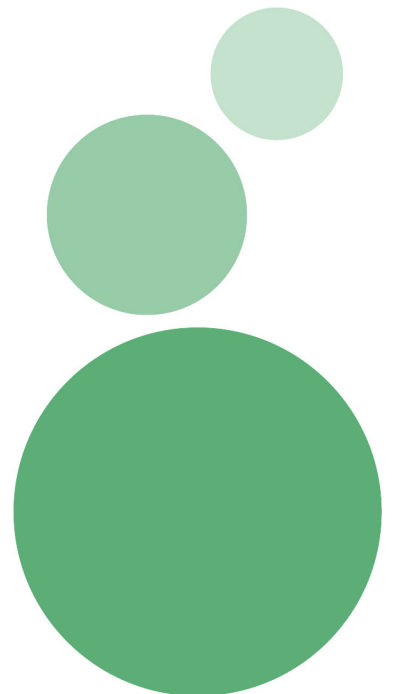


HEALTH ENGLAND
the national reference group for health and wellbeing



Prioritising investments in preventative
health

September 2009



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1.0 Key messages

This report summarises the results of a pilot project undertaken for Health England by the Matrix Knowledge Group. The aim of the project was to develop and demonstrate a prioritisation method to inform investment in preventative health interventions.

The key message emerging from the project is that it is possible to produce a method that prioritises preventative health interventions based on the evidence requirements of decision makers. The method developed overcomes the current lack of a formal process for prioritising investments in health interventions in England. It addresses commissioners' information needs, and supports better decisions and the achievement of World Class Commissioning standards.

The method developed represents an innovative approach to producing evidence to inform policy making that combines the insights of decision makers with rigorous academic research. The project also exploits the latest developments in web-based technology to make the results of the analysis available to decision makers. This allows them to interact with the analysis to maximise the value of the evidence.

The results of the project are summarised in Figure 1. They suggest that:

1. Increasing tax on cigarettes and alcohol is the intervention that best meets decision makers' objectives.
2. Mass media campaigns and brief interventions delivered by GPs also perform well in meeting decision makers' objectives.
3. Screening retirees for depression and providing support to carers with depression perform relatively badly at meeting decision makers' objectives.
4. All interventions outperform the use of statins, other than the interventions included in the analysis aimed at improving mental health.
5. There is a strongly correlation between the overall ranking of an intervention and its cost-effectiveness.

The online (<http://help.matrixknowledge.com/>) tool that accompanies this report allows decision makers to interact with the analysis. They can:

1. Request different presentations of the analysis such as re-running the analysis for subgroups of interventions and ranking intervention using different criteria.
2. Re-run the analysis at a PCT level rather than the national level presented in this report.
3. Benchmark interventions by re-running the analysis for new interventions.

This pilot project is the first stage in a broader research agenda to provide evidence to inform the commissioning of healthcare services. Proposed next steps in this agenda include:

1. Extending the project to include a greater range of interventions, both preventative and clinical.
2. Linking the prioritisation method to other projects that provide evidence to inform decision making, including work on programme budgets and prevalence models, such as that developed as part of the Informing Healthy Choices project.

Figure 1: Ranking of preventative health interventions

| Intervention | Problem targeted | Priority ranking | Priority score (% decision makers rank as top priority ¹) | Reach (% population affected) | Inequality score (% disadvantaged affected/ % all affected) | Cost-effectiveness (Cost per QALY gained ²) | Affordability (*** <£100; ** £100-£1bn * >£1bn) | Certainty (*** High quality evidence; ** Good quality evidence * Low quality evidence) |
|---|------------------|------------------|--|----------------------------------|--|--|--|---|
| Increase tax by 5% | Alcohol | 1 | 11.2 | 18.4% | 1.78 | -£5,267 | *** | ** |
| Increase tax by 5% | Smoking | 2 | 9.8 | 22.3% | 1.55 | -£3,320 | *** | *** |
| National mass media campaigns | Smoking | 3 | 9.6 | 22.3% | 1.55 | -£3,032 | *** | *** |
| Brief interventions delivered in GP practices | Smoking | 4 | 9.1 | 19.2% | 1.55 | -£2,169 | *** | *** |
| National mass media campaigns | Obesity | 5 | 9.0 | 0.1% | 1.00 | -£3,290 | *** | ** |
| Brief interventions delivered in GP surgeries | Alcohol | 6 | 8.6 | 15.9% | 1.78 | -£750 | ** | ** |
| Brief GP interventions to promote physical activity | Obesity | 7 | 8.6 | 33.7% | 1.00 | -£2,151 | ** | *** |
| Nicotine replacement therapy | Smoking | 8 | 8.4 | 12.8% | 1.47 | -£933 | ** | *** |
| Screening and treatment to reduce Chlamydia | STI | 9 | 7.3 | 11.3% | 1.00 | £370 | *** | ** |
| School based education | Obesity | 10 | 7.2 | 3.6% | 1.00 | £599 | *** | ** |
| School based education to increase condom use | STI | 11 | 6.0 | 0.5% | 1.57 | £4,965 | ** | * |
| Statins for primary prevention | Statins | 12 | 4.2 | 6.2% | 1.08 | £9,858 | * | ** |
| Assessment and support of caregivers | Mental health | 13 | 0.9 | 3.3% | 1.00 | £35,264 | * | ** |
| Screening to prevent depression in retirees | Mental health | 14 | 0.1 | 1.5% | 1.08 | £70,120 | *** | *** |

¹ Statistical techniques are used to combined data on the outcome of the intervention with decision makers' preferences for different outcomes to estimate the likelihood that the intervention would be chosen by decision makers when compared with the other interventions in Figure 1. Further detail on the calculation is available in section 5.5.

² The cost of the improvement in health achieved by an intervention, measured as the cost of achieving one extra QALY (a measure of health related quality of life)

2.0 Executive summary

Background and objectives

The achievement of World Class Commissioning in healthcare requires that decision makers have evidence available on which to allocate scarce resources to improve health and wellbeing. Existing research, however, typically fails to provide decision makers with the evidence they need.

There is currently no formal process in England that prioritises investments in health interventions. Research programmes undertaken by bodies such as NICE and NIHR provide valuable evidence on the effectiveness and cost-effectiveness of interventions. They fall short, however, of a formal process for ranking interventions.

The objective of this report is to develop and apply a method for prioritising preventative health interventions. Two principles informed the development of the prioritisation method:

1. The method needs to be useful and accessible for decision makers.
2. The method should build on and avoid replicating the considerable effort that has been expended to date to develop the existing evidence base by organisations such as NICE.

Method

The method used to prioritise interventions was a Multi-Criteria Decision Analysis (MCDA). This represents an innovative and groundbreaking approach to the prioritisation of preventative health interventions. The approach builds on and provides a number of improvements over the existing evidence base in that:

1. Decision makers define the criteria used to evaluate interventions.
2. Interventions are evaluated according to the number of people who benefit and the distribution of these benefits between population groups, as well as according to their cost effectiveness.
3. It ranks interventions in order of priority based on decision makers' preferences.

