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**A systematic review of economic evaluations of local authority commissioned preventative public health interventions in overweight and obesity, physical inactivity, alcohol and illicit drugs use and smoking cessation in the United Kingdom**

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## **Abstract**

### **Background**

Since 2013, local authorities in England have been responsible for commissioning preventative public health interventions. The aim of this systematic review was to support commissioning by collating published data on economic evaluations and modelling of local authority commissioned public health preventative interventions in the UK.

### **Methods**

Following the PRISMA protocol, we searched for economic evaluations of preventative intervention studies in four different areas: overweight and obesity, physical inactivity, alcohol and illicit drugs use and smoking cessation. The systematic review identified studies between January 1994 and February 2015, using five databases. We synthesised the studies to identify the key methods and examined results of the economic evaluations.

### **Results**

The majority of the evaluations related to cost-effectiveness, rather than cost-benefit analyses or cost-utility analyses. These analyses found preventative interventions to be cost effective, though the context of the interventions differed between the studies.

### **Conclusions**

Preventative public health interventions in general are cost-effective. There is a need for further studies to support justification of continued and/or increased funding for public health interventions. There is much variation between the types of economically evaluated preventative interventions in our review. Broader studies incorporating different contexts may help support funding for local authority-sponsored public health initiatives.

## Introduction

Public health has traditionally had a prominent role in healthcare delivery in the UK. With devolution of public health from the National Health Service (NHS) to local governments, public health budgets are reducing year-on-year<sup>1</sup>. Therefore it is important to evaluate the economic benefits of public health commissioned prevention and lifestyle programmes for improving health, including preventing longer-term morbidity and mortality. Interventions for overweight and obesity, physical inactivity, alcohol and illicit drugs use and smoking cessation consume much of public health resources and are commonly associated with many chronic diseases.

The King's Fund and the National Institute for Health and Care Excellence (NICE) both emphasise the need for evidence of cost-effectiveness of public health interventions.<sup>2,3</sup> Return on Investment (ROI) has been used broadly in the NHS and related organisations to encompass a range of measures and is expressed in monetary terms, referring to financial return on investment. Cost-benefit analysis (CBA) is expressed in monetary terms and can consider who has been impacted by investment in an intervention.<sup>4,5</sup> Cost-effectiveness analysis (CEA) can be used to decide which intervention or model to use. Cost-consequence analysis (CCA) measures what other benefits, other than the desired outcome, may occur or be reduced, based on a particular investment. Cost utility analysis (CUA) expresses benefits in terms of Quality-adjusted Life Years (QaLYs).<sup>5</sup>

Individual ROI tools for physical activity, alcohol and tobacco control have been published by NICE.<sup>6</sup> These tools enable selection of local area, types of services for investment and expected uptake of such services.

The Public Health Department at the Kent County Council (KCC) is exploring ways to demonstrate the combined adjusted impact and ROI of key preventative programmes with reference to NICE recommendations.<sup>7</sup> This work will contribute towards local service planning and transformation work such as Delivering the 5 Year Forward View.<sup>8</sup> A key challenge is estimating the potential reduction in health care demand in a defined local population, taking into account a variety of health and social risk factors, for which nationally available tools appear not sensitive enough to perform.

A 2013 NICE report found that the majority of public health interventions were a good use of public money and could be deemed cost-effective.<sup>9</sup> A Local Government Association paper highlights how important assessing value for money is for local authority public health teams and the importance for spending to be justified on cost-effectiveness evidence.<sup>10</sup>

We conducted a systematic review of the literature to collate the types of economic evaluations currently published on public health lifestyle and prevention programmes. The primary objective was to identify and summarise published studies that are economic evaluations or include economic evaluations of public health interventions focused on the following areas: overweight and obesity, physical inactivity, alcohol and illicit drug use, and smoking cessation.

## **Methodology**

### **Search strategy**

The literature review and reporting of the review were guided by the PRISMA statement and summary of revisions made to the recommendations from the Quality of Reporting Meta-analyses (QUORUM) conference.<sup>11,12</sup> Broad search categories were used to encompass the areas of intervention and types of economic analysis.

