

This is a repository copy of *Applying the three core concepts of economic evaluation in health to education in the UK*.

White Rose Research Online URL for this paper:
<https://eprints.whiterose.ac.uk/153488/>

Version: Published Version

Monograph:

Hinde, Sebastian orcid.org/0000-0002-7117-4142, Walker, Simon Mark orcid.org/0000-0002-5750-3691 and Lortie-Forgues, Hugues orcid.org/0000-0002-4060-8980 (2019) Applying the three core concepts of economic evaluation in health to education in the UK. Discussion Paper. CHE Research Paper . Centre for Health Economics, University of York , York, UK.

Reuse

Items deposited in White Rose Research Online are protected by copyright, with all rights reserved unless indicated otherwise. They may be downloaded and/or printed for private study, or other acts as permitted by national copyright laws. The publisher or other rights holders may allow further reproduction and re-use of the full text version. This is indicated by the licence information on the White Rose Research Online record for the item.

Takedown

If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.



UNIVERSITY
of York

RESEARCH



Centre For Health Economics



**Applying the Three Core
Concepts of Economic
Evaluation in Health to
Education in the UK**

Sebastian Hinde, Simon Walker,
Hugues Lortie-Forgues

CHE Research Paper 170

Applying the three core concepts of economic evaluation in health to education in the UK

^aSebastian Hinde

^aSimon Walker

^bHugues Lortie-Forgues

^aCentre for Health Economics, University of York, UK

^bDepartment of Education, University of York, UK

November 2019

Background to series

CHE Discussion Papers (DPs) began publication in 1983 as a means of making current research material more widely available to health economists and other potential users. So as to speed up the dissemination process, papers were originally published by CHE and distributed by post to a worldwide readership.

The CHE Research Paper series takes over that function and provides access to current research output via web-based publication, although hard copy will continue to be available (but subject to charge).

Acknowledgements

We would like to thank Professor Mike Drummond, Professor Chris Bojke, and Dr Thomas Patton, all of whom provided thoughtful comment on this paper at various stages. None of the authors have any conflicts of interest to declare. None of the authors received any funding to conduct this research. No ethical approval was needed.

Further copies

Only the latest electronic copy of our reports should be cited. Copies of this paper are freely available to download from the CHE website www.york.ac.uk/che/publications/. Access to downloaded material is provided on the understanding that it is intended for personal use. Copies of downloaded papers may be distributed to third parties subject to the proviso that the CHE publication source is properly acknowledged and that such distribution is not subject to any payment.

Printed copies are available on request at a charge of £5.00 per copy. Please contact the CHE Publications Office, email che-pub@york.ac.uk, telephone 01904 321405 for further details.

Centre for Health Economics
Alcuin College
University of York
York,
YO10 5DD, UK

www.york.ac.uk/che

©Sebastian Hinde, Simon Walker, Hugues Lortie-Forgues

Abstract

In a UK policy context, education and healthcare sectors share many characteristics; however, the role of economic evaluation in informing policy making is very different. While in health it has become a key part of the deliberative processes of the National Institute for Health and Care Excellence (NICE) in their recommendations to the NHS, it has not played the same role in education. In this article we explore three key components that are required to underpin robust evaluations: a clear perspective, the identification of a single maximand, and recognition of the opportunity costs. We demonstrate the importance of each, how it has been applied in the NICE framework, and how it may be implemented in a UK education setting. We conclude that the failure in education to address the three components has reduced the ability to consider the cost-effectiveness of funding decisions, potentially resulting in inefficient use of educational funding.

Keywords

Evaluation, economic evaluation, health economics, education, cost-effectiveness analysis

Introduction

In the UK, the health and education sectors share many common features. Government spending is the majority of total expenditure in both sectors (83.3% in health (Nuffield Trust 2015) and 88.9% in education (Bolton 2014)), with them jointly representing a significant part of total Government spending (29% combined total public spending) (HM Treasury 2018b). Furthermore, investments in both are valued for their intrinsic worth, as well as the externalities they create for the beneficiary and wider society (Sen 1979, Drummond 2015). In both sectors, there are a wide range of available options on which the limited pool of funding can be spent in order to generate the best outcomes, therefore requiring some form of decision as to how the public funds can be most effectively spent, most likely through formal or informal evaluation of the relative merits of the competing alternatives.

