Assessing the relative healthcare spending needs of the UK's devolved territories: an English perspective

Abstract. This paper considers the relative healthcare expenditure needs of England, Wales, Scotland and Northern Ireland. It applies the NHS weighted capitation formula – used to allocate resources to English Primary Care Trusts – to Health Boards in Wales and Scotland and Health and Social Care Trusts in Northern Ireland. According to this formula, per capita healthcare expenditure need in Wales is 16% higher than in England. Scotland's per capita expenditure need for healthcare is shown to be 12% higher than England's, while Northern Ireland's expenditure needs are 10% higher than England's. The paper considers implications for proposed reform of funding arrangements for the UK's devolved administrations.

Keywords: Healthcare expenditure needs; resource allocation formulae; Barnett formula

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1. Introduction

Devolved or sub-national governments typically face a vertical fiscal imbalance, that is to say they raise less in taxes than they spend. As a consequence, national governments generally distribute resources to these devolved governments in the form of grants. Often these grants are allocated to devolved governments following some assessment of the relative spending needs of the territories.

In the UK however, allocation of grant to the devolved territories (Scotland, Wales and Northern Ireland) is not based on any assessment of those territories relative spending needs, but by way of the Barnett Formula. The Barnett Formula allocates an unconditional block grant to each of the devolved territories based on changes in comparable spending in England and the population share of each territory (HM Treasury, 2010a).

The Barnett formula has been used as the mechanism for allocating grant to the UK's devolved territories since 1979, although there is increasing dissatisfaction with the formula. The principle objection to the formula is that it is unfair, in that it takes no account of the relative spending requirements of the devolved territories (McLean, Lodge, & Schmueker, 2008). Consequently, the Barnett Formula is seen to lead to allocations which are somewhat arbitrary, and which are often seen to be relatively generous to Scotland and to a lesser extent Northern Ireland, while being relatively unfair to Wales (Morgan, 2001; McLean & McMillan, 2003).

Recent years have seen growing calls to replace the Barnett Formula with a 'fairer' system of spending needs assessment. Impetus for change has come most notably from a House of Lords Select Committee (Select Committee on the Barnett Formula, 2009) which argued that 'public spending per head of population should be allocated across the United Kingdom on the basis of relative need', and the Holtham report on Funding and Finance in Wales which

made a similar recommendation (Independent Commission on Funding and Finance for Wales, 2010).

The somewhat arbitrary allocations made by the Barnett formula are the source of some tension to the UK's model of devolution, especially at a time of significant public sector pay restraint (Danson et al., 2012). Furthermore, ongoing debate around ceding greater fiscal autonomy to the UK devolved territories raises interesting issues around whether more fiscally autonomous territories would be able to provide similar levels of public services for an equivalent tax rate. There is therefore increasing interest in whether grant allocations to the UK territories could be based on a fairer system of spending needs assessment (Kay et al 2005 provide an earlier assessment of some of the politics involved).

The main obstacle to spending needs assessment is generally argued to be the fact that spending needs are politically subjective (Midwinter 2002). However, most of the UK territories use spending needs assessment to determine resource allocation to sub-national tiers of government within their respective territories. For example, England, Northern Ireland and Scotland each use spending needs assessments to allocate resources for healthcare to territorial healthboards, with each of these territories using similar models of spending need to inform these allocations.

The aim of this paper is to exploit the existence of these spending need models for healthcare to assess the healthcare spending needs of the UK's devolved territories. More specifically, the paper applies the spending needs formula used by the National Health Service in England (to allocate resources to Primary Care Trusts in England) to Wales, Scotland and Northern Ireland. To be clear, we are not proposing our own formula for allocating healthcare resources to the UK's devolved territories, but are instead applying the existing NHS formula (which has been used in one form or other to allocate healthcare resources in England since

1979). This formula, while fairly complex, can be argued to be 'trusted' in that it has been retained since 1979 by a variety of different political administrations.

By applying the NHS England healthcare formula to Wales, Scotland and Northern Ireland (NI), it is not claimed that the English formula is necessarily the 'correct' mechanism for allocating resources to the devolved territories (DTs). Rather, the exercise provides insight into what level of healthcare resources each DT would be allocated if revenue funding for healthcare was not allocated through Barnett, but if instead resources were distributed to the DTs using the same formula as is used to distribute resources within England. In a sister paper, the authors have applied the NHS Scotland resource allocation formula to England, Wales and NI as a useful comparison with the English formula (anonymised reference).

The analysis helps to shed light on the relative fairness of the current pattern of Barnett allocations, and contributes to the wider debate around the use of needs-based funding models to inform inter-governmental grant allocations (for example, Allers & Ishemoi, 2011; Bramley et al., 2011). Furthermore, by assessing relative spending needs for healthcare, the analysis can inform some of the debate about the possible equity implications of the devolved territories having greater fiscal autonomy. The implications for the possible replacement of the Barnett Formula by needs based spending models are discussed.

The remainder of this paper is structured as follows. Section 2 provides an overview of the weighted capitation formula used by the NHS in England. Section 3 describes the approach adopted to applying this formula to the UK's devolved territories. Results are provided in Section 4, and Section 5 concludes.