We searched five bibliographic databases: The Cumulative Index to Nursing and Allied Health Literature (CINAHL), EMBASE, Health Management Information Consortium (HMIC), MEDLINE and PsychINFO. We also searched the Cochrane database, as well as published reports of the NICE. We checked reference lists from the selected citations, along with reference lists and bibliographies of key professional guidelines and reports. Two researchers undertook the searches, with a third revisiting the alcohol search with MeSH terms in MEDLINE.

### **Search terms**

The search terms used are given in Appendix I.

All of the search terms in the table were combined with:

AND (economic OR "economic evaluation" OR "economic analysis" OR cost OR "cost evaluation" OR "Cost-Benefit Analysis" OR "Economic Models" OR "Cost Analysis").

### **Inclusion criteria**

English language studies published between January 1994 and February 2015 were included in the review if they were carried out in a local authority, primary care or community health care setting in the UK.

### **Exclusion criteria**

Studies conducted in a hospital and/or acute care setting, screening programmes and tertiary level interventions were excluded. Studies conducted outside of the UK were also excluded.

### **Study selection and data extraction strategy**

After the searches were completed, the results were imported into a citation manager, duplicates were removed and the abstracts were screened by one researcher. The selected abstracts were then reviewed by a second researcher and those excluded were also reviewed to ensure that the two researchers were in agreement over selection of articles for full text review.

Articles selected for full text review were then sourced and reviewed. Researchers reviewed each other's selections and discussed if there was disagreement over

inclusion. Where full text was not available, we attempted to contact the corresponding author.

### Data extraction and analysis

Data extraction tables were constructed including relevant information from the selected studies for each intervention area. This examined health intervention area, study aim/objective, type of economic evaluation, outcome and comment on study quality.

### Search results

Searches were carried out separately for all of the four areas. A total of 27 articles, including 7 from the grey literature, were selected for inclusion in the final review. Five studies were related to obesity and overweight, 12 to physical inactivity, 1 to alcohol and illicit drugs use, and 9 to smoking cessation.

Table 1 provides a summary of the articles identified at each stage of the literature search for the four areas. Two articles were selected for data extraction for overweight and obesity, 10 for physical inactivity, 1 for alcohol and illicit drugs use, and 7 for smoking cessation. The end of the table shows the number of articles selected for data extraction through grey literature searches, three of which were added to overweight and obesity, and four added to physical inactivity.

**Table I: Studies of overweight and obesity, physical Inactivity, alcohol and illicit drugs use and smoking cessation (grey literature searches and article selection)**

Search area	Search results [n]	Unique articles (duplicates removed) [n]	Studies selected for full text review [n]	Articles for final inclusion and data extraction [n]
Breastfeeding	352	260	14	1
Pharmacy healthy weight	20	12	2	0
Healthy weight programme	8	3	0	0
Young people healthy weight	1339	268	12	1

National child measurement program	48	27	0	0
Physical inactivity	894	289	9	10 (with additional articles identified through review articles)
Alcohol and illicit drugs use	345	169	14	1
Smoking cessation	245	113	8	7
Grey literature			16	3 Overweight and obesity 2 Physical inactivity 0 Alcohol 2 Smoking cessation .

## Results

The results are presented in the four public health intervention areas of obesity and overweight (and nutrition), physical inactivity, alcohol and illicit drugs use, and smoking cessation. We recorded information for public health intervention area, study, aim/objective, type of economic evaluation, outcome and comment on study quality.

Table II shows the number of studies in each of the four areas for the different types of economic evaluation: return on investment, cost-benefit analysis, cost utility

analysis, cost-effectiveness analysis, and cost-consequence analysis. Appendix II shows the results of each evaluation, listed by author and title/part title. This paper does not critically appraise the quality of the economic evaluations undertaken.

### **Overweight, obesity and nutrition**

All the five studies selected covered cost-effectiveness analysis.<sup>13-17</sup> One of these studies also covered cost-consequence analysis/<sup>17</sup>Two were predictive tools for the costs of implementing guidance on lifestyle weight management services for the overweight and obese in England.<sup>13,14</sup> Three compared different intervention models: care for childhood obesity, interventions to promote breastfeeding, and costs to the healthcare system of babies who are breastfed versus those who are formula fed.<sup>15,16,17</sup> Two of the five studies focussed on breastfeeding.<sup>15,17</sup> The other three emphasised obesity; one in adults<sup>13</sup> and two in children and young people.<sup>14,16</sup>

