Allocation adjustment for health inequalities

Executive Summary

1. This paper sets out NHS England's current approach to addressing health inequalities in the allocation formula and explores whether the most recent evidence suggests there is scope to improve this adjustment in the 2016-17 allocation round.

2. The current approach to the health inequality in allocations is to make a 10% and 15% adjustment within the core CCG and primary care allocation formula respectively. Within this, a standardised mortality rate (SMR) based adjustment is made using an exponential weighting factor. This has the effect of giving a larger health inequality adjustment to areas that have higher mortality rates.

3. Additional academic evidence has now become available on the impact of more healthcare spend on mortality rates. Specifically, Barr et al. (2014) finds that, over the period 2001 to 2011, additional healthcare spend reduced mortality rates, and that this effect was greater in more deprived areas.

4. This paper explores whether this evidence can inform how much weight should be placed on the health inequality adjustment within the allocation formula. It also explores whether the basis of this adjustment could be improved to increase the effectiveness of the health inequality adjustment.

5. In order to explore these questions, the effects Barr et al. identified for different deprivation levels can be used to simulate the impact of alternative adjustment mechanisms and weights (this uses the coefficients presented in Barr et al.'s paper). While this analysis and the issues examined fall within the discussion space of the Marmot curve, the work presented here is not directly comparable to this curve.[1]

6. The nature of the simulation which is contained in this paper needs to be clear. The approach adopted is not making an empirical assessment of the effectiveness of the health inequality adjustment to date. Nor does a simulation enable a definitive assessment of impacts under alternative scenarios. Rather, the simulation approach offers a directional assessment of the likely impact of alternative health inequality adjustment scenarios, with all other factors being held constant.

7. It is important to note that all results identified in this paper are subject to the caveats associated with the Barr et al. analysis. These caveats are discussed in the paper and their relevance for the policy questions at hand is elucidated. The main point to note is that these caveats caution against over-interpreting the Barr et al. results beyond the context in which they were estimated.

[1] The Marmot curve shows the empirical relationship between income deprivation level and life expectancy and disability-free life expectancy.

8. The paper finds that it may be possible to improve the basis of the health inequality adjustment. However given the caveats associated with the Barr et al. paper and given the limitations of simulation, confidence in these results is not sufficiently strong to enable a firm conclusion that positive impacts will be realised in practice. Given this, and given ACRA's existing recommendation on the public health health inequalities adjustment, ACRA's view is sought on the value of aligning the core CCG and primary care health inequality adjustments with that proposed for public health.

9. Beyond the 2016-17 allocation round, the paper provides suggestions for longer term work in this area. This includes broadening and updating the available evidence base. In particular it is recommended that the evidence base is developed with respect to the relative impacts of additional funds on health inequality in different care settings (e.g. primary care, core CCG, specialised services, public health).

Context of work

NHS England has determined allocations on an annual basis and as part of this the 'person-based resource allocation' (PBRA) formula calculates the distribution of the health budget across CCGs. An unmet need/health inequality adjustment is made as part of this allocation (see below).

The PBRA formula determines allocations on the basis of met need (e.g. adjusting for age) because it models utilisation of health care services - its key limitation is that it does not capture unmet need.

From a policy perspective then, there are two main drivers behind the unmet need/health inequalities adjustment:

a) Unmet need adjustment to address the limitations of the PBRA utilisation model; and
b) NHS England's statutory duty to reduce health inequalities.

N.B. For the remainder of this document, both of these drive the 'health inequality adjustment' which is discussed.

NHS England follows a two-step approach to adjust for health inequalities in target allocations[2]:

a) Set the weight of the health inequality adjustment in the overall formula (currently 10% for the core CCG allocation and 15% for primary care)
b) Determine the metric and the adjustment mechanism to address health inequalities within allocations (currently based on the standardised mortality rate under age 75 (SMR<75))

In line with this two-step approach this analysis targets two main questions[3]:

1. Can the money that is reallocated to address health inequalities be distributed in a more effective way?

2. Should more, less or the same weight be placed on the health inequality adjustment?

[2] Note that pace of change adjustments are applied after target allocations have been adjusted for health inequalities
[3] Note that the second question does not address the issue of the relative weights between different allocations — i.e. the appropriate level of weight used in different allocations (e.g. core CCG or primary care allocations).

