TECHNICAL POLICY PAPER ON RESOURCE ALLOCATION

FOR DEPT OF HEALTH, NHS ENGLAND AND ACRA

A PROPOSED TECHNICAL IMPROVEMENT TO THE MSOA SMR<75 FORMULA WHICH PROVIDES MORE EQUITABLE WEIGHTS FOR AREAS WITH VERY HIGH MORTALITY

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SUMMARY

This paper concerns a group scoring method for weighting and aggregation of Standardised Mortality Ratios for under 75 year olds (SMR<75s) which are measured at the level of Middle Super Output Areas (MSOAs – a geographical area of on average about 7000 people). The resultant weights called SMR<75 weights are used as health needs weights to inform financial allocations for all three main allocation budgets - at the level of local authority (LA) for Public Health (PH) or clinical commissioning group (CCG) or NHS England Local Area Teams for primary care. This method was used originally in January 2013 to calculate PH allocations for LAs in 2013/14 and 2014/15[1], but has also been used in December 2013 to calculate the health inequalities/unmet need adjustment for CCG and local area primary care allocations for 2014/15 and 2015/16[2].

There is an important statistical problem with the way this method was applied. The top group (group 10) of the ten groups used was 8.4 times as wide as the mean width of groups two to nine. This extreme irregularity of group width results in a strong downward damping of deprivation weight for those LAs which have a substantial number of MSOAs in the top band.

This paper challenges the two reasons given by the Dept of Health (DH) for this vast top group width. It attempts to show, that the top (highest SMR<75) group should be split into a number of smaller groups and hence that the damping caused by the extreme width of the top group is inequitable. Evidence is used from data on confidence intervals, variability of death counts over time, and communication from the body responsible for the underlying data (the Office for National Statistics – ONS). One example is given of splitting the top group into groups of the same width as lower groups, using the same mathematical function used for the allocations. This example gives substantial increases in SMR<75 weight to those LAs with the very worst mortality e.g. increases in weight of: Blackpool + 40%, Salford + 30%, Manchester + 18%. Fifteen LAs have increases over 10%. These figures indicate the large scale of the damping produced for those individual LAs with the worst health.

This paper also calculates the effect of the above splitting of group 10 on allocation targets for all three allocation budgets – public health, CCG and Primary Care.

Coincidentally the correction of the problem in the example given in this paper also largely prevents PH target allocations moving overall resource in England in the 'wrong' direction in terms of reducing health inequalities. Public health Manchester have written a complementary note on this isuue.[3]

The lowest group (group 1) is also too wide (2.8 times the average of groups 2 to 9) and is corrected in our example but it is less important because it only significantly affects two LAs and by much smaller amounts. Hence this paper is mainly concerned with the effect of the size of the top group.

Introduction

In January 2013 the Dept. of Health (DH) introduced a new set of allocation formulae for Public Health (PH) allocations to Local Authorities (LAs). The main health needs formula (other than the age-gender formula) in this set was one based on the Standardised Mortality Ratio for people under age 75.[1] This particular mortality measure is often simply called the u75 SMR, but the DH used the notation SMR<75 and this will be used in this paper, with the formula derived by using this measure being called the SMR<75 formula.

The SMR<75 formula is based on grouping values of SMR<75 for Middle Super Output Areas (MSOAs) – a standard census definition of areas in England of average population around 7000. Each MSOA SMR<75 is assigned to one of ten groups, each group being given a weighting. The weightings are based on an exponential function where the ratio of weights of the top group (group 10) to the bottom group (Group 1) is 5. These groups are given in the table below:

Table of groups used to weight SMR<75 scores of MSOAs

Group	SMR<75 range	% of MSOAs	Group width	Group weight
1	25.90 to 61.90	5	36.000	1.00
2	61.91 to 74.29	14	12.386	1.20
3	74.29 to 86.67	20	12.386	1.43
4	86.67 to 99.06	16	12.386	1.71
5	99.06 to 111.44	12	12.386	2.04
6	111.44 to 123.83	9	12.386	2.45
7	123.83 to 136.21	8	12.386	2.92
8	136.21 to 148.59	6	12.386	3.50
9	148.60 to 165.89	5	17.300	4.18
10	165.90 to 275.60	5	109.700	5.00

It can be seen from the table that groups 2 to 8 have the same width, group 9 is rather wider, and the extreme groups 1 and 10 are much wider, especially group 10 which is about 9 times as wide as groups 2 to 8.

This paper is concerned with the effect of the extra width of Groups 1 and 10, and particularly group 10. on the LA weights resulting from the SMR<75 formula, Group 10's width has a powerful damping effect on the weights of a sizeable number of LAs which have significant numbers of MSOA values in Group 10 – these are LAs with the highest overall mortality; Group 1's width affects only two LAs significantly and by a relatively modest amount.

This paper argues that the resultant damping of weights, and hence reduction of allocation targets, for LAs of high mortality is inequitable. The reason for this is that the damping means that the resultant SMR<75 weight for LAs of high overall mortality does not fully account for all the mortality in the LA.

This SMR<75 formula was used to inform 2013/14 and 2014/15 PH allocations to LAs. Subsequently, in December 2013, a decision was made to use the same formula for the health inequalities/unmet need adjustment in Clinical Commissioning Group (CCG) allocations and Primary Care allocations to Area Teams[2]. The relevant years for these additional allocation budgets are 2014/15 and 2015/16.

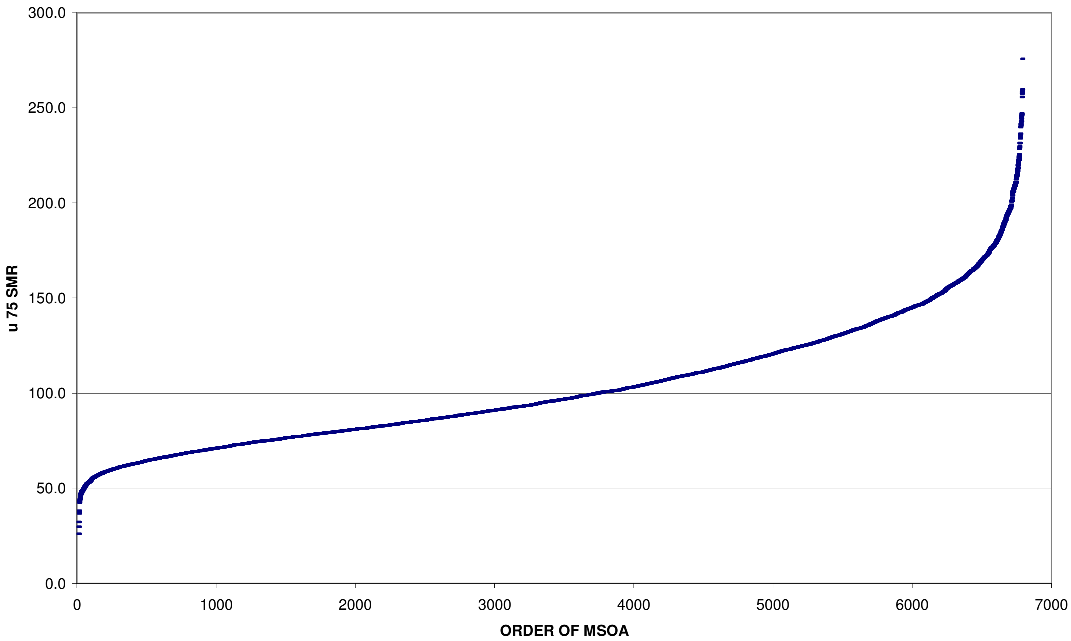
This paper assesses the impact of the width of Group 10 on allocation targets for all three allocation budgets – PH, CCG and Primary Care. It does this by re-calculating the SMR<75 weights based on 20 groups of even width rather than the original 10 groups. This re-calculation uses the same exponential function with the same ratio of 5 between the higher and lower 5% SMR<75 distribution points.