### **Physical inactivity**

Economic evaluation was often a secondary objective of an effectiveness intervention study. There was a large variety of physical inactivity interventions evaluated. Interventions included:

- Motivational interviewing to 'boost' physical activity levels
- Exercise referral systems
- Providing free access to council run gyms
- Physical activity classes
- Campaigns, including leisure centre based campaigns
- Advice
- Pedometer studies
- Brief interventions
- Cycling/walking activities

The majority of physical inactivity economic evaluations were cost-effectiveness analyses.<sup>18-24</sup> One report presented a simple return on investment analysis.<sup>25</sup> One evaluation was a combination of a cost-utility analysis and a cost-consequence analysis.<sup>26</sup> Another was a cost-effectiveness analysis combined with a cost-benefit analysis.<sup>27</sup> Two focused on cost utility analysis.<sup>28,29</sup>

### **Alcohol and illicit drugs use**

Only one study<sup>30</sup> of alcohol and illicit drugs use met the inclusion criteria for this area. Economic evaluation was the primary objective for this cost effectiveness and cost consequences study, with a comment that little research outside the United States has been published in this area. No return on investment articles in the area of alcohol in primary or community health care were specific to the UK.

Investigations into four treatment interventions took place in residential and community treatment settings in the Godfrey study.<sup>30</sup> Specialist inpatient and residential rehabilitation were investigated in residential settings. Methadone

maintenance and methadone reduction were investigated in community settings. Costs and consequences were measured in terms of units of resources consumed and valued in terms of long-term opportunity costs. Consequences measured included drug possession, dealing and acquisitive crime related to drug use. The data showed clear economic benefits to treating drug misusers in England.

## Smoking cessation

As with physical inactivity, the economic evaluation was often the secondary objective of an effectiveness study of a smoking cessation intervention. The types of smoking interventions being studied included:

- Changing attitudes to smoking amongst high risk individuals
- Behavioural support provided by either groups or pharmacies
- Nicotine Replacement Therapies
- Cut Down To Quit interventions

The majority of economic evaluations for smoking cessation were cost effectiveness analyses.<sup>31-38</sup> One study was a cost utility analysis.<sup>39</sup> Some of the cost effectiveness analyses included economic models.<sup>35,36,37</sup> While the majority of smoking cessation services were found to be cost-effective, level of cost-effectiveness varied amongst the different studies included. For example, cost-effectiveness sometimes depended on the age of participants.<sup>38</sup>

## Types of Economic Evaluations Used (Table II)

Two studies used return on investment. One study used cost-benefit analysis. Twenty-one studies used cost-effectiveness analysis. Four studies used cost-consequence analysis. Four studies used more than one economic evaluation to compare an intervention or interventions.

**Table II: Type of economic evaluation**

Type of economic evaluation	ROI	Cost-Benefit Analysis (CBA)	Cost Utility Analysis (CUA)	Cost-Effectiveness Analysis (CEA)	Cost-Consequence Analysis (CCA)
Overweight, obesity and nutrition	0	0	0	5 <sup>13-17</sup> (1 also included CCA)	1 <sup>17</sup> (also included CEA)
Physical inactivity	1 <sup>25</sup>	1 <sup>27</sup> (also included CEA)	3 <sup>26,28,29</sup> (1 also included CCA)	9 <sup>18-24</sup> (1 also included CCA and 1 also included CBA)	1 <sup>26</sup> (also included CUA)
Alcohol and illicit drugs	0	0	0	1 <sup>30</sup> (also included CCA)	1 <sup>30</sup> (also included)

use					CEA)
Smoking cessation	0	0	1 <sup>39</sup>	8 <sup>21-34,35-38</sup>	0

## Discussion

### Main finding of this study

This systematic review highlights a diversity of economic evaluations in public health interventions. Our analysis showed that the interventions were dissimilar. The results, alongside more comprehensive tools such as the NICE return on investment models, demonstrate evidence to support the case for local authority commissioned public health preventative interventions.

The majority of the economic evaluations related to cost-effectiveness. These evaluations found preventative interventions to be cost-effective. Some of the evaluations were economic models or modelling tools, rather than studies of cost-effectiveness. These included the NICE tools where specific criteria is entered to predict the costs; for example, implementing NICE guidance to support Commissioning lifestyle weight management programmes for children and young people. The NICE physical activity return on investment tool is another example. While the majority of smoking cessation services were found to be cost-effective, cost-effectiveness varied amongst the different studies included. The cost-effectiveness of the different physical inactivity interventions also varied by type of economic evaluation.

