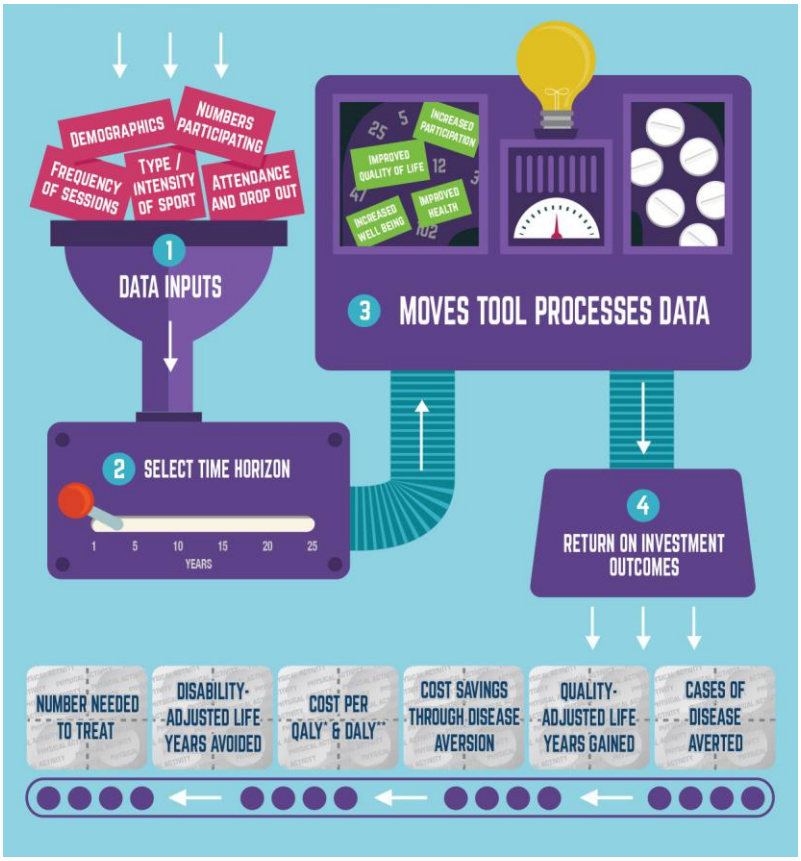
Model for estimating the Outcomes and Values in the Economics of Sport

(MOVES v.2.0)



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This version of the user guide for MOVES version 2.0 was published in November 2016

1.0 Introduction

Welcome to the upgraded Sport England Model (v.2.0) for estimating the Outcomes and Values in the Economics of Sport and physical activity (MOVES). This tool has been commissioned by Sport England as part of its role to provide expert information to the sector and has been created by the Health Economics Consulting group at the University of East Anglia's Medical School. The model will provide data that will enable, guide and support decision makers to plan and evaluate sport and physical activity interventions for their health benefits and cost-effectiveness to the healthcare system. This version of the tool was published in November 2016.

This tool is intended to be used by:

- Public health teams and commissioners
- County Sport Partnerships (CSPs)
- National Governing Bodies
- Project management with a specific remit for sport and health in the private sector
- Local government looking to provide cost-effective health promotion strategies; and
- Local sporting clubs bidding for funding.

This tool would be useful:

- For understanding and evaluating the cost-effectiveness of a sport and physical activity programmes where there are clear health benefits
- To set objectives and measures for new sport and physical activity programmes, based on the models' cost-effectiveness outputs
- To find out which sport and physical activity programmes work and what doesn't, and why
- To help sport and physical activity programmes continually improve what they do
- To track strategic progress of sport and physical activity programmes more clearly
- To demonstrate the return on investment (ROI) for sport and physical activity programmes
- To report to stakeholders
- For commissioners to use during planning, procurement and evaluation stages the commissioning cycle.

1.1 How does the tool work?

MOVES provides a cost utility analysis that considers the ratio between the costs of the intervention and the financial value of health it provides. Cost utility is presented as cost per quality adjusted life years (QALYs)[1] and cost per disability adjusted life year value (DALYs)[1].

MOVES is based on evidence that increased physical activity reduces the risk of developing a number of diseases including cardiovascular disease and diabetes. Treating these diseases carries a financial burden both for the NHS and social care services, as well as the local and national economy in addition to the reduced quality of life for patients.

To find the benefits of a sport or physical activity programme MOVES compares groups or populations of participants engaging in a programme with the same group as if they had not taken part in this programme.

At the heart of MOVES is an 'epidemiological engine' containing UK data regarding the population, age and gender and related disease rates for conditions amenable to change (e.g. cardiovascular and diabetes) through improved sport and physical activity levels.

[1] Please see the glossary of terms for further explanation of the QALY and DALY.

Estimates used in MOVES are based on the most robust data and evidence currently available for UK populations. Robust data collection and evaluation of interventions will support your ability to use the tool and strengthens the robustness of the outcomes that you will get when using the tool.

We hope MOVES will support the strategic positioning of sport and physical activity, help make the case for investment by identifying potential savings that can be made across the NHS and improvements to quality of life. It can also be used to support the review of interventions to improve the cost effectiveness of your delivery.

1.2 Background & Policy Context

The benefits of regular physical activity have been clearly set out across the life course and we know that being physically activity can help all of us to lead healthier and happier lives irrespective of age.

Physical activity includes all forms of activity, such as 'everyday' walking or cycling to get from A to B, active recreation as well as organised and competitive sport.

All sport, whether you are participating in a competitive event, cycling with family or having a kick about in the park is physical activity and can make a substantial contribution to meeting the Chief Medical Officer's Guidelines for physical activity of 150 minutes of moderate physical activity per week for adults.

Importantly it is never too late to adopt, and benefit from being more physically active since there is good evidence that the benefits apply across the age range, even in older adults who have previously been inactive. Older adults want to maintain their capacity to get out and about, retain independence but also stay engaged with their community; being physically active offers an ideal way to achieve these goals.

In December 2015 the Government published Sporting Future: A New Strategy for an Active Nation which looks beyond participation in sport to recognise how sport and activity changes people's lives and is a force for social good. At its heart are five outcomes; physical wellbeing, mental wellbeing, individual development, social and community development and economic development.

Sport England's Towards an Active Nation strategy published in May 2016 responds to the new challenges and opportunities presented by the Government Strategy. It details how we will use the public funding and resources that we are responsible for to benefit everyone in England.

We want to drive impacts across the five outcomes previously mentioned and continue to highlight the positive and valued contribution that sport and physical activity makes to health as well as the wider social and economic agendas.

1.2.1 Demonstrating the benefits of Physical Activity

There is an expanding evidence-base which demonstrates physical inactivity as being a leading cause of death from chronic diseases, such as from heart disease, stroke, diabetes, and cancers. In addition the economic burden incurred through health care costs, sickness absence and lost productivity are estimated to cost the UK economy £7.4 billion per annum (1,2). In response in 2011, the Start Active, Stay Active report delivered guidelines on the volume, duration, frequency and type of physical activity required across the life-course to achieve general health benefits.

The recommendations within the Start Active, Stay Active report were aimed at the NHS, local authorities and a range of other organisations designing services to promote physical activity. The document was intended for professionals, practitioners and policymakers concerned with formulating and implementing policies and programmes that utilise the promotion of physical activity, sport, exercise and active travel to achieve health gains.

1.2.2 The Policy context

Public Health England's "Everybody active, every day" framework also seeks to address the national physical inactivity epidemic and sets out actions focusing on four key areas:

1. Active society: creating social movement
2. Moving professionals: activating networks of expertise
3. Active environments: creating the right spaces
4. Moving at scale: scaling up interventions that make us active.

The accompanying "What works – the evidence" document set out specific recommendations for National Government, Public Health England, Local government, NHS commissioners, NHS providers, Sport and leisure organisations, Early years to Higher education institutions, Businesses and employers, and Voluntary and community organisations. The framework and actions highlight the need to monitor progress and understand the impact and return on investment of the interventions that are being invested in.

The Governments Sporting Future; A new strategy for an active nation and Sport England's Towards an Active Nation Strategy clearly sets out the way in which five key outcomes (seen in the diagram overleaf) will be delivered through the delivery of high quality, customer focused sport and physical activity interventions and programmes.

The outcomes in the Government Strategy for Sport and Sport England's Towards an Active Nation Strategy:

Physical Wellbeing	Mental Wellbeing	Individual Development	Social and Community Development	Economic Development

Sport England is developing a common evaluation framework for use with all of our proposals and investments. The framework takes a proportionate approach to determining impact that ensures the right approach for different partners so that evaluation adds value and it not a burden. It recognises the need to understand the Return on Investment of interventions.

The Sport England MOVES Model (v.2.0) supports the implementation of these approaches by providing an easy to use tool for considering the impact and cost-effectiveness of individual physical activity interventions. It has been designed to measure the cost-effectiveness of physical activity by evaluating the volume, duration, frequency and type of physical activity intervention weighted by relative risks. The cost-effectiveness results generated within the model provides evidence that supports the outcomes of the Start Active, Stay Active guidelines and the physical and mental health outcomes of the Government and Sport England Strategy.

1.3 MOVES version 2.0

The MOVES v.2 model is the second phase of MOVES v.1. The model interface and way the model runs remain unchanged to version 1, however, version 2 has improved functionality and incorporates new data and evidence bases to ensure its robustness. An overview of the outcomes provided by the two versions of the tool can be seen in table 1 overleaf.

Examples of the new functionality include;

- The inclusion of hip fracture and disability adjusted life years (DALYs) within the model to aid alignment to social care agendas.
- Allowing users to more explicitly define assumptions on input parameters. For example, users can specify how long people in the cohort will continue to engage in an activity beyond the initial year of the programme, independently of the drop-out rate from the programme.
- How the costs of the programme are distributed can also be decided by users, with the option to evaluate on the basis of a "per participant" cost or as a "per programme fixed cost" and as "on-going" or "one-time" cost.
- Advanced input options have been made available to users who have the relevant evidence and knowledge to make adjustments to the risk reduction from additional activity, and to the discount rate for costs and outcomes.
- Consideration of the numbers needed to treat to prevent an incidence of disease

Table 1: A comparison of the outcomes generated by the initial and updated version of the MOVEs tool to highlight the new analysis functions.

Version 1	Version 2
Cases of disease averted for 7 conditions	Cases of disease and mortality averted for 8 conditions
Quality of Life Years gained for 7 conditions	Quality of Life Years and Disability Adjusted Life Years gained for 8 conditions
Costs savings through diseases averted for 7 conditions (or rather funding that could be deployed elsewhere in the NHS)	Costs savings through diseases averted for 8 conditions (or rather funding that could be deployed elsewhere in the NHS)
Cost per QALY	Cost per QALY and DALY avoided
ROI per £1 invested for NHS and wider	ROI per £1 invested for NHS and wider
	Numbers needed to treat
	Probablistic Scenarios

The incidence rates attributed to the chronic diseases for the various age groups have been updated reflecting the most recent available evidence and also incorporate mortality data too.

This is the first time a model such as this has been attempted for all sports and physical activity.

A number of end-users and commissioning groups around the country were consulted for their feed-back prior to the launch of Moves version 1.0. MOVEs version 2.0 has undergone a series of technical testing phases to ensure its robustness.

If you have any specific queries regarding the tools functionality or any feedback on the tool please contact Get.Healthy@sportengland.org in the first instance.

2.0 Getting Started

2.1 How MOVES works; the basics

At the heart of MOVES is an 'epidemiological engine' containing UK data regarding the population, age, gender and related disease and mortality rates for conditions amenable to change through improved physical activity e.g. Heart disease, Diabetes etc.

MOVES compares groups or populations of participants engaging in a sport or physical activity programme with the same group as if they had not taken part in this intervention.

The user selects the activity of interest and a relevant intensity level; a proposed level of engagement in that activity (e.g. social or competitive in some cases); the expected frequency of the activity; typical age group/s involved; and the costs associated.

MOVES statistically adjusts usual rates of chronic illness found in the population to take account of the impact of activity chosen. It does this by changing the risks and comparative rates of diseases based on the level and intensity of additional physical activity created by the intervention.

The model assesses the financial (health care savings) and health impacts (diseases, treatments, QALYs and DALYs) of increases in physical activity for seven common diseases and hip fracture:

- Type 2 Diabetes
- Ischaemic Heart Disease
- Cardiovascular Disease (Stroke)
- Dementia
- Depression
- Breast Cancer
- Colon Cancer
- Hip Fracture

MOVES uses METs (Metabolic Equivalents) to measure the intensity of the diverse range of sports and activities that are available in the tool.

The model runs each participant population group a 1000 times for better statistical accuracy. This effectively means that it takes 1000 people and follows them through the process as though they had no intervention and then follows them through as having received the intervention.

The charts section of the tool shows the results of this testing and how to use interpret and use this information is explained in more detail in section 6 of this user guide.

By comparing the cost of the intervention with the different types of benefits accrued, an economic assessment of cost-effectiveness and return on investment is given. This provides details of the amount of money saved and QALYS gained from being involved in the intervention.

The assumptions and principles used within the model are summarised in the table overleaf.

Table 2: The assumption and principles used within the model

MOVES utilises the following principles	MOVES does not incorporate
• Uses the MET hours for intensity and type of sport • Results of the model are sensitive to the time horizon chosen due to nature of the chronic conditions. • Assumes that individuals who drop-out of the programme in the first year gain no benefit from the activity. Furthermore, the model allows for a drop-off in participation among completers over the analysis horizon. • We assume diminishing returns from additional activity, i.e. the benefits from activity are smaller for groups who are initially more active. • Allows users to assume the % of participants who manage to achieve health benefits • Population incidence of disease rates are based upon the general population (which includes active and non-active participants). The estimate of benefit should ideally be based on incidences of no/low activity participants; we assume the incidence disease rates are a reflection of this assumption. • Direct costs to the NHS relate to 1-year of treatment. • Discounting is applied at 3.5% (Standard practice) • The model runs each population cohort a 1000 times for better statistical accuracy • Mortality data is included within the model alongside morbidity data	• The model is not designed to take into account the health profile of specific patient groups, geographical areas or populations. • The cost of injuries due to sport or physical activity are not included in MOVES. • Social Care costs are not included in the current model

2.2 MOVES will generate the following information

- Cases of disease averted
- Quality of Life years gained
- Disability adjusted life years avoided
- Cost savings through diseases averted
- Costs per QALY
- Cost per DALY
- Number needed to treat (NNT)
- Probabilistic scenario values

2.3 What data do you need to collect or have available to use MOVES?

Prior to using the tool, you will need to ensure that you have the following information for the programme to enable you to consider the return on investment:

- Gender and ages of the participants
- the average physical activity level of the target group before the intervention takes place (aligned to the Health Survey for England classifications);
- the type of sport or physical activity of the programme;
- the length of each session;
- frequency of the session per week;
- the activity's relative 'intensity level';
- expected or actual number of 'drop-outs' from the programme;
- the projects or actual annual % maintaining activity level

Information on how to calculate or determine these inputs are included in chapter 3.0 using the model.

Embedding the Standard Evaluation Framework for Physical Activity within monitoring and evaluation processes (as highlighted in the "Everybody active, everyday" framework) will support practitioners in being able to collect the information required to use the tool.

If you are using the tool to plan a new programme or intervention, we recommend that you use the evidence from other similar programmes or previous delivery to inform your data inputs. This will strengthen the robustness of the inputs you use. It is also recommended that you ensure any assumptions that you have made in your data input modelling are recorded for use in any reports, decision making or business cases that you are making.

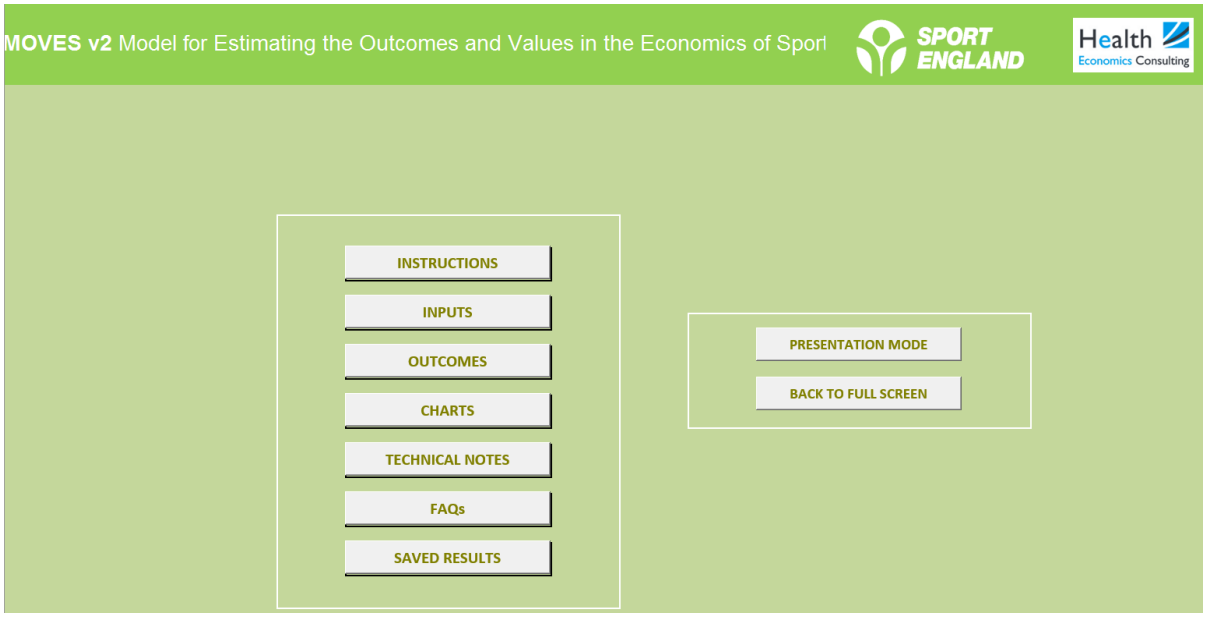
3.0 Using the Model

This section provides a step-by-step guidance to using the tool and further explanation of the results presented from the MOVES analysis.

3.1 Navigating the tool

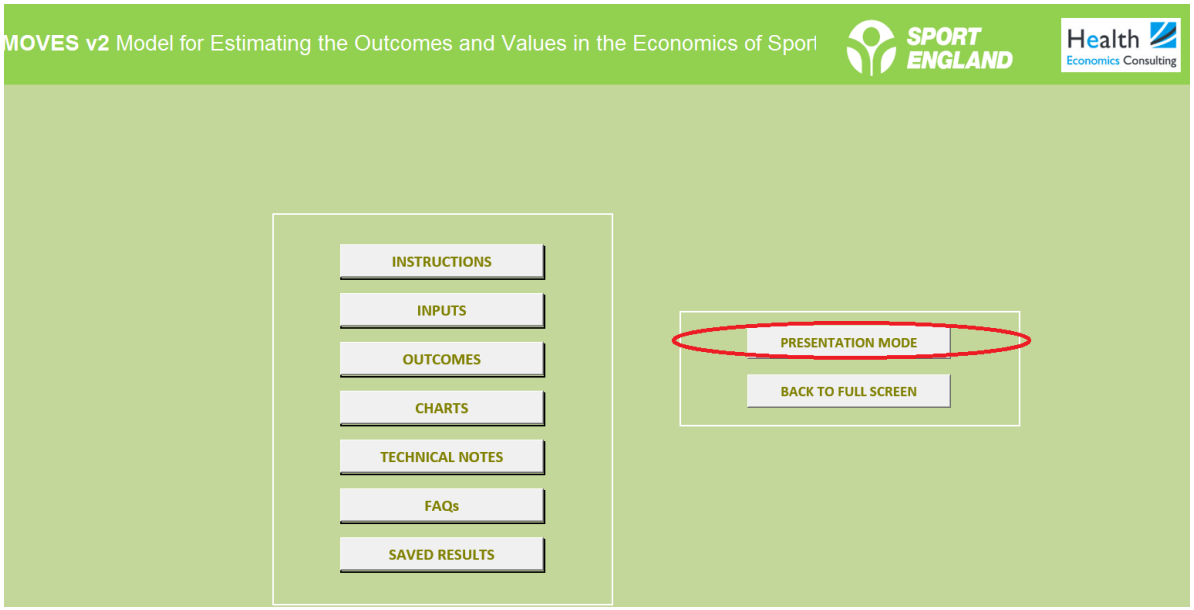
When you open the Excel based tool the first page that you will see is shown in figure 1. This is the menu screen for using the tool and enables you to navigate around the tool at any point during its use.

Figure 1: The front page of MOVES v2.0.



The tool has two screen modes that you can select from, giving you either a presentation mode, which removes the excel spreadsheet surround or full screen mode, which includes the excel spreadsheet surround. You can select your preference by clicking on the buttons on the right hand of the screen as shown in figure 2.

Figure 2: Selecting a screen mode



The Instructions Page

The instructions page is accessed by clicking onto the instructions tab on the main menu, highlighted in figure 3. It provides a brief overview about the tool and how to navigate around it as shown in figure 4.

Figure 3: Accessing the instructions page

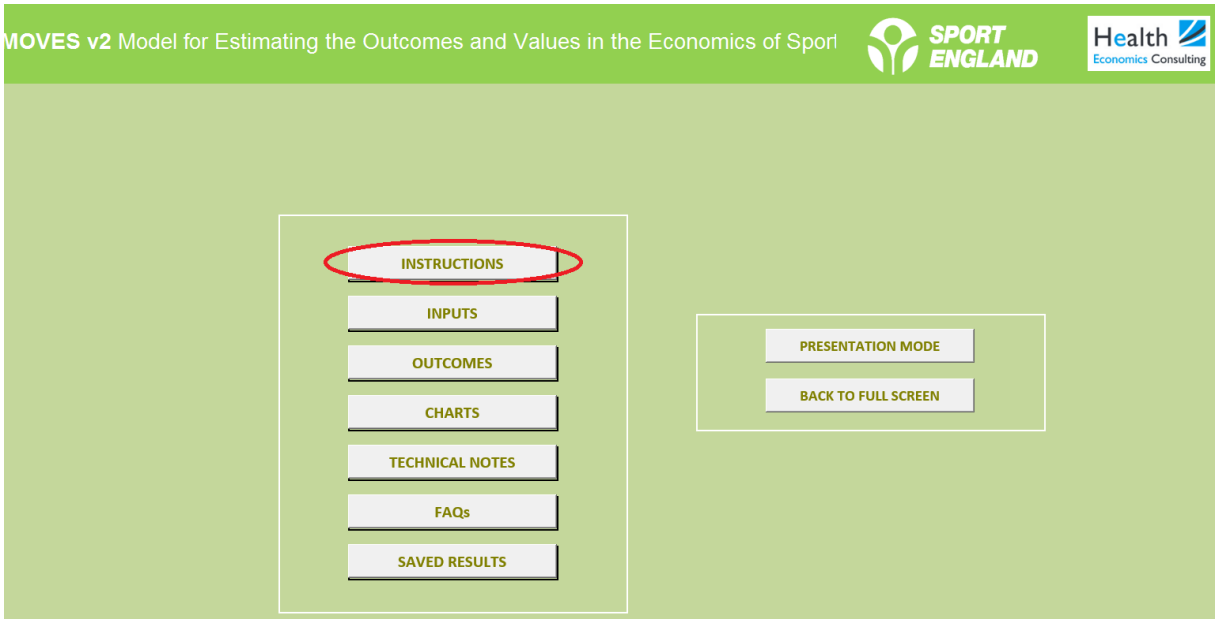
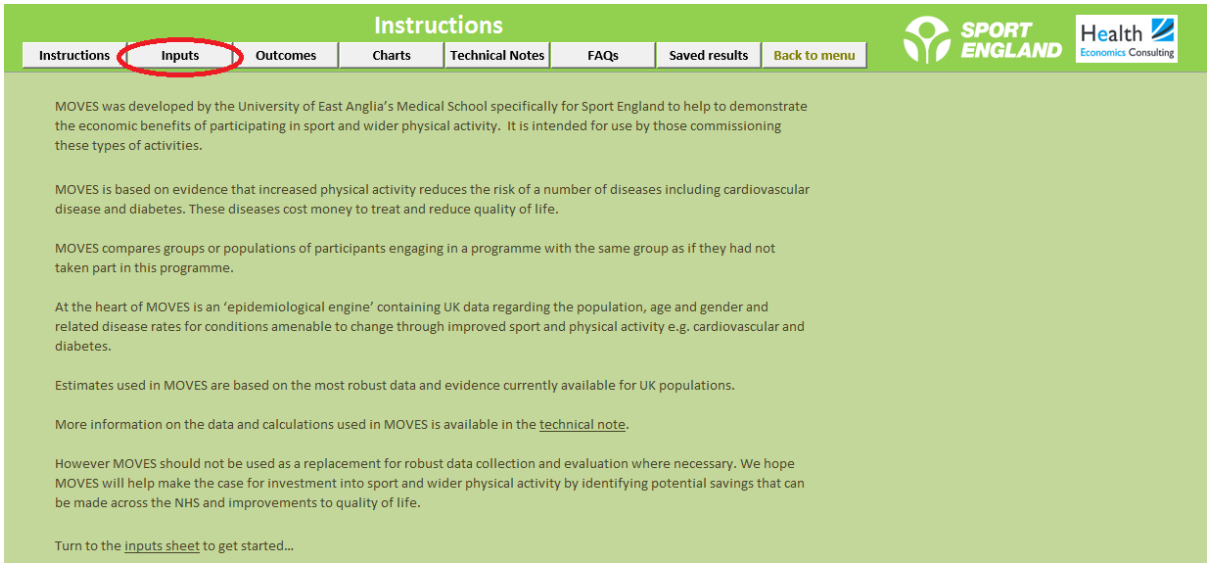


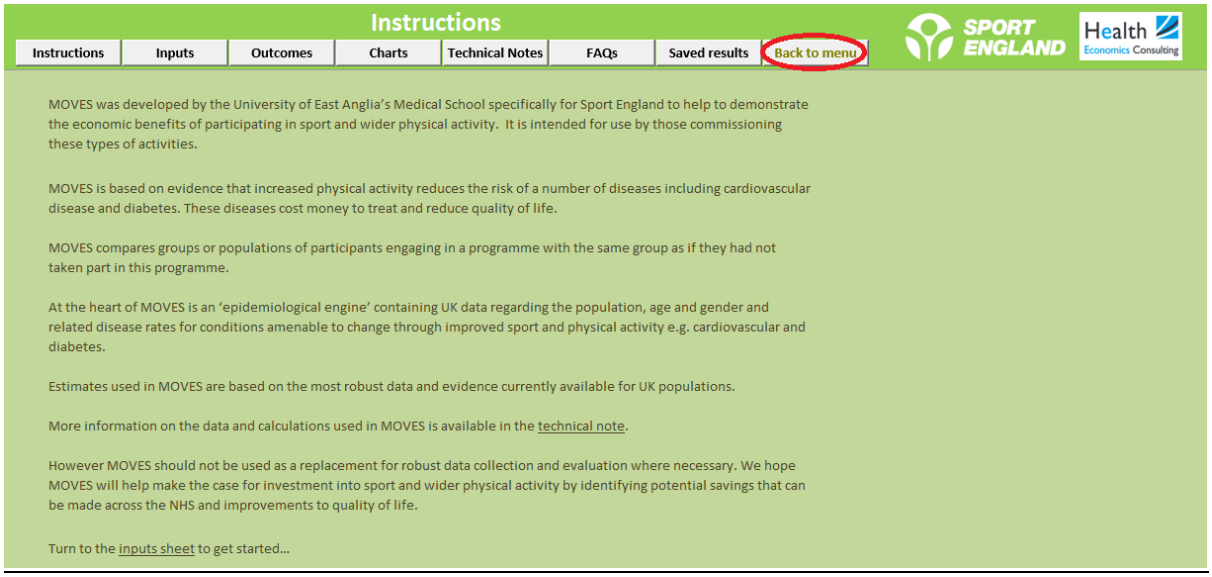
Figure 4: The instructions page and accessing the inputs section of the tool



You can access the inputs sheet from this page by clicking on the "inputs" button on the tool bar at the top of the page or the hyperlink at the bottom of the page. Both are highlighted in figure 4.

