



**Liverpool  
Public Health  
Observatory**

# **Prevention Programmes Cost Effectiveness Review: Diet and Healthier Eating**

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**PROVIDING INTELLIGENCE FOR THE PUBLIC HEALTH**

## The cost effectiveness review series

### Background

There are significant pressures placed upon public sector organisations to ensure that money is spent wisely to ensure the best value for money for services they provide. In the health sector, there is increasing pressure to justify spending on all areas of health care and in particular on preventive programmes. As a consequence, public health is increasingly being asked for cost effectiveness evidence as justification for funding or continued funding of particular initiatives. Although evidence is available nationally for a lot of public health initiatives, this information is not available in one place. The production of a review that includes information on cost effectiveness and potential cost savings in one place will make it easier for public health to develop a business case for continued investment in preventive services.

### About the series

The review series will provide a comprehensive review of the literature on evidence of the cost effectiveness and potential cost savings of preventive programmes and projects by topic area.

This is the third topic area covered by the cost effectiveness review series. It follows on from reviews on physical activity and alcohol. Further topic areas will be considered for inclusion as required.

## Diet and healthier eating interventions

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### Glossary

*LA*: local authority

*3<sup>rd</sup> sector*: voluntary and community organisations, social enterprises, mutuals and co-operatives.

*Cost-effectiveness analysis*: Cost-effectiveness analysis compares the relative costs and outcomes (effects) of two or more courses of action.

*Cost-effective*: good value for money, where the benefits are worth at least what is paid for them

*Cost savings*: Providing additional healthcare benefits and an overall reduced health service cost (i.e. pays for itself).

*NHS EED*: NHS Economic Evaluation Database <http://www.crd.york.ac.uk/crdweb/Home.aspx?DB=NHS%20EED>

*RCT*: Randomised controlled trial

*QALY*: Quality adjusted life year. Used in assessing the value for money of a medical intervention, based on the number of years of life that would be added by the intervention. Each year in perfect health is assigned the value of 1.0 down to a value of 0.0 for death. One QALY is equal to a year of life in perfect health

*DALY*: Disability-adjusted life year: While a QALY is a year of perfect health gained, a DALY is a year of perfect health lost

*Cost per DALY saved/ averted*: Cost effectiveness ratio expressed as the net cost of gaining 1 additional healthy year of life, relative to a no prevention or treatment only scenario (Cecchini et al, 2010).

*ACE-P*: The 'Assessing Cost Effectiveness in Prevention' method of economic evaluation widely used in Australia.

## Summary

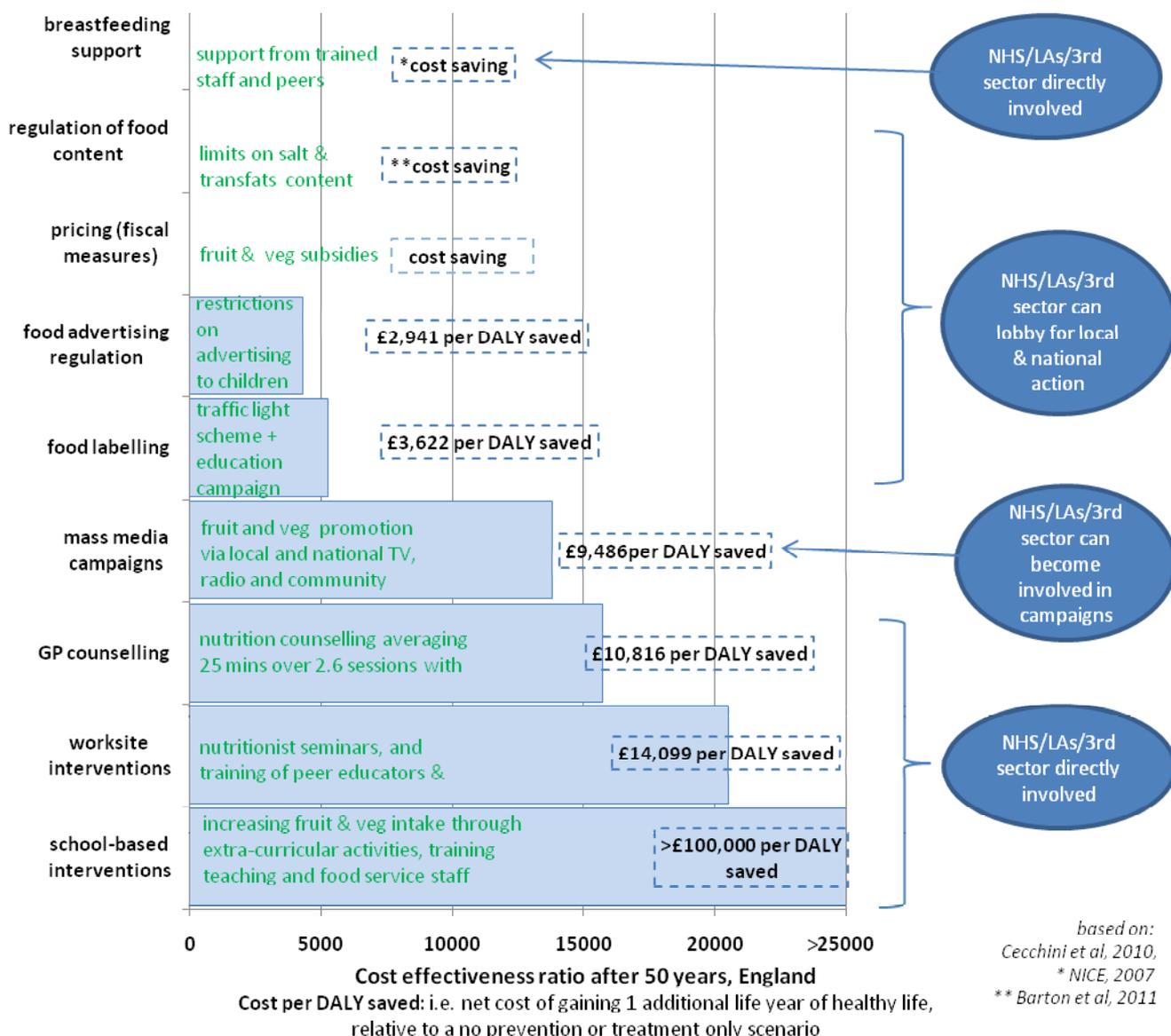
Poor diet could be costing the NHS on Merseyside £116.9m to £175.4m each year. A breakdown of estimated costs within Merseyside is shown in the following table:

Estimated annual cost to the NHS of poor diet on Merseyside (including Halton)					
Halton	Knowsley	Liverpool	St.Helens	Sefton	Wirral
£9.2m to £13.8m	£11.6m to £17.4m	£35.8m to £53.7m	£21.9m to £32.9m	£14.0m to £21.1m	£24.3m to £36.5m

*2010/2011 estimates, based on estimates by DH (2004) and Rayner and Scarborough (2005) uplifted using the HCHS index published by PSSRU (see Appendix 1)*

A range of healthy eating interventions could help to reduce these costs. They have been shown to be good value for money (cost-effective), even paying for themselves in some cases (cost saving).

The following chart shows the main cost effective nutrition interventions, with the most cost effective at the top. The chart is based mainly on one multi faceted modelling study, so that results are comparable. Less than £20,000 to £30,000 per disability adjusted life year (DALY) saved is considered an acceptable level of cost effectiveness (NICE, 2009). School based interventions become cost-effective after 63 years (OECD, 2010). The uncertainty associated with cost-effectiveness analysis should be noted (OECD, 2010; DH, 2011).



# Diet and healthier eating interventions

## Background

Nutrition is an important common determinant in several diseases and conditions, including obesity, heart disease, stroke, type 2 diabetes, dental decay and several cancers (Mozaffarian and Capewell, 2011). In October 2011, the Government launched its 'Call to action on obesity' (DH, 2011). It was noted that England has one of the highest rates of obesity in Europe, with more than 60% of adults and a third of 10 and 11 year olds overweight or obese. Across the Merseyside cluster, more than 1 in 5 children aged 10-11 are obese (22.2%), rising to almost a quarter in Knowsley (24.4%). Nationally, the figure is 19.0% (NHS Information Centre, 2011).

