

Exploring the cost effectiveness of early intervention and prevention



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Summary

- There are a wide variety of early intervention and prevention approaches that aim to improve health and wellbeing by taking action before health problems worsen, or by preventing health problems from occurring in the first place.
- Various methods are used to evaluate the cost effectiveness of these interventions, with the two most common being cost utility analyses (which assess value for money in terms of people's quantity and quality of life-years saved) and cost benefit analyses (which monetise a range of different outcomes). Other approaches for calculating cost effectiveness exist, such as return on investment, which allows assessment of the economic benefits of an intervention in relation to the investment made into it.
- While there are limitations in using these methods to evaluate the cost effectiveness of different interventions, a number of reviews have provided clear evidence that some prevention and early intervention activities are cost effective in improving public health outcomes.
- A NICE (National Institute for Health and Care Excellence) review of the cost effectiveness of 200 interventions found that 30 (15%) were cost saving and 141 (70.5%) were cost effective. Those interventions aimed at the whole population appear to be among the most cost effective; such as mass-media campaigns to promote healthy eating, legislation to reduce young people's access to cigarettes, provision of smoking cessation services, tax increases and advertising restrictions on tobacco and alcohol, and reducing salt intake.
- Early intervention data from the UK are limited; however, economic simulation modelling based on experiences in other countries shows that it has the potential to be cost effective. There is good evidence from longitudinal studies from the United States that early years programmes targeted at disadvantaged families (and focused on preschool education) are cost effective, with the net benefits increasing as the follow-up age of participants increases.
- To support greater use of prevention and early intervention activities there needs to be increased research funding to provide a more comprehensive evidence base, as well as greater coordination between public health and clinical practice. Policy makers must also commit to investing over the medium to long term, in order to see the cost savings of prevention and early intervention.

Background

Early intervention and prevention approaches aim to support people's health and wellbeing by taking action before health problems worsen, or by preventing health problems from occurring in the first place. Doctors have a key interest in supporting improvements in public health and maximising the potential for early intervention and prevention to improve health outcomes. The benefits of reducing avoidable ill health through early intervention and prevention are clear, and while these approaches *are* cost effective, it is important to consider the extent of this and the time scales involved. The need to assess value for money is especially pertinent, given the current financial pressures on the health system, as highlighted in a separate BMA briefing on *Funding for ill-health prevention and public health in the UK*.

This briefing is not intended to provide a systematic review of the literature, but provides a high-level summary, outlining how the cost effectiveness of prevention and early intervention can be evaluated, and exploring some of the available data on the cost effectiveness of these approaches.

Public health prevention

There are a wide variety of interventions aimed at improving public health through the prevention of disease. These range from clinical interventions, such as screenings and vaccinations, to population-level measures aimed at influencing health behaviours or addressing the social determinants of health. Population-level prevention might, for example, involve health education programmes, or laws and regulations to reduce the availability and promotion of alcohol, or assure clean air. A further example is establishing mental health support groups which, as well as preventing mental health problems, act as a protective factor for many physical illnesses. These interventions may be 'universal', where they are aimed at the whole population. 'Targeted' interventions focus on groups with particular needs, or that are particularly likely to benefit (eg the provision of cancer screenings to those who are at an increased risk).

The extent to which an intervention is intrusive and affects people's choices can vary. Ethical issues around behaviour change, public health and the role of the state are explored in more detail in a separate BMA briefing, *'Are UK governments utilising the most effective evidence-based policies for ill-health prevention?'*.

Early intervention

Whereas public health prevention aims to stop health problems from occurring in the first place, early intervention strategies aim to mitigate the effects of problems once they have been identified. Early intervention is therefore usually targeted at those who are vulnerable or at a higher risk of a problem.

Early intervention approaches have the potential to improve health and wellbeing of people of all ages. EIP (Early Intervention in Psychosis) services, for example, provide early support from a specialised early intervention team for those aged 14-35 who are undergoing a first episode of psychosis.¹ Most early intervention programmes, however, tend to focus on the earlier stages of people's lives, from before birth to young adulthood.