2. The English weighted capitation formula: overview

The Department of Health has used a weighted capitation formula to determine the allocation of available revenue resources to NHS areas in England since 1977-78. The principle of the weighted capitation formula is to distribute resources based on the relative needs of each area, with the principal objective being to enable Primary Care Trusts (PCTs) to commission similar levels of healthcare for populations with similar healthcare needs. The formula itself undergoes periodic review and amendment, overseen by the Advisory Committee on Resource Allocation (ACRA) which advises the Secretary of State for Health on the formula.

In the 2009-10 financial year, the weighted capitation formula informed the allocation of some £80 billion to NHS Trusts in England (Department of Health, 2009a), representing over 85% of health revenue expenditure in England (HM Treasury, 2010b). The remainder of this paper focuses on the formula that determines the allocation of this 85% of NHS expenditure. The remaining 15% could not be included in analysis because it is not determined by a formula (the remaining 15% of health revenue expenditure is allocated to national level functions including the National Institute for Clinical Excellence, the NHS Litigation Authority, R&D, and training and administration).

The English formula has been developed by examining how the use of healthcare services varies across small geographical areas with different population characteristics and varying access to healthcare facilities. This results in a series of regression equations which predict the relative expenditure need of different areas as a function of local population characteristics (such as age distribution and socio-economic characteristics). The information on anticipated use of healthcare services is combined with estimates of the costs of providing healthcare in different areas to arrive at an overall assessment of the expenditure needs of different PCTs.

The results of the capitation formula are expressed as an index where the average English expenditure need is equal to 1. Thus a PCT with an index score of 1.1 is deemed to have expenditure need 10% per capita above the average, whilst a PCT with an index score of 0.9 is deemed to have spending needs 10% below the average.

The English healthcare resource allocation formula has three components:

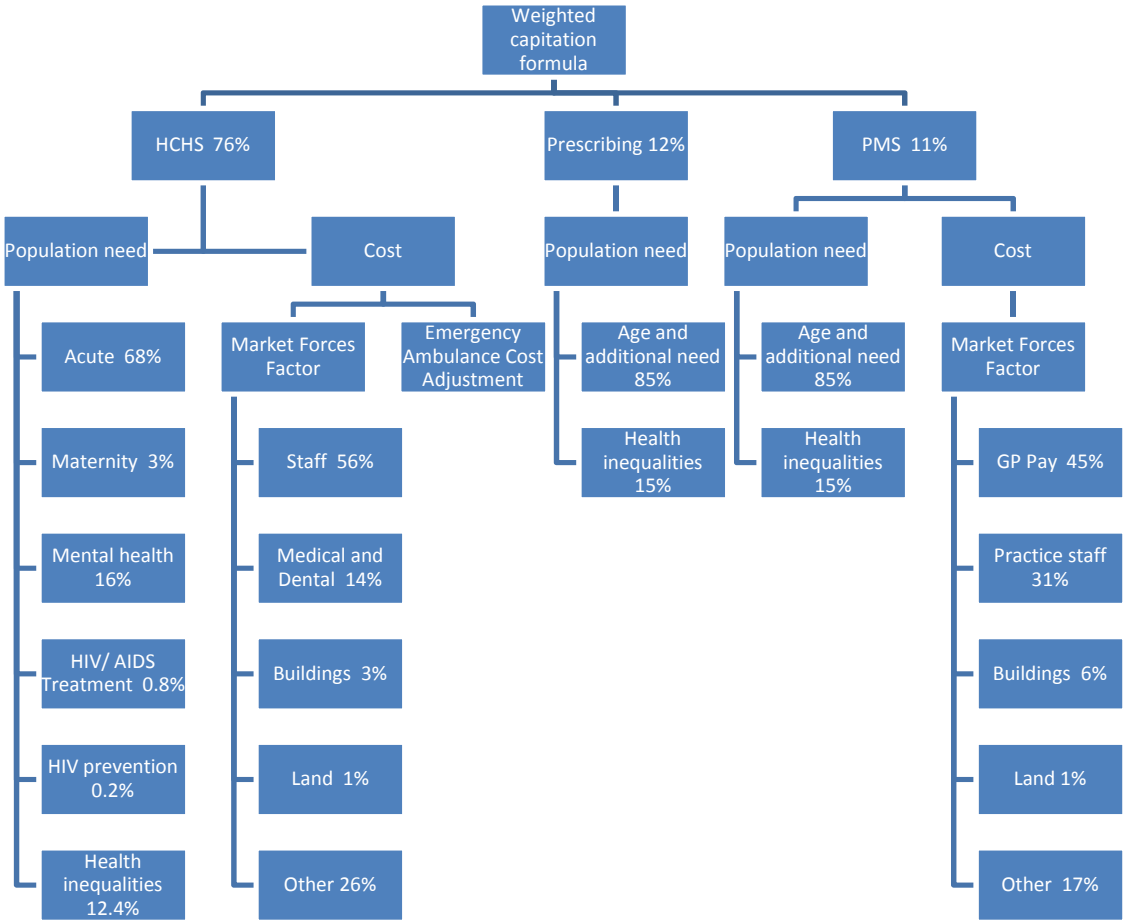
- Hospital and community health services (HCHS);
- Prescribing (the drugs bill);
- Primary Medical Services (PMS, i.e. GP surgeries and out-of-hours services)

