Population:

A cohort of employed men and women that have been on between 1 week and 6 months of sick leave.

Interventions:

- Workplace interventions for musculoskeletal disorders (Steenstra *et al*., 2005);
- Physical activity and education intervention for musculoskeletal disorders (Molde Hagen *et al*., 2003; Jensen *et al*., 2005; Sinclair *et al*., 1997);
- Physical activity and education and workplace visit for musculoskeletal disorders (Burke *et al.*, 1994; Haldorsen *et al*., 1998; Lindstrom *et al*., 1992; Skouen and Kvale, 2006).

Comparators:

- Usual care for musculoskeletal disorders (See section 2.2 for additional description of usual care)

Outcomes:

- Incremental cost per QALY gained
- Incremental cost per day on sick leave avoided

Perspectives:

- NHS and PSS
- Societal
- Employer

Following the initial analysis and several meetings with the Programme Development Group it was agreed that two additional interventions would be considered within the model:

- The use of an initial assessment to aim to establish the most appropriate intervention for each patient;
- The use of a case worker/manager/team to aim to establish the most appropriate intervention for each patient.

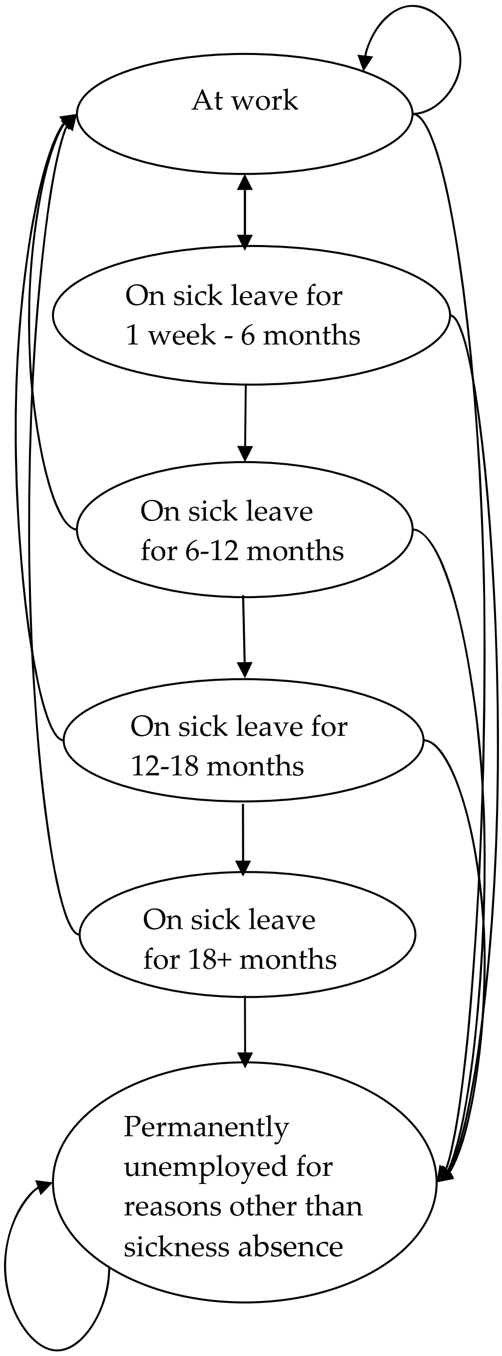
The assessment of these two additional interventions is described in Section 2.8.2.

2.2 Model methodology

A state transition model has been developed to represent a cohort of 1000 employed men and women that have been on sick leave between 1 week and 6 months over the remaining working lifetime following the long term sickness absence episode. Within the literature there is no clear definition of 'long term' sick leave. A minimum of one week was chosen to represent 'long term' sick leave as this is representative of the period of sickness absence within the effectiveness studies identified by the evidence review. Within this report, any person on sick leave for longer than one week will be hereafter referred to as on long term sick leave. Six-monthly cycles are used to model progression. The states within the model are (1) at work, (2) on sick leave for 1 week to 6 months, (3) on sick leave for 6-12 months, (4) on sick leave for 12-18 months, (5) on sick leave for more than 18 months and (6) permanently unemployed for reasons other than sickness absence.

Everyone begins in the 'on sick leave for 1 week to 6 months' state. Individuals may then progress through each 6-month period of sick leave in turn, or they may move to the 'at work' state from any of the sickness states within the model. Similarly, people may move to the 'permanently unemployed for reasons other than sickness absence' state from any of the states within the model. The last state 'permanently unemployed for reasons other than sickness absence' represents people dying and retiring from work; therefore it is assumed that once a person has entered this state they will not become employed again. It is important within the model to consider those people who will die or retire before state retirement age so that the benefits of the intervention are not overestimated within the model. The possible transitions between these states are shown in Figure 4.

Figure 4: Schematic of model



A half-cycle correction has been applied within the model to account for those people who would return to work half way through each 6-monthly cycle. Without this correction, the model assumes that everyone would move to the next state at the end of each cycle of six months. This would be particularly problematic for the first six months of the model, given that many of the costs are incurred at this stage, and hence, costs for the first six months within the model would be overestimated and QALYs would be underestimated. The studies of effectiveness identified by the evidence review which show graphs of the monthly probability of return to work suggest that this relationship is approximately linear. This means that at three months around half of the people on sick leave who return to work by six months will have already returned to work. Hence, the half-cycle correction is applied to adjust for those people returning to work half way through the cycle of six months, meaning that the estimates of costs and benefits within the model should be more realistic.

Based on the effectiveness papers identified by the evidence review, the average age of a person starting on long term sickness absence is 41. The current retirement age for men is 65 while the current retirement age for women is 60. However, from 2010 to 2020 the state pension age will increase to 65 for women. For both men and women, state pension age will gradually increase to age 68 by 2050. Therefore, for a person who is currently 41 years old, state retirement age is currently predicted to be 66 (Department of Work and Pensions, 2007). Hence within the model it has been assumed within the base case that the retirement age is 66 for both men and women. The probability of retiring early, however, is based on current historical data (Humphrey et al, 2003) given that no other data is available. This is not expected to be substantially affected by the change in retirement age. The proportion of people dying is based upon standard life tables (Office for National Statistics, 2004-06). Both the probability of retiring and the probability of dying are dependent upon age.

Currently within the UK, if an employee is on sick leave from work for more than three days they are eligible to receive Statutory Sick Pay (SSP) from their employer. If the employee continues to be on sick leave for six months, they may then receive Incapacity Benefit which is paid for via national insurance contributions. In order to receive Incapacity Benefit the person must fill in a questionnaire and may have to attend a medical assessment. Within the model the cost of these sickness benefits do not need to be included within either the NHS perspective or the societal perspective. This cost is not included within the NHS perspective because the NHS does not pay for Incapacity Benefit, and it is not included within the societal perspective because it is a transfer payment. That means that if the number of people receiving Incapacity Benefit decreases, less public funds may be required from national insurance contributions (since Incapacity Benefit is funded through national insurance contributions). This would, in theory, mean that the working population should be required to pay lower national insurance contributions. Because these are transfer payments between members of society there is no cost to society as a whole (no member of society stands to gain without other members of society losing out) and hence they do not need to be incorporated into the model.

Many employers also provide occupational sick pay to their employee. Within the UK, the amount of occupational sick pay (OSP) provided to employees is highly variable, ranging from no payment to up to six months of full pay followed by six months of half pay. If OSP is more than the SSP amount, the employee will receive the OSP amount. This is modelled as part of the employer perspective. The employer also has the opportunity to reclaim a proportion of the SSP amount under the Percentage Threshold Scheme. However, the CIPD Absence Management Annual Survey 2007 suggests that only around 14% of employers are aware of this scheme and that less than 1% of respondents to the survey have used the scheme in the last year (CIPD, 2007a). Therefore, the Percentage Threshold Scheme has not been incorporated into the model.

2.3 Model assumptions

Owing to the notable uncertainty surrounding the extrapolation of the data for both the comparators and the interventions beyond 12 months, the quality of life of individuals on long term sick leave and the costs associated with being on sick leave, a large number of assumptions were required within the model. The key model assumptions are defined below with discussion around each.

1. If the intervention has not been effective within the first six months, the person is assumed to be subsequently no more likely to go back to work than if they were in the comparator arm.

   Given limited follow up data within the effectiveness studies identified by the evidence review, an assumption is required about the effectiveness of the intervention following the time period of the studies. Assuming that the employee is no more likely to return to work after the first 6 months if given the intervention means that the effectiveness of the interventions is unlikely to be overestimated.

2. The intervention is assumed to be given only the first time the person goes on long term sick leave. Employees would be given ‘usual care’ only in subsequent sessions of long term sick leave.

   If the employee became sick again with the same problem, the healthcare professionals are unlikely to provide the same intervention. This assumption is tested within the sensitivity analysis.

3. The probability of going on further episodes of long term sick leave given that the person has already been on sick leave is assumed to be the same for the intervention group as for the usual care group.

   The skills and techniques developed as a result of the intervention may continue to have an impact on the individual after they have returned to work, such that they may be less likely *to go on further episodes of long term sick leave again. Given that no evidence has been identified around this due to the limited follow up of the studies, the model assumes minimum benefit of the intervention and this assumption is tested within the sensitivity analysis. The model does however assume that the employee is twice as likely to have a subsequent long term sickness absence as a person who in the general population who has not previously been on long term sick leave from work, based on a study of low back pain (Hestbaek et al., 2003).*

4. The health utility score associated with being at work is assumed to be the same (based on the mean of a sample of the general population who have previously been at work and on long term sick leave within the last ten years) for all individuals independent of their health status (Peasgood *et al*., 2006). Similarly, the health utility score associated with being on long term sick leave is assumed to be the same for all individuals independent of illness. That is, the model assumes that the quality of life of the individual is more greatly affected by being at work or on sick leave than by the illness itself.

   This assumption has been made because some people may go back to work when they have not recovered from their illness and some interventions actually encourage people to go back to work at this early stage. In addition, there is a wide range of severity in illness which should have been captured within the sample of the general population on sick leave.

5. When the employee is on sick leave, they are assumed to receive 15 weeks on full pay and 16.4 weeks on half pay.

   Some of the effectiveness studies identified by the evidence review suggest that the employees are receiving some sort of sick pay; however most do not specify whether or not the person is receiving sick pay during the time that the intervention is being provided. In the UK, employees receive 15 weeks full OSP and 16.4 weeks reduced OSP on average based on the CIPD Absence Management Annual Survey Report 2007. Given that the amount of pay received is highly variable between organisations within the UK, the effect of different amounts of occupational sick pay on the model results are tested within a sensitivity analysis. It is also recognised that there is likely to be a relationship between the length of time for which sick pay is available and the time to return to work of the individual. This relationship is highly complex and has been considered within the discussion section of the report.

6. Wages and productivity of a replacement worker are assumed to be the same as those given to the worker they replaced before becoming sick.
7. Once the individual suffering from illness goes back to work their productivity is assumed to be the same as it was before they became absent.

8. The value of any loss of leisure time is assumed to be included in the estimate of quality of life for being at work and on long term sick leave.
9. Once the person has reached pension age, there is assumed to be no substantial difference in the costs or benefits incurred by the people who have received the intervention and those that have received usual care.
10. The probability of dying is assumed to be no different for people on long term sick leave to people who are at work.

2.4 Progression through the model

All employees begin in the 'on sick leave for 1 week to 6 month' state. They then have a probability of going back to work based on the effectiveness studies identified by the evidence review. If the person does not return to work within 6 months, they will then move to being in the 'on sick leave for 6-12 months' state. The probability of going back to work during this period is 2.3% based on national statistics of people on incapacity benefit returning to work (Department of Work and Pensions, 2005). National statistics suggest that the probability of going back to work over the first 18 months of sickness absence varies and hence this has been broken down into separate periods. If the person does not return to work by 12 months they will move into the 'on sick leave for 12-18 months' state where they will have a 5.3% probability of returning to work based on national statistics (Department of Work and Pensions, 2005). Again, if the person does not return to work within this period they will move into the 'on sick leave for 18+ months' state. The person then either remains in that state with a 0.7% probability of returning to work each six months thereafter, based on national statistics (Department of Work and Pensions, 2005).