We see this use of groups of even width as a technical improvement.It is hoped, if future health needs formulae employ the grouping method, that a similar improvement can be considered before the next round of allocations.

1. The problem of the uneven widths of groups

The distribution of MSOA SMR<75s in England has very high and very low outlying values as shown in Figure 1. The very high values are an example of a long tail where a larger proportion of the distribution is in the tail than is the case for a normal distribution (the distribution has 4.4 % of values above 2 standard deviations compared with 2.3% for a normal distribution). Many health and deprivation metrics display such a distribution and for comparison Figure 2 shows the distribution of unemployment at MSOA level (5.1% of values above 2 standard deviations).

FIG 1 MSOA SMR<75 distribution 2006-10

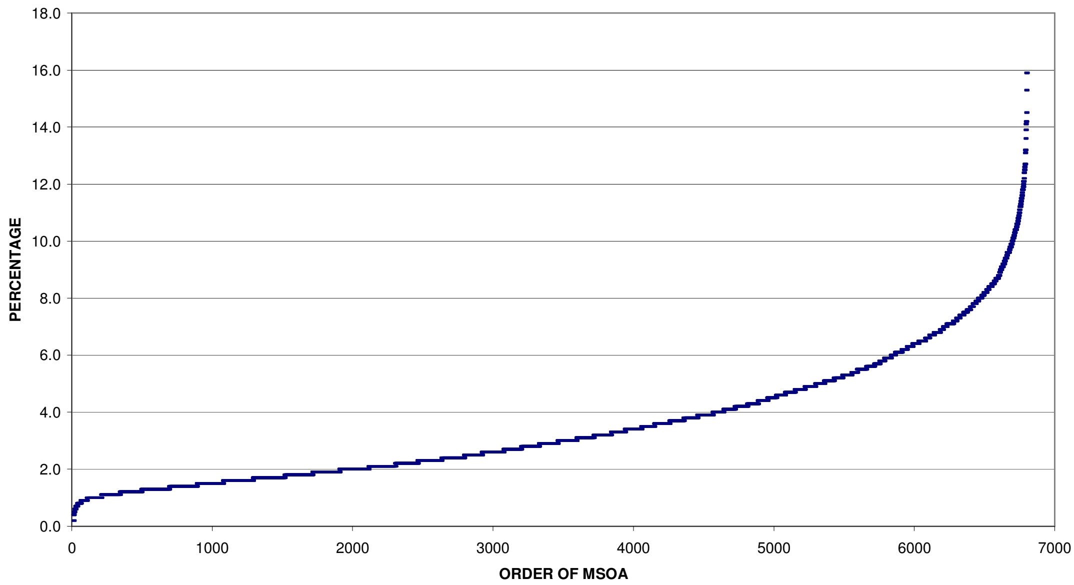


Source: Association of Public Health Observatories

The tails indicate the existence of a large number of high mortality and deprivation 'hotspots' and conversely a lower number of low mortality and deprivation 'coldspots'. The hotspots are well known to local authorities of high average mortality and deprivation; they have been recognised for a long time locally as 'problem areas'. The extreme high values of SMR<75 at MSOA level appear to be partly due to selection mechanisms whereby people with the poorest health (and hence usually poorest wealth) are usually concentrated in the poorest and hence cheapest areas.

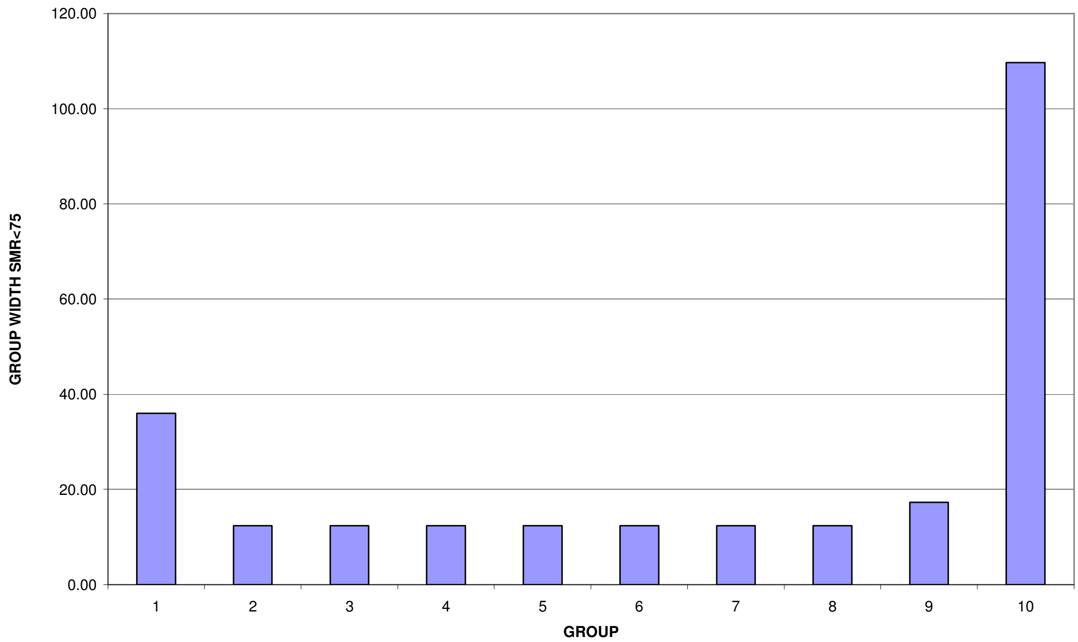
Concern at the accuracy of these tails may have influenced the application of the method of applying weights to groups of MSOAs depending on the value of the SMR<75. The widths chosen by the DH for the groups compress the weightings at the extremes - the ten groups have equal widths for groups 2 to 8 and a similar one for 9 but much larger widths for bands 1 and 10 as shown in Figure 3. This penalises local authorities with very high mortality (and conversely favours a few which have very low mortality). This problem was also evident in an earlier DH proposal and was pointed out by a number of respondents, including ourselves. But there has only been a very modest improvement since the original proposal.

FIG 2   Percentage of working age population claiming out of work benefits MSOAs 2011



Source: NOMIS

FIG 3   Width of SMR<75 groups used for SMR<75 formula



Some local authorities with overall high mortality have a large proportion of MSOA SMR<75s in group 10 and spread at values throughout the group and all these highly spread values are given the same score with a consequent damping of these high values leading to an overall aggregate score which undervalues the overall mortality of the LA. The examples of Manchester and Liverpool are given in Figures 4 and 5, showing their high proportion and high spread of SMR<75 values in group 10 (Manchester has nearly half of its MSOAs in this band)