HCHS accounts for 76% of the funds allocated through the formula and is thus the largest component. Prescribing and PMS account for 12% and 11% respectively. Within each of these components, the formula accounts for two factors:

- The *expenditure need* of the resident population. The population need is a function of both the age distribution of the population (the need for healthcare tends to be higher among the very young and very old), and the additional need for healthcare over and above that accounted for by age (higher levels of underlying morbidity and/or higher levels of socio-economic deprivation tend to increase need for healthcare).
- *Unavoidable costs*, i.e. the fact that the cost of commissioning or providing healthcare is not the same in every part of the country due to the impact of market forces on local costs.

Figure 1 provides an overview of the English formula in diagrammatic form. The following section of the paper discusses each element of the formula in further detail.

Figure 1: Overview of the English weighted capitation formula (adapted from Department of Health, 2009b)



3. Approach

The objective of this paper is to apply the English weighted capitation formula to Health Boards in Wales and Scotland, and Health and Social Care Trusts (HSCTs) in Northern Ireland. There are seven Health Boards in Wales, 14 in Scotland, and five HSCTs in NI[i]. Given that all these PCTs are coterminous with local authority boundaries, collating relevant data is generally relatively straightforward.

The English formula used to make allocations to PCTs in 2009/10 and 2010/11[ii] is applied. The remainder of this section outlines the structure of the English formula, and describes how the formula has been applied to PCTs in the three DTs. Further detail on the operation of the

formula itself is available from the Department of Health's resource allocation guidance manual (Department of Health, 2009b).

3.1 HCHS component

3.1.1Population need

The HCHS component of the English formula has adjustments for a number of elements, as shown in Table 1 (and Figure 1). The weight associated with the first five elements reflects the breakdown of HCHS gross expenditure in 2006/7 across all PCTs[iii]. The weight attached to the health inequalities element was determined by Ministers (see further explanation below).

Table 1. Elements in the HCHS component

Element	Weight
Acute	67.5%
Maternity	2.9%
Mental health	16.1%
HIV/ AIDS Treatment and care	0.8%
HIV Prevention	0.2%
Health inequalities	12.4%

For each element, the English formula makes adjustments for each PCTs' age related need, and its 'additional need' over and above age. The resulting 'population need ' is then adjusted to account for costs incurred by PCTs in providing healthcare. The remainder of this section discusses briefly the methodology used by the English formula to make these adjustments, and explains how the English formula has been applied to the DTs in this paper.

Acute

To calculate PCTs' relative needs for acute expenditure, the English formula uses data on the distribution of population across 18 age bands, and a variety of additional needs indicators, shown in

Table 2. Within each of the 18 age-bands, coefficients are applied to the relevant additional needs indicators to calculate a score which is used to estimate an average cost per head in each age-band. For example, for those aged 40-44, the PCT score is calculated as:

476.9

+ (418*death rate in 40-44 age category)

+ (22.4*standardised proportion aged 16-74 with no qualifications)

+ (27.6*standardised proportion of people with a long-term limiting illness)

+ 15.7 *proportion of Incapacity Benefit/ Severe Disability Allowance Claimants

The values of the additional needs variables used in this process are normalised so that they are each based around a national mean of 0 and standard deviation of 1, enabling straightforward comparison of variables that would otherwise be expressed on different scales.

Similar equations to the one shown above for the 40-44 age group (with different coefficients and combinations of needs indicators) are applied to the 17 other age groups. The resulting scores per person in each age band are multiplied by the population in each age band to derive a total score in each band for each PCT. The scores are summed across all age bands to derive an estimated total cost for each PCT. These total costs are normalised to the total (English) population to derive an acute weighted population, on the basis of which the total available resources are shared across PCTs.

Table 2: Additional needs indicators used in the English Acute element

Age-specific death rates within each of 18 age-bands, 2001-5
The standardised proportion of the population with no qualifications, 2001
The proportion of young people not staying in education, 2006
The standardised proportion of the population with a limiting long-term illness, 2001
Proportion of Pension Credit claimants, 2005
Proportion of births that are low birthweight, 2001-5
An indicator to reflect income deprivation affecting children
Proportion of under 16 population claiming Disability Living Allowance (DLA), 2005
Proportion of young people claiming New Deal, 2004
Proportion of the total population claiming Disability Living Allowance, 2005
Proportion of the population claiming Incapacity Benefit or Severe Disablement Allowance, 2005
Proportion of the over 60 population claiming DLA, 2005

In order to apply the English formula to the DTs, data was collated on each of the age and additional need indicators at local authority level and aggregated to the PCT level in each country[iv]. The data was also collated for PCTs in England in order that the expenditure need of each devolved territory PCT could be expressed relative to the English mean and standard deviation.