However, despite the similarities between the sectors, economic evaluation in the two sectors is very different in the methodological approach, quantity of applied research, and role in the policy making process in the UK. In health, economic evaluation has become a core component in decision making at national level, primarily through the National Institute for Health and Care Excellence (NICE), who incorporate economic evaluation in the majority of their Guidelines and technology appraisal guidance, using a consistent methodological approach (NICE 2013). NICE's recommendations are used to directly inform NHS commissioning and policy.

However, in UK education, there is no consistent use of economic evaluation in the decision making process, nor robust sector specific methodological guidance (relying on general public sector guidance if used (HM Treasury 2018a)). Furthermore, while there exists a pool of published literature considering the evaluation of interventions in education relevant to the UK, e.g. the Sure Start program (Department for Education 2011), the Perry Preschool programme (Gramlich 1986), Free School Meals (Education Policy Institute 2018), and ongoing work by the Education Endowment Foundation (EEF), this is of limited scale and is methodologically inconsistent. While the Education Endowment Foundation (EEF) are endeavouring to address much of this shortcoming through their evidence toolkit (EEF 2012), reporting guidance, and decision maker support, as we detail in this paper there are significant methodological developments that are further required if economic evaluation is to be informative in the decision making process (EEF 2015, 2019).

In this paper we argue that a consistent and robust methodology must be created and applied for the evaluation of education programmes, if the role of economic evaluation is to achieve a similar role in informing policy as in health. To do this, we consider the role of economic evaluation in healthcare decision making in the UK and how it has helped to ensure cost-effectiveness is key to decision making criteria, ensuring accountability and transparency. We explore three key features of the NICE evaluation method guide (NICE 2013), which we consider to have been vital in ensuring consistent and robust evaluations: a clear perspective, identifying a single maximand, and recognising the opportunity costs, exploring how each could be applied in an education setting in the UK. We explore two case studies in the respective fields (the Cancer Drugs Fund (CDF) in healthcare, and the Pupil Premium in education) to demonstrate how economic evaluation is imbedded differently in the two sectors, and demonstrate the value of economics to the decision making process.

The role of economic evaluation in healthcare decision making in England

Since 1999, NICE has played an important role as a gatekeeper for new pharmacological treatments to the NHS in England and the development of best clinical practice guidance for diseases. NICE makes recommendations on the basis of clinical and cost-effectiveness evidence, with a NICE approval meaning that technology should be widely available in England. The consideration of cost-effectiveness is integral to this process, with new treatments that are not considered to be a cost-effective use of limited NHS funding (using NICE's transparent methodology (NICE 2013)) very unlikely to receive NICE approval, with only six such cases occurring in the first 10 years, each being associated with specific exceptions (Rawlins, Barnett, and Stevens 2010).

Details of the specifics of the NICE process and the role of cost-effectiveness in the deliberations are published elsewhere (NICE 2013, Rawlins, Barnett, and Stevens 2010). In brief, the analyses are conducted based on strict methodological guidance (NICE 2013) which seeks to estimate the lifetime costs to the NHS and Personal Social Services (PSS) and health outcomes of patients (measured as Quality Adjusted Life Years (QALYs) (Weinstein, Torrance, and McGuire 2009)) of the new intervention and all comparators in the relevant patient population. Costs and outcomes which fall outside of this perspective are not explicitly included in the headline estimation of cost-effectiveness, being considered external to the remit of NICE and the NHS to maximise population health with the NHS budget. Any gains in health which imply an additional cost to the NHS are considered against a cost-effectiveness decision rule 'threshold' in order to account for the opportunity cost of the additional expenditure, whereby gains which cost less than £20,000 to £30,000 per additional QALY gained are considered cost-effective. Similar frameworks are used by many other health technology assessment agencies internationally (ISPOR 2009), in addition to representing the approach taken for many of the published economic evaluations in the UK (Drummond 2015).