MCDA approaches vary according to the source and nature of information used to inform decision making. The following steps, however, are common to all MCDAs:

1. **Identifying interventions to evaluate.** The interventions included in the analysis had to: a) be of interest to decision makers; and b) have been the subject of a review of effectiveness and/or cost-effectiveness. The final analysis was run for 17 interventions covering the following problem areas: alcohol use, mental health, obesity, smoking cessation, and sexually transmitted infections. The use of statins was also included as a benchmark intervention.
2. **Identifying criteria against which to evaluate the interventions.** The criteria included in the analysis had to be identified by decision makers and be measurable. Five criteria were included in the analysis:

- a. Cost-effectiveness: Cost per Quality Adjusted Life Year (QALY) gained, including healthcare costs avoided.
 - b. The proportion of the population eligible for the intervention.
 - c. The distribution of benefits: The ratio of the proportion of the most disadvantaged 20% of the population eligible for the intervention to the proportion of the population as a whole eligible for the intervention.
 - d. Affordability: The budget required to fund the intervention if all eligible people received the intervention.
 - e. Certainty: Confidence in the evaluation of the intervention, based on an assessment of the quality of the method and data used in the evaluation.
3. **Measuring the interventions against the criteria.** Four steps were undertaken to measure the criteria:
- a. Evidence of effectiveness and cost-effectiveness was reviewed.
 - b. Decision models were constructed to estimate the cost per QALY gained.
 - c. Prevalence data was analysed.
 - d. The quality of the analysis was estimated.
4. **Combining the scores for all criteria** to produce an overall assessment of each intervention. Criteria weights were calculated by undertaking a discrete choice experiment to elicit decision makers' preferences for the criteria.

Results

Of the 14 interventions for which rankings were produced, taxation is the most preferred intervention, with 5% increases in the tax on alcohol and cigarettes topping the priority list.

National mass-media campaigns and brief GP-based interventions also scored well. National mass-media campaigns for smoking cessation and reducing obesity were ranked third and fifth respectively. Brief interventions for smoking cessation, reducing obesity and reducing alcohol consumption were ranked fourth, sixth and seventh respectively.

School-based education intervention and mental health interventions were in the bottom half of the ranking.

The use of statins, an intervention that is generally acknowledged as being a high priority, was only ranked twelfth.

Three of the interventions that were investigated were not included in the final ranking. One of these interventions, Cognitive Behavioural Therapy to combat obesity was found to be ineffective. Two alcohol interventions were excluded as there was insufficient data with which to estimate their cost-effectiveness.

The analysis also highlights the strong correlation between an intervention's priority ranking and its cost-effectiveness. Figure 1 shows that interventions decision-makers were most likely to prefer also tended to have the lowest values of cost per QALY gained. One consequence of this is that the priority attached to interventions varies very little between PCTs.

H.E.L.P. (Health England Leading Prioritisation)

H.E.L.P., the online (<http://help.matrixknowledge.com/>) tool that accompanies this report allows decision makers to interact with the analysis. They can:

1. Request different presentations of the analysis such as re-running the analysis for subgroups of interventions and ranking intervention using different criteria.
2. Re-run the analysis at a PCT level rather than the national level presented in this report. The online tool contains local level data that allows the analysis to be run at a PCT level.
3. Benchmark interventions by re-running the analysis for new interventions.

Discussion

This report summarises the results of a prioritisation method developed and applied to inform investment in preventative health interventions. The method provides a number of benefits, including:

1. Addressing public health and commissioners information needs.
2. Supporting better decisions in public health, helping to target resource effectively.
3. Providing a practical tool that decision makers can use to interact with the prioritisation method to maximise the value of the analysis.
4. Supporting World Class Commissioning and the delivery of long term health improvement.

The method developed represents an innovative approach to producing evidence to inform policy making that combines the insights of decision makers with rigorous academic research. The project also exploits the latest developments in web-based technology to make the results of the analysis available to decision makers.

The project also raises questions about whether priorities vary between PCTs as is often thought to be the case. Priorities are strongly influenced by the cost-effectiveness of interventions, rather than local area characteristics, such as health need. The project was not designed to address this question directly, however. Thus, further research is required to investigate this issue further.

This project is the first stage in a broader research agenda to provide evidence to inform the commissioning of healthcare services. Proposed next steps in this agenda include:

1. Extending the project to include a greater range of interventions, both preventative and clinical.
2. Linking the prioritisation method to other projects that provide evidence to inform decision making, including work on programme budgets and prevalence models, such as that developed as part of the Informing Healthy Choices project.

3.0 Introduction

The Matrix Knowledge Group (www.matrixknowledge.com), supported by Imperial College London and Bazian Ltd, was commissioned by Health England to develop and apply a method for prioritising investments in preventative health and social care interventions.

This report summarises the method developed and the findings of applying the method to seventeen preventative health interventions. A web-based tool ('**H.E.L.P** – Health England Leading Prioritisation' (<http://help.matrixknowledge.com/>)) provides decision makers with the ability to interact with the results of the analysis and to prioritise new interventions.

The remainder of the report is organised as follows. The next section summarises the background to and objectives of the report. Subsequent sections cover the prioritisation method, the results of applying the method, a discussion of the methodological questions raised by the project, and proposed next steps.

Matrix would like to acknowledge the contribution of the various decision makers and advisors who participated in this project.

4.0 Background and objectives

4.1 The challenge facing decision makers in health

Decision makers in healthcare are faced with the challenge of achieving World Class Commissioning (WCC) Standards. WCC is about ensuring better health and wellbeing, better care for all as well as better value for money¹. In order to meet these standards, Primary Care Trusts (PCTs) need to ensure that their investments fulfil a number of criteria, including:

1. Meet local needs.
2. Are informed by evidence.
3. Are targeted at priorities.
4. Provide value for money.
5. Sustain long term improvement in health outcomes.

Furthermore, the process of implementing WCC standards needs to be transparent, objective and systematic.

A key element of achieving WCC standards is the use of evidence to inform decision making. Despite, the large investments in the production of evidence on the effectiveness and cost-effectiveness of healthcare interventions by organisations like the National Institute for Health and Clinical Excellence (NICE) and the National Institute for Health Research (NIHR), the use of evidence by healthcare decision makers remains limited. Research has identified a number of barriers to decisions makers using this information, including²:

1. A limited understanding of the outputs produced by research.
2. The variation in methods employed undermining the comparability of findings.
3. Research being perceived to ignore important benefits and equity considerations.
4. Research not addressing practical implementation considerations, such as budget impacts.

These concerns are of equal, if not greater, importance in the field of public health. Not only do public health decision makers face these barriers, but the evidence base is much less developed for public health than for clinical health. A recent review identified about 150 economic evaluations in the field of public health³, which compared with numerous thousands of economic evaluation in health more broadly⁴.

The importance of providing decision makers with useful and accessible evidence is emphasised by research on the challenges of decision making. Research on human judgements and decision making shows that the simplifications which we make to enable us to deal with complex problems sometimes do not work well⁵. For instance, people tend to be biased in favour of alternatives that can more readily be linked to what is familiar (the 'representativeness heuristic'), and to be unduly influenced by recent, memorable, or successful experience (the 'availability heuristic').

