CIVITAS

Formulas at war over two sorts of inequality in health funding

MERVYN STONE

Online Report: April 2010

55 Tufton Street
London SW1P 3QL

Civitas is a registered charity (no. 1085494)
and a company limited by guarantee, registered in
England and Wales (no. 04023541)

email: info@civitas.org.uk

Online Report: April 2010

Contents

Online Report: April 2010

Formulas at war over two sorts of inequality in health funding

England is now in its 16th year in the shadow of an unscientific formula for funding its National Health Service's primary care trusts. Responsibility for that has to be shared by both Conservative and Labour governments. Under Major, the basic construction was the work of a team of health economists at the University of York. Under Blair/Brown, things had to change and the research contract for a radically different formula (AREA) went to another team of health economists based in Scotland. Bits of their research were stuck together by the Department of Health's finance department to make a formula that lasted six years — until yet another team of health economists in London was engaged to meet powerful academic and political objections to the way the AREA formula took account of regional variations in age-profile.

Their new formula (CARAN) was snubbed because it had not found any grounds for favouring ethnic minorities or 'deprived' areas — and because the change in the way CARAN took account of the age factor reduced the favour that AREA had given to such areas. The Department of Health's scientific advisers in the Advisory Committee on Resource Allocation (ACRA) accepted the change that worked in favour of age — a technical inevitability that they may not have expected when they commissioned the CARAN research. But ACRA was also saying that there was some case for adjusting CARAN to swing things back in favour of ethnic minorities and deprived areas. ACRA admitted it had absolutely no idea how big that adjustment should be.

The outcome was that CARAN was not implemented until it had been cut and pasted by Ben Bradshaw, Minister for Health Services. It was left to minister Bradshaw to top-slice £10billion out of the PCT budget of £80billion and allocate it with a special formula so carefully designed that there has been little change from AREA funding, in the broad and politically important on-the-average balance between 'deprived' urban and 'affluent' or rural areas. The minister may have overlooked the fact that averages hide the underlying variation. From 2009, PCTs that have lost out as a result of all these shenanigans joined with previous losers under AREA to begin another round of protest at unscientific formula mongering. This paper is therefore about the funding formula for primary care trusts (PCTs) and the truth about the health inequality issue in particular.

1. Very different views of Health Inequality funding

In January 2009, Ben Bradshaw's 'shadow minister' Andrew Lansley asked him what proportion of primary care trust funding formula was for Health Inequalities and was told: [i]

> *One ACRA objective is to help to reduce avoidable health inequalities through resource allocation. To achieve this objective, a separate health inequalities formula has been developed which targets funds at the places with the worst health outcomes. This is a more* ***transparent*** *way of contributing towards the reduction in health inequalities through resource allocation and highlights our* ***commitment*** *to tackling the issue of health inequality. ACRA could not determine the proportion of allocations to apply the health inequalities formula to and left it to ministerial decision.* ***Ministers decided to apply the formula to 15 per cent of the allocations****, excluding the mental health component of the formula (which already includes an adjustment for* ***unmet need****) and HIV/AIDS.* ***This keeps the distribution of funding between the most and least deprived areas in line***

with the previous formula. (Emphasis is mine unless otherwise indicated)

In February 2010, the Rural Services All-Party Parliamentary Group (RSAPPG) assembled in Portcullis House (in all, five MPs, a Lord, a Duke and a Baroness) — in order to stir apathy about the formulae that are funding primary care trusts and schools. Unsurprisingly, their report took the view that *achieving equitable outcomes — the goal of any administration — costs more in rural areas* and that the funding formulae should be "adjusted" to allow for those costs.[ii] They did not recommend that the government's "adjusters", (past and present Ministers, mandarins, special advisers, consultants and contract researchers) should, at the same time, be obliged to defend their activities in some public court of science.

In April 2010, *Private Eye*[iii] stirred the embers of the 'cash-for-influence' bonfire**:**

> *More on Baroness Morgan, Tony Blair's former right-hand woman, and what she told the undercover reporter during Channel 4's cash-for-influence Dispatches exposé. ... Since leaving government she has advised Humana, a US firm that wants NHS contracts and she is currently advising Lloyds Pharmacy, which also wants NHS work. ... She told the fake lobbyists***:** *"Getting through the door is the key thing. So win your first contract and then you will get loads more contracts if the relations work... They've all got their Key Performance indicators, they have all got* ***to deliver this healthy living stuff,*** *they've got to meet it,* ***they don't know how to do it ..."***

All of which leaves onlookers like me with a nagging doubt — as to whether we are being told the full story. This paper is in line with the so-far unsuccessful efforts by Jane Galbraith and myself to persuade the Department of Health to withdraw its pretence that the current PCT-funding formula can be defended on any rational grounds.[iv]

2. The contesting witnesses in Portcullis House

Four of the witnesses in the Portcullis House oral evidence session on health in February 2010 raised contestable technical statistical questions about the formula, under the chairmanship of Graham Stuart, MP for Beverley & North Holderness. Two of the witnesses were doughty defenders of the formula, Richard Murray and Matt Sutton. The other two were its most outspoken critics, Sheena Asthana and myself.