The three key methodological features

We identify three features which we believe have facilitated the ability to conduct economic evaluation routinely in a healthcare setting in the UK, forming a cornerstone of the NICE methods guide, but are largely lacking in the equivalent education setting. The three features are: the definition of a clear evaluative perspective, the identification of a specific and consistent outcome to be maximised, and the explicit consideration of the opportunity cost of all funding decisions. We will explore each in turn, briefly defining its role in economic evaluation, and considering how it could be applied in an education setting.

We will take as a starting point that a public sector decision maker is seeking to conduct robust cost-effectiveness analyses, where the costs and outcomes of competing alternatives are contrasted, and as such are seeking to maximise some set of sector specific outcomes (e.g. health or education) subject to some exogenous budget constraint. The case for such a basis to any methodological framework in a setting such as the UK public sector is well explored elsewhere (Drummond 2015).

Definition of a clear perspective

In order to conduct robust, repeatable and transparent economic evaluation, the starting point must be a clear statement of the framework for the analysis, or the 'perspective', explaining whose costs and outcomes are considered relevant, how each will be valued, and over what time period (Drummond 2015). Without a clear perspective it is not possible to conduct consistent evaluations, as a programme deemed high cost from one stakeholder's perspective could be low cost from another's, in terms of their own budgetary input. For example, an education decision maker, such as a head teacher, considering the merits of providing a free healthy breakfast club to all students, may consider the additional cost to their budget and the benefits, in terms of additional pupil attainment, as relevant to the evaluation perspective. However, they could equally expand it to consider the cost saving to parents who no longer need to pay for the breakfast provision or their benefits from an earlier school drop off, or more widely the lifelong health related cost and outcomes of improving the children's diet. The conclusions of an evaluation with the short-term school focussed perspective are likely to be different from the long-term wider example, making a clear statement of which is used is therefore vital to the ability to interpret the result, as both have merits to different stakeholders.

In an education setting, Belfield and Levin (Belfield and Levin 2013) highlight that, despite many authors arguing for the incorporation of the full costs of an intervention into evaluation in education, little progress has been made to identify these costs or the attribution of them to specific budget constrained decision makers. While their focus is primarily the US, the same case can be made for evaluations in the UK. 'Full costs' can be considered to describe both the breadth of relevant costs in addition to downstream costs, i.e. those saved or accrued into the future, which are explicitly included in the NICE evaluation framework.

While the EEF are making good progress towards the consistent identification and estimation of the short term costs imposed on a budget constrained education section, their cost ranking score (as one of five levels from £70 per pupil per year to over £1,000) (EEF 2012) only provides limited detailed evidence. Furthermore, despite the stated exclusion of parental costs from their ranking, it includes costs that fall across multiple independent budgets (e.g. central Government, Local Authority, and at school level) and therefore risks conflating the issue of differential policy aims from different decision makers (Sculpher 2014).

In terms of downstream costs, the majority of evaluations in education simply report the budget impact of the initial intervention, with little to no consideration of the downstream cost implications

or where they may fall. For example, the evaluation of early years interventions such as the Sure Start Programme are considered high cost by the EEF assessment due to the high adult child ratio needed, but no consideration is given to possible downstream cost saving from potential reduced teacher input at a later stage of the pupils schooling due to the success of the programme (EEF 2012).

This is in contrast to the approach taken in health where all short term and downstream costs are included. As discussed earlier, the most common evaluative perspective taken in evaluations of health is to consider the costs applicable to the health and social care providers and the benefits accrued by the treated patient, the prime example being the NHS and PSS and patient perspectives respectively taken by NICE evaluations (NICE 2013). While the decentralisation of many health budgets, including public health, as a result of the Health and Social Care Act of 2012 (UK Parliament 2012), has made the identification of a consistent payer perspective more challenging, a clear statement of the perspective chosen remains vital (Sculpher 2014).

In education, authors such as McEwan (McEwan 2012) have highlighted the increasing trend in evaluation to take a societal perspective; however, such an approach, while intrinsically appealing, has been identified as being unfeasible given the exogenous nature of public sector budgets and their inflexibility to changes in demand and cross-sectoral transfers, as well as the challenges of differential opportunity costs, discussed later in this paper (Claxton et al. 2010, Walker et al. 2019).