You can access the main menu of the tool by clicking on the "back to menu" button at the top of the page at any point whilst you are using the model, as shown in figure 5.

Figure 5: Returning to the main menu through the tool bar.



3.2 Inputs: Demographics

This worksheet is where you will input the data for your project to enable the model to run the cost utility analysis for the sport or physical activity programme that you want to evaluate.

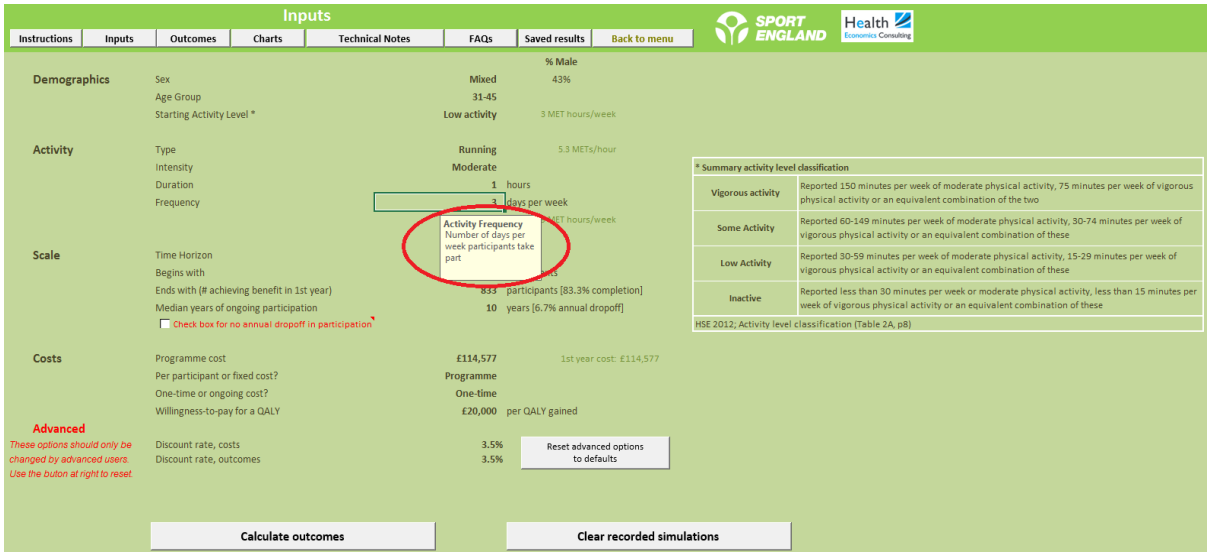
The page can be seen in figure 6 and will request you to input information for 18 different fields of information. Within the updated version of MOVES v2.0 there is an advanced option which allows users to change the risk reduction from additional activity and discount rate where they see fit. If you are unsure of how to proceed with these values, we recommend that they be kept at the default values.

You will be asked to either select information from a drop down list by clicking on the relevant cell or to use free text to enter information into each of the 15 mandatory fields and the 3 advanced fields.

Figure 6: The Inputs page

You will be prompted what information is required as you click on each input field. An example of the prompt as seen in figure 7 below.

Figure 7: Data input prompts

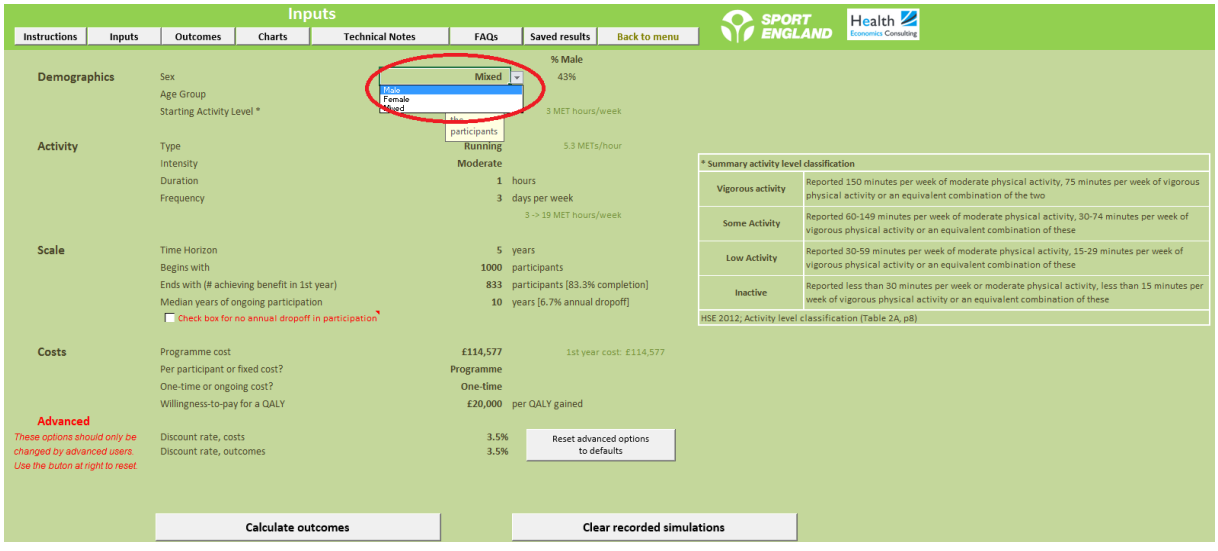


3.2.1 Demographic information

Gender

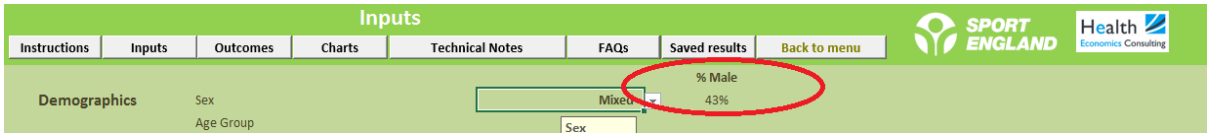
You will need to select the gender of those participating in the programme from a drop down list as shown in figure 8. The selection options are male, female or mixed.

Figure 8: Gender demographics



If the group taking part in your activity is mixed you will be asked to enter a ratio of how many of the group will be male. You should give this as a percentage figure, an example can be seen in figure 9.

Figure 9: Entering a ratio of male participants when the interventions participants are mixed sex.



3.2.2 Age group

You need to select the most appropriate age group for your participants from the drop down list as shown in figure 10.

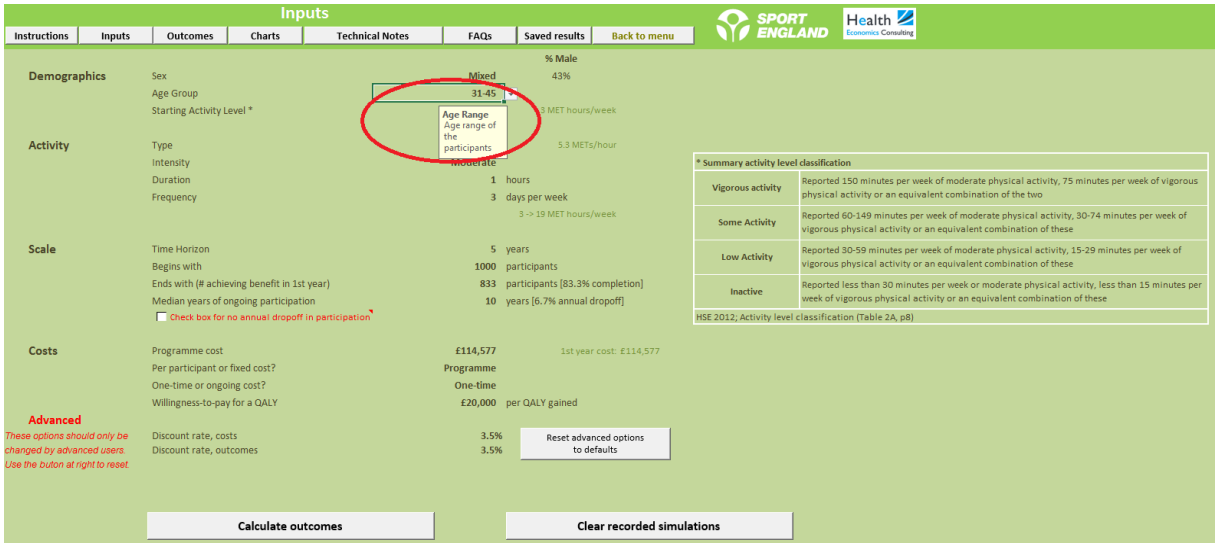
The age bandings available are 16 – 30 years, 31 – 45 years, 46 – 60 years and 60+ years. If your intervention targets mixed age groups, please select the age banding that is predominant for your group participants. Or alternatively if you have the relevant information for more specific age groups, it is possible to run separate simulations for the different age categories.

It is important when doing this to take into account the numbers you begin with and end with for the particular age group and the programme cost. For example, for a 16 – 30 years cohort, the number ends with may be less than a 60+ age cohort. Additionally, the total cost of the programme may need to be split proportionally to represent the costs the programme attributed to the 16-30 years cohort and the 60+ age cohort. For instance, if 27% of your group are aged 16-30 years then 27% of the costs of the programme would be attributable when undertaking the analysis on this section of your group. If a cost per participant is calculated, the costs per participant would not need to be split.

Users should note undertaking two separate simulations of different age groups allows for the costs and benefits generated to be compared. Not all results can be simply added together to create an overall picture. Therefore, we recommend if users wish to evaluate sub-groups within their full cohort to make comparisons on health outcomes values and results. See case studies in section 7 for further details.

This tool is not suitable for use for interventions predominantly targeting under 16 year olds due to limitations in the data and evidence needed for the algorithm the tool uses to consider the risk reduction from disease.

Figure 10: Selecting age band for participants



3.2.3 Starting Activity Level

You will need to have an understanding of the activity levels of your participants as they join your intervention (at baseline). You can do this by following the guidance in Public Health England's Standard Evaluation Framework for Physical Activity and asking a question about current activity levels as part of your participant forms. There are a range of tools that have been developed to do this including the single item measure for physical activity and the general practice physical activity questionnaire.

You must click on the activity level cell and select the appropriate level from the drop down box, as shown in figure 11.

The definitions for the activity level categories have also been summarised in the "Summary activity level classification" table presented within the model (shown in figure 12) and also below. They are based on the Health Survey for England classification (4). We recommend you use this to help define the starting activity level of the participants being evaluated within the model.

They are as follows:

Inactive: Reported less than 30 minutes per week of moderate physical activity, less than 15 minutes per week of vigorous physical activity or an equivalent combination of these

Moderately Inactive/low Activity: Reported 30 – 59 minutes per week of moderate physical activity, 15-29 minutes per week of vigorous activity or an equivalent combination of these

Moderately Active/Some Activity: Reported 60 – 149 minutes per week of moderate physical activity, 30 – 74 minutes per week of vigorous physical activity or an equivalent combination of these

Active/Vigorous Activity: Reported 150 minutes per week of moderate physical activity, 75 minutes per week of vigorous physical activity or an equivalent combination of the two

Figure 11: Selecting the starting activity level

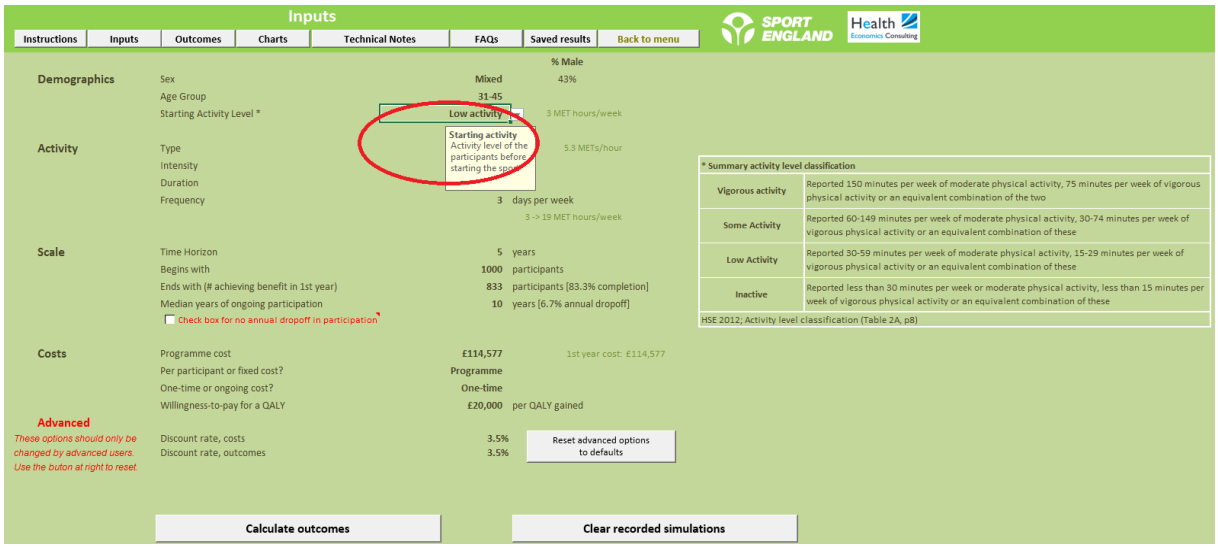
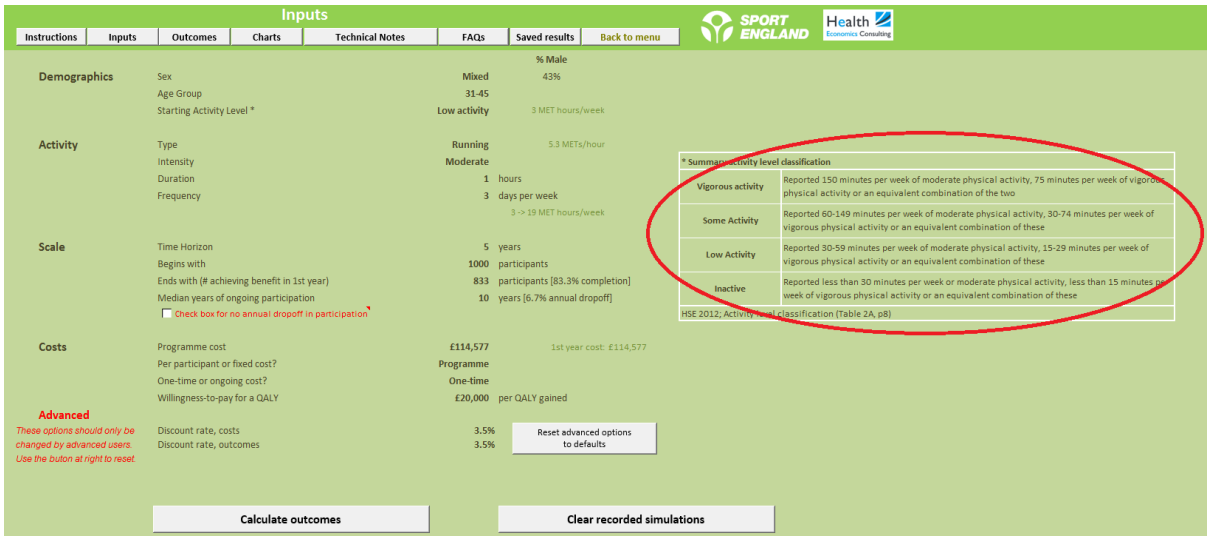


Figure 12: Definitions for the starting activity levels



3.3 Activity: Description of the Intervention

This section is where you input the information regarding the intervention that you want to assess. You will need information on the type of activity undertaken (the sport or physical activity), the intensity levels of the intervention, duration and frequency of the sessions.

This information is essential to the tool to enable the intensity of the sport or activity to be matched to the number of MET (Metabolic Equivalent) hours per week expended by the participant.

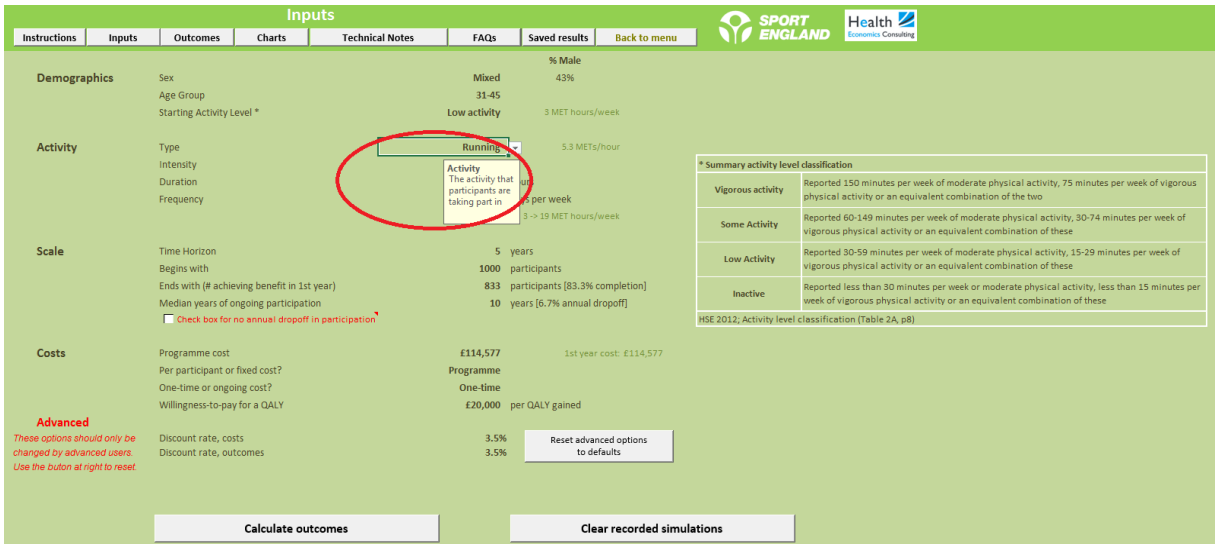
3.3.1 Activity

Click on the E9 cell to access a drop down list of 69 different sporting and physical activities as shown in figure 13. The 69 different sporting and physical activities are listed below:

Angling, Archery, Athletics, Badminton, Ballet or Modern or Jazz dancing, Baseball, Basketball, BMX Cycling, Boccia, Bowls, Bowling, Boxing, Canoeing, Cricket, Cycling (competitive), Cycling (leisure), Dancing, Diving, Fencing, Football, Goalball, Golf, Gym or Fitness or Conditioning, Gymnastics, Handball, Hockey (field), Horse riding, Jogging, Judo, Kayaking, Lacrosse, Martial Arts, Modern Pentathlon, Mixed Sports, Mountain Biking, Mountaineering, Movement and Dance, Netball, Orienteering, Rock climbing, Rounders, Rugby, Running, Sailing, Shooting, Skating, Snowboarding/skiing, Squash, Surfing, Swimming (competitive), Swimming (laps), Swimming (leisure), Tag rugby, Table Tennis, Taekwondo, Tennis, Track and Field (High jump and long jump), Track and Field (shot, discus and hammer), Track and Field (Steeple Chase), Trampoline, Triathlon, Volleyball, Volleyball (Beach), Walking, Water aerobics, Water Polo, Water Skiing, Water Volleyball, Weightlifting, Windsurfing and Wrestling.

The activity intensity dropdown lists are determined by the sport that is selected. If your specific sport is not on the list, please select unspecified sports from the list.

Figure 13: Selecting the activity



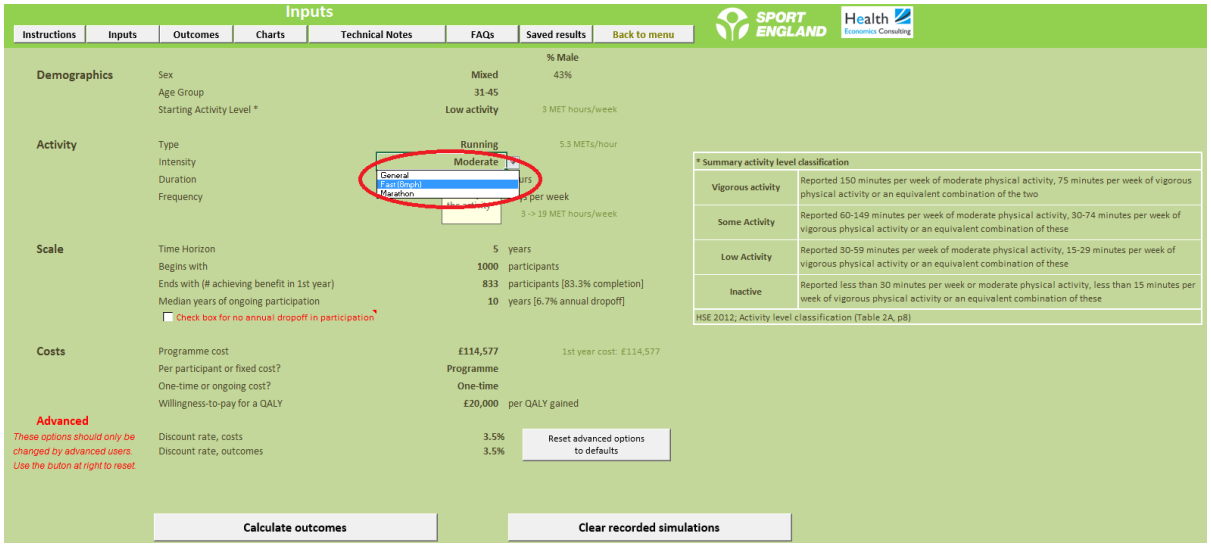
3.3.2 Relative Intensity levels

The activity intensity dropdown lists are determined by the sport or physical activity that is selected and is linked to the METs used when participating in that sport or physical activity.

For example, if you select Tennis as your sport the options for the intensity of the activity will be "Single" or "Double". If you select Basketball you will be asked to select the intensity from the following list; Game, Leisure, Training, Wheelchair.

Click on the drop down list icon alongside cell E10 to access the list of intensity levels for the sport that you have selected, as shown in figure 14.

Figure 14: The drop down list icon to access the intensity ratings for the sport or physical activity you are analysing

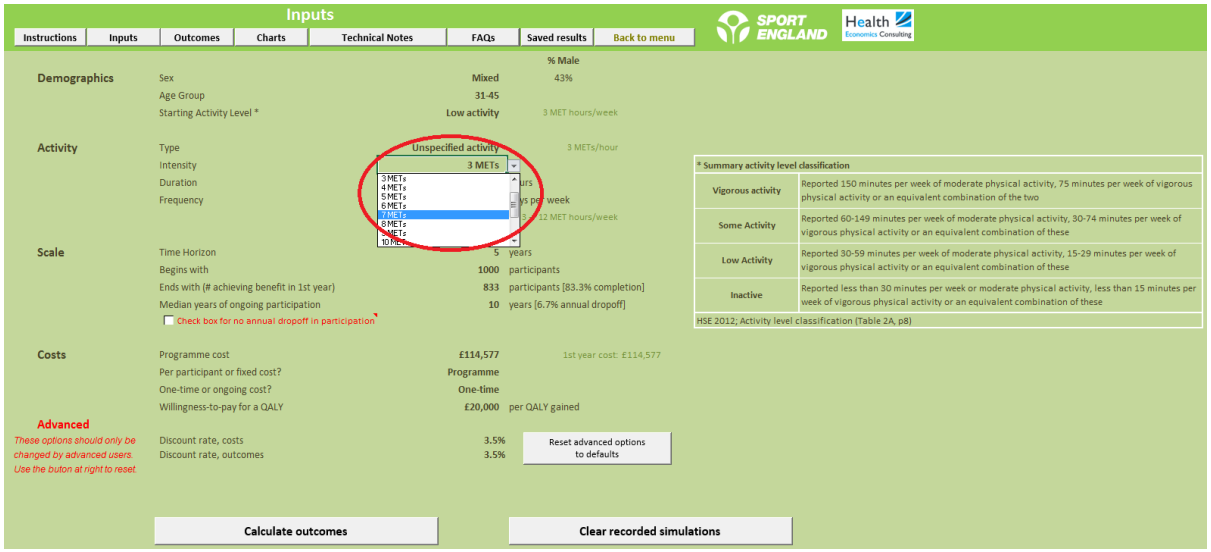


If you select mixed sports, you will need to select whether the intensity level is moderate or vigorous. If you have selected Unspecified Activity as your activity you will need to select an average intensity level for the sports that your project contains (see figure 15). Table 2 provides an overview of sports by METs and can help you to determine the intensity levels of similar sports. Alternatively you can find the METs for more sports in the 2011 Compendium of Activities.