Estimates of the costs to the NHS of treating ill-health related to poor diet vary from £4 billion each year to £6 billion (DH, 2004, Rayner and Scarborough 2005, Liverpool PCT, 2010). Allowing for inflation, these costs would have reached between £4.9 billion to £7.4 billion by 2010/11 (see Appendix 1). Poor diet costs the wider economy billions more. Based on these figures, in Merseyside (including Halton), it can be estimated that poor diet would have cost the NHS between £116.9 million and £175.4 million during 2010/11. The following table shows estimated costs within Merseyside:

Estimated annual cost to the NHS of poor diet on Merseyside (including Halton)					
Halton	Knowsley	Liverpool	St.Helens	Sefton	Wirral
£9.2m to £13.8m	£11.6m to £17.4m	£35.8m to £53.7m	£21.9m to £32.9m	£14.0m to £21.1m	£24.3m to £36.5m

*2010/2011 estimates, based on estimates by DH (2004) and Rayner and Scarborough (2005) uplifted using the HCHS index published by PSSRU (see Appendix 1)*

Nutrition interventions are potentially the most cost effective way of tackling coronary heart disease and other conditions (Dalziel and Segal, 2007). Such interventions would reduce obesity rates and decrease the incidence of ischaemic heart disease, stroke and some forms of cancer (OECD, 2010). Reducing obesity by 1% or preventing a 1% increase in obesity would result in cost avoidance for the NHS of between £66 and £74 million per year (NICE, 2006). Mozaffarian and Capewell (2011) list eight dietary targets that if achieved, would halve cardiovascular mortality annually. At present, only 4% of NHS funding is spent on prevention, possibly because of a lack of good quality evidence (Owen et al, 2011). It has been noted that there is not a great deal of evidence on the effectiveness and cost effectiveness of interventions to improve diets. One possible reason for this is the difficulty in assessing outcomes of interventions, because dietary change is hard to measure, either at individual or population level (OECD, 2010; DH, 2011). Some of the limitations of cost effectiveness analysis are presented in Box 1.

Owen et al (2011) noted that existing preventive initiatives have a short-term, clinical focus. Trials are generally too short to capture the long-term benefits of an intervention. Epidemiological modelling has been used in attempt to fill this gap. By combining available evidence from different sources, modelling enables predictions of future outcomes (Jacobs-van der Bruggen et al, 2009), as illustrated in the chart on p.3.

**The review:** This cost effectiveness review on healthier eating presents the available evidence on interventions at different levels:

### 1. **General population interventions**

- Fiscal measures (price/tax)
- Legislation/ regulation (including food labelling and content)
- Mass media campaigns.

### 2. **Targeted groups and individuals**

Brief interventions for individuals and life course groups at high risk. Interventions starting earlier in the life course are likely to have a greater impact and be more cost-effective in the long-term.

### 3. **Settings**

Interventions targeting the whole population of a setting.

The review includes direct NHS/ local authority/ third sector interventions, such as offering advice in primary care, and indirect interventions, including lobbying the government for changes in the legislation relating to manufactured food.

*Exclusions from Review Scope:* This is a review of existing evidence, not a research project in itself. The review will not include drug treatments or secondary care treatment such as surgical interventions. The focus is on healthier eating, for example increasing fruit and vegetable consumption, reducing salt, fat or sugar intake – and not on obesity.

#### **Box 1: Limitations of cost effectiveness analysis**

A degree of caution is required when reading the results of cost effectiveness analyses (Hanratty, 2010, OECD, 2010; DH, 2011). In the analyses presented here, there is often considerable uncertainty associated with the findings as a result of differences in the assumptions and parameters used:

- interventions targeting different age and weight groups will have different cost effectiveness ratios (Galani et al, 2007, see p.14 here);
- some studies will base QALYs simply on reductions in two or three conditions (e.g. heart disease and diabetes) (NICE, 2006 p. 727) and other studies will take additional factors into account, which will have an effect on cost effectiveness ratios;
- there is variation in whether and how weight regain over time is allowed for (Forster et al, 2011). It should be noted that the health benefits of lifestyle advice can persist even if weight is largely regained (Trueman et al, 2010);
- a range of different economic methods have been employed, making comparisons between studies difficult;
- it is difficult to generalise the results between countries because of variations in health care costs, disease prevalence and risk factor distributions (Jacobs-van der Bruggen, 2007).

Due to these limitations, the cost effectiveness ratios presented on the summary page are taken mainly from the modelling study most relevant to the UK, which considered a large range of interventions using the same parameters. This was the study by Cecchini et al 2010, which was largely based on studies presented in the WHO review *'Interventions on diet and physical activity: What works'* (WHO, 2009).

Evidence was gathered from various sources, using set search terms (details in [Appendix 1](#)). Searches were carried out for papers from 2000 until October 2011. Only those studies that gave details of costs and cost-savings / cost effectiveness were included. In systematic reviews or modelling papers, the primary studies that make up the review were not usually included. Critical appraisals of studies featuring in the NHS Economic Evaluation Database were used to assist in determining the quality of studies. The focus was on good quality UK studies. Other studies were included, except those with limited generalisability to the UK.

## Findings

The sections are ordered according to the degree of evidence on cost-effectiveness, with population approaches first, as these interventions have high cost effectiveness and are based on good quality evidence. Within each section, studies most relevant to the UK are listed first, followed by other studies in order of publication date. Thresholds of cost effectiveness are presented in Box 2.

### Box 2: What is an acceptable level of cost effectiveness?

**UK:** less than £20,000-£30,000 per DALY saved is considered cost effective (NICE 2009).

**US:** less than US\$50,000 per DALY saved is cost effective (OECD, 2010, p.196 and Cecchini et al 2010).

**Australia:** in the ACE-P work, the threshold is A\$50,000 (Vos et al, 2010 and Gortmaker et al 2011). ACE-P added another threshold of A\$10,000 to distinguish 'very cost-effective interventions (Vos et al, 2010).

**Europe:** the threshold per DALY saved was between €19,600 (Te Velde et al, 2011) to €20,000 (Jacobs-van der Bruggen et al (2007).

**Cost saving** = benefits outweigh costs, i.e. pays for itself

For this review, all currencies were converted to £s, for ease of comparison (see [Appendix 1](#)).

## 1. General population interventions

### Fiscal (price) interventions/ Legislation and Regulation/ Mass media campaigns

Population-wide prevention interventions, such as pricing controls, salt reduction and trans fat eradication have been shown to be cost saving measures that contribute to healthier eating patterns. Interventions would lead to reductions in conditions such as heart disease, diabetes, many common cancers and other chronic diseases, as well as a decrease in absolute inequalities (Barton et al, 2011; Mozaffarian and Capewell, 2011). The effects of such population measures are more equitable than with individual interventions, which tend to favour more affluent groups (Capewell and Graham, 2010). In addition to NHS savings, there are even greater social savings, for example with reduced workplace sickness. Intervention effects occur rapidly, with mortality reductions within a few years (NICE, 2010).

Health promotion campaigns delivered by the mass media to a population will help to improve awareness of the benefits of healthy eating. Although not cost-saving, these campaigns can be more cost-effective compared to more costly individual interventions (Cecchini et al 2010). In some cases, a sub-population may be targeted and use of the mass media may be combined with promotional work involving groups in the community.

Local and national restrictions on the location and food provided in fast food outlets are also potentially cost saving, but there is a lack of evidence at present (see [Appendix 2](#)).

Study (with critical appraisal where available)	Intervention	Cost-effectiveness/ savings
<b>Pricing/tax</b>		
Cecchini et al (2010). Multinational modelling study.	Pricing interventions. Involves decreasing the price of fruit and vegetables with subsidies and increasing the price	Pricing interventions are <b>cost saving</b> – i.e. pay for themselves, with 6,049 <a href="#">DALYs</a> saved per million population after 50 years in England.