This paper explores whether and how the recent evidence contained in Barr et al. informs these questions.

Barr et al. findings

Drawing on a period between 2001 and 2011 the Barr et al. paper has two main findings:

a) Additional money spent in an area has a positive impact on health outcomes (measured by the standardised mortality rate amenable to healthcare before the age of 75 (SMRa<75)).
b) The positive impact of extra money spent is higher in more deprived areas (measured by a greater reduction in SMRa<75 in more deprived areas as a result of additional funding).[4]

The second finding raises the possibility that health inequalities can be reduced further by targeting the health inequality adjustment even more to the most deprived areas. Given the correlation between deprivation and SMR<75, this suggests that further distribution toward areas which have a higher SMR<75 might be beneficial.[5]

N.B. It is important not to over-interpret statistical analysis like that contained in Barr et al. when applying such results to policy questions. The key points to note in this regard are:

a) diminishing marginal effects of additional funding are not captured;
b) time lags associated with the impact of additional funding are not captured;
c) the estimated effects are for all healthcare spend and are not differentiated by current and potential allocation contexts (public health, primary care, CCG and specialised services);
d) delineation between the effects of additional funding and the effectiveness of ancillary health inequality policies is not available;
e) impacts on the least deprived areas of significant reductions in funding are not captured; and
f) the period 2001-2011 covered by the paper may not be representative of the future, especially in light of changes in commissioning structure introduced by the Health and Social Care Act 2012.

How is the health inequalities adjustment currently made?

How is the weight placed on health inequalities in the allocation formula determined?

a) 90% of a CCG's allocation is determined by its met need characteristics (e.g. population size and demographic factors such as age). The remaining 10% of the allocation is based on a health inequalities adjustment.[6]
b) The size of this adjustment is based on judgement and continues the ministerial approach in use prior to the formation of NHS England.

What is the health inequality adjustment (within this 10% weight) based on?

a) SMR<75 is used as a proxy of health inequality. To capture within-CCG variation in health inequality, the adjustment is calculated at the 'middle layer super output area' (MSOA).
b) For the adjustment, MSOA are clustered into 10 groups based on their mortality rate. The adjustment for each group increases exponentially from 1 for areas with the lowest mortality rate (group 1) up to an adjustment of 5 for the areas with the highest mortality rates (group

[4] Given the high degree of correlation between SMR<75 and SMRa, Barr's SMRa based findings are taken to be relevant for SMR<75.
[5] The correlation between the income deprivation (IMD) and mortality (SMR<75) in 2010 ranges between 57% and 69%, depending the functional form used (non-logged and log respectively).
[6] For primary care allocations this adjustment is 15%.

10) — this has the effect of redistributing funds toward areas with the highest mortality rates.

c) On an MSOA level around 2% of the overall budget is reallocated to adjust for health inequalities. However, given that a CCG consists of multiple MSOAs, some of these (increasing and decreasing) adjustments cancel each other out such that a smaller proportion (around 1%) of the budget is reallocated at a CCG level.

d) Within this overall budget change, individual CCGs still experience notable budget changes as a result of the health inequality adjustment — e.g. for individual CCGs in 2014-15 target allocations this is estimated to range from -4% to +11%.[7]

How can we inform the questions at hand using currently available evidence?

Question 1

The evidence in Barr et al. raises the possibility that further targeting of health inequality adjustment funds to more deprived areas could further reduce health inequalities, by reducing mortality more quickly in these areas.

Given the correlation between SMR<75 and deprivation, this adjustment could be achieved by applying a more redistributive SMR<75 adjustment — i.e. one which continues to use SMR as the basis of adjustment but which redistributes even more funds towards areas with higher SMRs.

This approach of increasing the `redistributiveness' of the SMR<75 adjustment is being proposed by ACRA with respect to public health allocations. It is therefore helpful to estimate the impact of this same approach on CCG allocations. Alongside this, an alternative more redistributive policy simulation is conducted for comparison. As a final comparator, a simulation is run for a health inequality adjustment which directly accounts for deprivation status (see below).

Question 2

As the evidence in Barr et al. provides insight into the impact that additional funds can have on health outcomes, this can provide a basic assessment of what the impact might be of changing the amount of weight (and therefore budget) allocated to health inequalities. However, as this is beyond the intended purpose of the original research by Barr et al., over-interpretation of these results is cautioned against (see results section for further discussion).