Thus, a key requirement for the success of the WCC agenda within public health is to produce and disseminate evidence that is useful and accessible to decision makers. This report summarises the results of a project undertaken to support the WCC agenda by developing and applying a method for prioritising investments in preventative health interventions.

4.2 Existing prioritisation mechanisms

There is currently no formal process in England that prioritises investments in health interventions. Research programmes undertaken by bodies such as NICE and NIHR provide valuable evidence on the effectiveness and cost-effectiveness of interventions. They fall short, however, of a formal process for ranking interventions. For instance, while NICE evaluates interventions to determine whether they provide sufficient value for money to justify being invested in, the result of this process is a list of interventions that PCTs can invest in, rather than a ranking of these interventions against one another. Furthermore, this evaluation is undertaken against the relatively narrow criterion of cost per Quality Adjusted Life Year (QALY) gained. As a result, the current system of evidence generation is of limited use to decision makers. An assessment of the current system of generating evidence on preventative interventions concluded that⁶:

A prioritisation process is needed across the range of clinical and community preventive interventions in England and it should account for the detailed evaluations already undertaken within English organisations. Its formalisation might encourage greater consistency between organisations and might also increase the

usefulness of evaluations of public health interventions and programmes to a prioritisation process (pg. 3).

Such an exercise was recently undertaken in the US by the Preventive Services Task Force⁷. This work ranked a list of clinical preventative interventions based on their cost-effectiveness and clinical preventable burden. To ensure comparability of these estimates for each intervention, a consistent method was employed across the interventions, and reviews of the evidence were undertaken to inform the application of this method. An assessment of the US exercise undertaken by Brunel University for Health England, however, concluded that neither the method nor the results of the research were sufficiently relevant to transfer to the English context⁸. The Brunel evaluation identified a number of concerns with the US work, including:

1. The relevance to the UK setting of the perspective adopted by the analysis and the data employed in the analysis.
2. The need to include stakeholders in the evaluation process.
3. The absence of explicit consideration of equity.
4. The validity of summing ranks for cost-effectiveness and clinical preventable burden to produce an overall ranking.

The evaluation concluded that:

The US prioritisation exercise offers useful lessons but a separate exercise would be needed for England. Because of the challenge of achieving consistency and the likelihood that there would be incomplete data on compliance and equity, for example, existing models would have to be adapted and new models developed, particularly for community preventive interventions (pg. 4).

4.3 Objective and overview of the report

Given the importance of evidence to improving decision making in healthcare and the lack of any formal prioritisation mechanism, the objective of this report is to develop and apply a method for prioritising preventative health interventions.

Two principles have informed the development of the prioritisation method presented in this report:

1. The method needs to be useful and accessible for decisions makers.
2. The method should build on and avoid replicating the considerable effort that has been expended to date to develop the existing evidence base by organisations such as NICE.

The next section outlines the method developed to prioritise interventions. Subsequent sections summarise the results of the application of this method, discuss the key messages emerging from the project, and consider refinements that could be made to the method in future.

5.0 Method

5.1 Summary

The prioritisation method is built using a Multi Criteria Decision Analysis (MCDA) approach. MCDA approaches vary according to the source and nature of information used to inform decision making. The following steps, however, are common to all MCDAs:

1. Identifying interventions to evaluate (see section 5.2).
2. Identifying criteria against which to evaluate the interventions (see section 5.3).
3. Measuring the interventions against the criteria (see section 5.4).
4. Combining the criteria scores to produce an overall assessment of each intervention (see section 5.5).

A key characteristic of MCDA is what is referred to as ‘the socio-technical system’, or the balance between decision maker input and researcher measurement. The different components of the MCDA can each be classified as either deliberative or data-driven, depending on the source of data drawn on. Deliberation refers to the process of negotiation between various stakeholders, based on factors such as their own knowledge of the field, existing policy commitments, ethical values and so on. Data-driven components are those which are primarily based on research evidence, such as assessments of the clinical effectiveness or cost-effectiveness of particular interventions.

There is disagreement in the literature as to exactly what balance should be struck between decision maker and researcher input into a MCDA. Consequently, a mix of approaches to combining deliberative and data-driven components is adopted in the literature⁹. Figure 2 summarises the approach adopted by this report.

Figure 2: A summary of data employed in the MCDA

| Stage | Deliberative | Data-driven | Comments |
|---------------------------|--------------|-------------|---|
| Identifying interventions | ✓ | ✓ | The interventions had to be of interest to decision makers. and have been the subject of reviews of effectiveness and cost-effectiveness. |
| Identifying criteria | ✓ | ✓ | Criteria had to be identified by decision makers and be measured quantitatively. |
| Measuring criteria | | ✓ | The criteria included in the analysis were measured through a combination of evidence reviews and decision modelling. |
| Combining criteria | ✓ | ✓ | Criteria were weighted based on the results of a discrete choice experiment undertaken with decision makers. |

The balance between deliberative and data-driven components in the MCDA summarised in Figure 2 was chosen to fulfil the following principles:

1. The interventions included should be of current interest to decision makers.
2. Decision makers' opinions are a legitimate form of value or preference.
3. The analysis should draw on data where decision makers' knowledge is limited.

The remainder of this section outlines the methods adopted for each of the stages of the MCDA.

5.2 Stage 1: Identifying interventions to include in the analysis

The list of interventions included in the analysis was selected to be of interest to decision makers, as well as ensuring that data were available with which to evaluate the interventions. The following steps were undertaken to apply these criteria:

1. An initial long list of interventions was compiled from the following sources:
 - a. Interventions for which NICE had produced recommendations or was in the process of producing recommendations.
 - b. A range of local stakeholders were consulted in workshops. Attendees included directors of commissioning, public health and social services.
 - c. A range of national figures (such as national screening committees, department of health) were consulted by email or telephone interviews.
2. The scope of the project meant that the method could only be applied to a short list of interventions. The short list was constructed by applying the following criteria:
 - a. The intervention should have been identified by stakeholders during the workshop and interviews.
 - b. The intervention should have been recommended by NICE.
 - c. The intervention should be of relevance to the following national priorities: obesity, alcohol, smoking, sexually transmitted disease, and mental health.

Exceptions to these rules were made in a number of cases, as Health England were keen to include a broader range of interventions than would have otherwise have resulted from the application of the above rules. In particular, interventions of interest to both health and social care were included, such as mental health interventions. Furthermore, statins were included in the list, as these were considered a good benchmark intervention, as they are generally considered to be good value. The interventions included in the analysis are summarised in Figure 3.

Figure 3: Interventions included in the MCDA

| Problem targeted | Intervention |
|-------------------------|---|
| Alcohol | Brief interventions delivered in GP surgeries Increase tax by 5% National mass media campaigns School based group education |
| Mental health | Assessment and support of caregivers Screening to prevent depression in retirees |
| Obesity | Brief GP interventions to promote physical activity Cognitive Behavioural Therapy National mass media campaigns School based education |
| Smoking | Brief interventions delivered in GP practices Increase tax by 5% National mass media campaigns Nicotine replacement therapy |
| Statins | Statins for primary prevention |
| STI | School based education to increase condom use Screening and treatment to reduce Chlamydia |

5.3 Stage 2: Identifying criteria with which to evaluate interventions

Criteria for evaluating preventative health interventions were identified through three steps:

1. A review of the criteria used in previous MCDAs.
2. The engagement of stakeholders through a workshop.
3. The engagement of stakeholders through a survey.