Study (with critical appraisal where available)	Intervention	Cost-effectiveness/ savings
<p><a href="#">NHS EED</a>: 'results appear robust'.</p>	<p>of fatty foods with tax.</p>	
<p>Based on evidence rated 4 ('may be effective') in Gortmaker et al (2011) and Vos et al (2010).</p> <p>Australian modelling project. Used the Assessing Cost Effectiveness in Prevention (ACE-P) method of economic evaluation.</p>	<p><b>Unhealthy foods tax.</b> Involving a 10% price increase in seven food categories (including soft drinks, confectionery and snack foods).</p>	<p>An unhealthy food tax of 10% was regarded as being <b>cost-saving</b>.</p>
<p><b>Regulation of advertising</b></p>		
<p>Cecchini et al (2010).</p> <p>Multinational modelling study based on OFCOM (2006) &amp; OFCOM (2008).</p> <p><a href="#">NHS EED</a>: 'results appear robust'.</p>	<p>Restrictions on marketing of unhealthy food and drink to children.</p>	<p>After 50 years in England, this intervention has a cost effectiveness ratio of <b>£2, 941 per DALY averted</b> (i.e. the cost of gaining 1 additional healthy year of life). This is considered <b>cost-effective</b></p> <p>Excluding all TV advertising and sponsorship of foods high in fat, salt and sugar would result in annual health benefits of £125m in QALYs (increased quality and quantity of life) and £605m in VoL (the valuation of lives saved) (OFCOM, 2006). Such restrictions have been successfully introduced in Norway, Sweden, Belgium, Greece, Romania and Quebec (NICE, 2010).</p>
<p>Based on evidence rated 2 ('likely effectiveness') in Gortmaker et al (2011).</p> <p>Australian ACE-P modelling project.</p>	<p>Reduction of advertising of junk food and beverages to children. Target was those aged 0-14 years.</p>	<p><b>Cost-saving</b> (over the lifetime of a population).</p>
<p><b>Food labelling</b></p>		
<p>Cecchini et al (2010).</p> <p>Multinational modelling study. Based on 3 studies, listed in Cecchini et al 2010, webappendix 3.</p> <p><a href="#">NHS EED</a>: 'results appear robust'.</p>	<p>Compulsory food labelling.</p>	<p>After 50 years in England, this intervention has a cost effectiveness ratio of <b>£3,622 per DALY averted</b> (i.e. the cost of gaining 1 additional healthy year of life). This is considered <b>cost-effective</b>.</p>
<p>Based on evidence rated 5 ('inconclusive') in Gortmaker et al (2011) and Vos et al (2010).</p>	<p>Front of pack traffic light nutrition labelling. Based on the guidelines issued by the United Kingdom FSA - coupled with a 1-year national social marketing campaign to educate and inform the</p>	<p><b>Cost saving</b> (over the lifetime of a population).</p>

Study (with critical appraisal where available)	Intervention	Cost-effectiveness/ savings
Australian modelling project using the ACE-P method.	population on how to interpret the labels.	
<b>Regulation of food content</b>		
Cobiac et al (2010a).  Australian modelled analysis. <i>NHS EED: 'well carried out ...conclusions robust...limited by uncertainty in some model inputs'.</i>	Voluntary and mandatory restrictions on salt content. Compared with dietary advice on salt for those at risk and the whole population.	<b>Voluntary and mandatory limits were both cost saving</b> (i.e. with more health and less cost than if no intervention). Population health benefits could be 20 times greater with mandatory moderate salt limits in processed foods, compared to the current voluntary limits in Australia. Dietary advice on salt intake was not cost effective. A US study found voluntary agreement with manufacturers was more effective than a salt tax – both were cost-saving (Smith-Spangler et al, 2010).
Barton et al (2011).  UK Modelling study.	Legislation ('or other measures') to reduce salt intake.	<b>Cost saving:</b> Reducing salt intake by 3g/day (from the current level of 8.5g/day) would lead to reductions in blood pressure that would prevent approximately 4,450 deaths from cardiovascular disease in England and Wales. Annually, 30,000 cardiovascular events would be prevented, with <b>NHS savings worth at least £40m.</b>
NICE (2010)  CVD guidance.	Restrictions on salt.	In the NICE guidance, estimated benefits were higher than in Barton et al (2011): <b>Salt:</b> A 3 g reduction in mean daily salt intake by adults (to achieve a target of 6 g daily) would lead to around 14–20,000 fewer deaths from CVD annually. At least <b>£350 million in healthcare costs would be saved</b> annually in England & Wales. A mean reduction of 6 g per day would double the benefits, with an annual saving of £700 million in healthcare costs.
Barton et al (2011).  UK Modelling study.	Legislation to ban industrial trans fats.	<b>Cost saving:</b> Intake of trans fats could be reduced by approximately 0.5% of total UK dietary energy intake. In England and Wales, 2,700 deaths would be prevented annually, with a gain of 570,000 life years and <b>NHS savings of at least £230m each year.</b>  This is a conservative estimate – the reduction in trans fats is expected to be more than 0.5%. Benefits in deprived communities are predicted to be even larger, due to the current high consumption of trans fats reported amongst disadvantaged groups.
NICE (2010)  CVD guidance.	Restrictions on transfats.	<b>Transfats:</b> A reduction of IPTFA (industrially produced trans fatty acid) intake to approximately 0.7% of total fat energy might save approximately 571,000 life years – and <b>reduce healthcare costs by some £2 billion.</b> (Higher than the estimated benefits in Barton et al, 2011).
<b>Voluntary regulation of food content</b>		
Reported in Barton et al (2011)  UK Modelling study. Ref. 6 – FSA sodium level survey results.	Salt reduction campaign. Guidance to food industry, with voluntary targets.	<b>Cost saving:</b> The UK Food Standards Agency's five year salt reduction campaign cost around £15m (public awareness campaign and voluntary code of practice for industry). Average salt intake was reduced by 0.9g/day, with approximately 6,000 cardiovascular deaths prevented annually and <b>annual savings estimated at £1.5bn or £300m.</b>

Study (with critical appraisal where available)	Intervention	Cost-effectiveness/ savings
Also in NICE (2010) CVD guidance.		
<b>Mass media campaigns to improve population awareness</b>		
<p>Cecchini et al (2010).</p> <p>Multinational modelling study. Based on 3 studies, listed in Cecchini et al 2010, webappendix 3.</p> <p><a href="#">NHS EED</a>: 'results appear robust'.</p>	<p>Interventions around promoting fruit and vegetable consumption. Including one state wide TV based advertising campaign in Victoria, Australia and an employee based peer education campaign among lower socioeconomic, multicultural labour and trades employees in the US.</p>	<p>After 50 years in England, this intervention would have a cost effectiveness ratio of <b>£9,486 per DALY averted</b>. This is considered <b>cost-effective</b>.</p> <p>(N.B. Cecchini et al did not include the BBC 'Fighting Fit, Fighting Fat' campaign (FFFF), as it was carried out before 2006).</p>
<p>Cobiac et al, (2010b).</p> <p>Australian ACE-P modelling project, fruit and vegetable interventions, 2004-09 (Cobiac et al reference 34). Evidence rated 'weak' by Cobiac et al.</p>	<p>A UK initiative in a small geographical area, to increase fruit and vegetable intake. Involved building community networks, with collaboration between retailers, educators, primary care teams, employers and local media.</p>	<p>Has the potential to be <b>cost saving</b> to the health sector. This intervention was the most cost-effective of all those included in the analysis by Cobiac et al.</p>
<p>Dalziel and Segal (2007).</p> <p>Australian modelled economic evaluation – compared 8 nutrition interventions.</p> <p><a href="#">NHS EED</a>: 'methodology adequate, details of comparators lacking'.</p>	<p>BBC 'Fighting Fit, Fighting Fat' campaign (FFFF). UK media campaign lasting 7 weeks. Effective, but authors noted different approaches might be needed to maximize participation from groups most in need of lifestyle change.</p>	<p><b>Highly cost effective, at £2,300 per QALY gained.</b></p> <p>'Medium quality' evidence (HELP, 2009) – therefore some uncertainty in estimating the performance of the intervention (Dalziel and Segal, 2007).</p>
<p>Bemelmans et al (2008).</p> <p>Dutch modelling study.</p> <p><a href="#">NHS EED</a>: 'conclusions valid'.</p>	<p>Community based approach offered to 90% of the population to prevent overweight. Consisted of communication strategies, through mass media, combined with social support such as self-help groups, risk factor screening and/or counselling in various settings.</p>	<p>With an 80-year time horizon, the incremental <b>costs per QALY gained</b> in comparison with no intervention were <b>very cost effective, at £3,308</b>.</p> <p>If combined with a targeted lifestyle programme involving diet and physical activity sessions, then costs per QALY were slightly higher, but still very cost effective, at £3,771.</p>
<p>Jacobs-van der Bruggen et al (2007).</p> <p>Dutch modelling study.</p> <p><a href="#">NHS EED</a>:</p>	<p>Targeted the general population with a community-based nutrition and physical activity programme. Featured mass media campaigns and a range of activities in various settings, over a period of 5 years.</p>	<p>Compared with a no intervention strategy, the extra <b>cost per QALY gained</b> was <b>£2,118 to £2,665</b> (€3,100 to €3,900), which was <b>very cost-effective</b>, being well below the €20,000 per QALY gained Dutch cost effectiveness threshold. (Lifetime horizon).</p>