The evidence suggests that the probability of returning to work between 6-12 months is lower than the probability of returning to work between 12-18 months. This may be explained by the fact that employees are more likely to receive occupational sick pay from the employer up until 12 months; and hence the incentive to return to work increases beyond this period. Inevitably, the amount and duration of occupational sick pay received by the employee will affect the return to work behaviour of the employee during any sickness absence episode. This issue is considered further in the discussion of this report. It should also be noted that these figures are based only on people who receive Incapacity Benefit. Those who are not considered eligible for Incapacity Benefit are potentially more likely to return to work at an earlier stage, and hence these figures may be a slight underestimate. This has been tested within a sensitivity analysis.

The probabilities of returning to work may also appear low in comparison to other sources which state that, for example, 60% of people on Incapacity Benefit leave within a year (Bewley *et al*, 2007); however these statistics used within the model are based only on those people that have left Incapacity Benefit to return to work. Other reasons for leaving Incapacity Benefit include a closed certificate, the death of a claimant, by request of the claimant, failure to attend medical examination, failure to provide information and claimant not assessed as being incapable based on the personal capability assessment. No further explanation of each of these reasons is provided (Department for Work and Pensions, 2005). Given that these people do not return to work, it is likely that a large proportion of these claimants would move to other benefits, meaning that they would continue to be on leave from work. This data was taken from 2005 since the breakdown according to reason for leaving Incapacity Benefit was not provided within the statistics beyond this date.

Once a person has returned to work, they will have a probability of a recurrence of long term sickness absence. The prevalence of sickness absence from work within the UK is 3.4% and the proportion of these that are on long term sick is 34% (CIPD, 2007a). Therefore, the probability of any person in the general population being on long term sick leave is calculated to be 1.2% (i.e. 34% of 3.4%). However, the population within the model is those that have been on long term sickness absence previously, and hence evidence suggests that they are more likely to be absent from work due to long term sickness absence in the future. Based on a study of low back pain, a recurrence of long term sickness absence is assumed to be twice as likely as for the general population (Hestbaek et al., 2003). This implies that the probability of recurring sickness absence is 2.3%. This parameter has been varied within a sensitivity analysis. These probabilities are shown in Table 1 below.

Table 1: Probabilities of moving between states in the model

Parameter	Mean value	Source
Probability of being on long term sick leave and going back to work (0-6 months)	64.8%	Weighted average of the effectiveness studies
Probability of being on long term sick leave and going back to work (6-12 months)	2.3%	Department for Work and Pensions (2005)
Probability of being on long term sick leave and going back to work (12-18 months)	5.3%	Department for Work and Pensions (2005)
Probability of being on long term sick leave and going back to work (every 6 months after 18 months on sick leave)	0.7%	Department for Work and Pensions (2005)
Probability of being at work and experiencing sickness absence (>4 days) given already experienced long term sickness	2.3%	CIPD (2007a)

2.5 Effectiveness of the interventions

The relative risks of being on long term sick leave and going back to work within 6 months for each of the interventions assessed within the model in comparison to usual care for musculoskeletal disorders are shown in Table 2 below. The relative risk is the relative efficacy of the intervention in comparison to usual care. Therefore, a relative risk of 1.12 implies that out of 1000 people, 78 additional people will return to work within the first 6 months of sick leave if given the intervention in comparison to usual care. This can be calculated by multiplying the probability of returning to work within the first 6 months given usual care by the relative risk of returning to work given the intervention (i.e. 64.8%*1.12 = 72.6%). This means that out of 1000 people receiving the intervention, 726 are estimated to return to work within the first 6 months. Out of 1000 people receiving usual care, 648 are estimated to return to work within 6 months. This implies that 726 – 648 = 78 additional people will return to work within the first 6 months when given the intervention in comparison to usual care. Similarly, a relative risk of 1.06 and 1.43 equates to an additional 39 people and 279 people respectively returning to work within the first 6 months of sick leave given the intervention in comparison to usual care. The meta-analyses carried out to determine these relative risks is shown in Appendix A.

Table 2: Relative risk of effectiveness of interventions

Intervention	Mean value	Source/ calculation
Workplace intervention	1.12	Anema *et al.* (2007)/ Steenstra *et al.* (2006)
Physical activity and education	1.06	Meta-analysis of Jensen *et al*. (2005), Molde Hagen *et al*. (2003) & Sinclair *et al*. (1997)
Physical activity and education and workplace intervention	1.43	Meta-analysis of Burke *et al.* (1994), Haldorsen *et al.* (1998), Lindstrom *et al.* (1992) & Skouenand Kvale (2006)

Insufficient evidence around the efficacy of the use of an initial assessment to provide the most appropriate treatment for each patient and around the efficacy of the use of a case worker/manager/team being available led to these interventions being assessed within the model using a threshold analysis. This means that rather than assuming a specific relative risk of effectiveness for these interventions, the model calculates the level of efficacy required in order for the intervention to be considered to be cost-effective if society is willing to pay a certain amount for a QALY gain. This analysis is described in Section 2.8.2.

2.5.1 Quality of life estimates

The quality of life of the individuals within the model is based on whether the individual is at work or on sick leave. Quality of life of the individuals is not explicitly related to whether or not the person is still suffering from the illness, although it would be expected that there is a reasonable correlation between whether or not the person had gone back to work and the severity of their health condition. The quality of life estimates are derived based on a study by Peasgood *et al.* (2006) which uses data from the British Household Panel Survey (BHPS) to predict the quality of life of people who have been on long term sick leave or are currently on long term sick leave. The BHPS is a longitudinal annual survey designed to capture information on a nationally representative sample of around 10,000 – 15,000 of the non-immigrant population of Great Britain that began in 1991. The same individuals are re-interviewed in successive waves, although there is a large amount of attrition and new individuals are added to the sample so that the individuals within the sample population will have been followed up for different time periods.

Within the Peasgood *et al*. study, coding was used in SPSS (a statistical package) to derive SF-6D data which was available in waves 9 and 14 of the BHPS. The SF-6D generates utility scores from the SF-36, which is the most popular worldwide measure of general health, derived using questionnaires. The health utility estimates have been derived based on the population within the BHPS which were currently either employed or on long term sick, and had been employed and on long-term sick leave during the survey at least once since 1994. This data has been divided into age categories given that the quality of life of the individuals may change as the person ages, and the effect on quality of life of being on sick leave may vary according to the age of a person. For example, if the person is close to retirement age the impact of being on sick leave may be lower than if the person is younger. To ensure that the effect on quality of life observed by whether the person was at work or on sick leave could be explained by this variable alone, the model by Peasgood *et al.* was designed to allow for the impact of potential confounding variables using regression. These potential confounding variables included within this analysis were household income, marital status, whether or not the person is receiving Incapacity Benefit, level of education and household composition.

The quality of life of people that are on sick leave is assumed to be the same independent of time on sick leave. This is a simplifying assumption given the limited data available. In addition, the utility estimates for people that are at work and people that are on sick leave are assumed to account for wage and benefit payments respectively and hence including these within the cost estimates would be double counting. Similarly, any loss of leisure time is assumed to be included within these quality of life estimates. The model also assumes that the intervention has no negative implications upon the quality of life of a person on sick leave from work and that the impact of sick leave on the quality of life of family members is captured to some degree within the quality of life of the person on sick leave.

The utility scores associated with being at work and on sick leave are shown in table 3 below.

Table 3: Utility scores of being at work and on sick leave

	Utility at work	Utility on sick leave
Age < 35	0.83	0.66
Age 35 – 45	0.8	0.59
Age 45 – 55	0.76	0.61
Age > 55	0.76	0.61

This means that a person who is 41 will have a health utility score of 0.8 each year that they are at work and a health utility score of 0.59 each year that they are on sick leave.

QALYs are used to describe the difference in benefits between the intervention and usual care only from the NHS & PSS perspective and from the societal perspective. We assume that the employer will be interested only in the number of days on sick leave avoided and not on the quality of life of the employee.

2.6 Cost data

Costs included within the model were direct costs of the interventions and usual care and indirect costs such as the costs of production losses and costs of replacement workers. From an NHS and PSS perspective, only the costs of the intervention and usual care are included. From an employer perspective, any cost of the intervention to the employer is included, plus any OSP paid by the employer to the sick employee, plus the production loss of the sick employee. The calculation of production loss has been calculated using the Friction Cost Method. This method assumes that there are a sufficient number of unemployed members of society making it possible to replace a sick worker after a certain period of time to allow for the advertising and recruitment period, the 'friction period' (Drummond *et al.*, 2005). Therefore, costs have also been included for advertising and recruiting new workers, and for the salary of the new worker following the friction period. The cost of the employer's national insurance contributions which must be paid on top of the employee's salary has also been included. It has been assumed that the production loss is equal to the employee's salary. It has also been assumed that the productivity and salary of the new employee will be the same as that of the person who they have replaced.

The societal perspective includes all of the costs from the NHS and PSS perspective and those of the employer perspective minus the costs which are classed as transfer costs which the employer pays. These are costs between members of society which do not affect the aggregate value of resources available to society. These include the cost of occupational sick pay, the cost of the employer's national insurance contributions in addition to the occupational sick pay, and the cost of the salary to the replacement worker. Whilst the employer is losing money in paying these costs, another member of society is gaining these costs and hence society as a whole does not incur lost resources. Similarly, the costs of Statutory Sick Pay and Incapacity Benefit are not included within the societal perspective since via national insurance contributions these payments do not change the aggregate value of resources available to society. The cost of administration of these services is assumed to be minimal and hence has not been included within the model. Similarly, the cost of travel involved in receiving usual care/ the interventions has not been included within the societal perspective since this cost is assumed to be minimal.

After six months, only the cost of usual care is paid for by the NHS and included within the societal perspective. The model assumes that usual care will be given to the patient after the first six months of sick leave once they have received either the intervention or usual care for the first six months. It should be noted that usual care may change if it has not been effective in relieving the symptoms of pain or getting the patient back to work. However, the cost of usual care has been used as an approximation of the costs that may be incurred in the future if the person remains on sick leave. This cost has been varied in a sensitivity analysis to allow for the fact that patients may either continue to seek more intensive treatment if current care is ineffective, or they may decide to discontinue treatment in the future.

The calculation of costs included within the model from each of the model perspectives is shown in Table 4.

Table 4: Costs incurred from different perspectives

State in the model	Perspective		
	NHS & PSS	Societal	Employer
At work	£0	£0	£0
1 wk to 6 months sick leave	Cost of usual care (and intervention incurred by NHS)	NHS & PSS costs + employer costs – salary of replacement worker after friction period – occupational sick pay – employer's national insurance contribution	Cost of intervention incurred by employer + cost of replacement worker + production loss over friction period + salary of replacement worker after friction period + occupational sick pay + employer's national insurance contribution
6-12 months sick leave	Cost of usual care	Cost of usual care	Occupational sick pay + employers national insurance contribution
12 months + sick leave	Cost of usual care	Cost of usual care	£0

Cost parameters used within the model are shown in Table 5. Usual care for musculoskeletal disorders in the UK is based on the studies providing the evidence on effectiveness, personal communication with UK clinicians (Dr. S. Eldabe, Consultant in Anaesthesia and Pain Management; Prof. G. Waddell, Orthopedic surgeon, 2008) and a paper by Maniadakis *et al.* (2000) estimating 'the burden of back pain within the UK'. The cost of usual care does not include the initial diagnosis and assumes that surgery is not an option for the people within the model. The model assumes that within the first six months of sickness absence due to musculoskeletal disorders, individuals will visit their General Practitioner (GP) on average 4.5 times and receive some form of analgesics such as Ibuprofen. It has been assumed that around 7% of people with musculoskeletal pain will receive physiotherapy and will attend an average of 4 thirty-minute sessions each (Maniadakis, 2000). It has also been assumed that 5% of people with musculoskeletal disorders will visit an osteopath, 2% will visit a chiropractor and that 10% of patients will require a hospital outpatient visit (Maniadakis, 2000). A small proportion of musculoskeletal patients in the UK go on to receive further intervention such as CBT if the analgesics and physiotherapy do not seem to be effective; however, this has not been included within the cost of usual care, to prevent double counting and to prevent confounding the impact of the interventions upon return to work given that these were not a part of usual care within the studies identified by the literature review in general.

After six months, whilst the number of GP visits is likely to decrease once the individual is on Incapacity Benefit, the cost of interventions such as epidural injections is likely to increase. The model therefore assumes that the cost of usual care will remain the same during each subsequent six month period and this assumption has been tested within the sensitivity analysis.