Identification of the outcome(s) to be maximised

The issue of the outcome seeking to be maximised by the intervention being evaluated (the maximand) is arguably the most significant practical challenge in any evaluation. In order for the merits of an intervention to be compared against other funding opportunities, it is important to estimate and report all of the relevant outcomes, and ideally weigh them or combine them into a single composite outcome to facilitate direct comparison of the relative merits. Failure to do so results in an apples versus oranges dilemma, where it is impossible to directly compare the merits of different alternatives which are competing for a single limited source of funding, as the outcomes are incomparable.

In education, much of the current literature has either taken a narrow outcome measure of education such as future income potential (Belfield and Levin 2013), or excessively broad, for example the Department for Business Innovation & Skills “Quadrants” (Department for Business Innovation & Skills 2013) which links education to outcomes such as social tolerance to entrepreneurial activity. Additionally, many evaluations have sought to quantify the relevant outcome(s) as education outcomes themselves (such as exam results), rather than the consequences of education (the intrinsic value of education). The educational outcomes vary from selectively identifying outcomes relevant to the evaluated intervention, (e.g. test scores in McEwan (McEwan 2012) and arguably the EEF approach of months of impact (EEF 2012)), to reporting over a plethora of outcomes with no aggregation (e.g. the Sure Start evaluation which looked at 21 outcomes) (Department for Education 2011). While the recent development in the UK of Progress 8 and Attainment 8 scores (Spencer 2018) have sought to incorporate a broader definition of academic achievement, they arguably still fail to reflect the specific value of education.

The lack of a consistent outcome across multiple evaluations, against which different interventions vying for the same limited budget can be compared, makes them of limited help for the decision maker, who may be unable to compare the set of outcomes over which an education intervention is being assessed, without conducting an informal weighting of the merits of the different outcomes. Methods such as multi-criteria decision analysis (MCDA) (Communities and Local Government 2009) are available to conduct such weightings, but do not appear to have been widely applied in

education beyond the recent attempts by Hollands et al. (Hollands, Pan, and Escueta 2019) to apply it in a US setting to inform cost-utility analysis. It is important to reflect that funding decisions and value judgements are made with or without the existence of a single unifying maximand, but when one is not present they are made without consistency, clarity or accountability.

Importantly such a maximand does not need to be a single natural unit but can be a composite of many, reflecting the varied aims of education funding, just as measures in health such as the Quality Adjusted Life Year (QALY) are composite measures of different elements of health (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) (Dolan 1997), with their relative value explicitly estimated. While composite measures such as the QALY are far from a perfect measure of the value of healthcare funding (Neumann and Cohen 2018, Pettitt et al. 2016), at worst it is a useful starting point which can feed into the deliberative process of decision making where other outcomes can be considered.

Previous authors in education have highlighted the need for a composite outcome (McEwan 2012), and the EEF toolkit uses the measure of 'months impact' as an indicator of the additional months of academic progress that a child experiencing an intervention can expect to achieve when compared to one who does not. However, while this metric is intrinsically appealing, its methodological basis and means of estimation are unclear, with little detail in the Toolkit's guide (EEF 2015) and recent criticism of it as an approach (Baird and Pane 2019).

Other academic based metrics have been used in evaluations, such as examination results, attendance figures, and proportion of pupils staying in education past 16 years of age, all of which are easily estimated but arguably less indicative of general educational benefit. Measures associated with the broader benefits of education, such as the Strengths and Difficulties Questionnaire (SDQ) (Goodman 1997) and health related aspects, such as activity levels, obesity rates, and junior EQ-5D scores have also been considered in an education context (Education Policy Institute 2018).

On their own, none of these outcomes would be expected to reflect the full benefits of education, just as a single component of health would fail to reflect the intricacies of an individual's quality and quantity of life. Therefore, in order to determine a single maximand, some consensus is required as to what the overall purpose of education funding is, to inform the dimensions to include and the relative weight of each dimension. These decisions can be reached through, for example, academic study of stated preferences, either of society or the decision maker, or revealed preferences, which emerge from investment and disinvestment decisions.