Study (with critical appraisal where available)	Intervention	Cost-effectiveness/ savings
'limitations on generalisability between countries should be considered'.		

## 2. Targeted groups or individuals

### Community based or primary care led interventions for those at high risk

Interventions based on the intensive counselling (i.e. involving a dietician) of individuals at risk in primary care have the largest health impacts (OECD, 2010) but with much higher costs compared to other interventions. Although evidence for the effectiveness of motivational interviewing is strong, the National Obesity Observatory (2011) noted gaps in the evidence for brief interventions, including the need for more studies on their cost effectiveness.

There was a lack of evidence on the cost effectiveness of interventions targeting life course groups such as pregnant women, pre-school children, young parents and families and older people. Interventions with these groups would include cooking skills for parents and the work of community champions/health trainers.

Study (with critical appraisal where available)	Intervention	Cost-effectiveness/ savings
<b>Breastfeeding promotion</b>		
NICE (2007a).  UK Economic modelling of breastfeeding scheme.	Paid and voluntary peer support to increase breastfeeding initiation and duration.	<b>Cost-saving:</b> the scheme is dominant, i.e. the intervention is both cheaper and more effective than the alternative of no peer support.
Rice et al (2010).  UK Economic modelling of breastfeeding initiative.  <a href="#">NHS EED</a> : 'valid conclusions'.	For mothers of infants in neonatal units- more contact with staff specially trained in supporting breastfeeding, providing individual education, support, and a care plan.  Compared with the normal staff contact, without nurses who were specifically trained to support breastfeeding mothers.	<b>Cost-saving</b> – the intervention was more effective and cheaper than usual care.
Breastfeeding is the first step in nutrition which has important impacts on future eating behaviours and habits (Evans, 2011). In addition to general health and societal savings, 2.7 per 10, 000 cases of pre-menopausal breast cancer would be averted, as would 285 per 10,000 cases of infections requiring hospitalisation in the 1 <sup>st</sup> year of life (NICE, 2007a). Societal savings include the environmental benefits from not manufacturing formula milk, transporting it, management of waste from packaging. There are benefits to employers where breastfeeding policies are implemented, resulting in improved productivity because of reduced sickness and absence to care for sick children (NICE, 2007a).		
It should be noted that a Scottish study found that weekly breastfeeding groups led by a health professional did not provide good value for money. The costs of running groups were similar to the costs of usual care of visiting women at home. The authors concluded that resources may be better directed to the first two weeks after birth, when the highest proportion of women stop breast feeding (Hoddinott et al, 2009). <a href="#">NHS EED</a> : 'A well conducted RCT, using valid methodology'.		

Study (with critical appraisal where available)	Intervention	Cost-effectiveness/ savings
<b>Primary care interventions</b>		
<p>Wirral PCT (2010).</p> <p>Preliminary cost-effectiveness analysis. <i>'Limited quality due to missing data'</i> (Wirral PCT, 2010).</p>	<p>Wirral NHS weight management programme for obese individuals. Accessed following a health check with GP or practice nurse. Twelve week programme, with group and 1 to 1 sessions.</p>	<p>Averts 38 coronary heart disease deaths, and provides an additional 13.2 QALYs to the Wirral population per year. Net costs (taking into account health care costs saved) were £179,040 for 2007-8. <b>Significant value for money</b>, with net cost of <b>£13,564 per QALY gained</b>.</p>
<p>Cecchini et al (2010).</p> <p>Multinational modelling study. Based on 3 studies, listed in Cecchini et al 2010, webappendix 3.</p> <p><a href="#">NHS EED</a>: <i>'results appear robust'</i>.</p>	<p>Nutrition counselling interventions in primary care. Averaging 25 minutes over 2.6 sessions with a physician or dietician.</p>	<p>After 50 years in England, this intervention would have a cost effectiveness ratio of <b>£10,816 per DALY averted</b> (i.e. the cost of gaining 1 additional healthy year of life). This is considered <b>cost-effective</b>.</p>
<p>Jolly et al (2011).</p> <p>UK, RCT (randomised controlled trial).</p>	<p>Obese or overweight individuals were invited by their GP to participate in either a commercially provided weight management programme (such as Weight Watchers) or a primary care-led intervention, free of charge, with weekly sessions over a 12 week period. (The Birmingham 'Lighten Up' trial).</p>	<p>In a primary care population, group based programmes produced significant weight loss at one year after a 12 week programme. One to one primary care based programmes were ineffective and most costly to provide. <b>Short commercial and NHS group based programmes</b> have the potential to produce clinically useful weight loss at one year follow-up. In commercial programmes, <b>the cost per life year saved was about £77</b>. The authors conclude that that this intervention could be <b>very cost effective</b>. One to one primary care-led interventions showed no evidence of effectiveness.</p>
<p>Trueman et al (2010).</p> <p>UK Cost-utility analysis. <a href="#">NHS EED</a> comment: <i>'conclusions appear to be valid and robust'</i>. Loveman et al (2011): <i>'some cost detail lacking, but credible study'</i>.</p>	<p>Long-term cost-effectiveness of weight management in 65 practices. <i>'Counterweight programme'</i> – an intervention delivered in family practice and other settings, by practice nurses or other health care workers, with initial guidance and facilitation by dieticians or registered nutritionists. Involves promoting adoption of a healthy balanced diet, regular physical activity with a weekly weight loss target.</p>	<p>The intervention was found to be highly cost effective – actually <b>cost-saving</b> over a 3 year period (1 year intervention, 2 years follow-up), so that reduced use of healthcare resources could offset the total cost of providing the programme, as well as bringing many other quality of life benefits.</p>

