



*Improvement*

# Metrics Engine

**Price modelling process guide  
2017/18**

To create the final prices, the model uses two main processes:

- data preparation
- price calculation.

Each is split into smaller stages within the Metrics Engine.

This guide provides further details about what happens at each stage. The title for each stage has been numbered in the order it appears and this matches the description within the metrics engine.

### **Data preparation stages**

*The purpose of these stages is to ensure that the data is cleansed of outliers and ready to be put through the model to calculate prices. The stages below take the initial APC data from reference costs and apply three stages of data cleansing:*

- *Grubbs*
- *25/50 rule*
- *duplicates rule.*

#### **1. Initial reference cost data**

This stage shows the raw input data. The input for the model is reference costs. For the 2017/18 tariff the 2014/15 HRG4+ reference cost data is used.

#### **2. After applying Grubbs' method**

Outliers are removed from the raw reference cost dataset based on the Grubbs method, also known as the 'maximum normed residual test'.

The Grubbs test is defined as:

H0: the sample doesn't have outliers

H1: the sample has at least one outlier

The Grubbs score is calculated using the following formula:

$$G = \max |X_i - \mu| / \sigma$$

where G is the Grubb's score;  $X_i$  is the unit cost after the Market Forces Factor (MFF) is removed in a specific sample (the next section explains why we remove MFF) ,  $\mu$  is the sample mean and  $\sigma$  is the standard deviation.

The outliers are then identified (and subsequently removed) by comparing the Grubbs score for each observation in the sample with the Grubbs critical value for the sample.

The test detects one outlier at a time. This outlier is temporarily deleted from the dataset and the test is repeated until no outliers are detected. This test is undertaken across the natural logarithm of the unit cost after the MFF is removed for each healthcare resource group (HRG) and department.

**Note:** Unlike the next two data-cleansing methods, Grubbs only removes single results, whereas 25/50 and the duplicates rule removes all of a provider's data.

### **3. After applying 25/50 rule**

Providers are removed if they submit reference costs that are more than 50% lower than the national average for more than 25% of the HRGs submitted, and at the same time submit reference costs that are 50% higher than the national average for more than 25% of the HRGs submitted for each HRG and department.

### **4. After applying duplicates rule**

Providers are removed if they report reference costs that include more than 75% duplicate costs across HRGs and departments.

### **Price calculation stages**

*The next set of stages uses the cleansed reference cost and HES data and applies calculations and adjustments to produce a tariff price.*

### **5. Filter RC data**

This stage ensures we are scoping in the correct data from finished consultant episode (FCE) based reference costs. The two key criteria are:

- Supplier type is "Own". This means that any costs relating to a trust's outsourced services are removed.
- Department type is limited to day case ('DC'), elective ('EL'), elective excess bed-days ('EL\_XS'), non-elective ('NEL'), non-elective excess bed-days ('NEL\_XS') and short stay non-elective ('NES').

The data is split into two categories, 'inliers' and 'outliers'. 'Inlier' refers to the spell and the activity at this stage is measured in FCEs. 'Outlier' refers to excess bed days (EBD) and represents any activity beyond a certain length of stay deemed 'normal' (this varies for each HRG).

### **6. Remove MFF**

The market forces factor (MFF) is an estimate of the unavoidable cost differences between healthcare providers.

The unit costs reported in RC data by providers include costs that are particular to their geographical location(s). We need to remove these for the analysis as we wish to calculate an average national price. They are removed by dividing providers' reference costs by their particular MFF value.

### **7. Adjusting for A&E admission costs**

A&E attendances where patients are admitted generate both an A&E and non-elective payment. The costs associated solely with admitting the patient are removed from the A&E costs and added to the NE tariff. We do this to get a full and accurate NE cost base.

The input figure for the A&E attendance leading to NE admission is obtained from the A&E tariff calculation model.

### **8. FCE to Spell conversion (inc. combining DC and EL)**

A 'spell' is the period that the patient spends in hospital from admission to discharge. While admitted, a patient may see more than one consultant during a spell of care. Each of these consultant visits is called a finished consultant episode (FCE). Prices in the national tariff relate to a spell of care. We therefore need to convert these FCE costs (reported by providers) to spell tariffs.

FCEs are allocated to spells based on a hierarchy of diagnoses and procedures. Most spells have just one FCE, but some have more. Therefore each FCE has its own HRG and a spell HRG, which may or may not be the same.

This step is the first of three that form the FCE-to-spell conversion: the model maps the FCE activity onto the relevant spells and creates a total spell cost quantum that incorporates both inlier and outlier costs.

### **9. Calculating total cost of EBDs from new TPs**

The second step within the FCE to spell conversion is to calculate the cost of excess bed days (EBDs) based on the new trim points (TPs).

FCE EBDs are derived from applying reference cost grouper trim points to the provider's data. This ensures that a consistent length of stay (LoS) activity is used when bundling FCE EBD costs and unbundling spell EBD costs, and takes into account any differences in activity and LoS between RC and HES.

The number of spell-based EBDs is then multiplied by the long-stay payment for the relevant HRG chapter to calculate the total EBD costs for the spell.