Some early interventions are specifically targeted at the 'early years', focusing on the first years of life, including pregnancy, early parenting and the early parent-child relationship. For example, 'Family Foundations' is a group-based programme for couples expecting their first child, where the couples are taught good parenting and family communication skills.² Early interventions tend to focus on children who experience higher levels of disadvantage, as evidence shows that they are more vulnerable to poor physical and mental health, such as depression, anxiety, diabetes, and cardiovascular disease.³

Evaluating cost effectiveness

There are a number of ways in which prevention and early intervention can be cost effective. This may, for example, be through reducing the demand for, and the cost of, future healthcare interventions. There may also be benefits for society and the economy more widely. For example, a review of workplace health in 2014 estimated that the annual direct cost of absence to the economy was over £14 billion.⁴ Some interventions can be led by volunteers in the community, which can improve their potential to be cost effective. An example is the use of volunteer-led support for older people at risk of falls, or volunteer-led smoking cessation courses.

Taking into account such factors, a range of methods exist for evaluating the cost effectiveness of interventions to improve public health. Broadly, each method compares the cost of an intervention with the potential benefits, with the main difference between each being the way in which the benefits are measured. The following considers two of the most commonly used methods for evaluating cost effectiveness.

– Cost utility analysis

Cost utility analysis provides an assessment of value for money of medical interventions without monetising the outcomes. Instead it considers people's quantity of life-years saved, taking into account the quality of these life-years. This is expressed as 'QALYs'

(quality-adjusted life years). One QALY is equivalent to one year of life in perfect health.^a Cost utility is expressed as £ per QALY gained. For example, if a health intervention costs £20,000 and is expected to generate 4.5 QALY, the cost utility of the intervention is calculated by dividing £20,000 by 4.5, resulting in £4,444.44 per QALY gained.

– Cost benefit analysis

Cost benefit analysis assesses value for money by monetising the outcomes of an intervention. There are usually a range of outcomes to monetise, from changes in the health status of an individual, to changes in their behaviour/the behaviour of communities, to changes in the political, economic and social environment.⁵ A reduction of health care, a reduction of social care and a reduction of sick days lost in employment might be monetised. Cost benefit can be expressed as a 'cost benefit ratio'; a ratio of the benefits of an intervention, in monetary terms, relative to its costs, also expressed in monetary terms. For example, if a health intervention cost £75,000 a year, and resulted in reduced NHS demand saving £50,000, reductions in social isolation saving £30,000, and reduced sick days lost in employment saving £20,000, the total savings of £100,000 would result in a cost benefit ratio of 1.33 (£1.33 can be expected in benefit for every £1 spent). The principle advantage of cost benefit analysis is that it allows a comparison of interventions across different sectors (eg whether to build a hospital over a school).

There are also other ways to calculate cost effectiveness, such as return on investment. This approach is similar to cost benefit analysis, in that it calculates the difference between the costs and benefits of an intervention divided by the costs, and can be expressed as a percentage or a ratio.

Limitations in assessing cost effectiveness

There are a number of limitations in developing and comparing cost effectiveness estimates of different interventions. This is partly due to the wide variety of methods, interventions and measures of costs and outcomes required across studies.⁶ According to NESTA, the innovation foundation, the rigour of cost effectiveness analysis depends on the following factors.⁷

1. *The rigour of the evidence linking the intervention to an improvement in a particular outcome.*

There is a lack of well-conducted RCTs^b (randomised controlled trials) on public health interventions.⁸ Such trials can be very burdensome in terms of cost and time, and often randomisation is not possible due to practical or ethical reasons.⁹ This can make the assessment of the cost effectiveness difficult. The use of RCTs in evaluating public health interventions has been criticised as being unable to accommodate the complexity of some interventions, including underlying social and environmental factors, and only able to feasibly determine a cause-effect relationship for the more simple interventions, under narrow conditions (such as whether a drug works).¹⁰

Part of linking an intervention to an improvement in a particular outcome involves calculating the probability that each event will occur, and accounting how long each event will last. Observational studies^c can provide real-world data on the probabilities of particular outcomes associated with an intervention.¹¹

a If a new treatment on offer gives you an additional QALY, then this could correspond to one year of life in perfect health, two years of life in 50% health, or any other combination.

b A study in which a number of similar people are randomly assigned to two (or more) groups to test a specific intervention. One group (the experimental group) has the intervention being tested, the other (the comparison or control group) has an alternative intervention, a placebo or no intervention at all. The groups are followed up to see how effective the experimental intervention was. Outcomes are measured at specific times and any difference in response between the groups is assessed statistically.

c A study in which the investigator observes the natural course of events with or without control groups (for example, cohort studies and case-control studies).

