Institution: University of York

Unit of Assessment: 2, Public Health, Health Services and Primary Care

Title of case study: Allocating Resources in the National Health Service

1. Summary of the impact

York research has, continuously since the early 1990's, underpinned the methods by which a substantial proportion of the total NHS budget is allocated by the Department of Health to the organisations providing or arranging healthcare. Despite numerous NHS reforms, our research has produced formulae appropriate to each new system. These formulae have driven NHS policy on allocations across geographical areas and health care administrative entities in England, thereby ensuring that the population of approximately 55 million people receives a share of over £90 billion of healthcare resources that is fair and better reflects relative health care needs.

2. Underpinning research

The underlying principle of allocation formulae is to distribute resources on the basis of the relative need for health care services of the population. York has been at the forefront of developing methods for designing these formulae across the spectrum of NHS activity, encompassing primary and secondary care services. This dates back to seminal work in 1993 when research at York resulted in a step change in the methodology of NHS allocation formulae by combining small area level information on health care utilisation with small area census data to produce a more robust method of modelling population need than hitherto (1). Used by the Department of Health (DoH) to allocate resources in the English NHS, the `York formula' set the precedent for research and policy over the following 20 years and York researchers have made a regular, sustained intellectual contribution to this area of research introducing major methodological innovations. Research on resource allocation brings together a range of researchers from different institutions. York's main contributions have centred on devising modelling strategies, developing methods, interpreting results and advising on datasets.

The AREA research (Gravelle; jointly led with the University of Glasgow), formed the basis of allocations made from 2003/04 to 2009/10 and for the first time devised formulae suitable for allocations to Primary Care Trusts (2). Using newly assembled data for 8414 geographical areas, the research estimated utilisation models that took into account unmet need, in order to make the distribution of resources more equitable. It was innovative in deriving measures of specific morbidities (to measure relative need) at small area level from individual level survey data.

Capitation payments to general practices since 2004/05 have been based on work by York researchers, producing what is generally referred to as the "Carr-Hill formula". Carr-Hill led analysis of the impact on GP workload (and hence on the costs of delivering care) of a range of factors including rurality, age/sex of practice population and practice turnover (3). The research utilised novel data sources, including Inland Revenue accounts to explore the expenses attributable to GPs operating in rural areas and analysed 99 million computerised "file openings" recorded at GP practices in order to explore workload. Additional analyses (Gravelle; collaborating with Imperial College), used small area data from the Health Survey for England for the first time, to allow for socio-economic patient factors affecting consultation rates (4). Research by Carr-Hill, Dixon and Rice (collaborating with Brunel University) refined the measurement of health care needs, incorporating more sensitive age-specific needs adjustment and, for the first time, included outpatient hospital activity, producing the CARAN formula (5).

York researchers utilised new data sources in order to improve the way in which the formulae take account of the need for mental health services (Gravelle, Dusheiko, Smith, in collaboration with Manchester University) (6). In particular, use of the Mental Health Minimum Dataset allowed the formula to reflect a substantial amount of community-based activity delivered to people with mental health conditions, previously excluded from the formula.

A major recent development (Dusheiko, Gravelle, Rice; in collaboration with Nuffield Trust) was the derivation of a formula to assist PCTs in setting fair share indicative allocations to over 8000 general practices within PCTs in England. The analysis involved innovative data linkage methods

to combine the 55 million patients registered with a general practice with around 16 million annual hospital admissions and 84 million annual outpatient visits, together with demographic and morbidity characteristics, area measures of deprivation and practice and area supply characteristics. This research represents a significant innovation in several ways: analysis is conducted at the individual, rather than at the area level ("Person Based Resource Allocation"); the model is prospective (it predicts next year's expenditures based on current year's needs characteristics); and it includes detailed individual morbidity information (7).

Hugh Gravelle (Prof, August 1995-); Nigel Rice (Senior Research Fellow (SRF), Prof 1994-); Roy Carr-Hill (SRF, Prof, 1983-Sept 2011); Mark Dusheiko (Research Fellow (RF), SRF 1998-); Peter Smith (Reader, Prof, 1991-Sept 2009); Paul Dixon (SRF, 1989-April 2010), Trevor Sheldon (SRF, Prof, 1992-); Geoff Hardman (RF, 1984-Sept 2005), Steve Martin (RF, 1989-).

3. References to the research

The research has been published either in top peer reviewed journals (refs 1, 2, 7) or Resource Allocation Working Papers and reports to the Dept of Health (refs 3, 4, 5, 6) which are reviewed rigorously by both the Advisory Committee on Resource Allocation (ACRA) - an independent expert body that advises the Secretary of State for Health on the weighted capitation formula - and the Technical Advisory Group which supports ACRA. All the research was funded by the Dept of Health either via a competitive process or was subject to review by ACRA.