Economic evaluation was a secondary objective of the physical inactivity and smoking cessation studies. Three of the five overweight and obesity studies were NICE reports, meaning that there were only two other studies analysed: one that looked at the cost effectiveness of breastfeeding compared to formula feeding and one that focused on an intervention to prevent obesity in young people. Different types of smoking cessation interventions were the subject of the economic evaluations we reviewed. Sensitivity analyses influenced the findings of some of the studies. For example, Stevens<sup>29</sup> found that cost-effectiveness could be increased if uptake was increased.

### What is already known on this topic

Brousselle and colleagues<sup>40</sup> suggest that public health interventions are complex and context-sensitive. Intangible benefits, such as wellbeing, can be difficult to quantify. Buck<sup>2</sup> notes that public health may show improvement following local authority expenditure in areas not specific to public health (e.g., increased bike paths).

## **What this study adds**

This review shows that the number of UK-based, non-acute economic evaluation studies in the public health intervention areas of overweight and obesity, physical inactivity, alcohol and illicit drugs use, and smoking cessation is very small. There is a need for further studies, specific to the areas we explored, along with broader studies that cover more than one intervention area and/or population.<sup>40,41</sup>

While this systematic review supports the view that local authority-funded preventative public health interventions are cost-effective, there is much variation between types of interventions economically evaluated. An increase in the number of non-acute economic evaluation studies specific to interventions for obesity, physical inactivity, alcohol and illicit drugs use may improve statistical support for the reliability of those interventions, particularly if the interventions and populations are similar. There is also a need for studies involving broad approaches to public health interventions.

There are contradictory views on the usefulness of comparing broad approaches to economic evaluation<sup>39</sup>, versus a cautious approach with respect to context-sensitivity.<sup>40</sup> Broader studies emphasizing cost-effectiveness of interventions for different populations in a variety of settings may help support funding for local authority-sponsored public health initiatives. When we have enough studies available to conduct a meta-analysis, we can make widespread recommendations to commissioners with more confidence. While Brousselle<sup>40</sup> argues that public health commissioners should not draw general conclusions about the cost-effectiveness of public health interventions, Pokhrel<sup>41</sup> advocates for increasing the number of research studies that compare results on interventions in different contexts. Furthermore, it is recommended that interventions be compared across different countries on a large scale to support broad generalisation. Rutter notes that research activities are prone towards identifying simple health outcomes, rather than complex or population-level outcomes. A broad range of methods for intervention research and evidence synthesis is necessary to inform effective policies.<sup>42</sup>

## **Limitations of this study**

A limitation of this review is that we conducted separate searches for each of the four areas, without a fifth, broader search that may have included one or more areas. A broader search may have found articles that described an economic evaluation of an intervention as part of a larger topic. Increasingly, cost-effectiveness analyses are taking this broad approach, meaning more interventions can be compared against each other. Cost per life year saved, or cost per QALY saved is often measured in these broader approaches.<sup>5</sup> This increasingly broad approach indicates that the lack of heterogeneity in our results may not be a limitation.

By limiting the included articles to studies based in the UK, we may have missed evaluations of types of interventions that are carried out in the UK, but were based elsewhere in the published study. By limiting inclusion criteria to local authority-commissioned interventions, we may have missed out on economic studies that

were commissioned by other bodies, but could be commissioned by local authorities. The Comment on Study Quality column for our data extraction tables was intended to provide inspiration for possible comparison of studies, rather than a rigorous assessment of each study quality.

## Conclusions

This systematic review explores economic evaluations related to local public health interventions in the UK. Most of the evaluations focussed on cost-effectiveness, with preventative interventions shown to be cost effective. Further studies are needed, specific to economic evaluation of local authority-commissioned interventions and to consider accuracy of broad versus narrow approaches to evaluating cost-effectiveness.