FIG 4 Manchester MSOAs by SMR<75 group

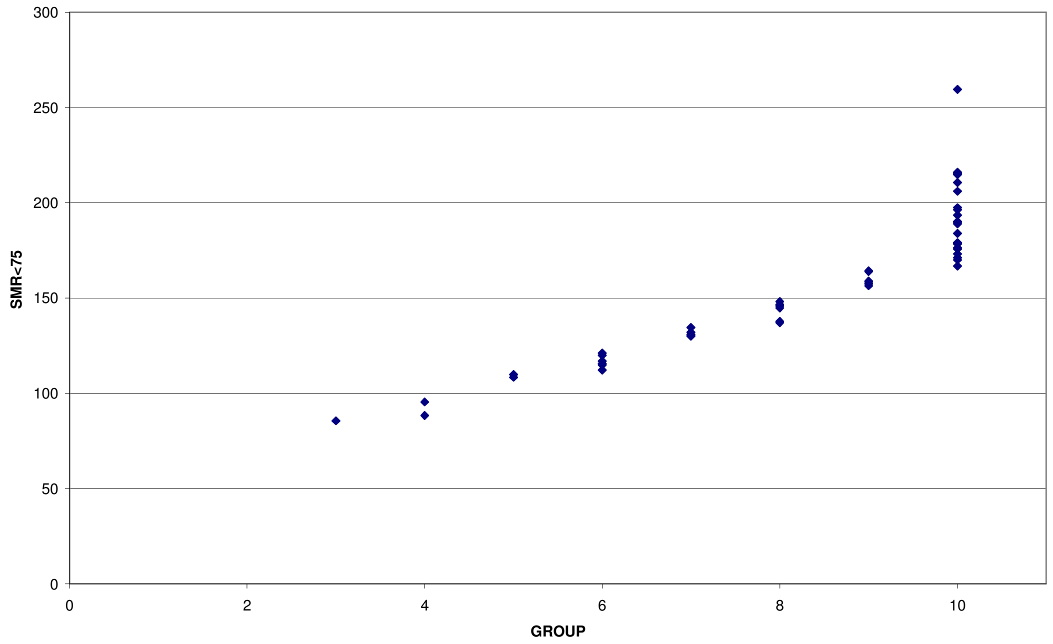
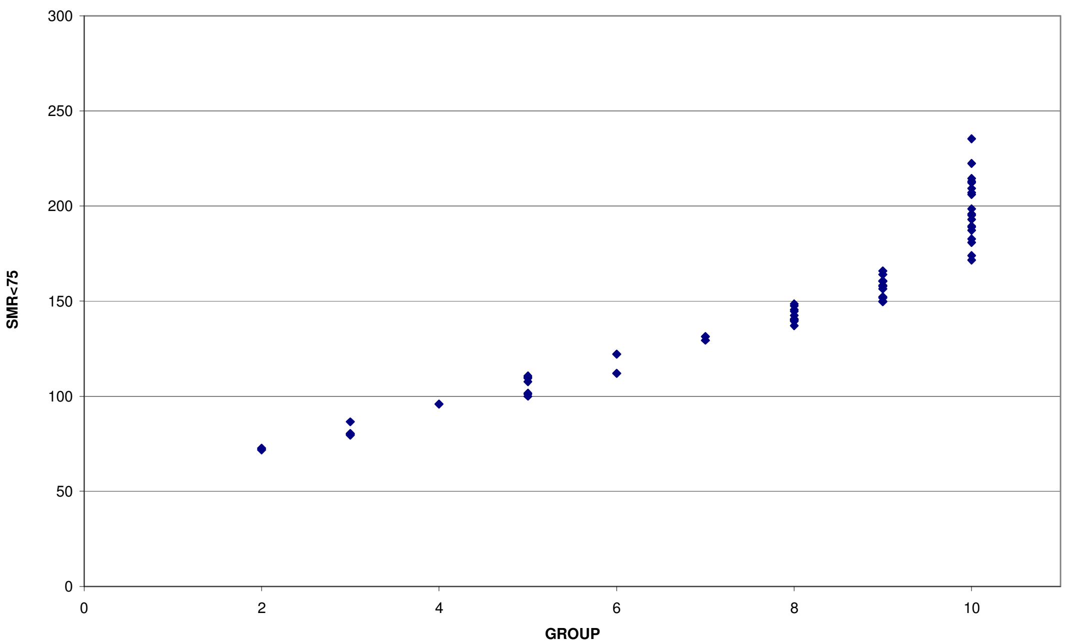
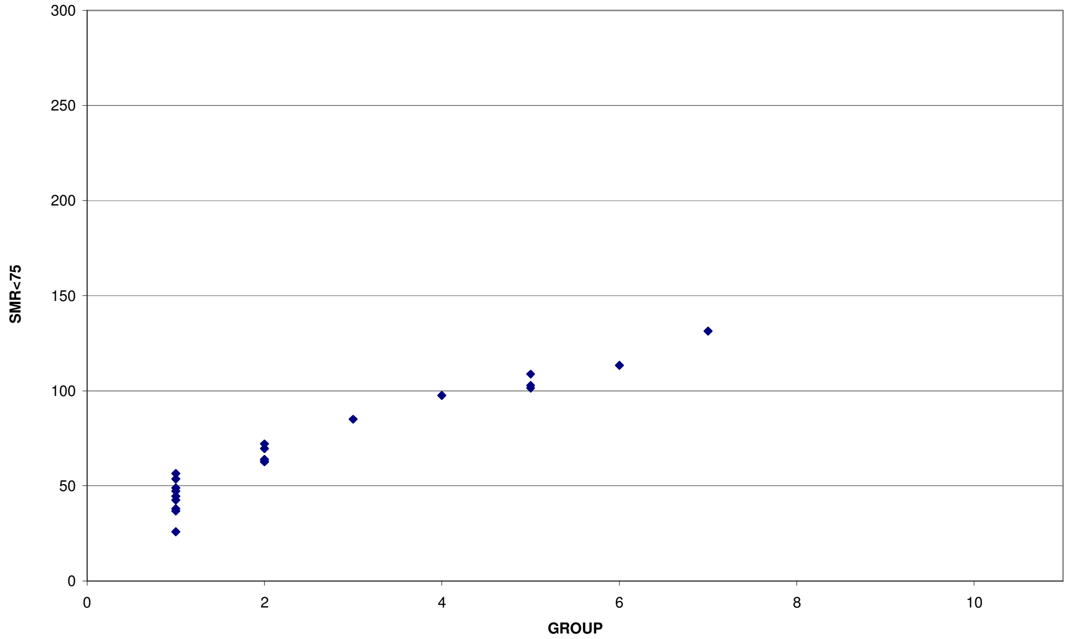


FIG 5 Liverpool MSOAs by SMR<75 group



At the other end of the scale group 1 is wide, though much smaller than group 10, and would amplify, rather than dampen, weights of LAs of very low mortality since a wide spread of low values are given the same weight. However there are few LAs with large numbers in this band and only Kensington & Chelsea significantly gain from this effect – see Figure 6 (Note the much lower values of SMR<75 than Manchester or Liverpool)

FIG 6 Kensington & Chelsea MSOAs by SMR<75 group



2. The DH justification of the extreme widths of groups 1 and 10.

The technical guide to PH allocations[4] gives two reasons as follows:

*'…**ACRA therefore recommended that each group should have at least 5% of MSOAs, to reduce the impact of random fluctuations in the SMR<75 over time and remove the impact of outliers which may be due to data issues…'***

And an earlier ACRA paper[5] expanded on this :

'***However, very high and very low SMR <75s may be at least partly due to random noise in the estimated SMR <75s. We cannot tell if they are true outliers or whether it is a data issue'***

These can be summarised as two reasons below:

(i) The very high and very low MSOA SMR<75s may be caused by inaccuracies in data and thus may not be true outliers.

(ii) There should be a minimum number of values (5%) in each group to reduce the impact of random fluctuations in SMR<75 over time causing movement of MSOAs between groups.

3. Tackling Reason (i) 'The very high and very low MSOA SMR<75s may be caused by inaccuracies in data and thus may not be true outliers'

This section considers confidence intervals, variability of deaths data and the view of the Office of National Statistics (ONS) who are responsible for the data used to calculate the SMR<75s at MSOA level.

3.1 Confidence Intervals of SMR<75 based on deaths data

For the high extreme group 10, recourse to confidence intervals (CIs) indicates the reliability of values in this group and indeed, their greater reliability (in terms of % confidence interval) than lower values in the other bands because of their greater number of deaths. Absolute CIs increase gradually with SMR<75 as the absolute number of the metric increases (this latter point will be dealt with under 'Tackling reason 2' below). For the extreme low group 1 CIs show absolute values less than other groups and percentage values higher. Table 1 gives mean 95% confidence intervals by group.