1. Carr-Hill R, Sheldon TA, Smith P, Martin S, Peacock S, Hardman G (1994) Allocating resources to health authorities: development of method for small area analysis of use of inpatient services. *British Medical Journal* 1994 http://dx.doi.org/10.1136/bmj.309.6961.1046
2. Gravelle H, Sutton M, Morris S, Windmeijer F, Leyland A, Dibben C, Muirhead M (2003) Modelling supply and demand influences on the use of healthcare: implications for deriving a needs-based capitation formula. *Health Economics*. 12: 985–1004. DOI:10.1002/hec.830
3. Carr-Hill R (2003) Dept of Health Resource Allocation Research Paper 27 GMS Contract Workload Formula http://webarchive.nationalarchives.gov.uk/20081211165009/http://www.dh.gov.uk/en/Managingyourorganisation/Financeandplanning/Allocations/DH_4108515?IdcService=GET_FILE&dID=175473&Rendition=Web
4. Morris S, Sutton M, Gravelle H. An analysis of the factors predicting GP consultations: a small-area level analysis using Health Survey for England data. Report to the DoH May 2003. Resource Allocation Research Paper 28 http://webarchive.nationalarchives.gov.uk/20110907135717/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_089608.pdf
5. Morris, S., Carr-Hill, R., Dixon, P., Law, M., Rice, N., Sutton, M., Vallejo-Torres, L. *Combining Age Related and Additional Needs (CARAN) Report. 2007 review of the needs formulae for hospital services and prescribing activity in England.* Final Report. DoH, 2007. http://webarchive.nationalarchives.gov.uk/20110322043809/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_093169.pdf
6. Sutton M, Whittaker W, Morris S, Glover G, Dusheiko M, Wildman J, Gravelle H, Burrows S, Simpson J, Fé-Rodríguez E, Birch, S, Smith PC. Report of the resource allocation mental health and prescribing project (RAMP). Dec 2010. Resource Allocation Research Paper 35 http://webarchive.nationalarchives.gov.uk/20110907135717/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_122619.pdf
7. 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 *British Medical Journal* 2011;343:d6608 http://dx.doi.org/10.1136/bmj.d6608

Grants (amount sub-contracted to York given, where contract held elsewhere):

Research on resource allocation (Carr-Hill) was undertaken as part of successive 5 year large programme contracts awarded to the Centre for Health Economics by the DoH (Aug 1996-July 2001 & Aug 2001-July 2006).

Carr-Hill R, Sheldon TA, Smith P. (1993) Small area study for the review of weighted capitation. NHS Executive £138,500.

Gravelle H (2002/3) Small area study of supply and demand determinants of healthcare resource use and estimation of relative needs for PCTS in England. £11, 653
Carr-Hill R (2007) Review of need formula. DoH (£32,300)
Smith PC, Gravelle H (July 2008-Oct 2009) Developing a PBRA formula for general practices in England. DoH (£219,907)
Gravelle H (2009) Programme budget level PBRA. DoH £11,500 [sub-contracted amount]
Gravelle H (2010) Resource Allocation for Mental Health and prescribing (RAMP) DoH (£26,340)
Gravelle H (Nov 2010-Dec 2012) Developing the mental health funding formula for allocations to general practices. DoH £35,312
Gravelle H, Rice N (Nov 2010-Sept 2011) Updating and enhancing a resource allocation formula at general practice level based on individual patient characteristics. DoH (£39,800)

4. Details of the impact

By devising and refining the methods and undertaking the empirical analysis on which formulae are based, York helped to ensure that the organisations responsible for commissioning services receive a fairer share of the NHS budget i.e. in proportion to the relative health care needs of their constituent populations. The path-breaking nature of the work was referred to in a review of Resource Allocation for the Secretary of State in 2008:*"A team from York University were awarded the contract ... and produced an impressive report based on state-of-the art techniques to derive estimates from small-area variations in utilization (Carr-Hill et al, 1994a): this was well described by Ken Judge, in evidence to the Health Select Committee as being 'widely acknowledged to be the most impressive and sophisticated undertaken so far in this field'* (*source 1*).

The DoH has been utilising this body of research for the allocation of resources for almost 20 years and in 2011-2012, weighted capitation formulae informed recurrent allocations of £85 billion to Primary Care Trusts and thence via Practice Based Commissioning (PBRA) to General Practices, directing resources according to relative population needs. Revising the formulae to take account of *unmet* need, rather than just reflecting current utilisation patterns, ensured that particular groups in the population (e.g., ethnic minorities and the socially disadvantaged) who were not utilising health care services at the same level as other groups with similar health characteristics, were not unfairly treated in terms of the resources allocated for their care. The decisive impact of York's research on NHS resource allocation is corroborated in the official history of resource allocation (*source 2*). Research led by, or involving York researchers as co-authors, is referenced throughout the account of how the formulae have been developed. The appendix shows that York's research features in 18 of the 27 "external" reports to the Dept of Health, used in the development of the formulae over several years (*source 3*).