Mr Murray may well have been the unnamed civil servant who was fleetingly referred to by the Department of Health's Chief Economist, Prof McCormick, as *the expert in the Department on the working of the formula,* in McCormick's oral evidence to the House of Commons Health Committee's inquiry into NHS Deficits, but he did not appear before that committee to defend the then current 'AREA' formula.[v]

Professor Matt Sutton was the leader of the team of health economists, contracted by NHS Scotland's Information & Statistics Division, that produced for England's Department of Health (DoH) the two multiple linear regression expressions that DoH's Finance Department chose to use as building components of the AREA formula. AREA was put to work in England for the seven years from 2003 to 2009, well-nigh dictating the distribution annually of tens of billions of pounds. Sutton is understandably a stout defender of any formula that he recommends to DoH**:** when concluding his oral evidence to RSAPPG, he was somewhat ungenerously addressed by chairman Graham Stuart MP as *the professor for the status quo.* Sutton became a member of the research team that DoH commissioned in 2006 to review the 'needs' components of the AREA formula and develop alternatives, whose final report[vi], recommended a new formula 'CARAN' for 2009 and beyond with only partial success, as will be seen.

Professor Sheena Asthana is professor of health policy in the Faculty of Health, University of Plymouth and one of the commissioners of CRC (Commission for Rural Communities).

With her colleague & partner, Dr Alex Gibson, she firmly maintains that a clear distinction has to be drawn between a) equality in the sense of equal access of individuals to *health-care* provision and b) equality in the sense of equal *health-status* of individuals (to the extent that these abstract concepts can be defined or determined).

Why was I there as a witness? Chairman Graham Stuart's constituency is in East Riding PCT. Preparing for the hearing, Mr Stuart asked me for help to understand why the formula should be giving 50% more per head to Hull, the next-door PCT. (This particular difference came up in the RSAPPG hearing with a light touch, when he told witness Murray that *in Hull they had surpluses when the East Riding had a deficit and they ended up buying a yacht* — and that *Hull must have been working out where to spend their money.*)

Did I help? That depends on whether I was able to persuade him that the formula is a grotesque construction — and that it became grotesque in the absence of any independent statistical assessment of what was being done. To get to that level of understanding, one has to go deeper than the purely arithmetic sensitivity of the formula to differences between PCTs in the values of the socio-economic variables that determine allocations — a sensitivity that has nothing to do with whether there is any principled reason to suggest that Hull *should* get 50% more than East Riding. What I did say to Mr Stuart was that he could find an elementary understanding in no more than 19 pages of the jargon-busting Civitas booklet *Failing to Figure.*[vii]

3. Background evidence from the RSAPPG report

The written evidence quoted and paraphrased by the RSAPPG secretariat did not include any document with Murray as a listed author, but Sutton was indirectly represented. Since his leadership of the research for the AREA formula, Prof Sutton has been a member of the CARAN research team and of NHS Scotland Resource Allocation Committee, whose publication[viii] was about the Scottish formula replacing the Arbuthnott formula**.** There are phrases of the NRAC report reminiscent of the econometric aspirations (some would say pretensions) of the AREA formula, much of which came from Scotland:

> *NRAC's work has involved complex analyses... the new formula should... improve the accuracy of predicting needs... take better account of... more accurately reflect... compensate for... take better account... to reflect... costs... in supplying services to remote and rural areas.* **(p. 39; page references are to the RSAPPG report.)**

Sutton was the professor of health economics on the NRAC committee and therefore presumably had a hand in devising the new Scottish formula. The fourth index of the new formula is based on the number of *per capita* road kilometres in any Health Board area and is therefore of interest to RSAPPG. In the RSAPPG secretariat's search for background material, they appear to have used the word *rural* as their search key. So they were able to provide their committee with extracts from Sections 3 & 5 (on *Need* and the *Market Forces Factor*, respectively) of a report of the Advisory Committee on Resource Allocation[ix]. RSAPPG therefore learned that the CARAN researchers had:

> *Attempted to include a number of **rural**ity indicators and measures of **rural** deprivation in the CARAN formula, but found they were not statistically significant. ... **rural** areas are not disadvantaged by the **sterilization of supply factors** when computing allocations.* **(p. 23**)

From this, ACRA had concluded that:

> *These findings suggest that the national models proposed in the review are not biased against rural areas. ACRA, therefore, has recommended that there is no need for further adjustment for **rural**ity.* **(p. 24)**

Likewise, the paragraphs of Section 5 under **Rurality** were found and reproduced. But the sad message that '...came down the wire' from that section was that ACRA had accepted CARAN's rejection of one sort of adjustment for rurality and had then gone on to reject CARAN's acceptance of a second sort of adjustment! There is no 'rural' in some crucially important paragraphs of Section 3 of the ACRA report — and hence not a word in the RSAPPG report about what they reveal:

i) *ACRA believes the stratified one-stage approach* [of CARAN] *is superior to previous utilization models and is an* ***important technical improvement*** *over the current two-stage approach. This is because it allows the relationship between age and additional need to vary between different age groups.* **(para. 3.12; paragraph references are to the ACRA report)**

ii) *The objectives of the resource allocation formula are to achieve equal access for equal need and to help reduce avoidable health inequalities. The current need formula* [AREA] *attempts to adjust for unequal access for equal need within the formula through the identification of* ***"unmet need"*** *for some groups of the population, for example, ethnic minorities.* **(para. 3.31)**