An example of such a composite measure may be one that considered the EEF's 'months impact', assuming the methodological estimation of the estimate could be consistently and transparently determined, alongside SDQ outcomes, both of which measure outcomes of intrinsic value in an education intervention. Alternatively, a de-novo measure could be constructed combining estimates of academic progress alongside non-academic outcomes and other measures such as lifetime earnings, with due consideration of the time over which benefits are accrued. Statistical methods and weightings could be used to account for possible correlation and the value of the components in terms of their intrinsic and investment value. Such decisions should ultimately be made by the decision maker with input from relevant stakeholders.

Consideration of opportunity cost

The value of any intervention must be determined by two factors. Firstly, the comparative outcomes of the new intervention compared to the competing alternative, such as the current activity it is seeking to replace (e.g. as would be the case at the release of a newer version of a currently used text book). But also, if the new intervention imposes an additional cost burden on a budget

constrained decision maker, the value of any activities that would be disinvested in must be considered, or if extra resources are made available to fund it, the value of any activities which could have been alternatively invested in are clearly relevant. These factors constitute the 'opportunity cost' of an activity, simply the full implications of funding a chosen intervention, measured by the benefits derived if the funding were spent (or saved) elsewhere.

The former has been considered in some education literature through the comparison of direct funding alternatives, often in the form of league tables where the costs and outcomes of all competing options are stated in an ordered table allowing a decision maker to clearly see what must be chosen from (Levin 2000, McEwan 2012). However, such approaches typically fail to reflect the second factor, the value of what would be funded if the new intervention were not invested in. Failure to reflect this in decision making risks the funding of increasingly expensive interventions that may be less cost-effective than those which are currently funded but would be disinvested in.

This later element of the opportunity cost, relating to the *cost-effectiveness threshold* as termed in a health setting as mentioned earlier, can either be directly observed through the comparison with a targeted disinvestment of comparable cost, or estimated as a marginal productivity, i.e. an estimate of the average cost burden that displaces one unit of benefit at the margin. While recent research in health has shown it is possible to estimate the threshold using the latter approach (Claxton et al. 2015), most decision making bodies in health still rely on assumed levels (NICE 2013, World Health Organisation 2008, Gold 1996). In education, threshold estimation by direct observation may be achievable at a school level, where budgets are small and displacements potentially easily observed.

The importance of economic evaluation, brief case studies

In this section we briefly overview two recent Government policies in the UK, the Cancer Drugs Fund (CDF) and the Pupil Premium, and explore how the existence of routinely applied economic evaluation methodology has contributed to the continued funding of the programmes. While it is rarely possible to definitively identify the key factor in changing national policy decisions, we conjecture that the extensive cost-effectiveness evidence that was generated against the CDF contributed to its closure. In contrast, the lack of equivalent research in education, or a framework against which to conduct it, has led to the inability to robustly monitor or evaluate the merits of the Pupil Premium.

The Cancer Drugs Fund (CDF)

In 2010 the CDF was established in order to provide NHS patients with access to what were considered to be the most promising cancer treatments. The main argument for the fund was that the benefits of cancer treatment was beyond those of usual healthcare, with its head claiming it was 'in the psyche of English people' (Jack 2014) to value cancer care more highly, and therefore that benefits of its treatment were being undervalued by the NICE process. Its role was therefore to provide funding for cancer treatments that had not been recommended by NICE or were yet to be appraised. An initial budget of £50 million per annum was allocated, however this quickly expanded, costing a total of £1.27 billion in the six years it was operational (Aggarwal et al. 2017).

A number of factors contributed to its closure in 2016 but possibly the most significant was the availability of evidence which demonstrated the lack of cost-effectiveness of the treatments being funded, with the majority of the drugs funded by the CDF having failed NICE's cost-effectiveness assessment (55%) (Aggarwal et al. 2017), implying that the CDF had an implied threshold of £223,627/QALY, in the region of ten times the usual NICE cost-effectiveness threshold of £20-£30,000/QALY (Leigh and Granby 2016).

Analyses of the CDF subsequently found that the majority of treatments funded (62%) were not associated with a statistically significant survival benefit (Aggarwal et al. 2017), and provided no evidence of meaningful value to the patients treated or to wider society. Estimates suggested that the funding of the CDF was resulting in 20,000 QALYs less per year than had the money been spent elsewhere in the NHS (Claxton et al. 2015). The combination of this clear loss of total public health, and emergent evidence that there was little evidence that cancer treatment was considered more valuable than other diseases (Shah 2017), combined to make the continued funding of the CDF politically untenable. Without such research it is likely that the CDF would have continued to be funded, entailing a significant loss of potential population health.