The cost of the 'education' part of the interventions is based upon the cost estimate of CBT within Curtis (2007) and the assumption that 10 hourly sessions will be required per employee. Physical activity is costed based on the cost of physiotherapy from Curtis (2007) and the assumption that 10 half hour sessions will be required. Within the effectiveness studies, the length and intensity of the interventions varies considerably. A different cost of the interventions has been tested within the threshold analysis described in Section 2.8. The workplace visit is based on the cost of the employer or line manager's salary for half a day since these studies suggest that a maximum of one visit will be made to the workplace per person. It has been assumed that the employer/ line manager of the person on sick leave earns an average salary. The cost of the workplace intervention is based on the Steenstra et al.(2005) study which the effectiveness evidence for this intervention is based upon. All costs are expressed in 2007 UK prices and rounded to the nearest pound.

There was limited evidence around the cost of the initial assessment intervention and the case worker/manager/team. This was assessed within a threshold analysis and described in Section 2.8.2.

Table 5: Cost parameters

Parameter (% receiving care)	**Av.cost per person**	**Source**
Cost of usual care for musculoskeletal disorder[4]	£216	
4.5 visits to GP	£140	Curtis (2007)
4.5 prescription	£50	Curtis (2007)
3 packs of analgesics or equivalent pain relief (64%)	£5	BNF (2007)
4 half-hour sessions of physiotherapy (7%)	£5	Curtis (2007)
2.5 sessions of osteopathy (5%)	£5	Curtis (2007)
2.5 sessions of chiropractic treatment (2%)	£2	Curtis (2007)
Hospital outpatient visit (10%)	£12	Curtis (2007)
Cost of usual care & workplace intervention	£743	
Usual care	£216	See above
Workplace intervention	£527	Steenstra *et al.* (2006)
Cost of usual care & physical activity & education	£999	
Usual care	£216	See above
Physiotherapy/ physical activity	£163	Curtis (2007)
CBT-type treatment	£620	Curtis (2007)[5]
Cost of usual care, physical activity, education & workplace visit	£1,045	
Cost of usual care, physical activity & education	£999	See above
Cost of workplace visit	£46	DWP (2007b)
Gross weekly salary	£457	DWP (2007b)
Friction period	10	CIPD (2007b)
Cost of OSP to employer during first 6 months of illness	£9,369	DWP (2007b) & CIPD (2007a)
Cost of OSP to employer during 6-12 months of illness	£1,234	DWP (2007b) & CIPD (2007a)
Cost of employers' national insurance contribution for first 6 months of OSP	£1,199	HMRC website (2007a)
Cost of employers' national insurance contribution for 6-12 months of OSP	£158	HMRC website (2007a)
Cost of hiring replacement worker (includes advertising costs, agency or search fees)	£4,333	CIPD (2007b)

[4] Proportions taken from Maniadakis (2000) and personal communication with Dr S. Eldabe & Prof. G. Waddell (2008).

[5] Based on cost of CBT for mental health disorders

All costs and benefits were discounted at 3.5% in line with the NICE reference case.

2.7 Sensitivity analyses

Extensive one-way sensitivity analyses has been carried out to assess the impact of changes to the current assumptions upon the model results. Given the limited data around the parameters within the model, lower and upper parameter values have been chosen which seem sensible in terms of the potential range of each of the parameters. Results of the sensitivity analysis are expressed in terms of cost per QALY gained for both the NHS perspective and the societal perspective and in terms of cost per day on sick leave avoided for the employer perspective.

The following assumptions have been tested within the sensitivity analyses:

1) The probability of recurring long term sickness absence

   The probability of a recurrence of long term sickness absence is based on the probability of any member of the general population experiencing long term sickness absence multiplied by a factor of two; based on a study on low back pain (Hestbaek *et al*., 2003). Given that there is no direct data around the probability of a recurrence this has been tested within the sensitivity analysis by varying this parameter from 1% to 5%.

2) The probability of a recurrence of long term sickness absence following intervention

   The probability of a recurrence of long term sickness absence may be reduced following the provision of one of the interventions rather than usual care because the employee may be able to apply the skills and techniques learnt from the intervention on a previous occasion to help to prevent a recurrence of long term sickness absence. This has therefore been tested within the sensitivity analysis by halving the probability of recurring sickness absence for the cohort receiving the intervention.

3) The baseline rate of return to work

   The baseline rate of return to work within 6 months (without intervention) may alter according to type of job or illness, or according to 'usual care'. This has therefore been tested within the sensitivity analysis by increasing and decreasing the baseline rate of return to work by 10 percentage points.

4) Employee given intervention every time they are on sick leave rather than usual care on subsequent occasions.

   It has been assumed that after being given an intervention during long term sickness absence on one occasion, if the person has a recurrence of long term sickness absence they will not receive that intervention again since they have already received it once and so may not be able to receive any further benefit from subsequent provisions of the intervention. However, it may be that if the intervention was effective at getting the person back to work the first time, it may be equally as effective on subsequent occasions. This assumption has therefore been tested within the sensitivity analysis.

5) Occupational sick pay provided during sickness absence

The amount of occupational sick pay provided during long term sickness absence will vary according to the individual employer and potentially according to the status of the employee. The average UK salary received whilst on sick leave has been assumed within the base case; however three scenarios have been tested of possible occupational sick pay in the UK. The first of these is that the employer pays the minimum amount to the employee by UK law (that is Statutory Sick Pay). The second is that the employer pays for six months on full pay and six months on half pay. The final scenario tested is as for the second scenario, but under the assumption that the person is on a salary which is twice as high as the average salary within the UK.

6) Probability of being on long term sick leave and going back to work doubles during each 6-month period after the first 6 months

The probability of returning to work following long term sickness absence is based upon national statistics of people leaving Incapacity Benefit to return to work. This may be a slight underestimate since there will be a small proportion of people that do not receive Incapacity Benefit after 6 months of sickness absence, and it is likely that this group will return to work more quickly than those that do receive Incapacity Benefit. Therefore, these probabilities have been tested within the sensitivity analysis by doubling the probability of return to work during each 6-month period that the person is on sick leave.

7) Utility associated with being at work decreased and increased

There is both uncertainty and variability in the health-related quality of life of people who are at work and of people who are on sick leave. The health utility scores which have been derived from a study by Peasgood *et al.* (2006) have been tested within a sensitivity analysis by decreasing and increasing the utility scores of those people in the ‘at work’ state by 10%. This means that there will be less and more difference between the quality of life of being at work and on sick leave respectively. Due to the uncertainty and variability associated with this parameter, an extreme scenario has been tested by decreasing the utility scores of those people in the ‘at work’ state so that their utility is only 0.02 of a utility greater than those people in the ‘on sick leave’ state.

8) Costing production loss

Within the base case model, it has been assumed that there are sufficient unemployed people within the UK in order to replace each worker who goes onto sick leave after some 'friction period' which allows for the advertising and recruitment of another worker. However, it may be that some employees within certain organizations and in more advanced positions within a company are more difficult to replace. Therefore, this assumption has been tested using the Human Capital Approach to costing production loss. This assumes that it is not possible to replace the sick worker, and hence production loss continues until that person reaches state pension age. This approach usually overestimates the true productivity loss and hence this should be treated as an extreme assumption.

9) Cost of care after the first six months of sick leave

The cost of care after the six months of sick leave has been assumed to be equal to that of usual care during the first six months of sickness absence. However, people may demand more intensive treatment given that previous treatment has not worked, or they may be happy with very limited treatment given that the usual care has not worked. These two scenarios have been tested within the sensitivity analysis.

10) Cost of usual care

The cost of usual care within the model is based upon several simplifying assumptions. Plausible ranges have therefore been tested within the sensitivity analysis by halving and doubling the current estimate. Altering this cost also alters the cost of care in subsequent six month periods beyond the first six months as in (8) above.

11) Cost of workplace visit

Each of the four effectiveness studies which include some form of workplace visit are vague around what this visit entails. Each of these studies suggests that the employee and NHS professionals will visit the workplace at most once per person. This means that this is likely to be a low cost. However, because the benefit associated with the physical activity, education and workplace visit intervention is so much greater than for the physical activity and education intervention alone, this cost has been tested within the sensitivity analysis in case more weight and cost was placed on this part of the intervention than was implied by the studies. The cost tested within the sensitivity analysis is equivalent to the cost of the workplace intervention.

12) Age at commencement of long term sick leave

The age that the individual goes onto long term sick leave may impact upon the cost-effectiveness of the intervention. Varying this parameter considers the variability in the population rather than any uncertainty. A young person potentially stands to gain more from returning to work, than a person who is close to retirement age.

Each of the parameters and/or structural assumptions varied within the sensitivity analysis are shown in Table 6 below.

Table 6: Parameters varied within sensitivity analysis

Parameter	Parameter value		
	Base case	**Lower value**	**Upper value**
Probability of recurring long term sickness absence	2.3%	1%	5%
Probability of recurring long term sickness absence following intervention	2.3%	1.2%	
Baseline rate of return to work	65%	55%	75%
Employee given intervention every time they are on sick leave rather than usual care on subsequent occasions	NA	NA	NA
Occupational sick pay provided during sickness absence	15 wks £457, 16.4 wks £228.50	6 mths SSP only	6 mths £457, 6 mths£228.50 & 6 mths £914, 6 mths £457
Probability of being on long term sick leave and going back to work doubles during each 6-month period after the first 6 months	2.3%, 5.3% & 0.7%	-	4.6%. 10.6% & 1.4%
Utility associated with being at work decreased & increased by 10% and equal to 'sick leave' utility + 0.02 Age <35 Age 35 – 45 Age 45 – 55 Age >55	At work / On sick leave 0.83 / 0.66 0.8 / 0.59 0.76 / 0.61 0.76 / 0.61	At work L1 L2 0.75 0.68 0.72 0.61 0.68 0.63 0.68 0.63	At work 0.91 0.88 0.84 0.84
Costing production loss	Friction Cost Approach	Human Capital Approach	
Cost of care after the first six months of sick leave	£usual care = £216	£0	£2000
Cost of usual care	£216	£108	£432
Cost of workplace visit	£45.70	-	Cost of workplace intervention = £527
Age going onto long term sick leave	41 years	20 years	55 years

A probabilistic sensitivity analysis (PSA), where all parameters are varied within plausible ranges at once, has not been carried out within this analysis due to time and resource constraints. Furthermore, carrying out a PSA may produce misleading results due to the lack of data available to characterise the uncertainty within the model parameters and due to the uncertainty around the model structure. This means that an incremental analysis between the interventions has not been carried out because the expected probability of each intervention being more cost-effective than each other intervention assessed is unknown. Therefore, each intervention is compared against usual care in terms of costs and QALYs gained and days on sick leave avoided. However, if an intervention dominates another intervention (i.e. is estimated to be more effective and less costly), then this has been stated within the results. These comparisons between the interventions should be treated with caution given that the data around the costs and efficacy associated with each of the interventions is uncertain and there are relatively small differences between the costs and benefits of each.

2.8 Subgroup analyses

Two subgroups were initially considered for analyses within this study:

1. interventions given to employees at an earlier stage of sickness absence (i.e. less than 8 weeks of sickness absence)
2. more and less intensive interventions.

2.8.1 Early interventions

Ideally, a study comparing the impact on return to work of two interventions, one given earlier and one given later following the onset of long term sickness absence, would have been identified by the evidence review to enable an economic comparison of the two. However, given that no such study has been identified, the studies used for the meta-analyses of physical activity and education (and workplace visits) provided before eight weeks of sickness absence were compared against those that were provided after eight weeks. Two studies graded '+' estimated the effectiveness of interventions given before 8 weeks, and two studies graded '+' estimated the effectiveness of interventions given after 8 weeks. The three remaining studies extended over this time point. The findings from these studies suggested that early interventions are less effective in helping those on long term sickness absence return to work than interventions given after 8 weeks of sickness absence. Given that interventions provided early following sickness absence will not be cheaper than later interventions, this evidence would suggest that early interventions would not be cost-effective in comparison to interventions given later.

This is contrary to other available evidence (Black, 2008) which suggests that an early intervention is beneficial in terms of both improving illness and return to work. The results here can be explained by the heterogeneity within the small number of studies compared and therefore should be treated with caution. A study comparing the impact on return to work of an intervention given soon after the start of sick leave from work with the impact of an intervention given later is required in order to assess the cost-effectiveness of this subgroup of interventions more appropriately.