How can we evaluate the impact of these changes?

We can simulate the impact on mortality of the policy changes set out above, using the coefficients which Barr et al. identified. The baseline for assessing these scenarios is the 2014/15 allocation excluding any health inequality adjustment [8] — this enables identification of the simulated (not actual) impact of making a health inequalities adjustment relative to not making any adjustment. The relative impact of one policy scenario over another is obtained by comparing their relative impact against the 'no adjustment' baseline (the results discussion below contains an applied example).

Each of the metrics reported for simulations inform a different aspect of the issue under consideration (changes in these metrics are considered):

a) The standard deviation indicates how wide the variation might be in mortality across CCGs — this shows how wide variation in SMR is between CCGs and this therefore provides an indicator of health inequalities;

[7] For MSOAs the comparative range was -6% and +21%.

8 For the 2014/15 allocation NHS England published a table that shows a hypothetical allocation excluding any health inequality adjustments. This allocation was never adopted in practice, but serves as a useful baseline scenario for the analysis.

b) The mean indicates what the average SMR performance across CCGs might be;
c) The maximum indicates how mortality might change in CCGs with the worst SMR performance;
d) The reduction in the gap between CCGs in SMR categories 1 and 10 enables a more focused comparison in the change in SMR performance for CCGs with the highest and lowest SMRs; and
e) The reduction in the gap between CCGs in deprivation categories IMD 5 (most deprived) and IMD 1 (least deprived) enables a more focused comparison in the change in the SMR performance for CCGs with the highest and lowest deprivation groups.

N.B. given the uncertainties associated with the Barr et al. results, and given the limitations of simulations, all results should be interpreted as broadly directional rather than specific.

How is the simulation conducted?

MSOAs are grouped into the 5 Income Index of Multiple Deprivation (IMD) categories from 1-5. This determines which coefficient is applied (see equation below).

The predicted mortality rates for each MSOA are estimated as their original mortality rate plus the change in allocation per head, multiplied by the Barr et al. coefficient for the relevant IMD category (i.e. the estimated effect) on mortality of additional funds. This can be expressed as:

$$Mortality^{NEW} = Mortality^{OLD} + [Change\ in\ allocation\ per\ head * Coefficient^{IMD\ status}]$$

CCG level results are then produced as a weighted average of the MSOAs in its area.[9]

Question 1: changing the adjustment mechanism

Four different adjustment scenarios are applied:

1. NHS England's 2014/15 approach using 10 SMR groups and an exponential weighting from 1 to 5.
2. The ACRA public health proposal, applied to CCG allocations. This proposal increases the number of SMR groups to 16, and increases the maximum (exponential) weight to 10 (the effect of this is that the adjustment is more redistributive than the current approach).[10]
3. An SMR adjustment which allocates funds to those areas with the highest SMR first.
4. A deprivation (rather than SMR) based health inequality adjustment which allocates funds to the most deprived areas with the highest SMRs.

Scenarios 3 and 4 'cascade' health inequality adjustments down starting with the highest priority areas identified in the simulation. In order to simulate a realistic distribution of funds, constraints must be set on how large an adjustment can be made for each (MSOA) area. In order to facilitate comparison between scenarios, the estimated range of adjustments identified in scenario 1 is used as the constraint in scenarios 3 and 4. This limits the maximum decrease in the MSOA allocation to -6% and the maximum increase in the MSOA allocation to 21%. After this constraint is met, redistribution continues with the next MSOA and so forth.

[9] Only 2 out of the 6781 MSOA span between two CCGs. In these cases the MSOA results are apportioned to both CCGs based on the population share.
[10] The draft consultation on this proposed change advises that this proposal has the effect of 5% of MSOAs with the highest mortality rates seeing a significant increase in their health inequality weighting.

Question 2: changing the budget allocation

In line with the second policy question, the effect of an increase or decrease in the weight that is placed on the health inequality adjustment is also simulated (currently set at 10%). In the equation above, this changes the 'change in allocation per head' term.[11]

Results

Can the money that is reallocated to address health inequality be distributed in a more effective way?