2. *The accuracy of data on the cost of the intervention itself.*

There are many costs to take into account when estimating the costs of the interventions. They may relate to the labour costs of trained staff and some level of central administration (eg auditing and budgeting, building space and equipment costs, medical supplies and medications and overhead costs such as electricity, water and maintenance).¹² They also include the costs of resources used by patients to obtain an intervention.¹²

3. *The accuracy of assigning an economic value to an intervention.*

For cost benefit analysis (which does not measure QALYs), accuracy also depends on the robustness of the methodology used to link improvement in outcomes to financial savings over the long term, and the costs of any services avoided. Assigning an economic value to an intervention can be complex, as there are many outcomes to measure (that are not all directly based on health care.) They are not always straightforward to measure, and some may only be realised decades after the intervention took place.¹³

RCTs and observational studies cannot compare all relevant alternative interventions that may be of interest. Instead, economic simulation models are commonly used, which create the framework for cost effectiveness estimations to be made, by combining effectiveness and cost data from other sources.¹⁴ They extrapolate from existing data to different population groups, points in time, or disease end points. Models have the advantage of providing the user with the ability to manipulate an intervention programme in ways that are not possible in real-time experiments with human subjects.¹¹

Discounting

When calculating the cost effectiveness of an intervention, the impact of time can be taken into account, by 'discounting'. This makes costs and benefits occurring now worth more than those occurring in the future. It reflects individual preference for benefits to be experienced in the present rather than the future, and for costs to be experienced in the future rather than the present. While there is general agreement of the need to discount costs, there is debate about whether to discount health benefits, and what, if any, this discount rate should be. The main argument against discounting health benefits is that health, unlike wealth, cannot be invested to make future gains. If health benefits are not discounted, this tends to show better cost effectiveness. NICE currently recommends discounting at the same annual rate of 3.5% for costs and health benefits.¹⁵

It is worth noting that assessing the relative cost effectiveness of different interventions engages a range of complex ethical issues about how and what should be valued, and how competing claims for public funds should be prioritised. While this is beyond the scope of this paper, it is discussed in detail elsewhere.^d

Exploring the cost effectiveness of public health interventions

Generally, NICE considers interventions that cost less than £20,000 per QALY gained as cost effective. It may consider those between £20,000 and £30,000 cost effective if certain conditions are satisfied; for example if an intervention improves other non-health related outcomes, such as reduced levels of public disorder resulting from reduced alcohol consumption.^{16,17} Alongside this 'cost utility' measure, NICE has recently also adopted the more wide-ranging 'cost benefit' approach to express cost effectiveness of public health interventions, considering all the health and non-health benefits of an intervention across different sectors.¹⁸

^d See, for example, the discussion of QALYs in Harris J (1987) QALYfying the value of life. *Journal of Medical Ethics* 13: 117-123.

A NICE analysis – of the cost effectiveness estimates of various interventions that informed public health guidance it published between 2006 and 2010 – found that out of 200 public health interventions that were analysed:

- 30 (15%) were cost saving
- 141 (70.5%) were cost effective – they cost less than £20,000 per QALY gained
- 7 (3.5%) cost between £20,000 and £30,000 per QALY gained.¹⁶

Overall, NICE highlighted that those interventions aimed at the whole population, such as mass-media campaigns to promote healthy eating and legislation to reduce young people's access to cigarettes, were the most cost effective.¹⁶ They also found some targeted interventions to be cost effective, including interventions to help people return to work following long-term sickness absence.¹⁶ **Table 1** sets out some examples of public health interventions and their cost per QALY and cost benefit ratio, most of which are cost effective according to NICE criteria.¹⁹

Table 1 – Cost effectiveness of public health prevention

Intervention	Cost per QALY	Cost benefit ratio
Nicotine replacement therapy to reduce smoking	-£3,273*	6.41
Assessment and support of caregivers for preventing depression	£124,479	0.17
School-based group education to reduce population levels of obesity	£1,058	4.71
Brief interventions delivered in GP surgeries to reduce problem drinking	-£3,021	16.27
Five minutes of GP opportunistic advice to smokers presenting at GP surgeries	-£5,507	13.35

* A negative cost per QALY indicates that the healthcare cost savings are greater than the original cost of the intervention.¹⁹

