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2015/16 APC SQL Model Handbook

Contents

Disclaimer

This model handbook is published by Monitor for the purposes of the engagement on the proposals for the National Tariff for 2015/16, to provide stakeholders with information about the proposed method for calculating national prices for that year and to enable stakeholders to respond to those proposals. The model handbook and the draft prices derived from following the steps in the handbook are illustrative only; in particular, there may be changes to the model described by this handbook and to the prices which appear in the final proposals to be published in the autumn for the purposes of the statutory consultation. Monitor shall not accept any responsibility or liability in respect of the contents or use of the model handbook or the draft prices.

1 Introduction to Admitted Patient Care Tariff Calculation Model

The model suite used to produce the **Admitted Patient Care** National Tariff prices for the admitted patient care tariff includes:

- a number of small pre-processing models used to prepare data for processing by the APC SQL model;

- APC SQL model (the subject of this document);

- A post-(SQL)-processing MS Excel-based model used to carry out a number of changes to the prices generated by the APC SQL model.

In this document, we describe the input data, processing steps /calculations and the outputs produced by the APC SQL model. The pre / post processing models are outside the scope of this handbook.

We originally developed the APC SQL processing model (henceforth "the SQL model") to replicate the modelling work previously conducted by the Department of Health's (DH) Payment by Results (PbR) Team. The DH models were developed using MS Excel, MS Access and IBM's SPSS (Statistical Package for the Social Sciences). Since originally developing it, we have made some changes to the APC SQL model to generate the 2015/16 prices which means it no longer replicates exactly the steps of the former PbR team's models.

In the remainder of this document we describe the functionality of the APC SQL model. In the sections that follow, we first provide an overview, followed by a detailed description of the calculation steps in the model.

The figure below provides a high level overview of the APC tariff model. Input data (external to the model) is highlighted in grey, calculation/processing steps in white circles, and final data outputs in white squares.

Figure: 1.1 Data flow diagram: overview of the APC tariff model
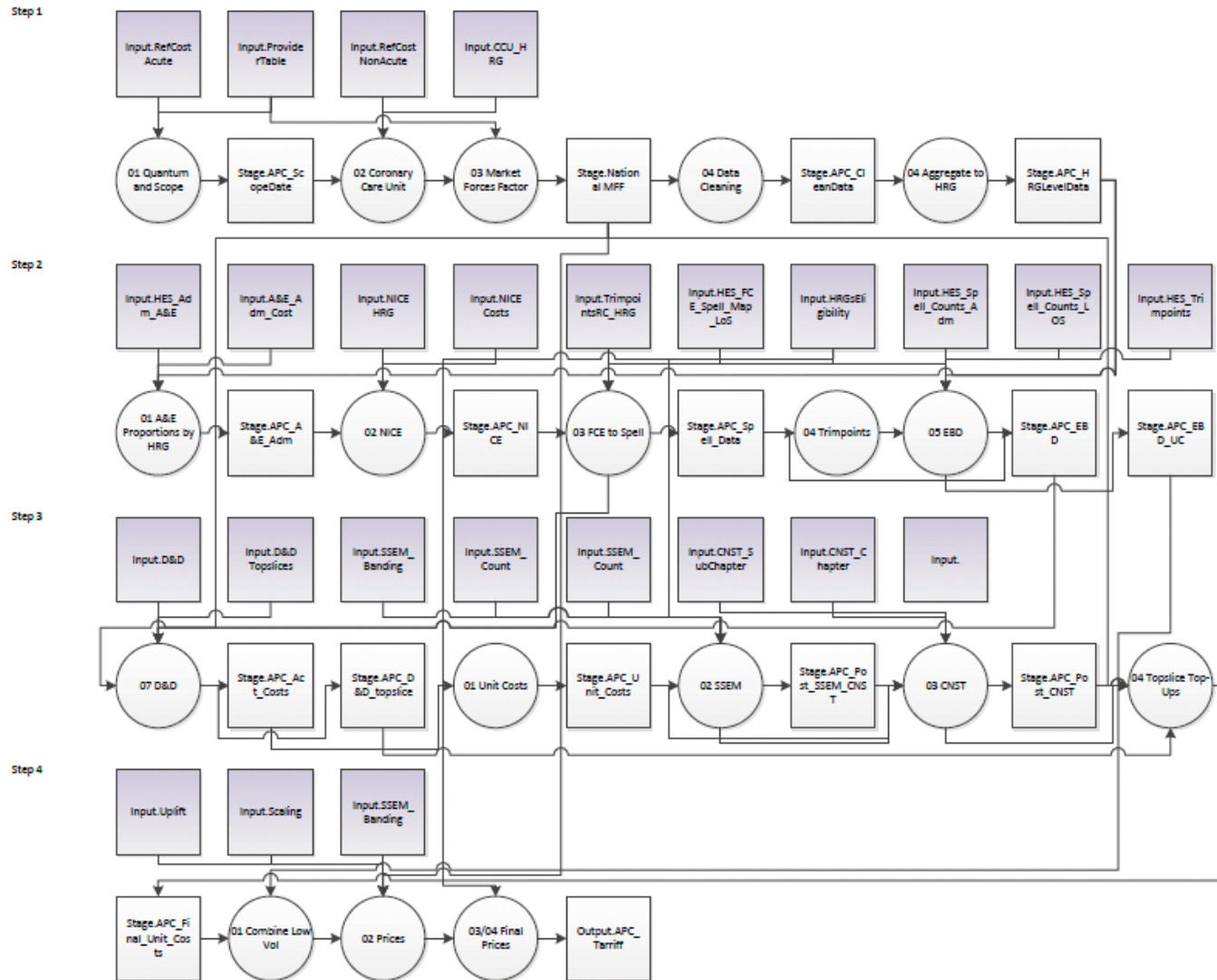
2 Calculation Steps

For each calculation step we provide a graphical overview to show where the step features in the APC model overview in figure 1.1. We then provide a description of the step, followed by the calculations that are performed in the step, including related input and output tables.

2.1 Calculating Inlier and Excess Bed Day (EBD) Costs

2.1.1 Overview

INPUT	CALCULATION	OUTPUT

```
Input.RefCost
Acute

          01 –
          Quantum
          & Scope          Stage.APC_Scope
                           Data

Input.Provider
Table
```
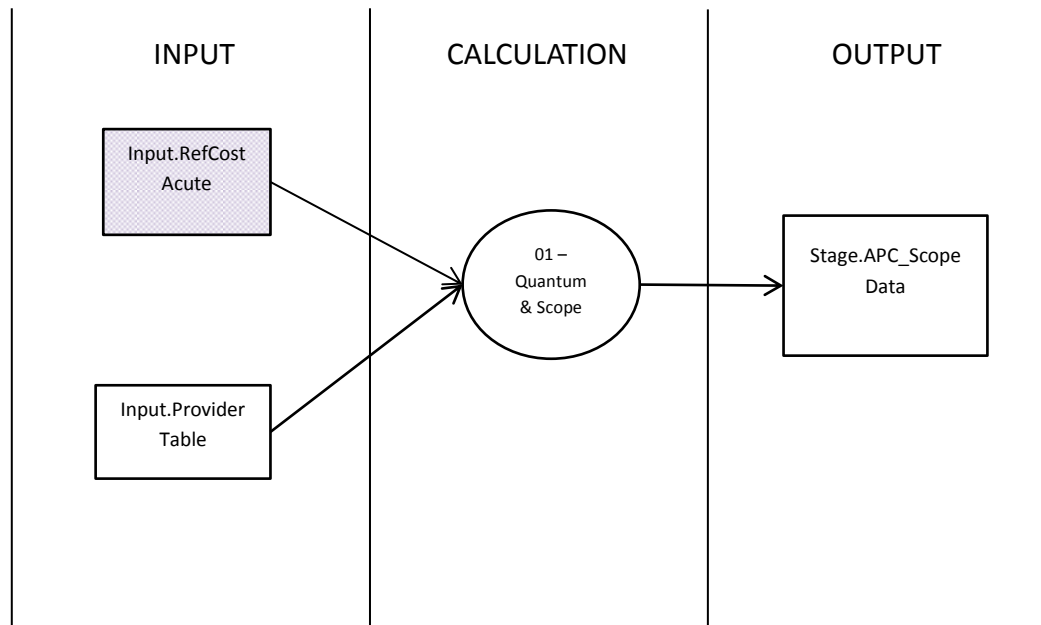
Spells of the same type may have different durations. We classify spells with a length of stay (LoS) falling within a given range (dependent on the particular HRG) as 'normal'. Spells with a LoS that are outside of this 'normal' range are called 'outliers', whilst those falling within the range are called 'inliers'.

This stage of the model filters for inlier spells so that only the relevant costs associated with inlier spells can be calculated. For outlier spells, an additional payment for each day over the maximum inlier limit – known as a trimpoint – is made. Such payments are called Excess Bed Day payments (EBD). These can also be calculated once the inlier and outlier spells are known.

In this first step the tariff model retrieves data from the adjusted (or pre-processed) Reference Cost (RC) database [Input.RefCostAcute] and using this data, we calculate total inlier costs and total EBD costs by provider and HRG by admission type (ie daycases (DC), elective inpatients (EL) non-elective inpatients (NE)). Reference Costs (RC) are collected and provided by the Department of Health (DH) in the form of the reference cost database[1]. The RC database collects the costs from all foundation trusts (FTs) and NHS trusts (NHSTs)[2].