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## Appendix I: Search categories and search terms

Intervention Area	Key interventions	Search terms
Overweight and obesity	Breastfeeding – uptake promotion	(breastfeeding OR breastfeeding AND promotion)
	Pharmacies - healthy weight programme	(Pharmacies AND (Obesity OR Overweight))
	Healthy living/ healthy weight programmes	(obesity OR overweight) AND ("weight reduction programs" OR "healthy people programs")
	Young people healthy weight programme	(overweight OR obesity) AND (adolescent OR "young person" OR child) (overweight OR obesity).
	National child measurement programme	(overweight OR obesity) AND "school health"
Physical activity	Physical activity promotion	("physical activity" OR exercise* NOT rehab* NOT physiotherapy).
Alcohol and illicit drugs use	Primary and secondary prevention of substance misuse	("Early intervention" OR "education program*" OR "prevention" OR "prevention program*" OR "education campaign" OR "awareness" OR "awareness campaign" OR "awareness program*" OR "intervention program*" OR "brief intervention" OR "brief advice" or "advice" OR "IBA" OR "guidance" AND "Substance-related disorders" OR "drug-related disorders" OR "drug use prevention" OR "drug use control" OR "drug misuse" OR "drug abuse" OR "drug abuse prevention" OR "substance abuse" OR "substance abuse prevention" or "substance abuse education program*" OR "drug abuse education program*" )
	Primary and secondary prevention of excess alcohol consumption	((("Primary Health Care"[Mesh]) OR "Community Health Services"[Mesh]) AND "Drinking Behavior/prevention and control"[Majr] AND Great Britain[Mesh])

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Smoking cessation	Smoking cessation and reduction	("Smoking Cessation" OR "smoking cessation methods" OR "smoking prevention" OR "smoking control")
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## Appendix II: Summary Results of the Evaluations and Evaluation Tools

Author(s)/Title or Part Title	Summary/Result
NICE 2014 PH53 Overweight and obese adults <sup>13</sup>	Modelling showed that even a small amount of weight loss is cost effective, but only if it is maintained long term on a lower weight trajectory. It was difficult to draw conclusions about why some programmes were more effective than others, or about the effect of specific components. Group programmes in general tend to be more cost effective.
NICE 2013. Costing Report: Managing overweight and obesity among children and young people <sup>14</sup>	The following impacts have been defined as significant: 1) More than 300 people are estimated to be affected by the recommendations (equivalent to 1 person per 170,000) 2) Initial costing work indicates that the national cost is more than £1 million (equivalent to £2000 per 100,000 population).
Ball TM, Wright AL. Health care costs of formula-feeding <sup>15</sup>	In the first year of life, after adjusting for confounders, there were 2033 excess office visits, 212 excess days of hospitalization, and 609 excess prescriptions for these three illnesses per 1000 never-breastfed infants compared with 1000 infants exclusively breastfed for at least 3 months. These additional health care services cost the managed care health system between \$331 and \$475 per never-breastfed infant during the first year of life.
Hollinghurst S, Hunt LP, Banks J, et al. Cost and effectiveness <sup>16</sup>	Cost and outcome data were available for 143 children in total. Cost per child was £1749 (SD £243) in the Mandometer® group, £301 (£76) in the primary care group, and £263 (£88) and £209 (£81) in the hospital groups. Mean reduction in BMI SDS was 0.40 (0.35), 0.17 (0.26), 0.15 (0.25) and 0.14 (0.32), respectively. Intensive management using Mandometer® was effective but costly (£432 per 0.1 reduction in BMI SDS) compared to conventional care (range £153-£173). A total of 26% children receiving conventional care achieved a clinically meaningful reduction in BMI SDS; however, use of Mandometer® training may be justified in children not responding to conventional lifestyle interventions.
Jacklin P, Retsa P, Dougherty M, Kwan I. NICE Maternal and Child Nutrition Programme <sup>17</sup>	Peer support which achieves a relatively high increase in breastfeeding rates actually saves the NHS money in the long run, because levels of hospitalisation of babies drop, breastfed babies grow up into healthier children and adults, fewer women develop breast cancer, and less has to be spent on infant formula. This is achieved at an estimated 20 percentage point increase in breastfeeding initiation. The point at which expenditure on breastfeeding support is unjustified in competition with other demands on NHS resources could be evaluated in terms of the expenditure per QALY gained. NICE currently adopts a threshold between £20,000

