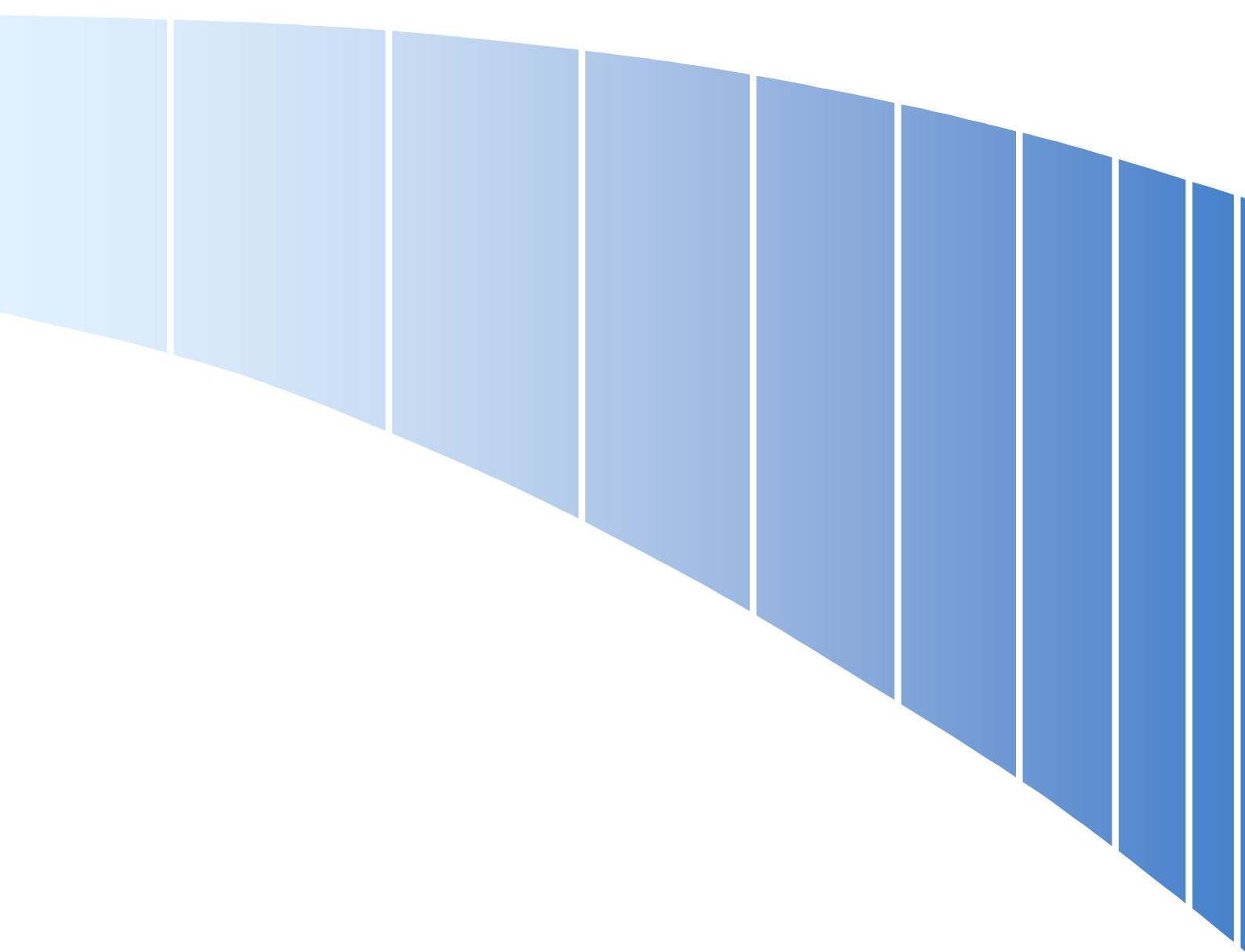


Payment by Results

Technical Working Paper: Estimating the Impact of Specialised Activity on Providers Costs for 2009-10



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Contents

1. Introduction & Background	3
2. Selection of specialised procedure and diagnosis codes	4
3. Regression analysis to estimate impact on providers' costs	6
4. Results and Supplements	8
5. Annex A – Regression Output	9
6. Annex B – List of Coded Definition Sets	11

