Public Health England

Protecting and improving the nation's health

User Guide

Diabetes Prevention Programme Return on Investment Tool

About Public Health England

Public Health England exists to protect and improve the nation's health and wellbeing, and reduce health inequalities. It does this through world-class science, knowledge and intelligence, advocacy, partnerships and the delivery of specialist public health services. PHE is an operationally autonomous executive agency of the Department of Health.

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Contents

Background

The NHS Diabetes Prevention Programme (DPP) is an evidence-based behavioural intervention to be offered at scale to those with non-diabetic hyperglycaemia (and therefore at high risk of type 2 diabetes) in England. The intervention will be funded nationally by NHS England and delivered locally by four providers. Clinical Commissioning Group (CCG) and Local Authority (LA) partnerships will be responsible for local programme management (including identification of individuals with non-diabetic hyperglycaemia).

The intervention consists of at least 13 sessions of one to two hours in length, over a minimum of nine months with the primary aim being to reduce the incidence of Type 2 diabetes. Reductions in blood glucose parameters and weight are secondary outcomes. It will be offered to individuals aged 18+ with “non-diabetic hyperglycaemia", defined as having an HbA1c (6.0–6.4%) or a fasting plasma glucose of 5.5 – 6.9 mmol/mol. Referral will happen via GP registers or NHS Health Checks, and a blood test must have been completed prior to referral. Direct recruitment through providers is also being considered.

The aim of the DPP Return on Investment (ROI) Tool is to allowlocal commissioners to quantify the ROI of implementing the DPP in their area, including costs and savings to the NHS as well as health impacts, under a range of possible scenarios.

Note that it takes some time (up to an hour per run) to generate results. After submitting a request you should see a confirmation screen giving an estimate of the time to generate your results based on how many are in the current queue. If you do not see a confirmation screen, please try again.

Please also add no-reply@sheffield.ac.uk as a trusted email address to avoid results going to junk mail

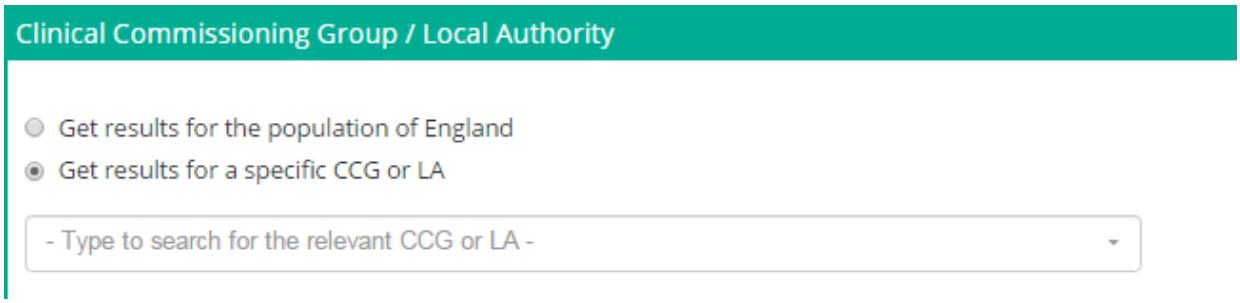
The Tool

The DPP ROI tool gives you the opportunity to create your own DPP implementation scenario. In this scenario, the DPP will be offered to a number of people with impaired glucose regulation'(IGR) within your local area (CCG or LA) and if taken up, delivered over the course of a single year. The effects on the health of the population are then estimated for 20 years following the DPP. The knock-on impacts on healthcare costs are also estimated, and the return on investment calculated. The results presented are the differences in these outcomes between providing the DPP and not providing the DPP.

Using the Tool

To create your own scenario, the tool gives you a number of options. Default values are automatically populated, but you can alter all the inputs.

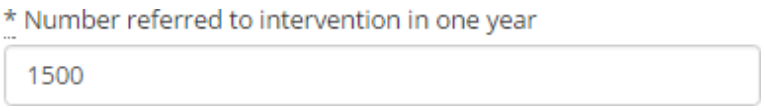
Local Area:



You can choose to generate results for the population of any CCG or LA in England. Alternatively, you can choose to get results for the whole of England. Select these from the drop-down list or type in the name of the CCG or LA you want. Results will be based on a sample of people which match the characteristics[1] of the population in that area.