Table 1 DH groups with 95% Confidence Intervals

Group	SMR<75 range	% of MSOAs	Group width	Mean absolute CI	Mean % CI
1	**25.90 to 61.90**	5	36.000	27.8	49.4
2	**61.91 to 74.29**	14	12.386	30.2	44.1
3	**74.29 to 86.67**	20	12.386	32.8	40.8
4	**86.67 to 99.06**	16	12.386	36.2	39.0
5	**99.06 to 111.44**	12	12.386	39.8	49.4
6	**111.44 to 123.83**	9	12.386	43.2	36.8
7	**123.83 to 136.21**	8	12.386	46.2	35.7
8	**136.21 to 148.59**	6	12.386	49.1	34.5
9	**148.60 to 165.89**	5	17.300	51.8	33.1
10	**165.90 to 275.60**	5	109.700	57.1	30.2

Source: DH and Association of Public Health Observatories 2006-10 data

Figure 7 shows the absolute confidence intervals for the SMR<75 (2006-10) of all MSOAs in England and Figure 8 shows those in group 10 i.e. over 165.9. Absolute CIs increase gradually but % CIs decrease. The CI differences do not appear to warrant the exceptional width of the extreme groups, especially the upper one. Figure 8 shows a very gradual increase in absolute CI throughout the 165.9 to 275.60 range. This very gradual increase is an extension of the gradual increase up to165.9, thus not offering any reason to effectively aggregate nine potential groups from 165.9 upwards when with a similar gradually increasing absolute CI the slightly smaller range from 61.91 to 165.9 is split into eight groups.

FIG 7 95% Confidence Intervals for SMR<75 for all MSOAs in England

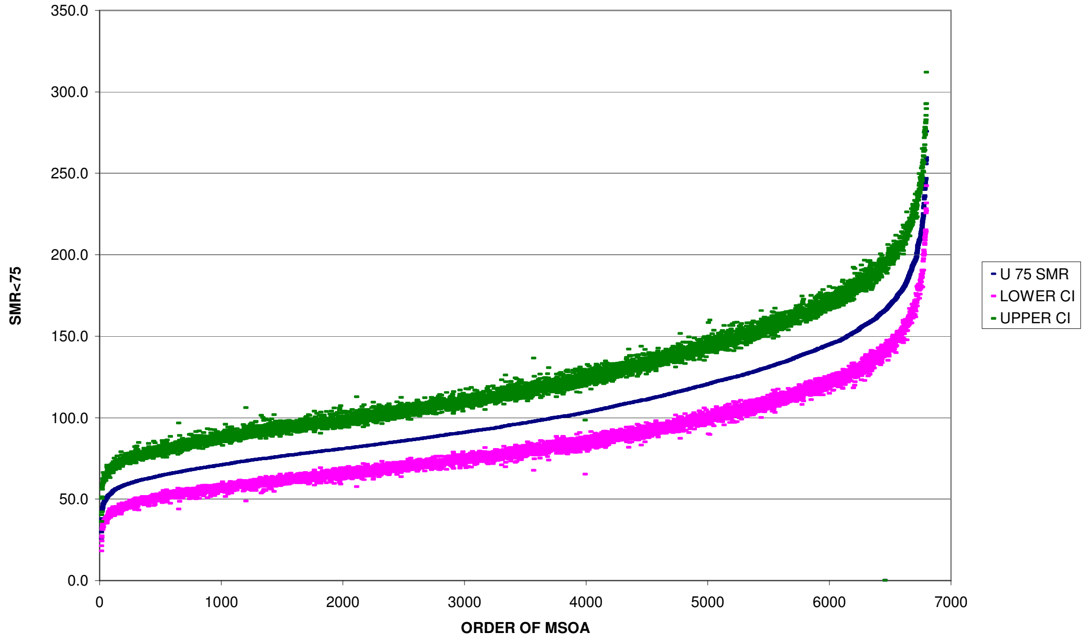
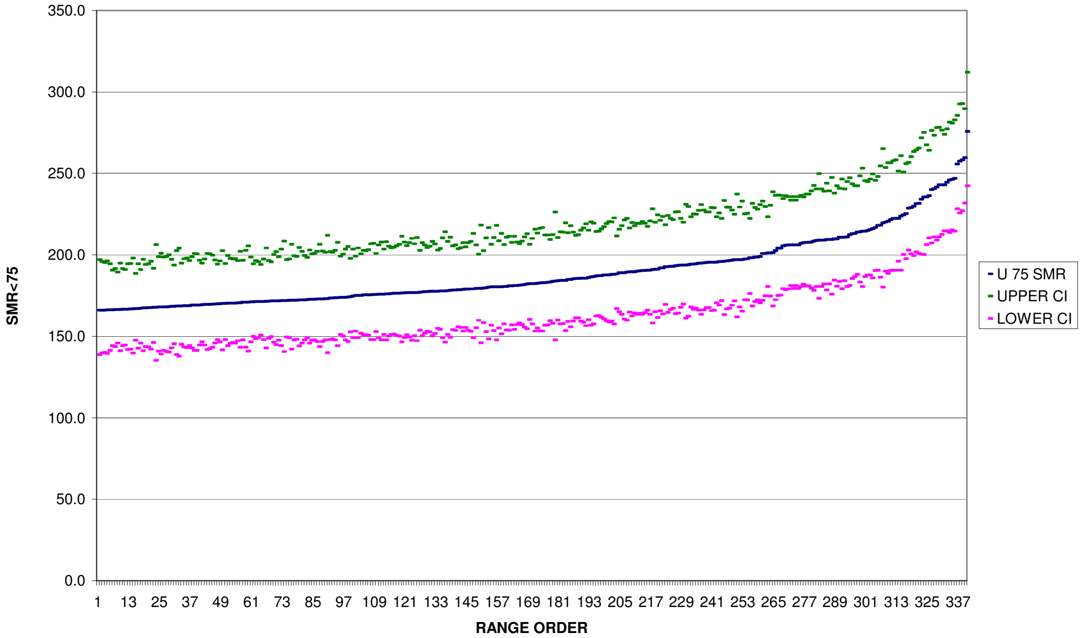


FIG 8   95% Confidence Intervals for MSOAs in England with SMR<75 greater than 165.9



Source data: Association of Public Health Observatories 2006-10 data

3.2 Variation in Manchester LA <75 deaths over time by group

If very high value SMR<75s are less accurate than lower values due to less accurate deaths data one would anticipate greater year by year variability. Such variability (as opposed to systematic bias) was tested on data in the City of Manchester to see if Group 10 exhibited suspiciously high variability. Data on numbers of registered deaths by year by MSOA were obtained from the Primary Care mortality database and analysed for the ten years 2001 to 2010. Each MSOA was allocated the appropriate group as defined by its SMR<75 using the ten DH groups, and the variation in annual <75 deaths over the ten years for each MSOA was estimated using the variance divided by the mean annual deaths. For small numbers of deaths expectation of a Poisson distribution is appropriate; in this distribution the variance is equal to the mean. The statistic of variance/mean (where the theoretical value is 1) indicates that the variability of group 10 is at the lower end of the scores as shown in Table 2

Table 2   Variability of Manchester LA annual <75 deaths by SMR<75 group 2001 to 2010

DH group	Group width SMR<75	No. MSOAs	Mean annual deaths	average var/mean
1	25.90 – 61.90	0		
2	61.90 – 74.29	0		
3	74.29 - 86.67	1	22	0.86
4	86.67 – 99.06	2	18	1.22
5	99.06 – 111.44	2	26	1.51
6	111.44 – 123.83	6	25	1.55
7	123.83 – 136.21	5	25	1.09
8	136.21 – 148.60	7	33	1.12
9	148.60 – 165.90	7	30	0.98
10	165.90 – 275.60	23	42	1.00

Table 3 shows that the proposed split of group 10 into smaller groups, described later in the paper in section 5 and table 5, does not indicate greater variability in the deaths numbers for higher SMRs.

In addition the correlation of variance/mean against 5 year 2006-10 SMR<75 for the 53 MSOAs in Manchester was significantly negative indicating a trend of reducing variability as SMR<75 increases.

This example indicates that the very high MSOA SMR<75 values in Manchester are based on deaths data which appears to be every bit as reliable as that for the lower SMR<75 values.