iii) *The AREA model for acute and maternity services included two variables with* ***counter-intuitive signs****.* ***Measures of ethnicity and employment deprivation were statistically significant predictors of health need but had negative coefficients.*** *That is, the higher the number of ethnic minority populations in an area and the higher the levels of employment deprivation, the lower the level of health care use.* **(para. 3.32)**

iv) *There are two possible explanations for this perverse result. Firstly, there is "****unmet need****" i.e. individuals in ethnic minority populations or in employment deprivation receive less care than expected given their relative morbidity, all other things being equal. Or, secondly, individuals in ethnic minority populations and in employment deprivation are healthier than the general population, all other things being equal.* ***Analysis of the HSE*** [Health Survey for England] *by the AREA researchers showed evidence in favour of the former and* ***ACRA included the two variables with the counter-intuitive signs in the model but not in the resource allocation formula****.* **(para. 3.33)**

v) *This adjustment has also received criticism on the grounds of transparency* [e.g. from Stone & Galbraith (2006)].[x] *The inclusion of variables with counter-intuitive signs in the model, but not the formula, ultimately* ***rests on judgement and interpretation****.* **(para. 3.34)**

vi) *The current review* [CARAN] *rejected the use of morbidity indices in the modelling on the grounds that they were opaque. The current review also failed to find clear evidence of unmet need in the stratified one-stage models. Attempts to force employment deprivation and ethnicity variables into the model did not produce a consistent pattern across consecutive age groups, so* ***ACRA decided not to include unmet need in the model****.* **(para. 3.35)**

vii) *ACRA believes that the new need model captures met need better than the current model because it is based on a stratified one-stage approach, which separates acute and maternity needs and includes outpatient data. However,* ***as the model is based on the utilisation of health care and does not include variables with counter-intuitive signs, it does little to take account of unmet need****. It captures the NHS response to need and existing levels of health inequality. It does*

nothing to reduce health inequalities. Therefore, it does not explicitly address the second objective of the formula, to help reduce avoidable health inequalities. **(para. 3.36)**

viii) *ACRA felt that it is technically very difficult to achieve the two objectives of the resource allocation formula within a single formula. To improve the approach to reducing health inequalities through resource allocation, ACRA has recommended a separate formula for health inequalities. This approach has the benefit of being much more* ***transparent*** *in the way it adjusts the formula for health inequalities. It is also easier to update. ...*

Recommendation: That there should be a separate formula. **(para. 3.37)**

Section 4 on *Health Inequalities* (where there is no 'rural') would have added valuable and revealing detail to the RSAPPG report :

i) *ACRA concluded that at present it is not technically possible to fully achieve both objectives of equal access for equal need and to reduce health inequalities within a robust and transparent single formula. Therefore, ACRA has recommended that a separate formula, which meets the second objective of helping to reduce health inequalities, would be more technically robust and more transparent.* **(para. 4.2)**

ii) *From the outset, ACRA determined that a health inequalities formula must be easy to understand, and responsive to currently* ***unmet need*** *and to the low quality care delivered to disadvantaged groups.* **(para. 4.3)**

iii) *ACRA's recommended measure of health inequalities is DFLE* [Disability-Free Life Expectancy] *as, unlike the other measures, it captures morbidity as well as mortality. ACRA felt it was important to include a measure of morbidity in the formula as this was considered to map better to the objective of reducing health inequalities.* **(para. 4.8)**

iv) *The 'raw' DFLE measure cannot be used directly as it is lower for more deprived PCTs. ACRA has recommended that the measure should be applied by comparing every PCT to a benchmark figure, for example, the local authority with the current highest healthy life expectancy in England.* **(para. 4.10)**

v) *This* ***'difference from best'*** *approach was favoured by ACRA as being closer to amenable DFLE than the raw data, although it was noted that differences in DFLE between areas are due to many factors as well as the impact of the NHS, such as income and historical patterns of employment by industry.* **(para. 4.11)**

vi) *ACRA considered several approaches to combining the health inequalities formula with the utilisation formula***:**

- *Additive approach – this is two separate "pots" of funding for the utilisation formula and the health inequalities measure*
- *Multiplicative approach – under this approach the (normalised) index from CARAN is multiplied by the (normalised) index for the health inequalities formula to give an overall index for each PCT's target share of resources.* **(para. 4.12)**

vii) *ACRA favoured the additive approach as it is considered to be the most* ***transparent*** *and is regarded as giving a more appropriate weighting between the two formulas.* **(para. 4.14)**

viii) *ACRA felt that a range of options could be considered in relation to the weights to be applied to a health inequalities formula. However, for illustrative purposes, ACRA considered the following options*:

- *applying the health inequalities formula to 10% of allocations;*
- *applying the health inequalities formula to 15% of allocations;*
- *applying the health inequalities formula to 20% of allocations.* **(para. 4.15)**

ix) *However, due to lack of evidence, ACRA concluded that it is not currently possible to technically determine the cost of reducing health inequalities between PCTs in a way that could be used to inform allocations. Therefore, no technical way of assessing how much weight should be applied to the health inequalities formula compared to the utilization formula, could be found. Ultimately, ACRA considered the weight to be applied to each formula to be a ministerial decision, based on the priority attached to reducing health inequalities rather than just responding to them.*