Reference costs are collected by HRG (which are based on a bundle of similar medical treatments). Examples of HRGs are:

- *AA15A - Intracranial Procedures Except Trauma with Other Diagnoses - category 3 with CC*

- *HB63Z - Minor Shoulder and Upper Arm Procedures for non Trauma*

- *VA10B - Multiple trauma diagnoses, score 24 - 32 with no interventions*

Reference cost data are based on "Finished Consultant Episode" (FCE) levels, ie they allocate all costs to consultant visits.

The RC database includes a number of data fields (ie "columns" of data), for example the number of FCEs performed and unit cost for each FCE. The data values (ie the "rows" of data) are presented for each provider, by HRG split by department, eg Non-elective Inpatient Longstay (NEI_L), Non-elective Inpatient Longstay Excess Bed Days (NEI_L_XS), Non-elective Inpatient Shortstay (NEI_S).

2.1.2   Calculation/process in this model step

In this step (calculating inlier and EBD costs) the tariff model pulls data (columns) from the adjusted RC database [Input.RefCostAcute] into the tariff calculation model (and stores it in [Stage.APC_ScopeData]). Key data (columns) copied over are:

- *[Unit Cost (inlier unit cost)]*

- *[FCE]*

---

[1] Reference costs for 2011/12 can be accessed from the following website - https://www.gov.uk/government/publications/nhs-reference-costs-financial-year-2011-to-2012
[2] All data relating to services supplied by non-NHS organisations and PMS+ providers are excluded from the reference cost database.

- *[Excess_Bed_Day_Unit_Cost]*

- *[Excess_Bed_Day_Activity]*

The model then pulls RC Code data from the [Input.ProviderTable] into the tariff model (and stores it in [Stage.APC_ScopeData]). RC Code data is an identifier code for each hospital. In doing this the tariff model creates a new column "Admission". This is calculated as follows:

a. From Department field in the [Input.RefCostAcute], take the first 2 letters and change all department codes with 'EI' to 'EL'.

b. The correct mapping across of the data contained in the [Input.ProviderTable] and [Input.RefCostAcute] into the tariff model (ie the [Stage.APC_ScopeData]) is done through matching of the provider ID field.

c. The Admission data column then only contains a value of either EL, NE or DC.

The table below shows the full list of department to admission code mappings.

Original department code	Change to admission code
DC	No change
EI	EL
NEI_L	NE
NEI_S	NE

The model then performs two calculations creating two new columns in [Stage.APC_ScopeData]:

d. It calculates the total inlier cost by provider, by HRG by admission method, using the following formula:

$$Inlier\ Cost = Unit\_Cost \times FCE$$

e. It calculates the total EBD cost by provider, by HRG by admission method, using the following formula:

$$EBD\_Cost = Excess\_Bed\_Days\_Unit\_Cost \times Excess\_Bed\_Days\_Activity$$

f. When making these calculations:

i. Only reference costs that are incurred by the provider itself are included. Cost incurred for outsourced services are excluded. This is done by applying a filter in the calculation process: Filter Supplier_Type = OWN

ii. These calculations are also only applied to those datasets (rows) that have a Admissions label relevant to the APC calculation process (i.e. datasets with an Admissions label of EL, NE, or DC)

2.1.3   Data used in this modelling step

Input tables used in this model step	Input fields from input table used
[Input.RefCostAcute]	[FK_ORGS_PROV_ID] [UNIT_COST] [FCE] [EXCESS_BED_DAYS_ACTIVITY] [EXCESS_BED_DAYS_UNIT_COST] [SUPPLIER_TYPE] [DEPARTMENT] [CURRENCY]
[Input.ProviderTable]	[RC Code]

2.1.4   Data outputs produced by this model step

Output tables generated by this model step	Output fields generated in output table (copied over)	Output fields generated in output table (calculations)
[Stage.APC_ScopeData]	[PROVIDER] - *[Input.RefCostAcute]. [FK_ORGS_PROV_ID]* [HRG] - *[Input.RefCostAcute].[CURRENCY]* [INLIER ACT] - *[Input.RefCostAcute].[FCE]* [EBD ACT] - *[Input.RefCostAcute]. [EXCESS_BED_DAYS_ACTIVITY]*	[ADMISSION] [INLIER COST] [EBD COST]

2.2 Inclusion of Coronary Care Unit (CCU) data

2.2.1 Overview

The main aim of this stage is to calculate the total CCU costs for six related CCU HRGS to be rebundled (or added back) into the calculation. However in 2011/12 Reference cost data, CCU costs are no longer reported separately. Therefore this step is redundant by default as there are no data related to CCU. We show this step because the output tables are used as inputs to the subsequent steps.

2.2.2 Calculation/process in this model step

The model looks for the six CCU HRGs within the input table [Input.CCU_HRG] from the reference cost data. As there are no costs, a zero value is returned and this whole step does not change the costs from the previous stage. The revised costs are saved in the table as detailed below.

2.2.3 Data used in this modelling step

Input tables used in this model step	Input fields from input table used
[Input.RefNonCostAcute]	[FK_ORGS_PROV_ID] [UNIT_COST] [ACTIVITY_P1] [SUPPLIER_TYPE] [SERVICE]
[Stage.APC_ScopeData]	[INLIER COST]
Input.[Input.CCU_HRG]	[CCU HRGs]

2.2.4 Data outputs produced by this model step

Output tables generated by this model step	Output fields generated in output table (copied over)	Output fields generated in output table (calculations)
[Temp.(#02e)]	[PROVIDER] [HRG] [ADMISSION] [INLIER ACT] [EBD ACT] [EBD TC] (*EBD COST from [Stage.APC_ScopeData]In Step 1*)	[INLIER TC] (*INLIER COST from [Stage.APC_ScopeData] in Step 1*)

2.3   Removing Market Forces Factor (MFF)

2.3.1   Overview
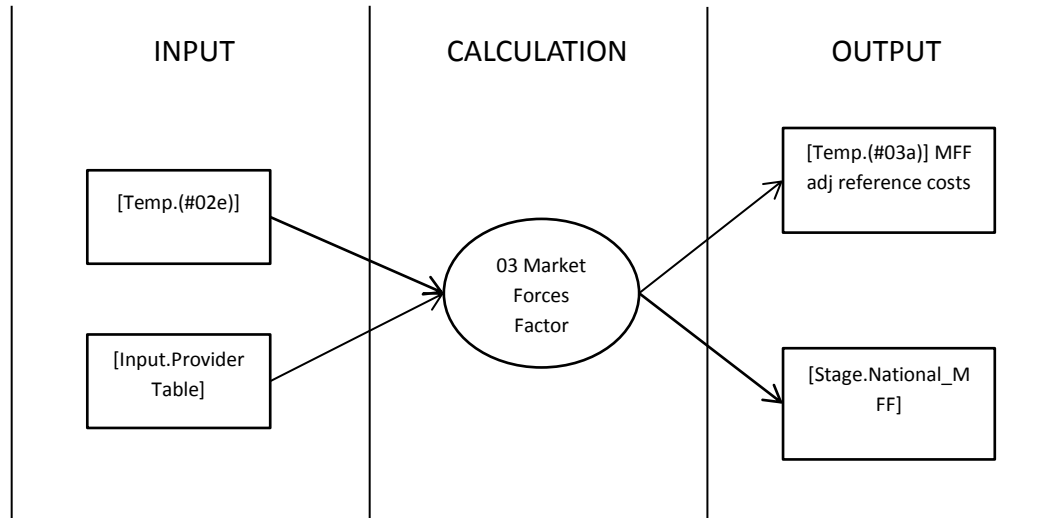
The Market Forces Factor (MFF) is an uplift factor applied to the prices paid to each provider in line with the unavoidable additional costs that each faces as a result of their geographical location. This ensures that providers are not under-reimbursed for their costs as a result of circumstances beyond their control. The MFF is calculated by ACRA (Advisory Committee Results Allocation). Each provider has a provider specific MFF. There are two versions of the MFF for each provider:

- The Target MFF – this is the provider's MFF and is derived from benchmarking the unavoidable cost differences of providers against each other so that the lowest MFF value is 1. The MFF in 2015/16 ranges between 1 and 1.3. In the tariff model this MFF is labelled Target MFF

- The Capped MFF 2013/14[3] – this uses the Target MFF, but ensures that the rebased MFF in any one year is no more than 2% higher than the previous year's Target MFF. For example if the Target MFF for this year is 1.5 and the prior year Target MFF was 1.1, then the capped MFF for this year is 1.3. For 2015/16, the Target MFF values remain the same as the Capped MFF in the PbR 2013/14 model.

The capped MFF is also used when a provider is paid for services covered by the tariff i.e. tariff price x provider specific capped MFF = actual price paid to a provider for a service.

The reference costs recorded by providers include their MFF uplift. We need to remove these additional MFF costs from the reference cost data before it can be used for analysis. Once we have used reference costs to derive average prices for each HRG, we add back the MFF at provider level in order to calculate the payment for the services they are providing[4].

Four types of costs are covered in the MFF:

- The national MFF, which compares total inlier costs across all providers before and after the MFF adjustment;

- Other Labour costs;

- Building costs; and

- Land values.

In this step the model also calculates:

- The national MFF, which compares total inlier costs across all providers before and after the MFF adjustment.

- The rebased MFF, which compares total inlier costs across all providers between the target MFF adjusted inlier costs and the payment MFF adjusted inlier costs.

2.3.2   Calculation/process in this model step

The tariff model calculates two different datasets in this step.