Table 3   Variability of Manchester LA annual <75 deaths within Group 10 when divided into new even groups, 2001 to 2010

proposed split of group 10 see table 5	Group width SMR<75	no MSOAs	Mean annual deaths	average var/mean
12	165.90 – 178.29	6	37	0.96
13	178.29 – 190.67	8	40	1.12
14	190.67 – 203.06	3	47	0.86
15	203.06 – 215.44	4	50	1.12
16	215.44 – 227.83	1	38	0.64
17	227.83 – 240.21	0	0	-
18	240.21 – 252.60	0	0	-
19	252.60 – 264.99	1	68	0.43
20	264.99 – 275.60	0	0	-

Note that these are mean annual deaths but that the SMR<75 in question used 5 year deaths 2006 -10 to improve accuracy.

3.3 Communication from the Office of National Statistics (ONS) on the reliability of the SMR<75 values for Group 10

The arguments above in sections 3.1 and 3.2 indicate that random effects of death counts cannot account for the very high values of SMR<75 in Group 10. If there were 'data issues' exaggerating the SMR<75 values of Group 10 these would have to be substantial systematic errors in collection of deaths data and/or in population estimates. We are not aware of any such errors, and it is certainly hard to imagine their existence in deaths data which have one of the most unbiased collection systems of any health metrics.

However we did contact the Office of National Statistics (ONS) to check on their view of the relative reliability of the deaths and population data which were used to calculate the MSOA SMR<75s in Group 10. ONS is responsible for producing this data.

ONS officials communicated by e-mail to Public Health Manchester that they have no evidence that the group 10 values are any less reliable than values of other groups. The full responses are given in Appendix 1, with the permission of the ONS respondents. Two responses were necessary from two departments, one covering the MSOA population estimates and one covering MSOA mortality counts.

The only caveat from the population estimate group at ONS indicated that reliability reduces with reducing population estimate at MSOA level. Using the same estimated population stream as used in the calculation of the SMR<75s used by the DH, but using the readily available 2011 rather than 2006-10, Group 10 had the largest mean population at 7502 compared with an overall mean of 7152 (these would be approximately 5 times larger in the calculation of the 5 year SMR<75). Hence it would be unlikely that Group 10 population estimates are less reliable than those of the other groups (they would have to be highly under-estimated to account for the high values).

The only caveat from the mortality group concerned a finding that a high proportion of health and care establishments in an area appears to increase mortality. But this effect would be expected to be largest for the very elderly and small for the under 75s. We are not aware of a geographical pattern in the proportions of health and care establishments but in view of the fact that the SMR<75 is being used as a proxy for health allocation needs it seems appropriate that higher numbers of health and care establishments which lead to higher mortality, would have higher health needs.

4. Tackling Reason 2. There should be a minimum number of values (5%) in each group to reduce the impact of random fluctuations in SMR<75 over time causing movement of MSOAs between groups.

It is not the ***number*** of MSOAs in a group which determines the proportion of SMR,75 values which move randomly between groups over time, ***but the variability of the data relative to the group width.*** Thus one key metric is absolute CI divided by group width. Table 4 gives this data for the ten DH groups.

Clearly the CI/group width metric justifies splitting the extreme groups. Taking the mean CI/group width for bands 2 to 9 of 3.17, this would justify, using the mean value as a guide, splitting group 10 into 6 groups and group 1 into 4 groups. Or taking the maximum CI/group width of 3.96 as the upper limit, it would justify splitting into 8 or 5 groups respectively. The example calculation below splits group 10 into 9 groups and group 1 into 3 groups in order to maintain equal widths. It is likely that the results obtained from this would be very similar to those using 8 and 4 groups respectively.

Table 4 DH Group widths and CIs

Group	Group width	Mean absolute CI	CI/Group width
1	36.000	27.8	0.77
2	12.386	30.2	2.44
3	12.386	32.8	2.65
4	12.386	36.2	2.92
5	12.386	39.8	3.21
6	12.386	43.2	3.49
7	12.386	46.2	3.73
8	12.386	49.1	3.96
9	17.300	51.8	2.99
10	109.700	57.1	0.52

Source: DH and Association of Public Health Observatories 2006-10 data

On the general question of the relation of group widths to year-on–year variation there is a trade off between accuracy/discrimination (narrower groups) and reduction of variation (wider groups) which would need experimental testing by e.g. Monte Carlo methods. Using the two datasets of SMR<75 of 2005-9 and 2006-10 the 10 group method of the DH gave an average absolute change in LA SMR<75 weight of 1.8% and the 20 group method described later in this paper (see section 5) gave one of 2.1%, the difference seeming barely significant. Also it is not clear how much of these changes can be viewed as non-random trends and how much as random effects.

5. Example of SMR<75 formula using approximately even groups throughout the range of SMR<75

A simple way of correcting for distortions caused by highly variable group widths is to maintain equal group widths throughout as in Table 5 (with one exception of maintaining one wider group 148.6 to 165.9 to keep the 1 to 5 weight ratio between the top and bottom 5% points in the SMR<75 distribution) and to continue the exponential curve.

Table 5 Actual and proposed SMR<75 groups

ACTUAL PROPOSED

SMR<75 Group lower limit	Group	SMR<75 weight		SMR<75 Group lower limit	Group	SMR<75 weight
25.90	1	1.00		25.90	1	0.70
61.90	2	1.20		37.13	2	0.84
74.29	3	1.43		49.51	3	1
86.67	4	1.71		61.90	4	1.20
99.06	5	2.04		74.29	5	1.43
111.44	6	2.45		86.67	6	1.71
123.83	7	2.92		99.06	7	2.04
136.21	8	3.50		111.44	8	2.45
148.60	9	4.18		123.83	9	2.92
165.90	10	5.00		136.21	10	3.50
275.60	10	5.00		148.60	11	4.18
				165.90	12	5.00
				178.29	13	5.98
				190.67	14	7.15
				203.06	15	8.55
				215.44	16	10.22
				227.83	17	12.23
				240.21	18	14.62
				252.60	19	17.48
				264.99	20	20.91
				275.60	20	20.91

Using the 20 groups of table 5 in place of the original 10 groups results in greater discrimination by overall local authority SMR<75 with substantially higher weights for local authorities with the very worst health. Tables 6 to 8 give descriptive statistics for the resulting weights of local authorities with Table 6 giving the original results based on 10 groups, table 7 giving new results for the proposed 20 groups, and table 8 giving the comparison between these two scenarios as a ratio of table 7 results to table 6 results.

Table 6   Results from the original 10 groups

	LOWER	UPPER	DIFF	RATIO
RANGE	0.56	1.78	1.22	3.20
INTER DECILE	0.74	1.45	0.71	1.96
INTERQUINTILE	0.78	1.28	0.50	1.64
INTER QUARTILE	0.79	1.26	0.46	1.58
wtd mean SMR < 100			0.80	
wtd mean SMR > 100			1.24	
Ratio of wtd means			1.55	

Table 7   Results from the proposed 20 groups

	LOWER	UPPER	DIFF	RATIO
RANGE	0.53	2.17	1.63	4.06
INTER DECILE	0.70	1.54	0.83	2.19
INTERQUINTILE	0.75	1.32	0.57	1.76
INTER QUARTILE	0.77	1.25	0.49	1.63
wtd mean SMR < 100			0.77	
wtd mean SMR > 100			1.28	
Ratio of wtd means			1.65	

Table 8   Ratios of proposed to original results

	LOWER	UPPER	DIFF	RATIO
RANGE	0.96	1.22	1.34	1.27
INTER DECILE	0.95	1.06	1.18	1.11
INTERQUINTILE	0.96	1.03	1.14	1.07
INTER QUARTILE	0.97	1.00	1.05	1.03
wtd mean SMR < 100			0.96	
wtd mean SMR > 100			1.03	
Ratio of wtd means			1.07	

Using the proposed 20 groups and weights above, the 10 largest increases in deprivation weights for LAs are shown in table 9.