2.8.2 Intensity of interventions

Only one study identified by the evidence review and graded as '+' or higher compares a low and high intensity intervention. Haldorsen *et al.* (2002) (also reported in Skouen and Kvale, 2006) compare ordinary treatment in Norway with a light multidisciplinary programme and an extensive multidisciplinary programme. Within the paper a cost-benefit analysis is described; however the analysis compares treatment versus ordinary care rather than the two interventions. At 14 months follow up, around 59% of those employees receiving the extensive multidisciplinary treatment return to work versus 57% of those employees receiving the light multidisciplinary treatment and 48% of those employees receiving ordinary treatment. This suggests a relative risk of return to work of 1.19 for light multidisciplinary treatment versus ordinary treatment and a relative risk of return to work of 1.04 for extensive multidisciplinary treatment versus light multidisciplinary treatment. The difference in costs between light multidisciplinary treatment and extensive multidisciplinary treatment is not clear. A threshold analysis has been carried out using the relative risks above to give an indication around the potential cost-effectiveness of interventions of different intensity. The results of this threshold analysis are presented in Section 3.1.1. However, it should be noted that this analysis uses evidence from only one RCT and further research is required in this area. Some expert members of the Programme Development Group, for example, suggest that a more intensive programme may hinder rather than facilitate return to work due to the considerable amount of time required for the more intensive interventions during which the employees are not able to return to work.

2.9 Threshold analyses

2.9.1 Threshold analysis around the implications of different costs and outcomes associated with the interventions

Due to the uncertainty around the effectiveness of the interventions being considered, an analysis has been carried out to test the implications of the interventions being less effective than suggested within the base case. The analysis tests the efficacy requirements of the intervention in order for it to be considered cost-effective at a threshold of £20,000 and £30,000 per QALY gained if the cost of the intervention is equal to the cost of the physical activity and education intervention (£783 plus the cost of usual care) and if the cost of this intervention is doubled. It should be noted that the results of this analysis are indicative only since this does not allow for other uncertainties within the model. These results are presented from an NHS and PSS perspective only since the results from the societal perspective are very similar and the results from the employer perspective are not presented in terms of a cost per QALY.

2.9.2 Threshold analysis around the use of an initial assessment/ case management

Several of the studies (Molde Hagen *et al*., 2003; Lindstrom *et al*., 1992; Skouen and Kvale, 2006; Streenstra *et al*., 2006) identified within the effectiveness review include the use of an initial assessment in order to establish the most appropriate intervention for each employee. Some of the studies (Molde Hagen *et al*., 2003; Loisel *et al*., 2002) also consider the use of a case worker/ manager/ team to ensure that each employee receives the most appropriate intervention. The only comparative study (i.e a study which considers the use of an initial assessment compared with not using an assessment) is Skouen and Kvale (2006). This study is based on a previous study by Haldorsen *et al.* (2002) and considers the use of a screening intervention involving a questionnaire and an examination by a physiotherapist in order to determine whether patients should receive ordinary treatment as delivered in Norway, light multidisciplinary treatment or extensive multidisciplinary treatment. This paper suggests that extensive multidisciplinary treatment does not improve return to work outcomes for people with a good prognosis, but it improves return to work outcomes for those with a poor prognosis. The cost-benefit analysis included within this study suggests that the net benefit associated with the interventions without initial assessment is negative NOK 2,501,000 [1996] which is equivalent to negative £352,953 [2007]. This suggests that the costs of the interventions outweigh the benefits; however the net benefit associated with the interventions provided following an initial assessment is estimated to be positive NOK 1,875,100 [1996] which is equivalent to £264,623 [2007], suggesting that the use of an assessment is likely to be considered economically attractive. The analysis presented within this paper assumes that the cost of intervention per person remains the same with or without the assessment. This includes the cost of the assessment itself and the cost of the different case mix of interventions. The assessment option therefore dominates no assessment as long as the combination of assessment and subsequent interventions is more effective than the interventions alone.

Within Haldorsen *et al.* (2006) the costs associated with the different intervention options are unclear; hence a threshold analysis has been carried out using our model. An exploratory analysis has been carried out varying both costs and the relative risk associated with the use of an initial assessment given the uncertainty associated with these parameters. The relative risk of using an initial assessment to establish subsequent intervention is estimated to be 1.05 based on the Haldorsen *et al.* study. This means that an additional 39 employees out of 1000 would be expected to return to work because of the initial assessment and the new case mix of interventions. The comparator within this analysis is a case mix of the types of interventions assessed within the existing model rather than usual care since by definition the assessment tool would necessitate the availability of a range of interventions. The relative risk used within this analysis therefore provides the additional benefits of the assessment on top of the introduction of the interventions described previously for the existing model. Assuming that the relative risk of providing an intervention rather than usual care is 1.19 based on Haldorsen *et al.* (2006), this equates to 77% of employees returning to work within the first six months rather than 65% of employees returning to work given usual care. Applying a relative risk of 1.05 as an example to the 77% of employees returning to work within the first six months of sickness absence suggests that 81% of employees will return to work as a result of the initial assessment and subsequent interventions. These calculations are expressed within the box below.

Example of RTW within the first 6 months of being on sick leave:

Usual care = 650/1000 employees RTW within 6 months
Intervention = 770/1000 employees RTW within 6 months (=650 x 1.19)
Initial assessment + intervention = 810/1000 employees RTW within 6 months (=770 x 1.05)

Given that none of the studies identified within the systematic review provided comparative efficacy data around case worker/managers/team, this exploratory analysis may also be used to consider the impact of using case management alongside the interventions assessed within this report. It should, however, be noted that for both an initial assessment and case management the analysis does not consider uncertainty around any of the other assumptions within the model and hence the results of the analysis should be treated as indicative only.

3 Results

Base case results and the results of the sensitivity analysis are presented, in turn, from an NHS and PSS perspective, a societal perspective and an employer perspective. The estimated cost per QALY associated with a workplace intervention, a physical activity and education intervention and a physical activity, education and workplace intervention have been presented here in comparison with usual care. The analyses associated with the assessment intervention and case management intervention have been presented under the 'threshold analysis' heading at the end of each results section below since limited evidence meant that only a threshold analysis around these interventions could be carried out.

3.1 NHS and PSS perspective

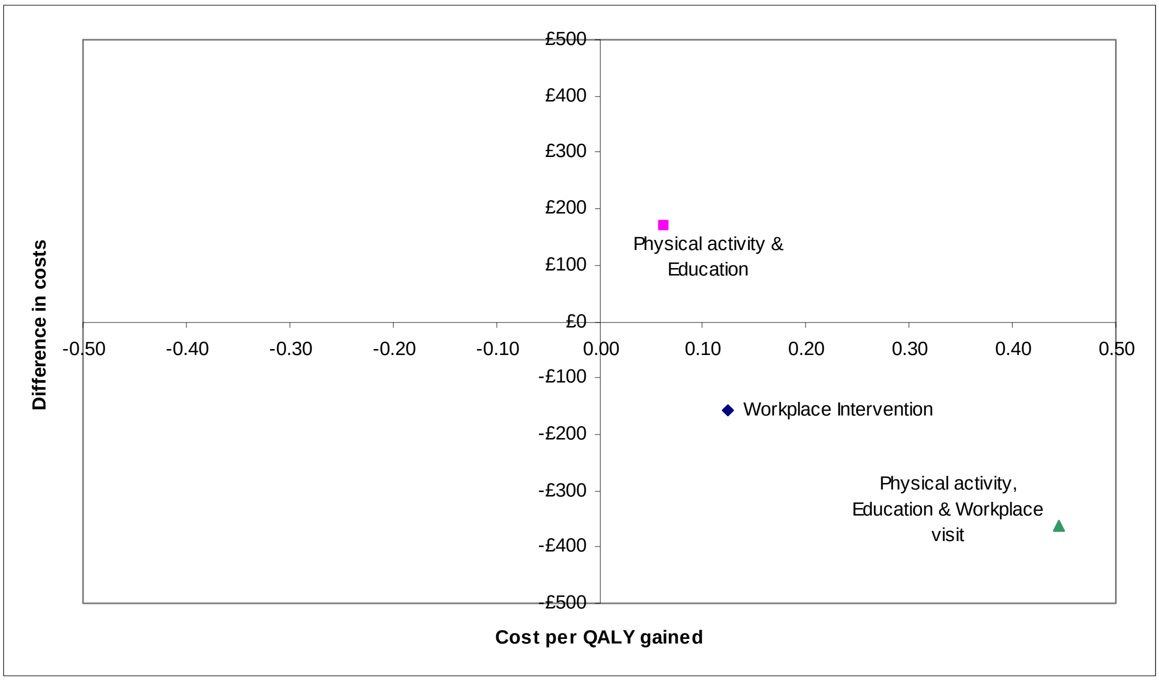
Results of the analysis from an NHS and PSS perspective are shown in Table 7 below:

Table 7: Cost-effectiveness results (NHS and PSS perspective). Costs and QALYs discounted at 3.5% per year.

	Usual care (UC)	Workplace intervention (WI)	Physical activity & education (PA)	Physical activity & education & workplace visit (PW)
Costs	£1,093	£935	£1,264	£731
Days on sick leave	2,697	2,333	2,515	1,393
QALYs	9.15	9.27	9.21	9.59
Cost per day on sick leave avoided	-	Dominates UC & PA (-£0.43)	£0.94	Dominates UC, PA & WI (-£0.28)
Cost per QALY gained	-	Dominates UC & PA (-£1,276)	£2,758	Dominates UC, PA & WI (-£816)

These results are also presented in a cost-effectiveness plane in Figure 5 below.

Figure 5: Cost-effectiveness plane of base case results from NHS & PSS perspective



These results suggest that the workplace intervention and the physical activity, education and workplace visit both dominate over usual care (i.e. they are cheaper and more effective than usual care). The results also suggest that the workplace intervention also dominates the physical activity and education intervention and that the physical activity, education and workplace visit intervention dominates all other interventions assessed. The physical activity and education intervention is slightly more effective than usual care but also £171 per person more expensive than usual care on average. This results in a cost per QALY gained of £2,758 and a cost per day on sick leave avoided of £0.94 for the intervention in comparison to usual care. Given that the accepted threshold for which interventions are usually considered 'cost-effective' is around £20,000 - £30,000 per QALY gained, a cost per QALY gained of around £3,000 suggests that this intervention is very likely to be considered cost-effective. A cost per day on sick leave avoided of £0.94 means that for each day of sick leave that is avoided by providing the intervention, it will cost the NHS 94 pence.

The results of the sensitivity analysis for this group of patients are shown in Table 8 below.

Table 8: Sensitivity analysis results in terms of cost per QALY gained compared with usual care (NHS and PSS perspective)

Parameter (B = base case, L = lower value, U = upper value)	Param-eter value	Workplace intervention (WI)	Physical activity & education (PA)	Physical activity & education & workplace visit (WP)
Base case result		Dominates UC & PA (-£1,276)	£2,758	Dominates UC, PA & WI(-£816)
Probability of recurring sickness absence (B=2.3%)	L=1%	Dominates UC & PA (-£1,284)	£2,491	Dominates UC, PA & WI(-£853)
	U=5%	Dominates UC & PA (-£1,262)	£3,318	Dominates UC, PA & WI(-£740)
Probability of recurring sickness absence following intervention is half that of recurrence following usual care (B=2.3%)	1.2%	Dominates UC & PA (-£1,325)	Dominates UC (-£411)	Dominates UC, PA & WI (-£925)
Baseline rate of return to work	L=55%	Dominates UC & PA (-£1,273)	£3,995	Dominates UC, PA & WI (-£643)
	U=75%	Dominates UC & PA (-£1,280)	£1,833	Dominates UC, PA & WI (-£946)
Employee given intervention every time they are on sick leave rather than usual care on subsequent occasions		Dominates UC & PA (-£1,276)	£5,480	Dominates UC, PA & WI (-£332)
Salary associated with sickness absence		Assumption has no impact on results		
Probability of being on long term sick leave and going back to work doubles during each 6-month period		Dominates UC & PA (-£1,263)	£3,411	Dominates UC, PA & WI (-£730)

Parameter (B = base case, L = lower value, U = upper value)	Param-eter value	Workplace intervention (WI)	Physical activity & education (PA)	Physical activity & education & workplace visit (WP)
Utility associated with being at work decreased and increased by 10%	L=10% decrease	Dominates UC & PA (-£2,346)	£5,070	Dominates UC, PA & WI (-£1,501)
	U=10% increase	Dominates UC & PA (-£877)	£1,894	Dominates UC, PA & WI (-£561)
Utility associated with being at work = utility associated with being on sick leave + 0.02		Dominates UC & PA (-£10,818)	£23,374	Dominates UC, PA & WI (-£6,918)
Replacement worker		Assumption has no impact on results		
Cost of care after the first year of sick leave (B=£216)	L=£0	£0 (Dominates PA)	£4,035	£461 (Dominates PA)
	U=£2000	Dominates UC & PA (-£11,802)	Dominates UC(-£7,768)	Dominates UC, PA & WI (-£11,342)
Cost of usual care (B=£216)	L=£108	Dominates UC & PA (-£638)	£3,396	Dominates UC, PA & WI (-£178)
	U=£432	Dominates UC & PA (-£2,553)	Dominates UC(-£1,482)	Dominates UC, PA & WI (-£2,093)
Cost of workplace visit		Assumption has no impact on results		
Age going onto long term sick leave (B=41)	L=20	Dominates UC & PA (-£1,234)	£1,658	Dominates UC, PA & WI (-£904)
	L=55	Dominates UC & PA (-£1,442)	£8,634	Dominates UC, PA & WI (-£286)

The sensitivity analysis suggests that varying the key assumptions within plausible ranges does not have a big impact upon the model results in general. If the probability of recurrence of long term sickness absence is reduced by half due to the intervention, then the physical activity and education intervention dominates usual care. Similarly, if the cost of usual care were to be greater than estimated within the base case, the physical activity and education intervention is likely to dominate over usual care. Conversely, if the cost of usual care were to be lower than estimated within the base case, the cost per QALY gained of the physical activity and education intervention would increase and the physical activity, education and workplace visit intervention may no longer dominate usual care. Varying the age of the person who goes onto long term sick leave suggests that physical activity and education (the only intervention which does not dominate over usual care) becomes less likely to be cost-effective for older employees, however the cost per QALY gained remains below that of NICE's £20,000 - £30,000 threshold, even if the intervention is provided at age 55.