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[3] The field name in the model Capped MFF 2013/14 contains values that are applicable for 2015/16 model run.
[4] Note that the adding back of the MFF at a provider level takes place outside of the APC SQL model.

    i.   MFF adjusted cost data

    ii.   Two national MFF data points

MFF adjusted cost data

Using provider cost data in the [Temp.(#02e)] table (as calculated in Step 2.1 - Calculating Inlier and EBD Costs) and MFF data for each provider in the [Input.ProviderTable], the tariff model:

    i.   divides the total inlier costs and total bed day costs for each provider by the provider's MFF.

        a.   *[Inlier TC (target MFF)] = [Inlier TC] ÷ [Target MFF]*

        b.   *[EBD TC (target MFF)] = [EBD TC] ÷ [Target MFF]*

    ii.   divides the total inlier costs for each provider by the provider's capped MFF.

        c.   *[Inlier TC (payment MFF)] = [Inlier TC] ÷ [Capped MFF 2013/14]*

    iii.   These calculations create three new columns in the tariff model:

        d.   *[Inlier TC (target MFF)]*

        e.   *[EBD TC (target MFF)*

        f.   *[Inlier TC (payment MFF)]*

Two National MFF data points

In this step the tariff model calculates two numbers:

    i.   the national MFF and

    ii.   the MFF rebased.

These two numbers are used in a later step in the model (when calculating Drugs and Devices (D&D), Specialised Services top-ups and Injury Cost Recovery (ICR) Scheme from the calculations using the national MFF; and when calculating the final tariff using the MFF Rebase) and are stored in a separate table called 'Stage.National_MFF'.

The National MFF is calculated as the total inlier costs across all providers before the target MFF adjustment divided by the total inlier costs across all providers after inlier costs have been adjusted by the target MFF

    a. $[Nat\ MFF] = \sum Inlier\ TC \div \sum Inlier\ TC\ (target\ MFF)$

The MFF rebased is calculated as the total inlier costs across all providers after inlier costs have been adjusted by the target MFF divided by the total inlier costs across all providers after inlier costs have been adjusted by the Capped MFF. As the target MFF and capped MFF 2013/14 are equal this year, the MMF rebase factor is equal to 1 and therefore the total inlier costs before and after MFF adjustment remain the same.

    b. $[MFF\ rebase] = \sum Inlier\ TC\ (target\ MFF) \div \sum Inlier\ TC\ (payment\ MFF)$

2.3.3   Data used for this modelling step

Input tables used in this model step	Input fields from input table used
[Temp.(#02e)] – from previous step	[INLIER TC] [EBD TC]
[Input.ProviderTable]	[TARGET MFF] [CAPPED MFF 2013/14]

2.3.4 Data outputs produced by this model step

Output tables generated by this model step	Output fields generated in output table (copied over)	Output fields generated in output table (calculations)
[Temp.(#03a)]	Provider – [Temp.(#02e)].[Provider] Admission - [Temp.(#02e)].[Admission] HRG - [Temp.(#02e)].[HRG] Inlier Act - [Temp.(#02e)].[Inlier ACT] Inlier TC - [Temp.(#02e)].[Inlier TC] EBD Act - [Temp.(#02e)].[EBD ACT] EBD TC - [Temp.(#02e)].[EBD TC]	[INLIER TC (TARGET MFF) [EBD TC (TARGET MFF)] [INLIER TC (PAYMENT MFF)]
[Stage.National_MFF]		[NAT MFF] [MFF REBASE]

2.4   Data Cleaning

2.4.1   Overview

INPUT	CALCULATION	OUTPUT

```
INPUT                    CALCULATION                           OUTPUT

[Temp.(#03a)] MFF  ──▶  ( 04 Data  )  ──▶  [Temp.(#03a)] MFF  ──▶  ( 04        )  ──▶  [Stage.APC_Tariff]
adj reference costs      ( Cleaning )       adj reference costs      ( Aggregate )
                                                                     ( to HRG    )
```
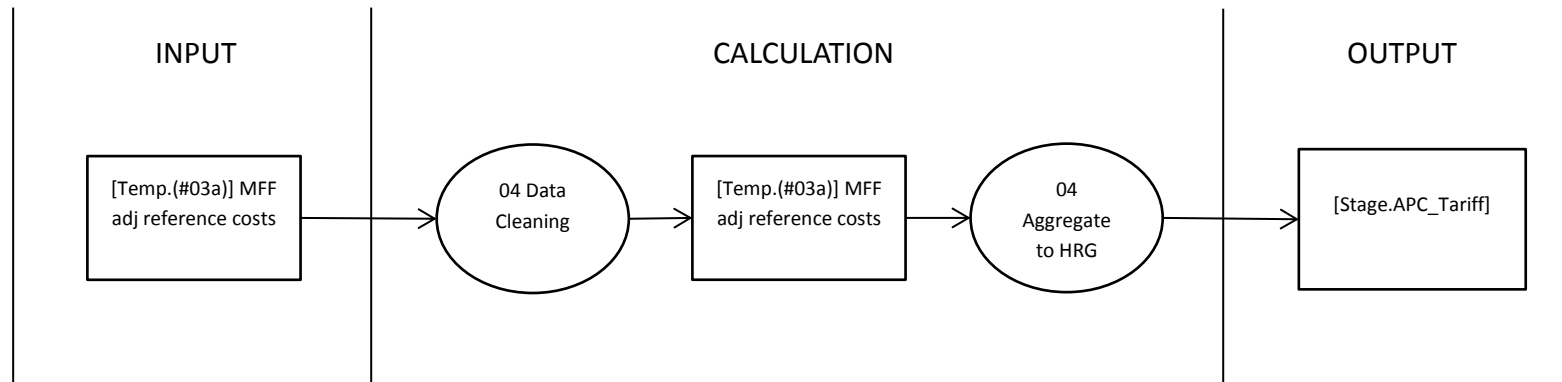
For RC 2011/12 dataset, data cleaning is done on both inlier and EBD costs. In addition, further cleaning is done on the EBD activity data. It is only necessary to include data covering activities within the financial year i.e. between 1 April 2011 and 31 March 2012. If the number of EBDs reported are greater than the maximum possible in a single year, i.e. greater than 365 days, we remove these bed days and their associated costs.

Some of the reported reference costs data fall outside of a normal expected range. Often these data points are caused by data recording or data entry errors. Leaving these extreme costs within the tariff calculation could skew the average tariff calculation price. For this reason, we carry out data cleaning to uphold the principle that the tariff should reflect accurately reported costs as far as possible.

It is worth noting that although the SQL model currently contains data-cleaning code, we now perform this outside this step outside the SQL model as a pre-processing step. This step is therefore no longer active and the number of data rows at the start of the process is the same as at the end of the process, ie no data is now cleaned out as a result of this step.

2.4.2   Calculation/process in this model step

The model previously flagged each outlier datapoint with '1' and to cancel this effect, all datapoints are now flagged as '0', ie no change.

2.4.3 Data used for this modelling step

Input tables used in this model step	Input fields from input table used
[Temp.(#03a)] – from previous step	[INLIER ACT] [INLIER TC (Target MFF)] [EBD ACT] [EBD TC (Target MFF)]

2.4.4 Data outputs produced by this model step

Output tables generated by this model step	Output fields generated in output table (copied over)	Output fields generated in output table (calculations)
[Stage.APC_HRGLevelData]	[HRG] – *[Temp.(#03a)].[HRG]* [ADMISSION] – *[Temp.(#03a)].[HRG]*	[CLEAN_INLIER_ACT] [CLEAN_INLIER_TC] [CLEAN_EBD_ACT] [CLEAN_EBD_TC] [CLEAN_TC]

2.5   Inclusion of costs in Accident and Emergency (A&E) leading to admissions

2.5.1   Overview

```
INPUT              CALCULATION           OUTPUT

┌──────────────┐
│ Input.HES_Adm│
│    _A&E      │
└──────────────┘
                        ╱⎯⎯⎯⎯⎯⎯⎯╲         ┌──────────────┐
┌──────────────┐       │ 01 – A&E │        │Stage.APC_A&E_Ad│
│ Input.A&E_Adm│───────│Proportion│───────▶│      m       │
│    _Cost     │       │  s by HRG│        └──────────────┘
└──────────────┘        ╲⎯⎯⎯⎯⎯⎯⎯╱

┌──────────────┐
│ Stage.APC_HRG│
│   LevelData  │
└──────────────┘
```
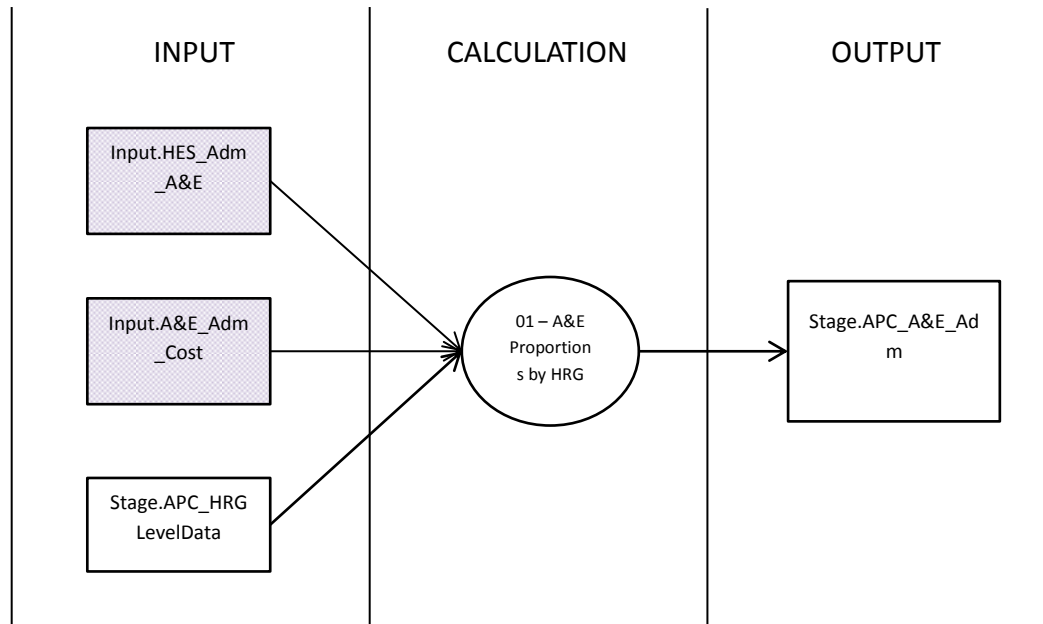
The tariff model includes all attendances leading to admission. This includes A&E attendances where patients admitted via A&E generate both an A&E and non-elective (NE) payment. The costs associated solely with admitting the patient are removed from the A&E costs and added to the non-elective payment tariff. We do this to get an accurate, fully costed NE cost base.