The Pupil Premium

The Pupil Premium was introduced in 2011 with the aim of decreasing the attainment gap for the most disadvantaged children. The Premium provides direct funding to schools, who are given almost complete freedom to spend the money in a way they believe will most benefit the specific pupil groups. At launch, the Premium had an annual budget of £623 million across England, this has increased to £2.4 billion in 2018/19 alone.

Schools are required to publish a breakdown of how the premium is spent, with assessment of its effectiveness being conducted during Ofsted inspections. However, the assessments typically consist of simple summaries of expenditure compared to changes over time in some exam outcomes in the deprived pupils, e.g. (Tomsett 2019), with no consistent guidance on the evaluative methodology to

apply, and little in the way of consideration of the counterfactual results had the funding not been available.

The Department for Education officially recommends the use of the Education Endowment Foundation's (EEF) teaching and learning toolkit to inform the investment decisions (DfE and ESFA 2019); however, in addition to the limitations raised earlier in this paper, there is little evidence that the tool is changing investment decisions, rather than being used to justify prior funding plans.

Since the launch of the Pupil Premium, there have been attempts to evaluate its effectiveness. In 2013, the Department for Education commissioned an independent evaluation of the Premium (Carpenter 2013), including a survey of school decision makers showing that over 45% indicated they were using academic research to inform their funding decisions, however there is little to indicate this included any consideration of cost-effectiveness.

Similarly, the Sutton Trust and EEF produced a series of recommendations to improve the Premium, largely based on the results of a series of surveys of senior school leaders (Sutton Trust and Education Endowment Foundation 2015), summarising a range of sources of decision making guidance for spending decisions but with little to no consideration of cost-effectiveness of the various alternatives. Other analyses, including by Ofsted (Ofsted 2013) and DEMOS (DEMOS 2014), are limited in their application of robust comparative analysis, and with no considerations of cost-effectiveness (with neither mentioning it at any point in their deliberations).

Overall, while there has been some attempt to ensure reporting and effective spending of the Pupil Premium, the lack of the three elements explored in the paper in an education setting has meant that there is no framework against which to robustly estimate the full benefits or costs of the policy. As a result, it is impossible to determine whether the Pupil Premium represents the best means of achieving the aims of improving educational outcomes in the most deprived pupils.

Discussion

In this paper we have explored some of the key methodological areas which we believe should be addressed if the evaluation of education programmes in the UK are to be conducted in a transparent and consistent way. We have argued that clear National methodological guidance is needed that provides a clear statement of whose perspective evaluations should consider, seek to establish a single maximand or some weighting of relevant educational outcomes, and attempt to reflect the opportunity costs of new interventions. Using the case studies, we have explored how the failure to have such an evaluative framework in education could be resulting in wasteful spending, as there are only limited checks on the cost-effectiveness of large budget policies such as the Pupil Premium.

One possible means of achieving such national guidance and consistency would be the creation of a National non-departmental public body charged with producing such guidelines, much as NICE does for health. This is a role that the EEF have been starting to achieve, through their guidance and toolkit, but is arguably outside the remit of a charitably funded group.

The creation of such a body would also facilitate the consideration of cross-sectoral costs and outcomes across public sectors such as health and education, if evaluation methodologies were consistent across UK public bodies. Currently, despite many interventions across public sectors having significant cross-sectoral cost and outcome impacts, evaluative guidelines and practical applications routinely fail to consider spill over effects between sectors (NICE 2013). The failure to reflect these cross-sectoral impacts may be leading to significant inefficiencies across both education and health, with the failure to incorporate the costs and outcomes of the other in the maximisation problem resulting in a potentially sub-optimal outcomes in terms of overall social welfare.

While it is impossible to estimate the benefits of economic evaluation to the NHS or its use in the NICE decision making process, the availability of a consistent framework against which to assess the cost-effectiveness of healthcare interventions is unquestionably valuable. The lack of such a framework for those conducting evaluations in education should be addressed as a priority, as without it existing research is unable to fully address the question of whether an intervention represents a cost-effective use of a limited education budget, or whether funding and educational opportunities are being wasted through a lack of accountability and robust evidence.