3.1.1 Threshold analyses

Effectiveness of interventions assessed above

The results of the analysis around the effectiveness of an intervention costing around £800 to remain cost-effective at a threshold of £20,000 and £30,000 per QALY gained are presented in Table 9 below.

Table 9: Number of additional people out of 1000 required to return to work within 6 months (rr[6])

Additional cost of intervention to usual care	Threshold at which the intervention is considered 'cost-effective'	
	£20,000	£30,000
£783	8 (1.012)	5 (1.008)
£1,566	15 (1.023)	10 (1.016)

This shows that at an additional cost of around £800 for the intervention, an additional 8 and 5 people out of 1000 are required to return to work within 6 months of sick leave for the intervention to be considered to be cost-effective at a threshold of £20,000 and £30,000 per QALY gained respectively. The number returning to work would need to approximately double if the additional cost of the intervention were doubled.

Since both costs and effectiveness of the interventions assessed within the model are highly uncertain an analysis varying both the additional costs and the relative efficacy

[6] rr is the relative risk of the intervention in comparison to usual care and is another way of expressing the efficacy of the intervention relative to usual care

of the intervention has been carried out. The results of this analysis are presented in Figure 6 below.

Figure 6: Cost per QALY gained associated with an intervention aimed to return employees to work compared with usual care from NHS & PSS perspective

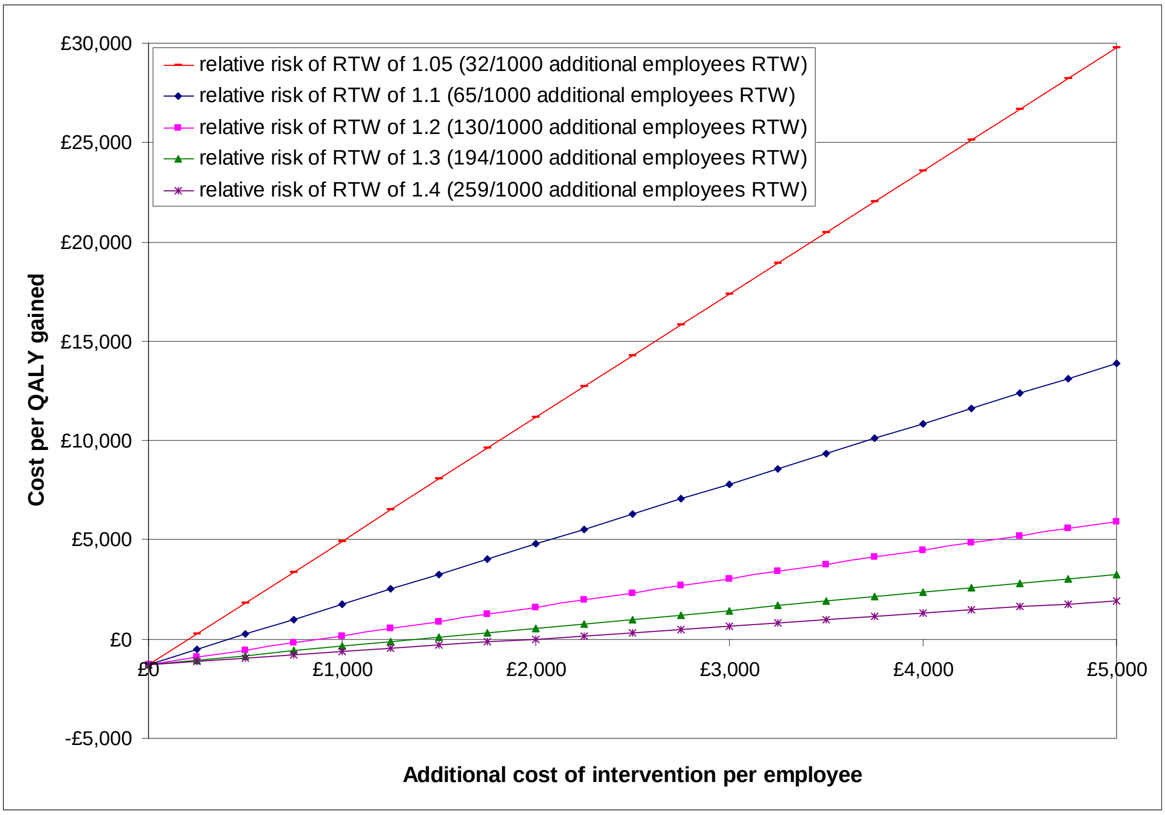


Figure 6 suggests that if the intervention costs less than an additional £3,000 and returns at least an additional 3% of people to work (32/1000) in comparison to usual care then it is likely to be considered cost-effective at a threshold of £20,000 per QALY gained.

The results of the above analyses could potentially be used to help to consider the cost-effectiveness of interventions for people with minor mental health disorders to return to work. For this analysis to be useful for this population the assumptions stated in section 2.3 of the report would need to be considered to be applicable to people with minor mental health disorders. In particular:

(1) For minor mental health interventions there is a question about whether the interventions would be effective as rapidly. Within the model it has been assumed that if the intervention has not been effective within the first six months then the person is assumed to be subsequently no more likely to go back to work than if they were in the comparator arm. This may therefore lead to an underestimation of the effectiveness of the intervention and hence would be a conservative assumption if applied to interventions for minor mental health disorders.

(2) The quality of life associated with people on sick leave due to minor mental health disorders may differ greatly from the quality of life associated with general sickness absence.

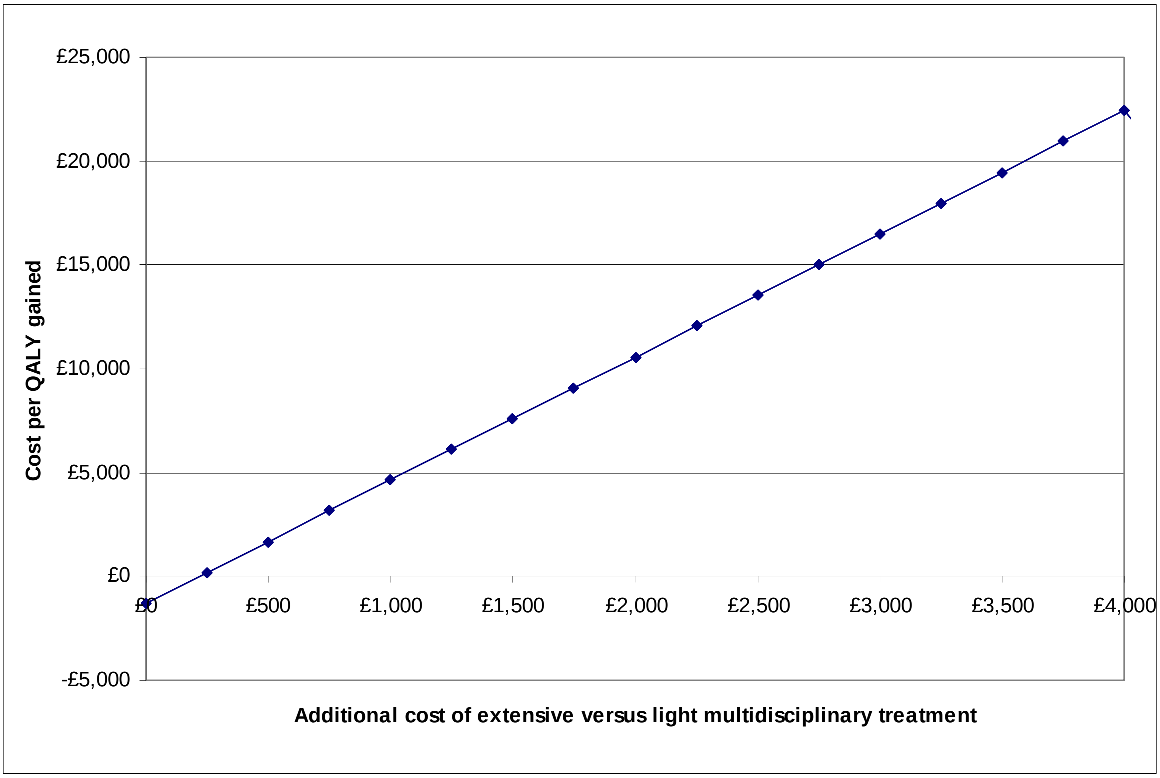
(3) Within the model it has been assumed that the probability of recurring sick leave will be twice that of a person who has not been on long term sick leave previously. This is based on a study of low back pain and hence may not be accurate for employees with minor mental health disorders.

If it seems reasonable that these assumptions are likely to hold for minor mental health disorders then it may be possible to use this analysis within this context for those suffering from musculoskeletal disorders. The cost of the interventions would also need to be similar to those associated with musculoskeletal disorders. Caution around the interpretation of the results should be taken if this approach is adopted due to the assumptions required within this analysis.

Intervention Intensity

The threshold analysis around the intervention intensity is based on a relative risk of returning to work of 1.04 for the more intensive interventions compared with the less intensive interventions (based on Haldorsen *et al.* (2006)). This analysis suggests that the cost of the intensive intervention would need to be greater than £3,610 per person more than the cost of the less intensive intervention for the more intensive intervention to exceed a cost per QALY of £20,000 compared with the less intensive intervention. This is based on the relative risk of returning to work following a less intensive intervention versus usual care in Norway of 1.19. Figure 7 shows that for an additional cost of up to around £250 per person the more intensive intervention dominates the less intensive intervention. However, this result should be treated with caution due to the limited data available around the effectiveness of more intensive intervention options. Obviously, if a more intensive intervention option is not as effective as a less intensive intervention option, it is unlikely to be cost-effective. Further research is therefore required in this area.