Recommendation: That the weight to be given to the health inequalities formula should be a ministerial decision as no technical way of assessing how much weight should be applied to the health inequalities formula has been found. **(para. 4.16)**

4. Notes on the background evidence

i) **'*Sterilization of supply factors*' (p. 23)**: Supply factors are variables, such as *mean waiting time for hospital treatment* and *number of GPs,* that were built into the complex mathematical expressions from which AREA and CARAN econometricians hoped to derive a plausible formula for allocating resources. These variables were 'sterilized' in the derivation so that their variation from PCT to PCT could not influence the actual allocation: e.g. PCTs whose services had achieved low waiting times would not get a smaller allocation, and PCTs that already had a rich supply of GPs would not get a larger allocation.

ii) ***' Important technical improvement'*** **(para. 3.12) :** ACRA give this one reason why they prefer CARAN to AREA. They do not refer to the critique of AREA's treatment of age by Stone & Galbraith[xi] and Stone[xii].

iii) **'*Unmet need'* (para. 3.31) :** YORK (the formula that AREA replaced) was invented by health economists at the University of York[xiii]. Among the socio-economic factors that could be calculated for each of nearly 5000 'wards' covering England was the proportion of the population described as 'black ethnic'. The formula that was fitted to the utilization of acute NHS services to explain its variation from area to area had a ***counter-intuitive sign*** **(para. 3.32)** for that factor : '*suggesting that areas with higher proportions of black residents exhibit lower utilization than expected. The study team and its advisers interpreted this finding as reflecting* ***supply*** *rather than need, perhaps because wards with large ethnic minority populations tend to be close to acute hospitals. The* [*ethnic factor*] *was therefore not considered as a needs variable.'* And there the ethnicity question rested until after 2000, when ACRA asked a fresh team of health economists to propose '*a methodology to adjust for specific unmet need* ' for the new AREA formula. ACRA must have rejected YORK's suggestion (hospital proximity), along with any idea that ethnic minorities might be healthier than the general population in their area, before raising the question of unmet need i.e. whether this group received less care than it needed.

iv) ***'Analysis of the Health Survey of England (HSE) data'*** **(para. 3.33):** ACRA thought that AREA's Chapter 4, 'Testing for unmet need with individual data'[xiv], provided

evidence for the interpretation of counter-intuitive signs as measures of unmet need, whose 'sterilization' might compensate financially for the putative inadequate provision (or take-up) of care by ethnic minorities. But I do not like to think that more than a handful of statisticians would be tempted to agree with ACRA about that. The analysis of the HSE data is an incredible mix of recondite statistical techniques in a purely empirical theory-free framework — least-squares multiple and logistic regressions of huge linear models with up to 120,000 observations and up to 66 adjustable parameters — models that manage only poorly to fit the self-reported health data. Chapter 2 of the AREA report had already given a warning about the reliability (for the interpretation that ACRA relied on) of the HSE data, namely that it '*should be borne in mind that the propensity to report health problems may vary by ethnic group, socio-economic status ...'.* What is even more incredible is that later decisions (that reallocate billions of pounds) should have such a tenuous hold on reality — but the fact that the abstract concept of 'unmet need' gets a mention in Ben Bradshaw's response to Lansley, without any attempt at justification, may be a mark of what political 'steerage' had been at work by then.

v) An adjustment that '***rests on judgement and interpretation' (*****para. 3. 34)** does not rest on hard evidence.

vi) ***'ACRA decided not to include unmet need in the model'*** **(para. 3.35) :** Here, ACRA accepts the finding of the CARAN team that they could not find evidence of 'unmet need' in the way that AREA claimed to have done.

vii) ***'As the model is based on the utilisation of health care and does not include variables with counter-intuitive signs, it does little to take account of unmet need'*** **(para. 3.36) :** This is where ACRA finds the argument for top-slicing CARAN and putting the money into meeting 'unmet need'.

viii) **'*Transparent'* (paras. 3.37 and 4.14) :** Transparency is a necessary but not sufficient condition for eliciting the truth of any matter.

ix) **'*Difference from best'* (para. 4.11) :** 'Best' was taken to be a DFLE of 70 years. So the health inequalities formula will allocate Bradshaw's '15%' to a PCT in proportion to the PCT's *per capita* number of disability-free years up to age 70.

x) **'*For example, 50:50'* (para. 4.12) :** Could this be an accidental relic of 'cut & paste' of an earlier draft — a trigger-happy version of what ended up as Bradshaw's 85:15. (= roughly the 70:10 on p.1)

5. Written evidence

Asthana and her colleague Dr Alex Gibson (RAE Consulting) provided 19 pages of statistical analysis of the health inequalities issue (minister Bradshaw's 15%) , from which I have selected the following observations and conclusions:

i) *Few would deny that tackling health inequalities is a key policy objective, on grounds of both social justice and the need to deliver longer term cost savings to the NHS. However, it is legitimate to ask whether the new health inequalities element of the weighted capitation formula serves the interests of either equity or efficiency.* **(p. 97)**

ii) *... while it is difficult to establish what percentage of the NHS budget has been directed towards public health/preventive activities in the past, data suggest that there is a*

significant gulf between previous expenditure and the new health inequalities budget (*which accounts for around 13% or £10bn of PCT revenue* [**on the average!**]). **(p. 97)**

iii) *There are no guarantees that PCTs that are receiving large health inequalities allocations are directing these funds towards preventive and public health activities rather than using them to maintain existing services. Such use of NHS funding would both would both weaken policy drivers to improve efficiency* ***and*** *reinforce inequity, with less deprived and rural populations receiving relatively less funding for their health care needs than their more deprived urban counterparts* (authors' emphasis). **(p. 98)**

iv) *... the size of the Health Inequalities budget cannot be justified with reference to any current or plausible future expenditure on public health programmes or illness prevention.* **(p. 113)**

v) *... it is important that any funding...is targeted at effective preventive activities and that there is an explicit link between allocations and the costs of such activities.* **(p. 114)**