References

- Aggarwal, A., T. Fojo, C. Chamberlain, C. Davis, and R. Sullivan. 2017. "Do patient access schemes for high-cost cancer drugs deliver value to society?—lessons from the NHS Cancer Drugs Fund." *Annals of Oncology* 28 (8):1738-1750. doi: 10.1093/annonc/mdx110 %J Annals of Oncology.
- Baird, Matthew D., and John F. Pane. 2019. "Translating Standardized Effects of Education Programs Into More Interpretable Metrics." 48 (4):217-228. doi: 10.3102/0013189x19848729.
- Belfield, Clive, and Henry Levin. 2013. "The cumulative costs of the opportunity gap." *Closing the opportunity gap: What America must do to give every child an even chance*:195.
- Bolton, P. 2014. "Education Spending in the UK." *House of Commons Library Social and General Statistics*.
- Carpenter, H., Papps, I., Bragg, J., et al. 2013. "Evaluation of Pupil Premium, Research Report " *Department for Education: Manchester*.
- Claxton, K., S. Martin, M. Soares, N. Rice, E. Spackman, S. Hinde, N. Devlin, P. C. Smith, and M. Sculpher. 2015. "Methods for the estimation of the National Institute for Health and Care Excellence cost-effectiveness threshold." *Health Technol Assess* 19 (14):1-503, v-vi. doi: 10.3310/hta19140.
- Claxton, K., S. Palmer, M. Sculpher, and S. Walker. 2010. "Appropriate perspectives for health care decisions." *CHE Research Paper* 54.
- Communities and Local Government. 2009. "Multi-criteria analysis: a manual." *Department for Communities and Local Government: London*.
- DEMOS. 2014. "A tale of two classrooms: London results skew national picture as educational inequality on the rise." <https://demos.co.uk/press-release/a-tale-of-two-classrooms-london-results-skew-national-picture-as-educational-inequality-on-the-rise/> (accessed 02/07/2019).
- Department for Business Innovation & Skills. 2013. "The Benefits of Higher Education Participation for Individuals and Society: key findings and reports "The Quadrants"." *BIS Research Paper* 146.
- Department for Education. 2011. "National evaluation of Sure Start local programmes: an economic perspective." *Department for Education: Manchester*.
- DfE and ESFA. 2019. "Pupil premium: funding and accountability for schools." *Department for Education: Manchester*.
- Dolan, P. 1997. "Modeling valuations for EuroQol health states." *Med Care* 35 (11):1095-108.
- Drummond, M., Sculpher, M., Claxton, K., Stoddard, G., Torrance, G. 2015. "Methods for the Economic Evaluation of Health Care Programmes, fourth edition." *Oxford University Press*.
- Education Policy Institute. 2018. "Evaluation of Universal Infant Free School Meals." *Education Policy Institute: London*.
- EEF. 2012. "The Teaching and Learning Toolkit." *EEF: London*.
- EEF. 2015. "EEF Guidance on Cost Evaluation." *EEF: London*.
- EEF. 2019. "The EEF guide to becoming an evidence-informed school governor and trustee." *EEF: London*.
- Gold, Marthe. 1996. "Panel on Cost-Effectiveness in Health and Medicine." *Medical Care* 34 (12):DS197-DS199.
- Goodman, Robert. 1997. "The Strengths and Difficulties Questionnaire: a research note." *Journal of child psychology and psychiatry* 38 (5):581-586.
- Gramlich, Edward M. 1986. "Evaluation of education projects: the case of the perry preschool program." *Economics of Education Review* 5 (1):17-24. doi: [https://doi.org/10.1016/0272-7757\(86\)90159-7](https://doi.org/10.1016/0272-7757(86)90159-7).
- HM Treasury. 2018a. "The Green Book: Central Government Guidance on Appraisal and Evaluation."
- HM Treasury. 2018b. "Public Expenditure Statistical Analyses 2018." *HM Treasury: London*.