### **10. Calculating revised inlier costs based on revised EBD costs**

This is the third and final step of the FCE to spell conversion. The new revised inlier cost is calculated by subtracting the revised EBD costs calculated above from the total spell cost for each HRG, resulting in a residual inlier cost.

### **11. Revised costs after D&D removed**

High cost drugs and devices (D&D) are reimbursed outside the tariff using locally agreed prices. The reference costs of each HRG includes costs of high cost drugs that were not unbundled at the time of the reference cost collection and high cost devices. We need to remove (or unbundle) the costs of these high cost D&D from the total cost quantum relating to specific HRGs.

The cost adjustments made here are restricted to no more than 50% of the total cost of the HRG after the high cost D&D removal. If the adjustment exceeds 50%, the rest of the high cost D&D removal is done through top-slicing which can be found below in step 13, 'Revised unit costs after applying top-slice'.

### **12. Revised total costs after SSEM adjustments**

Certain HRGs attract a reduced short-stay emergency (SSEM) tariff for adult emergency spells with a length of stay less than two days. The level of the SSEM tariff is based on the average NE length of stay of the HRG because emergencies are, by definition, always non-elective.

Before this stage, the model assumes that all NE spells attract the full tariff. From this point on, however, the model differentiates between SSEM and non-SSEM spells. Due to the reduction in the overall non-elective cost as a result of SSEM reductions, inlier costs are increased to ensure that the overall cost remains the same before and after the adjustment.

From this point on the total non-elective cost should be:

$$\text{Total NE Cost} = ((\text{Total NE activity} - \text{short stay NE activity}) \times \text{NE Unit Cost}) + (\text{short stay NE activity} \times \text{short stay NE Unit Cost})$$

However, due to limitations in the way the metrics engine works, the total cost displayed is:

$$\text{Total NE Cost} = (\text{Total NE activity} * \text{NE Unit Cost})$$

It is therefore slightly overstated from this stage onwards.

(**Note:** this does not affect activity or unit cost)

### **13. Revised unit costs after applying top-slice %**

Top slicing is the process of adjusting the price of all (or a subset of all) HRGs to compensate for costs that cannot be targeted at specific HRGs. Top-slices adjust for:

- Specialised services – Additional payments are made outside the tariff for specialist activity in the form of top-ups. The cost of specialised care is contained in the reference costs and therefore we would be overcompensating if we did not remove these costs from the tariff. We estimate the costs to commissioners for this and removed from all EL and NE HRGs.

- Injury Cost Recovery Scheme (ICRS) – these costs relate to admissions resulting from a road accident and are paid outside of the tariff so are removed *only* from NE HRGs.

- D&D exclusions – we calculate these as described above and apply them separately to EL and NE HRGs.

### **14. Prices after SSEM**

At this stage in the model the SSEM cost for each HRG is calculated based on the final NE price.

### **15. Adjust long stay payments for paediatrics**

We transform the long stay payments so that they are displayed for paediatric and non-paediatric treatments at sub-chapter level.

### **16. Modelled prices after implementing reference quantum reconciliation factor (QR1)**

The purpose of the QR1 reconciliation is to reconcile the total model cost quantum to the total reference cost quantum used to inform the prices. The formula is:

$$QR1 = ((\text{Target RC}) / ((\text{Modelled Quantum})) - 1$$

### **17. Modelled prices after implementing cost based adjustment factor (CB)**

The purpose of this step is to account for costs that should not be considered for the tariff.

### **18. Modelled prices including cost uplift assumptions (IA)**

To make the prices comparable to the current official tariff, they are uplifted to the previous year's value taking into account inflation, efficiency and CNST.

### **19. Modelled prices after implementing manual adjustments**

Where instructions have been given to manually adjust a price, this is where we do it. The price at this stage is the result directly after the manual adjustment instruction. Where no manual adjustment has been made the price remains the same.

### **20. Modelled prices after implementing manual adjustments reconciliation factor (QR2)**

This ensures that the overall HRG chapter quantum for the model is the same before and after manual adjustments and affects all prices. The formula is:

$$QR2 = ((\text{Quantum prior to manual adjustments}) / ((\text{Quantum post manual adjustments})) - 1$$

### **21. Modelled prices after implementing the smoothing factor (SMF)**

To account for significant changes in the tariff at different levels (chapter, subchapter or even HRG level) a smoothing factor is used to ensure prices do not move by too much year on year.

[The method for 17/18 for the smoothing factor has not yet been fully decided]

### **22. Modelled prices after implementing the adjustment factor as a result of smoothing (QR3)**

This quantum reconciliation factor is used to ensure that the total quantum after applying the smoothing factor remains unchanged and uses a similar formula to QR2 (above).

### **23. Modelled prices after implementing the scaling factor (SCF)**

At this stage we apply a scaling factor which will ensure that the total modelled price quantum in the model is equal to an externally set target quantum. This factor is calculated through a separate payment engine.

### **24. Final prices**

Final modelled prices are uplifted to the prospective tariff year's value, taking into account inflation, efficiency and CNST eg the prices shown have been uplifted into the 2017/18 financial year assumptions.



***Improvement***

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