Specialist Top-ups in 2009-10

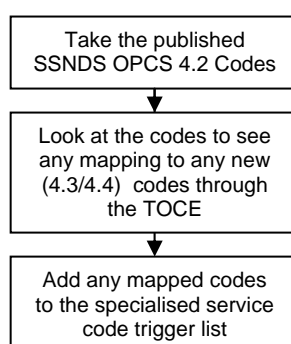
1. Introduction & Background

- 1.1 For the past few years, PbR has operated a system of top-ups for reimbursing specialised activity. The specialist top-up policy was introduced as a means of addressing the shortcomings of HRGv3.5 in differentiating between specialised and routine activity. These shortcomings stem from the fact that version 3.5 was designed for benchmarking rather than payment purposes and are based on a dated version of OPCS procedure and intervention codes. With HRGv3.5, tariff prices calculated on average cost mean that where an HRG has a mix of specialised and routine activity the price under-reimburses specialised activity. The top-up was designed to address this and adjust the tariff price to reflect and reimburse the higher costs.
- 1.2 Regression modelling is used to estimate the impact of specialised activity on providers' costs. With the introduction of HRG4, we have re-run the same regression model as in previous years.
- 1.3 Procedure and diagnosis codes identified from the Specialised Services National Definition Sets (SSNDS) have been used as indicators of specialised activity. Where a relationship between this type of activity and increased cost was found to be statistically significant, a specialised supplement to the tariff has been calculated. This supplement is a percentage of the relevant HRG tariff, known as a "top-up".
- 1.4 The purpose of this note is to set out the details of the statistical analysis from which the tariff supplements have been derived.

2. Selection of specialised procedure and diagnosis codes

- 2.1 The Specialised Services National Definition Sets (SSNDS) contain descriptions of activity that is regarded as specialised. The set comprises 35 different specialised services. Some of these definitions are detailed, and directly identify the procedure/intervention and diagnosis codes which are counted as specialised.
- 2.2 All of the definition sets that are coded were included in this analysis and totals 25. The list of included definition sets are provided in Annex B.
- 2.3 It should be noted that owing to delays with the current SSNDS being published (based on OPCS 4.4 codes) the previous version (2nd revision) of the SSNDS has been used (based on OPCS 4.2 codes).
- 2.4 To help minimise the impact of the differences between OPCS 4.2 and 4.4 the PbR development team have derived (based on the published SSNDS 4.2 codes) the relevant OPCS 4.4 codes.
- 2.5 The existing 4.2 codes were compared against the 4.4 codes that are "assigned" to them through the 4.4-4.2 table of coding equivalence (TOCE) used within the NHS Information Centre's HRGv3.5 grouper software. This enabled any new OPCS 4.4 (and 4.3) codes to be included in the specialist service coding. This is illustrated in figure 1 below.

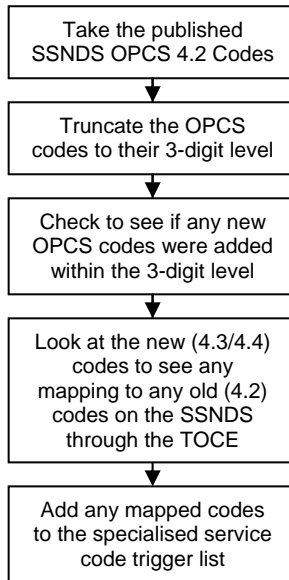
Figure 1



- 2.6 For example, M478 is the original OPCS 4.2 code, however, through the TOCE, OPCS 4.4 code M475 is mapped back to M478; therefore, both of these codes were included on the specialist service-coding list.

2.7 In addition, the OPCS 4.2 codes were analysed at their higher 3-digit level to see if any new codes were added after OPCS 4.2 (i.e. in OPCS 4.3 or 4.4). Those codes that were added were then compared with the data in the TOCE to see if any of the newly added codes mapped back to a 4.2 code that is included in the specialist service coding and if so, the code was added to the OPCS 4.4 list. This is illustrated in figure 2 below.

Figure 2



2.8 For example, A704 and A705 were added under the OPCS 4.3 revision. A704 maps back to A701 (which is on the specialist service-coding list) and A705 maps to A708 (which is not on the specialist service-coding list), therefore A704 was added to the specialist service-coding list and A705 was not.