Late arrival on the witnessing scene, Stone offered the booklet *Failing to Figure* as it contains 19 pages of straightforward text about the formula.[xv]

6. Snippets of the oral evidence

Rather confusingly, some of the oral evidence takes the formula to be CARAN, while some witnesses take it to be CARAN + Health Inequality (roughly 85% + Ben Bradshaw's nominal 15%).
In the first evidence session, DoH's Richard Murray was the first to talk about the formula. He generously lifted the lid of the can of worms that Bradshaw had labelled with words like 'transparent' and 'commitment' :

I wish I could say that the allocation formula was simple ... Unfortunately, it's not. It's quite a complex piece of analysis and statistics ... ACRA works within the broader objectives that the government has set out ... to achieve equal access for equal need ... [*and reduce*] *health inequalities ...* ***a new objective set for ACRA in the late 1990s*** [before the AREA research was done] *... The current formula is different to the one that preceded it* [AREA]. *The researchers* [in DoH's Technical Advisory Group?] *came back to the department to say that they could not deal with the two objectives within the same formula ... they thought the CARAN element did very well on equal access for equal needs but it couldn't deal with reducing health inequalities.* [*ACRA recommended*] *what* [*a second formula*] *should be based on ... disability-free life expectancy.*

But couldn't say how much money ... you should put into it other than to say that, if you put in zero, then ... you have not met the second objective. *Ministers had to take the decision and came up with 15% ... we review on a fairly regular constant basis, picking up things as the world of statistics moves on ... as the population of England moves on ... .* **(pp. 60-61)**

Asked by Lord Dear if he could inject an *element of qualitative judgement into the formula,* Murray replied:

Where qualitative judgement comes into the formula at the moment is where the ***ministers set their raw objectives for ACRA to consider****. ... The problem about those judgements is that there isn't just one, there are hundreds. ... By setting up ACRA as an independent group, that publishes its reports, that commissions out work to universities,* [*it's*] *an objective attempt at setting the formula.* ***It's not really supposed to be subject to***

ministerial movements *behind the backdoor ... The scope for ministerial involvement is there but it is made very explicit ...* ***No minister has ever rejected a recommendation from ACRA****.* **(p. 69)**

Questioned by Philip Dunne about the health inequalities adjustment of CARAN, asking how ministers arrived at 15%, Murray replied:

... some of the work that the researchers did around the new [CARAN] *formula didn't indicate that the previous* [AREA] *formula had been incorrect. We just couldn't reproduce it as data had moved on. We didn't have the same collections we used to have due to changes in service provision etc. And so* ***the health inequality adjustment was set*** *to be such that on average (and* ***I stress the words "on average"*** *because with a lot* [*of*] *PCTs there is a wide distribution above and below)* [it] *was* ***as generous on health inequality as the*** [AREA] ***formula before ... it left policy on health inequalities where it was under the previous*** [AREA] ***formula****.* **(p. 74)**

In the second evidence session, Asthana, Stone and Sutton were asked to make brief introductory remarks. Sutton began by telling the MPs what they needed to remember:

... we all need to remember how multi-variable this exercise is ... the formula accounts for population, for age, for additional needs, for the market forces factor ... when we look at the figures on allocations what we are really looking at is ministerial decisions on the difference between what the area is allocated and what the target allocation is. So, whilst a lot of the figures discussed may look like they are driven only by age or driven only by deprivation, you need to remember that they are driven by loads of other things, some of them being analysis and some of them being ministerial decisions. **(pp. 79-80)**

Comparing the English and the Scottish formulae, Sutton continued:

The formula used in Scotland has a very explicit cost adjustment for rurality ... but I think there is a very clear distinction in the Scottish formula, probably reflecting its geography, between increased volume of services and increased cost of services...

This provoked Graham Stuart to ask whether the *bigger issue* is rurality (and the additional cost) or age, to which Sutton replied:

I don't believe there is a problem with the way age is treated in the [CARAN] *formula. I am clear on that.* ***I think there is a risk that we are distracted by variables that are correlated with rurality.*** *I think there is much more to be learned by looking explicitly at rurality — the role of rurality in the formula. Does it increase or decrease the volume of services, and does it increase or decrease the cost of providing that given volume of services?*

Stone started by paying respect to Professor Sutton's Scottish interests:

It is interesting to hear about the Scottish Arbuthnott formula---but I think the log jam that we have here in England needs to be broken: *the ice needs to be broken. The basic fact, that affects the clash between looking at the outcomes and all of this very technical discussion about an apparently scientific formula, is that the formula is rubbish! I set out the case for that in the booklet* Failing to Figure... *there are 19 pages in it about the formula which are addressed to laymen. I would like to be here as a representative of the Royal Statistical Society, but I can't do that because I am no longer at the centre of* [*that Society*]*. I no longer have many contacts but I do have general support from all the statisticians I talk to.*