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

2.5.2   Calculation/process in this model step

At this stage the tariff model has aggregated the costs to each HRG by admission method and has removed provider level information.

We now use the A&E costs that generated a non-elective (NE) admission, and apportion these costs according to the inlier total costs, and add them back to the inlier costs through the output table from the Data Cleaning step in section 2.4.

Calculating A&E inlier costs proportions

The model starts by calculating the percentage of A&E [A&E%] associated with each NE activity for each FCE HRG from table [Input.HES_Adm_A&E] as follows:

    i. $[A\&E\%] = [A\&E\ FCE] \div [NE\ FCE]$

    ii.   The results are stored in a temporary table [Temp.(#01a)]

The model then uses this A&E percentage to calculate the cost proportion for each FCE HRG / NE admission combination in [Stage.APC_HRGLevelData] and sums up the total costs as follows:

    i. $[A\&E\ TC] = [CLEAN\_INLIER\_TC] \times [A\&E\%]$

    ii. $[A\&E\ TC] = \sum A\&E\ TC$

    iii.   Both results are stored in temporary table [Temp.(#01b)] and [Temp.(#01c)] respectively with a single value stored in the latter table.

A&E costs allocation to HRGs

Using the A&E cost proportions, the model then uses weightings to calculate the final A&E cost attributed to each FCE HRG / NE admission combination. Once we have calculated these weightings, we apply them to the total A&E quantum (A&E AD TC) leading to admissions from the [Input.A&E_Adm_Cost] table to calculate the final cost allocation.

The model first joins tables [Temp.(#01b)], [Temp.(#01c)], [Input.A&E_Adm_Cost] and [Stage.APC_HRGLevelData] using fields [SPELL HRG] = [HRG] and [ADMISSION] = [ADMISSION], retaining only records in table [Stage.APC_HRGLevelData]. The key fields used are listed below:

Tables	Fields pulled through
[Temp.(#01b)]	[HRG] [ADMISSION] [A&E TC]
[Temp.(#01c)]	[A&E TC]
[Input.A&E_Adm_Cost]	[A&E AD TC]
[Stage.APC_HRGLevelData]	[HRG] [ADMISSION] [CLEAN_INLIER_TC] [CLEAN_INLIER_ACT]

The model then does the following calculation steps to arrive at the A&E costs to add back into the inlier costs. The steps are as follows:

i. Calculating the revised inlier TC including A&E costs for each HRG / admission method combination

If admission method is 'NE', then $[CLEAN\ INLIER\ TC\ WITH\ A\&E] = [CLEAN\_INLIER\_TC] + \{[A\&E\ AD\ TC] \times \frac{[A\&E\ TC]}{\sum[A\&E\ TC]}\}$

Otherwise

$[CLEAN\ INLIER\ TC\ WITH\ A\&E] = [CLEAN\_INLIER\_TC]$

Finally, the revised total costs are calculated as follows

i. $[CLEAN\ TC] = [CLEAN\ INLIER\ TC\ WITH\ A\&E] + [CLEAN\ EBD\ TC]$

The final results in the above two steps are stored in table [Stage.APC_A&E_Adm].

2.5.3   Data used for this modelling step

Input tables used in this model step	Input fields from input table used
[Input.HES_Adm_A&E]	[FCE HRG] [NE FCE] [A&E FCE]
[Input.A&E_Adm_Cost]	[A&E AD TC]
[Stage.APC_HRGLevelData]	[HRG] [ADMISSION] [CLEAN_INLIER_TC] [ADMISSION] [CLEAN_EBD_TC]

2.5.4   Data outputs produced by this model step

Output tables generated by this model step	Output fields generated in output table (copied over)	Output fields generated in output table (calculations)
[Stage.APC_A&E-Adm]	[HRG] – *[Stage.APC_HRGLevelData].[HRG]* [ADMISSION] – *[Stage.APC_HRGLevelData].[ADMISSION]* [CLEAN INLIER ACT] – *[Stage.APC_HRGLevelData].[CLEAN_INLIER_ACT]* [CLEAN EBD ACT] – *[Stage.APC_HRGLevelData].[CLEAN_EBD_ACT]* [CLEAN EBD TC] – *[Stage.APC_HRGLevelData].[CLEAN_EBD_TC]*	[CLEAN INLIER TC WITH A&E] [CLEAN TC]

2.6　NICE Technology Appraisals

2.6.1　Overview
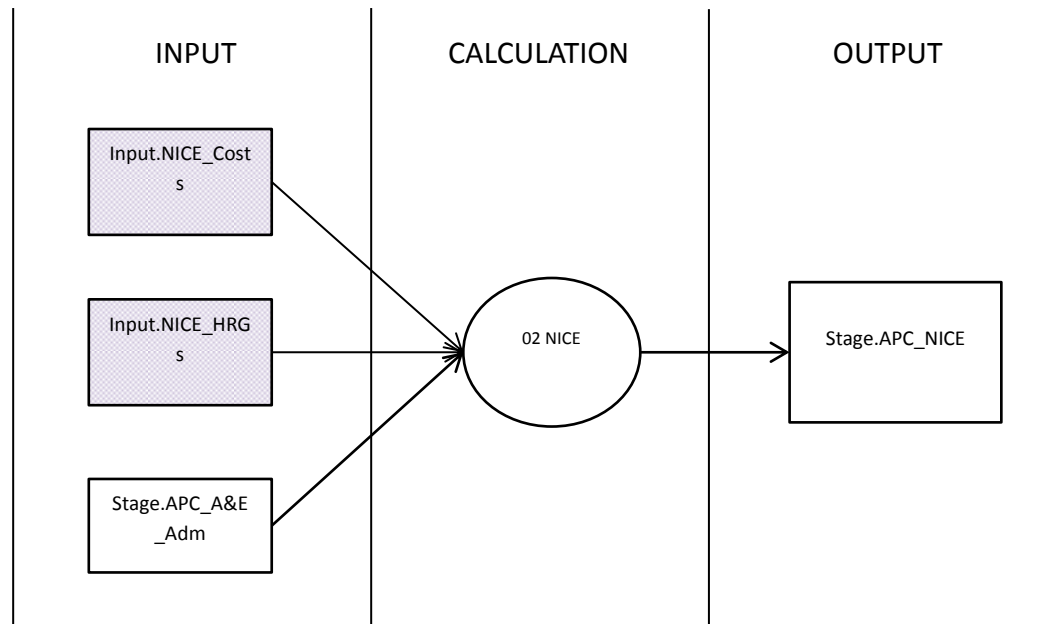
Some costs, notably those arising from National Institute for Health and Care Excellence (NICE) recommendations on the use of new medicines and treatments, have come into effect in the period between reference cost reporting and calculating new tariff prices. We need to add these costs to the reference costs.

The aim in this part of the SQL model is to calculate the cost associated with each of the thirteen HRGs concerned and add these costs to the total cost of the respective HRGs.

In the 2015/16 tariff calculation there are no NICE costs to include. Therefore the prices at the start of this process are the same as the prices at the end of this process.

2.6.2 Calculation / process in this model

We add zero cost values to the costs for each HRG from the previous step. This results in no change in prices in the current version of the SQL model.