The majority of the Acute needs indicators were available at local authority level in each country, from a range of sources. The exceptions were:

- Data on the proportion of births that are low birthweight was not available for sub-areas of Northern Ireland (NI), and thus it was assumed that the five PCTs in NI each had the same score as NI as a whole. While this will affect the accuracy of the results for individual PCTs in Northern Ireland, it will not affect the accuracy of the assessment of NI's expenditure needs.
- Data on New Deal for Young People claimants in 2004 was not readily available across all DTs. Instead, a proxy indicator was developed which was the proportion of all 18-24 year olds who had been claiming JSA for at least 6 months (to be eligible for New Deal for Young People, claimants had to be aged 18-24 and have been claiming JSA for six months or more).

- The indicator of Income deprivation affecting children used in the English formula is defined as ‘the proportion of all children aged 0-15 living in income-deprived households, where these are defined as families receiving income support or income based JSA or Pension Credit (Guarantee) or those not in receipt of these benefits but in receipt of Child Tax Credit with an equivalised income below 60% of the national median income before housing costs’. This indicator was not available for sub-areas in the DTs. In order to apply the English formula, a proxy indicator was developed based on two sources. First, data was collated on the proportion of the under 16 population in each PCT that reside in households receiving Income Support. This was combined with data from the Department for Work and Pension’s HBAI (Households Below Average Income) research on the proportion of children in each region who live in households with income below 60% of the UK median. The proxy index weights the two indicators 0.7 and 0.3 respectively, with these weights selected to achieve the best fit between the proxy indicator and the actual indicator used in the English formula. The correlation between the proxy index and the actual index used in the English formula was high, reflected in a Pearson correlation coefficient between the two variables of 0.96.

Maternity

The Maternity need index calculates an average score per birth in each PCT derived from the equation:

2308.8 +

24.7*proportion of low-weight births

- 96.06*mean house price

As with the Acute element, the variables are normalised before being applied to the coefficients. The resulting average costs per birth are multiplied by the number of registered births to derive the total score for each PCT.

Applying the Maternity element of the English formula to Wales, Scotland and NI was simply a case of collating data on the number of births by PCT, and combining this with data at PCT level on the two needs indicators. For Northern Ireland however, data was not available for sub-areas on either low-weight births or house prices. Therefore a Maternity score was calculated for NI as a whole, and assumed constant across all five PCTs in NI.

Mental health

The mental health element of the English formula first calculates need associated with the age structure of the population, and then calculates the 'additional need' associated with socio-economic factors. The age weights range from 0.0032 for the 0-4 year age band to 3.2985 for the 85+ age band, and represent the relative cost per head of providing mental health care to individuals in each age group. For each PCT, the age weights are multiplied by the population in each age group and summed over all age groups to estimate age-weighted need.

The additional need score across all ages is calculated as:

0.385

+ 0.358*Comparative Mortality Factor under 65 years

+ 0.338*Proportion aged 60+ claiming income support

+ 0.636*Psycho-social morbidity index

+ 0.034*Indicator of housing deprivation.

Further detail on the derivation of the four additional need indicators is available from the authors on request. Due to data availability the indicator of housing deprivation was excluded from analysis. This does not effect the comparability of results as the indicator is excluded from all areas, including England. The weight attached to the housing deprivation indicator is small, and sensitivity analysis in the results section examines the significance of its exclusion.

HIV/ AIDS treatment and care

This element accounts for 0.8% of the HCHS index. This element is based wholly on the results of the annual SOPHID (Survey of Prevalent HIV Infections that are Diagnosed). SOPHID data is publicly available for Scotland, Wales and NI as a whole, but not for sub-areas within those territories. The incidence of diagnosis at national level was disaggregated to PCTs based on the PCTs' share of population. At the level of the DTs themselves, these estimated scores will be accurate as they are based on observed diagnoses; at the level of PCTs within DTs however, the approach is likely to over-estimate prevalence of HIV in rural areas and underestimate it in urban areas (given that the prevalence of HIV/AIDS tends to be relatively more concentrated in urban areas (Health Protection Agency, 2010)).

HIV Prevention

This element accounts for 0.2% of the HCHS index and is derived from SOPHID data combined with data on the proportion of the population aged 15-44. It was a straightforward process to derive this element for PCTs in each country.

Health inequalities

The elements of the English HCHS formula so far described reflect the objective of providing equal access to healthcare for those in equal need i.e. to enable PCTs to commission similar levels of healthcare for populations with similar healthcare needs. Since 1999, the English formula has also contained an objective to reduce avoidable health inequalities. The health

inequalities element in effect introduces an additional objective to the formula, specifically to allocate resources in such a way as to 'contribute to the reduction of avoidable inequalities in health'. The health inequalities element implies that resources should be distributed not only to reflect the existing burden of sickness but also targeted to reduce the health gap between the most and least advantaged groups. Tensions can however arise between the two objectives, and as a result there has been significant debate around the weighting of the health inequalities element of the English formula.

The health inequalities element uses an indicator of disability free life expectancy (DFLE), which is the number of years from birth a person is expected to live which are free from limiting long-term illness, thus capturing morbidity as well as mortality. By its very nature, it is not possible to determine an objective weighting for the health inequalities element (it is unobserved). Ministers therefore decided to apply it to 15% of the 2009/10 allocations[v], although in subsequent years its weight was reduced to 10%. The potential significance of this is discussed in the section on results.