Table 2: The Metabolic Equivalent Task (METs) for

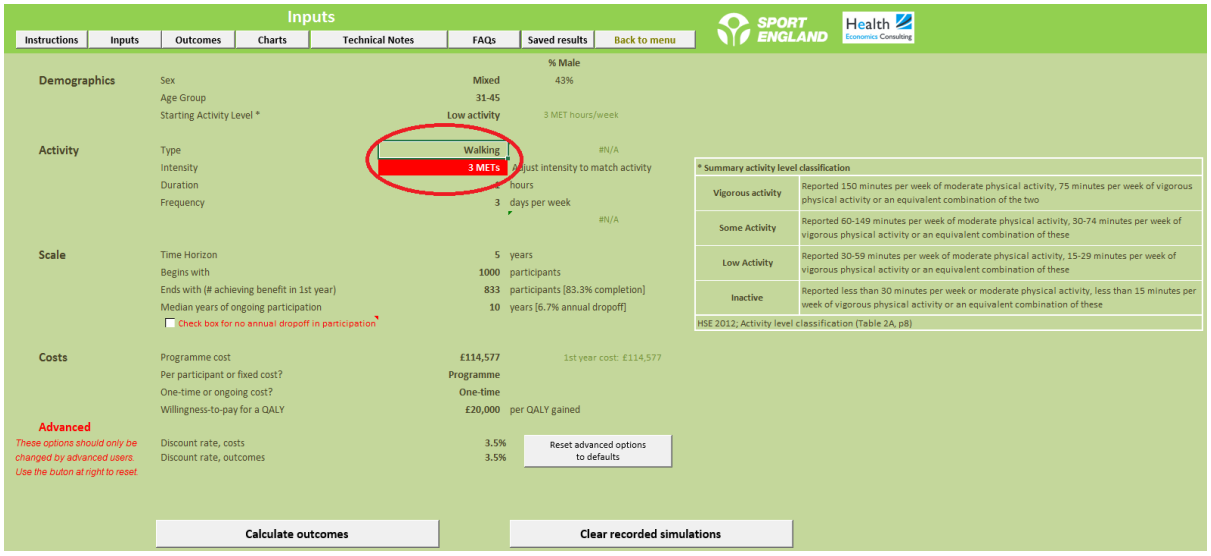
Sports MET rating	4.0 - 5.9 Met	6 - 6.9 MET	7 - 7.9 MET	8 - 9 MET	10 +MET
Sports with similar MET level	- Cricket - Golf - Badminton - Archery - Baseball/ Softball - Canoeing - Rounders - Rowing - Table tennis	- Athletics - Basketball - Equestrian - Fencing - Netball - Recreational walking Volleyball - Waterskiing - Weightlifting - Wrestling	- Boxing - Cycling - Football - Hockey - Dance - Snowsport - Tennis - Wheelchair Basketball - Wheelchair Rugby	- Handball - Health & Fitness - Lacrosse - Mountaineering - Orienteering - Rugby League - Rugby Union - Triathlon	- Judo - Swimming (Laps+) - Squash - Taekwondo

Figure 15: The intensity level options for unspecified sport programmes



If you change the sport or physical activity without then selecting the appropriate intensity from the dropdown list you will get a prompt to do so with the following message appearing on the worksheet; “change intensity as it is not valid for this type of activity”. This is shown in figure 16.

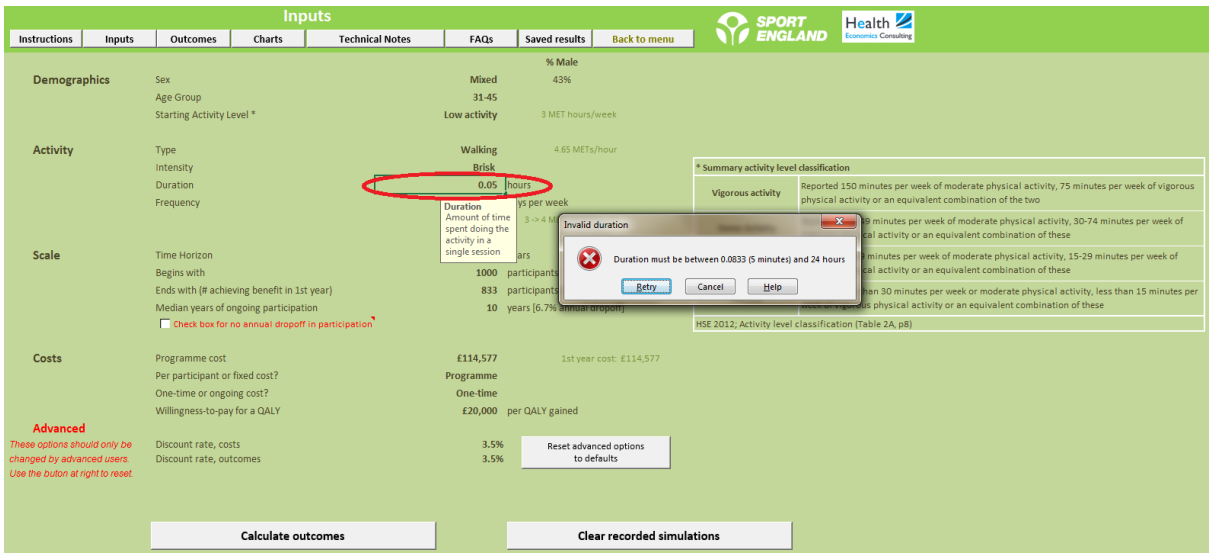
Figure 16: The prompt you will receive to change the intensity selection if it does not match the new sport or physical activity selection.



3.3.3 Duration of Activity

Click on cell E11 to input the duration of a single activity session in hours. There is no drop down list available, instead type any number from 5 minutes to 24 hours to represent the duration of the sport or physical activity. If you type a number less than 5 minutes an error will occur asking you to retry inserting a different number as shown below.

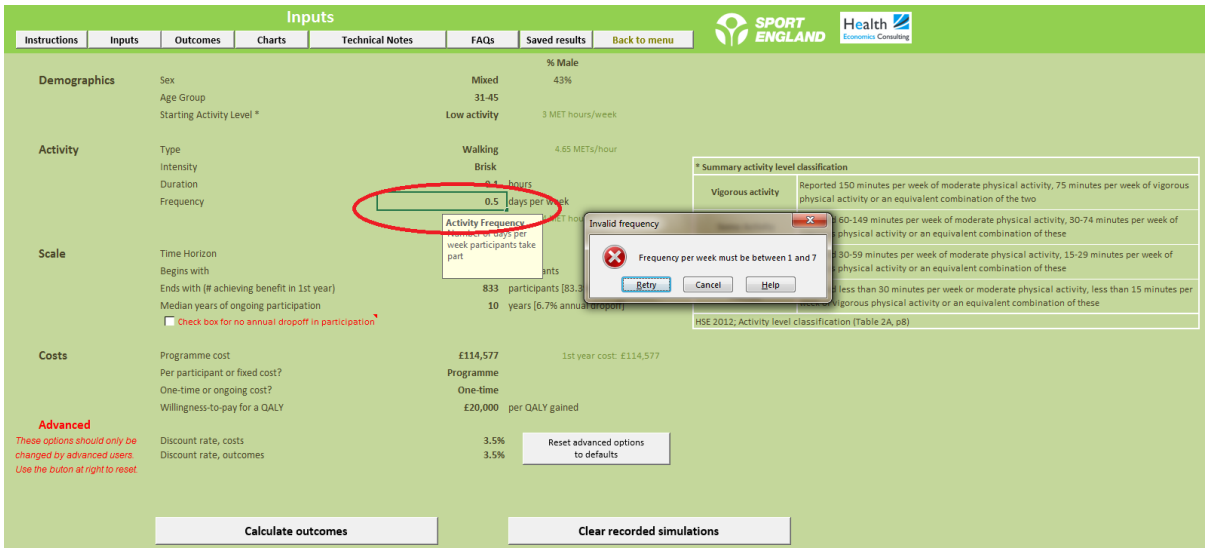
Figure 17: Selecting the duration of a single activity session and an example of the invalid duration message: type any number between 5 minutes and 24 hours



3.3.4 Activity Frequency

You need to input the number of days per week that the intervention happens on. The model will accept any number of days from 1 to 7, if you insert a number greater or less than this range, an error will occur asking you to retry inserting a different number as shown below. Click on cell E12 to insert a number from 1 session a week up to 7 sessions a week.

Figure 18: Entering data for the activity frequency per week and the invalid frequency message



3.4 Scale of the Intervention

3.4.1. Time Horizons - The role of 'time horizons" in MOVES

This is the period over which you would like to know how long the benefits will accrue for. The time horizon for the model can be set at 1, 5,10,15,20 and 25 years. This allows the user to assess the health benefits after the first year, then at 5 year intervals for 25 years.

It may be helpful to consider the time horizons available as providing you with the health benefits that are accrued in the very short term (1 year), short term (5 years), medium term (10 – 20 years) and long term (25 years) from an intervention.

Most of the conditions included in MOVES are chronic conditions which will only present over a longer time horizon and so the results of the model are sensitive to the time horizon chosen. The costs avoided will depend on the type of condition treated and how soon it would have otherwise occurred e.g. some health benefits will obviously take longer than others to acquire and so the total gains of a programme will depend on the time horizon you chose. For example, reductions in the level of dementia of a group may take many decades to produce through increased activity or exercise, whilst reducing cases of depression in the same group may only take a few months.

Additionally, for each disease the incidence of numbers occurring is dependent on the age group. For younger age groups, the incidence of depression is greater than for older age groups, whilst the incidence of dementia is lower at younger age groups and increases as the cohort ages. In general, assuming a longer time horizon for younger age groups will allow the incidences of most of the diseases to be captured best by the model. To enable the lifetime benefits of interventions to be considered many public health interventions return on investments will consider longer term benefits i.e. a time horizon of 25 years.

Cost-effectiveness is therefore time dependent. The time-horizon is important as it assumes that the level of activity is continued throughout this period and therefore that the programme changes peoples' attitudes towards physical activity and their long-term behaviour.

Bear in mind that the tool allows for a drop-off in participation over time, independent of the completion rate in the initial year of the programme. The user can specify the median time that initial completers will continue to participate in the activity; that is, how many years until 50% of the initial completers have stopped participating. The shorter the time, the more quickly participation falls. It is also possible to override this function and specify full participation over the entire analysis horizon, but this is likely to be unrealistic in most scenarios. Individuals not maintaining participation return to baseline risk following dropout so this means that the impact of interventions may be front-loaded, with large gains in early years and small or no gains in later years.

In setting a relevant time-horizon we assume the costs and benefits are both on-going during this period, although the further in the future you forecast these benefits, the less certainty there is in the accuracy. This effectively means that the further into the future the benefits occur, the less weight they carry – or as economists say, the more highly 'discounted' they are.

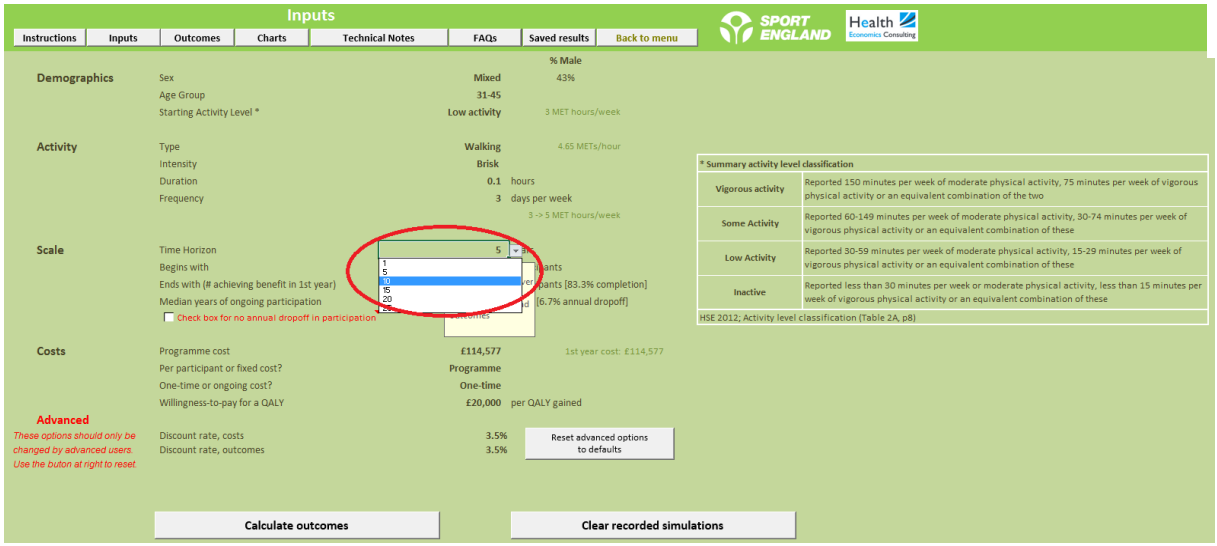
In determining the time horizon that you use for your analysis you may want to consider what or who you are wanting to influence. For example, if you are wanting to make a business case to influence a 3-5-year Commissioning Cycle you may be more interested in the benefits that would accrue over that period of time, however this may mean that you miss the longer term benefits that would accrue for the health conditions considered. Alternatively, you may want to run the

modelling over a range of short, medium and long term time horizons to present a comprehensive overview of the potential return on investment for an intervention.

Selecting the time horizon

There is a pre-determined drop down list of time spans available for the analysis. Select the closest one, which you assume the activity you are assessing will be maintained over by the participants. The selection options are 1 year, 5 years, 10 years, 15 years, 20 years and 25 years. Select the appropriate number by clicking on the list.

Figure 19: The drop down list for time horizon selection

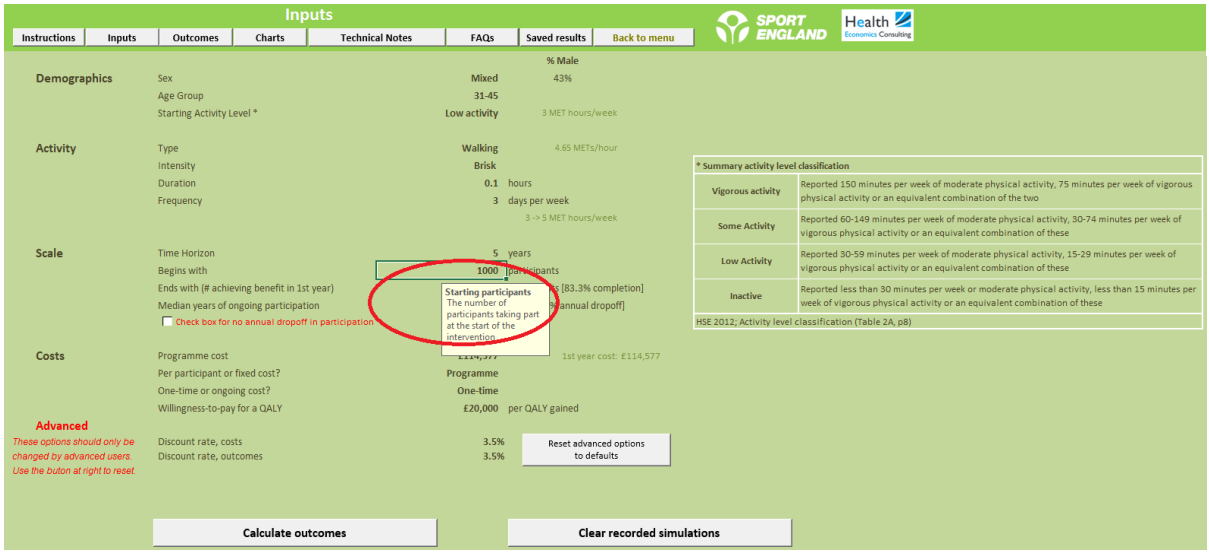


3.4.2 Number of Participants: Begins With

Cell E16 requires the total number of participants that start the intervention. This is described as the number taking part at the beginning of the intervention on the prompts within the tool.

This cell is a free text box that can be populated by clicking on the cell and inserting the number of participants.

Figure 20: The total number of participants starting the intervention

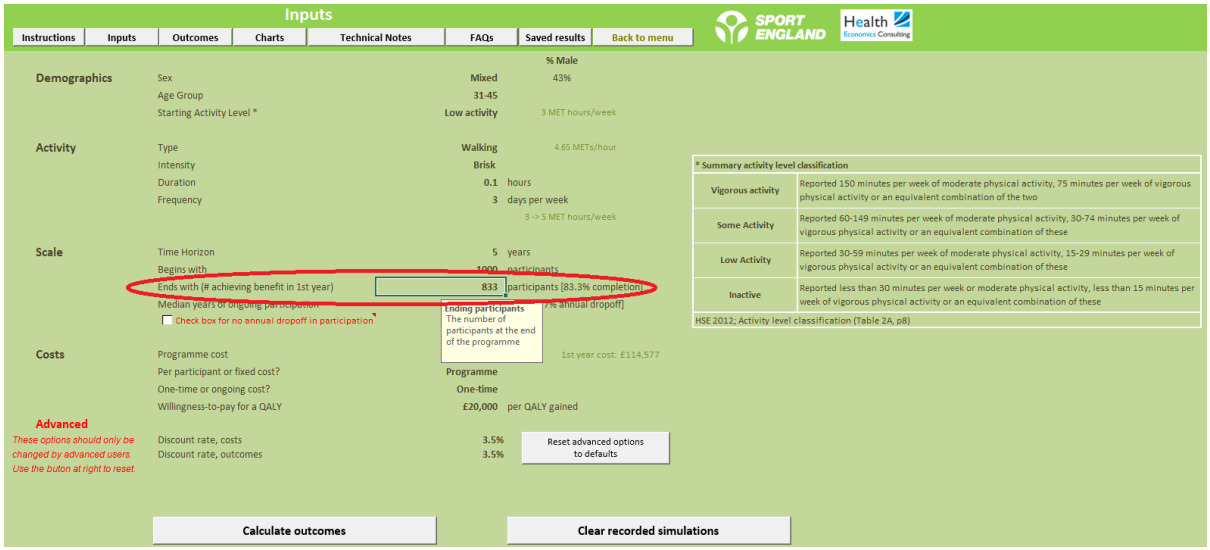


3.4.3 Number of Participants: Ends with

Cell E17 is the total number of participants that complete the intervention. This is described as the number taking part at the end of the intervention on the prompts within the tool.

This cell is a free text box that can be populated by clicking on the cell and inserting the number of participants.

Figure 21: The number of participants completing the intervention



3.4.4 Median years of ongoing participation

Cell E18 allows the user to specify the median number of years that participants who complete the initial programme will continue in the participation at sufficient intensity to maintain their risk reduction. This is shown in figure 22. This option allows for the fact that it is unlikely all

programme completers will maintain their activity levels over the entire time horizon being analysed. Users should specify the number of years they expect the typical participant will maintain their activity levels. The model calculates the decline in participation so that after the specified number of years, only 50% of the original completers will remain active.

Users may be unaware of the median number of years of ongoing participation as this number can be difficult to know and may vary depending on the demographic data and individual programme. To guide the user in choosing a median number of years of ongoing participation, we suggest users pick the assumption that most closely represents the cohort they are modelling from table 3. Where users do not have sufficient data to understand the exact number of years where only 50% of the original completers will remain active, table 3 can be used to make assumptions about the maintenance of participants and therefore estimate a median number of years.

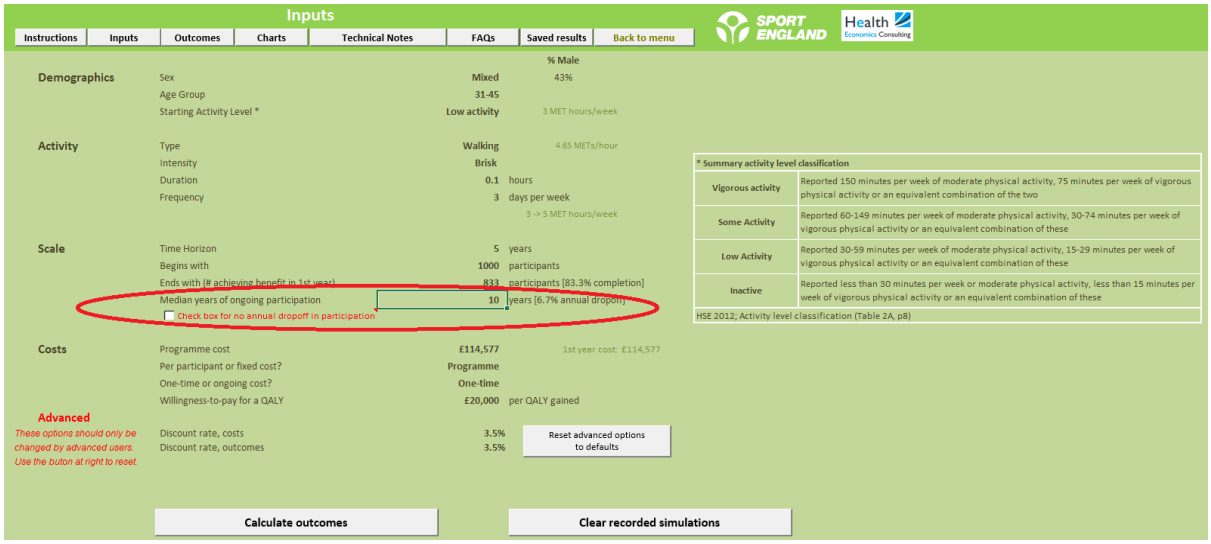
For example, as shown in the table if users assume after 2 years from the start of the programme there is around a 60% participation rate, we recommend a median of 3 years of ongoing participation be chosen. Users should note the number of years from the start of the programme includes the first year within the programme. Therefore, if a user has a participation rate for a one year follow up, the "2 years from the start of the programme" column should guide the user to match the participation rate to the suggested median number of years of participation.

Table 3: Guide to choosing the median number of years

	If participation rate X years from the start of the programme is this...							
2	5	10	15	20	25	30		...then enter these years of participation
25%	3%	0%	0%	0%	0%	0%		1
50%	18%	3%	1%	0%	0%	0%	→	2
63%	31%	10%	3%	1%	0%	0%	→	3
71%	42%	18%	7%	3%	1%	1%	→	4
76%	50%	25%	13%	6%	3%	2%	→	5
79%	56%	31%	18%	10%	6%	3%	→	6
82%	61%	37%	23%	14%	8%	5%	→	7
84%	65%	42%	27%	18%	11%	7%	→	8
86%	68%	46%	31%	21%	15%	10%	→	9
87%	71%	50%	35%	25%	18%	13%	→	10
88%	73%	53%	39%	28%	21%	15%	→	11
89%	75%	56%	42%	31%	24%	18%	→	12
90%	77%	59%	45%	34%	26%	20%	→	13
91%	78%	61%	48%	37%	29%	23%	→	14
91%	79%	63%	50%	40%	31%	25%	→	15
92%	81%	65%	52%	42%	34%	27%	→	16
92%	82%	67%	54%	44%	36%	29%	→	17
93%	82%	68%	56%	46%	38%	31%	→	18
93%	83%	69%	58%	48%	40%	33%	→	19
93%	84%	71%	59%	50%	42%	35%	→	20
94%	85%	72%	61%	52%	44%	37%	→	21
94%	85%	73%	62%	53%	45%	39%	→	22
94%	86%	74%	64%	55%	47%	40%	→	23
94%	87%	75%	65%	56%	49%	42%	→	24
95%	87%	76%	66%	57%	50%	44%	→	25
95%	88%	77%	67%	59%	51%	45%	→	26
95%	88%	77%	68%	60%	53%	46%	→	27
95%	88%	78%	69%	61%	54%	48%	→	28
95%	89%	79%	70%	62%	55%	49%	→	29
95%	89%	79%	71%	63%	56%	50%	→	30

Setting a higher number of years of ongoing participation means that the drop-off from year to year is relatively small, whilst a smaller number of years means that participants drop-off more quickly. There is an option for the model to assume no drop-off in participation over time but we believe that in most cases this is an overly-optimistic assumption and not recommend using it. We encourage users to leave the box unchecked and to specify median years of participation

Figure 22: The Median number of years of ongoing participation



3.5 Costs

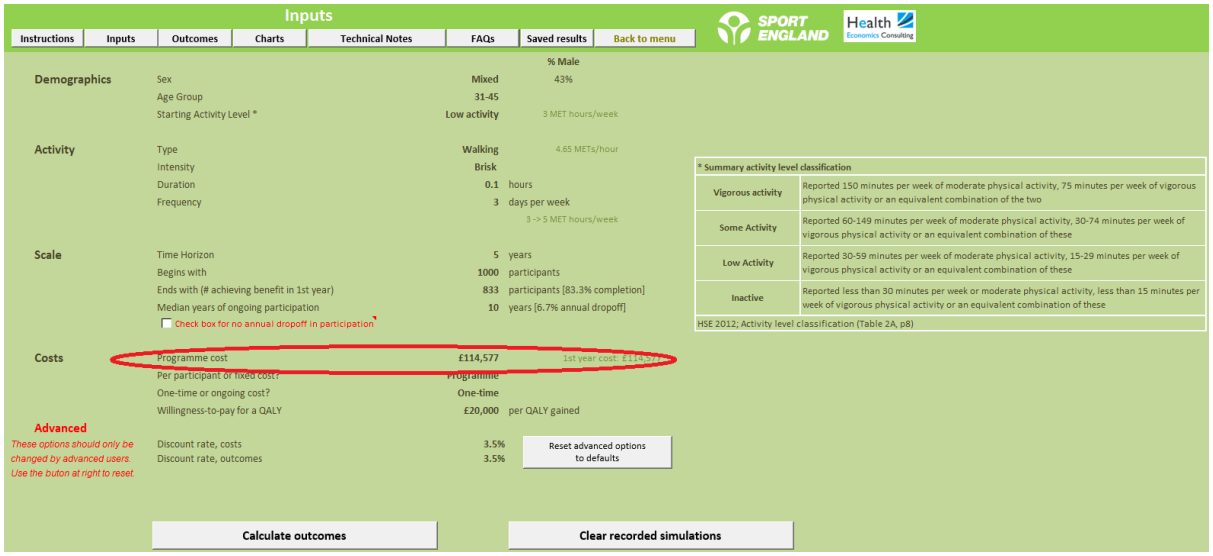
3.5.1 Costs

Cell E20 requires information with regards to the cost of the programme. An added option within the MOVES v2.0 is the choice to model if the cost is a “per participant” or “fixed cost programme cost” and if it is a one-time or ongoing (annual) cost.

Figure 23 presents an example of a per participant on-going programme cost. The model calculates the per participant cost as £100 for the 100 participants. i.e. a £10,000 annual cost. Users should take note of this added option and be aware the costs correspond to the correct options chosen.