Study (with critical appraisal where available)	Intervention	Cost-effectiveness/ savings
NICE (2006).  UK Modelled cost effective analysis.	<b>Family programmes</b> lead by health professionals to prevent obesity and improve dietary intake and/or physical activity. Provided on-going tailored support and incorporated a range of behaviour change techniques. Based on US study targeting females aged 7-12 years.	Incremental cost effectiveness ratio was <b>£1,826 per QALY, which was cost effective</b> , relatively low and well within accepted ranges. Based on lifetime QALY gains. Assumed that weight is maintained over 1 year and that 75% would respond to the intervention.
NICE (2006).  UK Modelled cost effective analysis.	Nutrition counselling by primary care staff.	Incremental cost effectiveness ratio was <b>£2,314 per QALY, which was cost effective</b> , relatively low and well within accepted ranges. Based on lifetime QALY gains. Assumed that weight is maintained over 1 year and that 75% would respond to the intervention.
Dalziel and Segal (2007).  Australian modelled economic evaluation – compared 8 nutrition interventions.  <a href="#">NHS EED</a> : 'methodology adequate, details of comparators lacking'.	'OXCHECK' nurse checks in UK general practice. Patients screened for heart disease and cancer risk factors, offered 45-60minute consultation with 10-20 minute follow up and 30 minute annual recheck.	<b>Highly cost effective, at £5,100 per QALY gained.</b> <i>'High quality trial'</i> (Dalziel and Segal, 2007). NOTE: in the Oxcheck study, 'if the study population had only a single initial health check lasting one hour and no follow up visits, seven practice nurses would be employed full time for one year to prevent one coronary death in men, and an additional 41 would need to be employed to prevent one death on women' (Haq et al, 1995).
OECD (2010).  GCEA (generalised cost effectiveness analysis).	Nutrition counselling (physician based) and intensive counselling (physician plus dietician) of at risk individuals in primary care. The outcome measured was increase in fruit and vegetable consumption and decrease in the proportion of energy intake from fats.	Largest costs of delivery, but largest health impact compared to other (mainly population based) interventions, so still <b>cost-effective: Physician plus dietician counselling has a cost effectiveness ratio of £3,876 per DALY averted</b> , which is <b>2<sup>nd</sup> only to fiscal measures in cost effectiveness</b> of the 9 interventions considered by the OECD. <b>Physician only counselling has a cost effectiveness ratio of £11,204 per DALY averted</b> (the 4 <sup>th</sup> most cost effective of the interventions considered).
Based on evidence rated 1 (sufficient) in Gortmaker et al (2011).  Australian ACE-P modelling project. Original studies are quoted in Haby et al (2006), references 32 & 33.	<b>Family-based targeted programme for obese children aged 10-11.</b> Involved sessions with a trained counsellor every 2 or 3 months over 14-18 months. Where GPs were involved, they were trained and undertook 4 consultations with parents over 12 weeks. Interventions were focussed on behaviour change and not weight loss. (Part of LEAP programme: Live, Eat And Play).	<b>Cost-saving</b> (over the lifetime of a population).

Study (with critical appraisal where available)	Intervention	Cost-effectiveness/ savings
<p>Forster et al (2011).</p> <p>Australian ACE-P modelling project. Analysis of two dietary weight loss interventions.</p>	<p>Targeting self-selected groups of overweight or obese adults:</p> <ol style="list-style-type: none"> <li>1) Dietary approaches to stop hypertension (DASH) programme. Recruited through mass mailings and screening, participants kept food diaries and attended 10 group based and 2 individual meetings with dieticians over 6 months. Also included separate exercise counselling.</li> <li>2) Low fat diet programme. A 1-year programme involving a series of monthly small group meetings with dieticians plus food diaries.</li> </ol>	<p>The <b>DASH</b> programme was <b>cost-effective, at £6,628 per DALY averted</b>.</p> <p>The <b>low fat diet</b> programme was <b>cost effective, at £7,180 per DALY averted</b>. (allows for some weight regain, but excludes costs to patients in travelling time etc.).</p> <p>Forster et al note their study compares favourably with that of Cobiac et al, (2010c).</p>
<p>Cobiac et al (2010b).</p> <p>Australian ACE-P modelling project, fruit and vegetable interventions 2004-09 (Cobiac et al reference 52).</p>	<p>Brief individual counselling carried out by nurses in primary care.</p> <p>Targeting a <b>low income</b>, deprived inner city area in the UK to improve uptake of fruit and vegetables. One 15 minute baseline consultation, and one follow-up consultation, with an assessment of intervention effects at 12 months.</p>	<p>Found to lead to marked increases in fruit and vegetable consumption, with a cost-effectiveness ratio of <b>£4,628 per QALY (i.e. cost effective)</b>.</p> <p>Intervention effects applied for 1 year, and health effects measured to 20 years.</p>
<p>Cobiac et al (2010c).</p> <p>Australian modelling project, using the ACE-P method of economic evaluation.</p> <p>Lighten Up study=weak evidence; Weight Watchers study=stronger evidence (Cobiac et al, 2010c).</p>	<p>Compares two dietary programmes:</p> <ol style="list-style-type: none"> <li>1) a government led 'Lighten up to a healthy lifestyle' 2 month diet and exercise programme, with 6 group workshops and 3 individual appointments with trained health professionals, for adults wishing to improve their diets.</li> <li>2) a 6 month commercial Weight Watchers program, with advice on low calorie diet.</li> </ol>	<p>Both programmes produced small improvements in population health, but neither is considered highly cost effective in reducing obesity.</p> <p>However, if patient costs are excluded (as in Forster et al 2011), the <b>cost effectiveness ratio for Weight Watchers</b> is below the £20,000 – £30,000 per DALY averted cost effectiveness threshold, at <b>£11,789 per DALY averted</b> over the lifetime of the population. The equivalent ratio for Lighten Up is £27,945 per DALY (not as cost effective).</p> <p>Although the Weight Watchers program is more expensive per person, it is more effective in reducing BMI. Results allow for some decay in intervention effect e.g. weight regain.</p>
<p>Cobiac et al (2010b).</p> <p>Australian ACE-P modelling project, fruit and vegetable interventions 2004-09 (Cobiac et al reference 35). 'Evidence limited' (Cobiac et al 2010b).</p>	<p>Information mail-out to callers to a cancer information service, aiming to increase fruit and vegetable intake.</p> <p>Compared a single, untailored set of brief educational messages to multiple, tailored messages.</p>	<p><b>'Very cost effective', at £3,755 per DALY averted</b> when the intervention involved multiple sets of materials and was re-tailored (i.e. based on new information gained at 5 months follow-up).</p> <p>'Cost effective' at £5,240 per DALY averted if multiple tailored; and £11,789 if tailored with a single set of messages.</p>

Study (with critical appraisal where available)	Intervention	Cost-effectiveness/ savings
Eriksson et al (2010).  Swedish cost-effectiveness analysis.	Lifestyle intervention plus standard care, for men and women, aged 18 to 65 years, at moderate to high risk for cardiovascular disease. Compared to standard care alone. Supervised diet counselling and exercise sessions for 3 months, followed by regular group meetings over a 3-year period.	Lifestyle intervention in primary care is <b>highly cost-effective</b> in relation to standard care, <b>at £1,147 to £3,309 per QALY gained.</b>
Moodie et al (2008).  Australian RCT. LEAP trial (Live, eat and play). Part of ACE-P project. <a href="#">NHS EED</a> : 'author's conclusions appear robust'.	GP brief intervention. Involved training sessions for GPs. Screened and targeted overweight and mildly obese <b>children aged 5-9</b> with 4 consultations around eating and activity.	<b>Cost effective:</b> Limited effectiveness on weight, but dietary habits improved significantly. If the intervention was introduced across Australia, the <b>cost per DALY saved was estimated at £1,840</b> (additional cost minus future savings).
Dollahite et al (2008).  US economic evaluation.	Community nutrition programme for <b>low-income</b> multi-ethnic adults. Six or more food and nutrition lessons, as part of a state-wide programme. (New York State Expanded Food and Nutrition Education Program).	The intervention was <b>cost-effective, at £10,647 per QALY gained.</b>
Galani et al (2007).  Swiss, modelled analysis. <a href="#">NHS EED</a> : 'quality of methodology adequate and conclusions appear valid'.	Analysis of long-term lifestyle interventions in overweight and obese people. Included the RCT by Lindstrom et al (2006) where the main goals were weight reduction and reduced fat and increased fibre intake, in addition to increased physical activity. Involved sessions with a trainee nutritionist – 7 in the 1st year and every 3 months after that, for an average of 4 years. Post-intervention follow-up at 3 years.	Lifestyle intervention is cost-effective in the long-term prevention and treatment of obesity. <b>Obesity:</b> Ranged from <b>cost saving in obese males aged 45-55</b> to a cost effectiveness ratio (ICER*) of £79,381 (i.e. not cost effective) in obese females aged 25. <b>Overweight:</b> Cost effectiveness ratios ranged from <b>£7,935 in overweight males aged 55, (cost effective)</b> to £136,909 in females aged 25 (not cost effective).  *ICER=incremental cost effectiveness ratio. i.e. additional cost per life-year gained when the lifestyle intervention was compared with standard care.
Dalziel and Segal (2007).  Australian modelled economic evaluation – compared 8 nutrition interventions.  <a href="#">NHS EED</a> : 'methodology adequate, details of comparators lacking'.	Secondary prevention: Heart attack patients recruited from hospital before discharge. Involved 1 hour session – asked to sign a consent form to comply with Mediterranean diet – follow up after 1 year & long term evaluation after around 4 years (Lyon Diet Heart Study).	<b>Highly cost effective, at £410 per QALY gained.</b> <i>'High certainty of cost effectiveness.... based on good quality clinical trial'</i> (Dalziel & Segal 2007).