So it's clear there is a clash between our professions which should have been engaged

right from the start of this problem — because what we are dealing with here is not a specialized econometric problem that only econometricians can solve, but a general problem of mathematical statistics which should have brought in thinking statisticians at an early stage. I am not putting myself forward as the thinking statistician here. I can refer, however, to the world's top statistician who wrote to me in 2006 to say "I have read your submission [to the Health Committee] *with interest. You make a strong, overwhelming I think, case that the present allocations are irrationally based." ... There are other comments of this sort but that is just an aside to the professional problem that we have here*: *that a profession that should have been involved has not been* [significantly] *involved.*

On the issue of these formulae I take it, Mr Chairman, that you were talking about the CARAN formula when you said that age wasn't appropriately treated in that formula. In the move from AREA to CARAN, we've actually had a transition between two classes of fundamentalists. I was reminded yesterday of Peter Brook's new play 'Eleven and Twelve' where two groups disagreed on whether a sufic prayer should be repeated 11 or 12 times, and this led to almost warfare and other consequences. I regard this dispute between AREA and CARN as a similar controversy — worthless. Worthless to engage in it at great length instead of looking at other approaches. Professor Asthana does, I think, like the CARAN formula because its output, I would say has outputs that (just looking at the basic formula — just the needs formal dispensing with health inequalities) are generally consistent with what she, a very dedicated researcher, has found to be what is suggested by an approach to direct measurement of care. Which is what we have to go to, and the case for that is what has been put to you today. ... there is no case, at the moment, for deviating very much (certainly not in the direction it presently deviates) from 'equality' —in the sense that every person in the country (in populations of 300,000 so you don't need anecdotes) gets allocated by the formula a sum which is constant, so everybody gets the same amount of money wherever they live and however old they are. And then you have the health inequality thing on the side, to achieve those generally broader purposes. **(pp. 80-81)**

For Asthana, the *bigger issue* was political:

... CARAN did, I think, address the problem that the AREA formula had ... (of) additional needs effectively cancelling out the effect of age... CARAN, by using a one-stage stratified model, basically addressed that issue ... So if you actually look at the needs-element of CARAN it does involve a fundamental redistribution of resources. My question — on what the big issue is to take into the next government — is on what basis the decision was made to ignore that academic evidence and, instead, to ensure the current allocation is exactly the same as the AREA allocation. So, in other words, the value judgement has been made to maintain the status quo despite the fact that that status quo was deeply problematic in terms of achieving the objectives of equal access for equal means...

The problem I have is... where this figure of 15% was plucked out. ... there is a quote from Ben Bradshaw himself... "this keeps the distribution of funding between the most and the least deprived areas in line with the previous formula". There was an absolutely explicit decision to maintain the status quo. Now my problem really is... why conduct a review if you are going to ignore its findings? **(p. 81)**

Stone took Asthana's reference to a *witch's cauldron of regression analysis which yields meaningless things* **(p. 84)** as an excuse for adding some personal colour to his brief introduction:

I think the die was cast in the wrong direction for the whole methodology by the introduction of utilization-based approaches by York in 1994. I got entangled with this farrago in 2002 because I picked up a public health report from Hillingdon... it pretended to be able to move resources from one electoral ward to another on the basis of four deprivation measures of the kind which Prof Asthana was just referring to. ... A Director of Public Health ... was

looking for national guidance on this. So I thought: *"At the national level, are they using formulae?" . ... I looked at the sources and found that they were, and it was horrifying. And from then on, for the last 8 years, I've been pursuing this mission to persuade the English to rethink this — and not get involved in obscurantist discussions about this or that aspect of the formula.* **(p. 84)**

This may have encouraged Professor Sutton to reminisce, before answering a question from Baroness Byford about how he would (and how quickly he could) change the formula :

Prof Stone has been pushing us hard for a number of years and I actually think that's very good. I don't think he's reassured by the fact that ***there are a lot of people involved in this exercise****. There was a lot of scrutiny involved in this exercise, and there are a lot of people committed to it — but* ***that is the thing which is key for me****. In terms of what I'd like to see developed in the formula, I actually think we're quite innovative in terms of the research teams which designed the formula. I think that the advisory committee received a lot of very varied advice ... perhaps the way in which we developed the formula was a little bit too quickly for policy-making. So there must be limitations put on it in terms of being too innovative.*

My only concern about this current push that we should go to direct measurement is that I don't think it's feasible*. ... There are now over 1000 categories for HRG4* [hospital categories of resource use?], *and that's just once a patient has got through the door. ... we need to classify them to be able to accurately measure how much of the resource they're going to use on this particular visit...* ***imagine that we want to do the whole population****... to do their entire healthcare needs over the period of a year... we are talking about a very very major exercise. So direct measurement sounds very attractive but, if you're worried about this being an industry already,* ***it could become a very large industry indeed.*** **(p. 85)**

Invited to comment on that, Stone said he thought it betrayed:

... ***a lack of imagination, if I may say so without giving offence****, on the idea of sampling. The statistician I quoted earlier... is very keen on using efficient sampling as a way of dealing with problems of huge amounts of data, records that are incomplete, and so on. I would recommend a direct informed approach, by those with medical knowledge, to patients selected at random, in stratified sampling preferably, of GP-registered patients... with an analysis of what call the patients made on NHS services in the previous year. The advantage of that type of approach is that it is self-correcting as far as biases are concerned. Admittedly it might be a difficult exercise but if you narrowed it down to samples you can actually do it with limited use of resources.* **(pp. 85-86)**

which Asthana complemented by reporting that she had:

... just completed a two-year project which did that very same thing. We've aligned direct estimates with case-mix, clinical estimates of need, and we've done indicative budgets for mental health for practice-based commissioning.