Previous MCDAs

Figure 4 summarises the criteria employed by previous MCDAs of preventative health interventions identified in the literature.

Figure 4: Criteria employed in previous MCDAs of preventative health interventions

| Source | Intervention types | Location | Cost-effectiveness | Effectiveness | Burden of disease | Equity | Feasibility | Acceptability | Affordability | Certainty |
|------------------------------|-----------------------|----------|--------------------|---------------|-------------------|--------|-------------|---------------|---------------|-----------|
| Maciosek et al ¹⁰ | Preventive (clinical) | USA | ✓ | ✓ | ✓ | | | | | |
| Wilson et al ¹¹ | PCT services | UK | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Doherty et al ¹² | Surveillance | Can. | | ✓ | ✓ | | | | | |
| USOTA ¹³ | Medicaid | USA | ✓ | ✓ | | | | | | |
| Heller et al ¹⁴ | Preventive | UK | ✓ | ✓ | ✓ | | | | | |

Stakeholder workshop

During a workshop held in February 2009, health and social care decision makers were asked to identify appraisal criteria they would find most useful in assessing preventative interventions and to give a clear definition for each criterion. Attendees included directors of commissioning, public health and social services. These generated a long list of approximately 40 different types of information that decision makers considered important when making investment decisions. These were grouped thematically in the following ways:

- Impact on outcomes (e.g. health, education).
- Distribution of impact (e.g. impact on different age groups, genders).
- Impact on access (e.g. convenience of access, waiting times).
- Timing of outcome.
- Directness of impact (e.g. impact on those targeted, impacts on others).
- Proportion benefiting (e.g. incidence of health problem, prevalence of health problem).
- Feasibility (e.g. time required to deliver, skills required to deliver).
- Cost (e.g. cost to healthcare providers, future healthcare costs).

Online survey

The outcome of the literature review and the workshop was used to develop an online questionnaire which asked respondents to rate the importance of different criteria. Specifically, criteria were presented as different types of information that could be used when making investment decisions, and respondents were asked to state how important it was to have the information when making a decision. The standard question used was:

In your professional capacity, if you were trying to decide whether to invest in a preventative health or social care intervention, how important would the following information be?

The survey was run online, and emails were sent to over 700 senior figures in health and social care requesting their participation. A total of 83 surveys were completed. Respondents were mainly from the health sector (77%) with a small number from social care (19%) or joint health and social care (4%). This represents a better response rate from health than from social care. A copy of the survey can be found on the website that accompanies this report (<http://help.matrixknowledge.com/page/Stakeholder-Survey.aspx>).

The analysis of the survey results demonstrated that respondents considered each type of information to be of some importance i.e. very important or fairly important. The type of information that was rated as *very important* in each theme included:

- Impacts on health (95%).
- The direct effects on those targeted (86%).
- Prevalence of the health problem (81%).
- Impacts on different age groups (70%).
- Outcomes at 2 years (68%).
- Impact on budget (65%) and Capacity required to deliver intervention (65%).
- Convenience of access (61%).
- If it is the only way of achieving the outcomes (60%).
- Impact on future healthcare expenditure (57%).

Summary of criteria

The results of the review, workshop, and survey were combined to identify the following criteria for inclusion in the analysis:

- Cost-effectiveness: Cost per QALY gained, including the long-term impact on healthcare costs avoided and quality of life gains.
- The proportion of the population eligible for the intervention.
- The distribution of benefits: The ratio of the proportion of the most disadvantaged 20% of the population eligible for the intervention to the proportion of the population as a whole eligible for the intervention.
- Affordability: The budget required to fund the intervention if all eligible people received the intervention.
- Certainty: Confidence in the evaluation of the intervention, based on an assessment of the quality of the method and data used in the evaluation

This final list of criteria excluded the feasibility and acceptability of interventions. These criteria were excluded as they could not be measured quantitatively. It is, however, acknowledged that

these criteria should be considered alongside the results of the MCDA undertaken on quantitative estimates.

5.4 Stage 3: Data collection

The method for collecting data to measure the criteria comprised the following steps:

1. Reviews of evidence of effectiveness and cost-effectiveness.
2. Construction of decision models to estimate the cost per Quality Adjusted Life Year (QALY) gained.
3. Analysis of prevalence data.
4. Quality grading of the criteria estimates.

The remainder of this section summarises the methods employed in each of these steps.

Reviews of effectiveness and cost-effectiveness

Searching: A review of reviews was undertaken for each of the interventions covering the following databases:

- Health Technology Assessment Database (HTA).
- Economic Evaluation Database (EED).
- Database of Abstracts of Reviews of Effects (DARE) (including Cochrane systematic reviews).
- National Library of Guidelines Specialist Library (now NHS Evidence).
- Database of promoting health effectiveness reviews (DoPHER).

If a high quality review or set of reviews was found for an intervention then no more searching was undertaken for that intervention. If however the review level search did not uncover suitable evidence for an intervention, supplemental, in-depth searches for review level evidence were undertaken. Finally, if still no evidence was forthcoming, a *de novo* review was done where literature sources were searched for primary cost-effectiveness studies for that intervention.

It was only necessary to do one *de novo* review for one intervention: National mass media campaigns to reduce population consumption of alcohol. The *de novo* review consisted of systematic searches for reviews and individual studies of cost-effectiveness in MEDLINE and EMBASE (using search filters as necessary), and grey literature searches of Google Scholar, Intute and the TRIP database. References of relevant or near relevant articles were hand-searched, and citation searches in Google Scholar and 'related article' searches in Pubmed and OviD were used to identify further relevant articles.

Evidence review: The initial search identified 2674 (unfiltered) documents relating to the 17 interventions in the shortlist. Duplicate articles were removed, and after first pass appraisal 291 reviews articles were deemed relevant. To this list was added a further 71 documents that were

found through supplemental searching. Following a second appraisal 84 documents were included in the final report.

The following hierarchy was applied to prioritise evidence for inclusion in the review. The following types of evidence were prioritised:

1. Reviews of existing reviews, such as those that underpin NICE guidance.
2. Evidence applicable to the UK setting.
3. Evidence of effect where estimates of cost were available from the same study.

Data extraction: Data was extracted from review documents, supplemented by extraction from the primary studies where necessary. Data was extracted on: author, publication date, intervention, population, intervention effect, intervention cost, and method.

Further details on the review methods are available on the website accompanying this report (<http://help.matrixknowledge.com/page/Identifying-evidence-on-intervention-effect.aspx>).

Decision modelling

The review of effectiveness and cost-effectiveness studies identified data on the short-term behavioural effects of the interventions. Decision models were constructed to extrapolate these short-term behavioural effects into lifetime health gains, and to value these gains in terms of public sector costs avoided and improvements in participants' well-being. These long-term benefits were discounted at 3.5% in accordance with H.M. Treasury guidance.