2.9 The design of the HRGs to be used for payment in the 2009/10 financial year is dependent on the use of OPCS-4.4 codes. As such, codes introduced or amended as part of the OPCS-4.5 enhancement are accommodated by the HRG4 2009/10 Local Payment grouper, though HRG design is not driven by the new codes. Thus, the grouping software (both the Information Centre Local Grouper and the SUS Grouper) will use a Table of Coding Equivalence (TOCE) to map all new OPCS 4.5 codes back to OPCS 4.4 codes. As part of this mapping, any new OPCS 4.5 code that is mapped back to an OPCS 4.4 code that is in the specialised service-coding list will also be eligible to receive a top-up.

2.10 Procedure/intervention codes, as in 2008-09, will trigger a top-up in any position¹. For diagnosis codes, as in 2008-09, only the primary diagnosis code will trigger a top-up.

¹ The final procedure/intervention and diagnosis code specialised service “trigger list” for 2009-10 is available on the PbR website in the Guidance and Supporting Information section.

3. Regression analysis to estimate impact on providers' costs

- 3.1 Multiple regression analysis is a statistical technique used in analysing relationships between variables. For specialist top-ups the regression analysis looks at the relationship between cost and activity to see how much, if any, the cost of providing specialised activity differs to non-specialised activity.
- 3.2 A dataset was assembled using HES activity data and Reference Cost data from 2006-07. The specialised activity from HES is used to try and explain the variation observed in the cost data from Reference Costs.
- 3.3 The regression model and dataset are explained below. Annex A provides the regression output along with some more specific detail of certain aspects of the regression

Cost Data

- 3.4 The purpose of the regression model is to see how much of the difference between a provider's cost of a HRG and the national average cost can be explained by the level of specialised activity performed by that provider in that HRG. To achieve this the cost variable is specified as a ratio of the provider's reference costs and the national average for each HRG.
- 3.5 For example, if it cost a provider £150 to carry out a procedure in an HRG in 2006-07 and the national average for that HRG was £100 then the cost ratio is ($\text{£}150 / \text{£}100 = 1.5$). This means that it cost the provider 50% more than the national average. How much of this 50% can be explained by the level of specialised activity undertaken by this provider is the object of the regression model.
- 3.6 Prior to calculating the cost ratio, the reference costs of each provider are divided by the corresponding MFF payment index value. This is consistent with the tariff calculation methodology. It means that the reference costs are stripped of the location-specific costs faced by providers. All costs are consequently expressed relative to the lowest MFF provider.

Activity Data

- 3.7 Activity data in the model is included as variables specified as proportions. For each HRG for each provider the number of specialised spells as a proportion of the total number of spells is calculated.
- 3.8 For example, if a provider undertook 4 specialised spells and 6 non-specialised spells in 2006/07 for a particular HRG then the proportion of specialised spells is $[4 / (4 + 6)] \times 100 = 40\%$.

- 3.9 As in previous years, in addition to the specialised definition sets, a variable is included to capture activity performed on children. In HRGv3.5 few HRGs were specific to children and the regression analysis showed that a top-up was needed to adequately reimburse for the higher cost of treating them. HRG4 includes a dedicated chapter for paediatrics and additional age splits. To test whether HRG4 sufficiently differentiates between adults and paediatrics we included a variable capturing the proportion of paediatric spells in each HRG by provider.
- 3.10 Within the specialised services mapping, it is likely to be the case that the major specialist providers are doing more complex work than providers that only see a smaller number of specialised cases. In order to reflect this and reduce the “noise” in the data, we only counted activity as specialised for a certain set of providers.
- 3.11 For definition sets where a restricted list of eligible providers exists e.g. for specialised children’s services, we only included data from these organisations.
- 3.12 If, for a definition set, all providers are eligible to receive top-ups we included data only from major specialist providers. Major specialist providers were defined as those trusts that between them provide 50% of specialist activity. For payment, of course all providers receive top-ups (assuming that they are eligible, where relevant).
- 3.13 Providers who are deemed a major specialist or eligible provider for one definition set may not be for another definition set. It is therefore not justified to simply remove the entire data record for a provider. To account for this, we make use of a dummy variable. The dummy variable is set to 1 where a provider is either a major or eligible provider for a definition set and 0 otherwise. This means that the proportion of spells for that definition set is set to 0 when the dummy variable is 0.
- 3.14 Excluded from the dataset are HRGs for which the activity is largely specialised. The regression model is trying to see how much of the variation in costs can be explained by the amount of specialised activity undertaken. With highly specialised HRGs the variation around the national average would be small and so this would weaken any relationship between specialised activity and costs.
- 3.15 HRGs are defined as being largely specialised if nationally, 80% or more of the spells in a HRG are specialised for any one of the 25 coded definition sets. If this criterion is met then the HRG is excluded from the dataset²³.