The cell is a free text; you need to input the amount you have calculated.

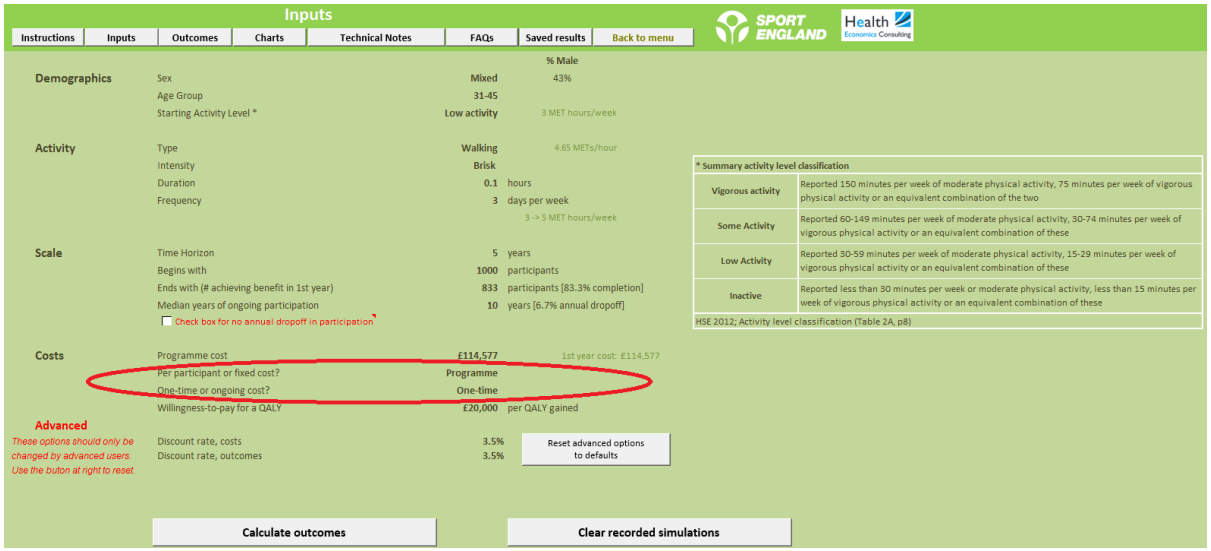
Figure 23: Inputting the programme cost



Once the programme cost has been inserted into the inputs page, users must be careful to ensure they are aware of how the costs are modelled – either as per participant/fixed cost or one-time/ongoing costs.

We recommend ongoing per participant costs as the most realistic costing option. This approach has the advantage of directly linking the costs of an individual's participation to the benefits they generate from that participation. Costing assuming aggregate programme costs does not capture the link of individual participation to the benefits generated from participation.

Figure 24: Deciding upon the per participant/fixed cost and one-time/ongoing cost



3.5.2. Willingness to pay

The willingness to pay threshold represents the 'price' that the health system is willing to pay for a unit of health. In MOVES this is defined as the willingness to pay per QALY gained. Interventions or programmes which can generate a QALYs at less than this cost represent acceptable 'value for money'. The main reason for a threshold is constraints on resources. NICE is the body which sets the willingness to pay threshold, and recommends to value as £20,000. Therefore, any year of life which is valued below this threshold should be considered and implemented. As NICE compare all NHS technology assessments to the £20,000 threshold we do not recommend changing this default value, although some users may wish to test higher thresholds in some circumstances. For example, NICE will consider a threshold as high as £30,000 per QALY when there are special considerations.

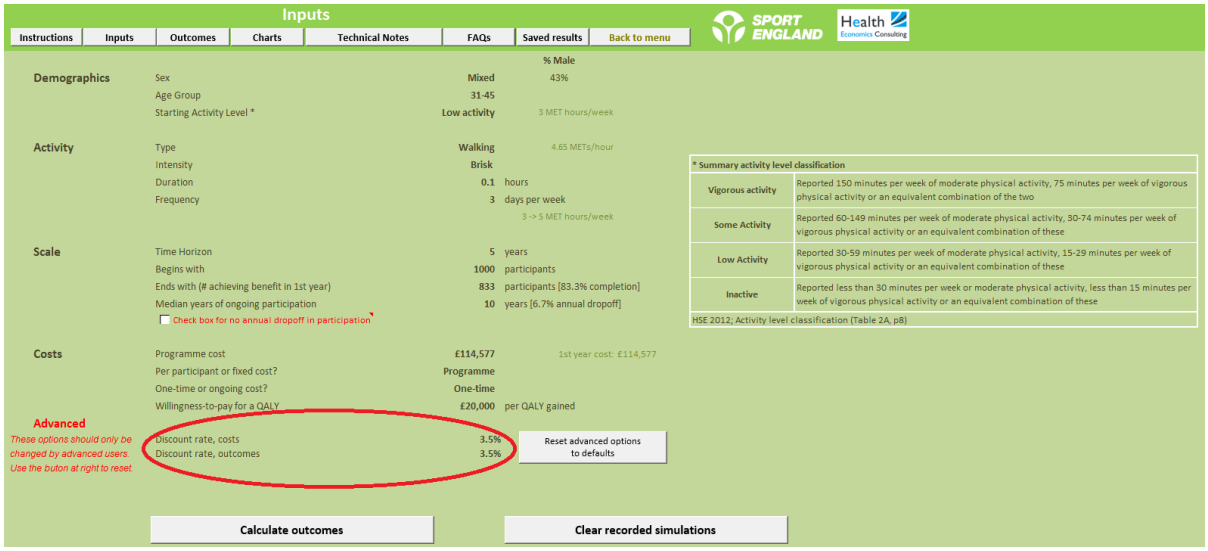
3.6 Advanced options

Another added feature to MOVES v2.0 is the advanced options for users to set if desired. We recommend only where users have an understanding of these parameters, or have had previous experience with health economics modelling to adjust the assumptions set in the default model.

The discount rate is another option for users to change from the default setting if desired. Currently NICE guidance recommends costs and outcomes to be discounted at a rate of 3.5%. The discount rate assumes that the benefits that may be accrued in the future will be worth less than if they are accrued in the present. This has been debated among health economists and although there is sometimes different opinions over the exact rate that should be used, the principle of discounting is widely accepted. If users have a strong reason or evidence specific to the programme or activity being modelled to suggest that future costs and outcomes may be discounted more or less heavily than NICE believes, they can make adjustments to the rate at which costs and benefits are discounted. This option was included to make the calculations of the model as transparent as possible, but in general we do not recommend changing the discount rates.

Figure 25 shows where adjustments to the advanced option settings can be made. Additionally, if users wish to reset changes back to the default values, users can click the “reset advanced options to default” button.

Figure 25: Making adjustments to the advanced option settings



3.6 To Run the Analysis

Once you have inputted all the required data you need to click on the “calculate outcomes” button highlighted in figure 26.

Figure 26: Clicking on the calculate outcomes button runs the cost effectiveness analysis

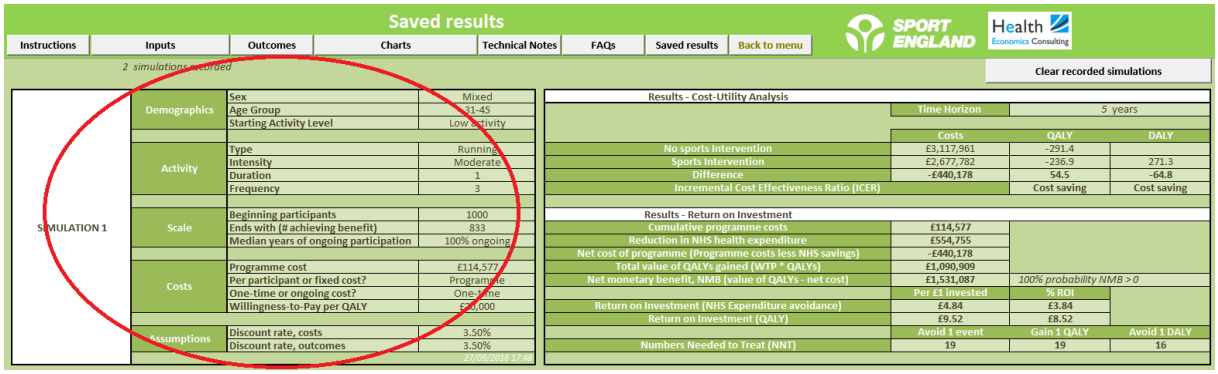
It can take up to two minutes for the analysis to run. A message will appear on the screen to remind of you of this.

You will be asked if you want to save the results of the simulation. Click yes and you will be taken to the saved results section of the tool shown in figure 27.

4.0 Saved Results section

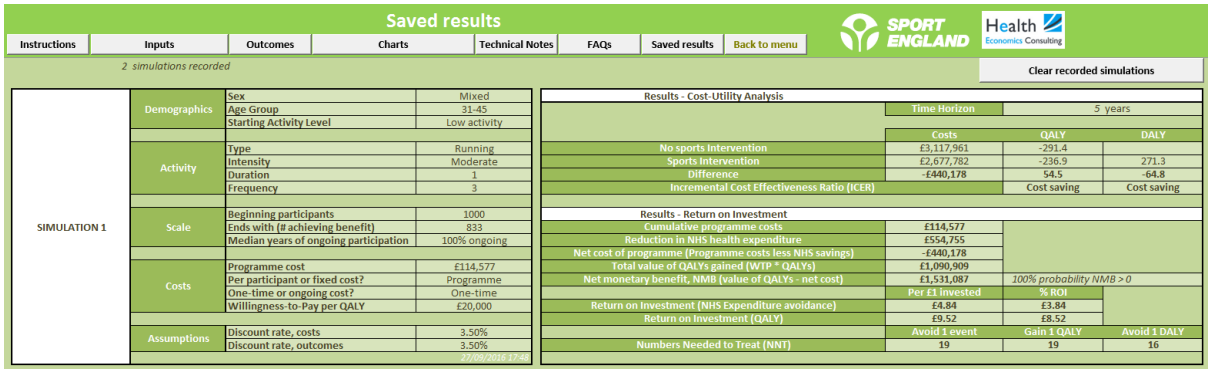
The saved results section of the tool enables up to 15 simulations of the tool to be run and saved and provides an overview of the analysis that has been undertaken. The results of the most recent analysis can also be found in the outcomes section of the tool which provides detailed explanations for each section of the Return on Investment analysis (see pages 36 - 43). If you prefer reviewing the outcomes of the analysis in the "outcomes" page of the tool, we recommend that you take screen shots of each analysis that you complete and save them for future use.

Figure 27: The Saved Results section of the tool



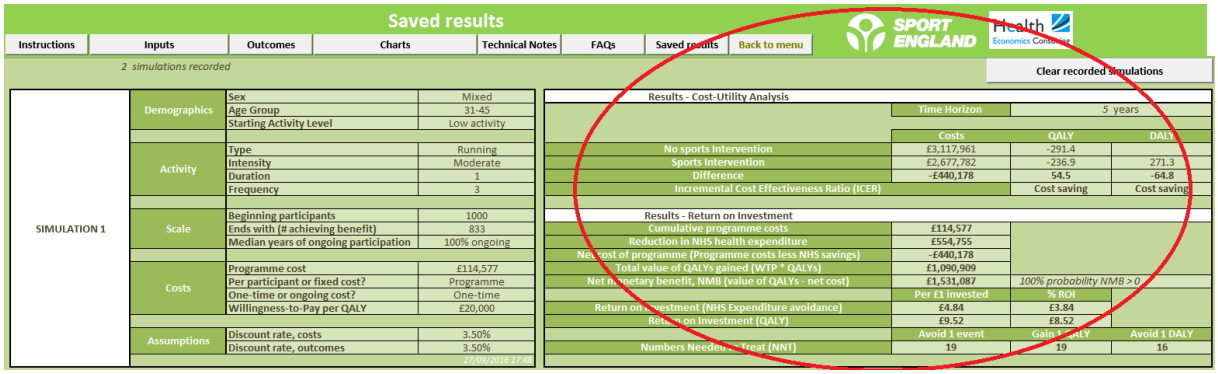
The initial columns on the sheet provide an overview of the information that you input into the tool, as highlighted in figure 27.

Figure 28: The inputs as they are shown in the saved results sheet



This sheet provides a detailed overview of the cost-effectiveness analysis and the return on investment analysis from a savings made to the healthcare sector and a QALY perspective. This is highlighted in figure 29.

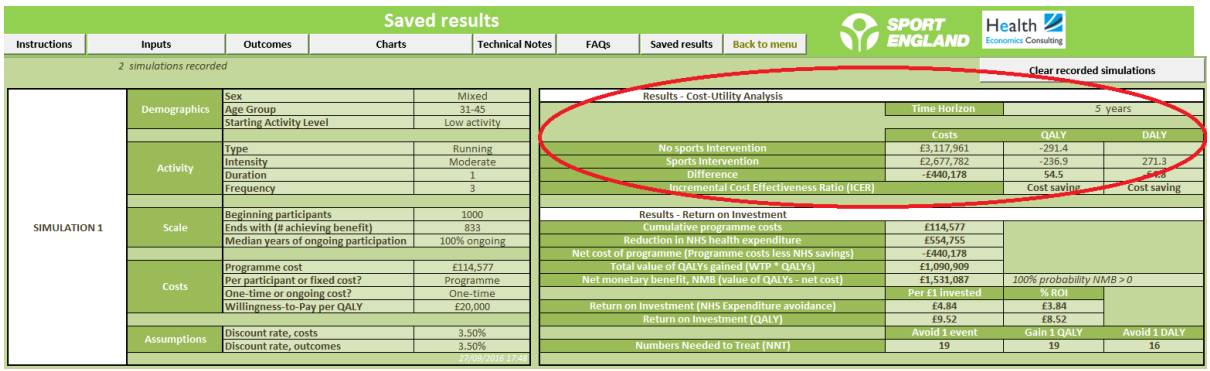
Figure 29: The Results of the analysis



4.1 Cost Utility Results

The cost utility section of the results shows the analysis in terms of cost per QALY gained by increasing physical activity, shown in figure 30.

Figure 30: The Cost Utility Results



The analysis identifies and compares the cost per QALY for the intervention and no intervention and presents the incremental cost effectiveness ratio (ICER). The Incremental Cost Effective Ratio is the ratio of the change in costs to the increase in benefits from the intervention. Further information on the ICER calculations can be found in the outcomes chapter on pages 39 – 41.

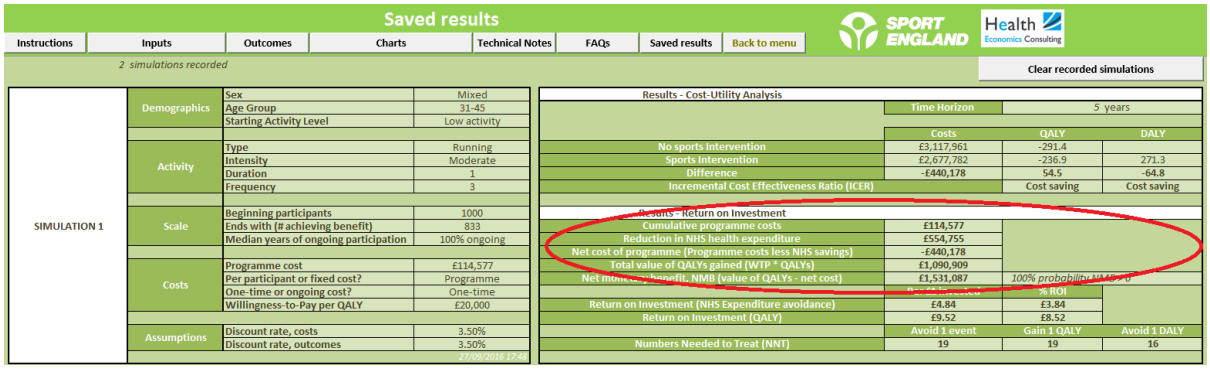
4.2. Return on Investment Results

This section shows the net cost of the programme as the cumulative cost of the programme as specified within the inputs of the model minus the reduction in NHS expenditure as a result of the intervention. The section also shows the total value of QALYs gained which is calculated by multiplying the number of QALYs gained by the willingness to pay for a QALY (QALYS gained x value of QALY (£20,000). These are highlighted in Figure 31.

The net monetary benefit (NMB) is also shown. This is calculated as the difference between the total values of QALYs gained minus the net cost of the programme. Essentially, the net monetary benefit approach allows the change in costs and change in effects to be compared in the same

monetary unit i.e. as costs. The net monetary benefit decision rule is simply: if the NMB value is greater than 0, then the sport or physical activity is cost-effective. The probability the NMB is greater £0 is also presented. This allows the user to understand the likelihood the sport or physical activity will be cost-effective in monetary terms.

Figure 31: The Return on Investment Results



The Return on Investment for NHS expenditure and QALYs is shown in the bottom two lines of the section, highlighted in figure 32.

The Return on Investment (ROI) for the NHS measure looks at the money saved by the NHS as a result of the programme. It looks purely at costs (not benefits). It compares the reduction in treatment costs to the costs of delivering the programme. A ROI less than 1 indicates that the programme costs more to deliver than was saved in terms of treatment costs. A ROI greater than 1 indicates that the programme saved enough in terms of treatment costs to more than cover its own costs. A ROI less than 1 does not necessarily mean the programme is not worthwhile, as by adding in the benefits of the programme you could make a more comprehensive case for investment. Also, if the NHS are not paying for the intervention then any benefit to them may be seen as a bonus.

The QALY return on investment looks at the benefits achieved from a monetary perspective by the programme. It is the product of the Quality Adjusted Life Years gained (as with less disease, people live fuller, longer lives) and the monetary value associated with those QALYs. The benefits are accrued as a product of the willingness-to-pay threshold value. The value also presents a measure of how much the NHS is willing to pay for the benefits that are gained as a result of the intervention. A value greater than £1 would indicate that the benefits are worth more than the programme investment. A value between £0 and £1 would indicate the benefits would produce a positive return, but less than the £1 invested by the NHS. We would hope to see a value greater than £1, i.e. a case where the benefits are worth more than the programme costs. It should be noted that this measure does not take into account savings to the NHS through a reduction in treatment costs. For a holistic view, the QALYs gained and cost difference should be considered to calculate the ICER value. Where the ICER value is less than the £20,000 NICE threshold value, the intervention could still be considered a cost-effective intervention. This is presented in Figure 33.

Figure 32: The Key Return on Investment Figures

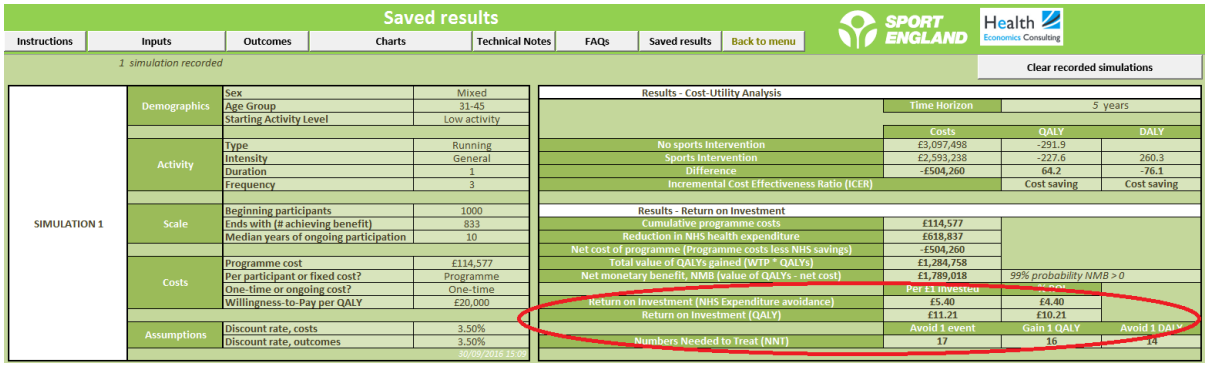
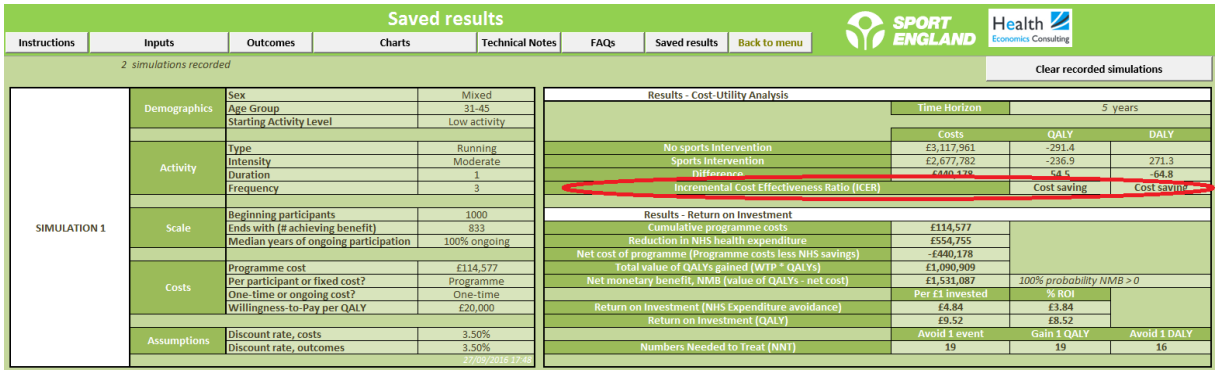


Figure 32 also presents the Numbers needed to treat, the extra participant numbers in the intervention that would be needed to avert one disease event. The number of participants need to gain one extra QALY and to avoid one extra DALY is also presented. This can be useful when planning or reviewing an intervention.

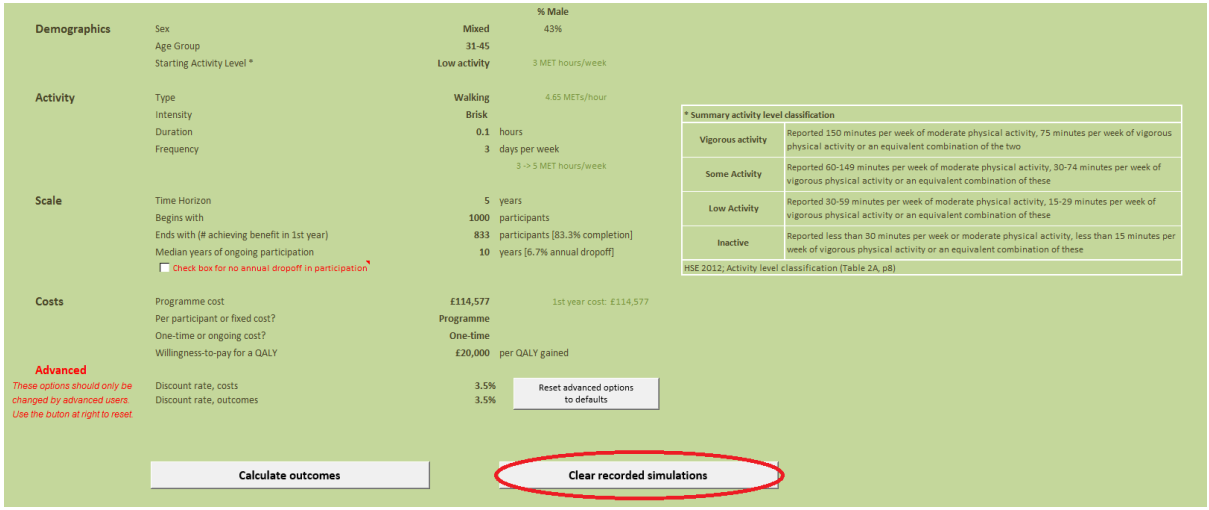
Figure 33: The Incremental Cost-Effective Ratio



4.3 Clearing the recorded simulations

When the maximum number of simulations is reached, click on the clear-recorded simulation button on the inputs page of the tool, to enable further analysis to be run and saved (figure 36). Please be aware that when you click the button all previous simulations will be deleted. You may wish to take screen shots of the previous simulations or cut and paste them into a new set of worksheets should you wish to keep the information.

Figure 34: Clearing the recorded simulations



5.0 The Outcomes Section of the Tool

The outcomes section of the tool can be accessed by clicking on the "outcomes" button on the toolbar at the top of the worksheet, highlighted in figure 35. It can also be accessed from the main menu page by clicking on the button highlighted in figure 36.