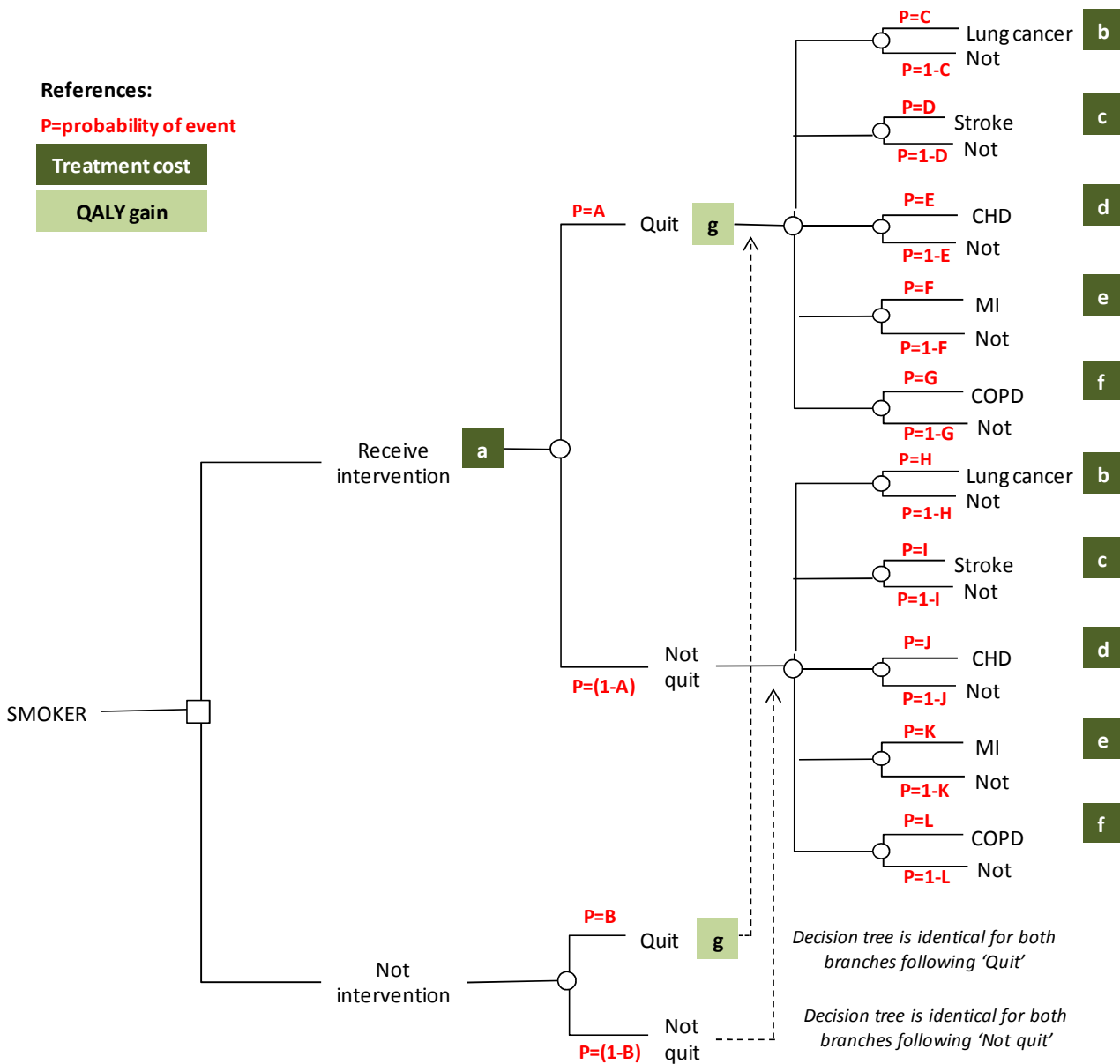
It was intended that the estimate of the public sector cost implications of the interventions include both healthcare and social care costs. Reviews of the evidence, however, indicated that there was insufficient data to model the impact of short-term behavioural changes on longer-term social care costs. Consequently, the modelling only included healthcare costs.

The need to standardise estimates of long-term well-being impacts in order to compare interventions meant that the model employed QALYs to measure quality of life impacts. Research on alternative measures is insufficiently developed to provide the data necessary to estimate quality of life changes across the interventions.

Separate decision models were constructed for each of the seventeen interventions included in the analysis. Figure 5 illustrates the structure of the decision models constructed, using the example of a smoking cessation intervention. The review provided data on the probability of quitting smoking with ($p=A$) and without ($p=B$) the intervention, and the cost of the intervention (a). Supplementary searches were required to identify the following model parameters:

- Epidemiological data to estimate the likelihood of experiencing a range of long-term health outcomes for those who quit ($p=C$ to $p=G$) and don't quit ($p=H$ to $p=L$).
- Economic studies of the value of these health states, both in terms of healthcare costs (b-f) and quality of life (g).

Figure 5: Example of a decision model for a smoking cessation intervention



Detail on each of the 17 models is available on the website accompanying this report (<http://help.matrixknowledge.com/page/Decision-modelling.aspx>). The most appropriate effect data was selected for inclusion in each model. The effect data was selected to prioritise the following effect data: UK-based estimates; estimates produced using high quality research designs; estimates for which corresponding cost data were also available; and estimates for which corresponding epidemiological data was available with which to model long-term benefits.

Analysis of the proportion benefiting

The reviews and decision models estimated the cost-effectiveness criteria. Three of the remaining criteria (affordability, proportion benefiting, and distribution of benefits) required evidence on two further parameters:

- The proportion of the population who are eligible for the intervention.
- The proportion of the population who are disadvantaged and eligible for the intervention.

These parameters were employed to measure the criteria in the following way:

- Proportion benefiting: The proportion of the population who are eligible for the intervention.
- Distribution of benefits: The ratio of the proportion of the population who are disadvantaged and eligible for the intervention and the proportion of the whole population who are eligible for the intervention.
- Affordability: The proportion of the population who are eligible for the intervention was combined with an estimate of the size of the population to arrive at a total number of people who could receive the intervention. This was then combined with the estimate of the unit cost of the intervention used in the decision modelling to calculate the budget required to deliver the intervention.

Data to estimate these parameters were identified from the following sources:

- Office of National Statistics (ONS)
- Departmental and associated organisations
- Charities for the health states or behaviours
- Google.co.uk

Detail on which data was employed to measure the parameters is available on the website accompanying this report (<http://help.matrixknowledge.com/page/Affordability2c-reach2c-inequality-score.aspx>).

Certainty: quality grading

The final criteria included in the evaluation of the intervention was certainty: confidence in the evaluation of the intervention, based on an assessment of the quality of the method and data used in the evaluation. Each of the criteria estimates were graded for the quality of the data and methods employed to arrive at the estimate. Quality grading scales were developed using existing scales in the fields of research design¹⁵, economic evaluation¹⁶, and statistics¹⁷. Further detail on these quality grading scales is available on the website accompanying this report (<http://help.matrixknowledge.com/page/Quality-Grading.aspx>).