² With multivariate analysis it is not possible to exclude data for some variables and include it for others. Data records are excluded listwise. It was therefore not possible to exclude data from only the definition set for which it is largely specialised..

³ For payment, HRGs will still attract top-ups for any specialised definition set for which it is not largely specialised. HRGs which are not eligible for specialist top-ups are listed in the *Payment by Results Mandatory Tariff 2009-10*.

3.16 The specification of the regression model is as follows:

$$\left(\frac{\text{Reference Cost}_{i,j}}{\text{National Average}_i} \right) = \text{cons} + \sum_{k=1}^{25} \beta_k D_k X_{i,j,k} + \beta_{nsc} Z_{i,j} + \text{error}$$

Where:

i = spell HRG

j = trust

k = SSNDS {see annex B for the 25 SSNDS used}

nsc = non-specialised children

D = dummy variable; 1 if provider is eligible or major and 0 = otherwise

X = proportion of specialised spells

Z = proportion of paediatric spells

3.17 Each of the explanatory variables were weighted in the regression analysis. As the explanatory variables are expressed as proportions it is important to weight them so that higher volumes of spells are given greater weight. Without this weight a provider who undertakes 2 spells, one of which is specialised, is given the same weight as a different provider undertaking 200 spells of which 100 are specialised for the same HRG. The weight reflects the greater confidence in the costs returned of higher volume providers and gives greater weight to more specialist providers.

4. Results and Supplements

4.1 The tariff supplements are based on the coefficients from the regression analysis, rounded to the nearest percentage point. Where appropriate these were then uplifted to help ensure a smoother transition from the previous top-up percentages.

4.2 The final tariff supplements for specialist top-ups for 2009-10 are shown in table 1 below.

Table 1

Service ID	Specialised Service	Tariff top-up
23	Children Specialised	78%
34	Orthopaedic	14%

4.3 Details on implementing the supplements within PbR are provided in the Payment by Results: Guidance 2009-10.

5. Annex A – Regression Output

5.1 The regression output from the statistical package is provided in table 2 below:

Table 2

Regression with robust standard errors

Number of obs = 64802
F(25, 64776) = 4.91
Prob > F = 0.0000
R-squared = 0.0060
Root MSE = .39024

ratio	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
p_nonkids	-.0287815	.0097675	-2.95	0.003	-.0479259	-.0096371
mp_cancer	.1972101	.144046	1.37	0.171	-.0851202	.4795404
mp_blood	(dropped)					
mp_haemo	-.1151158	.3621434	-0.32	0.751	-.8249169	.5946854
mp_women	.1571443	.1462608	1.07	0.283	-.129527	.4438156
ep_spinal	.0436422	.0589035	0.74	0.459	-.0718088	.1590931
ep_neuro	.066322	.100235	0.66	0.508	-.1301386	.2627827
mp_cystic	1.862529	.7752875	2.40	0.016	.3429654	3.382093
mp_renal	-.1502757	.0919037	-1.64	0.102	-.3304069	.0298556
ep_cardiac	.0642079	.1120998	0.57	0.567	-.1555077	.2839235
mp_hiv	-.086627	.2556689	-0.34	0.735	-.5877381	.4144842
mp_cleftlip	.0257305	.0401964	0.64	0.522	-.0530544	.1045154
mp_immuno	.4006248	.2498452	1.60	0.109	-.089072	.8903215
mp_allergy	.1043812	.2266653	0.46	0.645	-.3398828	.5486453
mp_infect	.0813	.0359456	2.26	0.024	.0108466	.1517535
ep_hepatol~y	-.063438	.0498902	-1.27	0.204	-.1612228	.0343468
ep_children	.3687912	.044122	8.36	0.000	.282312	.4552703
mp_derma	-.0519819	.1663284	-0.31	0.755	-.3779857	.2740218
mp_endo	-.0295337	.0459912	-0.64	0.521	-.1196764	.060609
mp_hyper	-.738742	.1976057	-3.74	0.000	-1.126049	-.3514347
ep_respira	-.0146985	.0742351	-0.20	0.843	-.1601993	.1308022
mp_vascular	-.0571878	.03742	-1.53	0.126	-.130531	.0161553
mp_ear	.4479016	.3482183	1.29	0.198	-.2346063	1.13041
mp_colo	-.0117848	.2023733	-0.06	0.954	-.4084366	.384867
mp_ortho	.1410406	.0624356	2.26	0.024	.0186669	.2634144
mp_obesity	.000685	.0828186	0.01	0.993	-.1616394	.1630095
_cons	1.039473	.0068182	152.46	0.000	1.026109	1.052836