Figure 35: Accessing the Outcomes section through the toolbar

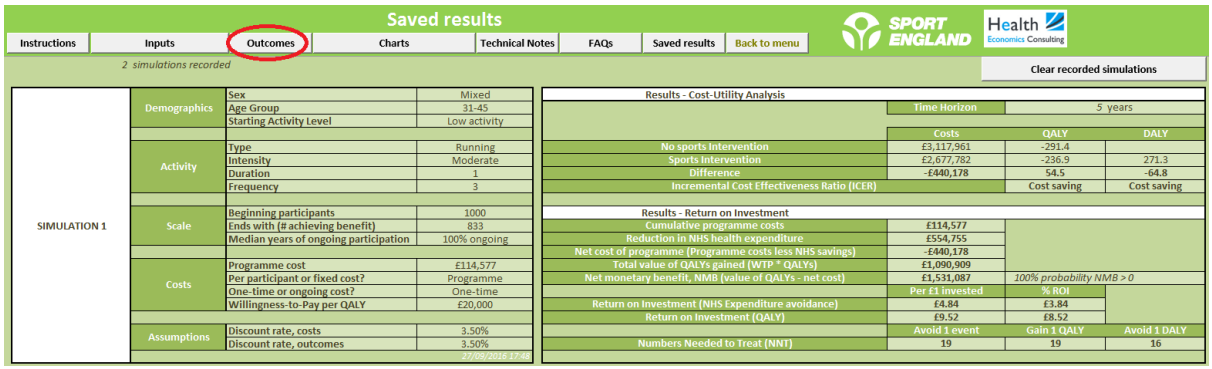


Figure 36: Accessing the Outcomes section through the main menu page

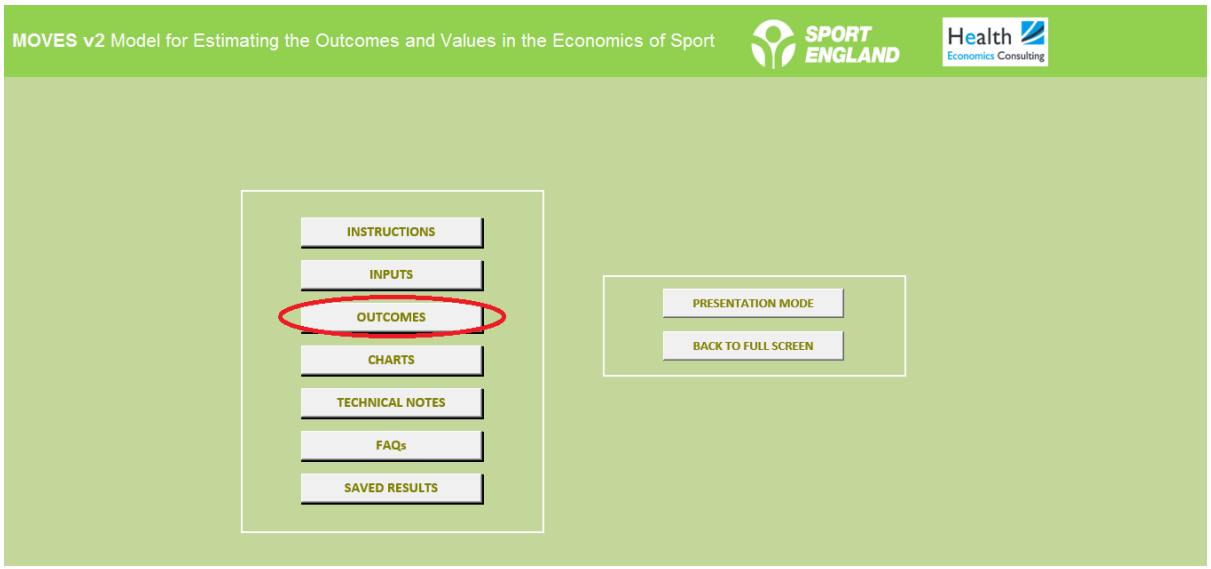
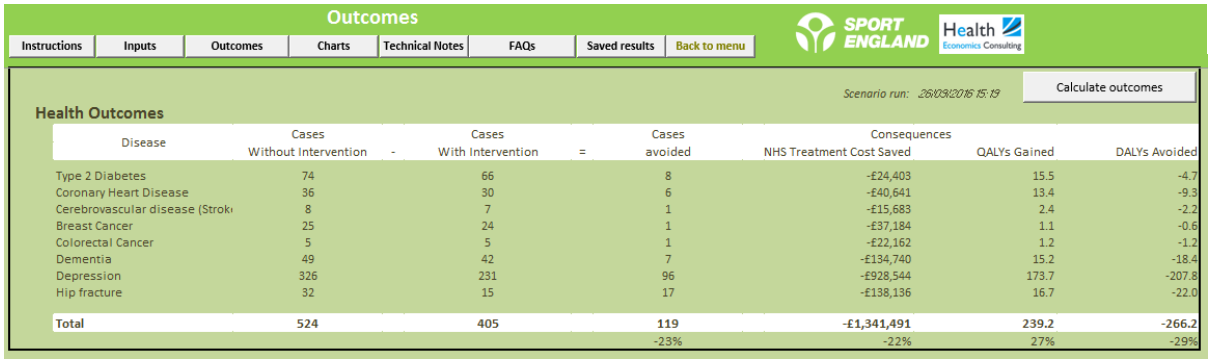


Figure 37 shows the outcomes page when it is first opened.

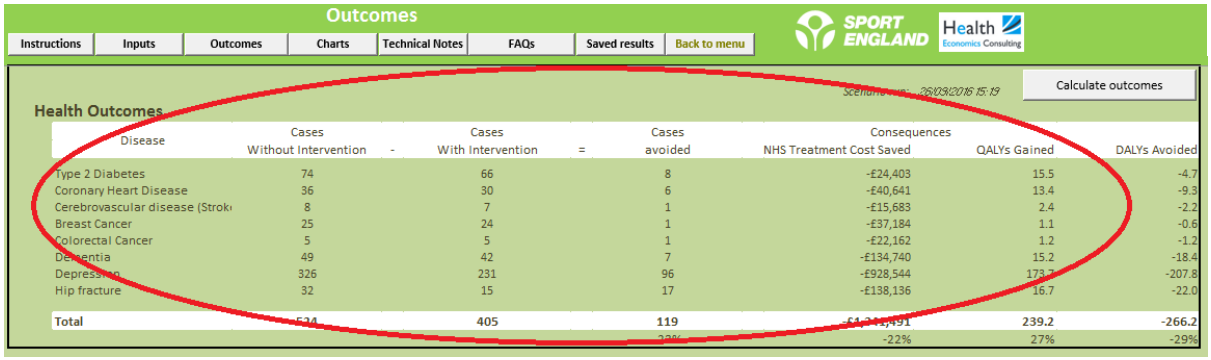
Figure 37: The outcomes page



5.1 Health Outcomes

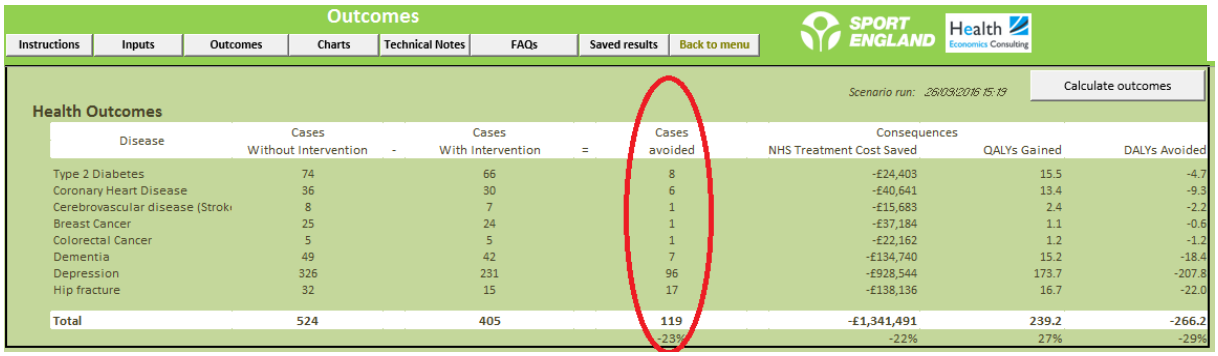
The first section of the outcomes worksheet provides an overview of the health outcomes with and without the intervention across the 8 diseases, providing figures for the NHS treatment costs saved, QALYs gained and DALYs avoided.

Figure 38: The Health outcomes section



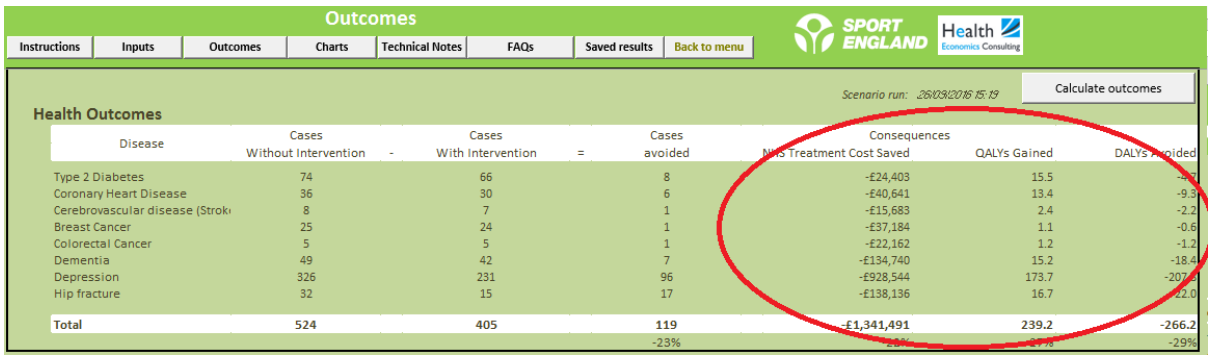
The column providing details of the difference in disease rates without and with the intervention presents the number of cases of the disease that could be prevented by the intervention. An example of this can be seen in figure 39.

Figure 39: Incidences of disease saved



This section always includes the calculations for the NHS treatment costs saved across the 8 diseases the QALYs gained, and the DALYs avoided from participating in the intervention. These figures are highlighted in figure 40.

Figure 40: The NHS treatment costs saved, QALYS gained and DALYs avoided



Disease	Cases Without Intervention	-	Cases With Intervention	=	Cases avoided	Consequences NHS Treatment Cost Saved	QALYs Gained	DALYs Avoided
Type 2 Diabetes	74		66		8	-£24,403	15.5	-9.7
Coronary Heart Disease	36		30		6	-£40,641	13.4	-9.3
Cerebrovascular disease (Stroke	8		7		1	-£15,683	2.4	-2.2
Breast Cancer	25		24		1	-£37,184	1.1	-0.6
Colorectal Cancer	5		5		1	-£22,162	1.2	-1.2
Dementia	49		42		7	-£134,740	15.2	-18.4
Depression	326		231		96	-£928,544	173.7	-207.2
Hip fracture	32		15		17	-£138,136	16.7	-22.0
Total	**524**		**405**		**119**	**-£1,341,491**	**239.2**	**-266.2**
					-23%	-21%	-37%	-29%

The treatment costs saved are shown as a negative number for example -£1,341,491; these are savings to the healthcare system or funds that could be diverted elsewhere. A positive number would suggest costs accruing to the healthcare system. You may want to remove the minus sign from the figure when you present them to others to avoid confusion.

5.2 Cost Effectiveness Analysis

5.2.1. Cost per QALY

The second section of the outcomes page provides the results of the cost-effectiveness analysis. The first calculation given is for the incremental cost effectiveness ratio. The ICER is the ratio of the change in costs to the increase in benefits from the intervention.

The "Without Intervention" cost is the expected cost for the number of cases which may occur for each of the eight conditions modelled within the tool without the intervention having taken place; in other terms, the cost of disease.

Without Intervention Cost = Cost of disease

The "With Intervention" cost is the expected cost for the number of cases that may occur whilst participating in the intervention for each of the eight conditions modelled within the tool, plus the programme cost.

With Intervention Cost = Cost of disease + Programme Cost

The Quality Adjusted Life Year (QALY) values are calculated as the total QALYs that result from participants being in the 'without intervention group' and the 'with intervention group'. It is important to note that QALYs are generated in the without intervention group as well as the with intervention group over the time horizon that you have selected.

The QALYs gained through the intervention delivery is calculated as the total QALYs in the 'without intervention group' minus the total QALYS accrued in the 'intervention group'.

QALYs lost to disease with no intervention- QALYs lost to disease in intervention group= QALYs gained due to intervention

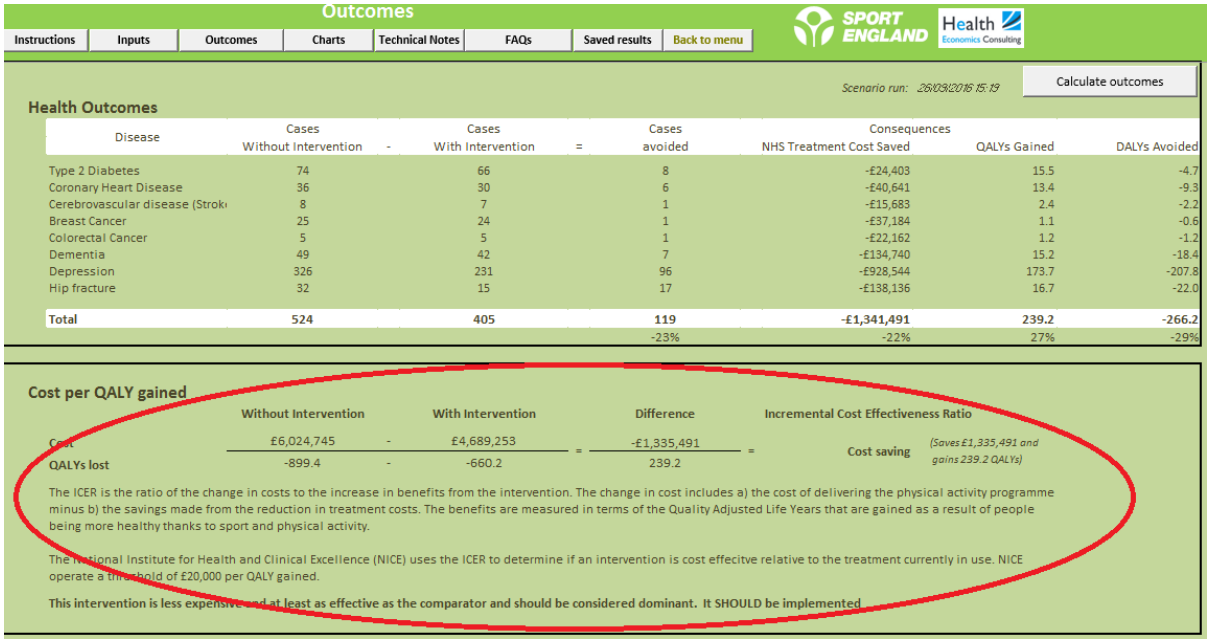
In the example below, 239.2 QALYs are gained i.e. there are more QALYs gained in the intervention group than in the without intervention group. The 'with intervention cost' is -£1,335,491, implying that the with intervention cost saves money. Where the with intervention cost saves money, it is common practice in health economics to only report the cost saving result and not the cost per QALY value. In this example, as the intervention saves money, intuitively the intervention should be implemented as stated. Figure 41 presents how the model will report cost savings result. If the difference between the without intervention and with intervention cost is positive, i.e. the intervention costs more, the cost per QALY is then calculated as the change in cost between the without intervention group and with intervention group, as a ratio of the QALYs gained. i.e. the incremental cost effectiveness ratio (ICER)[2].

Difference in the cost with and without intervention / the number of QALYs gained= ICER

Whether or not an intervention is cost effective is driven by how much the decision maker/commissioner is willing to pay for an additional QALY. The National Institute for Health and Clinical Excellence (NICE) uses the ICER to determine if an intervention is cost effective relative to the treatment currently in use. NICE operate a threshold of £20,000 per QALY gained.

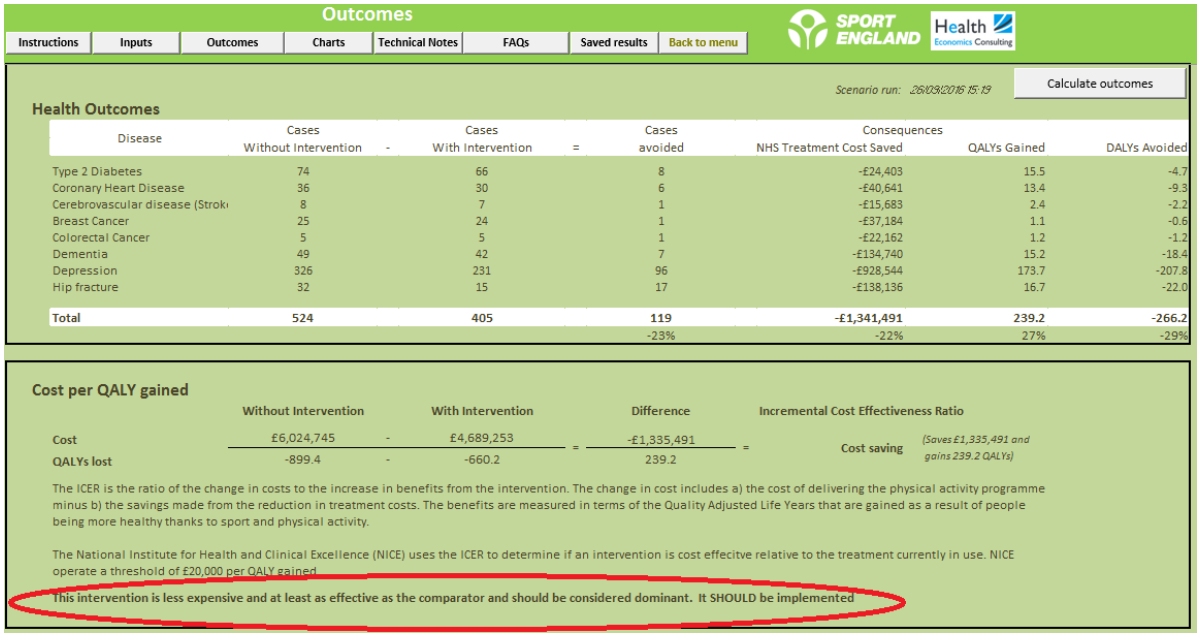
[2] Please see the "what is the ICER?" answer in the FAQs for further explanation.

Figure 41: The ICER calculation



The last line in this part of the section (line 29) provides an explanation of whether the intervention is cost effective or not and whether the intervention should be implemented or not. This is presented in figure 42. Where the difference in cost between the intervention and no intervention is negative, the ICER value is not calculated. The model will present the ICER value as "cost saving". A cost saving result indicates the intervention is less expensive than no intervention, even where the programme costs are considered. The benefits of intervention will be the same or greater than no intervention. When reporting cost savings, we recommend you report the amount the intervention saves in comparison to the without intervention approach. For the above example as presented in figure 41 you could report that the intervention leads to a cost saving of £1,335,491 and a total QALY gain of 239.2 QALYs.

Figure 42: The cost effectiveness explanation



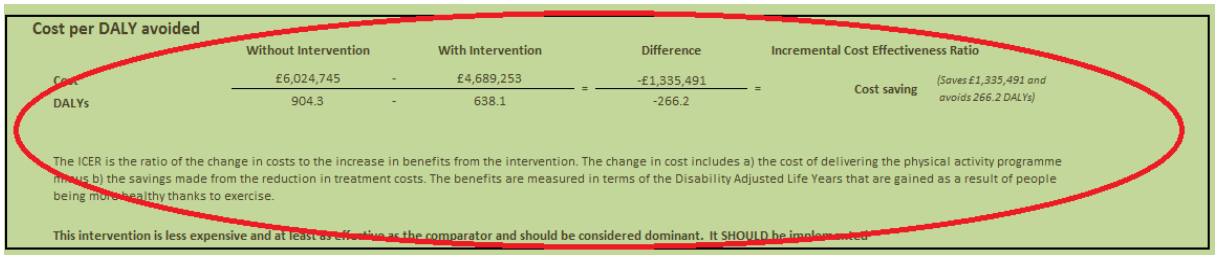
5.2.2. Cost per DALY

The cost per DALY avoided is presented and calculated in the same manner as the cost per QALY gained however the benefits are measured in terms of disability adjusted life years that are avoided as a result of people participating in a sport or physical activity.

Figure 43 highlights the cost per DALY avoided within the outcomes page. The DALYs avoided in this case is the number of "healthy years" that will not be lost for those who took part in the intervention. The DALY is thought to be one lost year of "healthy" life (WHO reference). Therefore, in the example above 0.2 years of healthy life will not be lost as a result of the intervention. Where the difference in DALYs avoided is negative, we can assume the number of healthy years are not lost as a result of the intervention.

Users should note that whilst the calculation of cost per DALY is the same method as the cost per QALY, the two are not comparable and should be treated as two independent outcome results.

Figure 43: Cost per DALY avoided

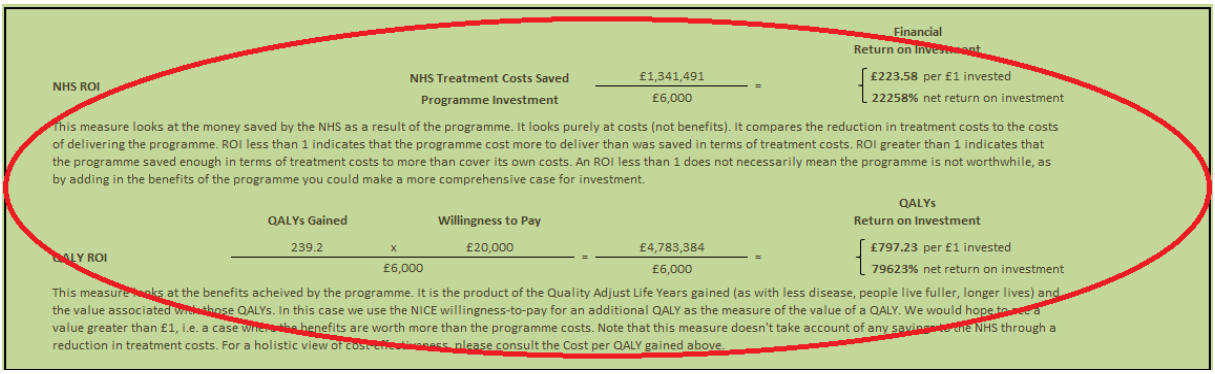


5.3 Return on Investment

5.3.1 The Return on Investment for the NHS each £1 invested in the intervention

The Return on Investment (ROI) for the NHS measure looks at the money saved by the NHS as a result of the programme. It looks purely at costs (not benefits). It compares the reduction in treatment costs to the costs of delivering the programme. A ROI less than 1 indicates that the programme costs more to deliver than was saved in terms of treatment costs. A ROI greater than 1, as shown in figure 44 indicates that the programme saved enough in terms of treatment costs to more than cover its own costs. A ROI less than 1 does not necessarily mean the programme is not worthwhile, as by adding in the benefits of the programme you could make a more comprehensive case for investment. Also if the NHS is not investing in the intervention, any ROI to them may be considered as added value and may be useful in strategic positioning conversations.

Figure 44: The Return on Investment for the NHS each £1 invested in the intervention



5.3.2 The Return on Investment for the Benefits of the Intervention

The QALY return on investment looks at the benefits achieved from a monetary perspective by the programme. It is the product of the Quality Adjusted Life Years gained (as with less disease, people live fuller, longer lives) and the value associated with those QALYs.

ROI= QALYs gained x value of QALY (£20,000)

The benefits are accrued as a product of the willingness-to-pay threshold value. The value also presents a measure of how much the NHS is willing to pay for the benefits that are gained as a result of the intervention. If a higher WTP threshold of £30,000 is assumed, the amount per £1 invested would increase to reflect the increase in the amount willing to be paid for the QALY's gained. A value greater than £1 would indicate that the benefits are worth more than the programme investment. A value between £0 and £1 would indicate the benefits would produce a positive return, but less than the £1 invested by the NHS. We would hope to see a value greater than £1, i.e. a case where the benefits are worth more than the programme costs. It should be noted that this measure does not take into account savings to the NHS through a reduction in treatment costs. For a holistic view, the QALYs gained and cost difference should be considered to calculate the ICER value. Where the ICER value is less than the £20,000 NICE threshold value, the intervention could still be considered a cost-effective intervention.

Figure 45: The return on investment for the benefits of the intervention

5.3.4. Number Needed to Treat (NNT) and Probabilistic Scenarios

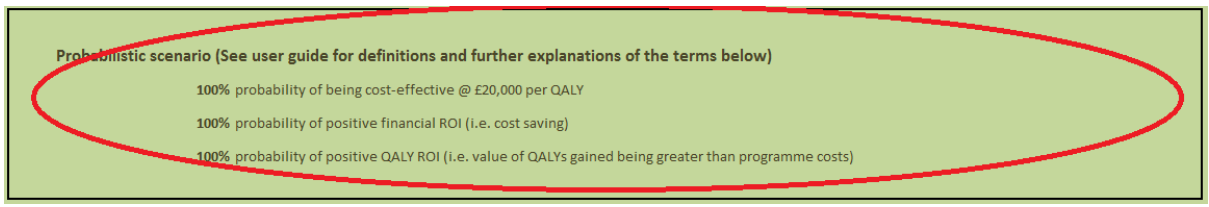
The numbers needed to treat presents the numbers of participants required to avoid 1 disease event, the number of participants to gain 1 QALY and to avoid 1 DALY. This is particularly useful in planning and reviewing interventions.

These results can be compared with different NNT outcome results simulated from the MOVES model, however we do not recommend they be used for comparison with other cost-effectiveness models.

Figure 46 presents where these values can be found.

The probabilistic scenarios are highlighted below in figure 47. These values present the probability of the result being cost-effective, cost saving and returning a positive QALY return on investment. We recommend reporting the results of the probabilistic scenarios to support robustness of the cost-effectiveness and return on investment results within reports to investors or commissioners.

Figure 47: Probabilistic Scenario outputs



6.0 The Charts Section of the Tool

This section of the tool provides advanced analysis for users who are interested in understanding more about the detail behind the results. You don't need to understand the charts to be able to use the tool however it can be helpful in determining the results because it will enable you to take into account the distribution of the simulations that are run for each scenario.

The ICER should not be viewed only as a single number. The disease model within MOVES runs each population cohort a 1000 times for better statistical accuracy. This effectively means that it takes 1000 people and follows them through the process as though they had no intervention and then follows them through as having received the intervention.

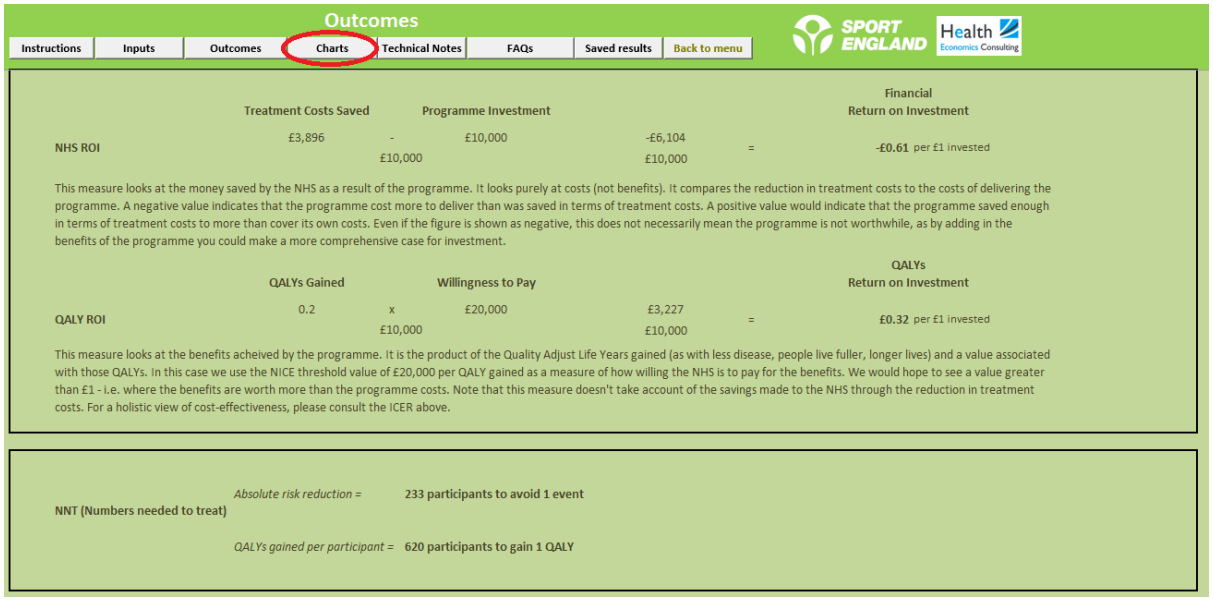
Each time you run a simulation, the population cohort is taken from a new group of 1,000 people that meet the characteristics you have inputted. For this reason, it is possible to run the same case study model but get slightly different outcomes on each occasion.