To apply the health inequalities element of the English formula to PCTs in the three DTs, the DFLE indicator was calculated for each PCT from data on death rates and illness rates across different age groups.

3.1.2 Cost

The English formula calculates a Market Forces Factor (MFF) to compensate for unavoidable differences faced by NHS organisations in the costs of commissioning or providing healthcare in different parts of the country (essentially a cost of living allowance). The MFF consists of four elements as follows (the weights attached to each element within the overall excess cost index are shown in brackets):

- The Staff MFF (56.1%) reflects the fact that it is more expensive to employ staff in some areas than others due to market forces[vi];
- The Medical and dental London weighting (13.8%) is designed to reflect the higher direct costs of employing doctors and dentists in London and the southeast;
- The Buildings MFF (3%) and Land MFF (0.6%) reflects the variation in the costs of acquiring and maintaining premises across different parts of the country;
- Other costs (26.5%), including equipment and consumables, are assumed not to vary across the country and are given a common index of 1 for all PCTs.

Further detail on the calculation of the MFF, and the derivation of the MFF for the DTs, is available on request.

The MFF is combined with a second excess cost index known as the Emergency Ambulance Cost Adjustment (EACA). The EACA index was not applied to the DTs because of difficulties in accessing relevant data, but the overall effect of EACA on the English index is very small. Sensitivity analysis in the results section of this paper examines the likely effect of excluding EACA from the calculations of healthcare expenditure need in the DTs.

3.2 Prescribing Component

3.2.1 Population need

The Prescribing Component of the English Formula contributes 12.4% to the overall weighted capitation index. The Prescribing index takes account of:

- Age and sex related need;
- Additional need over and above that accounted for by age and sex; and
- Health inequalities.

There is no adjustment for unavoidable excess cost in the Prescribing component, as prescribing costs are assumed not to vary across the country.

In the English formula, the age and sex related need for each PCT is calculated by multiplying the population of the PCT in nine age groups by specified weights for each group. For example, a weight of 0.8 is attached to each female aged 0-4, while a weight of 11.8 is applied to each male aged 75+. It was straightforward to apply these weights to the gross population in each PCT in England and the DTs.

The Prescribing additional need score is calculated as:

0.997
+ 0.044*percentage of the population with a limiting long-term illness
+ 0.050*proportion of Disability Living Allowance (DLA) claimants
+ 0.007*proportion of births that are low birthweight
+ 0.006*Low Income Scheme Index (LISI)

The first three indicators were straightforward to collate for PCTs in the DTs (with the caveat as before that the proportion of low birthweight births is not available for sub-areas of Northern Ireland). The LISI for a GP practice is derived from practice prescribing data and is defined as the percentage of all prescriptions that are exempt from prescription charges on the grounds of low income. A proxy for PCTs in the DTs was developed, based on the number of claimants of Jobseekers Allowance, Income Support and Pension Credit (claimants of these benefits are eligible to receive free prescriptions in England). The proxy for LISI, collated for English PCTs, acts as a reasonably reliable indicator of English PCTs' actual LISI score (r = 0.90).

The age and additional need elements are combined and together weighted 85% of the Prescribing component; the health inequalities element (indicated as before by Disability Free Life Expectancy) accounts for the remaining 15%.

3.3 Primary Medical Services Component

3.3.1 Population need

The PMS component is worth 11.3% of the total capitation formula. The formula for PMS first considers age related need, based on research showing the average length of GP consultations by each age and sex group. 'Additional need' is calculated using two key variables: the standardised proportion of the population with a limiting long-term illness, and the standardised mortality ratio for those aged under 65. A health inequalities element is applied in the same way as for the HCHS component and given a weighting of 15%. It was straightforward to apply the PMS element of the English formula to the PCTs in the DTs.

3.3.2 Cost

In terms of unavoidable excess cost, the market forces factor (MFF) for PMS consists of several elements (weighting in brackets):

- GP Pay MFF (44.9%)
- Practice staff MFF (30.7%)
- Land MFF (1.2%)
- Buildings MFF (5.8%)
- Other (17.5%).

More detail on the derivation of the indices for the DTs is available on request.

4. Results

4.1 A note on the reliability of results

From the preceding discussion it will be clear that, given data availability, it has not always been possible to apply all elements of the English capitation formula to the DTs. Occasionally it has been necessary to derive proxy variables or (very occasionally) exclude variables entirely.

Where a proxy indicator has been used to estimate the need formula for the DTs, the same proxy has been used to calculate English PCTs' need score, in order that DT results are comparable with the English results. In order to test the reliability of the estimated results, it is possible to compare our estimated index scores for English PCTs (using proxies as described) with the actual scores for those English PCTs (as published by the Department of Health using the full complement of data required). The results of this analysis demonstrate that our estimates, despite relying on a number of proxy indicators, replicate the pattern of allocations made by the English formula in a robust manner. The correlation between the estimated scores for English PCTs and those PCTs' actual scores is very high (r=0.99), and furthermore, 99% of the estimated English PCT scores are within 5% of their actual index scores used by the NHS to inform revenue allocations in 2009/10.