A recent BMJ systematic review also found that local and national public health interventions are highly cost saving.²⁰ It found that the median return on investment for public health interventions was 14.3 to 1 (£14.30 saved for every £1 invested), and the median cost benefit ratio was 8.3.²⁰

Whilst not specific to the UK, the WHO's (World Health Organization) global action plan for the prevention and control of non-communicable diseases (2013-2020) explores the costs and benefits associated with different preventative interventions.²¹ This analysis highlighted a range of 'best buy' interventions considered by the WHO to be 'very cost effective'.^e These include tax increases and advertising restrictions on tobacco and alcohol, the provision of public information on diet and physical activity, and reducing salt intake.

e The WHO considers interventions that are very cost effective as those that generate an extra year of healthy life for a cost that falls below the annual gross domestic product per person, which in the UK was approximately £28,500 in 2016.

Focus on: the cost effectiveness of local tobacco control policies

Smoking is the single greatest cause of preventable premature death in the UK and places a heavy financial burden on the NHS.²² There have been a variety of tobacco control policies put in place to reduce the harms associated with tobacco use. The provision of nicotine replacement on its own can be cost saving, and the provision of smoking cessation services appears to be highly cost effective. Smoking cessation services provide a combination of behavioural support alongside pharmacotherapy designed to help people give up smoking.²³ Cost effectiveness analysis shows that Stop Smoking Services cost under £1,000 per QALY,²⁴ which is well under the NICE threshold of £20,000. This is due to a combination of their relative low cost to implement and the significant impact that stopping smoking has on improving health outcomes.²⁵

Using the more wide-ranging cost benefit analysis, the cost effectiveness of a local smoking cessation service in Bury was analysed by NICE, measuring the outcomes across the NHS and business sector.¹⁶ It was suggested that investing £751,692 in smoking cessation interventions for one year (equivalent to current practice) would achieve estimated gross savings of £321,579 overall in the first two years (not including the implementation cost). The cost savings are summarised in **Table 2**.¹⁶

Table 2 – Breakdown of costs saved from smoking cessation services

Sector	Item	Number of events saved	Cost saving (£)
Business	Days lost from smoking due to workplace absence (excludes smoking breaks)	1,272	113,162
NHS	GP and other consultations, hospital admissions and prescriptions	2,135	205,004
	Passive smoking-related treatment (for example treating asthma as a result of exposure to passive smoke)	148	3,322

Exploring the cost effectiveness of early intervention

There are limited data on the cost effectiveness of early years interventions in the UK, including for Sure Start, the UK early years initiative launched in 1998. A 2010 economic evaluation of Sure Start concluded that there was insufficient information to reliably predict long-term economic impacts.²⁶

However, based on data from the US, the Social Research Unit has used economic simulation models to fit the circumstances of English councils, to provide a range of estimates of the predicted cost benefits of different types of early years programmes and interventions (**see Table 3**).²⁷ These programmes are all based on parent-child interactions, which in the short term aim to improve children's social and emotional skills, fostering their cognitive development and wellbeing, with a view to supporting long-term improvements in health. Some of the outcomes monetised from these programmes were based on reductions in disruptive behaviour disorder symptoms, child abuse and neglect, crime, and substance abuse, and increases in high school graduation and employment.²⁷

Table 3 – Cost effectiveness of early years programmes

Intervention	Cost (£)	Benefits (£)	Cost benefit ratio
Triple P system	118	596	5.05
Fast	230	697	3.03
Pcit	1,273	2,583	2.03
Family Nurse Partnership	7,562	14,694	1.94
Incredible years (parent training)	1,211	1,654	1.37
Parents as teachers	3,540	2,558	0.72
Strengthening families	730	472	0.65
Parent-child home programme	4,690	2,923	0.62

Functional Family Therapy is an early intervention programme working with youth aged 10-18 with mental health and substance misuse problems, and antisocial behaviour.²⁸ It originates from the US, but has been utilised by a number of local authorities in the UK, and provides an example of an early intervention programme used in the UK for which the costs and benefits (non-discounted) have been estimated (see Table 4).⁷ The estimated benefits include not only those that directly improve the health of the individuals involved, but also wider effects such as on education and crime.²⁹

Table 4 – Breakdown of cost effectiveness of Family Functional Therapy

Costs per young person	£2,501
Benefits to tax payers	£5,775
Benefits to participants	£2,177
Benefits to others	£17,650
Total benefits	£25,603
Benefits – costs (net present value)	£23,102
Cost benefit ratio	£10.24

