

Institution: University of York		
Unit of Assessment: 2 - Public Health, Health Services and Primary Care		
Title of case study: Spending Healthcare Resources Wisely		
Period when the underpinning research was undertaken: 2005 - 2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Adriana Castelli	Senior Research Fellow	May 2004 - present
Andrew Street	Professor	April 1999 - Aug 2017
Hugh Gravelle	Professor	Oct 1995-Dec 2010; Feb 2011 - present
Nigel Rice	Professor	Feb 1994 - present
Karl Claxton	Professor	Oct 1989 - present
Mark Sculpher	Professor	Nov 1997- present
Peter C Smith	Professor	Aug 1993 – Sep 2009; Nov 2017-present
Period when the claimed impact occurred: 2014 - 2020		
Is this case study continued from a case study submitted in 2014? N		
<p>1. Summary of the impact (indicative maximum 100 words)</p> <p>Research by York economists has informed decisions on: the <u>size</u> of the annual NHS budget for England (around £127 billion in 2017/18); the <u>distribution</u> of these funds across England; and how the funds are <u>used</u> throughout the NHS to help maximise benefits to patients. Our research led firstly, to new measures of NHS productivity that are used routinely by government; secondly, to a novel approach for allocating resources to commissioners of healthcare services; and thirdly, to the development of innovative methods to evaluate the cost-effectiveness of interventions and policies. By influencing the way in which most of the NHS budget in England is determined, allocated and spent, population health is improved through a more efficient and equitable allocation of resources. The research has also influenced policy internationally.</p>		
<p>2. Underpinning research (indicative maximum 500 words)</p> <p>Size of the NHS budget</p> <p>1. Research led by York economists [A] originally developed, and has improved continually, the methods underpinning the estimates of the productivity of the NHS in England. Using our analyses we produce annual updates of inputs, outputs and productivity growth for the Department of Health & Social Care (DHSC). Comprehensive estimates of productivity are produced annually by York economists [B]. These build on detailed methodological work which accounts for the radical and constant change in the underlying datasets that feed into the estimates, as well as identifying improvements in how to measure changes in the quality of healthcare outputs produced, rather than focusing on quantity alone. Recent research has focused on measuring productivity at the level of hospital trusts, using advanced methods to identify both the degree of variation between trusts and the drivers of that variation [C]. As an illustrative example, if hospitals at the bottom quartile could become as efficient as the average performers, then the research shows that between £2.5 billion and £4 billion could be saved or re-allocated.</p> <p>Distribution of the budget</p> <p>2. All the economics and econometrics input into research published in 2011 [D] with the Nuffield Trust was provided by York economists. This research developed novel methods leading to a new approach for allocating resources to general practices in England, building on many years of previous York research. The innovative feature of the Person Based Resource Allocation (PBRA) approach was to link data sources which allowed detailed <u>individual</u> level morbidity data on all registered patients to be combined with demographic and geographical area level data in order to reflect more fully the healthcare needs of local populations. Previously allocations were based on aggregate area level analyses which were less nuanced and did not reflect individual health care needs. PBRA produces a fairer and more accurate distribution of resources to local areas, allowing Clinical Commissioning Groups to purchase healthcare appropriate to their populations.</p> <p>Using the budget effectively</p>		

3. York economists have estimated the marginal productivity of NHS expenditure or the shadow price of the NHS budget constraint [E]. This indicates the health opportunity costs associated with additional NHS spending and informs how the cost-effectiveness of interventions and policies can be assessed. Our research developed the methods and principles underlying a framework for the economic evaluation of healthcare interventions. We have (i) argued that economic evaluation of interventions should take account of the opportunity cost of the use of resources involved; and (ii) recalculated the appropriate threshold at which the opportunity cost should be set [F]. This resulted in the recommendation for a lower “Cost per Quality Adjusted Life Year” threshold of £15,000 to assess value for money of interventions in the NHS, as well as producing estimates for the appropriate thresholds in many other countries.

3. References to the research (indicative maximum of six references)

This substantial body of research has produced a very large number of outputs. To indicate the breadth and depth of the research the following citations (from peer reviewed journals, resulting from peer reviewed research awards eg, NIHR, DHSC) have been selected.