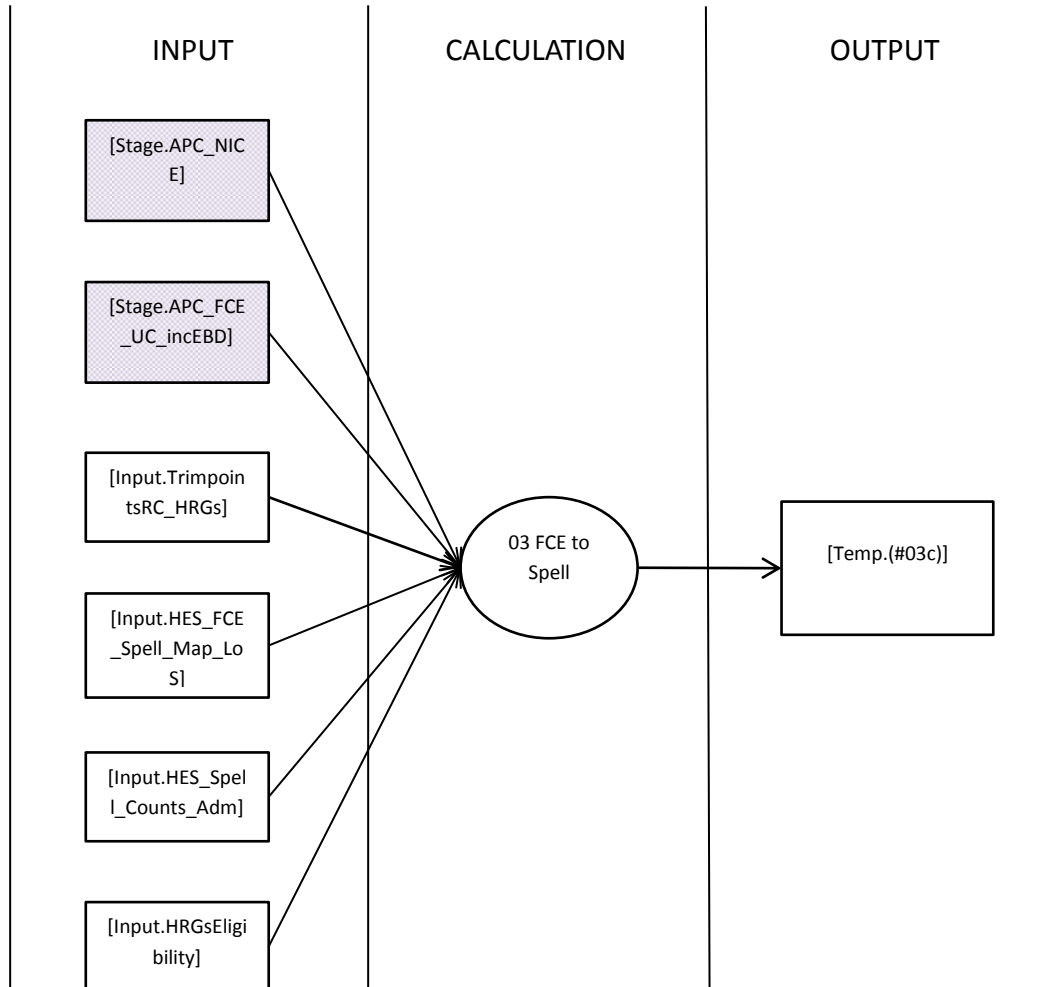### 2.6.3 Data used for this modelling step

Input tables used in this model step	Input fields from input table used
[Input.NICE_HRGs]	[HRG] [TYPE]
[Input.NICE_Costs]	[TYPE] [INCLUSION]
[Stage.APC_A&E-Adm]	[HRG] [ADMISSION] [CLEAN INLIER ACT] [CLEAN INLIER TC WITH A&E] [CLEAN EBD TC] [CLEAN TC]

2.6.4 Data outputs produced in this model step

Output tables generated by this model step	Output fields generated in output table (copied over)	Output fields generated in output table (calculations)
[Stage.APC_NICE]	[HRG] – *[Stage.APC_A&E-Adm].[HRG]* [ADMISSION] – *[Stage.APC_A&E-Adm].[ADMISSION]* [CLEAN INLIER ACT] – *[Stage.APC_A&E-Adm].CLEAN INLIER ACT]* [CLEAN EBD ACT] – *[Stage.APC_A&E-Adm].[CLEAN EBD ACT]* [CLEAN EBD TC] – *[Stage.APC_A&E-Adm].[CLEAN EBD TC]*	[CLEAN INLIER TC WITH NICE] [CLEAN TC]

2.7 FCE to Spell Cost conversion

2.7.1 Overview

INPUT	CALCULATION	OUTPUT

[Stage.APC_NICE]

[Stage.APC_FCE_UC_incEBD]

[Input.TrimpointsRC_HRGs]

[Input.HES_FCE_Spell_Map_LoS]

[Input.HES_Spell_Counts_Adm]

[Input.HRGsEligibility]

03 FCE to Spell

[Temp.(#03c)]

A spell is the period from admission to discharge within a single provider for a single patient. Whilst admitted, a patient may see more than one consultant during a spell of care. Each of these is called a Finished Consultant Episode (FCE). Prices in the National Tariff are based on Spell unit costs and there needs to be a transformation from FCE costs to Spell costs. The Heath and Social Care Information Centre (HSCIC) allocates all FCEs (reported by providers) to spells, based on a hierarchy of diagnoses/treatments. Most spells have just one FCE, but some have more. The IC gives each spell an HRG code. Therefore each FCE has its own HRG and a Spell HRG, which may or may not be the same.

2.7.2 Calculation / process in this model

The aim of the FCE to spell conversion stage is to calculate total spell level costs (including EBD) by HRG / admission method combination. We subsequently remove the cost of spell-based EBDs to create inlier spell unit costs.

Calculating FCE unit costs

The model starts by pulling data (columns) from table [Stage.APC_NICE] from the NICE Technology Appraisals calculation. Key data (columns) copied over are: 1) [CLEAN INLIER ACT], 2) [CLEAN INLIER TC WITH NICE], 3) [CLEAN EBD TC] and 4) [CLEAN TC]

The model then calculates the unit costs by dividing the total costs by the number of activities as follows:

i. Calculating inlier unit costs

$$[UC \; exc \; EBD] = \frac{[CLEAN \; INLIER \; TC \; WITH \; NICE]}{[CLEAN \; INLIER \; ACT]}$$

ii. Calculating EBD unit costs

$$[EBD\_UC] = \frac{[CLEAN \; EBD \; TC]}{[CLEAN \; EBD \; ACT]}$$

iii. Calculating total unit costs

$$[UC \; inc \; EBD] = \frac{[CLEAN \; TC]}{[CLEAN \; INLIER \; ACT]}$$

iv. The results are then stored in a table [Stage.APC_FCE_UC_incEBD]

FCE to Spell conversion and combining DC and EL admission methods

To start the FCE to spell conversion the model joins three tables using fields [FCE HRG]=[HRG] and [ADM] = [ADMISSION], retaining records where the HRGs appears in tables [Input.TrimpointsRC_HRGs] and [Input.HES_FCE_Spell_Map_LoS]. The tables and key fields used are listed below:

2.7.3　　Tables and key fields used for this modelling step

Tables	Fields pulled through
[Stage.APC_FCE_UC_incEBD]	[HRG] [ADMISSION] [UC exc EBD] [EBD_UC]
[Input.HES_FCE_Spell_Map_LoS]	[FCE HRG] [SPELL HRG] [EPI_LOS] [FCE ACTIVITY]
[Input.TrimpointsRC_HRGs]	[HRG] [FCE_trim]

With every combination of FCE HRG and Spell HRG stored in the input table [Input.HES_FCE_Spell_Map_LoS][5], the model adds up all FCE activities related to each spell HRG [SPELL HRG]. This results in the mapping of FCE HRG to SPELL HRG. The model then calculates the Spell inlier [SPELL INLIER] and EBD [HES FCE EBD] costs by multiplying the activities by the unit costs as follows:

  i.　　Excludes HRG = 'UX'

  ii.　　Calculating spell inlier costs

$$[SPELL\ INLIER] = [FCE\ ACTIVITY] \times [UC\ exc\ EBD]$$

---

[5] This table has the FCE to Spell mapping from HES data

iii.　Calculating EBD costs

If admission [ADM] <> 'DC' as no day cases would have excess bed days AND the FCE trimpoint is less than the episode length of stay [FCE_trim]<[EPI_LoS], then

$$[HES\ FCE\ EBD] = \{[EPI\_LoS] - [FCE\_trim]\}^6 \times [FCE\ ACTIVITY] \times [EBD\_UC]$$

Otherwise

$$[HES\ FCE\ EBD] = 0$$

iv.　The results are then stored in temporary table [Temp.(#03b)]

2. After the spell inlier costs and EBD costs have been calculated, the model combines 'DC' and 'EL' admission methods by changing all 'DC' characters to 'EL'

In the final steps of this section, we calculate the total spell costs.

The model joins three tables using fields [SPELL HRG] = [SPELL HRG], [SPELL HRG] = [HRG CODE] and [ADM] = [ADM]. It retains all HRGs in [Input.HRGEligibility] where the field [Mandatory IP] = 1.

It then calculates the spell total cost and activities for each HRG / admission method combination where 'DC' and 'EL are combined:

i.　$[SPELL\ TC] = [SPELL\ INLIER] + [HES\ FCE\ EBD]$

ii.　$[SPELL\ ACT] = \sum[SPELLFLAG]$

iii.　The results are then stored in a temporary table [Temp.(#03c)]