Table 1 shows the results of the simulations described above. All scenarios are assessed relative to the baseline where no health inequality adjustment is made. Row 2 therefore indicates that NHS England's 2014/15 adjustment is simulated to have a positive effect on reducing health inequalities (relative to no health inequality adjustment being made), with a reduction across all SMR metrics. Note that this assessment is based on a simulation and does not assess whether this effect has actually occurred in practice. A positive impact is also projected in terms of decreasing the SMR performance difference when comparing the most and least deprived areas by around 3.5% (the IMD 1 and IMD 5 comparison).

Row 3 indicates that the ACRA public health proposal is also simulated as having a positive effect if applied to CCG allocations. The estimated marginal impact of this change relative to the current adjustment is shown in row 4. The simulation projects a further reduction in the standard deviation of around half a percent, and a reduction in max SMR of around 1%. There is a small marginal improvement in the IMD 1 to IMD 5 comparison.

Row 5 indicates that the alternative SMR adjustment (based on ranking of areas by SMR) is estimated to have a further positive effects on SMR. For example, the marginal impacts in row 6 show the standard deviation is estimated to decrease by over one percent and the max SMR by around half a percent more. This suggests that further health inequality (reduction) gains might be available if this type of SMR adjustment were to be applied. Note that the impact of this adjustment on maximum SMR is smaller than that of the 'ACRA' (public health) proposal. However, the marginal impact of the IMD 1 to IMD 5 comparison is larger.

Row 7 shows the alternative scenario where a 'direct deprivation' adjustment is simulated (funds are allocated to the most deprived areas with the highest SMRs). The results show that some additional marginal SMR improvements might be achieved using a direct deprivation based adjustment. This scenario shows the largest impact on the IMD 1 to IMD 5 comparison, out of all the scenarios (which is to be expected given this adjustment targets deprivation directly). However, a change in the basis of adjustment (to include deprivation directly) would require a more developed evidence base than the Barr et al. paper currently provides.[12]

[11] A change in weight will result in a proportional increase of the budget share that is reallocated based on the health inequality adjustment, as well as a proportional increase in the range of the maximum decrease or increase for an area (CCG or MSOA). For example if the 10% weight leads to 2% budget share reallocation with the maximum CCG decrease and increase range being -5% to +10%, increasing the weighting to 20% would lead to a 4% budget share being reallocated with the CCG range being -10% to +20%.

[12] Annex A provides a full set of all scenarios run, including alternative weight scenarios.

Table 1 — simulated impacts of current and alternative health inequality adjustments

Row		Std. dev.	Mean	Max	SMR 1 to 10	IMD 1 to 5	CCG redistribution range
(1)	NHSE 2014/15 HI [A]	-2.81%	-0.49%	-1.91%	-3.09%	-3.43%	-4.4% to 11.1%
(2)	ACRA public health [B]	-3.39%	-0.49%	-3.07%	-4.11%	-3.72%	-4.2% to 17.4%
(3)	ACRA marginal impact [B - A]	-0.58%	0.00%	1.16%	-1.02%	-0.29%	-
(4)	'Peakier' SMR adjustment [C]	-4.07%	-0.58%	-2.50%	-5.53%	-4.72%	-5.3% to 14.1%
(5)	'Peakier' SMR marginal impact [C - A]	-1.26%	-0.09%	-0.59%	-2.44%	-1.29%	-
(6)	Deprivation adjustment [D]	-4.35%	-0.65%	-2.97%	-4.83%	-6.36%	-5.7% to +16.5%
(7)	Deprivation marginal impact [D - A]	-1.54%	-0.16%	-1.06%	-1.74%	-2.93%	-

Overall these simulated impacts suggest that it may be possible to improve the basis of the health inequality adjustment. However, given the caveats associated with the Barr et al. evidence, and given the limitations of simulation, confidence in these results is not sufficiently strong to enable a firm conclusion that positive impacts will be realised in practice.

Bearing this context in mind, the results indicate that bringing the core CCG health inequality adjustment in line with ACRA's proposed approach for public health may offer marginal improvements (which are additional to any long term trends on health inequality reduction) while the 'alternative SMR and 'deprivation'' scenarios show larger reductions in the standard deviation of SMR, the ACRA (public health) proposal is associated with the largest reduction in max SMR when applied to the core CCG allocation.[13] It is therefore requested that ACRA consider these tradeoffs and make a recommendation as to whether the core CCG allocation should be bought in line with the recommendation for public health.

In the longer term, consideration should be given as to whether an even more redistributive SMR adjustment and/or a deprivation based adjustment would yield further health inequality (reduction) benefits. Development of the Barr et al. and wider evidence base would be required to support further work in this area.