	and £30,000 for this purpose. It is estimated that this is achieved when there is an increase in initiation rates of about 15 percentage points.
Goyder E, Hind D, Breckon J, et al, A randomised controlled trial and cost-effectiveness evaluation <sup>18</sup>	Although some individuals do find a community-based, brief MI 'booster' intervention supportive, the low levels of recruitment and retention and the lack of impact on objectively measured physical activity levels in those with adequate outcome data suggest that it is unlikely to represent a clinically effective or cost-effective intervention for the maintenance of recently acquired physical activity increases in deprived middle-aged urban populations.
Murphy SM, Edwards RT, Williams N, et al. An evaluation of the effectiveness and cost effectiveness <sup>19</sup>	The National Exercise Referral Scheme was effective in increasing physical activity among those referred for CHD risk only. Among mental health referrals, NERS did not influence physical activity but was associated with reduced anxiety and depression. NERS is likely to be cost effective with respect to prevailing payer thresholds.
Isaacs AJ, Critchley JA, Tai SS, et al. Exercise Evaluation Randomised Trial <sup>20</sup>	On cost-effectiveness grounds, assessment and advice alone from an exercise specialist may be appropriate to initiate action in the first instance. Subsidised schemes may be best concentrated on patients at higher absolute risk, or with specific conditions for which particular programmes may be beneficial. Walking appears to be as effective as leisure centre classes and is cheaper. Efforts should be directed towards maintenance of increased activity, with proven measures such as telephone support. Further research should include an updated meta-analysis of published exercise interventions using the standardised mean difference approach.
Shaw R, Fenwick E, Baker G, et al. Pedometers cost buttons <sup>21</sup>	Pedometer based walking interventions may be considered cost-effective and suitable for implementation within the wider community. However, several research gaps remain, including the importance and impact of the researcher/participant relationship, the impact of assessment on motivation and effectiveness, and the longer term impact on physical and mental health, resource utilisation and quality of life.
Stevens W, Hillsdon M, Thorogood M, McArdle D. Cost-effectiveness of a primary care based <sup>22</sup>	Moderate physical activity can be successfully encouraged in previously sedentary men and women aged 45-74 through a primary care based intervention. The process of recruitment was the most important variable cost. A high uptake rate would maximise cost-effectiveness, and sensitivity analysis suggests that unit costs could be halved with a more effective recruitment strategy.
Laine J, Kuvaja-Köllner V, Pietilä E, et al. Cost-Effectiveness of Population-Level <sup>23</sup>	The most efficient interventions to increase physical activity were community rail-trails (\$.006/MET-h), pedometers (\$.014/MET-h), and school health education programs (\$.056/MET-h).

NICE. 2014. Physical activity return on investment tool. <sup>24</sup>	This tool enables the user to evaluate a portfolio of interventions in their geographical area (e.g. region, county or local authority) and models the economic returns that can be expected in different payback timescales.
NICE. 2013 Costing Report Brief physical activity advice in primary care <sup>25</sup>	The annual resource impact of implementing the recommendations considered in this report is uncertain. However, as the recommendations aim to support and extend the reach and impact of existing stop smoking services, there are potential additional costs involved. Organisations are advised to assess the resource implications at a local level.
Trueman JP, Anokye NK. Applying economic evaluation to public health interventions <sup>26</sup>	The incremental cost per QALY of Exercise Referral Schemes is £20,876. Based on a cohort of 100 000 individuals, CCA estimates cost of ERS at £22 million to the healthcare provider and £12 million to participants. The benefits of ERS include additional 3900 people becoming physically active, 51 cases of CHD avoided, 16 cases of stroke avoided, 86 cases of diabetes avoided and a gain of ~800 QALYs.
Frew EJ, Bhatti M, Win K, Sitch A, Lyon A, Pallan M, Adab P. Cost-effectiveness of a community-based physical activity programme <sup>27</sup>	The societal value placed on the Be Active programme was greater than the operation cost therefore the Be Active physical activity intervention results in a net benefit to society.
Pringle A., Cooke C., Gilson, N., Marsh K., & McKenna, J. Cost effectiveness of interventions to improve moderate physical-activity <sup>28</sup>	Future cost savings to the NHS per intervention participant ranged from c£769 to c£4,891. In the case of each of the interventions, this saving per participant exceeds the implementation cost per participant, which ranged from c£55 to c£3,420 (N = 6940).
NICE. 2006. Modelling the cost effectiveness of physical activity interventions <sup>29</sup>	When costs are defined as only including the costs of the intervention, all the interventions have a cost per QALY gained significantly less than £30,000 when compared separately with 'usual care': the cost/QALY gained estimates for the interventions reviewed vary from c£20 to c£670. When costs are defined to include the healthcare costs avoided through avoiding health states, all the interventions are dominant when compared separately with 'usual care'. That is, they result in an increase in quality of life for participants and net costs savings to the health service: net costs saved per QALY gained vary from c£530 to c£3,150.
Godfrey C, Stewart,D. Gossop,M. Economic analysis of costs and consequences of the treatment of drug misuse <sup>30</sup>	Crime costs fell by pound 16.1 million during the first year, and by pound 11.3 million during the second year. Health-care costs were relatively small but approximately doubled during the course of the study. The ratio of consequences to net treatment investment varied from 18 : 1 to 9.5 : 1, depending on assumptions. This is likely to be a conservative estimate of the benefit-cost ratio because many potential benefits were not estimated.
Stevens W, Thorogood M, Kayikki S. Cost-effectiveness of a community anti-smoking campaign <sup>31</sup>	The estimated cost-effectiveness of this intervention was 105 pound (range 33-391 pound) per life year gained. Campaigns targeted