4.2 HCHS Component

Results of applying the English HCHS formula for age and additional need (the 'need weighted population') are shown in Table 3. For the Acute element, Wales' per capita needs are 14.1% higher than England's. Scotland's are 8.3% higher than England's, and Northern Ireland's are 2.9% higher. Wales' significantly higher needs for Acute are due to a combination of it having a relatively more elderly population, and it having high additional needs relative to England. In contrast, Northern Ireland's relatively low score is due to the

fact that it's population structure is more skewed towards younger age groups, associated with lower costs. This is compensated for by Northern Ireland having high 'additional needs' due to deprivation and illness. Scotland's higher expenditure need is a result of it having high needs for deprivation and illness, while the population effect is neutral.

For the Maternity programme, both Wales and Scotland have per capita needs below the English average, largely due to lower birth rates. Northern Ireland has above average need, due largely to higher birth rates, but also lower house prices which are associated with higher additional need.

For the Mental Health care programme, all three DTs have per capita needs significantly higher than England. This is a result of the fact that the additional needs indicators used to derive this index – including the under-65 mortality factor, the rate of Income Support claimants, levels of income deprivation, and standardised illness ratio – are all indicators that the DTs score more highly on than England. Whether or not actual rates of mental health illness in the DTs are so much higher than in England is a moot point – the fact is that the relationship between these indicators and healthcare utilisation in England suggests that the DTs are likely to require significant additional resources compared to England to meet their mental healthcare needs.

All three DTs have scores for HIV treatment and care substantially below England's, reflecting a lower prevalence of this disease.

In contrast, all three DTs score significantly more highly than England on health inequalities. The health inequalities element explicitly recognises that basing NHS allocations on existing patterns of health service utilisation is unlikely to address health inequalities sufficiently, and allocates additional resources to those areas that have low Disability Free Life Expectancy (DFLE), an indicator which combines information on morbidity and mortality, and which has

been selected to proxy the level of health inequalities. There has been significant debate in recent years as to the weight that should be attached to the health inequalities element, and indeed whether it should be included at all (see for example House of Commons Health Committee 2009; Stone & Galbraith 2006; Stone 2010).

Overall, the results in Table 3 suggest that, on the basis of age and additional need, Wales, Scotland and NI have per capita expenditure needs 18.9%, 14.0% and 12.2% higher than England respectively for Acute care. If the health inequalities element was not included (i.e. if the policy goal was simply to ensure equal access to healthcare for those in equal need, with no policy objective to reduce health inequalities), then relative need would reduce to 13%, 9.4% and 5.3% higher in Wales, Scotland and NI respectively.

Table 3: Need index for HCHS

Indices	Acute	Maternity	Mental	HIV treatment	HIV care	Inequalities	Total
Weights	**67.53%**	**2.93%**	**16.05%**	**0.84%**	**0.21%**	**12.44%**	**100.0%**
England	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Wales	1.141	0.918	1.164	0.342	0.696	1.607	1.189
Scotland	1.083	0.892	1.227	0.508	0.788	1.443	1.140
NI	1.029	1.095	1.213	0.204	0.697	1.585	1.122

The English HCHS formula does not explicitly distinguish between age related need and additional needs as a result of higher morbidity and deprivation, so the scores in Table 3 combine the two effects. Nonetheless, it is possible to disentangle the effects of age from the effects of additional need by controlling the population demographic in each devolved territory so that it has the same age structure as England, and re-running the analysis. This isolates the effect of additional need, while the effect of age can be derived by comparing the total scores with and without age controlled for.

The results of this disaggregation are shown in Table 4. Wales' expenditure need is 3.6% higher than England's as a result of its relatively more elderly population; NI's relatively

younger population on the other hand means that it has lower per capita spending need than England for age-related need. Scotland's age-related need is approximately the same as England's.

Northern Ireland has the highest additional need of the UK territories at almost 20% per capita higher than England's, and this offsets its lower age-related need to an extent. Wales' additional need is slightly higher than Scotland's.

Table 4: Disaggregating the HCHS need index into age and additional need

	Age related need	Additional need*	Total need index
England	1.000	1.000	1.000
Wales	1.036	1.148	1.189
Scotland	1.006	1.133	1.140
Northern Ireland	0.938	1.196	1.122

* The additional need index includes the health inequalities element weighted at 15%

Table 5 combines the need index with the cost index. The effect of the cost element is to reduce Scotland's per capita need by around 3 percentage points and Wales' and NI's by around 4 percentage points, relative to England's. With the need and excess cost components combined, Wales, Scotland and NI have per capita expenditure need for HCHS 14.5%, 11.1% and 8.2% higher than England respectively.

Table 5: HCHS index

	Need weighted population (A)	Unavoidable cost weighted population (B)	Final HCHS index (C=A*B)*
England	1.000	1.000	1.000
Wales	1.189	0.961	1.145
Scotland	1.140	0.972	1.111
Northern Ireland	1.122	0.961	1.082

* The figures in the Total column may not sum exactly as expected because the index scores are normalised so that the sum of scores across all PCTs is equal to the total crude population.