[1] Characteristics used are: age, sex, ethnicity, deprivation and diabetes prevalence

Number of people identified:



You can choose the number of people to offer the DPP to in your scenario. This number multiplied by the percentage uptake is the number of people, on average, who will receive the intervention in your scenario.

Uptake:

Select the percentage of those offered the DPP who will take up the intervention. The default is set at 32%, this is the uptake rate estimated by PHE and NHS England for the national programme.

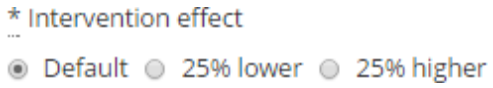
Cost:

The default cost of £270 is the estimated per person mid average cost of providing the DPP at national level. This is based on the cost of national providers providing the intervention and is based on an assumed retention rate as follows:

- Registration - 100% retained
- 25% complete - 75% retained
- 50% complete - 65% retained
- 75% complete - 50% retained
- 100% complete - 20% retained

This **does not include** any costs accrued locally, for example, in identifying high risk individuals or referring them to the DPP. You could set your scenario to include only national costs, only local costs (if you have estimates of what these are), or both (e.g. £270 plus local costs).

Effectiveness:



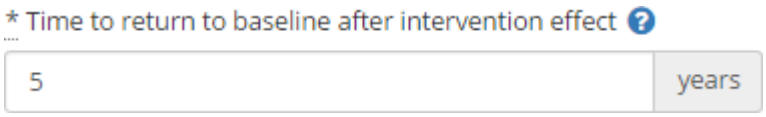
The default effectiveness of the DPP (in terms of improved metabolic indicators[2]) is based on the results of a recent meta-analysis of pragmatic lifestyle interventions for the prevention of type 2 diabetes[3] commissioned by PHE. It is expected that the DPP will fulfil between 9 and 12 NICE recommendations[4] and therefore effectiveness estimates were taken from the subgroup of studies in the meta-analysis that met this criteria. Effectiveness is also stratified by baseline BMI, such that individuals with high BMI will lose more weight than individuals with lower BMI, again based on data from the PHE meta-analysis.

The mean effectiveness of the intervention is assumed to be:

- Weight loss: 3.24 kg
- BMI reduction: 1.47 kg/m^2
- HbA1c reduction[5]: 0.20 %
- Systolic Blood Pressure reduction[5]: 6.57 mmHg
- Total Cholesterol reduction[5]: 0.28 mmol/l

If you wish to, you can test scenarios where effectiveness is either 25% lower or 25% higher than expected and see the impact on health, costs and ROI.

Time to return to baseline:



People who receive the DPP are assumed to regain weight at a linear rate over a period of several years, reaching the BMI/cholesterol/blood pressure/HbA1c levels that they would have been without the DPP intervention. The default for this time period used in national-level modelling is 5 years, though evidence for this is still limited. You can change this value to test scenarios where the effects last longer or fade more quickly.

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[2] Weight, BMI, HbA1c, Systolic Blood Pressure and Total Cholesterol

[3] Available at https://www.gov.uk/government/publications/diabetes-prevention-programmes-evidence-review

[4] A set of 20 recommendations for best practice in identifying people at high risk of type 2 diabetes and the provision of effective, cost effective and appropriate interventions for type 2 diabetes, set out in PH38. Available at https://www.nice.org.uk/guidance/ph38

[5] Not reported in the PHE study and therefore extrapolated from values reported in an earlier meta-analysis (Dunkley AJ, Bodicoat DH, Greaves CJ, et al. Diabetes Prevention in the Real World: Effectiveness of Pragmatic Lifestyle Interventions for the Prevention of Type 2 Diabetes and of the Impact of Adherence to Guideline Recommendations: A Systematic Review and Meta-analysis. Diabetes Care 2014 Apr;37(4):922-33) to reflect the weight loss reported by the PHE study, assuming a linear relationship between these variables.

Generating Results:

Enter your email address and click the 'Generate Results' button to create your scenario.

The tool uses a mathematical model (see Section 5) to simulate your scenario and generate results. This simulation process usually takes at least an hour, and after clicking 'Generate Results' the tool will take you to a page which tells you the approximate time it will take to create your report, depending upon how many other analyses are in the queue in front of you. You can navigate back to the inputs page and create another scenario immediately if you wish. This scenario will then be added to a queue and processed after your previous one was completed.