	at groups with high smoking prevalence may be more cost-effective than general population campaigns
Bauld L, Boyd KA, Briggs AH, et al. One-year outcomes and a cost-effectiveness analysis <sup>32</sup>	The group service achieved a higher quit rate (6.3%) than the pharmacy service (2.8%) but was more intensive and required greater overhead costs. The lifetime analysis resulted in an incremental cost per QALY of £4,800 for the group support and £2,600 for pharmacy one-to-one counseling. Despite disappointing 1-year quit rates, both services were considered to be highly cost-effective.
Parrot S, Godfrey C, Raw M, et al. Guidance for Commissioners on the Cost Effectiveness [Review] <sup>33</sup>	For a typical health authority a comprehensive programme of face to face smoking cessation interventions could be implemented at an annual cost of £331 000. Such a programme is estimated to save 1300 life years over a 40 year period. In cost effectiveness terms our estimates range from £212 to £873 per discounted life year gained.
Wang D, Connock M, Barton P, et al. 'Cut down to quit' with nicotine replacement therapies [Review] <sup>34</sup>	CDTQ is highly cost-effective compared with no quit attempt. CDTQ remains cost-effective if dilution from abrupt quitting forms a small proportion of CDTQ attempts. In an alternative analysis in which smokers who switch from an abrupt quit to CDTQ retain the success rate of abrupt quitters, all forms of CDTQ appear cost-effective.
Orme ME, Hogue SL, Kennedy LM, et al. Development of the health and economic consequences [Modelling tool] <sup>35</sup>	The model successfully captures the complexity required to model smoking behaviour and associated mortality, morbidity, and health care costs.
NICE 2014. Tobacco Return on Investment Tool [Modelling tool] <sup>36</sup>	The tool will automatically estimate the smoking and ex-smoking populations based on up-to-date statistics. This population composition is used to model the impact of smoking on relevant endpoints, taking into account short-, medium- and long-term events.
NICE 2013. Costing Report: Tobacco harm reduction <sup>37</sup>	Potential costs are likely to vary widely depending on: 1) how the recommendations are integrated into existing stop smoking services 2) the prevalence of smoking among different groups of people and the number of these people who are likely to access services. Organisations are advised to assess the resource implications at a local level.
Stapleton JA, Lowin A, Russell MA. Prescription of transdermal nicotine patches <sup>38</sup>	If GPs were allowed to prescribe transdermal nicotine patches on the NHS, for up to 12 weeks, the incremental cost per life year saved would be: Pound Sterling 398 per person younger than 35 years; Pound Sterling 345 for those aged 35-44 years; Pound Sterling 432 for those aged 45-54 years; and Pound Sterling 785 for those aged 55-65 years. The low cost per life year saved would make GP intervention against smoking a cost-effective life-saving treatment.
Crealey GE, McElnay JC, Maguire TA, O'Neill C. Costs and effects associated with a	Our findings indicate that the cost per life-year saved when using the Pharmacists Action on

community<sup>39</sup>

Smoking programme ranges from 196.76 pounds sterling (Pounds) to 351.45 Pounds for men and from 181.35 Pounds to 772.12 Pounds for women (1997 values), depending on age. This compares favourably with other disease prevention medical interventions such as screening for hypertension or hypercholesterolaemia.