4.3 Prescribing Component

The results of applying the GP Prescribing component of the English formula are shown in Table 6. NI has the highest 'additional needs' but this is tempered by its relatively younger population structure (the 'additional needs' in the Prescribing component are derived as a

function of long-term illness rates, levels of Disability Living Allowance claimants, income deprivation, and low birthweight births). Overall, application of the English formula indicates that Wales, Scotland and NI have per capita spending needs for Prescribing of 25.9%, 15.8% and 17.3% higher than England respectively. Once again, the health inequalities element shifts resources in favour of the three DTs.

Table 6: GP Prescribing Index

	Age index (A)	Additional needs index (B)	Combined age and additional need index (C = AxB)	Health inequalities index (D)	Prescribing index (E = (C*0.85)+(D* 0.15))
England	1.000	1.000	1.000	1.000	1.000
Wales	1.050	1.141	1.198	1.607	1.259
Scotland	1.024	1.082	1.107	1.443	1.158
NI	0.938	1.174	1.100	1.585	1.173

4.4 Primary Medical Services Component

Table 7 shows the results of applying the English PMS formula. Wales' relatively older population means it scores above 1 for the age-sex index, whilst NI scores slightly below 1. All three devolved countries have higher additional needs than England, as a result of higher rates of standardised mortality and limiting long-term illness. The effect of the excess cost index is not as significant as it was for the HCHS index because, in addition to considering higher wage costs in certain areas, it also rewards more deprived areas on the grounds that these areas need to pay a premium to compensate doctors for the disamenity of living in those areas.

The final PMS index indicates per capita expenditure need 17.7%, 16.4% and 13.2% higher than England for Wales, Scotland and NI respectively.

Table 7: Primary Medical Services Index

	Age-sex need (A)	Additional need (B)	Health inequalities (C)	Excess Cost (D)	Total* = ((A*B*.85)+(C*.15))*D
England	1.000	1.000	1.000	1.000	1.000
Wales	1.037	1.083	1.607	0.982	1.177
Scotland	0.999	1.130	1.443	0.987	1.164
NI	0.971	1.096	1.585	0.988	1.132

* The figures in the Total column may not sum exactly as expected because the index scores are normalised so that the sum of scores across all PCTs is equal to the total crude population.

4.5 Unified results

Table 8 brings together the results of the HCHS, Prescribing and PMS indices to present the 'unified' formula scores. Wales' per capita healthcare expenditure needs are 16.3% above England's, Scotland's are 12.3% above, and Northern Ireland's are 9.9% higher.

If the Health Inequalities element was weighted 10% rather than 15% (as it is in the 2011 formula), then the per capita expenditure needs of the three countries would reduce slightly to 14.3%, 10.8%, and 7.6% higher than England's. If the Health Inequalities aspect was not included in the formula at all, the per capita healthcare expenditure needs of the DTs would be lower still, as shown in the final column of Table 8.

Table 8: Unified index

	HCHS	Prescribing	PMS	Total*	Total (excluding health inequalities)
Weights	76.3%	12.4%	11.3%	100%	100%
England	1.000	1.000	1.000	1.000	1.000
Wales	1.145	1.258	1.177	1.163	1.104
Scotland	1.111	1.157	1.164	1.123	1.077
NI	1.082	1.173	1.133	1.099	1.030

* Totals may not sum exactly due to rounding the weights to one decimal point

4.6 Sensitivity testing: EACA and housing deprivation

As noted previously, there are two indicators that we were not able to derive for the DTs, and which have been excluded from analysis. These are the Emergency Ambulance Cost

Adjustment (EACA) element of the HCHS excess cost calculation; and the indicator of housing deprivation used in the Mental Health element of the HCHS component. It is feasible that the exclusion of these indicators may disadvantage the assessment of relative need of the DTs, particularly in the case of EACA which includes an adjustment to reflect the degree of rurality.

For EACA, sensitivity analysis show that, even on an assumption that all PCTs in the DTs had EACA scores as high as the highest scoring English PCTs (Herefordshire and Northumberland, the most sparsely populated English PCTs), the overall effect would be to increase the unified need scores of Wales, Scotland and NI by less than one percentage point. Clearly the assumption that all PCTs in the DTs are as sparsely populated as Northumberland and Herefordshire is unreasonable, and thus the actual impact of excluding EACA is likely to be significantly less than one percentage point.

In terms of housing deprivation, sensitivity analysis indicates that the effect of excluding this indicator is extremely small at national level. Indeed, if the DTs had a similar level of housing deprivation as the northeast and northwest regions of England, there would be no discernible impact on the unified need index for each country relative to England.

5. Conclusions

In the debate around how the UK's devolved territories should be funded, there is increasing interest in the potential for using needs based models to determine grant allocations. This paper attempts to inform this debate by assessing the devolved territories spending needs for healthcare, recognising that expenditure on healthcare accounts for around 40% of each devolved territories' total Departmental Expenditure Limits (DEL) allocations.

Applying England's healthcare allocation formula to the DTs indicates that the relative per capita healthcare spending needs of all three of the DTs are higher than those of England (Table 9). Wales' per capita spending needs are 14-16% higher than England's; Scotland's are 11-12% higher; and Northern Ireland's are 8-10% higher. The upper and lower bounds for each country represent different weightings attached to a policy goal that healthcare should address health inequalities, as well as providing equal access to those of equal need.