We can learn more about the variability of the ICER, and thus the confidence we may have in the single estimate, by considering the distribution of results.

Each of the points in the charts represents the results of a single run of the simulation. Collectively they depict the distribution of results. This section of the tool provides charts detailing the probabilistic cost-effectiveness scatterplot, treatment cost savings by cases averted and cost effectiveness acceptability distribution curve.

This section of the tool can be accessed by clicking on the charts button in the toolbar at the top of the worksheet (shown in figure 48). It can also be accessed via the main menu.

Figure 48: Accessing the charts section of the tool



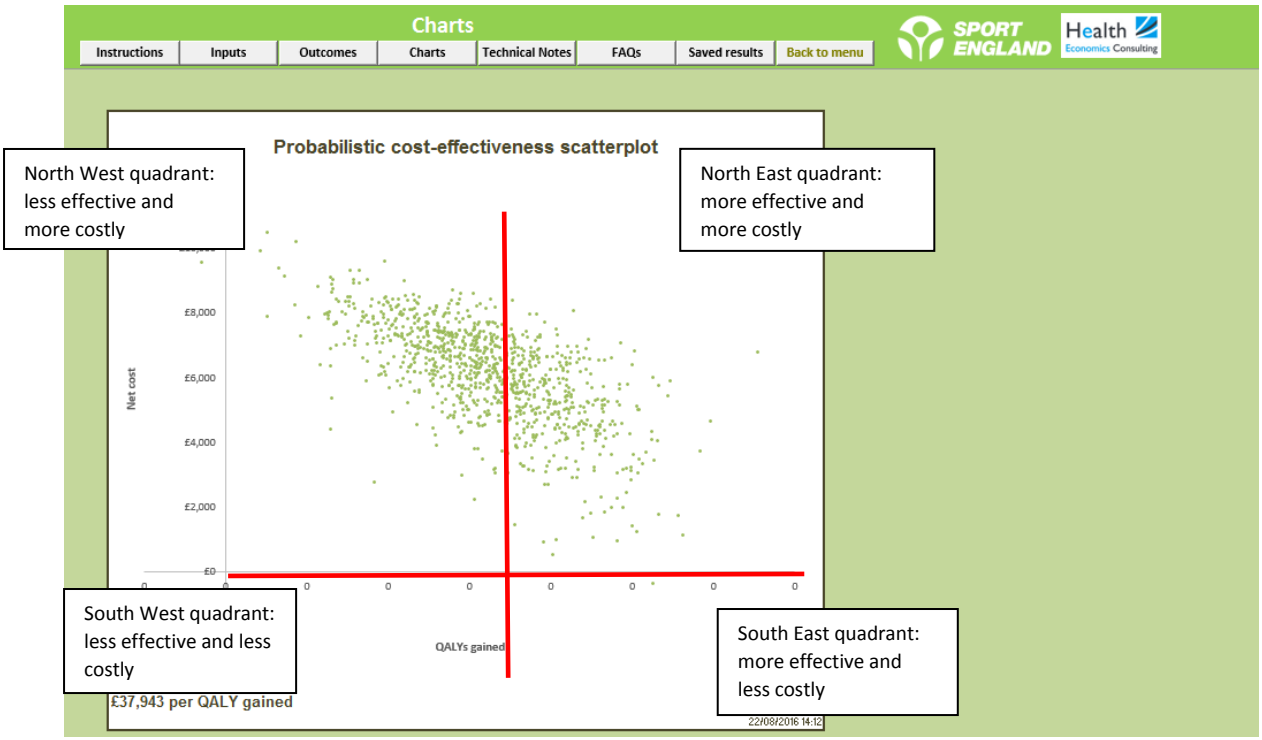
6.1 Cost Effectiveness Scatterplot

The first chart shown in the worksheet is for the cost effectiveness distribution. Shown in figure 49.

The Cost-Effectiveness Scatterplot presents the two components of the ICER against one another - costs vs benefits. This shows how each component varies around its mean, and how each component varies with respect to the other.

Figure 49 presents the results that are generated from running the model probabilistically (i.e. 1000 times to account for the variation (uncertainty) that occurs around the input parameters). Each point represents a cost per QALY value. Interpretation of the dispersion of where the points accumulate will provide the user with an idea of how their cost per QALY value may differ as a result of uncertainty.

Figure 49: Cost-Effectiveness Scatterplot



A very disbursed pattern rather than a closely concentrated one indicates that we must take care when interpreting the single number ICER (the average value masks the variation underneath).

If the majority of the ICER points are found within the South East quadrant of the chart, it suggests that the intervention is more effective and less costly than the alternative, in this case no intervention. This effectively suggests that the "sport intervention" is the dominant intervention. It follows therefore that the "no sport intervention" is the dominated intervention. In other words, the "sport intervention" costs less and is more effective than no intervention.

If the majority of the points are found in the North East quadrant of the chart, it suggests that the intervention is more effective but is also costlier than the alternative, in this case no intervention.

If the majority of points are found in the South West quadrant of the chart, it suggests that the intervention is less effective and less costly than the alternative, no intervention.

If the majority of points are found in the North West quadrant of the chart, it suggests that the intervention is less effective and costlier and would be deemed not cost effective.

You should consider whether the distribution of the ICERs cross either axis at any point then, in those cases at least we may be better-off not implementing the programme as it is too expensive or not sufficiently effective. This is not necessarily a concern if only a few points cross the axis but if significant numbers do then the programme may be considered less cost effective. Further examples of this analysis can be seen in the Case Study section of the User Guide.

6.2. Cost-Effectiveness Acceptability Curve

The second chart shows the Cost-Effectiveness Acceptability Curve comparing the results against a range of thresholds of willingness to pay (Figure 50). As the threshold rises, the proportion of simulations (or probability of) being judged cost-effective increases. You may use this curve to understand what the probability of cost effectiveness is given how willing one (the funder) is to pay per QALY gained. Similarly, the cost-effectiveness acceptability curve allows you to find the willingness-to-pay threshold to ensure the programme is 100% cost-effective (i.e. where the willingness-to pay-value hits the 100% probability of cost-effectiveness).

Figure 50 shows that at £20,000 per QALY gained, there is a 95% probability the programme will be cost-effective.

NB: The NICE threshold value for willingness to pay is £20,000 per QALY gained.

Figure 50: The Cost-Effectiveness Acceptability Curve

The information in this chart is used to determine the probabilistic scenarios in the tools outcomes.

7.0 Using the Outcomes of the Tool

The following case studies have been developed to highlight the effects of the time horizon on the outcomes of the MOVES analysis and provide an example of how the figures from the tool can be extracted into sentences within reports, commissioning plans and presentations.

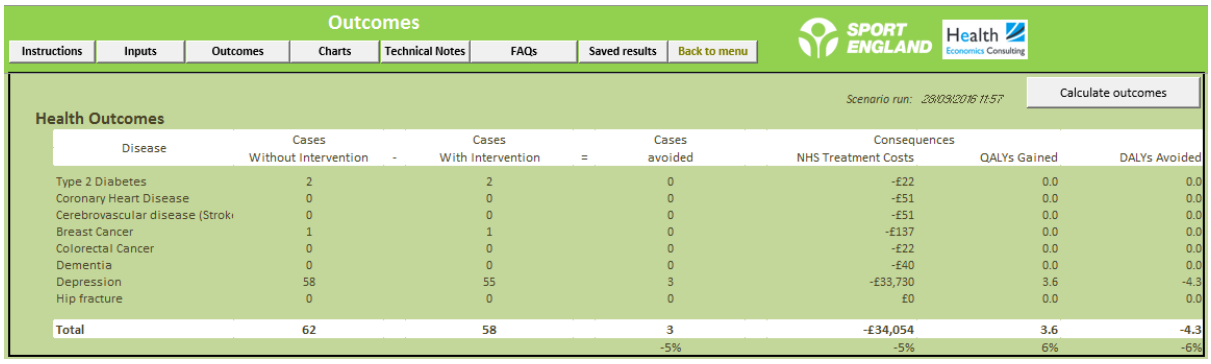
7.1 Case Study 1

A running programme for a mixed group of 31-45 year olds who are moderately inactive is set up, costing £200 per participant each year. 43% of the group are male. The session encourages participants to run at an average speed (general) for 1 hour 1 days per week and attracts 200 participants across the year with 70 dropping out over that time. The analysis is run for a 5-year time period to look at the shorter-term benefits. We assume the median years of ongoing participation is 10 years and assume the default settings for discount rate on the costs and outcomes

Figure 51: The Inputs

The results of the analysis are shown in figures 52, 53 and 54.

Figure 52: The Health Outcomes



Disease	Cases Without Intervention	-	Cases With Intervention	=	Cases avoided	Consequences NHS Treatment Costs	QALYs Gained	DALYs Avoided
Type 2 Diabetes	2		2		0	-£22	0.0	0.0
Coronary Heart Disease	0		0		0	-£51	0.0	0.0
Cerebrovascular disease (Strok	0		0		0	-£51	0.0	0.0
Breast Cancer	1		1		0	-£137	0.0	0.0
Colorectal Cancer	0		0		0	-£22	0.0	0.0
Dementia	0		0		0	-£40	0.0	0.0
Depression	58		55		3	-£33,730	3.6	-4.3
Hip fracture	0		0		0	£0	0.0	0.0
Total	62		58		3	-£34,054	3.6	-4.3
					-5%	-5%	6%	-6%

Figure 53: Cost Effectiveness Analysis

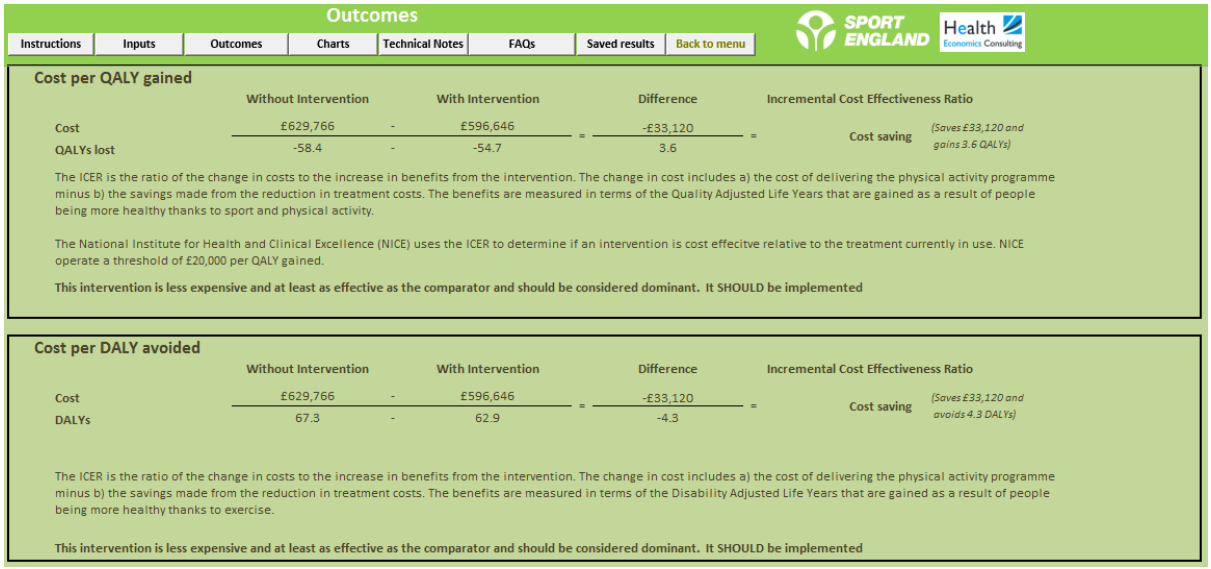


Figure 54: The Return on Investment Analysis

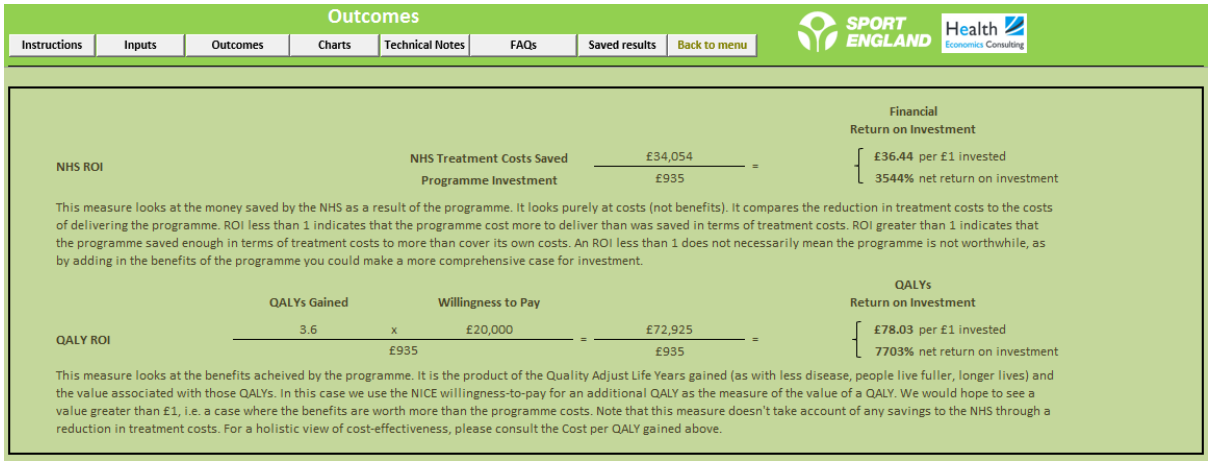


Figure 55: Numbers needed to treat and probabilistic scenario results

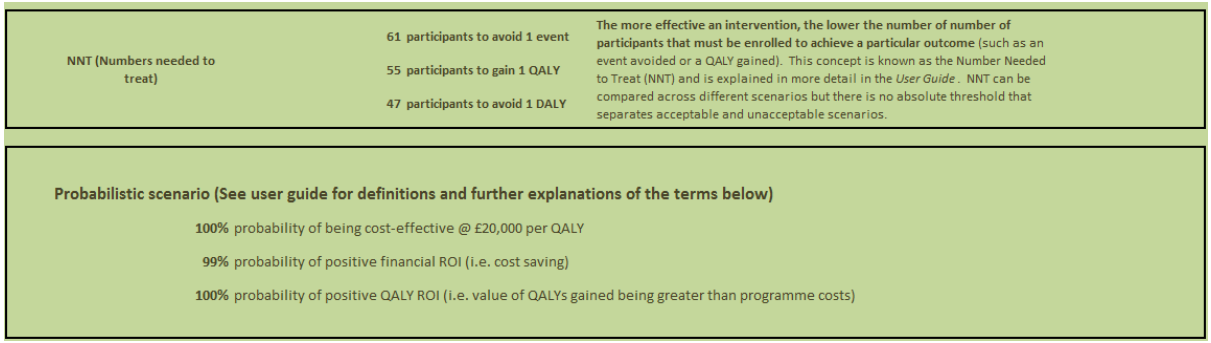


Figure 52 presents that a total of 3 cases of disease are avoided. In terms of NHS treatment costs, this sport intervention will lead to a saving to the NHS of £34,054. A total of 3.6 QALYs are gained and a total of 4.3 DALYS are avoided, as a result of the intervention.

In terms of the cost effectiveness results, the analysis shows that the cost per QALY and cost per DALY is cost saving, as reported in Figure 53. The intervention will result in savings to the NHS and savings overall, even where the programme cost is accounted for. As the intervention is less expensive overall, we do not report the ICER value for the cost per QALY or DALY. However, we can report that the programme will result in cost savings of £33,120 and gains in benefits of 3.6 QALYs and 4.3 DALYs.

As the intervention is cost-saving, we can conclude the intervention is less expensive and at least as effective as no intervention. The intervention dominates the no intervention and as stated in Figure 53, the intervention SHOULD be implemented. This can be clearly seen in Figure 56 which shows the ICER points in the south east quadrant. This highlights that the "sport intervention" is the dominant intervention. It follows that the "no sport intervention" is the dominated intervention. In other words, the "sport intervention" costs less and is more effective.

The NHS return on investment result suggests for every £1 invested by the NHS, £36.44 will be returned, as a result of the NHS saving costs. Where the measure of benefits is quantified in monetary terms, the return of investment for the programme in terms of QALYs is £78.03 per £1 spent. Therefore, for every £1 invested by the NHS, the programme will return almost the same amount back, or a 4003% net return on investment. These results are presented in figure 54.

The numbers needed to treat show that 61 participants are needed to avoid 1 event, 55 participants to gain 1 QALY, and 47 participants to avoid 1 DALY.

The probability the result will lead to a positive return on investment on the benefits is 100% and probability the result remains cost saving is 99%. This is reflected graphically in figure 56 which presents almost all of the points in the southwest quadrant. The probabilistic scenario shows that the probability the programme will definitely produce a cost-effective result is 100%. This is shown in the cost-effectiveness acceptability curve in figure 57. At a £20,000 cost per QALY threshold, the probability of cost-effectiveness is 100%.

Figure 56: Probabilistic cost-effectiveness scatterplot

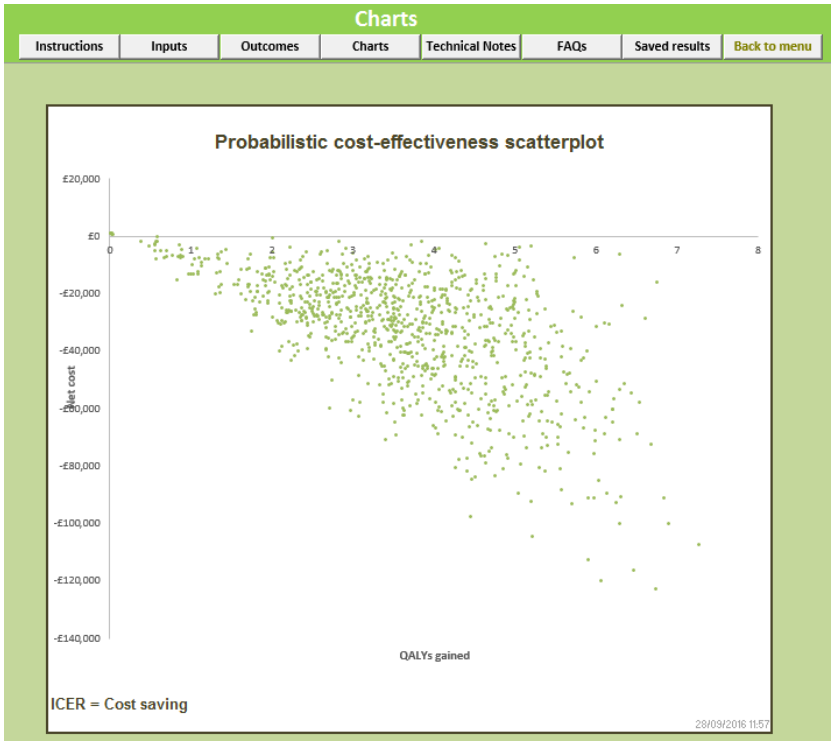
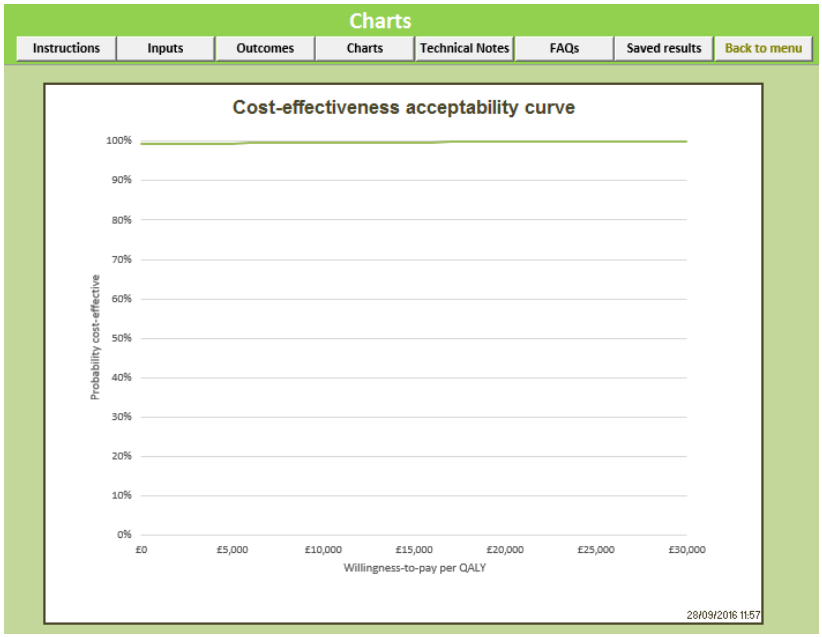


Figure 57: The Cost-effectiveness acceptability curve



7.2 Case Study 2

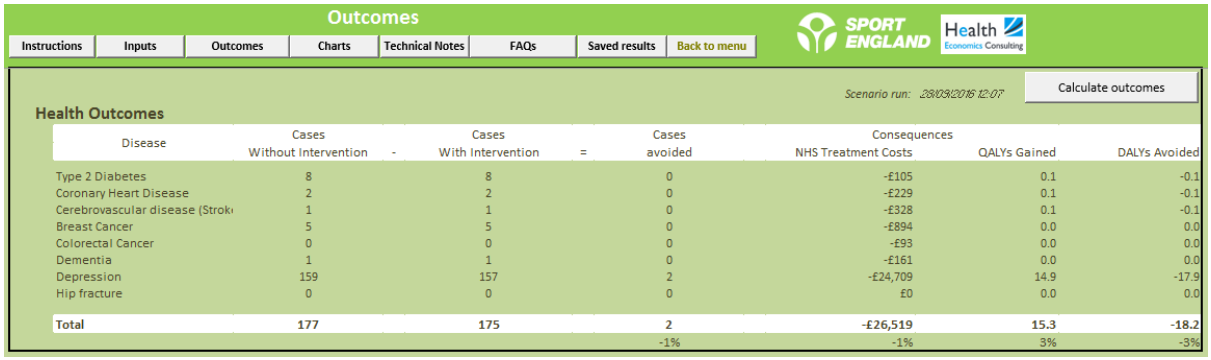
A running programme for a mixed group of 31-45 year olds with low activity is set up, costing £200 per participant each year. 43% of the group are male. The session encourages participants to run at an average speed (general) for 1 hour 1 days per week and attracts 200 participants across the year with 70 dropping out over that time. The analysis is run for a 25-year time period

to look at the longer-term benefits. The median years of ongoing participation is set at 10 years. We assume the default setting for the advanced options.

Figure 58: The inputs for the analysis

The results are shown are in figures 59, 60 and 61.