Table 9   Top 10 increases in LA SMR<75 weight by using the proposed 20 groups

	Local Authority	LA SMR<75 2006-10	% MSOAs in group 10	% increase in weight
1	Blackpool	150.7	31.6	40.1
2	Salford	144.9	30.0	29.5
3	Middlesbrough	131.6	31.6	19.9
4	Wirral	119.5	26.2	19.6
5	Kingston upon Hull	136.6	21.9	17.7
6	Manchester	159.5	43.4	17.5
7	North East Lincolnshire	118.3	8.7	17.5
8	Stockton-on-Tees	114.3	12.5	17.2
9	Liverpool	147.8	32.2	15.2
10	St. Helens	120.4	17.4	14.8

This table shows that all top 10 gainers of using more groups are poor health areas with high local authority SMR<75 values; they generally have a high percentage of MSOA SMR<75s in original band 10. The actual gain in weight is of course only crudely related to the percentage in this group because the distribution within the band width of 165.9 to 275.6 will vary between local authorities.

These increases are offset by a small compensating reduction of about 3.8% in those local authorities which have no MSOA SMR<75s in group 10. The expansion of groups at the low end has little effect because so few local authorities have significant numbers of MSOAs of very low value, though Kensington and Chelsea is one with 42.9% of its MSOA SMR<75s under 61.9 and the expansion of the number of bands at the low end takes account of this with a reduction in weight of 8.6%.

The full set of LA SMR<75 weight changes is given in Appendix 2.

6. Converting changes in deprivation weight to changes in allocation target

6.1 Public Health allocations

The SMR<75 weight covers 87% of expenditure and so makes a large impact on allocation targets. The remaining 13% covers some of the substance misuse budget and uses activity and performance data. The diluting effect of this will vary by LA depending on the comparison of SMR<75 weight and this other weight. Table 10 gives the top ten increases in target allocation produced by using the 20 groups proposed in this paper rather than the 10 groups used by the DH.

Table 10 Top 10 increases in Public Health target allocation by using the proposed 20 groups

	% increase in weight	% increase in £ target	£ million increase in target
Blackpool	40.1	31.3	3.6
Salford	29.5	26.5	5.0
Manchester	17.5	15.5	7.9
Middlesbrough	19.9	15.3	1.8
Wirral	19.6	15.3	3.0
Kingston upon Hull, City of	17.7	14.3	2.8
North East Lincolnshire	17.5	14.0	1.3
Stockton-on-Tees	17.2	13.7	1.5
Liverpool	15.2	12.5	5.2
St. Helens	14.8	12.6	1.3

Changing from 10 to 20 groups moves £36 million overall in target allocation from better health LAs to poorer health LAs. Table 11 summarises this.

Table 11 Overall change in Public Health target allocation by using the proposed 20 groups.

	Target £ million	Change £ million	% change
Poorer health u75 SMR >100	1,587	36.0	2.3
Better health u75 SMR <100	1,072	-36.0	-3.4

The overall effect as shown in Table 11 is regrettable and seems to contradict policy to reduce health inequalities. Nevertheless the biggest effect of the problem of Group 10 is on individual LAs with the highest mortality, as exemplified in Table 10. It is these individual LAs that would gain most from the improvement addressed in this paper. Thus for Public Health target allocations, 38 LAs would gain an average 9.1% (balanced by 113 LAs losing an average of 3.4%) with 15 LAs gaining more than 10%. This general point about changes to individual areas being much greater than the overall change also applies to CCG and Primary Care allocations in the next section.

6.2 CCG and Primary Care allocations

Here the SMR<75 weights are diluted much more than in public health. For CCGs the SMR<75 weights are applied with a 'weight' of 10% and for Primary Care with a 'weight' of 15%. Therefore the changes in target allocation brought about by using the proposed 20 groups will be much less in percentage terms for individual CCGs than the change in SMR<75 weight. But because the total CCG and primary care quanta are much larger (2014/15 CCG c. £64b, Primary Care c.£12b compared with c.£2.8b for Public Health) the changes in terms of £ at CCG level can be expected to be larger than those in public health allocations. Analysis of the allocation spreadsheets released by NHS England in March 2014 gave the results in tables 12 and 13 for the five biggest increases in target allocation produced by using the proposed 20 groups.

Table 12 Top five increases in CCG target allocation for 2014/15 by increasing from 10 to 20 groups

CCG	%	£ million
NHS Bradford City CCG	10.6	13.2
NHS North Manchester CCG	6.5	16.2
NHS Blackpool CCG	5.2	11.8
NHS Salford CCG	3.9	13.0
NHS Hull CCG	2.4	7.7

Table 13 Top five increases in Area team Primary Care target allocation for 2014/15 by increasing from 10 to 20 groups

Primary Care Area Team	%	£ million
Greater Manchester	2.1	14.6
Merseyside	1.8	5.7
Lancashire	1.5	5.2
West Yorkshire	0.8	4.3
Durham, Darlington and Tees	0.6	1.8

The highest reductions are smaller being around 0.6% for both CCGs and Area Teams but they outnumber the increases.

Changes in immediate actual allocations by increasing the number of groups will be much less than those in target allocations shown above because of the damping effect of pace of change policy, the change in target allocation representing the longer-term allocation aim.

7. The North/South effect in target allocations

Because there are many more high u75 SMR MSOAs in the North than in the South of England, the North has a relative disadvantage compared to the South caused by the large width of Group 10. In particular a group of northern inner city areas are badly affected. The northern disadvantage affects all allocations – public health, CCG and Area team primary care. It is much higher in percentage terms for public health allocations, though not in £ terms, than for CCG or primary care allocations. Public health results below are for 2013/14 and CCG and Primary care results are for 2014/15.

In general, for all three allocation budgets, the largest and most important effects are for those individual LAs, CCGs and ATs which have high mortality, the great majority being in the northern half of England. The overall North/South effect is much smaller in percentage terms because of the dilution effect of those northern areas which do not have high mortality.

7.1 North/South effect for Public Health

The size of the movement of target allocation is similar to that of Table 11 for the movement from LAs with SMR<75 <100 to LAs of SMR<75 >100. Tables 14 and 15 show this effect for two definitions of 'North' - Table 14 uses the approximate historical division of England into two roughly equal populations of a line from Severn to Wash, while Table 15 uses a narrower definition of North of the three northernmost Regions which excludes the two Midlands Regions.

Table 14 North/South change in PH target allocation for 2013/14 by using the proposed 20 groups (using approx. Severn to Wash dividing line)

	Target £ million	Change £ million	% change
North (5 Regions)	1,376	+36.7	+2.7
South (4 Regions)	1,283	-36.7	-2.9

Table 15 North/South change in PH target allocation for 2013/14 by using the proposed 20 groups (using 3 region definition of North, excluding Midlands)

	Target £ million	Change £ million	% change
NE,NW,YH	868	+42.6	+4.9
South & Midlands	1,792	-42.6	-2.4

7.2 North/South effect for CCGs

These are equivalent calculations to those in section 7.1

Table 16 North/South change in target allocation for 2014/15 for CCGs by using the proposed 20 groups (using approx. Severn to Wash dividing line)

	Target £ million	Change £ million	% change
North (5 Regions)	30,634	+99.5	+0.3
South (4 Regions)	32,110	-99.5	-0.3

Table 17 North/South change in target allocation for CCGs by using the proposed 20 groups (using 3 region definition of North, excluding Midlands)

	Target £ million	Change £ million	% change
NE,NW,YH	18,695	+118.3	+0.6
South & Midlands	44,049	-118.3	-0.3

7.3 North/South effect for Primary Care

These are equivalent calculations to those in sections 7.1 and 7.2.