---

[6] This calculation gives the excess bed days
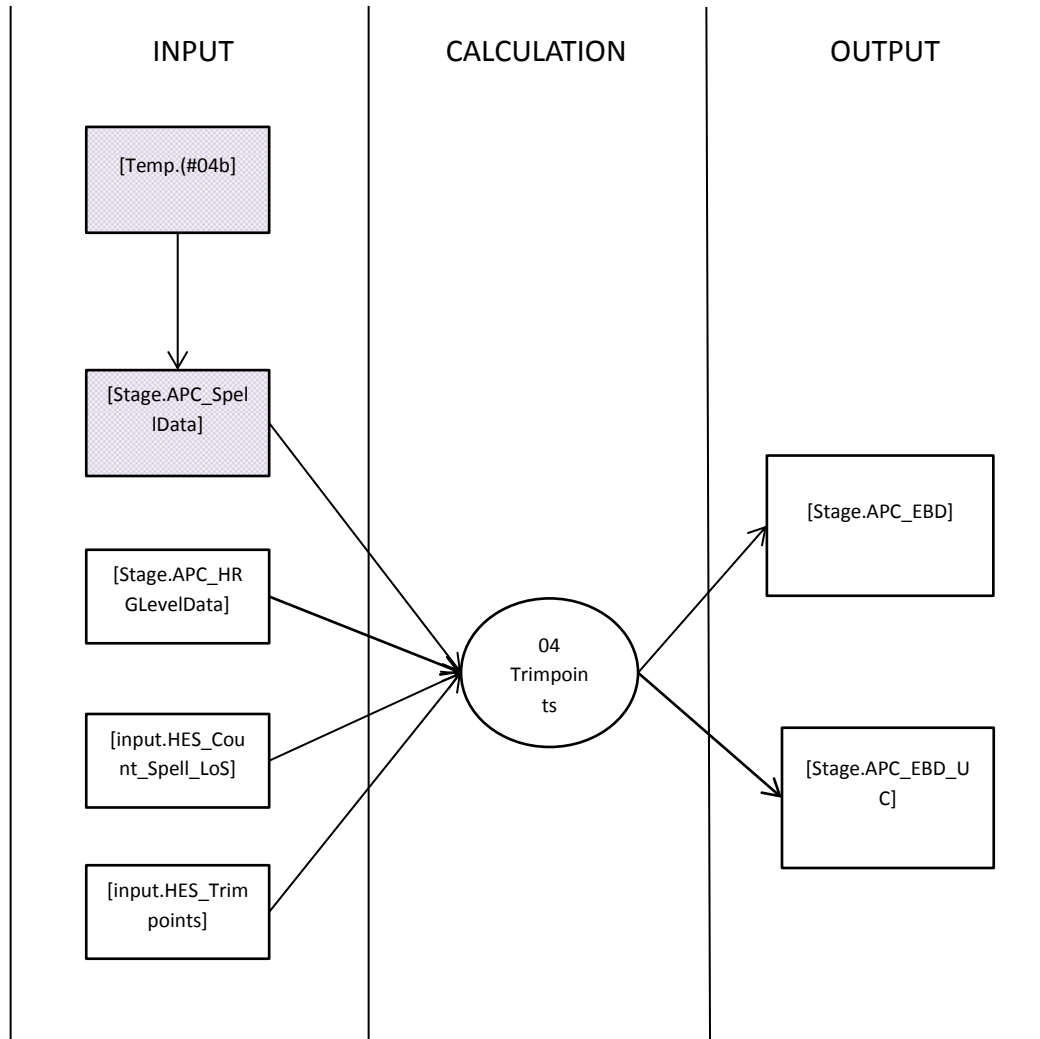
2.7.4 Data used for this modelling step

Input tables used in this model step	Input fields from input table used
[Stage.APC_NICE]	[CLEAN INLIER ACT] [CLEAN INLIER TC WITH NICE] [CLEAN EBD TC] [CLEAN TC] [ADMISSION] [HRG]
[Input.TrimpointsRC_HRGs]	[HRG] [FCE_Trim]
[Input.HES_FCE_Spell_Map_LoS]	[SPELL HRG] [ADM] [EPI_LoS] [FCE ACTIVITY]
[Input.HES_Spell_Counts_Adm]	[SPELL HRG] [ADM] [SPELLFLAG]
[Input.HRGsEligibility]	[HRG Code] [Mandatory IP]

2.7.5 Data outputs produced in this model step

Output tables generated by this model step	Output fields generated in output table (copied over)	Output fields generated in output table (calculations)
[Temp.(#03c)]	[SPELL HRG] - *[Input.HES_FCE_Spell_Map_LoS].[SPELL HRG]* [ADM] - *[input].[HES_Spell_Counts_Adm].[ADM]*	[SPELL TC] [SPELL ACT]

2.8   Calculating trim points

2.8.1   Overview

INPUT | CALCULATION | OUTPUT

[Temp.(#04b]

[Stage.APC_SpellData]

[Stage.APC_HRGLevelData]

[input.HES_Count_Spell_LoS]

[input.HES_Trimpoints]

04 Trimpoints

[Stage.APC_EBD]

[Stage.APC_EBD_UC]

For each HRG we need to calculate its normal range of LoS. The upper limit of this range is what we call the Trimpoint. This is the LoS beyond which an additional payment is made for each additional day of treatment for a single spell. This additional payment is an EBD payment, covered in section 2.1. EBD payments need to be identified and isolated from the inlier costs of each HRG. Trimpoints allow us to do this.

2.8.2   Calculation / process in this model

Flagging low volume HRGs and capping EBD unit costs

The model starts of by copying the data (columns) from [Temp.(#03c)] from the previous section 2.7.5. It stores it in a staging table [Stage.APC_SpellData], alphabetically sorting it by [SPELL HRG].

It then splits 'EL' and 'NE' admission types [ADM] into two separate columns for each spell HRG and only carries over these two new columns together with the [SPELL HRG] into a new temporary table [Temp.(#04b)].

The next step of this stage aims to flag low volume HRGs. This flag is needed to ascertain which trimpoint value should be associated with each HRG. The model starts off by creating a flagging column [COMBINE] for every HRG in table [Temp.(#04b)] using the following rules:

i.   If admission method = 'EL' is less than 50, then

$[COMBINE] = '1'$

Or if admission method = 'NE' is less than 50, then

$[COMBINE] = '1'$

Or if admission method 'EL' + 'NE' is less than 150, then

$[COMBINE] = '1'$

Otherwise

$[COMBINE] = 0$

ii.   The results are then stored in another temporary table [Temp.(#04c)]

In addition to flagging low volumes in the above steps, the model then caps each FCE EBD unit cost for each chapter level HRG within the table [Stage.APC_HRGLevelData]

It starts off by calculating EBD unit cost from table [Stage.APC_HRGLevelData] by dividing the sum of each chapter EBD total costs by the sum of each chapter EBD activities as follows:

i. $[FCE\ EBD\ UC] = \frac{\sum_1^n [CLEAN\_EBD\_TC]}{\sum_1^n [CLEAN\_EBD\_ACT]}$ where n=chapter level (e.g. , A, B etc.)

It then caps each chapter EBD unit cost [FCE EBD UC] creating another column, by applying the rules that: if the unit cost is less than 100, substitute 100; if the unit cost is greater than 500, substitute 500, otherwise the cost remains the same

ii. If [FCE EBD UC] is > 500 or less than 100, then

$[FCE\ EBD\ UC\ CAPPED] = 500\ or\ 100$ respectively

otherwise

iii. $[FCE\ EBD\ UC\ CAPPED] = [FCE\ EBD\ UC]$

iv. Three new columns are created, [CHAPTER], [FCE EBD UC] and [FCE EBD UC CAPPED] and are then stored in another temporary table [Temp.(#05a)]

Removing EBD costs from spell total costs

The next step of the model is to calculate the EBD costs to be removed from the spell total costs to derive the inlier costs.

The model starts off by calculating the actual number of EBDs. It does this by joining three tables using fields [SPELL HRG] =[HRG] and [SPELL HRG] =[SPELL HRG], retaining only records with HRGs that appear in all three tables. The tables and key fields used are listed below:

Tables	Fields pulled through
[Temp.(#04c)]	[SPELL HRG] [COMBINE]
[Input.HES_Count_Spell_LoS]	[SPELL HRG] [ADM] [SpellLoS_1YR] [SPELL FLAG]
[Input.HES_Trimpoints]	[HRG] [DC/EL] [NE] [DC/EL/NE]

It then needs to select the correct value for the trimpoint ([TP]) which would be the cut-off point for the inlier and excess bed days.

By excluding all admission types of 'DC' and 'UX', the model selects the trimpoints values by applying the following criteria:

    i.   if [Combine] = 1 from [Temp.(#04c)], then use the HES trimpoint value from [input.HES_Trimpoints], field [DC/EL/NE]

            otherwise, if [ADM] = 'EL' from [input.HES_Trimpoints] table, then use this trimpoint value from field [DC/EL]

            otherwise, use [NE] trimpoint value from [input.HES_Trimpoints] table

    ii.   the appropriate trimpoints are then stored in a new data column [TP]

Once the appropriate trimpoint values have been selected for the spell HRGs, the model then calculates the EBDs for each occurrence of the Spell HRG / admission method combination in table [Input.HES_Count_Spell_LoS] only when the length of stay [SpellLos_1YR] is greater than the trimpoint [TP]. The resulting value is multiplied by the number of spell activities [SPELL FLAG] as follows:

    i.   if length of stay [SpellLos_1YR] is greater than [TP] then,

$$[EBDs] = \sum_{HRG=1}^{n} \{[SpellLoS\_1YR] - [TP]\} \times [SPELLFLAG]$$

Otherwise

$$[EBDs] = 0$$

ii. The results are stored in another temporary table [Temp.(#05b)] showing the [SPELL HRG], chapter level [Chapter], admission [ADM], trimpoint [TP] and excess bed days [EBDs]

The next step is to calculate the spell EBD total costs for each HRG / admission method combination costs based on the new trim points.

Using the capped EBD unit costs [FCE EBD UC CAPPED] for each chapter HRG in table [Temp.(#05a)], the model calculates the EBD total cost [EBD TC] by multiplying the capped EBD unit costs by the EBDs from [Temp.(#05b)] where the chapter level is the same in both tables as follows:

i. $[EBD\ TC] = [FCE\ EBD\ UC\ CAPPED] \times [EBDs]$

ii. This is stored in a temporary table [Temp.(#05c)]

The final steps in this section are to remove the spell EBD total costs from the spell total costs.

The model joins the tables [Temp.(#05c)] and [Stage.APC_SpellData] using fields [SPELL HRG] = [SPELL HRG] and [ADM] = [ADM] retaining only records in table [Temp.(#05c)].

The model then subtracts the EBD total cost [EBD TC] in [Temp.(#05c)], from [SPELL TC] in [Stage.APC_SpellData] to produce the spell inlier total costs for each HRG / admission method combination.

iii. $[INLIER\ TC] = [SPELL\ TC] \times [EBD\ TC]$

iv. The results are stored in table [Stage.APC_EBD].