Figure 59: The health outcomes



Disease	Cases Without Intervention	-	Cases With Intervention	=	Cases avoided	Consequences NHS Treatment Costs	QALYs Gained	DALYs Avoided
Type 2 Diabetes	8		8		0	-£105	0.1	-0.1
Coronary Heart Disease	2		2		0	-£229	0.1	-0.1
Cerebrovascular disease (Stroke	1		1		0	-£328	0.1	-0.1
Breast Cancer	5		5		0	-£894	0.0	0.0
Colorectal Cancer	0		0		0	-£93	0.0	0.0
Dementia	1		1		0	-£161	0.0	0.0
Depression	159		157		2	-£24,709	14.9	-17.9
Hip fracture	0		0		0	£0	0.0	0.0
Total	**177**		**175**		**2**	**-£26,519**	**15.3**	**-18.2**
					-1%	-1%	3%	-3%

Figure 60: Cost effectiveness Analysis

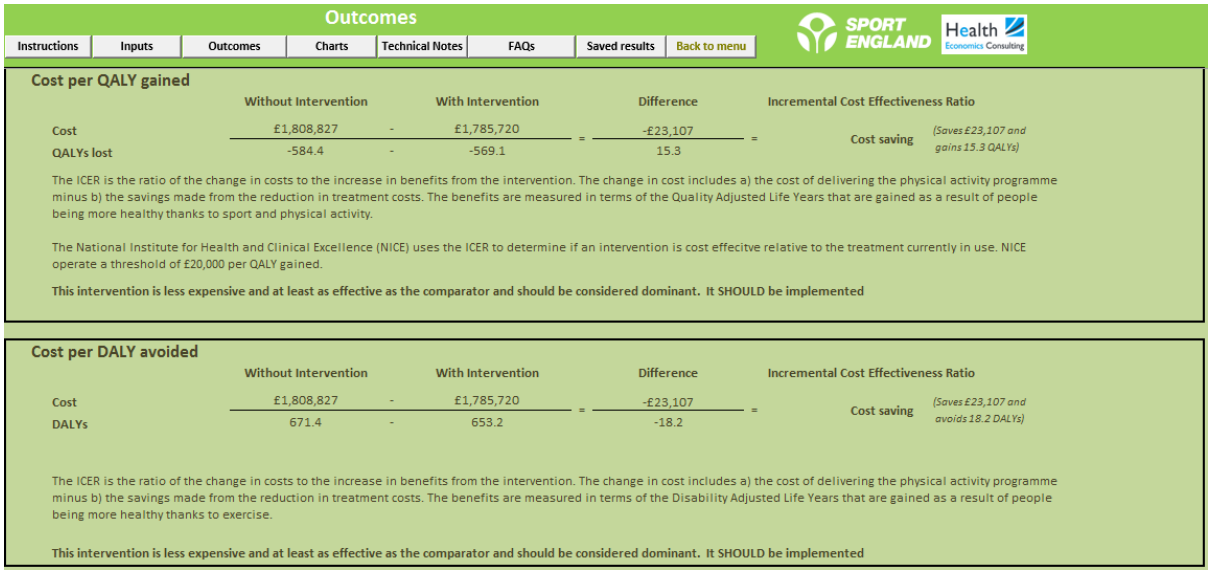
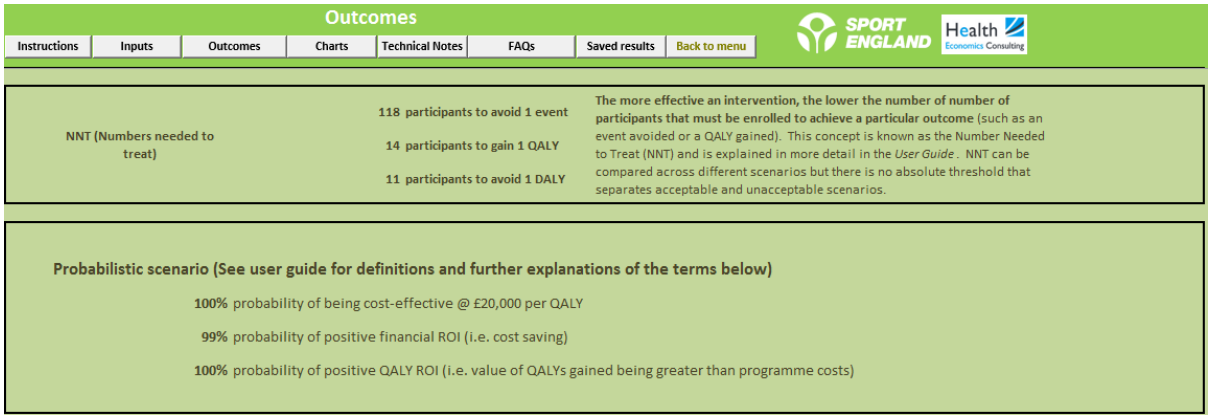


Figure 61: The Return on Investment Analysis

Figure 63: Numbers needed to treat and Probabilistic scenario analysis

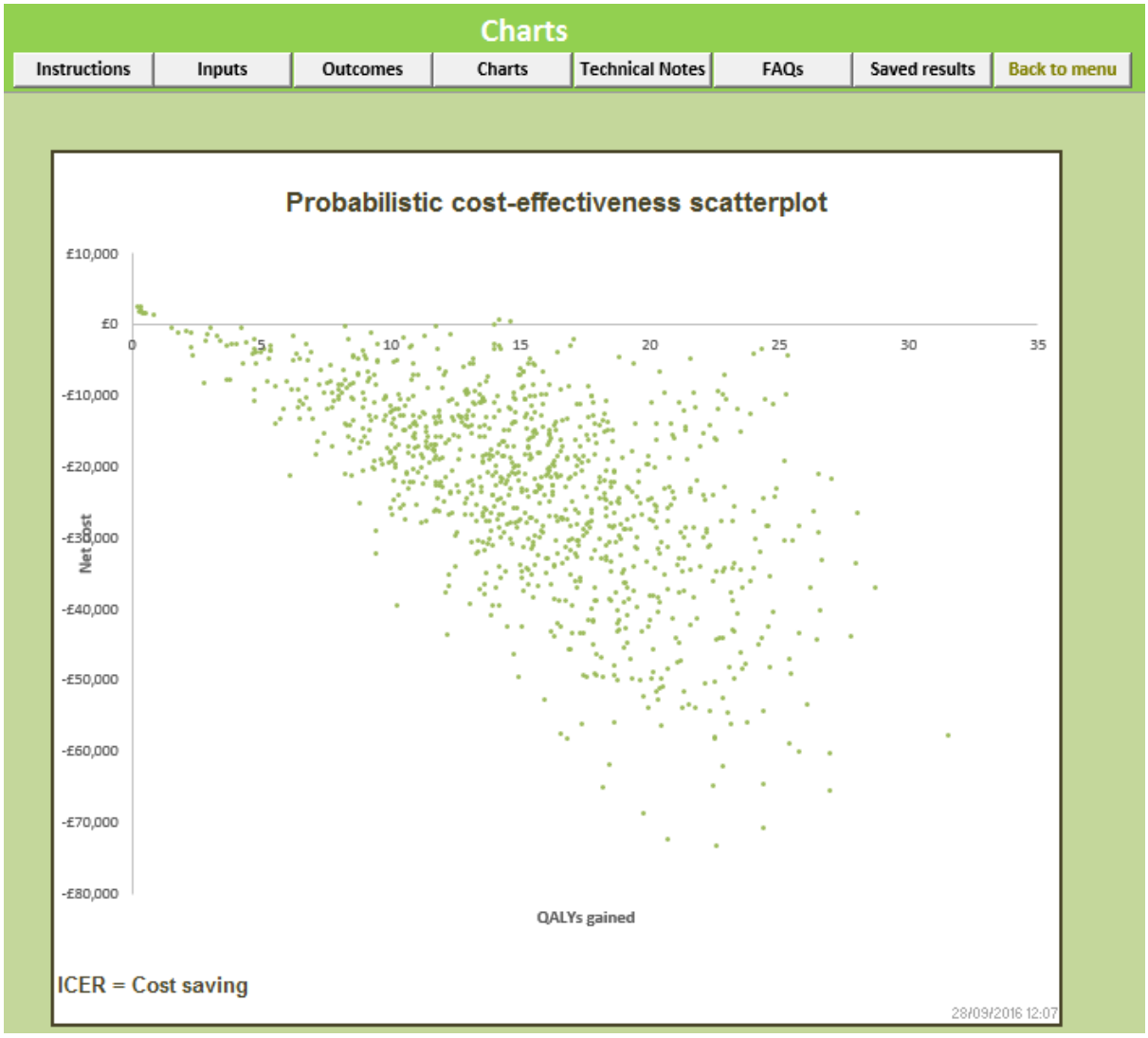


The results presented in figure 59 show a total of 2 disease cases avoided. In terms of NHS treatment costs, the running programme could lead to savings of £26,519 over the 25-year time horizon. A total of 15.3 QALYs would be gained and 18.2 DALYs avoided.

As the analysis projects the results over a 25-year time horizon, the running programme continues to be cost saving, however, saves less money at a 25-year time horizon of £23,107. The programme is cost saving, therefore less expensive than the without intervention costs and leads to a gain in QALYs of 15.3 and 18.2 DALYs avoided. The number of cases avoided is now 2 and not 3 as in case study 1. Users should note that under most scenarios the number of people maintaining their activity levels will fall over time. Depending on how rapidly participation falls, it could mean that there are no active participants in the latter stages of a long analysis horizon and that everyone has returned to baseline risk. In such a scenario, extending the analysis horizon would not add any cases avoided.

The overall result continues to be cost saving, however at a lower value than in case study 1. This is demonstrated in the financial return of the investment which has decreased from 35444% to 677%. Due to the longer time horizon, the total number of QALYs gained over time has increased and in terms of the QALY ROI, a great return of investment is displayed. As a result, the probabilistic scenario results still present the programme to be effective, with 100% probability. This is reported in figure 64, which continues to present the majority of the scatterplots in the southeast quadrant. This allows the user to conclude that the programme is continues to be cost saving at a longer time horizon.

Figure 64: The Cost-effectiveness scatterplot



7.3 Using the results for Strategic positioning

The MOVES tool has been designed to evaluate programmes that you as an organisation may wish to commission or have already commissioned. The tool can also be used to aid you in strategically positioning your organisation and programme delivery by including health and return on investment outcomes. By aligning the results of your analysis of current programmes of delivery with the priorities of local health organisations you may have an opportunity to develop a more strategic relationship with Public Health Teams, Clinical Commissioning Groups, NHS Trusts and wider health bodies.

The outcomes from the tool will enable you to make the case for how you are already contributing to their priorities and possibly open the door for a closer relationship in the future to provide mutually beneficial outcomes. An example of aligning the results of the tool with local health priorities can be seen in table 3.

The analysis results can also enable you to consider how your current delivery could be more closely aligned to health priorities, if you were to make minor adjustments to your current delivery mechanisms (see section 7.5).

7.4 Using the results for making the business case for physical activity interventions

If you would like to use the tool to make the business case for investment into a specific intervention it is recommended that you undertake some research into your local Joint Strategic Needs Assessment Priorities and the priorities of the organisation you are seeking investment from e.g. the Health and Wellbeing Board, Clinical Commissioning Group. You should also have a good understanding of any specific commissioning prospectus that you are responding too.

This will enable you to select the most appropriate data from the tool to develop your business case. An example of this can be seen in table 3.

Table 3: An example of aligning the results of the tool with local health priorities

CCG Priorities	5 Year Time Horizon	20 Year Time Horizon
Reduce premature mortality	28 cases of depression averted. Depression increases risk of mortality by 50% an doubles risk of CHD 1 case Type 2 Diabetes averted	17 cases of depression averted, 1 case of Diabetes, 1 case CHD, 1 case of Breast Cancer
Reduce emergency admissions		Potentially reduce 1 case CHD and 1 case of Breast Cancer requiring admission to hospital.
Improved quality of life for long term conditions	33.1 QALYs gained 38.3 DALYs avoided	126 QALYs gained 144 DAYs avoided
Improved Mental Health and well-being	28 cases of depression averted. 33.1 QALYs gained	17 cases of depression averted. 126 QALYs gained
Efficiencies and budget savings	£306,843 available for redeployment in the NHS. ROI of £2.68 for every £1 for NHS. Total benefits £5.78 to health	£300,208 available for redeployment in the NHS. ROI of £2.62 for every £1 for NHS. Total benefits £22.07 to health

The data derived from MOVEs can help to form part of the business case for investment but it is believed it will be at its most compelling when aligned to other data, evidence and knowledge for instance:

- local statistics, metrics and definitions
- the evidence base for physical activity, inactivity and participation for health and wellbeing
- the evidence base for effective interventions.

It is recommended that for transparency and clarity that you include reference to the assumptions made in the tool and any additional assumptions that you have made in your use of it when reporting on the data generated by the tool.

7.5 Using the results to inform decision making to improve the effectiveness of projects

You may want to use the tool to improve the cost-effectiveness of your programme. By running the analysis on a current programme you can determine the baseline data from which you can

ask a series of questions that can aid you in determining approaches that will improve your programme delivery.

There are a range of questions you may want to consider from the baseline data, examples include:

- What are the most important local priorities and how are you delivering against these?
- Can the programme be delivered more efficiently to reduce the costs of the programme whilst still providing a quality service to participants?
- Do you have a high amount of participant drop out in the programme? Is that affecting your cost effectiveness? How might you be able to prevent this?
- Would delivery to a different age group enable you to provide greater health outcomes, increase cost effectiveness?
- Is there capacity in the programme to accept more participants? Are there other recruitment routes that you could consider to maximise participant numbers?
- Would increasing the intensity of the activity provide greater outcomes and cost effectiveness? Is this possible with the target group you have?
- Would a different activity provide greater impact for the target group? Would they want to try a different activity?

You can test the scenarios you are considering by running the analysis a number of times, making the appropriate changes to the inputs sheet to determine the best approaches for improving the cost-effectiveness of your programme.

8.0 Technical Notes

8.1 Disease Incidence and age groups

Disease incidence data was taken from the latest published or publicly available UK-specific data. To derive age and sex-specific incidence data, the overall population incidence was multiplied by the appropriate proportion of disease attributed to a certain sex and age group (information on proportion calculated from Murray and Lopez, 1996). This enables the model to calculate the appropriate incidence of disease for the population in question. The incidence data from the scientific literature (3,5–10) reflecting the diseases included in the model were reported for the following age groups: 16-30, 31-45, 46-60 and 60+. The age group 0-15 is not included in the model as there is lack of appropriate evidence to calculate the incidence rates for this age group.

8.2 Dose-response relationship

The number of MET hours per week determines the change in risk for disease and injury. In general, this means that a higher number of MET hours per week (high frequency/duration of activity) will result in a higher reduction of risk for disease.

Whilst there is good evidence to support the hypothesis that increasing physical activity is good for health, the precise nature of the relationship is not yet understood. Therefore, we assumed a curvilinear relationship between relative risk reduction and disease. In other words, the benefits gained from increasing the time and intensity of exercise increases rapidly but levels off after a certain number of hours and intensity. MOVES assumes that an individual who has little or no physical activity at the start of a programme will benefit much more than someone who is already physically active.

The model further assumes that individuals only gain health benefits from an activity for as long as they continue to participate in that activity. The model allows the user to specify the proportion of initial participants who complete a programme in the first year ('completers'), as well as the proportion of completers who continue to maintain an equivalent activity level in subsequent years ('maintainers'). A maintenance rate of 100% implies that ALL completers in the first year will maintain their activity levels over the entire model horizon. As this seems implausible, we encourage users to specify some rate less than 100% based on their knowledge and experience. [Note that the maintenance rate is *cumulative*: a rate of 90% means 90% maintain activity levels in the 2nd year, 90% of that 90% (90% x 90% = 81%) maintain activity levels in the 3rd year, 90% of that 81% maintain activity levels in the 4th year (81% x 90% = 73%), etc.]

8.3 Costs

MOVES v2 adds the option to specify one-time or ongoing programme costs (for the length of time the programme is running), on a per participant or aggregate basis. We recommend ongoing per participant costs as the most realistic costing option.

Unit cost data is based on direct costs to the NHS only for one year of treatment and was gathered from the most recent UK estimates (9,11–15). We gathered information on the first year of treatment and cost information for subsequent years of treatment. We multiply first year costs by each new case averted and subsequent yearly costs of the number of cumulative cases averted.

8.4 Benefits

The model assesses benefits in multiple ways: 1) cases of disease averted, 2) quality-adjusted life years (QALYs) gained, and 3) disability-adjusted life years (DALYs) avoided. We calculate the

number of new cases averted for an increase in physical activity by multiplying the relative reduction for each disease by the population incidence (adjusted for age and sex). QALYs gained are calculated by estimating the difference in QALYs lost due to preventable morbidity and mortality during intervention versus no intervention. DALYs avoided are calculated in the same way.

QALYs are a composite measure of both the quantity and quality of life in respect of a disease or the net gain in respect of a treatment for a disease (when QALY values are compared to another treatment or no treatment). For example, a year of full health is worth 1 QALY whilst half a year of full health (or a year of life at only 50% health) is equal to 0.5 QALYs. DALYs are essentially the reverse of the QALY, where 0 represents no disability (perfect health) and 1 represents death.

Condition-specific preventable mortality(3,10,16–20) has been added to the model in the estimates of QALYs (21) and DALYs (22,23). This mortality is calculated as the difference between the number of prevalent cases subject to condition-specific mortality rates and an otherwise identical group subject to a common background mortality rate. The difference between these two estimates represents the QALYs lost or DALYs added due to condition-specific mortality, although it is not presented as a distinct outcome in the model.

8.5 Discounting

Usually costs and benefits are worth less the further into the future they occur. Such adjustment is known as 'discounting'. Current NICE guidance recommends that costs and benefits be discounted by 3.5%(24).

8.6 Uncertainty

The model is probabilistic to deal with uncertainty around the relative risk (normal distribution) and the cost of treatment (gamma distribution) information. The model runs each population cohort a 1000 times for better statistical accuracy.

8.7 Risk Reduction Modelling

Within the model, the relationship between additional activity and the observed risk reduction, also known as the dose-response curve was included. The relatively large risk reductions as people go from being inactive to more active have been drawn from a recent paper which examines this effect on the 8 diseases modelled within MOVES (25). It should be noted by users that these reductions level off as people reach very high activity levels (e.g. a marathon runner would see a lower reduction in risk from 1 additional hour of activity than someone who is more inactive).

9.0 Frequently Asked Questions

This document provides an overview of the frequently asked questions and answers for the MOVES tool.

What does MOVES stand for?

MOVES stands for "Model for estimating the Outcomes and Values in the Economics of Sport" and is a tool that can be used to evaluate the potential benefits of sports and physical activity interventions. The model presents the number of cases of diseases averted, the cost savings and quality of life years (QALYs) gained in terms of a cost-effectiveness result and estimates the return of investment of the sport or physical activity intervention. A cost-effectiveness result in terms of disability adjusted life years avoided (DALYs) and numbers needed to treat (NNT) are two outcome values that have recently been included within MOVES V.2.0.

What is the difference between MOVES v.1.0 and MOVES v.2.0?

MOVES v.2.0 has been extensively redesigned to provide users with a wider range of input options and assumptions to choose from. It also incorporates the latest evidence and data sources available. The epidemiological engine behind the model has also been updated to model the initial cohort of participants through time and allow for the risk of disease to change as participants age (for example, the risk of dementia will increase as the cohort ages but the risk of depression decreases). Furthermore, it now includes a range of 69 unique sport and physical activities.

Users are now given more choice to test different assumptions, including drop-out rates and the proportion of participants that complete the programme, as well as the proportion of initial participants that maintain that level of activity over time. A more flexible costing algorithm allows users to model one-time or on-going (i.e. annual) costs, on a programme or per participant basis. We feel that modelling ongoing costs on a per-participant basis is the most appropriate approach as it allows a direct link between programme costs and the health outcomes of individuals in the model.

Disability adjusted life years (DALYS) avoided is a new health outcome included within the model. This additional health outcome allows cost-effectiveness to be expressed in terms of the number of years of disability[3] and death *avoided* due to the programme. Users should note this result is not the same as the cost per QALY result and the two results are not directly comparable. Similarly, although NICE recognises £20,000 as an acceptable price to pay for an additional QALY, there is no equivalent acceptable price for a DALY avoided so for the purposes of the model the NICE Threshold is adopted for DALYs also.

MOVES v.2.0 has updated the disease-specific incidence rates, costs, utilities and now includes condition-specific mortality rates. This means that in addition to accounting for the loss in quality-of-life associated with a particular condition the model also accounts for premature deaths. Hip fracture has also been added to MOVES v2.0 as a preventable condition. Together these changes expand the scope of health benefits and cost savings associated with any sport or physical activity intervention.

[3] See user guide glossary of terms for further explanations.

What assumptions are made in the model?

As with any economic model, MOVES must make a number of assumptions. For example, MOVES assumes that within any year, activities with equivalent METs will confer the same health benefits, regardless of the duration of those programmes. That is, a programme with a 12-month duration is assumed to be no more effective in terms of risk reduction than a programme with a 6- or 9-month duration. This is undoubtedly a simplification, but clear evidence on the relationship between the duration of an activity and its relative health benefits does not exist at this time. MOVES v2 also assumes that risk reductions only persist for as long as a participant maintains their activity levels. If a participant drops out of the programme, their risk levels return to baseline. Again, this is likely a simplification but it seems a more conservative and plausible approach than assuming participating in one, 6-month activity programme can confer lifetime health benefits.

An overview of the assumptions in the model can be seen in the table below

MOVES utilises the following principles	MOVES does not incorporate
• Uses the MET minutes for intensity and type of sport • Results of the model are sensitive to the time horizon chosen due to nature of the chronic conditions. • Assumes that individuals who drop-out of the programme in the first year gain no benefit from the activity. Furthermore, the model allows for a drop-off in participation among completers over the analysis horizon. • We assume diminishing returns from additional activity, i.e. the benefits from activity are smaller for groups who are initially more active. • Allows users to assume the % of participants who manage to achieve health benefits • Population incidence of disease rates are based upon the general population (which includes active and non-active participants). The estimate of benefit should ideally be based on incidences of no/low activity participants; we assume the incidence disease rates are a reflection of this assumption. • Direct costs to the NHS relate to 1-year of treatment. • Discounting is applied at 3.5% (Standard practice) • The model runs each population cohort a 1000 times for better statistical accuracy	• The model is not designed to take into account the health profile of specific patient groups, geographical areas or populations. • The cost of injuries due to sport or physical activity are not included in MOVES. • Social Care costs are not included in the current model

MOVES utilises the following principles	MOVES does not incorporate
• Background mortality is included within the model (3,10,16–20)	

Working from better assumptions will always improve the outputs of the model. The more accurate the data that can be collected, the better the cost-effectiveness and cost-benefit calculations will be. The Standard Evaluation Framework is a great starting point when planning or evaluating a sport and physical activity intervention.

It is suggested that you to input the ongoing per participant yearly costs to assess the implications of the programme on health resources. This is assumed as a yearly ongoing cost depending on the length of time the programme is running for, however, in reality per participant costs may vary between years. Note that all costs are discounted at a rate of 3.5% to take account of their future value

Who should use this tool?

The model is designed for a wide variety of users such as public health programme bodies and sports commissioners. In particular, the MOVES tool has been created to enable a variety of decisions makers to evaluate chosen sport and physical activity programmes in terms of its cost-effectiveness to the healthcare system.

Can MOVES be used to treat specific population or treatment groups?

The model is not designed to take into account the health profile of specific patient groups, geographical areas or populations. MOVES is intended to represent the general population group in the UK. Users should therefore be aware that the model could underestimate benefits in some populations and over-estimate them in others, depending on the local population

Does MOVES include the cost of injuries?

The cost of injuries due to sport or physical activity are not included in MOVES.

Does MOVES take into account local geography?

The tool does not take into account local geography, the algorithm uses the best available data for England and the UK.

Where does the data used in the model come from?

The model draws on various data sources to calculate the disease, age and sex-specific incidence numbers(3,5–10,26) . The number of METS corresponding to the activity have been drawn from the 2011 Compendium of Physical Activities. Costs and benefits have been searched from the relevant literature sources to estimate the costs and effectiveness of the new intervention compared to the no intervention(11–15). For a comprehensive list of all the data sources used within the model please see the references list within the MOVES V2 user guide.

What is a QALY?

Quality Adjusted Life Years (QALYs) are a value which places a weight on the time spent in different health states. Perfect health is equivalent to 1 and 0 is death. Values less than 0 can be calculated representing health states worse than death. A QALY is a common measurement which can be used to compare estimated values of quality of life between different interventions.

In MOVES V2 the number of QALYs in the no intervention group are compared with the number of QALYs in the intervention group to calculate the QALY gain or loss. A gain in the total number of QALYs in the intervention group would be considered an effective programme in terms of the outcomes. Combining the health outcomes with the cost of the intervention provides a cost-utility value in terms of an incremental cost-effectiveness ratio (ICER). This value calculates the ratio of the change in costs to achieve the increase in benefits from the intervention. A value below the NICE threshold value of £20,000 per QALY would be considered a cost-effective intervention and would be considered for funding by the NHS.

What is a DALY?

A Disability Adjusted Life Year (DALY) is the measure of the number of years lost due to being in a disabled, ill health state or early death

The value is usually calculated as:

Disability Adjusted Life Year (DALY) = Years of Life Lived with Disability + Years of Life Lost

The value can often be thought as the opposite of the QALY and therefore 1 DALY can be thought of as one year of disability or one lost year of healthy life.

I have run the same case study through the tool and got slightly different outcomes for the analysis. Why is this?

The model runs each population cohort a 1000 times for better statistical accuracy. This effectively means that it takes 1000 people and follows them through the process as though they had no intervention and then follows them through as having received the intervention.

Each time you run a simulation, the population cohort is taken from a new group of 1,000 people that meet the characteristics you have inputted. For this reason, it is possible to run the same case study model but get slightly different outcomes on each occasion.

How do I choose a time horizon for my analysis?

Most of the conditions included in MOVES are longer-term, chronic conditions and so the results of the cost effectiveness model are sensitive to the time horizon chosen.

The costs avoided will depend on the type of condition treated and how soon it would have otherwise occurred e.g. some health benefits will obviously take longer than others to acquire and so the total gains of a programme will depend on the time horizon you chose. For example, reductions in the level of dementia of a group through increased activity or exercise may take many decades to take effect, whilst reducing cases of depression in the same group may only take a few months. Within public health evaluations the longer term benefits and return on investment are usually evaluated. If you wish to consider the lifetime benefits of an intervention, we recommend a 25-year time horizon be chosen.

However, in determining the time horizon to use for your analysis you may want to consider what or who you are wanting to influence. For example, if you are wanting to make a business case to influence a 3-5-year Commissioning Cycle you may be more interested in the benefits that would accrue over that period of time, however this may mean that you miss the longer term benefits that would accrue for the health conditions considered.

You may also want to discuss the options with the individuals you are seeking to influence. Are they interested in the short, medium or long term benefits?

Alternatively, you may want to run the modelling over a range or short, medium and long term time horizons to present a comprehensive overview of the potential return on investment for an intervention at different points. We recommend the following the time periods when considering the time horizons:

- Very short term (1 year)
- Short term (5 years)
- Medium term (10 - 20 years)
- Long term (25 years)

Bear in mind that when you set the time-horizon the model assumes that costs and benefits are both on-going during this period. This means that the further into the future you forecast these benefits, the less certainty there is in the accuracy and the more highly discounted the benefits will be (see page 48 for more details on discounting).

Ensure that you are comfortable with the assumptions in the tool and the data sources used to develop the algorithm that sits behind the tool so that you are able to explain the time horizon decisions that you have made if the information you present is scrutinised.

Is the assumption that behaviour change continues over the time horizon for some participants considered usual within cost effectiveness analysis?

Whilst behaviour change can be modelled in several different ways for economic analysis, the assumptions made for behaviour change over the time horizon are common for this type of analysis.

It is recommended that you consider running the analysis for interventions across short, medium and long term time horizons to fully understand the impacts of interventions and utilise the data that is of most interest to your audience.

MOVES v2.0 takes into consideration the change in risk of disease over time for the initial cohort of participants. i.e. the risk of dementia increasing as the cohort ages, but the risk of depression decreasing with age. The model represents behaviour change by providing the option to input or estimate the number of participants who begin in the sport or physical activity and the number of participants who end. The model then calculates a % completion rate. Additionally, the model makes an assumption of the % of participants who maintain the benefit i.e. the proportion of participants who initially participate in a sport or physical activity at a sufficient intensity to achieve a reduction in risk, and who continue to participate to maintain that reduction over the time horizon selected. The relationship between additional activity and the observed risk reduction, also known as the dose-response curve, was drawn from a meta-analysis of clinical studies. It shows relatively large risk reductions as people go from being inactive to more active but these reductions level off as people reach very high activity levels (e.g. a marathon runner would see a lower reduction in risk from 1 additional hour of activity than someone who is more inactive).

What if the analysis indicates that my intervention is not cost effective?

In this circumstance use the tool to help model changes to the intervention that may increase the cost effectiveness of the intervention. You may want to use the following questions as a start point for this:

- Are your costs accurate? Can the programme be delivered more efficiently to reduce the costs of the programme whilst still providing a quality service to participants?
- Do you have high numbers of participant drop out in the programme? Is that affecting your cost effectiveness? How might you be able to prevent this?
- Would delivery to a different age group enable you to provide greater health outcomes and increase cost effectiveness?
- Would increasing the intensity of the activity for the group provide better outcomes? Is this possible with the target group that you have?
- Would a different activity provide greater impact for the target group? Would they want to try a different activity? Would a mix of sports provide greater benefits for those participating?
- Would delivering to a greater % of women or men increase your cost effectiveness outcomes for the conditions?
- Can you consider using a 0% discount rate? Whilst a 3.5% discount rate is common practice in health economics literature, there is also much debate if discounting should be applied. You may wish to consider the implications of no discounting.
- Is there capacity to increase the number of participants without adding to the cost of the intervention (Only if costs are calculated as a one-time fixed cost)?