York authors in bold

- A. Castelli A, Dawson D, Gravelle H, Jacobs R, Kind P**, Loveridge P, **Martin S**, O'Mahony M, Stevens PA, Stokes L, **Street A**, Weale M. A new approach to measuring health system output and Productivity. *Natl Inst Econ Rev* 2007;**200**:105-117. [10.1177/0027950107080395](https://doi.org/10.1177/0027950107080395)
- B. Bojke C, Castelli A, Grasic K, Street A**. Productivity growth in the English National Health Service from 1998/1999 to 2013/2014. *Health Econ* 2017;**26**:547-65. [10.1002/hec.3338](https://doi.org/10.1002/hec.3338)
- C. Aragon Aragon MJ, Castelli A, Gaughan J**. Hospital Trusts productivity in the English NHS: uncovering possible drivers of productivity variations. *PLoS One* 2017;**12**:e0182253. [10.1371/journal.pone.0182253](https://doi.org/10.1371/journal.pone.0182253)
- D. Dixon J, Smith P, Gravelle H, Martin S**, Bardsley M, **Rice N**, Georghiou T, **Dusheiko M**, Billings J, De Lorenzo M, Sanderson C. A person based formula for allocating commissioning funds to general practices in England: development of a statistical model. *BMJ* 2011;**343**:d6608. [10.1136/bmj.d6608](https://doi.org/10.1136/bmj.d6608)
- E. Martin S, Rice N, Smith PC**. Does health care spending improve health outcomes? Evidence from English programme budgeting data. *J Health Econ* 2008;**27**:826-42. [10.1016/j.jhealeco.2007.12.002](https://doi.org/10.1016/j.jhealeco.2007.12.002)
- F. Claxton K, Martin S, Soares M, Rice N, Spackman E, Hinde S**, Devlin N, **Smith PC, Sculpher M**. Methods for the estimation of the NICE cost-effectiveness threshold. *Health Technol Assess* 2015;**19**:1-503. [10.3310/hta19140](https://doi.org/10.3310/hta19140)

4. Details of the impact (indicative maximum 750 words)

Size of the NHS budget

1. Annual national estimates of productivity influence policy and affect decisions on NHS resources. The DHSC competes with all other government departments for a share of national resources. In recent years the relative “protection” of the health budget has sharpened the focus of DHSC negotiations with the Treasury, requiring evidence of efficient resource use in the NHS. The former Chief Analyst of DHSC noted, “*By detailing the amount and quality of care secured from NHS resources this work provides evidence about what the NHS is doing with the budget it receives and helps identify opportunities for better use of funding.*” [1a] Health expenditure in England is around £127 billion per annum and demonstration of overall productivity is key to achieving a more favourable settlement for the NHS. York research provides evidence of this productivity. The Office for National Statistics (ONS) uses the York quality adjustments each year in their estimate of productivity which in turn feeds into the National Accounts. York’s research is referenced in ONS documents which explain the quality adjustments used since 2005 to adjust productivity measures (retrospectively at first, from 1998/99 onwards) [1b]. Annual publications from the ONS acknowledge the research, e.g. in 2020: “*The English financial year productivity figure is produced on a similar basis to an alternative healthcare productivity measure produced by the Centre for Health Economics ... [they provide a link to CHE research]. ...the largest element of the quality adjustment is produced by the University of York and used in both publications*” [1c]. The ONS also refers to ongoing research at York that

is improving the quality measures further, including the development of criteria to assess suitability of quality measures across all public sectors [1d]. The quality adjustments make a distinct difference to the estimate of productivity, accounting for an average of 28% of the increase in productivity between 2014 and 2018, and for 57% of the growth in the most recently available year (2018) [1e]. York research is recognised widely; e.g. cited in 2015 in Parliament: *“The most comprehensive and reliable estimates of productivity for the National Health Service in England are compiled by the Centre for Health Economics at the University of York. Their published series provides data from 1998/99 onwards...”* [1f].