Once complete, a link to your online report will be emailed to the address provided. This is the only way to access your results, so it's important to provide a valid email address. Your report is stored so you can access it again at any time using the link in the email. The email also contains a link to a user questionnaire. If you have time, filling out this questionnaire will help us to provide a better service to future users of the tool.

Please note: to prevent results emails ending up in your junk email folder, please make **no-reply@sheffield.ac.uk** a trusted email address, or check your junk mail if you do not receive an email to your inbox within the specified time.

Results

The tool automatically generates an online report using the results for the scenario you specified. This report gives the cumulative effects on both health and social care costs (except in table 5, where some annual results are shown) over a 20 year time horizon. All costs are discounted[6] at 3.5% and all QALYs at 1.5%. All data shown is incremental (net), i.e. the difference in health or costs between your scenario and a baseline scenario where no DPP was offered. The tool takes an NHS and Personal Social Services (PSS) perspective.

[6] For an explanation of discounting, please see https://data.gov.uk/sib_knowledge_box/discount-rates-and-net-present-value

The report is broken down into sections giving the following:

- Disease outcomes for your locality
- Cost savings for your locality
- Health Economic results for your locality (from both NICE and Department of Health perspectives)[7]
- Detailed Model results for your locality: this table can be downloaded as a CSV file so you can use the results in your own analysis.
- Comparison of results for your locality with English data

Results tables report the first 5 years following the intervention in full, and thereafter at five year intervals (i.e. years 1;2;3;4;5;10;15 and 20 following the DPP).
In order to compare the results of your scenario to those for England as a whole (using the default settings), your results are converted to effects per 1,000 people receiving the intervention (regardless of how many people you selected to be offered the DPP). These are then compared to the equivalent average results for 1,000 people receiving the intervention in England as a whole.

A full table of results (health outcomes, cost savings and economic assessment) for all years 1 to 20 following implementation of the DPP intervention can be seen in Section 4 of the online report (Table 6), and downloaded to a separate csv file using the 'Download to CSV' button, for your own analyses.

[7] NICE perspective is from the NHS and personal social services, whereas DoH takes a broader, societal view.In practice, the difference in this case is that for the NICE perspective we look at cost-effectiveness, using a threshold of £20k per QALY whereas for the DoH perspective we look at cost-benefit, valuing a QALY at £60k

Using the results

The reported results refer to a single year of DPP intervention. This allows you to see the profile of effects over time. You may however wish to calculate the total expected outcomes of implementing the DPP and continuing with the programme for a number of years. This can be done manually using the data from the downloadable csv file. In this instance the total net cost values for all years have to be manually undiscounted by the user. An example is shown in the table below, assuming a four year programme with the same number of individuals receiving the DPP each year. To obtain total net costs for the four year programme, simply stagger the undiscounted net costs for the full programme by one year, for each year the programme continues to run and sum the results for each financial year. The discounting must then be reapplied ensuring that discounting is applied at the rate used in the tool and set by PHE (3.5% for costs and 1.5% for QALYs). If you wish to estimate outcomes for multiple years with different numbers of individuals receiving the DPP each year, single year results can simply be linearly extrapolated to take account of this.

	2016/17	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**
Total Costs to NHS (net) (discounted)*	£151,955	£138,405	£123,311	£110,505	£97,570	£79,579
Total Costs to NHS (net) (undiscounted)	£151,955	£143,425	£132,418	£122,970	£112,514	£95,096
Y1	£151,955	£143,425	£132,418	£122,970	£112,514	£95,096
Y2		£151,955	£143,425	£132,418	£122,970	£112,514
Y3			£151,955	£143,425	£132,418	£122,970
Y4				£151,955	£143,425	£132,418
Total Costs Y1-4	£151,955	£295,380	£427,798	£550,768	£511,327	£462,998
Total Costs discounted Y1-4	£151,955	£285,391	£399,354	£496,761	£445,592	£389,832

*example costs for illustration only, representing a tool output

Notes on economic evaluation and the QALY

A purely financial assessment of return on investment would look at the financial costs compared to savings over the long term from an intervention. However, an economic assessment attempts to value non-financial benefits as well. Both NICE and the Department of Health use economic assessments to compare the long term benefits of an intervention to its costs, although they use slightly different perspectives (NICE looks at the NHS and personal social services, whereas the Department of Health looks at society as a whole).