Why does the tool need to know the % of men and women participating in mixed gender interventions?

This enables the tool to consider the prevalence of disease across different genders, with some conditions being gender specific (e.g. breast cancer and hip fracture) and some disease conditions having increased prevalence rates for specific genders. For instance, there are 2.3 million people living with CHD in the UK, over 1.4 million men and 850,000 women. Around 110,000 men and 65,000 women in the UK suffer a heart attack each year[i].

How do I factor in participants joining after the intervention has started?

The number of participants you input into the tool should be the total number that started the intervention across its delivery period. The tool assumes they start their behaviour change at the beginning of the intervention but factors in the number that drop out across the period.

Can I run an analysis on just my organisations contribution to the project rather than all investment?

Yes, if you decide you would like to analyse how your organisations contributions may impact the project investment we suggest that you run the model on how this may impact on a "per-participant one-time/ongoing cost". The one-time/ongoing cost would be your organisation cost. The cost-effectiveness and return on investment costs can be compared to the result when you assume total costs of the project. However, it is important that you do also consider the total cost of your programme, including what is being given in cash and kind.

I can't see where the "with and without intervention" figures for the health conditions come from, why is this?

The model runs each population cohort a 1000 times for better statistical accuracy. This effectively means that it takes 1000 people and follows them through the process as though they had no intervention and then follows them through as having received the intervention. The data sources listed below have been used to develop the algorithm that sits behind the tool to determine the likely prevalence of the condition in a 1000 people if they undertook the intervention and if they did not.

It would be complicated to show all of the calculations within the tool numerically, so it presents the overall findings numerically and shows the distribution of the results for the cohort within the charts.

Why does the model focus on just eight conditions when there is evidence that physical activity can prevent more than 20 long term conditions?

The model focuses on the eight conditions that has the strongest evidence base for physical activities ability to prevent them. Hip fracture has been added as an additional condition in MOVES V2. The source of this information is taken from:

- Kyu et al (2016) Physical activity and risk of breast cancer, colon cancer, diabetes, ischemic heart disease, and ischemic stroke events: systematic review and dose-response meta-analysis for the Global Burden of Disease Study 2013
- Hernlund et al (2013) Osteoporosis in the European Union: medical management, epidemiology and economic burden

The Start Active Stay Active report from the Department of Health provides an overview of the strength of the evidence base for physical activity and specific conditions.

The funding for my current project is coming to end, how can the MOVES tool help me?

Providing that you have collected the appropriate data, as set out in the user guide during the project's delivery you will be able to use the tool to:

1) *Evaluate the return on investment for your current project delivery*. Using the tool will enable you to include the health outcomes generated and cost effectiveness results in your evaluation reports to present to the projects current investors, wider stakeholders and partners. This information can add value to the other quantitative and qualitative data that evaluation reports often include. You may wish to consider;
   - Evaluating the outcomes over different time horizons to understand how your project accrues benefits and cost savings
   - Clearly documenting how your project is meeting local health priorities by aligning the MOVES outcomes to these
   - What other tools and information can be used to help provide a full picture of the outcomes from your project

2) *Model what would make the project more effective if you were to continue delivering it or develop something new from the learning.* You can use the tool to model the impact of any potential changes that you could make to the programme to make it more cost effective or improve the health outcomes if you were to continue delivering it. Start this process by considering the questions listed on pages 5 and 6 of this FAQ document. You may want to include this modelling within any evaluation report that you develop for the project.

3) *Utilise the findings from your evaluation and modelling to develop a business case for future investment into the project or a revised version of it.* To do this we recommend that you:

- Have an understanding of the priorities that potential investors have and consider how the outcomes from the MOVES tool modelling can be used to document your projects ability to meet these.
- Include the assumptions used in the modelling within the business case document to enable potential investors to understand the robustness of the data that has been generated.
- Consider the layout of the business case and the additional information that you may need to fully make the case for investment. The headings below will give you some ideas and are taken from a business case that successfully received investment from health partners.

1) Purpose of Document
   - Background
   - Rationale for project
   - Scope of document (what it does and doesn't include)
2) Project details
   - Objectives
   - Stakeholders (alignment to priorities of each stakeholder)
   - Target Audience
   - Benefits (MOVES information, details of assumptions, wider benefits)
3) Options Appraisal and recommendations
   - Do nothing
   - Provide resource
4) Costs and Timescales
5) Risks for all options

How is the ICER calculated?

The Incremental Cost Effectiveness Ratio (ICER) as the name suggests, expresses in monetary terms the ratio between the difference in costs (treatment costs and costs of delivering a programme) and the difference in QALYs gained between the intervention and no intervention (intervention A and intervention B).

Incremental Cost Effectiveness Ratio (ICER) =

$$\frac{\text{“without intervention cost” – “with intervention cost”}}{\text{“without intervention QALY – with intervention QALY}}$$

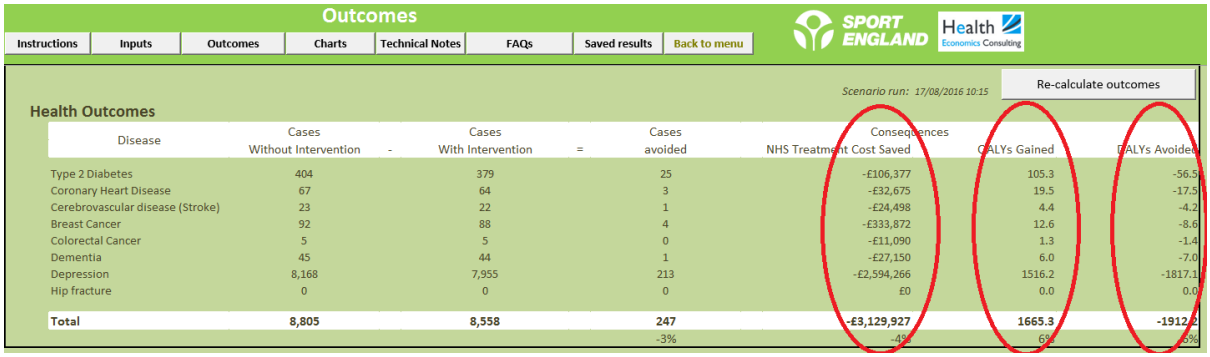
My model's ICER calculation shows that the "with intervention" option is costlier than the "without intervention" option. Is this normal?

For higher cost programmes it is possible that within the modelling you may see your "with intervention" option costing more than the "without intervention" one. This is something that you would see in many cost effectiveness studies where intervention B costs more than intervention A. However, since intervention B significantly improves the quality of life and its cost per QALY is below the threshold of £20,000, intervention B is considered to be a cost effective intervention. If you were to look at the ICER chart for an intervention that has a costlier "with intervention" than "no intervention" the majority of the dots will lay in the north east quadrant of the chart, highlighting that the intervention is costlier and more effective.

What do all the health outcomes values mean and what does it mean when I get negative figures in the modelling?

This section will provide further explanation of each of the health outcome terms within the model. The meaning of negative figures depends on which part of the tool's outcomes that the figures appear in.

Health Outcomes



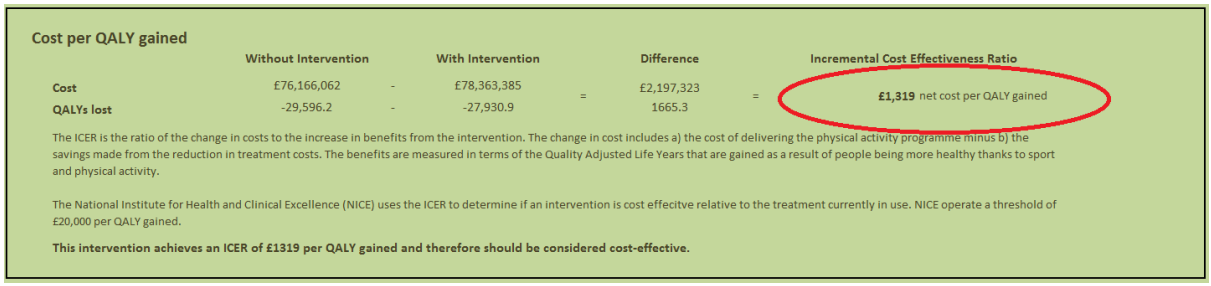
NHS treatment costs saved is the value that could be saved as a result of the number of cases of the diseases avoided. This does not take into consideration any of the programme costs. It only looks at the costs that are avoided as there are fewer cases of the diseases occurring. The negative figure shown in the Health Outcomes section relates to the fact that money has been saved to the NHS. The negative number can be seen as money less spent.

QALYs gained are the number of QALYs that will occur as a result of the sport or physical activity. These QALYs are gained due to cases of diseases avoided, which have been translated into a QALY gains. Similarly, the DALYs avoided are the disability adjusted life years that will no longer occur as a result of the health benefits of the sport or physical activity.

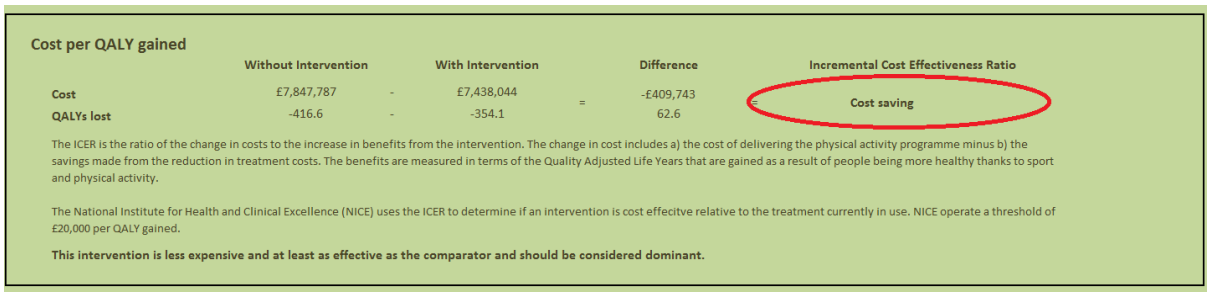
Cost per QALY gained

The cost per QALY gained is the term used to explain the incremental cost effectiveness ratio (ICER) value where the benefits are measured in terms of QALYs. The ICER is the ratio of the change in costs to the increase in benefits from the intervention. The change in costs includes

the cost of delivering the programme and the NHS treatment costs saved. The benefits are measured in terms of the Quality Adjusted Life Years that are gained as a result of people being healthier thanks to sport and physical activity. The ICER can be shown as a positive or "cost saving" (see the diagrams below), but not negative.



The ICER gives an indication as to which quadrant of the probabilistic cost-effectiveness scatterplot the intervention sits in. When the ICER is positive, the sport intervention is costlier than doing nothing. The majority of the points on the chart will appear in the north east quadrant of the cost-effectiveness scatter plot. If the ICER value is below £20,000 per QALY gained, the intervention will be considered cost-effective as under the NICE guidelines threshold.

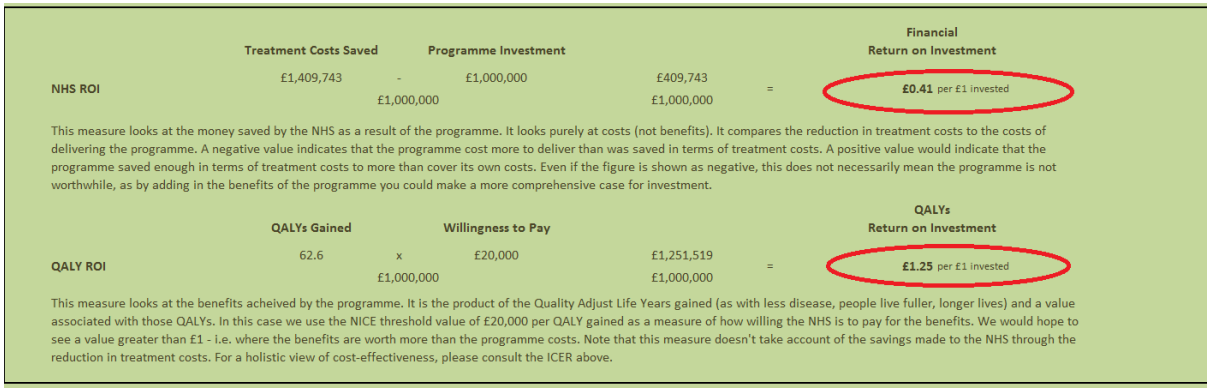


Where the ICER value is cost saving, the ICER value is not calculated. It is common practice in health economics to only report the cost saving result. A cost saving result indicates the intervention is less expensive than no intervention, even when the programme costs are considered. The benefits of intervention will be the same or greater than no intervention. When reporting cost savings, we recommend you report the amount the intervention saves in comparison to no intervention. In the above example you could report that the intervention leads to a cost saving of £409,743 and a total QALY gain of 62.6.

Cost per DALY gained

The cost per DALY gained is the term used to explain the incremental cost effectiveness ratio (ICER) value where the benefits are measured in terms of Disability Adjusted Life Years (DALYs) gained as a result of people participating in the intervention. This health outcome is calculated in the same manner as the cost per QALY; change in costs include the cost of delivering the programme and the NHS treatment cost savings, however the benefits are measured in terms of DALYs. Users should note that whilst the method to calculate the cost per DALY is the same as the cost per QALY, the two measures are not comparable, and should be seen as two independent health outcomes.

Return on Investment



	Treatment Costs Saved		Programme Investment			Financial Return on Investment
NHS ROI	£1,409,743	-	£1,000,000	£409,743	=	**£0.41** per £1 invested
		£1,000,000		£1,000,000		

This measure looks at the money saved by the NHS as a result of the programme. It looks purely at costs (not benefits). It compares the reduction in treatment costs to the costs of delivering the programme. A negative value indicates that the programme cost more to deliver than was saved in terms of treatment costs. A positive value would indicate that the programme saved enough in terms of treatment costs to more than cover its own costs. Even if the figure is shown as negative, this does not necessarily mean the programme is not worthwhile, as by adding in the benefits of the programme you could make a more comprehensive case for investment.

	QALYs Gained		Willingness to Pay			QALYs Return on Investment
QALY ROI	62.6	x	£20,000	£1,251,519	=	**£1.25** per £1 invested
		£1,000,000		£1,000,000		

This measure looks at the benefits acheived by the programme. It is the product of the Quality Adjust Life Years gained (as with less disease, people live fuller, longer lives) and a value associated with those QALYs. In this case we use the NICE threshold value of £20,000 per QALY gained as a measure of how willing the NHS is to pay for the benefits. We would hope to see a value greater than £1 - i.e. where the benefits are worth more than the programme costs. Note that this measure doesn't take account of the savings made to the NHS through the reduction in treatment costs. For a holistic view of cost-effectiveness, please consult the ICER above.

The Return on Investment (ROI) for the NHS measure looks at the money saved by the NHS as a result of the programme. It looks purely at costs (not benefits). It compares the reduction in treatment costs to the costs of delivering the programme. A ROI less than 1 indicates that the programme costs more to deliver than was saved in treatment costs. A ROI greater than 1 indicates that the programme saved enough in terms of treatment costs to more than cover the intervention costs. A ROI less than 1 does not necessarily mean the programme is not worthwhile, as by adding in the benefits of the programme you could make a more comprehensive case for investment. Also, if the NHS are not paying for the intervention then any benefit to them may be seen as a bonus.

The QALY return on investment looks at the benefits achieved from a monetary perspective by the programme. It is the product of the Quality Adjusted Life Years gained (as with less disease, people live fuller, longer lives) and the value associated with those QALYs. The benefits are accrued as a product of the willingness-to-pay threshold value. The value also presents a measure of how much the NHS is willing to pay for the benefits that are gained as a result of the intervention. A value greater than £1 would indicate that the benefits are worth more than the programme investment. A value between £0 and £1 would indicate the benefits would produce a positive return, but less than the £1 invested by the NHS. We would hope to see a value greater than £1, i.e. a case where the benefits are worth more than the programme costs. It should be noted that this measure does not take into account the savings to the NHS through a reduction in treatment costs. For a holistic view, the QALYs gained and cost difference should be considered to calculate the ICER value. Where the ICER value is less than the £20,000 NICE threshold value, the intervention could still be considered a cost-effective intervention.

Numbers needed to treat (NNT)

It is useful to understand how many participants must be enrolled in an intervention in order to achieve a particular outcome. The more effective the intervention, the lower the number of people that need to take part in the intervention, this is known as the Numbers Needed to Treat (NNT). Each case of disease avoided, comes with multiple good years of life gained (QALYs) as well as disability avoided (DALYs). As a result, you will need to treat more people avoid 1 case of disease than to gain 1 QALY or avoid 1 DALY. In the above example, 27 participants are needed to avoid 1 case of disease, but only 4 participants are needed to gain 1 QALY and avoid 1 DALY. The numbers needed to treat to gain 1 QALY/avoid 1 DALY are much lower than to avoid 1 event.

Depending on how you decide to interpret the results, you could consider presenting 27 participants avoiding 1 event as 6.75(27/4) QALYs gained or 6.75 DALYs avoided.

What references are used to inform the different parts of the tool?

A full list of the references used in the tool can be found at the end of the user guide for the tool.

The table below summaries which data sources have been used in the development of each element of the tool.

Part of Model	Data Source
Disease Incidence (including by gender, age etc.)	• Office for National Statistics. National Life Tables, Great Britain, Based on data for the years 2011 – 2013. Sep 2014 • Sharma M, Nazareth I, Petersen I. (2016) – Type 2 Diabetes • Davies AR, Smeeth L, Grundy EMBD. (2007) – CHD • Wang Y, Rudd AG, Wolfe CDA. (2013) – Stroke • Matthews FE et al (2016) – Dementia • McCrone PR (2008) – Mental Health • Hernlund E et al (2013) – Osteoporosis • Adult Psychiatric Morbidity Survey (2014) Depression incidence derived from prevalence rates in Table 2.3.
Preventable Mortality	• Leal J, Gray A and Clarke P (2008) • Roger V (2004) • Rutten-Jacobs et al (2013) • Office for National Statistics. National Life Tables, Great Britain, Based on data for the years 2011 – 2013. Sep 2014 • Rait et al (2010) • Hernlund E et al (2013)
Treatment Costs	• Department of Health. NHS reference costs collection guidance for 2013 – 2014. 2014 • Hex N et al (2012) • Luengo-Fernandez R (2006) • Hall PS et al (2015) • Pool J, Alzheimer's Society (2016)
Relative Risk Reduction	• Kyu et al 2016 • Hernlun E et al (2013)
QALYs and DALYs	• Sullivan PW et al (2011) • World Health Organization. Global Burden of Disease 2004 Update. • Salomon et al (2014)

What calculations does the tool use to determine the incidence of disease?

Incidences of disease have been referenced from various sources calculating the incidence per 100,000 for each disease modelled within MOVES. On the basis of the incidence per 100,000, the incidence per age-group was calculated by applying the relative risk for increasing activity levels.

What calculations does the tool use to determine the unit costs saved?

In order to calculate the unit costs saved the model first calculates the number of incident cases of each disease which occur in the no intervention group and the intervention group. On the basis

of the numbers in each group, unit costs to treat each disease are multiplied to the numbers occurring. The unit costs saved is then the difference between the cost of treating the without intervention group and the with intervention group.

If I am undertaking an impact evaluation of my intervention how is the additionally of the activity considered within the tool?

Level 3 of the NESTA standards of evidence highlights the need to be able to establish the causality of your intervention if you want to meet higher levels of evaluation evidence. This means that you can demonstrate how much of any change in behaviour has been driven by your project rather than by-outside influences. This is done by using a control or comparison group who are not involved in your project. It shows the additionality of behaviour change that your project has created over business as usual (what would have happened anyway) in the location you are working.

Additionality is not something that is systematically captured by sport and physical activity projects but is being considered more and more as our approaches to evaluation develop.

The MOVEs tool itself does not take into account the additionality of the changes you describe in your inputs. You would need to consider this prior to inputting your data to the tool. This would improve the robustness of the modelling you do.

For instance if you have information about the number of people who would have taken up a similar activity anyway (even without your project) from your evaluation with a control group then you could reduce the number of participants participating in the programme by the number of people who would have undertaken a similar activity anyway so that causality is factored into your modelling i.e. you input a 'net' number of additional participants rather than a 'gross' total number of participants into the tool.

If you did do this we would recommend that you state within any reporting that causality has been factored into the modelling of your inputs.

Should you not have any primary data regarding the number of people who would have undertaken a similar activity anyway from work with control groups we would recommend including a statement in any reporting that highlights that causality has not been factored into the evaluative economic analysis inputs.

10.0 Glossary of terms

Annual % achieving benefit
This is the proportion of participants who participate in the sport or physical activity, generating sufficient METS gains to achieve a reduction in disease risk. i.e. a reduction in the incidence of Type 2 diabetes, Ischaemic Heart Disease, Cerebrovascular disease, Breast Cancer, Colorectal Cancer, Dementia and Depression. This also corresponds to the % of participants remaining in the 1st year i.e. the completion rate.

Annual % maintaining activity
The proportion of participants maintaining benefit represents those participants who initially participate in a sport or physical activity at a sufficient intensity to achieve a reduction in risk, and who continue to participate at an intensity sufficient to maintain that reduction. This proportion may not be known, but we recommend assuming a 95% proportion of participants maintain benefit at baseline analysis.

Comparative risk assessment: is a systematic way of looking at environmental problems that pose different types and degrees of health risk. It combines information on the inherent hazards of pollutants, exposure levels, and population characteristics to predict the resulting health effects.

Cost-effectiveness Acceptability Curve: compares the results from the tool against a range of thresholds of willingness to pay. It enables an understanding of the probability of cost effectiveness given how willing the funder is to pay per QALY gained.

Cost-effectiveness analysis: is a form of economic analysis that compares the relative costs and outcomes (effects) of two or more courses of action.

Cost-effectiveness Probabilistic Chart: Plots the costs and benefits against each other to identify how each component varies around its mean and with respect to each other.

Cost of illness studies: describe the economic burden of disease on society

Disability Adjusted Life Years (DALYs): is the measure of the number of years lost due to being in a disabled, ill health state or early death.

Discounting: An adjustment made to the cost and benefits to take into consideration that they are worth less the further into the future they occur. The tool follows HM Treasury's Green Book recommendation to discount the costs at 3.5%. NHS costs averted have not been discounted as it is assumed that the averted funds will be used elsewhere in the NHS and are vied as freed up resources rather than savings.

Disease burden: is the impact of a health problem in an area measured by financial cost, mortality, morbidity, or other indicators.

Epidemiological engine: Epidemiology is the study of how often disease occurs in groups of people and why they occur. This tool uses the most up-to-date UK epidemiological data to consider the disease outcomes and population risks for conditions amenable to change through improved sport and physical activity e.g. cardiovascular disease and diabetes.

Inactive: Reported less than 30 minutes per week or moderate physical activity, less than 15 minutes per week of vigorous physical activity or an equivalent combination of these. 1 vigorous minute of physical activity is equal to 2 minutes of moderate physical activity.

Incidence: is a measure of the risk of developing some new condition within a specified period of time (usually a year).

Incremental Cost Effective Ratio: is the ratio of the change in costs to the increase in benefits from the intervention. The change in cost includes a) the cost of delivering the physical activity programme minus b) the savings made from the reduction in treatment costs. The benefits are measured in terms of the Quality Adjusted Life years that are gained as a result of people being healthier thanks to exercise.

Low activity: Reported 30-59 minutes per week of moderate physical activity, 15-29 minutes per week of vigorous physical activity or an equivalent combination of these.

Metabolic Equivalent Task: is a physiological measure expressing the energy cost of physical activities and is defined as the ratio of metabolic rate (i.e. the rate of energy consumption) during a specific physical activity to a reference metabolic rate (normal resting state), set by convention to 3.5 ml $O_2 \cdot kg^{-1} \cdot min^{-1}$.

Mortality rate: is a measure of the number of deaths (in general, or due to a specific cause) in a population, scaled to the size of that population, per unit of time. Mortality rate is typically expressed in units of deaths per 1000 individuals per year; thus, a mortality rate of 9.5 (out of 1000) in a population of 100,000 would mean 950 deaths per year in that entire population, or 0.95% out of the total.

Non-communicable disease: A non-communicable disease, or NCD, is a medical condition or disease which by definition is non-infectious and non-transmissible between persons.

Prevalence: in a statistical population is defined as the total number of cases in a population at a given time, or the total number of cases in the population, divided by the number of individuals in the population.

Quality Adjusted Life Years (QALY)

A QALY is defined as a measure of a person's quality of life over a defined period of time. Quality of life (also known as utility) is measured on a scale from 0 to 1, with 0 representing death and 1 representing perfect health. For the majority of healthy people, their utility value would be close to 0.98. The utility value is weighted to a person's individual years of life, therefore a person who lives 10 years at a quality of 0.6 would represent 6 QALYs (10 x 0.6) for the 10-year period. The key advantage of the QALY is that it allows for changes in quality or in length of time to be summarised in a single measure. Within the MOVES v2 tool, the total QALYs gained from the intervention group are compared to the no intervention group to calculate the total QALY gained as a result of people participating in the sport or physical activity.

Relative Risk: is the risk of an event (or of developing a disease) relative to exposure. Relative risk is a ratio of the probability of the event occurring in the exposed group versus a non-exposed

group. Expressed as an index, where e.g. a RR of 1.5 is equivalent to a 50% greater risk or - 1.3 is a RR of 30% less risk compared to doing nothing or another intervention.

Some Activity: Reported 60-149 minutes per week of moderate physical activity, 30-74 minutes per week of vigorous physical activity or an equivalent combination of these.

Utility weight: the value for a utility or preference for a particular health outcome or health state and can range from zero to one (where 0= death and 1=perfect health). Utility weights may be measured using direct methods such as time-trade off or standard gamble, or indirect methods such as SF-36, Euro QoL, Health Utility Index (quality of life health survey), etc. Note: negative values of states worse than death are quite possible.

Vigorous Activity: Reported 150 minutes per week of moderate physical activity, 75 minutes per week of vigorous physical activity or an equivalent combination of the two.

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