The York productivity measures have been used in other contexts to support and inform important policy decisions. First, the trends in both total factor and labour productivity assist policymakers in determining appropriate NHS pay awards. Annual reports of the NHS Pay Review and the Doctors and Dentists Pay Review reproduce evidence submitted by the DHSC about York’s research, as illustrated in examples from 2018 [2a][2b]. Pay is a major element in NHS spending, hence using the trends in underlying productivity of labour to help decide the level of pay awards each year, is vital to determining the resources available for the NHS. Second, the Office for Budget Responsibility uses the productivity estimates to inform their long-term projections of health spending and fiscal sustainability which in turn affects decisions made on NHS spending by the Treasury [2c]. Third, York research was part of the evidence on hospital efficiency submitted by NHS England to the Health Select Committee in 2016 (only 3 non-government sources of evidence were cited, and York’s was one of these). The data were used to estimate efficiency savings that could be expected from NHS trusts, hence feeding into the overall calculation of the net funding requirements and reflected in the national settlement for the NHS budget [2d]. Street was specialist adviser to the 2016 Comprehensive Spending Review and the national and trust level research was cited, the latter as evidence of scope for efficiency improvements [2e].

In summary, York research has strengthened the evidence underpinning spending decisions and in turn this has determined the size of the budget made available for the NHS and hence the amount of health and care services that can be delivered to the whole population. York expertise (Castelli) has been sought by those seeking to improve the methods of measuring productivity outside the health sector: e.g., Ministry of Justice; and outside the UK: e.g., World Health Organisation; China and Malaysia [3a]. The Deputy Director General of the Malaysia Productivity Corporation noted that the York research (and hands-on training provided to them by Castelli) helped them to develop successfully the healthcare measurement framework for Malaysia [3b].

Distribution of the budget

2. The PBRA method (sometimes called the “Nuffield Formula”) was adopted in 2013 by the Advisory Committee on Resource Allocation (ACRA), an independent expert body that advises the Secretary of State for Health on how national resources are allocated to commissioners. ACRA is currently chaired by Smith and Cookson is also a member - both are at York and other York economists (Gravelle, Rice) are/have been members of ACRA and its Technical Advisory Group in the past, with a combined input of 38 years of service. The new PBRA formula recommended by ACRA was accepted by NHS England in December 2013, and they referred to the changes as helping to *“ensure that funding matches the needs of local populations”* and is *“equitable and fair”* [4a].

This formula has been used every year since 2014/15 to allocate resources to CCGs [4b]. In principle, if every individual had a budget allocated personally to them that met their individual healthcare needs, this would be the most accurate allocation. In practice, individual allocations are aggregated across practice lists/CCGs to create a flexible budget that pools risks. PBRA uses a wealth of individual level data to increase the accuracy of the formula which predicts needs and hence ensures that resources are allocated appropriately to better meet the healthcare needs of local populations. The National Audit Office noted: *“By using newly available data at the level of individual patients to create a more detailed model of healthcare*

utilisation, NHS England's new approach is better at predicting relative needs"; and, with reference to the implementation of PBRA: "NHS England adjusted 90% of each clinical commissioning group's target allocation for 2014-15 for related need. The adjustment ranged from a 27.9% increase to a 25.0% decrease, compared with what target allocation would have been based on population size alone" [4c].

Although the PBRA formula was first used for 2014/15 allocations it now has even more influence: it forms the basis for 57% of the CCG annual allocations by NHS England (£59.4 billion from a total £104.3 billion allocated to CCGs to meet healthcare needs in 2019/2020), including an extension of the PBRA method to mental health (£9.4 billion) (latter by University of Manchester based on the original methods) and specialist services (£8 billion by formula). Current plans will extend it to prescribing and maternity allocations (£9.5 billion) [5a]. CCG allocations have most recently been set for the period 2019/20 - 2023/23 using this formula [5b]. Hence the methods developed by York have been used since 2014/15 to produce a formula that allocates an increasingly large proportion of the NHS budget in a fair and accurate way, maximising the congruence between healthcare needs and the services commissioned for, and provided to, the entire population.