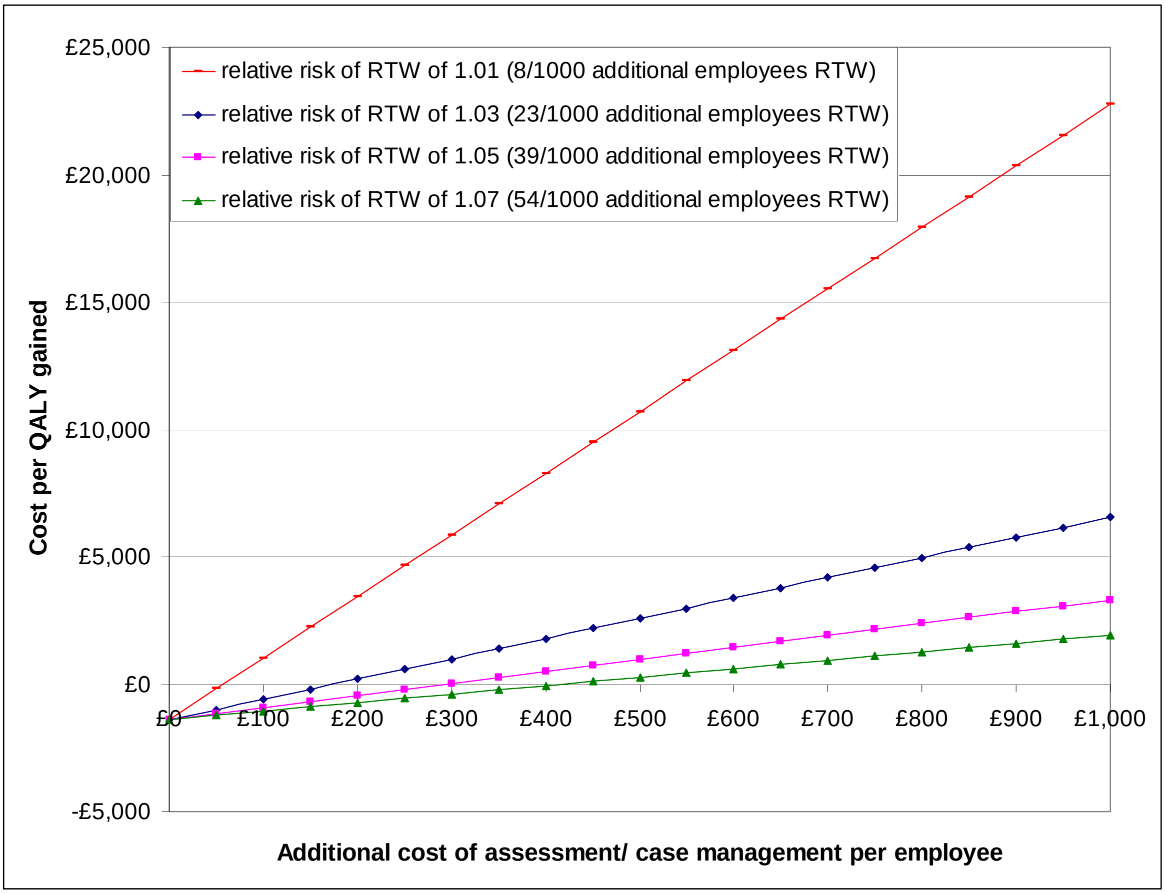
Figure 7: Cost per QALY gained associated with an extensive multidisciplinary intervention from NHS & PSS perspective



<u>Use of an initial assessment and/ or case worker/manager/team</u>

This analysis suggests that the use of an initial assessment and/or case worker/manager/team is likely to be considered cost-effective at a cost per QALY gained of £20,000 if at least 8 out of 1000 additional employees return to work at an additional cost of less than £900 per employee as shown in Figure 8 below.

Figure 8: Cost per QALY gained associated with an initial assessment/ case worker/manager/team from NHS & PSS perspective



This result would alter moderately if the return to work rate of the comparator was different. This result should therefore be treated as indicative only. The cost of the assessment will vary according to which NHS healthcare professional delivers the service and the degree to which the case mix of interventions provided changes; however it is anticipated that this cost is unlikely to increase above £1,000 per employee. The total additional cost of assessment/case worker/manager/team comprises a cost of the assessment/case worker/manager/team itself plus the cost of the different case mix of interventions subsequently provided. If the assessment/case worker/manager/team were paid for by the employer, the additional cost to the NHS would be reduced. The results of this analysis should be treated with caution given that there is limited evidence to suggest that an initial assessment and/ or case management is effective.

3.2 Societal perspective

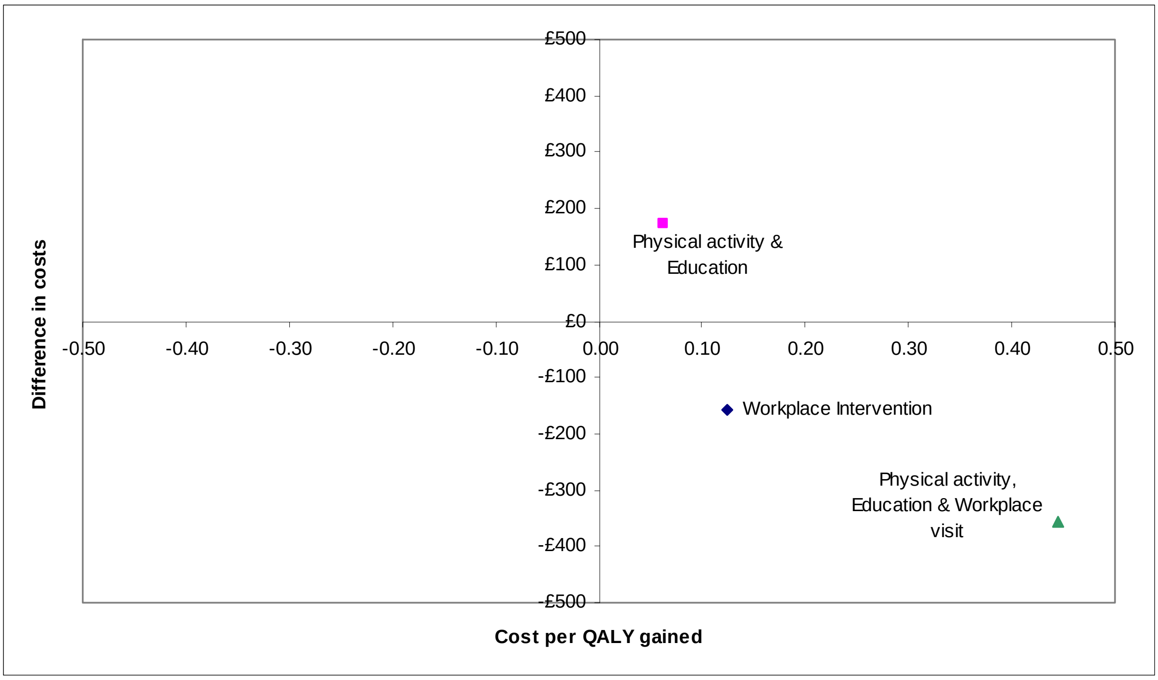
Results of the analysis from a societal perspective are shown in Table 10 below.

Table 10: Cost-effectiveness results (Societal perspective)

	Usual care (UC)	Workplace intervention (WI)	Physical activity & education (PA)	Physical activity & education & workplace visit (PW)
Costs	£5,856	£5,700	£6,028	£5,501
Days on sick leave	2,697	2,333	2,515	1,393
QALYs	9.15	9.27	9.21	9.59
Cost per day on sick leave avoided	-	Dominates UC & PA (-£0.43)	£0.95	Dominates UC, PA & WI (-0.27)
Cost per QALY gained	-	Dominates UC & PA (-£1,260)	£2,775	Dominates UC, PA & WI (-£800)

These results are also presented in a cost-effectiveness plane in Figure 9 below.

Figure 9: Cost-effectiveness plane of base case results from societal perspective



The results from a societal perspective are very similar to those of the NHS and PSS perspective and suggest that both the workplace intervention and the physical activity, education and workplace visit dominate over usual care (i.e. they are less costly and more effective). The latter also appears to dominate all other interventions assessed. The cost per QALY gained of the physical activity and education intervention is £2,775, which again is considerably below the NICE threshold of £20,000 to £30,000 per QALY gained. The cost per day on sick leave avoided is £0.95, meaning that for each day of sick leave that is avoided by providing the intervention, it will cost society 95 pence. This cost would be incurred by the NHS in this case given the results shown in Table 7.

The results of the sensitivity analysis for this group of patients are shown in Table 11 below.

Table 11: Sensitivity analysis results in terms of cost per QALY gained compared with usual care (Societal perspective)

Parameter (B = base case, L = lower value, U = upper value)	Param-eter value	Workplace intervention (WI)	Physical activity & education (PA)	Physical activity & education & workplace visit (WP)
Base case result		Dominates UC & PA (-£1,260)	£2,775	Dominates UC, PA & WI (-£800)
Probability of recurring sickness absence (B=2.3%)	L=1%	Dominates UC & PA (-£1,958)	£1,818	Dominates UC, PA & WI (-£1,527)
	U=5%	Dominates UC & PA (-£144)	£4,724	Dominates UC, PA & WI (-£666)
Probability of recurring sickness absence following intervention is half that of recurrence following usual care (B=2.3%)	1.2%	Dominates UC & PA (-£5,830)	Dominates UC (-£5,899)	Dominates UC, PA & WI (-£3,005)
Baseline rate of return to work	55%	Dominates UC & PA (-£1,239)	£4,028	Dominates UC, PA & WI (-£610)
	75%	Dominates UC & PA (-£1,282)	£1,831	Dominates UC, PA & WI (-£947)
Employee given intervention every time they are on sick leave rather than usual care on subsequent occasions	NA	Dominates UC & PA (-£1,260)	£5,497	Dominates UC, PA & WI (-£316)
Salary associated with sickness absence		Assumption has no impact on results		
Probability of being on long term sick leave and going back to work doubles during each 6-month period		Dominates UC & PA (-£1,473)	£3,201	Dominates UC, PA & WI (-£940)

Parameter (B = base case, L = lower value, U = upper value)	Param-eter value	Workplace intervention (WI)	Physical activity & education (PA)	Physical activity & education & workplace visit (WP)
Utility associated with being at work decreased and increased by 10%	10% decrease	Dominates UC & PA (-£2,316)	£5,101	Dominates UC, PA & WI (-£1,470)
	10% increase	Dominates UC & PA (-£865)	£1,906	Dominates UC, PA & WI (-£549)
Utility associated with being at work = utility associated with being on sick leave + 0.02		Dominates UC & PA (-£10,677)	£23,516	Dominates UC, PA & WI (-£6,777)
Replacement worker (B=Friction Cost Approach)	Human Capital Approach	Dominates UC & PA (-£71,374)	Dominates UC (-£67,340)	Dominates UC, PA & WI (-£70,914)
Cost of care after the first six months of sick leave (B=£216)	L=£0	£17 (Dominates, PA)	£4,051	£447 (Dominates PA)
	U=£2000	Dominates UC & PA (-£11,786)	Dominates UC (-£7,751)	Dominates UC, PA & WI(-£11,326)
Cost of usual care (B=£216)	L=£108	Dominates UC & PA (-£622)	£3,413	Dominates UC, PA & WI (-£161)
	U=£432	Dominates UC & PA (-£2,536)	£1,498	Dominates UC, PA & WI (-£2,076)
Cost of workplace visit		Assumption has no impact on results		
Age going onto long term sick leave (B=41)	L=20	Dominates UC & PA (-£859)	£2,033	Dominates UC, PA & WI (-£529)
	L=55	Dominates UC & PA (-£3,293)	£6,783	Dominates UC, PA & WI (-£2,137)

Again, the results of the sensitivity analysis are similar to those of the NHS and PSS perspective and suggest that varying the key assumptions within the model generally do not have a large impact upon the model results. Again, all of the interventions are likely to be less cost-effective for an older individual than a younger employee; however the cost per QALY gained is £6,783 which is considerably below the NICE threshold of £20,000 to £30,000 per QALY gained. Using the Human Capital Approach of measuring productivity loss rather than the Friction Cost Approach suggests that all interventions will markedly dominate over usual care.

3.2.1 Threshold analyses

Due to the similarity between the results of the threshold analysis from the societal perspective and the NHS perspective, there would be no merit in repeating these results here.