The final step is to create an additional table to store all the capped EBD unit costs associated with each HRG. The model retrieves the chapter level capped EBD unit costs from table [Temp.(#05a)] based on all the HRGs in [Temp.(#05b)] and stores the final results in table [Stage.APC_EBD_UC].

2.8.3 Data used for this modelling step

Input tables used in this model step	Input fields from input table used
[Temp.(#04b]	[SPELL HRG] [ADM] [SPELL TC] [SPELL ACT]
[Stage.APC_SpellData]	[SPELL HRG] [ADM] [SPELL TC] [SPELL ACT]
[Stage.APC_HRGLevelData]	[HRG] [CLEAN_EBD_ACT] [CLEAN_EBD_TC]
[**Error! Reference source not found.**]	[SPELL HRG] [ADM] [SpellLoS_1YR] [SPELLFLAG]
[**Error! Reference source not found.**]	[HRG] [DC/EL/NE] [DC/EL] [NE]

2.8.4 Data outputs produced in this model step

Output tables generated by this model step	Output fields generated in output table (copied over)	Output fields generated in output table (calculations)
[Stage.APC_EBD]	[SPELL HRG] - *[Stage.APC_SpellData].[SPELL HRG]* [ADM] - *[Stage.APC_SpellData].[ADM]*	[SPELL ACT] [EBD TC] [INLIER TC]
[Stage.APC_EBD_UC]	[HRG] - *[Error! Reference source not found.].[HRG]*	[FCE EBD UC CAPPED]

2.9   Removal of costs associated with high costs drugs and devices (D&D)

2.9.1   Overview
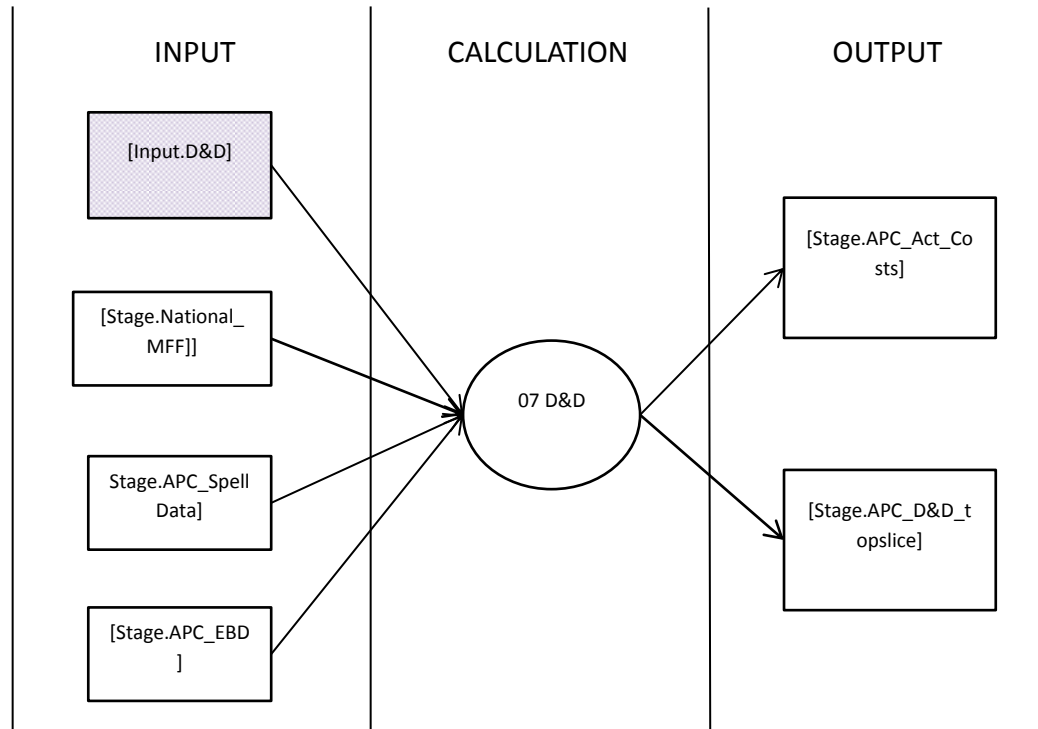
The costs of each HRG include costs of high cost drugs and devices (D&D) at this stage. We now need to remove (or unbundle) the costs of these high cost D&D from the total cost relating to specific HRGs. This is necessary because the high cost drugs and devices are reimbursed through a separate tariff at locally agreed prices.

In addition to the unbundling of high cost D&D, the cost adjustments made here are restricted to not more than 50% of the total cost of the HRG after the high cost D&D removal. The rest of the high cost D&D removal is done through Topslicing which can be found in section 2.13.

2.9.2 Calculation / process in this model

Grouping D&D costs to EL and NE admission methods

The model starts by using table [Input.D&D] to calculate the high cost D&D costs [DandD Total] for each HRG / admission method combination. The admission methods within this table are still split between 'DC', 'EL' and 'NE'. As the model has already changed all 'DC' to 'EL' in the FCE to Spell Conversion section, it also needs to convert 'DC' to 'EL' in this stage as an extra step. It sums D&D as follows:

i. $[D\&D\ Grouped] = \sum_{HRG=1}^{n}[DandD\ Total]\ where\ 'DC' =' EL'$

As explained in section 2.3, we remove the market forces factor from the reference costs. For consistency, the MFF also has to be removed from - the high cost D&D costs. However the high cost D&D costs for each HRG were not supplied for each Provider, therefore we have used the average national MFF (see calculation outlined in section 2.3 – Removing Market Forces Factor). The model divides [D&D Grouped] by the national MFF [NAT MFF] to give the high cost D&D costs excluding MFF [D&D exc MFF]. This is stored in a temporary table [Temp.(#07b)].

Limiting cost removal to 50%

We have applied a general guideline that no more than 50% of the total cost of each spell-based HRG / admission method combination can be removed for high cost D&D exclusions in any given year. This is to prevent a HRG, particularly those with low activity, being disproportionately affected.

The model starts this restriction by joining three tables using the HRG fields and [ADM] = [ADM], retaining only fields that are contained in Stage.APC.EBD. The tables and key fields used are listed below:

Tables	Fields pulled through
[Temp.(#07b)]	[HRG Code] [ADM] [D&D exc MFF]
[Stage.APC_SpellData]	[SPELL HRG] [ADM] [SPELL TC] [SPELL ACT]
[Stage.APC_EBD]	[SPELL HRG] [INLIER TC] [EBD TC]

The model then calculates the amount of total cost restriction by: i) dividing the spell total cost in table [Stage.APC_SpellData] by 2 and; ii) calculating the total cost excluding D&D by subtracting the D&D excluding MFF costs [D&D exc MFF] in table [Temp.(#07b)] from the inlier total cost [INLIER TC] in table [Stage.APC_EBD]

i. $[50\% \: TC] = \frac{[SPELL \: TC]}{2}$

ii. $[TC \: exc \: D\&D] = [INLIER \: TC] - [D\&D \: exc \: MFF]$

Finally, the model then restricts each total inlier costs excluding D&D [TC exc D&D] by the following criteria, putting the number '1' flag where the total inlier costs excluding D&D is less than half of the inlier total cost spell cost [50% TC].

i. if [TC exc D&D] < [50% TC] then return value [50% TC] and create a column to flag this as '1'

ii. if [ADM] = 'OP', then return value [TC exc D&D]

iii. otherwise, return value [TC exc D&D]

iv. The results of the above three criteria are then stored as a separate column called [Limited TC] (the revised inlier total costs) within a new temporary table [Temp.(#07c)]

The model then moves the four data columns from table [Temp.(#07c)] into another table [Stage.APC_Act_Costs]. The fields moved are [Spell HRG], [ADM], [SPELL ACT] and [REVISED TC] (previously called [LIMITED TC])

Calculate limiting top-slice amount

The final step in this stage of the removal of high cost D&D is to calculate the amount of top-slice cost to unbundle through top-slice. To do this the model calculates the total amount of D&D limited slice amount [D&D Limit Slice] using the fields below from [Temp.(#07c)] and returns a single value as follows:

    a. $[D\&D\ Limit\ Slice] = \sum[Limited\ TC] - (\sum[SPELL\ TC] - \sum[EBD\ TC] - \sum[D\&D\ exc\ MFF])$

    b. The results are stored in a temporary table [Temp.(#07e)]

The model finally calculates the total amount of D&D top slice figure by first using fields from three tables to create two figures. The tables and key fields used are listed below:

Tables	Fields pulled through
[Temp.(#07e)]	[D&D LimitSlice]
[Input.D&D_topslice]	[TOTAL]
[Stage.National_MFF]	[NAT MFF]

The total amount D&D top slice is calculated by dividing the D&D amount [Total] by the national MFF [NAT MFF] to remove the MFF effect. In addition, the limited amount of top slice is renamed as follows:

    c. $[DandD\ TS] = \dfrac{[Total]}{[NAT\ MFF]}$

    d. $[LIMIT\ TS] = [D\&D\ Limit\ Slice]$

    e. The results are then stored in staging table [Stage.APC_D&D_topslice]

2.9.3   Data used for this modelling step

Input tables used in this model step	Input fields from input table used
[Input.D&D]	[HRG CODE] [ADMISSION] [DandD Total]
[Stage.National_MFF]	[NAT MFF]
[Stage.APC_SpellData]	[SPELL HRG] [ADM] [SPELL TC] [SPELL ACT]
[Stage.APC_EBD]	[SPELL HRG] [ADM] [EBD TC] [INLIER TC]