Using the budget effectively

3. York research on health opportunity costs in the NHS was described by the former Chief Analyst of the DHSC as *"the single most important piece of work" being done for the DHSC* [6]. Through frequent meetings with policy makers and analysts at DHSC, NICE and the Health & Care Alignment Working Group (a cross departmental group tasked with aligning how economic evaluations are undertaken), the research has been influential in policy analysis by the DHSC. The DHSC now routinely uses £15,000 per Quality Adjusted Life Year (QALY) as an empirical estimate of the health the NHS generates (loses) with increases (decreases) in funding, because of York's research. This evidence is used in DHSC impact assessments which are a mandatory requirement for all new policies introduced across government. Since 2014, DHSC has undertaken 23 impact assessments using the £15,000 per QALY estimate, considering policies ranging from dental charges regulation to accelerated access to new medical technologies [7]. The total financial impact of these policies was estimated in the assessments at £1.9 billion but, prior to the York research, the implications for population health were not routinely considered. This is now included in the 23 impact assessments and was estimated in total as 125,846 QALYs which the DHSC values at £7.6 billion, a four-fold difference. It has also been used in specific policy decisions: eg, the reform of the Cancer Drugs Fund following the NAO review which requested evidence from York on the health opportunity costs versus benefits [8] and resulted in removal of less cost-effective drugs.

The methods were extended to public health and social care and have influenced Public Health England's (PHE) approach to the evaluation of the health gained from spending on public health interventions. The York research demonstrated that spending extra money on public health interventions could produce greater overall health gains than spending it elsewhere in the healthcare system, leading PHE to make a "prevention over cure" argument [9a]. The Chief Economist of PHE stated that this argument was the central message in discussions with the Treasury on public health spending and "... was influential in securing a better settlement than in previous years", as well as feeding "directly into the deliberations" of the Health & Social Care Taskforce, a joint group between the Treasury and Number 10; and the York research team was commended for the "policy relevance and impact of this work" [9b].

Impact beyond the NHS has been achieved by motivating research in other countries (by York researchers as well as others) which has informed international decision-making, most notably by governments in Norway and Canada which have based recommendations for pharmaceutical pricing and regulatory reform directly on York's threshold estimates [10a][10b]. The Canadian Patented Medicines Prices Review Board stated the York research was "instrumental" in them advancing price regulatory reform and without it they would have been unlikely to advance reforms that are "expected to save the health care system billions of dollars" [10c]. In the USA

the research informed lower benchmark drug prices adopted by the Institute for Clinical and Economic Review (ICER - known as an independent drugs “watchdog” in USA), allowing Medicaid and private insurers to negotiate lower prices (reflecting health opportunity cost), making drugs more affordable and maximising the health gained from spend. ICER stated that the research “*directly informed*” their approach and the reduction of their value based benchmark [10d]. In each case, overall population health is improved as a result of better allocation of health resources.

5. Sources to corroborate the impact (indicative maximum of 10 references)

1. Impact of productivity research on national budgets

(a-f) Feedback from DHSC; citations in documents from the Office of National Statistics and estimates of the difference that quality adjustments make to national figures

2. Impact of productivity research on wider decision making

(a-e) Government documents showing impact relating to pay review, fiscal sustainability and efficiency.

3. Impact of productivity research beyond the UK

(a-b) Examples of international influence including letter from MPC

4. Impact of resource allocation research on core NHS budget allocations

(a-c) Government documents (NHS England, NAO) showing the adoption of the PBRA formula and the difference it made compared to previous methods.

5. Impact of resource allocation research on wider allocations

(a-b) NHS England documents showing roll-out of PBRA formula over time and to additional elements of the NHS budget.

6. Importance of health opportunity costs research

Letter from former Chief Analyst, DHSC July 2020

7. Impact of health opportunity costs research on DHSC policy

Example of DHSC impact assessments.

8. Impact of health opportunity costs research on Cancer Drugs Fund

Investigation into the Cancer Drugs Fund. National Audit Office report 2015

9. Impact of health opportunity costs research on Public Health

(a-b) Blog and letter from PHE officials testifying to the importance and impact of research.

10. Impact of health opportunity costs research beyond the UK

(a-d) Government documents from Norway, Canada and the US citing the research and letters from institutions testifying to the impact.