5.5 Stage 4: Producing a ranking

Having estimated the criteria against which the interventions were evaluated, the final stage of the MCDA is to combine the scores for each of the criteria into an overall evaluation of the intervention, or to weight the criteria. Further detail on the DCE is available on the website accompanying this report (<http://help.matrixknowledge.com/page/Producing-a-Ranking.aspx>).

Introduction to weighting methods

A number of methods are employed in the literature to combine criteria scores into an overall assessment of an intervention. For instance, previous attempts to rank preventative health intervention in the US have given equal weighting to cost-effectiveness and clinically preventable burden¹⁸. The assumption that these criteria are of equal importance in decision making has been criticised as not necessarily corresponding with decision makers' views, as well as the possibility that it might lead to the prioritisation of cost-ineffective interventions¹⁹.

A number of alternative methods are proposed in the literature, including:

1. Asking stakeholders to assign 100 points between criteria in accordance with their relative importance²⁰.
2. Asking stakeholders to assign the most important criterion a weight of 100, and then allocating each of the other criteria a weight to reflect their relative importance²¹.
3. Pair-wise comparison of criteria to determine the relative importance of criteria ('How important is criterion *A* relative to criterion *B*?')²².
4. Swing-weighting: an assessment of the importance of a 'swing' between the minimum and maximum scores on one criteria to a similar 'swing' on another criteria²³.

This report adopts an alternative methodology often employed in economic analysis – a Discrete Choice Experiment (DCE). DCEs involve presenting respondents with a series of hypothetical scenarios (choice sets) that are described using a consistent set of parameters called attributes. Faced with a number of such interventions, respondents are then asked to choose their preferred intervention. Given respondents' choice of interventions, statistical analysis can be employed to estimate the relative impact of each attribute on the choice made. These results can then be used, amongst other things, to predict whether one intervention would be preferred over another.

Discrete choice experiment

Given that it was important to keep the DCE relatively short in length to ensure that it did not burden already busy decision makers, it was not possible to include all the criteria within the DCE. It was decided to include only three criteria to ensure the collection of more accurate data²⁴. The three criteria included in the analysis were: cost-effectiveness, distribution of benefits, and proportion of people benefiting. Affordability was excluded from the DCE, as it was assumed that decision makers would assess interventions against the other criteria and then choose the intervention that is ranked highest and that they can afford.

An online survey was designed to engage a large number of respondents as efficiently as possible. A draft survey was piloted at a small workshop of decision makers and necessary adjustments made. An e-mail inviting potential respondents to undertake the questionnaire was sent to 446 decision makers, including: directors of finance, commissioning, and public health in PCTs.

Respondents were presented with twelve questions ('choice sets'), each containing three hypothetical interventions ('scenarios'). Respondents had to choose the one intervention they would invest in from each set of three. Each intervention was described by each of the 3 criteria.

Results

A total of 1117 questions were answered by 99 respondents. The respondents were primarily senior staff working in healthcare²⁵. This resulted in 3351 observations. Multinomial regression analysis using the conditional logit model was undertaken on the data. Figure 6 summarises the results of the regression analysis. All of the coefficients were statistically significant ($p \leq 0.05$), suggesting that all attributes / criteria had an impact on respondents' choice of intervention.

The co-efficient on each attribute had an intuitively sensible sign. The coefficient for cost effectiveness was negative, which indicates that respondents are more likely to invest in an intervention that has a lower £/QALY value. The coefficients for proportion benefitting and distribution of benefits were positive, indicating that respondents are more likely to invest in an intervention if it benefits a greater proportion of the population or if it has a greater impact on health inequalities.

Figure 6: Results of the discrete choice experiment

| Attribute | Coefficient | Std. Err. | P | 95% CI |
|---------------------------------------|-------------|-----------|--------|---------------------|
| Proportion benefitting ^a | 0.0435987 | 0.0201 | 0.0300 | 0.0041 - 0.0831 |
| Distribution of benefits ^a | 0.119895 | 0.0539 | 0.0260 | 0.0143 - 0.2255 |
| Cost effectiveness ^a | -0.0000586 | 0.0000 | 0.0000 | -0.00006 - -0.00005 |

^a Indicates $P < 0.05$.

The coefficients indicate the effect that a 1 unit increase in the attribute with which the coefficient is associated has on the probability of a scenario being chosen.

Using the DCE results to prioritise health interventions

In order to prioritise the 17 interventions, the results of the DCE are used to assess the probability of each intervention being funded, as per equations 1 and 2.

$$U_a = e^{[(\beta_{CE} \cdot CE_a) + (\beta_{DB} \cdot DB_a) + (\beta_{PB} \cdot PB_a)]} \tag{1}$$

Where

U_a = Utility produced by intervention a

β_{CE} = The coefficient on the cost-effectiveness criterion from the regression analysis

β_{DB} = The coefficient on the distribution of benefit criterion from the regression analysis

β_{PB} = The coefficient on the proportion benefiting criterion from the regression analysis

CE_a = The cost per QALY gained of intervention a

DB_a = The distribution of benefits of intervention a

PB_a = The proportion benefiting of intervention a

The relative probability of intervention a being chosen compared with the other interventions is given by equation 2.

$$P_a = \frac{U_a}{\sum_{i=0}^n U_i} \tag{2}$$

Where

P_a = The probability that intervention a is chosen compared with the other interventions being evaluated

U_a = Utility produced by intervention a

$\sum_{i=0}^n U_i$ = The sum of the utility produced by all the interventions being evaluate

Confidence in the DCE result

The confidence grade attached to the probability score for each intervention was estimated by combining the confidence grades for each of the criteria used in the DCE: proportion benefiting, distribution of benefits, and cost effectiveness. The confidence grades for each of the criteria were weighted to reflect the relative importance of the criteria identified in the DCE.

6.0 Results

Figure 7 summarises the result of the MDCA. The results reported in Figure 7 reflect the implementation of the interventions at a national level. Equivalent results at PCT-level are available through the website that accompanies this report (<http://help.matrixknowledge.com/interventions/>).

Three interventions were not included in the final ranking. One of these interventions, Cognitive Behavioural Therapy to combat obesity was found to be ineffective²⁶. Two alcohol interventions were excluded as there was insufficient data with which to estimate the cost-effectiveness. Both these interventions targeted young people's alcohol use. The lifetime benefits of this intervention could not be estimated due to the lack of epidemiological data on the relationship between young peoples' alcohol use and alcohol use later in life²⁷.

Figure 7 demonstrates that taxation is the highest priority intervention, with 5% increases in the tax on alcohol and cigarettes topping the priority list. Furthermore, both these interventions rank high in terms of their affordability.

National mass-media campaigns and brief GP-based interventions also scored well. National mass-media campaigns for smoking cessation and reducing obesity were ranked third and fifth respectively. Brief interventions for smoking cessation, reducing obesity and reducing alcohol consumption were ranked fourth, sixth and seventh respectively.

School-based education intervention and mental health interventions were in the bottom half of the ranking. School-based education to reduce obesity and increase condom use were ranked tenth and eleventh. Intervention to address mental health problems (assessment and support for carers, and screening of retirees) were ranked thirteenth and fourteenth.

Statins, an intervention that is generally acknowledged as being a high priority, was only ranked twelfth.