3.3 Employer perspective

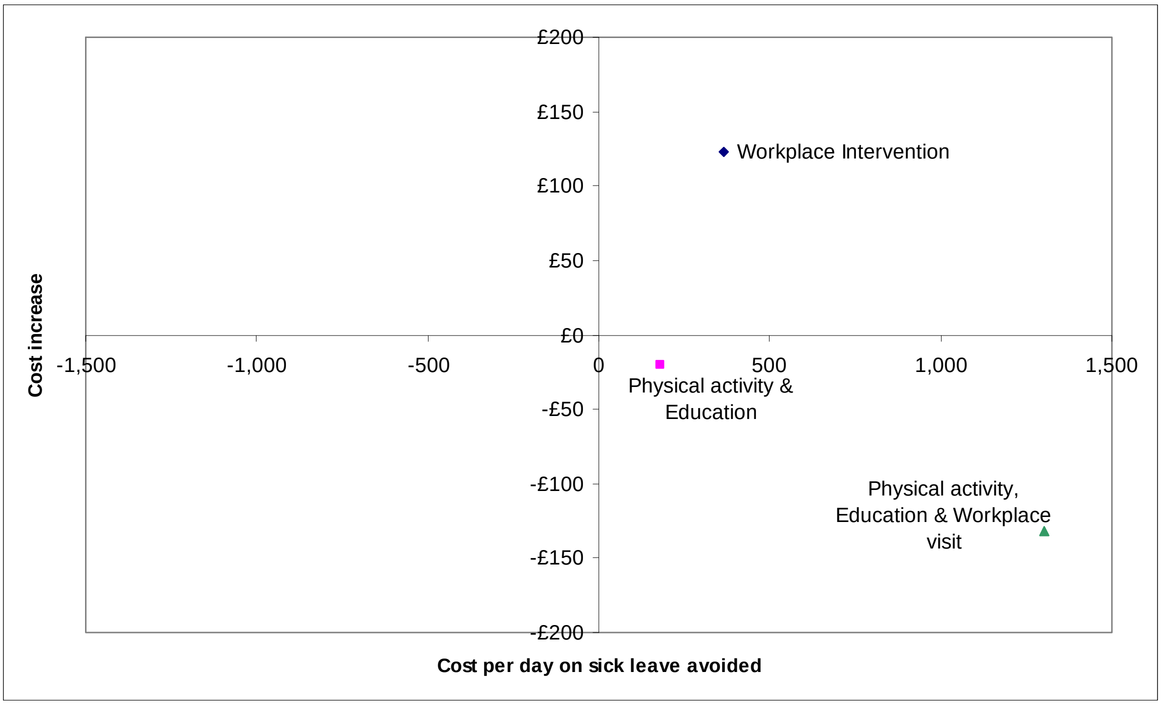
Results of the analysis from an employer perspective are shown in Table 12 below. It has been assumed that the employer will be interested only in the number of days on sick leave avoided and not on the quality of life of the employee.

Table 12: Cost-effectiveness results (Employer perspective)

	Usual care (UC)	Workplace intervention (WI)	Physical activity & education (PA)	Physical activity & education & workplace visit (PW)
Costs	£8,283	£8,407	£8,263	£8,152
Days on sick leave	2,697	2,333	2,515	1,393
Cost per day on sick leave avoided	-	£0.34	Dominates UC & WI (-£0.11)	Dominates UC, WI & PA (-£0.10)

These results are also presented in a cost-effectiveness plane in Figure 10 below.

Figure 10: Cost-effectiveness plane of base case results from employer perspective



These results suggest that both the physical activity and education intervention and the physical activity and education and workplace visit dominate over usual care, and that the latter of these interventions dominates over all other interventions assessed within the model. Both of the interventions which dominate usual care incur no or small costs to the employer and accrue benefits for the employer in terms of the number of days on sick leave. The workplace intervention incurs a greater cost to the employer and hence does not dominate usual care as for the other perspectives considered within the model. The cost per day on sick leave avoided is 34 pence per person for this intervention.

The results of the sensitivity analysis for this group of patients are shown in Table 13 below.

Table 13: Sensitivity analysis results in terms of cost per day on sick leave avoided compared with usual care (Employer perspective)

Parameter (B = base case, L = lower value, U = upper value)	Parameter value	Workplace intervention (WI)	Physical activity & education (PA)	Physical activity & education & workplace visit (PW)
Base case result		£0.34	Dominates UC & WI (-£0.11)	Dominates UC, WI & PA (-£0.10)
Probability of recurring sickness absence (B=2.3%)	L=1%	Dominates UC (-£0.09)	Dominates UC (-£0.50)	Dominates UC, WI & PA (-£0.49)
	U=5%	£1.23	£0.71	£0.72 (dominates WI)
Probability of recurring sickness absence following intervention is half that of recurrence following usual care (B=2.3%)	1.2%	Dominates UC (-£2.20)	Dominates UC (-£3.25)	Dominates UC, WI & PA (-£1.24)
Baseline rate of return to work	55%	£0.50	Dominates UC & WI (-£0.10)	Dominates UC, WI & PA (-£0.09)
	75%	£0.22	Dominates UC & WI (-£0.12)	Dominates UC, WI & PA (-£0.12)
Employee given intervention every time they are on sick leave rather than usual care on subsequent occasions		£0.39	Dominates UC (-£0.19)	Dominates UC, WI & PA (-£0.21)

Parameter (B = base case, L = lower value, U = upper value)	Parameter value	Workplace intervention (WI)	Physical activity & education (PA)	Physical activity & education & workplace visit (PW)
Salary associated with sickness absence (B=15wks £457, 16.4wks £228.50)	L=6 mths SSP only	£0.45	£0.00	£0.01 (dominates WI)
	U1=6mth £457, 6mths £228.50	Dominates UC (-£0.12)	Dominates UC (-£0.57)	Dominates UC, WI & PA (-£0.56)
Probability of being on long term sick leave and going back to work doubles during each 6-month period		£0.27	Dominates UC (-£0.27)	Dominates UC, WI & PA (-£0.26)
Utility associated with being at work decreased and increased by 10%		Assumption has no impact on results		
Utility associated with being at work = utility associated with being on sick leave + 0.02		Assumption has no impact on results		
Replacement worker		Assumption has no impact on results		
Cost of care after the first six months of sick leave		Assumption has no impact on results		
Cost of usual care		Assumption has no impact on results		
Cost of workplace visit (B= £45.70)	Equal to cost of WI	£0.34	Dominates UC (-£0.11)	Dominates UC & WI (£0.00)
Age going onto long term sick leave (B=41)	L=20	£0.38	£0.11	£0.12 (dominates WI)
	L=55	Dominates UC (-£0.26)	Dominates UC (-£1.43)	Dominates UC, WI & PA (-£1.40)

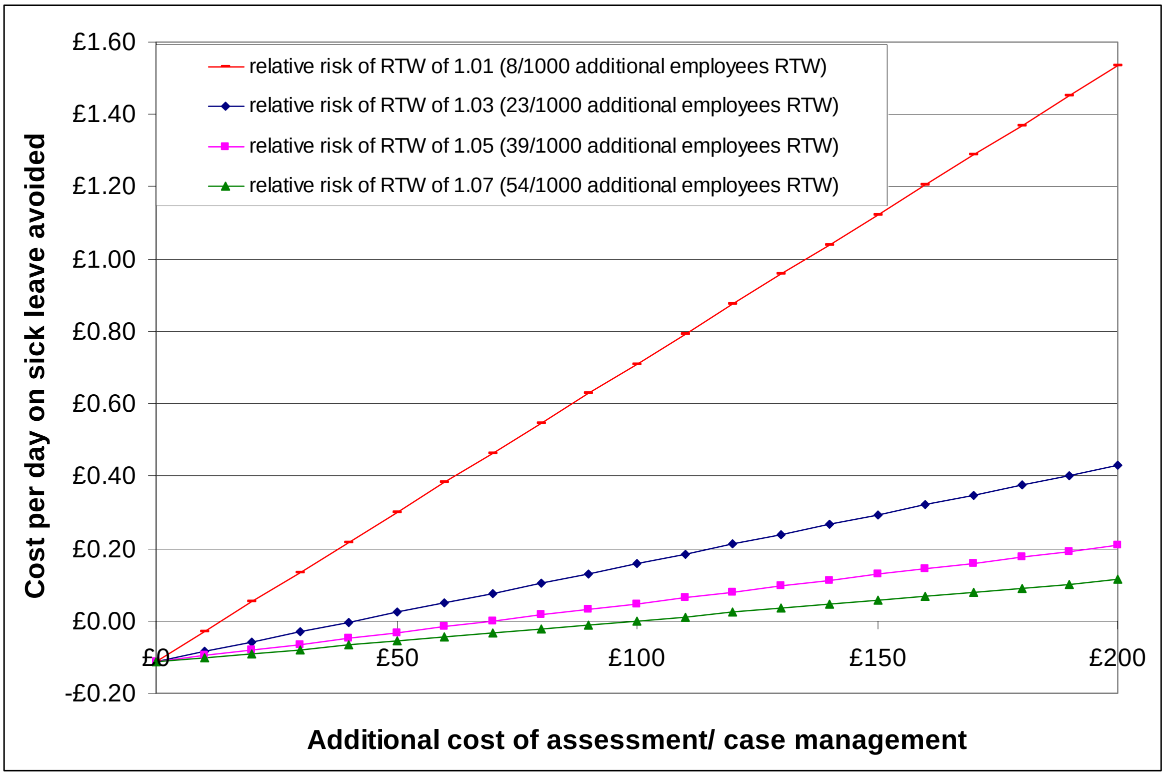
The results of the sensitivity analysis from the employer perspective suggest that where a greater amount of Statutory Sick Pay is paid by the employer, the interventions become more economically attractive. Similarly, where the probability of a recurrence of long term sickness absence is reduced by half due to the intervention, all of the interventions dominate over usual care. The age that the employees go onto sick leave has the opposite impact compared with the NHS and PSS and societal perspectives. This is because within a younger population, while they have more to gain from returning to work in terms of quality of life, they also have a higher probability within their working life of returning to long term sick leave. This means that the employer is more likely to be required to pay for another occurrence of long term sick leave in terms of costs of production loss, replacement workers and occupational sick pay.

3.3.1 Threshold analyses

If the NHS were to pay for an initial assessment/case worker/manager/team then this would dominate over no assessment/case worker/manager/team from an employer perspective since there would be an improvement in return to work at no extra cost to the employer.

If the employer was to pay for the assessment/case worker/manager/team rather than the NHS, the cost per day on sick leave avoided is shown in Figure 11 below. Any differences in the cost of the interventions due to the different case mix resulting from the assessment/case worker/manager/team will incur a cost to the NHS and hence does not need to be included within this analysis.

Figure 11: Cost per day on sick leave avoided associated with assessment/ case worker/manager/team from employer perspective



This shows that the interventions would continue to be cost saving to the employer if the assessment/ case worker/manager/team were to cost the employer less than £100 per employee and the relative risk of return to work with the assessment/ case worker/manager/team was at least 1.07. If the use of an initial assessment/ case worker/manager/team was associated with a relative risk of 1.01 then it would need to cost the employer less than £10 per employee in order to be cost saving. Again, this result would alter slightly if the return to work rate of the comparator was different. This result should therefore be treated as indicative only. Moreover, this result should be treated with caution given that there is limited evidence to suggest that an initial assessment and/or case worker/manager/team is effective.

4 Discussion

4.1 Discussion of results

The results suggest that the workplace intervention, the physical activity, education and workplace visit and the physical activity and education intervention appear to be cost-effective at a threshold of £20,000 - £30,000 per QALY gained from both a NHS and PSS perspective and a societal perspective. The intervention involving physical activity, education and a workplace visit is likely to be considered more economically attractive than the intervention involving physical activity and eduation without some sort of workplace involvement. The former intervention is also likely to be considered economically attractive in comparison to a workplace intervention as described by Steenstra *et al.* (2005). The low cost per QALY gained associated with each of these interventions is due to the minimal costs associated with the intervention in comparison to the costs associated with production loss. Since many of these costs are incurred within the first six months of sickness absence, the assumptions around the extrapolation of current data into the future have a limited impact upon the model results.

More generally, it seems likely that any intervention which is effective may be considered cost-effective at a threshold of £20,000 - £30,000 per QALY gained. From an NHS perspective, provided that, with the intervention, 8 additional people out of 1000 who are off work, return to work within 6 months in comparison with those given usual care, the cost-effectiveness ratio remains below £20,000 per QALY gained when the additional cost of the intervention, over and above that of, usual care is around £800. If the cost of the intervention doubles, then the additional number of people returning to work within 6 months is required to approximately double in order for the cost per QALY gained to remain below £20,000.

From an employer perspective, the interventions involving physical activity and education, with or without a workplace visit, are likely to be cost-saving to the employer. The workplace intervention is estimated to cost the employer around 34 pence per day on sick leave avoided. Where the employer pays greater occupational sick pay or if the probability of a recurrence of sickness absence were to decrease after receiving the intervention in comparison to usual care, the workplace intervention also becomes cost-saving to the employer.

The probability of returning to work following receipt of Incapacity Benefit may improve given the Pathways to Work initiative (Bewley *et al.*, 2008). The sensitivity analysis around these parameters suggests that this would not impact upon the model results substantially. Finally, the sensitivity analysis around the age of the employer suggests that from an NHS and PSS perspective and from a societal perspective, the interventions will not be considered as economically attractive if given to older people compared with younger age groups. However, the cost per QALY gained remains below £9,000 for a person who is 55 years old and hence the interventions would be considered cost-effective at a willingness-to-pay threshold of £20,000 per QALY gained. From an employer perspective, it actually appears more economically attractive to pay for an intervention to return an older employee to work due to the increased probability of recurrence of a younger employee.