QALYs are a commonly-accepted approach to measuring the benefit to patients of a change in their health. The QALY is a measure of health that attempts to capture improvements to both quality and length of life. The impact of illness on a patient is

measured in terms of health-related quality of life using a single scale between one (perfect health) and zero (death). QALYs are then calculated by multiplying the health-related quality of life value with the length of life spent in that health state, for example, 10 years at 0.5 produces 5 QALYs.

In this model, QALY benefits arise two ways:

- If a patient's death is delayed as a result of their improved health (they experience more life-years)
- If a patient's health-related quality of life improves as a result of not experiencing a health event, experiencing it later, or receiving treatment for a condition which they would not otherwise have had.

Health-related quality of life changes with disease state, reflecting the impact that condition has on the patient experience. This includes impacts such as:

- Pain
- Anxiety or depression
- Mobility
- Ability to carry out self-care
- Ability to engage in normal activities

For example, after a stroke, a patient may experience mobility issues, reduced ability to care for themselves and reduced ability to engage in their normal activities, thus reducing their overall health-related quality of life.

For more information on how NICE appraises health interventions, see this resource: https://www.nice.org.uk/about/what-we-do/our-programmes/nice-guidance/nice-technology-appraisal-guidance

And for more information on economic appraisal in government see the Green Book: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/220541/green_book_complete.pdf

The Model

The tool uses a mathematical model to simulate your scenario and generate results. The model generates a simulated population which matches your local population in terms of age, sex, ethnicity, deprivation and diabetes prevalence. Each individual within the model has their own profile of metabolic indicators. Over time they can experience a range of events including:

- Developing diabetes
- Developing hypertension or high cholesterol
- A CVD event (myocardial infarction, stroke, transient ischaemic attack, angina)
- Cancer (breast, bowel)
- Depression
- Osteoarthritis
- Microvascular complications from diabetes (ulcer, amputation, blindness, nephropathy)

When an event is experienced, or a condition diagnosed, costs are accrued for diagnosis and treatment. The individual is also at risk of death at any point in the model. The model follows the health effects and associated costs of the individuals in the simulated population over time. Results are produced by comparing the health outcomes and costs from your scenario with those in a baseline scenario where no DPP was offered.

The model includes a number of assumptions and limitations which you should be familiar with when using the results.

Assumptions and limitations:

- People receiving the intervention get immediate effects but then return linearly to their baseline levels of metabolic risk factors.
- Overall assessments of net cost, cost-effectiveness and cost-benefit include costs to the NHS only. Social care savings are provided, where available, but are not included in calculations of net cost, cost-effectiveness and cost-benefit.
- Cashable savings are assumed to include prescription and medication savings and laboratory test savings only. This may underestimate total cashable savings. Other savings in primary and secondary care include healthcare practitioners' time, equipment and overheads which, if saved, may or may not lead to direct budget impacts (for example, if practitioners shift their time to other activities this may create indirect benefit elsewhere in the healthcare system rather than producing a direct release of cash).

- The model does not include the process or costs of identifying high-risk individuals, they are assumed to have been identified already. The user can alter the intervention cost to include identification costs if required.
- Those who decide not to take up the intervention incur no costs and no benefits of intervention.
- It is assumed that effectiveness estimates take account of non-completion of the intervention by some individuals. However, not all studies in the meta-analysis used an intention to treat basis for their effectiveness estimate, meaning that effectiveness may be slightly over-estimated by the tool.
- Costs come from a range of sources and it was not always possible to split out all costs into all categories (e.g. cashable savings like medications), where this was not possible, the split was either estimated or it was assumed that all costs were secondary care costs.
- Only limited social care costs are included. These were available for the costs of care after stroke and osteoarthritis. However, there are likely to be other social care costs associated with diabetes and associated conditions which have not been included.

Local population

The local population (CCG or LA) is simulated using a baseline population taken from the Health Survey for England 2011. This dataset provides survey weights for the calculation of values which are representative of an English population. For the purpose of the tool, calibration weighting was used to develop new survey weights for each local area, matching on population characteristics (age, sex, ethnicity, deprivation and diabetes prevalence). These weights are used in each scenario to provide simulated results which are representative of the local population selected.

A more detailed description of the methodology behind the model, the assumptions used and a full list of all model parameters and data sources is available from the Technical Appendix.

Simplified Schematic of the Model Underlying the DPP ROI Tool