Figure 7 also highlights the strong correlation between an intervention's priority ranking and its cost-effectiveness. That is, interventions decision-makers were most likely to prefer also tended to have the lowest values of cost per QALY gained.

Figure 7 reports the results of the analysis run at a national level. The online tool that accompanies this report enables decision makers to re-run the analysis at a PCT level (<http://help.matrixknowledge.com/interventions/>). Very little variation is observed in the results of the analysis between PCTs. This reflects the high weight given to cost-effectiveness by decision makers, a parameter that is assumed not to vary between PCTs.

Figure 7: Ranking of preventative health interventions

| Intervention | Problem targeted | Priority ranking | Priority score (% decision makers rank as top priority ³) | Reach (% population affected) | Inequality score (% disadvantaged affected/ % all affected) | Cost-effectiveness (Cost per QALY gained ⁴) | Affordability (*** <£100; ** £100-£1bn * >£1bn) | Certainty (*** High quality evidence; ** Good quality evidence * Low quality evidence) |
|---|------------------|------------------|--|----------------------------------|--|--|--|---|
| Increase tax by 5% | Alcohol | 1 | 11.2 | 18.4% | 1.78 | -£5,267 | *** | ** |
| Increase tax by 5% | Smoking | 2 | 9.8 | 22.3% | 1.55 | -£3,320 | *** | *** |
| National mass media campaigns | Smoking | 3 | 9.6 | 22.3% | 1.55 | -£3,032 | *** | *** |
| Brief interventions delivered in GP practices | Smoking | 4 | 9.1 | 19.2% | 1.55 | -£2,169 | *** | *** |
| National mass media campaigns | Obesity | 5 | 9.0 | 0.1% | 1.00 | -£3,290 | *** | ** |
| Brief interventions delivered in GP surgeries | Alcohol | 6 | 8.6 | 15.9% | 1.78 | -£750 | ** | ** |
| Brief GP interventions to promote physical activity | Obesity | 7 | 8.6 | 33.7% | 1.00 | -£2,151 | ** | *** |
| Nicotine replacement therapy | Smoking | 8 | 8.4 | 12.8% | 1.47 | -£933 | ** | *** |
| Screening and treatment to reduce Chlamydia | STI | 9 | 7.3 | 11.3% | 1.00 | £370 | *** | ** |
| School based education | Obesity | 10 | 7.2 | 3.6% | 1.00 | £599 | *** | ** |
| School based education to increase condom use | STI | 11 | 6.0 | 0.5% | 1.57 | £4,965 | ** | * |
| Statins for primary prevention | Statins | 12 | 4.2 | 6.2% | 1.08 | £9,858 | * | ** |
| Assessment and support of caregivers | Mental health | 13 | 0.9 | 3.3% | 1.00 | £35,264 | * | ** |
| Screening to prevent depression in retirees | Mental health | 14 | 0.1 | 1.5% | 1.08 | £70,120 | *** | *** |

³ Statistical techniques are used to combined data on the outcome of the intervention with decision makers' preferences for different outcomes to estimate the likelihood that the intervention would be chosen by decision makers when compared with the other interventions in Figure 1. Further detail on the calculation is available in section 5.5.

⁴ The cost of the improvement in health achieved by an intervention, measured as the cost of achieving one extra QALY (a measure of health related quality of life)

H.E.L.P. (Health England Leading Prioritisation)

H.E.L.P., the online (<http://help.matrixknowledge.com/>) tool that accompanies this report allows decision makers to interact with the analysis. They can:

1. Request different presentations of the analysis such as re-running the analysis for subgroups of interventions and ranking intervention using different criteria.
2. Re-run the analysis at a PCT level rather than the national level presented in this report. The online tool contains local level data that allows the analysis to be run at a PCT level.
3. Benchmark interventions by re-running the analysis for new interventions.

7.0 Discussion

7.1 Summary

The achievement of World Class Commissioning in healthcare requires that decision makers have evidence available on which to allocate scarce resources to produce better health and wellbeing. The existing research, however, fails to provide decision makers with the evidence they need. The evidence is inaccessible and does not cover all the information considered important by decision makers. This report presents the results of a prioritisation method developed to overcome these limitations and inform investment in preventative health interventions.

The results of this analysis suggest that:

1. Increasing taxation is the intervention that best meets decision makers' objectives.
2. Mass media campaigns and brief interventions delivered by GPs also perform well in meeting decision makers' objectives.
3. Screening retirees for depression and providing support to carers with depression perform relatively badly at meeting decision makers' objectives.
4. All interventions outperform the use of statins, other than the interventions included in the analysis aimed at improving mental health.
5. The preference for an intervention is strongly correlated with its cost-effectiveness.

7.2 Discussion of the method employed

The method employed to prioritise interventions comprised the use a Multi-Criteria Decision Analysis (MCDA). By breaking decision making down into steps, MCDA approaches provide an open and explicit basis for decision making and a framework for combining decision makers' objectives and values with researcher measurement of performance²⁸. This method represents an innovative and groundbreaking approach to the prioritisation of preventative health interventions. It builds on and provides a number of improvements over the existing evidence base, including:

1. It uses decision makers' opinions to define the criteria used to evaluate interventions.
2. It combines the different benefits of an intervention into a single score.
3. The effects of the interventions included in the analysis are measured over the lifetime of recipients.
4. The criteria are measured using a standard method to ensure comparability.

The methodological questions raised by the report are, however, complex and challenging. It is, consequently, worth considering how the method summarised in this report might be refined and built upon in the future. This final section considers a number of key methods questions raised by this project, the response to these questions proposed by this report, and alternative responses that might be considered going forward.

What interventions should be included in the analysis?

The scope of the project only allowed for a limited number of interventions to be included in the analysis. The interventions were selected to ensure that they were of interest to decision makers and that there was data with which they could be evaluated. This inevitably, however, means that interventions are excluded from the analysis. Furthermore, given the need to ensure that data was available with which to evaluate the interventions, it would tend to be established interventions that are included. Innovative interventions that have yet to be evaluated will tend to be excluded. There are two ways to overcome this gap in the analysis:

1. Future iterations of this project can extend the list of interventions included in the analysis.
2. In the meantime, the interactive web-based tool that accompanies this report enables decision makers to use the data gathered during the project to benchmark new interventions (<http://help.matrixknowledge.com/>).

What criteria should be used to evaluate interventions?

Five criteria are used to evaluate the interventions included in the analysis: cost-effectiveness, proportion benefiting, distribution of benefits, affordability, and certainty. The first three of these criteria are included in the DCE to rank the interventions. The desire to produce a quantitative ranking of the interventions meant that a number of criteria were excluded from the analysis. In particular, the acceptability and feasibility of the interventions were highlighted as important by stakeholders engaged during the project.