- Hollands, Fiona, Yilin Pan, and Maya Escueta. 2019. "What Is the Potential for Applying Cost-Utility Analysis to Facilitate Evidence-Based Decision Making in Schools?" 48 (5):287-295. doi: 10.3102/0013189x19852101.
- ISPOR. 2009. "Transferability of Economic Evaluations Across Jurisdictions." *ISPOR: NJ USA*.
- Jack, Andrew. 2014. "Which way now for the Cancer Drugs Fund?" 349:g5524. doi: 10.1136/bmj.g5524 %J BMJ : British Medical Journal.
- Leigh, S., and P. Granby. 2016. "A Tale of Two Thresholds: A Framework for Prioritization within the Cancer Drugs Fund." *Value Health* 19 (5):567-76. doi: 10.1016/j.jval.2016.02.016.
- Levin, H., McEwan, P. 2000. "Cost-Effectiveness Analysis: Methods and Applications, 2nd edition." *SAGE Publications*.
- McEwan, Patrick J. 2012. "Cost-effectiveness analysis of education and health interventions in developing countries." *Journal of Development Effectiveness* 4 (2):189-213. doi: 10.1080/19439342.2011.649044.
- Neumann, Peter J., and Joshua T. Cohen. 2018. "QALYs in 2018—Advantages and ConcernsQALYs in 2018—Advantages and Concerns." *JAMA* 319 (24):2473-2474. doi: 10.1001/jama.2018.6072 %J JAMA.
- NICE. 2013. "Guide to the methods of technology appraisal 2013." *NICE: London*.
- Nuffield Trust. 2015. "NHS in Numbers." <https://www.nuffieldtrust.org.uk/resource/nhs-in-numbers> accessed: 31/7/2018.
- Ofsted. 2013. "The Pupil Premium." *Ofsted: Manchester*.
- Pettitt, DA, S Raza, B Naughton, A Roscoe, A Ramakrishnan, A Ali, B Davies, S Dopson, G Hollander, JA %J Journal of Stem Cell Research Smith, and Therapy. 2016. "The limitations of QALY: a literature review." 6 (4).
- Rawlins, Michael, David Barnett, and Andrew Stevens. 2010. "Pharmacoeconomics: NICE's approach to decision-making." *British journal of clinical pharmacology* 70 (3):346-349. doi: 10.1111/j.1365-2125.2009.03589.x.
- Sculpher, M., Walker, S., Hinde, S., Claxton, K. . 2014. "Research to inform Resource Allocation in Health and Social Care." *EEPRU Research Report* 017.
- Sen, Amartya. 1979. "Personal Utilities and Public Judgements: Or What's Wrong with Welfare Economics?" *Economic Journal* 89 (355):537-58.
- Shah, Koonal Kirit. 2017. "Is willingness to pay higher for cancer prevention and treatment?" *Journal of Cancer Policy* 11:60-64. doi: <https://doi.org/10.1016/j.jcpo.2016.09.006>.
- Spencer, B. 2018. "Understanding Progress 8 and Attainment 8." *Satchel Blog* <https://blog.teamsatchel.com/understanding-attainment-8-progress-8> (accessed 02/07/2019).
- Sutton Trust and Education Endowment Foundation. 2015. "The Pupil Premium, Next Steps." *Sutton Trust: London*.
- Tomsett, J. 2019. "Pupil Premium Funding at Huntington School: Statement 2017-19." <https://huntingtonschool.co.uk/wp-content/uploads/2019/02/Huntington-School-Pupil-Premium-funding-statement-January-2019.pdf?x83792> (accessed 02/07/2019).
- UK Parliament. 2012. "Health and Social Care Act."
- Walker, Simon, Susan Griffin, Miqdad Asaria, Aki Tsuchiya, Mark %J Applied Health Economics Sculpher, and Health Policy. 2019. "Striving for a Societal Perspective: A Framework for Economic Evaluations When Costs and Effects Fall on Multiple Sectors and Decision Makers." 17 (5):577-590. doi: 10.1007/s40258-019-00481-8.
- Weinstein, Milton C., George Torrance, and Alistair McGuire. 2009. "QALYs: The Basics." 12 (s1):S5-S9. doi: 10.1111/j.1524-4733.2009.00515.x.
- World Health Organisation. 2008. "WHO guide for standardization of economic evaluations of immunization programmes." *WHO: Geneva*.