[13] A further assessment of the impact of these changes is contained in '(ACRA(2015)25 Impact of changing the number of bins in the unmet need adjustment in the CCG target formula and the wider application of the adjustment'

Should more, less or the same weight be placed on the health inequality adjustment?

Table 2 shows the simulated impact of changing the weight which is placed on the health inequality adjustment, in the allocations formula. The scenarios hold constant the current method of reallocating funds (i.e. the SMR-based adjustment using 10 bins and an exponential weighting of 1 to 5).

The results indicate that the change in SMR metrics is broadly proportional to the nature of the weight change but this is driven by the set nature of the Barr coefficients, rather than reflecting what would happen in reality (when diminishing returns would be expected). The key question with respect to these results is therefore whether Barr's results would be expected to hold if the size of the health inequality adjustment were changed in this manner. Both Ben Barr and ACRA's Technical Advisory Group (TAG) were engaged on this issue and both were uncertain about whether Barr et al. results were applicable if the health inequality weight was changed significantly (e.g. doubled).

Given this and given the caveats of the Barr analysis cited above it is not recommended to infer whether Barr's identified effects hold when changing the overall weight placed on the health inequality adjustment. This caution particularly applies given that the allocation funds during the period of Barr's analysis were accompanied by other policies and support for targeting health inequalities. It is therefore not recommended that the weight placed on the health inequality adjustment is changed at this time. However, it is recommended that further work is undertaken to develop an understanding of the contribution of different types of health inequality policies and their synergies. Such work could also explore the relative importance of health inequality adjustments between different settings (public health, primary care, core CCG and specialised services); at their September meeting TAG expressed a particular interest in understanding these split effects.

Table 2 — simulated impacts of current and alternative HI allocation weights

	NHSE 2014/15 HI Adjustment		
SMR	**Halve weight (w=0.05)**	**Maintain weight (w=0.10)**	**Double weight (w=0.20)**
Std. dev.	1.41%	-2.81%	-5.60%
Mean	0.24%	-0.49%	0.98%
Max	0.95%	-1.91%	3.81%
CCG redistribution range	-2% to 6%	-4% to 11%	-9% to 22%

Annex A – Simulated impacts of current and alternative health inequality adjustments relative to the baseline scenario

	NHSE 2014/15 HI adjustment (weight = 0.05)	**NHSE 2014/15 HI adjustment** (weight = 0.10)	**NHSE 2014/15 HI adjustment** (weight = 0.20)	**'Max SMR<75' adjustment** (weight = 0.05)	**'Max SMR<75' adjustment** (weight = 0.10)	**'Max SMR<75' adjustment** (weight = 0.20)	**ACRA Proposal** (weight = 0.10)
IMD 1 and IMD 5 gap (MSOA level)	-1.71%	-3.43%	-6.85%	-2.36%	-4.72%	-9.44%	-3.72%
SMR 1 and SMR 10 gap (MSOA level)	-1.55%	-3.09%	-6.19%	-2.77%	-5.53%	-11.06%	-4.11%
Std. dev.	-1.41%	-2.81%	-5.60%	-2.04%	-4.07%	-8.08%	-3.39%
Mean	-0.24%	-0.49%	-0.98%	-0.29%	-0.58%	-1.16%	-0.49%
Max	-0.95%	-1.91%	-3.81%	-1.25%	-2.50%	-5.01%	-3.07%
CCG redistribution range	-2.2% to 5.5%	-4.4% to 11.1%	-8.7% to 22.1%	-2.7% to 7%	-5.3% to 14.1%	-10.6% to 28.2%	-4.2% to 17.4%

	'Direct deprivation' adjustment (weight = 0.05)	**'Direct deprivation' adjustment** (weight = 0.10)	**'Direct deprivation' adjustment** (weight = 0.20)
IMD 1 and IMD 5 gap (MSOA level)	-3.18%	-6.36%	-12.72%
SMR 1 and SMR 10 gap (MSOA level)	-2.42%	-4.83%	-9.66%
Std. dev.	-2.18%	-4.35%	-8.60%
Mean	-0.33%	-0.65%	-1.30%
Max	-1.48%	-2.97%	-5.93%
CCG redistribution range	-2.8% to 8.2%	-5.7% to 16.5%	-11.3% to 33%