The criteria included in the analysis were arrived at through consultation with stakeholders and correspond with the criteria proposed by Fox-Rushby *et al* following the review of a similar project undertaken in the US. Fox-Rushby *et al* conclude that²⁹:

We recognise that information on marginal CPB [Clinical Burden of Disease] could inform decisions as to which cost-effective interventions should figure most prominently in a focussed national policy. For example, if an 'effort constraint' exists (e.g. gaining ministerial approval and stakeholder acceptance), and there is a limited capacity for

adopting policy changes each year, then from a set of cost-effective interventions it may be appropriate to focus national policy change and implementation efforts on those diseases with the largest CPB. However, equity considerations would also be taken into account in English policy making (pg. 4)

The exclusion of criteria is a function of the deliberative – data-driven balance adopted by the MCDA. Given the requirement to measure criteria quantitatively from the existing research, criteria for which such evidence was not available – feasibility and acceptability – were excluded. A number of avenues are available to capture these criteria:

1. Adopt the same MDCA method, and leave consideration of feasibility and acceptability to decision makers when the use the results of the MCDA.
2. Update the MCDA to include stakeholder (deliberative) assessment of the feasibility and acceptability of an intervention.

Which costs and benefits should be included in an evaluation?

The analysis of cost-effectiveness included in this report measured health gains and healthcare costs avoided. Surveys undertaken as part of the project identified a greater range of costs and benefits of interest to decision makers, including social care costs (<http://help.matrixknowledge.com/page/Stakeholder-Survey.aspx>). The need to include a wider range of costs and benefits is acknowledged by NICE's recent guidance on evaluating public health interventions, which suggests that all public sector costs be included in an analysis³⁰.

Recent additions to the literature have supported the adoption of a broader perspective, but also suggest that this broader perspective adopt a multi-sector structure. Decision-makers tend to be responsible for delivering specific outcomes using budgets that are typically fixed at a departmental level. In this instance, an analysis needs to talk to this specific perspective - it needs to measure the impact individual decision makers' budgets, and measuring the different outcomes of interest to different decision makers³¹.

The analysis reported in this report attempted to include social care costs as well as healthcare costs. However, the limited evidence on the impact of behavioural outcomes on long-term social care costs meant that this was not possible. Further research is required before broader and multi-sector perspectives can be captured by the prioritisation method.

How should quality of life effects be measured?

Comparison of the effectiveness and cost-effectiveness of preventative health interventions requires a standardised outcome measure. The approach adopted in this report is to measure the impact on participants' quality of life using QALYs. This approach is driven by the availability of such measures in the existing literature as a result of the developments made in health economics³². While it is important to acknowledge the value provided by this measure, it is argued that QALYs do not capture all the benefits of preventative health interventions³³.

As no standardised outcome measure currently exists that might replace the QALY, a number of authors have suggested that natural units (e.g. cases of cancer avoided, improved physical activity levels) be employed to measure the impacts or preventative health interventions, and a cost-consequence approach to economic evaluation adopted³⁴. This approach would, however, be limited in its ability to compare interventions with different objectives.

A number of alternative approaches are available to capture the value of preventative health outcomes, including:

1. Applying economic valuation techniques, such as stated preferences, to measure peoples' willingness to pay for preventative health outcomes³⁵.
2. Developing measures equivalent to the QALYs that capture the dimensions of value produced by preventative health interventions.
3. Employing subjective well-being estimates to measure the value of preventative health outcomes³⁶.

Further work is required to determine the acceptability and feasibility of these approaches.

How should the relative value of outcomes be determined?

When decision makers choose to invest in a public health intervention they have a number of objectives in mind. It is important that these objectives are incorporated into any analysis of interventions designed to inform investment decisions. These objectives can, however, sometimes compete with one another. For instance, an intervention may improve the overall health of the population but increase health inequalities. The DCE summarised in this report was designed to elicit data from decision makers on the way they 'trade off' competing objectives. This data can be used, in combination with data on the attributes of interventions not included in the DCE, to estimate the probability that an intervention is preferred by a decision maker, which can in turn be used to rank the interventions according to decision makers' preferences.

The DCE methodology has a number of advantages, including:

- It is a proven methodology, having been frequently used to measure preferences in health economics, and is grounded in economic theory³⁷.
- The data required can be collected using a large-scale survey, allowing a wide range of respondents to be reached relatively efficiently, unlike other methodologies such as swing weighting and the pair-wise comparisons, which are best used in a workshop setting.
- It produces range-sensitive weights. That is, it facilitates comparison of different levels of attributes, rather than being based on abstract comparison of attributes, an approach employed by pair-wise comparisons.

The use of the DCE, however, raises a number of methodological questions. First, are consistent results obtained from DCEs? That is, would similar criteria weights be obtained if the

DCE was run with a different group of decision makers, or with the same group of decision makers at a different point in time? Further research is required to answer this question and to identify how preferences vary between decision makers operating in different contexts.

Second, whose values should be used to weight criteria? This report estimated weights by eliciting the preferences of the decision makers responsible for allocating public funds. Their preferences possess a certain level of legitimacy, especially within a democratic system. However, it is often argued that it is the preferences of the public that should be employed to allocate resources³⁸. Further discussion of the appropriate source of value is required to determine the appropriate methodology for weighting criteria.

How should the cost-effectiveness of interventions be modelled?

This report modelled the cost-effectiveness of seventeen preventative health interventions using simple decision-tree model structures. While there is little guidance on what model structures are most appropriate for specific interventions³⁹, it is proposed that more dynamic model structure would better reflect the nature of preventative health interventions⁴⁰. For instance, Markov simulation models or system dynamic models may better reflect the fact that behavioural outcomes are recurring events and the long-term benefits are a function of accumulated behavioural change rather than behavioural change at a single time point. Further research is required to understand the challenges of applying dynamic models to preventative health interventions.

How should uncertainty be included in the prioritisation method?

Uncertainty is inherent in any prioritisation method. A range of data has been employed in the method summarised in this report, all of which is subject to uncertainty. This is normally dealt with by either reflecting the uncertainty in confidence intervals around point estimates, or undertaking sensitivity analysis to test the impact on rankings of changes in model parameters.

The approach adopted by this report is to report just the mean score for each intervention and then to grade the certainty with which the mean has been estimated. The disadvantages of this approach are that researcher judgement is required to assess the quality of data used in the analysis, and it does not demonstrate whether the intervention ranking would change as a result of this uncertainty.

The decision to grade the uncertainty associated with mean scores was taken for two reasons:

1. The requirement to make the results of the analysis accessible to decision makers. Ideally, a probabilistic sensitivity analysis would have been undertaken to reflect how the results of the analysis change as parameters vary. However, the results of this type of analysis do not lend themselves to quick access by decision makers.
2. The decision analytic paradigm suggests that, rather than quantifying uncertainty as is proposed by the classical frequentist paradigm, the appropriate decision is to choose the intervention that produces the greatest benefits⁴¹. That is, certainty is relevant to

decision making, in that the presence of uncertainty means that a decision may be wrong. The appropriate response to uncertainty, however, is to inform the decision as to whether to pursue further research, rather than influencing the adoption decision.

Consequently, the certainty grading undertaken by this project can be used to identify areas where further research is required.

7.3 Next steps

It is intended that this project is the first stage in a broader research agenda to provide evidence to inform the commissioning of healthcare services. Proposed next steps in this agenda include:

1. Extending the project to include a greater range of interventions, both preventative and clinical.
2. Linking the prioritisation method to other projects that provide evidence to inform decision making, including work on programme budgets and prevalence models, such as that developed as part of the Informing Healthy Choices project.

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