Table 18 North/South change in target allocation for 2014/15 for Primary Care by using the proposed 20 groups (using approx. Severn to Wash dividing line)

	Target £ million	Change £ million	% change
North (5 Regions)	5,789	+28.7	+0.5
South (4 Regions)	6,230	-28.7	-0.5

Table 19 North/South change in target allocation for 2014/15 for Primary Care by using the proposed 20 groups (using 3 region definition of North, excluding Midlands)

	Target £ million	Change £ million	% change
NE,NW,YH	3,669	+34.4	+0.9
South & Midlands	8,350	-34.4	-0.4

Postscript

This paper has been written to encourage the statistical improvement of a method. The method is the particular application of the small area (MSOA) SMR<75 (or similar metric) grouping, weighting and aggregation method used originally to calculate LA health needs weights in the PH allocations for 2013/14 and 2014/15. The same method has been subsequently been used to calculate the deprivation/unmet need adjustment in CCG and Primary Care allocations for 2014/15 and 2015/16.

But the author is not convinced that this is the best method for calculating health needs weights for LAs or CCGs. One disadvantage of grouping is that it approximates by reducing the original information, rather like digitising analogue signals. As already mentioned in this paper, in the general question of the relation of group widths to year-on–year variation there is a trade off between accuracy/discrimination (narrower groups) and reduction of variation (wider groups) which would need experimental testing by e.g. Monte Carlo methods. Using the two datasets of u75 SMR of 2005-9 and 2006-10 the 10 group method of the DH gave an average absolute change in local authority deprivation weight of 1.8% and the 20 group method in this paper gave one of 2.1%, the difference seeming barely significant. Also it is not clear how much of these changes can be viewed as non-random trends and how much as random effects.

It would seem obvious that the use of a direct function of SMR<75 at MSOA level would be more accurate, but the question of whether any increased year-on-year random variability is acceptable needs investigation. It is understood that one of the reasons why groups were first introduced was that they allow communication of inter-decile etc. ratios for judgment calls by experts, but a direct function would also have an equivalent point ratio which is meaningful.

A number of respondents in the 2012 consultation on public health allocation formulae expressed concern about the variability over time of MSOA level data as an issue whatever the grouping method. More precise than data at MSOA level would be direct use of data at LA/CCG level which would require evidence or judgment of a mathematical function at this level. We did present some evidence for a formula using LA-level u75 SMR in the 2012 consultation on PH allocation formulae. At this level Directly Standardised Rates (DSRs) could be used in place of SMRs; some argue that use of DSRs in this area is more appropriate. Information on internal inequalities within LAs/CCGs would be lost but a separate calculation and adjustment could be made for this which would make it more transparent. In the current grouping method with exponential curve the components of the SMR<75 weights which are due to LA internal inequalities are not evident, which does not seem ideal under the requirement of transparency in resource allocation methods.

References

1. Department of Health, 'Ring fenced public health grants to local authorities 2013-14 and 2014-15' and associated papers 10 January 2013. https://www.gov.uk/government/publications/ring-fenced-public-health-grants-to-local-authorities-2013-14-and-2014-15

2. NHS England, Clinical Commissioning Group allocations 2014/15 and 2015/16. 20 Dec 2013. http://www.england.nhs.uk/2013/12/20/ccg-allocations/

3. Public Health Manchester. 'Note on how the public health allocation formula moves resource in the 'wrong' direction – from poorer health LAs to better health LAs'. February 2014.

4. Department of Health, Exposition Book Public Health Allocations 2013-14 and 2014-15: Technical Guide (2013) Para 3.6 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/213324/Public-Health-Weighted-Capitation-FormulaTechnical-Guide-v0.13.pdf

5. Advisory Committee on Resource Allocation (ACRA) Paper (2012)16 – Public Health - finalisation of formula. Para 18 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/213331/ACRA201216-Public-Health-Finalisation-of-formula.pdf

Appendix 1 Responses by e-mail from ONS

This question was e-mailed to ONS:

20 January 2014

Dear ONS

I would be very grateful if you could comment on the following issue:

The Dept of Health publication 'Exposition Book Public Health Allocations 2013-14 and 2014-15:technical guide' obtainable in the link below attempts to explain why all MSOAs with under 75 Standardised Mortality 2006-10 above 165.9 (the top 5%) are given the same weight for allocation purposes.

One of the two reasons given in para 3.6 is : 'to remove the impact of outliers which may be due to data issues' .

We in Manchester have 43% of our MSOAs in this high u75 SMR group and we are not aware of these figures being any less reliable than lower u75 SMRs. Deaths data in these high u75 SMR MSOAs show no more time variation than those with lower values. Also we imagine that it is not possible to define varying reliablilty in population estimates in different mortality groups of MSOAs.

Are we correct in our thinking i.e that there is no indication available of worse reliability of MSOA population age band estimates for MSOAs with the highest 5% of u75 SMR ?

Could you please also ask your colleagues the equivalent question for death data.

The technical guide is at :
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/213324/Public-Health-Weighted-Capitation-FormulaTechnical-Guide-v0.13.pdf

The source of u75 SMR is the Association of Public Health Observatories (APHO)who give data sources in their file attached.

I look forward to hearing from you

John

John Hacking
Senior Research Officer
Public Health Manchester
Manchester City Council

1.1 Response from the population estimates group

30 January 2014

Dear John

Sorry for the delay in responding to your e-mail.

There are no specific quality issues with particular age-groups in the MSOA population estimates. However, where the population numbers in any given age-group are particularly small, then caution is required when interpreting the estimates. This is the same advice that also applies when using the data when it is broken down to lower (smaller) levels of geography such as OA or LSOA. It is possible that particularly high figures for SMRs correspond to age groups with low population counts and this is why some caution has been applied in assuming equivalent weights for allocation purposes.

Analysis of the latest mid-2011 SOA population estimates (based on the 2011 Census) versus the series based on rolling forward from the 2001 Census (the data used for this analysis) shows that the quality of the estimates can vary between areas but I am not aware of any specific issue that would affect those MSOAs with high u75 SMR.

http://www.ons.gov.uk/ons/rel/sape/soa-mid-year-pop-est-engl-wales-exp/mid-2011--census-based-/stb---super-output-area---mid-2011.html#tab-Comparison-with-series-rolled-forward-from-2001-Census

However, I am not familiar with this specific use of the MSOA population estimates and would advise contacting the authors of the report to get further information on the reasons for the assumptions they have made in their analysis.

I have copied this reply to the ONS team who produce MSOA deaths data, who should be able to advise you on any potential issues with that data source.

Thanks,
Fiona

Fiona Aitchison
Senior Research Officer | Population Estimates Unit | Population Statistics Division | Office for National Statistics | Segensworth Road | Titchfield | Hampshire | PO15 5RR | Room 2300

1.2 Response from the mortality group

11 March 2014

Dear John

My apologies for not getting back to you sooner. We don't know of any specific issues regarding the number of deaths in MSOAs with high SMRs - other than this might be due to random variation or the issues regarding small populations that Fiona has mentioned already.

ONS didn't calculate the SMRs for the report and we always recommend caution when interpreting figures for small areas. For example when calculating ward level life expectancies in the past ONS have included an indicator to show the proportion of people aged 65 and over who were resident in a health and care communal establishment - this is because the mean life expectancy was on average 2 years lower in wards where there was a high proportion of those aged 65+ resident in medical and care establishments.

I hope this helps - please do let me know if you have any further queries.
Many Thanks
Claudia

Claudia Wells | Head of Mortality Analysis | Life Events and Population Sources Division | Office for National Statistics | Cardiff Road | Newport | Wales | NP10 8XG

Appendix 2

Effect on deprivation weights of LAs by splitting group 10 into 9 groups and group 1 into 3 groups, whilst maintaining the original exponential function with the ratio of the lower 5% point to the upper 5% point at 1 to 5.