The exploratory analysis around the potential cost-effectiveness of the use of an initial assessment and/ or case worker/manager/team with the aim to establish the most appropriate intervention for each employee suggests that if this results in at least a 1% improvement in the return-to work rate and costs less than about £900 per employee, then it is likely to be cost effective (at a threshold of £20,000 per QALY). It is not known whether this result applies to all groups of workers or only to the kind of workers covered by Haldorsen's study, so caution is needed in generalising this result.

4.2 Model limitations

The model makes many simplifying assumptions given the limited availability of data and the many different conditions and interventions. The lack of long term follow up data means that there are assumptions within the model about the impact on return to work of the intervention beyond 12 months. These have been tested within the sensitivity analysis which suggests that different assumptions around the extrapolation of the data have a minimal impact upon the model results.

The effectiveness of the interventions are based on studies carried out in countries outside of the UK. The majority of these studies are based in countries which have a particularly high sickness absence rate, in particular Norway, the Netherlands and Sweden. The poor sickness absence rates are likely to be due to these countries providing generous insurance schemes for sick employees. Given that the UK does not provide identical schemes, there is uncertainty around whether these results can be applied to the UK setting. However, employers within the UK do provide occupational sick pay. In addition, it is anticipated that the relative effectiveness of the interventions in comparison to usual care should be similar.

The effectiveness studies identified by the evidence review contain a certain amount of heterogeneity and hence caution should be taken around combining these studies within a meta-analysis. However, given the multiple forms of physical activity and provisions of education, to model a specific type would provide results of limited value. In addition, given that none of the studies are UK-based, being so specific about the intervention would suggest a degree of precision within the model which it has not been possible to achieve given the limited availability of data. By considering these interventions generally, an indication of the effectiveness of some form of physical activity and education can be suggested by the model.

There may be a relationship between sickness benefits paid to the employee and return to work. For example, if a person only receives Statutory Sick Pay during the first six months of sickness absence they may be considerably more likely to return to work than those who continue to receive their full salary for the first six months. This would render the intervention less effective in absolute terms even if the relative efficacy was similar. However, this relationship is highly complex given that if no occupational sick pay is provided, employees may be more likely to return to work in an unsatisfactory state of health which may reduce productivity. In addition, they may be more likely to worsen the condition which caused the original sickness absence if it is left untreated and/or they have not fully recovered before returning to work. There are also other factors to take into account which might affect the time to return to work such as level of salary, working hours and whether there is any flexibility in terms of phased return to work, returning to original job or alternative job. For example, within the UK it has been suggested that longer working hours are partly responsible for the high levels of sickness absence (Bonato *et al*., 2004). Modelling the complex relationship between each of these factors is beyond the scope of this assessment, however, should be considered within further research.

Average figures have been used based on the UK population for parameters such as salary, cost of replacing a worker, friction period (time to replace sick worker) and retirement age. This is therefore assumed to be independent of the types of people who are absent from work due to musculoskeletal disorders. However, those people on sick leave due to musculoskeletal disorders are more likely to be manual workers who may receive a lower salary than those professionals that are more likely to be absent from work due to minor mental disorders (CIPD, 2007a). Manual workers may also receive occupational sick pay for a shorter period of time and by considering the population as a whole, the model may under or overestimate indirect costs since some employees may be easier to replace than others. These factors have been assessed within the sensitivity analysis which suggests that the impact on the model results is minimal.

It has been assumed that the health utility score of individuals is based upon whether they are at work or on sick leave rather than their state of illness. A reasonable correlation between returning to work and state of illness would be expected. When the individual returns to work the model also assumes that the intervention will no longer be required, and thus implicitly that the individual has returned to a reasonable state of health. With regard to the former of these, there are likely to be many factors (other than age which has been taken into account within the utility estimates) that will impact upon the health utility score. Although some people in the at-work state may have lower utilities than some people who are on sick leave, because the utility estimates are based on a sample of the general population who have both been on sick leave and at work within the last ten years, these factors should be captured within the estimates. This should include the variable level of illness of the individual. With regard to the latter, there may be occasions when the individual continues to receive an intervention following his or her return to work and hence the costs of the intervention and usual care may have been slightly underestimated; however, this would impact upon both arms of the study and hence have limited impact upon the model results.

It has been assumed that people may die or retire whilst in any state of the model based on the age of the individual. It should be noted that this may be a slight underestimate since people may also become unemployed due to losing their job, being made redundant or for elective reasons such as caring for a family member. It is expected that this would not have a big impact upon the model results since the majority of people who lose their jobs are likely to get another job and, given that people within the base case model are over 40, only a small proportion will take time off work as a result of having had a baby. Moreover, this would impact upon both arms and therefore would be expected to have a minimal impact upon the model results.

Whilst the model incorporates early retirement, it does not take into account the relationship between early retirement and sick leave. If a person is aged 60 and moves to long term sickness absence they may be less likely to return to work than a person who is aged 45. Given that this would affect both the intervention group and the usual care group within the model; this complex relationship would not be expected to have a substantial impact upon the model results.

A one-way sensitivity analysis has been used to test the impact of the key model assumptions upon the results. Because each assumption is tested individually, the impact upon the model results of several of the assumptions being incorrect given further data may be larger than that for each of the assumptions individually. A probabilistic sensitivity analysis, whereby all parameters are varied within plausible ranges, was not considered feasible given time and data constraints. However, each of the interventions either dominate usual care or have a cost per QALY gained considerably below the NICE threshold of £20,000 - £30,000 per QALY gained, and each of the assumptions individually do not have a large impact upon the model results. Therefore, the combination of these uncertainties is not expected to alter the conclusions presented here.

4.3 Other issues

We have assumed that the cost to society of Incapacity Benefit and Statutory Sick Pay is zero given that these are transfer payments and have no resource implications to society as a whole. However, it should be noted that, in theory, those people that are at work are required to pay higher national insurance contributions when there are more people on Incapacity Benefit and hence there is a distinct advantage to these people of returning people on sickness absence back to work.

4.4 Further research

As outlined previously, the evidence reviews provided limited data around the effectiveness of the interventions aimed to help employees return to work following sickness absence. There was a substantial amount of heterogeneity between the studies identified by the effectiveness review in terms of the population, comparators, interventions and outcomes. The follow up of these studies was limited, making extrapolation of data highly uncertain. In addition, very few of the studies provided any data around the quality of life of the employees.

The evidence review covering incapacity benefit also identified very limited data on interventions to help those who are unemployed and in receipt of incapacity benefit (or other similar benefit) return to work paid and unpaid. The 3 papers which were identified for this research question were all of relatively poor quality (no/poor comparators, small sample sizes, badly defined interventions) and hence the effectiveness of these interventions was not sufficiently well established to warrant an assessment of their cost-effectiveness.

Further research to improve the evaluation of all four research questions is recommended which:

1. Is within the UK setting;
2. Provides follow up data beyond 12 months;
3. Reports comparable return to work outcomes between studies;
4. Reports quality of life data of the employees who are both at work and on sick leave.

4.5 Conclusion

The economic analysis indicates that, from an NHS and PSS or societal perspective, the workplace intervention, the physical activity, education and workplace visit and the physical activity and education intervention are likely to be considered to be cost-effective at a willingness-to-pay threshold of £20,000 per QALY gained. The physical activity and education intervention was estimated to result in a cost per QALY gained of around £2,800 in comparison to usual care from both an NHS and PSS perspective and a societal perspective. The remaining two interventions assessed within the model were estimated to be more effective and less costly than usual care. This can be explained by the low costs of the interventions in comparison to the large reduction in production occasioned by longer sickness absences without intervention. It is estimated that 8 additional employees out of 1000 need to return to work within 6 months for the intervention to be considered cost-effective in comparison to usual care at a threshold of £20,000 per QALY gained (assuming that the intervention costs around £800 per person on sick leave in addition to usual care). From the employer perspective, the interventions which do not require large cost input from the employer are likely to be cost-saving to the employer. The workplace intervention which is assumed to cost the employer £527 per person on sick leave is estimated to cost the employer **a net** 34 pence per day on sick leave avoided after taking into account productivity loss and costs such as Occupational Sick Pay. This result is underpinned by the assumption that an employee can be replaced within 10 weeks. If this period was greater, it would be more likely that the workplace intervention would be cost saving to the employer.

The exploratory analysis around the potential cost-effectiveness of the use of an initial assessment and/ or case worker/manager/team with the aim to establish the most appropriate intervention for each employee suggests that if this results in at least a one percentage point improvement in the return-to work rate and costs less than about £900 per employee, then it is likely to be cost effective (at a threshold of £20,000 per QALY). It is not known whether this result applies to all groups of workers or only to the kind of workers covered by Haldorsen's study, so caution is needed in generalising this result.

There are limited data and hence a large amount of uncertainty in this area. In order to try and address this, the key model assumptions have been tested within a one-way sensitivity analysis. Since many of the costs are incurred within the first six months of sickness absence, the assumptions around the extrapolation of current data into the future have a limited impact upon the model results and therefore the model appears reasonably robust to changes in the key model assumptions. However, caution should be taken when interpreting these results given that the evidence on the costs and effectiveness of the interventions is based on studies carried out in non-UK countries. Differences in insurance schemes, the health care systems and patients' attitudes to work lead to questions around the generalisability of these studies within the UK setting. Thus, this modelling work is intended to be indicative only. Further research is recommended as described in Section 4.4 above.

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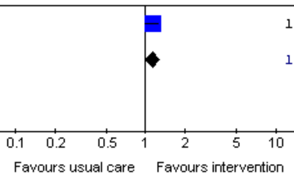
Appendix A

Review: Interventions aimed at return to work following sickness absence
Comparison: 01 Workplace intervention versus usual care
Outcome: 02 Return to work at 6 months

Study or sub-category	Treatment n/N	Control n/N	Weight %	RR (random) 95% CI
Steenstra	84/96	78/100	100.00	1.12 [0.99, 1.28]
Total (95% CI)	96	100	100.00	1.12 [0.99, 1.28]

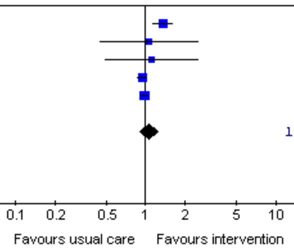
Total events: 84 (Treatment), 78 (Control)
Test for heterogeneity: not applicable
Test for overall effect: Z = 1.75 (P = 0.08)



Review: Interventions aimed at return to work following sickness absence
Comparison: 04 Physical activity and education versus usual care
Outcome: 01 Return to work at 6 months

Study or sub-category	Treatment n/N	Control n/N	Weight %	RR (random) 95% CI
Hagen	145/237	99/220	25.51	1.36 [1.14, 1.62]
Jensen (females)	8/30	7/28	3.00	1.07 [0.45, 2.56]
Jensen (males)	11/33	6/20	3.33	1.11 [0.49, 2.54]
Sinclair (females)	136/173	206/248	33.11	0.95 [0.86, 1.04]
Sinclair (males)	158/182	243/275	35.05	0.98 [0.92, 1.05]
Total (95% CI)	655	791	100.00	1.06 [0.91, 1.24]

Total events: 458 (Treatment), 561 (Control)
Test for heterogeneity: Chi² = 16.45, df = 4 (P = 0.002), I² = 75.7%
Test for overall effect: Z = 0.74 (P = 0.46)



Review: Interventions aimed at return to work following sickness absence
Comparison: 03 Physical activity and education and workplace visit versus usual care
Outcome: 01 Return to work at 6 months

Study or sub-category	Treatment n/N	Control n/N	Weight %	RR (random) 95% CI
Burke	188/303	25/94	15.02	2.33 [1.65, 3.30]
Haldorsen	69/142	46/81	16.80	0.86 [0.66, 1.10]
Lindstrom	44/51	38/52	17.76	1.18 [0.97, 1.44]
Skouen A (females)	31/58	22/59	13.80	1.43 [0.95, 2.16]
Skouen A (males)	15/21	13/31	12.16	1.70 [1.04, 2.79]
Skouen B (females)	18/30	22/59	13.17	1.61 [1.03, 2.50]
Skouen B (males)	11/17	13/31	11.29	1.54 [0.90, 2.66]
Total (95% CI)	622	407	100.00	1.43 [1.08, 1.89]

Total events: 376 (Treatment), 179 (Control)
Test for heterogeneity: Chi² = 27.34, df = 6 (P = 0.0001), I² = 78.1%
Test for overall effect: Z = 2.48 (P = 0.01)