Study (with critical appraisal where available)	Intervention	Cost-effectiveness/ savings
<p>Dalziel and Segal (2007).</p> <p>Australian modelled economic evaluation – compared 8 nutrition interventions.</p> <p><a href="#">NHS EED:</a> <i>'methodology adequate, details of comparators lacking'.</i></p>	<p>Intensive lifestyle change to prevent diabetes in overweight people.</p> <p>GP and nutritionist provide tailored advice with 7 sessions in year one followed by 4 more visits (Finnish Study).</p>	<p><b>Highly cost effective, at £750 per QALY gained.</b></p> <p><i>'High certainty of cost effectiveness.... based on good quality clinical trial'</i> (Dalziel &amp; Segal 2007).</p>
<p>Dalziel and Segal (2007).</p> <p>Australian modelled economic evaluation – compared 8 nutrition interventions.</p> <p><a href="#">NHS EED:</a> <i>'methodology adequate, details of comparators lacking'.</i></p>	<p>Nutrition counselling for primary care patients screened for overweight, hypertension or diabetes.</p> <p>Six sessions, 1 to 1 with a dietician over 12 months, plus 2 follow-up visits (Australian study).</p>	<p><b>Highly cost effective, at £4,200 per QALY gained.</b></p> <p><i>'Evidence was poor quality, with potential for bias'</i> (Dalziel and Segal, 2007).</p>
<p>Roux et al (2006).</p> <p>US cost effectiveness review.</p> <p><a href="#">NHS EED:</a> <i>'methods appropriate'.</i></p> <p>Loveman et al (2011): <i>'some cost detail lacking, but credible study'.</i></p>	<p>Evaluation of four weight loss strategies: diet only; diet and pharmacotherapy; diet and exercise; and a combination of diet, exercise and behaviour modification.</p> <p>Targeting obese &amp; overweight women in primary care. All interventions were implemented for a 6-month period followed by a 6-month maintenance programme.</p>	<p>The combination of diet, exercise and behaviour modification was the dominant strategy. It was cost-effective, at <b>£6,711 per additional QALY gained</b>. The diet-only strategy was less effective and more costly than routine care.</p>

### 3. Targeted settings

Interventions can be targeted at the whole population of a setting, such schools and workplaces. They include healthy food provision, cookery lessons, and restrictions on vending machines. The benefits can have social multiplier effects, reaching into the families of those who are exposed to the interventions. These effects are not usually included in analyses, due to lack of evidence (OECD, 2010).

Interventions in settings such as nursery schools, youth centres, fast food outlets, hospitals and care homes/social care are also potentially cost effective (see [Appendix 2](#)), but lack of evidence means they cannot be included here.

Study (with critical appraisal where available)	Intervention	Cost-effectiveness/ savings
<b>Worksite interventions</b>		
<p>Cecchini et al (2010).</p> <p>Multinational modelling study. Based on five studies, listed in Cecchini et al 2010, webappendix 3.</p> <p><a href="#">NHS EED</a>: 'results appear robust'.</p>	<p>Worksite health promotion interventions.</p> <p>Involved seminar organisation, nutritionist input and training of peer educators and food service staff.</p>	<p>After 50 years in England, this intervention would have a cost effectiveness ratio of <b>£14,099 per DALY averted</b> (i.e. the cost of gaining 1 additional healthy year of life). This is considered <b>cost-effective</b>.</p>
<p>NICE (2006).</p> <p>UK Modelled cost effective analysis.</p>	<p>Based on a Dutch study with 7 sessions of workplace-based tailored counselling promoting physical activity and healthy dietary habits</p>	<p>Incremental cost effectiveness ratio was <b>£3,018 per QALY, which was cost effective</b>, relatively low and well within accepted ranges.</p> <p>Based on lifetime QALY gains. Assumed that weight is maintained over 1 year and that 75% would respond to the intervention.</p>
<p>Cobiac et al (2010b).</p> <p>Australian ACE-P modelling project, fruit and vegetable interventions 2004-09 (Cobiac et al reference 36).</p>	<p>Worksite promotional materials and cafeteria changes in the Netherlands.</p>	<p><b>Cost-effective, at £20,522 per DALY averted</b> (AUD\$47,000).</p> <p>Falls just within the cost effectiveness threshold of \$50,000 per DALY averted. However, uncertainty around intervention effectiveness led to a 50% probability that the intervention would be effective if rolled out in Australia.</p>
<p>Dalziel and Segal (2007).</p> <p>Australian modelled economic evaluation – compared 8 nutrition interventions.</p> <p><a href="#">NHS EED</a>: 'methodology adequate, details of comparators lacking'.</p>	<p>Reduced fat diet. Diabetes prevention study - participants with impaired glucose tolerance identified through a workforce survey.</p> <p>One year structured programme with intensive education involving monthly small group sessions. Australian study.</p>	<p><b>Highly cost effective, at £4,000 per QALY gained.</b></p> <p>'Intermediate quality' evidence (Dalziel and Segal, 2007).</p>
<p>Dalziel and Segal (2007).</p> <p>Australian modelled economic evaluation – compared 8 nutrition interventions.</p> <p><a href="#">NHS EED</a>: 'methodology adequate, details of comparators lacking'.</p>	<p>Small group sessions mostly held in workplaces.</p> <p>1.5 hours per week for 6 weeks, run by trained leader, encouraging healthy eating and exercise.</p> <p>Australian 'Gutbusters' programme.</p>	<p><b>Highly cost effective, at £7,900 per QALY gained.</b></p> <p>However, evidence was 'poor quality, with potential for bias' (Dalziel and Segal, 2007).</p>

Study (with critical appraisal where available)	Intervention	Cost-effectiveness/ savings
<b>School and worksite interventions</b>		
<p>OECD (2010).  GCEA (generalised cost effectiveness analysis, i.e. evaluation of the efficiency of a mix of interventions that tackle unhealthy diets)</p>	<p>School and worksite based interventions to increase fruit and vegetable intake and decrease the proportion of energy intake from fat.</p>	<p>After <b>13 years, worksite interventions become cost effective</b>, with a cost-effectiveness ratio of <b>\$49,000 (£33,690) per DALY averted</b>.  <b>School-based interventions</b> take longer to become cost-effective – by year 64, they are below the \$50,000 cost effectiveness threshold, at <b>\$48,000 (£33,003) per DALY averted</b>. (See <a href="#">Appendix 3</a> for time line)</p>
<b>School based interventions</b>		
<p>Cecchini et al (2010).  Multinational modelling study. Based on four studies, listed in Cecchini et al 2010, webappendix 3.  <a href="#">NHS EED</a>: 'results appear robust'</p>	<p>Interventions in school aimed at increasing fruit and vegetable consumption.  Involves extra teaching hours for extra-curricular activities, training teachers and food service staff, and the use of brochures, books, posters and equipment.</p>	<p>School-based interventions do not demonstrate their <b>cost-effectiveness</b> until <b>after about 50 years</b> – cost effectiveness ratios improve after this time as the interventions realise their full potential. After 20 years, the cost effectiveness ratio was still greater than US\$1m per DALY averted for England.</p>
<p>NICE (2006).  UK Modelled cost effective analysis.  Based on study rated 'well conducted' by <a href="#">NHS EED</a>.</p>	<p>Based on a US study of girls aged 11-14 (Wang et al, 2003). The intervention group received 'Planet Health' sessions.  Focused on 'decreasing television viewing, decreasing consumption of high fat foods, increasing fruit and vegetable intake, and increasing moderate and vigorous physical activity.</p>	<p>Incremental cost effectiveness ratio was <b>£266 per QALY, which was very cost effective</b> – the most cost-effective of the four public health obesity interventions in the NICE analysis.  Based on lifetime QALY gains. Assumed that weight is maintained over 1 year and that 75% would respond to the intervention.  <i>Expert opinion:</i> Health England (HELP, 2009) did a cost effective analysis based on the same US Wang et al study – and came up with a cost per QALY of £599. They predicted that <b>cost savings</b> were estimated to occur in the long-run of 5 years or more after the intervention.  Te Velde et al (2011) said the Wang study was too optimistic in assuming that the effects of the programme were permanent. They quote another study that recalculated the cost effectiveness to be between \$69/QALY to \$35,860/QALY – <b>still highly cost-effective</b>.</p>
<p>Based on evidence rated 3 ('limited effectiveness') in Gortmaker et al (2011).  Australian ACE-P modelling project. Original studies are</p>	<p>Multi-faceted school based programme including nutrition and physical activity (targeted children aged 6).  Involved teacher-led sessions of 13-20 hours annually, supplemented with posters and workbooks and involving parents' meetings. One study was a peer-led programme were older children</p>	<p><b>Cost-saving</b> (over population lifetime).</p>