Sutton returned to the issue to say he was:

... a little bit worried about how hungry we are going to be for data ... about being able to do this by sampling people. Yes we could, but then ***we could only allocate resources to a sample of people, because you would need to have that information on everybody to be able to allocate resource to those individuals****.* **(p. 86)**

which provoked Stone to observe that:

All you need is an estimate for populations of 300k. You should be able to get reliable enough estimates in order to allocate to populations of 300k something that's probably better than the present stuff. **(p. 86)**

and also Asthana, to add that:

... you don't need to have ***estimates*** *for every single HRG, the primary resource allocation makes allocations to populations.*

The chairman allowed Prof Sutton to have *the final word* — which he devoted to the health inequalities issue as follows:

... in terms of this compartmentalizing of the two aspects of the formula ... the NHS can work on health inequalities not just through health interventions ... I don't think we should misunderstand that that was what was going on there. The NHS reduces health inequality through the provision of health care. So the evidence now suggests that the supply of GPs ... the more we spend on all aspects of cancer treatment, the more we spend on all aspects of coronary heart disease, we improve health in those areas.

So we shouldn't think that this [health inequality] *is a lost cause and all we can do is public health interventions (and there's not enough evidence for those public health interventions). The allocation of NHS resources to areas has an impact on that area's health. So we should* [not] *compare that 15% (£10bn) with the cost of a leafleting campaign. The 15% is there because we are saying that the core NHS resource should be directed towards reducing health inequalities.* **(p. 95)**

7. Notes on the oral evidence

Parliamentary committees appear to be in possession of an evergreen hope — that complex issues can be clarified by placing disputing academic witnesses at the same table in Portcullis House and subjecting them to the same questioning. That was the clear import of the chairman's opening words :

As we know, we are discussing the formula, and it is a great privilege to have three such distinguished students of this astonishingly complex and difficult issue. **(p. 79)**

However, given the tendency for such unscripted confrontations to slip into the confusions that belie everyday conversation, their real value has to come from painstaking analysis of a transcription which, in this case, the witnesses were allowed to correct to be a true record of what they said or intended to say. But witnesses are conventionally expected to answer the questions put to them by the committee and not to rudely question anything fellow witnesses say, no matter how questionable it may be. Sometimes truth will out only if that convention is violated — which happened in note **(iv).**

i) **'*As generous on health inequality as the*** [AREA] ***formula'*** **(p. 74) :** The gravamen of the RSAPPG case against the 'CARAN + Health Inequality' formula that replaced AREA in 2009 is that it was far too generous.

ii) **'*I stress the words "on average"'*** **(p. 74) :** Here Murray acknowledges that the '*adjustment*' of CARAN, with a nominal 15% top-slice given to the vagaries of the DFLE health inequality measure, may be having severe consequences for a good number of PCTs. While '*policy*' may have been left '*where it was under the previous formula* [AREA]', the simultaneous drastic change in the way the formula incorporates the age-profile factor may have additionally affected some PCTs with an aged age-profile. I

echoed Murray's point in my later evidence **(p. 97).**

iii) **'*I think there is a risk that we are distracted by variables that are correlated with rurality*' (pp. 79-80) :** The interplay of correlations was the central activity in the statistical playground in which his research team constructed the mathematical expressions that found their way into AREA. Hidden correlations can easily have misleading consequences even for that elusive concept — a true linear model. The blind omission of a variable that ought to be in the model (e.g. a particular measure of sparsity) and that is negatively correlated with a variable that is included (e.g. ethnic proportion) would give a downward bias to the estimated coefficient of the included variable. A positive coefficient for ethnicity might even change sign, and ACRA might have looked no further than that for an explanation of those 'counter-intuitive' signs, instead of seeing them as evidence of unmet need.

iv) **'*A lack of imagination, if I may say so without giving offence*' (pp. 85-86) :** Perhaps lateral thinking rather than 'imagination' is what was missing from this advice to the committee. It is surprising that the economist who led the research team that guided England in its allocation, since 2003, of many hundreds of billions should not acknowledge the economic value and wide use of statistically-designed random sampling, for which one need go no further than the daily reports of polls of voting intentions whose estimates can be within one or two percentage points of the truth with samples as small as 2000. A PCT's *per capita* healthcare need could be estimated with enough precision from professionally designed and controlled interviews of a stratified sample of GP-registered patients in each PCT — once the weightings of a rich enough categorization of healthcare need had been agreed (which would admittedly be the most challenging part of the approach).