The results suggest that current actual healthcare expenditure in Wales and Northern Ireland is lower than would be the case if these territories' healthcare allocations were made on the basis of the English formula, while Scotland's current actual healthcare expenditure is slightly above what it would be allocated by the English formula.

These results suggest on the one hand that the devolved territory spending on health that is made possible by the current Barnett Formula is perhaps not so far from the level of allocation that would be made if the allocations were based on needs assessment. On the other hand however, the analysis would support the view of those who argue that the Barnett formula allocations are relatively more generous to Scotland and less generous to Wales and Northern Ireland.

Table 9: Actual per capita health spending and assessed per capita expenditure need for the UK territories

	Actual per capita health spending*	Actual per capita health spending (England = 100)	Relative per capita need (lower bound)**	Relative per capita need (upper bound)
England	£1,539	1.000	1.000	1.000
Wales	£1,668	1.084	1.143	1.163
Scotland	£1,765	1.147	1.108	1.123
NI	£1,627	1.057	1.076	1.099

* Actual per capita health spending over the period 2004/5 – 2008/9 was derived from HM Treasury, 2010b

** The lower bound reflects an assumption that the health inequalities element is weighted 10% (as it was in 2010/11), while the upper bound reflects an assumption that the health inequalities element is weighted 15% (as it was in 2009/10).

NI's expenditure needs are assessed to be lower than Scotland's and Wales' largely because NI has a younger population. But for all three DTs, the expenditure need over England is largely the result of having higher rates of illness and mortality. All three DTs face lower costs in providing healthcare than England, but these lower delivery costs only partially compensate for their poorer rates of overall health (combined, in the case of Wales, with a relatively elderly population).

Of course, this does not mean that the English formula is 'correct'. In a sister paper (anonymised reference), we applied *Scotland's* healthcare resource allocation formula to England, Wales and NI. This indicated that the per capita healthcare spending needs of Wales, Scotland and NI were 10%, 11% and 4% higher than England respectively. The reasons for the differences in expenditure assessment made by the English and Scottish formulas are explored in more detail in forthcoming work, but largely relate to differences in the treatment of excess costs, and differences in the policy significance attached to the health inequalities aspect.

The analysis in this paper shows that whilst it is clearly possible on a practical level to develop objective healthcare spending needs formula for sub-areas within a territory, the devolved nature of healthcare across the UK territories and consequent differences in policy focus may make application of UK-wide needs assessment more challenging. Indeed, the weighting that should be attached to the health inequalities of the English formula has been subject to regular debate in recent years, and it would seem likely that these types of debates would become magnified in a devolved territory context, particularly now given the increasing evidence of policy divergence in health (e.g. Forbes et al., 2010) as well as other policy areas. As policy diverges, the question of which needs to assess becomes more intractable. This may explain why the spending need formula used by the Spanish

government to allocate grant to Spain's Autonomous Communities relies on a very simplistic, high-level formula based on a small number of broad demographic indicators (Bosch, 2009).

Nonetheless, the fact that each of the UK's devolved territories have markedly higher spending needs than England raises interesting issues in the debate around the potential for greater fiscal autonomy for those countries. In particular, increased fiscal autonomy, normally advocated on efficiency grounds, may place additional onus on inter-governmental grant allocation as a tool to achieve UK-wide policy goals in relation to equity and cohesion. Thus greater fiscal autonomy may result in more rather than less pressure to replace the Barnett Formula for determining grant allocations with a more objective spending needs assessment.

Notes

[i] Throughout the remainder of this paper, the term PCTs is used to collectively refer to PCTs in England, Health Boards in Wales and Scotland, and Health and Social Care Trusts in Northern Ireland.

[ii] The English formula is updated on a fairly regular basis as the results of new research are made available, with the result that the most recent version of the formula (used to make allocations in 2011/12) contains some minor amendments to the version discussed in this paper.

[iii] In fact, spending on Acute services accounts for only 58% of all PCT expenditure, while spending on mental health accounts for only 14% of all expenditure. However, the formula for Acute services is also used to determine PCT allocations for Community Health Services, while a combination of the Acute and Mental health formulae are used to determine allocations for Accident and Emergency, Learning Difficulties, and Other Contractual programmes, resulting in the weights shown in the table.

[iv] In the English formula, the population in each age group is derived from data on the GP registered population. Because we do not have access to data on the age structure of GP registered populations in each PCT in each country, our analysis is based on the ONS population estimates for each PCT. The difference between the GP registered population and the ONS population estimate is extremely marginal, particularly since the English formula scales the GP registered population back to the ONS estimate.

[v] The health inequalities element is applied to all elements of the HCHS component other than Mental Health (which already includes an adjustment for unmet need) and HIV/ AIDS. Hence overall the health inequalities adjustment is applied to HCHS with a weight of 12.4%.

[vi] The Staff MFF is applied to all staff other than medical and dental (M&D) staff, because the indirect costs of M&D staff do not vary across the country in the same way as they do for other NHS staff.

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