The only longitudinal studies assessing the long-term economic impact of early years interventions, that are based on RCTs, are on three US preschool education programmes. Data from these programmes – the Abecedarian, Perry High Scope and Chicago Parent Centres programmes – are summarised in Table 5.³⁰ These programmes all targeted disadvantaged families, supporting behavioural and emotional development, and providing high-quality care with an emphasis on education.³⁰

Table 5 – Cost effectiveness of preschool education programmes in the US

Study	Age of child at follow-up	Cost estimate	Estimated benefit	Estimated net benefit	Source
Abecedarian	21	£48,100	£119,900	£71,800	Barnett 2007
Chicago Parent Centres (pre-school programme)	21	£5,600	£39,900	£34,300	Reynolds 2002
Perry High/ Scope	40	£12,000*	£193,700	£181,700	Milagros 2005
	40	£12,000	£103,300	£91,300	Heckman 2010
<i>Inclusive of intangible crime costs</i>	27	£11,000	£96,000	£85,000	Karoly 2005
<i>Exclusive of intangible crime costs</i>	27	£11,000	£56,600	£45,600	Karoly 2005

* Slight variations in cost estimates for the Perry High programme represent methodological variation between studies. For example Heckman's 2010 analysis took into account wage data missing from previous studies.

As Table 5 indicates, these programmes are all cost effective. A recent follow-up (2014) of the Abecedarian programme, indicated that, at age 35, individuals had lower rates of hypertension than those in a comparison group, and a significantly lower risk of experiencing CHD (coronary heart disease) within the next 10 years.³¹ This indicates that net benefits increase with age. Participants in all three of the programmes above were found to be less likely to engage in unhealthy behaviours in adulthood, such as frequent drug use or smoking.³²

Much of the data exploring the cost effectiveness of early intervention programmes, in particular early years programmes, are from studies in the US, and caution must be taken when comparing US cost data to a UK context. For example, deprivation and inequality are less extreme in the UK where we have universal health and social welfare.⁸ Research showing that those in greater need benefit more than others suggests that the UK may have less capacity to benefit. Incarceration rates are also far higher in the US, so cost savings findings from reduced crime may not transfer easily to the UK.⁸

Promoting research into prevention and early intervention

Historically, there has been relatively little investment in public health research to develop the evidence base for early intervention and prevention; spending on preventative public health research accounts for just 5.4% of the total spending on health research.³³ There has been an historical reluctance to fund early years research in the UK, because of its long-term nature, meaning that it can be costly.³⁴ Those evaluations which have been conducted have often been on low budgets with limited scope.³⁴

Recently there have been a number of funding initiatives for public health research, but they have been relatively small-scale and fragmented.³³ This highlights the need for increased funding and greater coordination between public health and clinical practice to make the necessary shift to prevention, and to fill evidence gaps on:³³

- the complex interlinking factors that influence public health and prevention³³
- the development, testing and sustainable implementation of prevention strategies, in which organisations and sectors (eg NHS, social care, third sector, independent sector, education) can work together to create new ways of preventing or reducing the impact of public health problems³⁵
- the cost effectiveness of public health interventions³⁵
- how to most effectively promote lifelong health through investment in early years, including before birth.³³

Implications for policy

Despite complexities in developing the evidence base for the cost effectiveness of early intervention and prevention, data suggest that these approaches are often cost effective, and may even be cost saving. However, it may take several years before the health benefits of these approaches are seen, despite the fact the costs may need to be incurred 'up front'.¹⁶ Some interventions may not be deemed cost effective in the short term, but should be recommended for funding over the medium to long term.¹⁶ For example, the PHE (Public Health England) 'menu of preventative interventions' for local areas, advises that over a 10 year period, interventions to make mental health trusts smoke-free and provide quitting support, could generate an average net saving per person to the NHS of £1,890 per annum.³⁶

The health care system tends to focus on the treatment of illness rather than prevention and early intervention,³⁷ despite what the data suggest about their cost effectiveness. This may be because policy makers are reluctant to invest in interventions that are cost effective in the long term, due to the relatively short parliamentary time scales in the UK. Policy makers must therefore commit to investing over the medium to long term, in order to make cost savings further down the line. Moving forward, a transitional shift to funding early intervention and prevention would be a cost effective and sustainable approach for reducing demand for health care and wider public services in the future.

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