8. The real story and present reality

Formula mongering took decades to reach present sophistication. The first formula was Richard Crossman's transparent weighting of three regional variables — indices for population, bed-years and hospital cases. It was not long before ambitious civil servants were exploiting the new discipline of health economics to go where statisticians would not dare to tread. New variables and techniques were introduced until YORK set the pattern in 1994 that is still with us.

There was no Darwinian struggle of 'survival of the fittest' for the simple reason that there was no scientific criterion of fitness. So it became a pretentious game under the aegis of ministers who were able to appeal for 'independent authority' to a body, ACRA, whose membership was subject to ministerial favour and whose advice could only be published with ministerial approval. A DoH witness in the 2005 Health Committee Inquiry into NHS Deficits even told the committee that resource allocation must always be subject to political control.

The change from YORK to AREA in 2003 was dictated by the need to respond to the new government's aspirations to engineer equality in both immediate care and ultimate health — and the Scottish colour of government was a happy match to the source of health-economics know-how that AREA then exported to England. By the late noughties, however, DoH decided to respond to serious criticism of the ad hoc way in which the AREA formula dealt with the age-profile variable. But did not, it appears, imagine that AREA's provision for 'unmet need' would be affected by treating the age-profile variable differently from all the others. But it did. When age-profile was released from its cage in the AREA formula by the new team of health economists, it was more free to express, in CARAN, the large differences in health care usage between age-bands — and thereby dominate the other variables whose influence on utilization is weaker. That dominance was enough for CARAN to be obliged to exclude the ethnicity and deprivation variables from any role in their formula — along with any 'counter-

intuitively signed' coefficients that ACRA could have taken to be evidence of 'unmet need'. Nevertheless, looking at the poor state of health in much of the population of deprived areas, the Minister was adamant that there was unmet need in those areas. So from 2009 there would have to be a compensatory 15% top-slicing.

9. An electoral purdah?

In early April 2010, I was looking forward to attending a University College London seminar on April 20th, to hear what Steve Morris had to say about the measurement of health inequality. Morris is now a UCL professor of health economics following his successful completion of the CARAN report. It was a disappointment to learn, almost at the last minute, that the seminar had been cancelled. I later discovered the reason for the cancellation — it seems that Professor Morris had been instructed not to talk about his research.

Morris's department fills another floor of the building that now accommodates my own department. UCL's Department of Statistical Science started as the birthplace of the English school of statistics under Karl Pearson and has been responsible for many of the theoretical breakthroughs that underlie the principled use of statistical method. Those breakthroughs often depended on the free exchange of information and research with other UCL departments. Ministerially-inspired misapplication of university research involving the statistical methods of multiple regression and correlation analysis (to which Karl Pearson made important contributions) is at best a cruel irony. In reality, it is a betrayal of what is still the spirit of leading universities — but not, it appears, the spirit of the age we are now living through.

On April 24, the Straight Statistics think-tank had a report entitled *' Scientists gagged until the people vote' .* It seems that government is taking a relaxed view about research councils imposing silence on research reports until after the election. So perhaps we should not be surprised that Professor Morris has also been told to keep quiet by some body — given the high public profile of his research. Which raises the question that may have been in the mind of the censoring body — that people may think that, given that an academic issue is important enough to merit the stifling of nigh-private discussion in a routine academic seminar, it may be an issue that the electorate ought to know about.

References

[i] Hansard, *Written Questions, 12 January*: *Column 177W,* London: The Stationery Office 2009.
[ii] RSAPPG, *The implications of national funding formulae for rural health and education provision,* 2010.Downloadable from www.rsonline.org.uk
[iii] Issue 1260
[iv] Stone, M., *Failing to Figure*: *Whitehall's costly neglect of statistical reasoning.*London: Civitas, 2009.
[v] McCormick, B., House of Commons Health Committee Inquiry into *NHS Deficits: First Report of Session 2006-07,* London: The Stationery Office 2005, Vol. II, p. 62.
[vi] Morris, S. *et al., Combining Age Related and Additional Needs* (*CARAN*) *Report,* RARP 30*,* London: Department of Health 2007.
[vii] Stone, M., *Failing to Figure*, *20*09.
[viii] NRAC, *Delivering Fairer Shares for Health in Scotland,* NHS Scotland Resource Allocation Committee 2007.
[ix] ACRA, *Report of the Advisory Committee on Resource Allocation,* London: Department of Health 2008.
[x] Stone, M., and Galbraith, J. I., 'How not to fund hospital and community health services in England', *J. Roy. Statist.Soc. A (Statistics in Society)*, 2006.
[xi] Stone, M., and Galbraith, J. I., 'How not to fund hospital and community health services in England', *J. Roy. Statist.Soc. A (Statistics in Society)*, 2006, Vol. 169, p.143.
[xii] Stone, M., House of Commons Health Committee Inquiry into *NHS Deficits: Sixth Report of Session 2005-06,* London: The Stationery Office, 2005, Vol. II, pp. 183-192.
[xiii] Carr-Hill, R. *et al., A Formula for Distributing NHS Revenues Based on Small Area Use of Hospital Beds,* University of York Centre for Health Economics, 1994.
[xiv] Sutton, M. *et al.,* 'Allocation of resources to English areas: individual and small area determinants of morbidity and use of health resources (AREA)', Department of Health: RARP 26, 2002.
[xv] Stone, M., *Failing to Figure*, *20*09.