5.2 The variables in the table are named using the following convention:

<provider data prefix>_<SSNDS name>

The provider data pre-fix is coded as follows:

- *p* denotes data included from all providers
- *mp* denotes data from major providers (dummy variable applied such that data from non-major providers is set to zero)
- *ep* denotes data from eligible providers (dummy variable applied such that data from ineligible providers is set to zero)

The SSNDS name is in an abridged form. The full name is detailed in Annex B.

- 5.3 Definition sets receive a top-up where the coefficient is significant at 5% or below⁴. These are highlighted in yellow in the regression output table.
- 5.4 Negative coefficients are assumed to equal zero.
- 5.5 There are a couple of definition sets which have positive and significant coefficients which do not result in a top-up; the reasons for which are provided below:
- cystic fibrosis and hyperbaric services are outside the scope of PbR
 - the high costs for infectious disease isolation units are intended to be covered by additional funding from PCTs (see PbR Technical Guidance)
- 5.6 The statistics package “dropped” the variable for blood and marrow transplantation definition set because no data existed. All HRGs which contained specialised activity from this definition set were excluded from the dataset on the basis that they were all largely specialised i.e. 80% or more of the activity nationally was specialised.
- 5.7 The R-squared value⁵ of 0.006 is a function of the disaggregated level of data used in the analysis. It is expected that a dataset size of over 64,000 observations comprising HRG-level data by provider will have marked variation. The purpose of the model is not to explain the cost variation but to understand how much of the cost variation is attributed to specialised activity.
- 5.8 The regression analysis uses robust standard errors in estimating the model. This is used to counteract the non-uniform variance of the error term across observations observed – and expected – in this dataset.
- 5.9 The statistical package used to estimate the model is STATA v8.0.

⁴ The significance level of each explanatory variable is shown in the table headed P>|t|. A significance level of 5% or below is a value of 0.05 or lower.

⁵ The R-squared value measures the proportion of the total variation in the dependent variable (cost ratio in this model) explained by the regression model.

6. Annex B – List of Coded Definition Sets

SSNDS Code	SSNDS Abridged Name	SSNDS Name	Age Group
1	Cancer	Specialised Cancer Services	Adult
2	Blood	Specialised Services For Blood And Marrow Transplantation	All
3	Haemo	Specialised Services For Haemophilia And Other Related Bleeding Disorders	All
4	Women	Specialised Services For Women's Health	Adult
6	Spinal	Specialised Spinal Services	All
8	Neuro	Specialised Neurosciences Services	Adult
10	Cystic	Cystic Fibrosis	All
11	Renal	Specialised Renal Services	Adult
13	Cardiac	Specialised Cardiology And Cardiac Surgery (Adult) Including Cardiothoracic Transplantation (All Ages)	All
14	HIV	Specialised Services For Hiv/Aids Treatment And Care Services	All
15	Cleft	Cleft Lip And Palate Services	All
16	Immuno	Specialised Clinical Immunology Services	All
17	Allergy	Specialised Services For Allergy	All
18	Infect	Specialised Services For Infectious Diseases	Adult
19	Hepato~y	Specialised Services For Hepatology	All
23	Children	Specialised Services For Children	Children
24	Derma	Specialised Dermatology Services	Adult
27	Endo	Specialised Endocrinology Services	Adult
28	Hyper	Hyperbaric Treatment Services	Adult
29	Respira	Specialised Respiratory Services	Adult
30	Vascular	Specialised Vascular Services	Adult
32	Ear	Specialised Ear Surgery	All
33	Colo	Specialised Colorectal Services	Adult
34	Ortho	Specialised Orthopaedic Services	Adult
35	Obesity	Specialised Morbid Obesity Services	All