Study (with critical appraisal where available)	Intervention	Cost-effectiveness/ savings
quoted in Haby et al (2006), references 21, 22, 23.	were trained and worked with small groups giving advice and carrying out lunchbox checks.	
Based on evidence rated 3 ('limited effectiveness') in Gortmaker et al (2011).  Australian ACE-P modelling project. Original study quoted in Haby et al (2006), reference 24.	School-based education programme to reduce sugar-sweetened drink consumption. Involved 1 hour session each term in 6 junior schools, with follow-up/ reinforcement by teachers, linked art and quiz sessions and promotion of tap water.	<b>Cost-saving</b> (over population lifetime).
Te Velde et al (2011).  Dutch cost effectiveness analysis.	Two school-based interventions promoting fruit and vegetable intake amongst children aged 10-11 were compared to 'no intervention'. <b>'Pro-children'</b> included free fruit & vegetable provision, compulsory curriculum activities and family involvement. <b>'Schoolgruitem'</b> was similar, but with voluntary curriculum activities and no family involvement.	Nationwide implementation would be <b>highly cost effective</b> in both cases. Costs per DALY averted were <b>£4,968 for 'pro-children'</b> and <b>£9,257 for 'schoolgruitem'</b> , over the lifetime of children aged 10 in 2003.  'Pro-children' was more expensive but more effective.

Most of the studies included in this review are nutrition focused. There are numerous lifestyle intervention studies that look at physical activity as well as diet, but it was beyond the scope of this review to look at all of them. They include the US CATCH (Coordinated Approach to Child Health) school intervention by Brown et al (2007), and studies by Ackerman et al (2006) and Gustafson et al (2009). Additional studies are detailed in the first report of the Liverpool Public Health Observatory cost effectiveness series, on physical activity interventions (Lewis et al 2010).

## Conclusion

It has been noted that there is much variation in spending on prevention by PCTs, suggesting that a lack of information about cost-effectiveness of interventions may be hindering priority setting (Owen et al, 2011).

The OECD (2010) and TFAH (2008), amongst others, have noted a lack of evidence in the cost-effectiveness literature for healthier eating interventions. This review found a lack of data on cost effectiveness of dietary interventions in many areas, such as the work of community champions/health trainers and in settings such as hospitals and care homes, where the only literature was about diet relating to medical conditions. There is also a lack of cost effectiveness data on early years' nutrition interventions, healthy school meals, and action around fast food outlets and dental health. The recent modelling studies that have been done often based their analysis on much older studies, many of them from before 2000 (e.g. Cecchini et al 2010, OECD 2010 and NICE 2007b). It is important not to let the lack of data prevent action in these areas. As mentioned in the introduction, dietary outcomes are

difficult to measure. There is a need for economic evaluations to be conducted to strengthen the evidence base for diet and healthy eating interventions.

Despite the limited evidence available, it is clear that a multi-faceted approach to prevention is required, involving health and non-health sectors (Gortmaker et al, 2011). Based on the evidence that is available, the WHO calculated that the **three highly cost-effective ‘best buys’** for improving diet and physical activity are:

- replacement of transfat with polyunsaturated fat;
  - reduced salt intake in food; and
  - public awareness through mass media on diet and physical activity
- (WHO, 2011a and 2011b).

Of the more targeted measures, GP counselling can be as cost-effective as mass media campaigns (Cecchini et al, 2010). The preventive interventions considered in this review are much more cost effective than most clinical interventions such as those for the treatment of diabetes (Bemelmans et al, 2008). The cost effectiveness of preventive interventions is generally underestimated, as wider effects are often not included in analyses due to lack of evidence, such as reaching into the families of those exposed to the interventions, and considerable savings to healthcare services, including ongoing rehabilitation care, avoiding primary care episodes, medication costs, disability payments, homecare and outpatient follow-up (NICE 2010 CVD costing report).

The time-frame for the effects of interventions is an important consideration. The effects of population measures targeting adults can be surprisingly rapid; based on empirical evidence (Capewell & O’Flaherty Lancet 2011; NICE, 2010), Interventions with high risk individuals will produce their effects even earlier (OECD, 2010). According to some of the modelling studies presented here, school-based health promotion might apparently take decades to start paying for itself (see timeline in [Appendix 3](#)), with regulation of food advertising to children likewise (Cecchini et al, 2010). This raises questions about the time assumptions underlying some of the modelling.

NICE (2006) reported that in the long term, targeting children can be the most effective strategy. The OECD suggested that policy makers might be advised to consider combining interventions that produce their effects over different time periods, in order to minimise delays in returns from prevention strategies and increase their overall impacts. Combined approaches are more cost effective anyway, partly due to people being ‘caught’ more than once by population and targeted interventions (Bemelmans et al, 2008).

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## Appendices

### Appendix 1: Additional details of methods used

#### **Sources**

Evidence was gathered from various sources including National Institute for Health and Clinical Excellence (NICE) publications; Department of Health; National Obesity Observatory; the NHS Economic Evaluation database (NHS EED); MEDLINE; CINAHL, SCOPUS, the Cochrane Library, NHS Evidence/FADE.

#### **Search terms**

Search terms used were as follows:

*diet\* + cost (added 'effectiveness' or 'saving' if needed to narrow search)*

*Nutrition + cost; 'Health\* eat\*' + cost; Obesity + cost; Weight + cost*

*For each, added cook\* and community/ family*

*Also workplace, hospital + food, fast food, transfats, salt, fat, sugar, school + cooking, +catering, + food, healthy catering; Nutrition + dent\*; Diet + dent\**

#### **Estimating and updating costs:**

The DH (2004) and Raynor & Scarborough (2005) estimates of costs were uplifted to 2010/11. This was done using NHS (and social care) specific inflation indices published by the Personal Social Services Research Unit in their *Unit Costs of Health and Social Care* report (section 16.2). These were the most appropriate indices available. <http://www.pssru.ac.uk/archive/pdf/uc/uc2011/section5.pdf>

The treasury website provides examples of how to use their deflators – this was used as a guide:

[http://www.hm-treasury.gov.uk/data\\_gdp\\_index.htm](http://www.hm-treasury.gov.uk/data_gdp_index.htm)

The uplifted estimates by were then applied to the UK and local authority populations aged 15+, mid 2010 (the most recent population estimates available).

#### **Currencies**

Currencies were converted to £s, using a historical conversion calculator for February 1<sup>st</sup> of the year previous to the study concerned (<http://www.oanda.com/currency/converter/> ).