Through successive re-organisations of the NHS, York research has defined and under-pinned the development of allocation formulae in order to ensure that a more equitable distribution of resources is achieved, regardless of which organisations (District Health Authorities, PCTs, Clinical Commissioning Groups) have had responsibility for the provision and purchasing of health care services (*source 2*). Without the research, the financial allocations made to these organisations would have been made on a cruder basis, ignoring many of the sources of the relative difference in the healthcare needs of local communities. The impact of the formula can be illustrated by comparing the allocations to a hypothetical benchmark: in 2011/12, adjusting the allocations to reflect population needs (as in the most recent formula) has the effect of re-distributing approximately 10% of the total budget of over £100 billion compared with a benchmark scenario under which each area received a share based purely on the size of their population. The use of the formula, compared to this "equal shares" scenario, would increase health care budgets by up to £571 per head of the population in 56% of PCTs and reduce allocations by up to £440 in the remaining 44% of PCTs, thus reflecting a re-distribution to areas most in need.

The research undertaken on general practice General Medical Services (references 3 and 4) and in particular the element of the research by Carr-Hill (reference 3) became widely known as the "Carr-Hill formula", and has underpinned the capitation payments – the "global sum allocation formula" – since 2004. The BMA said *"The new Carr-Hill allocation formula will provide equity, recognise casemix and practice circumstances, and ensure money will flow according to patient*

need" (*source 4*). The lack of adjustment for factors influencing workload and the cost of providing services were perceived as flaws and the new contract stated *"The introduction of a global sum payment, combined with new rewards for quality, will address these flaws. A new GMS resource allocation formula, developed by Professor Roy Carr-Hill of York University, will provide the basis for allocating funds for global sum resources and for quality payments"* (*source 5*). The formula and its adjusted versions (reference 5) continues to inform capitation payments to general practices, involving around £3 billion per annum (*source 5*).

In addition to the research impacting on the main allocation formula, other York research has also had a significant effect on allocations. Research on the mental health formula led the DoH working group (ACRA) to recommend to Ministers: *"One of two recommendations to have a significant impact on PCT target allocations is that for mental health. ACRA recommends a new approach to the mental health component of the weighted capitation formula. The approach is a major step forward in how funding is allocated for mental health services"* (*source 6*) Hence improving the accuracy with which resources can be allocated to reflect the relative mental health needs of the population and the costs to commissioners of delivering those services.

The most recently developed Person Based Resource Allocation (PBRA) mechanism was the basis of the "toolkit" to enable PCTs to compare actual expenditure on acute care at practice level with a needs-based standard allowing for the differences in needs amongst general practices. This can promote an even fairer distribution of NHS funds, to the direct benefit of society. This research is cited in the Department of Health's Guidance to PCTs which also cites the role of research on mental health (covered in reference 6): *" The 2011/12 toolkit introduces new methodologies for the Prescribing and Mental Health parts of the toolkit. This is based upon the results of the Resource Allocation for Mental Health and Prescribing (RAMP) project, which was developed as part of the methodology for PCT allocations. In the 2010/2011 toolkit we introduced a new methodology for the Acute care component. This was based on research that the Department of Health commissioned … to develop an acute formula based on the prediction of individual patient costs. We have retained this methodology for the 2011/12 toolkit and the data underlying the formula have been updated."* (*source 7*).

5. Sources to corroborate the impact

1. Review of Weighted Capitation Formula, report submitted to the Secretary of State for Health in June 2008 by Prof Gwyn Bevan
http://webarchive.nationalarchives.gov.uk/20110907135717/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_093167.pdf
2. Annual report by DoH on the formula used and the underpinning methods, which also contains a history of resource allocation. Resource Allocation: weighted capitation formula. 7th edn, 2011.
www.gov.uk/government/uploads/system/uploads/attachment_data/file/152060/dh_124947.pdf.pdf.
3. List of major research and working papers commissioned on resource allocation, also here:
http://webarchive.nationalarchives.gov.uk/+/www.dh.gov.uk/en/Managingyourorganisation/Financeandplanning/Allocations/DH_4108515#dhContent
4. Investing in General Practice: the new General Medical Services Contract
http://www.nhsemployers.org/SiteCollectionDocuments/gms_contract_cd_130209.pdf This contains the quotations cited in the text as well as extensive further references to the Carr-Hill formula and an Appendix D (Carr-Hill resource allocation formula) explaining it in more detail.
http://www.nhsemployers.org/SiteCollectionDocuments/gms_contract_annex_d_cd_130209.pdf
5. British Medical Association letter to GPs (2/11/11) explaining their national 2012/13 contract agreement with all the UK health departments, referring to the use of the "Carr-Hill formula" and to the work undertaken by Professor Roy Carr-Hill in 2001-03 http://bma.org.uk/practical-support-at-work/contracts/independent-contractors/contract-agreement
6. Letter to Andrew Lansley 27/9/10 from David Fillingham Chief Exec, Advancing Quality Alliance (AQuA) North West & Chair of ACRA:
www.gov.uk/government/uploads/system/uploads/attachment_data/file/147600/dh_122685.pdf.pdf
7. Practice Based Commissioning Budget Guidance for 2011/12. DoH March 2011
www.gov.uk/government/uploads/system/uploads/attachment_data/file/153550/dh_125566.pdf.pdf