	Local Authority	Original SMR<75 weight	New SMR<75 weight	% difference
1	Blackpool	1.55	2.17	40.1
2	Salford	1.59	2.06	29.5
3	Middlesbrough	1.45	1.73	19.9
4	Wirral	1.22	1.45	19.6
5	Kingston upon Hull, City of	1.37	1.61	17.7
6	Manchester	1.78	2.09	17.5
7	North East Lincolnshire	1.17	1.37	17.5
8	Stockton-on-Tees	1.10	1.29	17.2
9	Liverpool	1.62	1.86	15.2
10	St. Helens	1.21	1.39	14.8
11	Bradford	1.26	1.42	12.8
12	Oldham	1.46	1.65	12.6
13	Bolton	1.35	1.51	12.4
14	Blackburn with Darwen	1.51	1.68	11.5
15	Stockport	0.98	1.08	10.6
16	Nottingham	1.41	1.54	9.1
17	Leicester	1.42	1.53	7.9
18	Rochdale	1.38	1.49	7.7
19	Halton	1.47	1.58	7.3
20	Southampton	1.16	1.23	6.1
21	Darlington	1.19	1.26	5.7
22	Newcastle upon Tyne	1.27	1.34	5.6
23	Sunderland	1.26	1.33	5.6
24	Plymouth	1.02	1.06	4.5
25	Derby	1.19	1.24	3.8
26	Wigan	1.26	1.30	3.6
27	Leeds	1.10	1.13	3.4
28	Tameside	1.38	1.42	2.9
29	Knowsley	1.51	1.55	2.4
30	Lancashire	1.07	1.09	1.9
31	North Somerset	0.77	0.78	1.9
32	Sefton	1.08	1.10	1.6
33	Portsmouth	1.23	1.24	1.3
34	North Tyneside	1.17	1.19	0.9
35	Bournemouth	0.97	0.98	0.9
36	Lambeth	1.56	1.57	0.8
37	Stoke-on-Trent	1.32	1.33	0.6
38	Northamptonshire	0.94	0.94	0.6
39	Rotherham	1.06	1.06	0.1
40	Bury	1.09	1.09	-0.3
41	Coventry	1.30	1.29	-0.3
42	Gateshead	1.22	1.21	-0.5
43	Hartlepool	1.35	1.35	-0.5
44	Birmingham	1.30	1.29	-0.7

	Local Authority	Original SMR<75 weight	New SMR<75 weight	% difference
45	Warrington	1.09	1.08	-0.8
46	Medway	1.11	1.10	-1.2
47	Kirklees	1.13	1.12	-1.3
48	Wandsworth	1.12	1.10	-1.3
49	Calderdale	1.09	1.07	-1.5
50	Brighton and Hove	1.23	1.21	-1.5
51	Newham	1.62	1.59	-1.5
52	Cumbria	0.96	0.94	-1.7
53	Northumberland	0.90	0.89	-1.8
54	Peterborough	1.11	1.09	-1.9
55	Luton	1.28	1.25	-1.9
56	South Tyneside	1.23	1.21	-2.1
57	North Lincolnshire	1.03	1.01	-2.2
58	Kent	0.86	0.84	-2.3
59	Doncaster	1.15	1.12	-2.7
60	Walsall	1.21	1.17	-2.8
61	Greenwich	1.48	1.44	-2.9
62	Barnsley	1.26	1.22	-3.0
63	East Sussex	0.79	0.76	-3.0
64	Bristol, City of	1.13	1.10	-3.1
65	Lincolnshire	0.87	0.84	-3.1
66	Sandwell	1.46	1.41	-3.2
67	Essex	0.79	0.77	-3.2
68	Sheffield	1.02	0.99	-3.2
69	Norfolk	0.75	0.72	-3.3
70	West Sussex	0.77	0.74	-3.4
71	Nottinghamshire	0.92	0.89	-3.5
72	Tower Hamlets	1.63	1.56	-3.8
73	Islington	1.63	1.57	-3.8
74	Wolverhampton	1.26	1.22	-3.8
75	Hackney	1.62	1.56	-3.8
76	Barking and Dagenham	1.45	1.39	-3.8
77	Wakefield	1.16	1.11	-3.8
78	Reading	1.20	1.15	-3.8
79	Redcar and Cleveland	1.08	1.03	-3.8
80	Southwark	1.35	1.30	-3.8
81	Waltham Forest	1.30	1.25	-3.8
82	Haringey	1.31	1.26	-3.8
83	County Durham	1.05	1.01	-3.8
84	Lewisham	1.29	1.24	-3.8
85	Camden	1.26	1.22	-3.8
86	Telford and Wrekin	1.03	0.99	-3.8
87	Southend-on-Sea	1.02	0.98	-3.8
88	Slough	1.22	1.17	-3.8
89	Bedford	0.99	0.96	-3.8
90	Dudley	0.94	0.91	-3.8
91	Hounslow	1.12	1.08	-3.8
92	Milton Keynes	1.01	0.97	-3.8
93	Swindon	0.97	0.93	-3.8
94	Trafford	0.96	0.93	-3.8
95	Cheshire West and Chester	0.91	0.88	-3.8
96	Hammersmith and Fulham	1.15	1.10	-3.8

	Local Authority	Original SMR<75 weight	New SMR<75 weight	% difference
97	Torbay	0.87	0.84	-3.8
98	Ealing	1.08	1.04	-3.8
99	Brent	1.08	1.04	-3.8
100	Staffordshire	0.87	0.84	-3.8
101	Derbyshire	0.86	0.83	-3.8
102	Thurrock	0.96	0.92	-3.8
103	Hillingdon	1.03	0.99	-3.8
104	Cheshire East	0.84	0.81	-3.8
105	Solihull	0.83	0.79	-3.8
106	Warwickshire	0.85	0.82	-3.8
107	Worcestershire	0.79	0.76	-3.8
108	Enfield	0.95	0.91	-3.8
109	Havering	0.92	0.89	-3.8
110	Herefordshire, County of	0.76	0.73	-3.8
111	East Riding of Yorkshire	0.77	0.74	-3.8
112	Bexley	0.88	0.85	-3.8
113	Gloucestershire	0.78	0.75	-3.8
114	Redbridge	0.90	0.87	-3.8
115	Sutton	0.89	0.85	-3.8
116	Shropshire	0.75	0.72	-3.8
117	Isle of Wight	0.78	0.75	-3.8
118	Central Bedfordshire	0.79	0.76	-3.8
119	Cornwall	0.73	0.70	-3.8
120	North Yorkshire	0.75	0.72	-3.8
121	Poole	0.75	0.72	-3.8
122	Bracknell Forest	0.85	0.82	-3.8
123	Leicestershire	0.72	0.69	-3.8
124	Suffolk	0.70	0.68	-3.8
125	Buckinghamshire	0.78	0.75	-3.8
126	Kingston upon Thames	0.79	0.76	-3.8
127	Windsor and Maidenhead	0.81	0.78	-3.8
128	Merton	0.79	0.76	-3.8
129	Bath and North East Somerset	0.71	0.68	-3.8
130	West Berkshire	0.75	0.72	-3.8
131	Barnet	0.79	0.76	-3.8
132	Harrow	0.74	0.72	-3.8
133	Richmond upon Thames	0.71	0.68	-3.8
134	Wokingham	0.64	0.61	-3.8
135	Rutland	0.56	0.53	-3.8
136	Isles of Scilly	0.50	0.48	-3.8
137	Devon	0.67	0.65	-3.9
138	Somerset	0.70	0.67	-3.9
139	Hampshire	0.73	0.70	-3.9
140	Wiltshire	0.71	0.69	-4.0
141	Croydon	1.03	0.99	-4.0
142	Dorset	0.64	0.61	-4.0
143	Surrey	0.74	0.71	-4.0
144	Oxfordshire	0.81	0.77	-4.1
145	Hertfordshire	0.82	0.79	-4.1
146	Cambridgeshire	0.74	0.71	-4.1
147	Bromley	0.77	0.74	-4.1
148	South Gloucestershire	0.67	0.64	-4.1

	Local Authority	Original SMR<75 weight	New SMR<75 weight	% difference
149	York	0.79	0.76	-4.1
150	Westminster	0.90	0.85	-5.5
151	Kensington and Chelsea	0.76	0.70	-8.6
	England	1.00	1.00	0.0