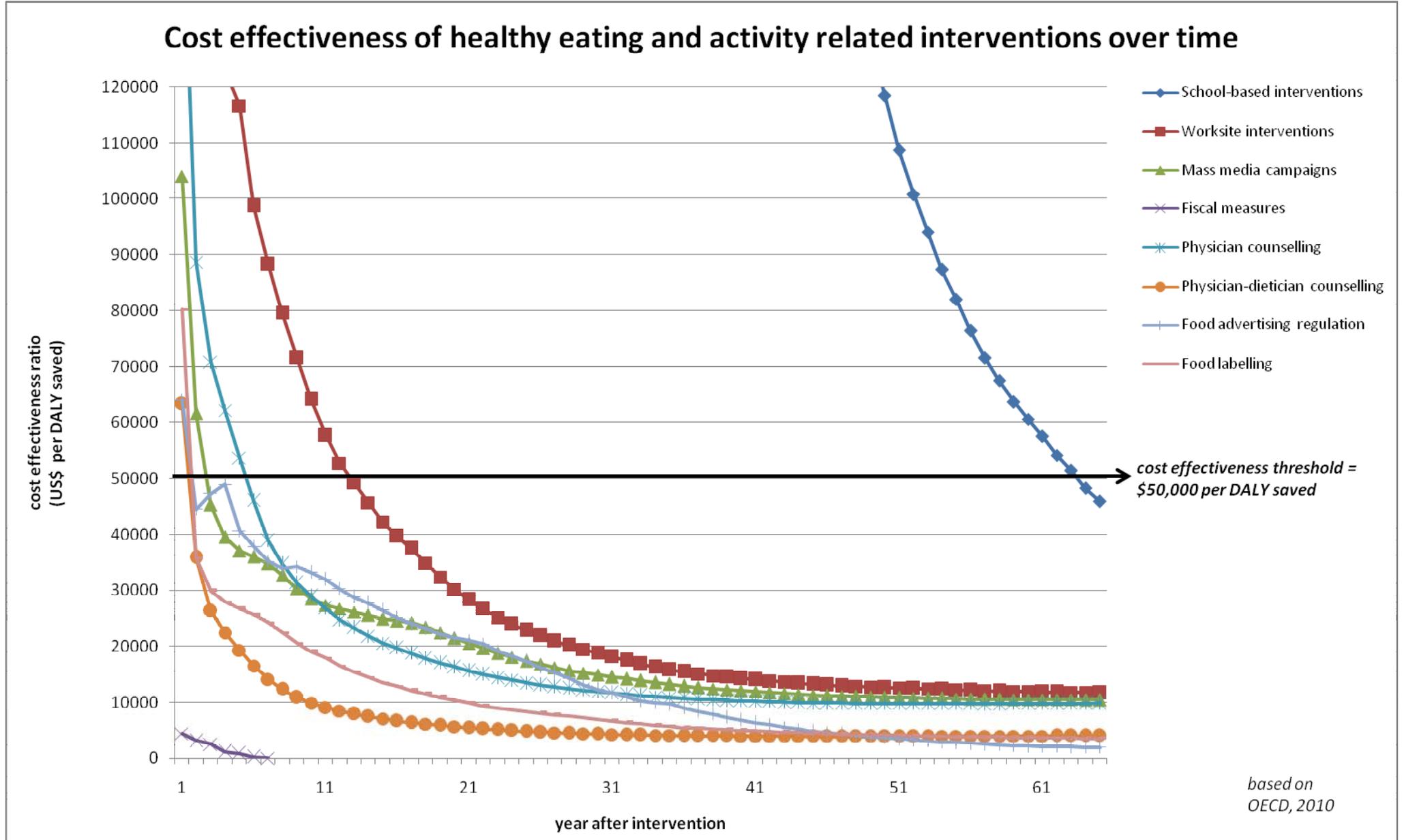
## **Appendix 2: Settings: some of the potentially cost effective interventions with lack of evidence**

There are many interventions that cost little to implement and will have obvious health benefits, but so far lack evidence of cost effectiveness. These include the following:

Study	Intervention	Cost-effectiveness/ savings
<b>Early years</b>		
Liverpool Nursery Nutrition Programme managed by HM Partnerships. <a href="http://www.hmpartnerships.co.uk">www.hmpartnerships.co.uk</a>	Programme of accredited training and supporting resources in nutrition for nursery staff.	Phase 2 programme costs = £137,422 with 45 nurseries (73 staff) taking part. Improvements to food provision and practice were reported in the nurseries, impacting on the health of over 2,200 children who attend the settings
Snack Right campaign. <a href="http://www.champspublichealth.com/page.aspx?pageid=611&amp;ParentID=609">http://www.champspublichealth.com/page.aspx?pageid=611&amp;ParentID=609</a>	Targeted at parents and carers of preschool children in deprived neighbourhoods of Cheshire and Merseyside, encouraging them to eat an additional portion of fruit. No evidence of cost effectiveness so far, but there is evidence of behaviour change. Total Cost of programme - £263,000. Academic evaluation indicated the families with whom Snackright engaged had moved into "contemplation stage". Snacking Outcomes – 41% of children (1003 children/824 families) signed up to direct marketing programme reported they continued to snack healthily four weeks later. Participation: 3788 children, parents and carers attended 64 snack right events from targeted families. Applications for healthy start vouchers in Merseyside increased by 25%.	
<b>Fast food</b>		
Heart of Mersey, (2011), Takeaway briefing paper. <a href="http://www.heartofmersey.org.uk/cms/useruploads/files/takeaway_food_a_briefing_paper.pdf">http://www.heartofmersey.org.uk/cms/useruploads/files/takeaway_food_a_briefing_paper.pdf</a>	<i>Restrictions on the location and food provided in fast food outlets:</i> The paper lists several recommendations, including a limit on the 'proliferation of fast food outlets through zoning and control of outlets by imposing limits on concentrations' (more on p.7 of briefing paper). Waltham Forest is given as an example of a borough in London where successful development of supplementary planning guidance and the use of local development frameworks has facilitated exclusion zones for fast food outlets around schools where there are a large number of outlets within a geographical area. This has also happened in Tower Hamlets and Barking and Dagenham.	
	In addition to reducing the number of takeaways, the NICE CVD guidance (NICE 2010) also makes recommendations to support owners and managers of takeaways and other food outlets to improve the nutritional quality of the food they provide.	
<b>Elderly care homes</b>		
Simmons et al (2010). <a href="http://www.ncbi.nlm.nih.gov/pubmed?term=20424804">http://www.ncbi.nlm.nih.gov/pubmed?term=20424804</a>	For residents at risk of weight loss. Twice daily choice of snacks and fluids offered in between meals, as an alternative to the usual intervention of expensive liquid supplements.	The snack intervention was slightly less expensive and more effective than the supplement intervention in improving caloric intake. Other benefits not measured would include improved quality of life.
UK RCT (randomised controlled trial)		
<b>Hospitals</b>		
The Cheshire and Merseyside Hospital Food Project <a href="http://www.heartofmersey.org.uk/cms/useruploads/files/HoM_Hospital_Food_Project_2007_-_2009_-_Evaluation.pdf">http://www.heartofmersey.org.uk/cms/useruploads/files/HoM_Hospital_Food_Project_2007_-_2009_-_Evaluation.pdf</a>	A Heart of Mersey project to improve the food in hospital trusts across Cheshire and Merseyside saw the purchase of some healthier options increase by 50%. Initial findings from the Nourish campaign evaluation in 2009 showed that more than a third of staff in the six participating hospitals were aware of the measures that had been introduced to encourage healthier eating. The campaign aimed to increase awareness about healthy eating options and the importance of a good diet among more than 30,000 hospital staff, as well as hospital visitors.	

**Appendix 3: Time line.** Based on OECD, 2010 (data from links in OECD charts).

School based interventions become cost effective 64 years after the intervention. Fiscal measures are cost-saving after 7 years.



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**Liverpool  
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Liverpool Public Health Observatory was founded in 1990 as a research centre providing intelligence for public health for the five primary care trusts (PCTs) on Merseyside, which currently include Liverpool, Halton and St.Helens, Knowsley, Sefton and Wirral. It receives its core funding from these PCTs.

The Observatory is situated within the University of Liverpool's Division of Public Health, with access to academic support and materials. It is an independent unit. It is not part of the network of regional public health observatories that were established ten years later, in 2000.

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