2.9.4   Data outputs produced in this model step

Output tables generated by this model step	Output fields generated in output table (copied over)	Output fields generated in output table (calculations)
[Stage.APC_Act_Costs]	[SPELL HRG] - *[Stage.APC_SpellData].[SPELL HRG]* [ADM] - *[Stage.APC_SpellData].[ADM]* [SPELL ACT] - *[Stage.APC_SpellData].[SPELL ACT]*	[REVISED TC]
[Stage.APC_D&D_topslice]		[LIMIT TC] [DandD TS]

2.10 Calculating unit costs

2.10.1 Overview
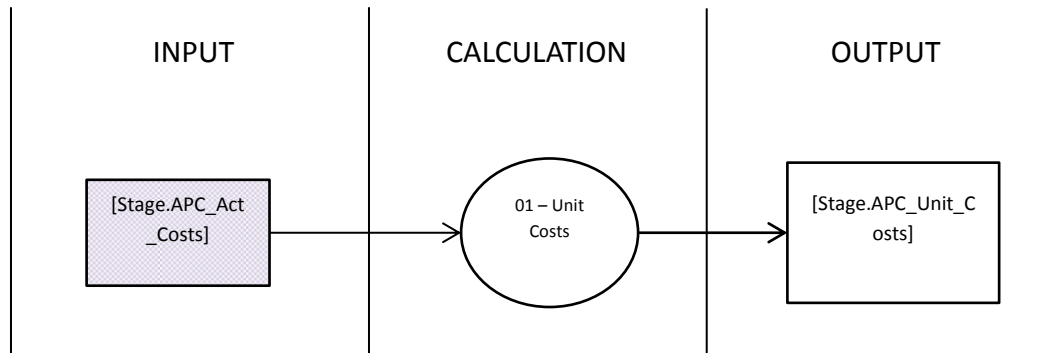
Once the high cost drugs and devices costs have been removed from the HRG costs, we have completed all the cleaning of the HRG cost data and we are ready to calculate the unit costs for each Spell HRG for each admission method (DC, EL and NE). This stage starts to prepare the tariff in a format that can be used to derive unit costs.

2.10.2 Calculation / process in this model

To work out the unit costs, the model starts off by creating two temporary pivot tables showing the total cost [REVISED TC] (the inlier total costs) and number of activities [SPELL ACT] for each Spell HRG / admission method combination by using all the data columns in table [Stage.APC_Act_Costs] from the previous step – Removal of costs associated with D&D.

3. The first temporary table has the following calculations:

    i. $[EL] = \sum_{HRG=1}^{n}[SPELL\ ACT]\ where\ ADM = 'EL'$

    ii. $[NE] = \sum_{HRG=1}^{n}[SPELL\ ACT]\ where\ ADM = 'NE'$

    iii.   The results are stored in temporary table [Temp.(#01a)]

4. The second temporary table has the following calculations:

iv. $[EL] = \sum_{HRG=1}^{n}[REVISED\ TC]\ where\ ADM = 'EL'$

v. $[NE] = \sum_{HRG=1}^{n}[REVISED\ TC]\ where\ ADM = 'NE'$

vi. The results are stored in temporary table [Temp.(#01b)]

Using these two temporary tables, the model calculates the unit costs by simply dividing the total cost by the activities for each Spell HRG / admission method combination.

i. It starts off renaming EL and NE in [Temp.(#01a)] to 'EL ACT' and 'NE ACT' respectively and renames 'EL' and 'NE' in [Temp.(#01b)] to 'EL TC' and 'NE TC' respectively

ii. *Then,* $[EL\ UC] = [EL\ TC]\ \div [EL\ ACT]$

iii. *And,* $[NE\ UC] = [NE\ TC]\ \div [NE\ ACT]$

iv. The results are then stored in a staging table [Stage.APC_Unit_Costs]

2.10.3   Data used for this modelling step

Input tables used in this model step	Input fields from input table used
[Stage.APC_Act_Costs]	[SPELL HRG] [ADM] [SPELL ACT] [REVISED TC]

2.10.4   Data outputs produced in this model step

Output tables generated by this model step	Output fields generated in output table (copied over)	Output fields generated in output table (calculations)
[Stage.APC_Unit_Costs]	[SPELL HRG] - *[Stage.APC_Act_Costs].[SPELL HRG]*	[EL ACT] [NE ACT] [EL TC] [NE TC] [EL UC] [NE UC]

2.11   Short Stay Emergency tariff (SSEM) adjustment

2.11.1   Overview
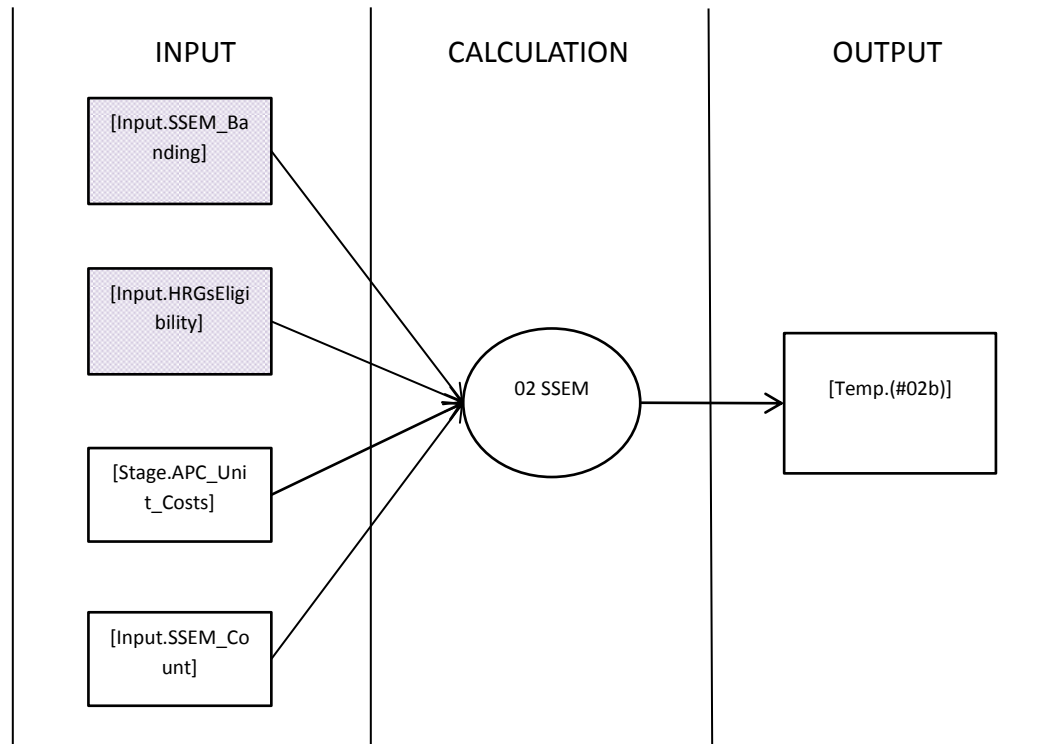
Certain HRGs attract a reduced short stay emergency (SSEM) tariff for adult emergency spells with a length of stay less than 2 days. This reflects the lower resource costs of delivering these spells. The level of the SSEM tariff is based on the average NE length of stay of the HRG. Only the NE length of stay is used in this calculation because emergencies are by definition always non-elective.

Prior to this stage in the process, the SQL model assumed that all NE spells attract the full tariff. From this point on, however, the model differentiates between SSEM and non-SSEM spells. As the SSEM tariff is a percentage of the main tariff, treating the short stay spells separately causes a reduction in the overall cost quantum of the tariff.

2.11.2   Calculation / process in this model

To counteract the reduction in the overall cost quantum , we inflate the NE tariff prices based on:

a. the proportion of NE spells that attract the short stay adjustment
b. the short stay banding of the HRG

We have not altered the percentage reductions for each SSEM banding from the 2012/13 tariff and the model starts off by using these percentages from an input table [Input.SSEM_Banding] shown below.

SSEM Banding

Band	ALoS	Tariff_%
1	0 to 1	1
2	2	0.7
3	3 to 4	0.45
4	>5	0.25

Allocating banding for each eligible HRG

The model joins tables [Input.SSEM_Banding] and [Input.HRGsEligibility] using fields [SSEM Banding] = [Band], retaining HRGs in table [Input.HRGsEligibility] where field [Mandatory IP] =1. Key data fields used from table [Input.SSEM_Banding] are: [Band], [ALoS] and [Tariff_%] and key data fields used from table [Input.HRGsEligibility] are: [HRG Code], [SSEM Banding] and [Mandatory IP]

5. The model then renames the following fields as follows:

a. [HRG Code] = [HRG]
b. [Eligible for SSEM] = [ELIGIBLE]
c. [Mandatory IP] = [MAND IP]
d. [Band] = [BAND]
e. [Tariff_%] = [TARIFF %]

The results are stored in temporary table [Temp.(#02a)]

Applying the SSEM reductions

The model joins three tables using the HRG fields, retaining records in table [Stage.APC_Unit_Costs]. The tables and key fields used are listed below:

Tables	Fields pulled through
[Stage.APC_Unit_Costs]	[RAW NE UC] = [NE ACT] [SPELL HRG] [NE ACT] [NE UC] [NE TC]
[Input.SSEM_Count]	[SPELL HRG] [SSEM]
[Temp.(#02a)]	[HRG] [BAND] [ELIGIBLE] [TARIFF %]

The model then calculates the amount of SSEM to uplift for each HRG based on the data rows in table [Stage.APC_Unit_Costs] by doing the following calculations in order:

i. Firstly, it calculates the percentage of SSEM to use by dividing the SSEM activities by the NE activities

$[SSEM \, \%] = [SSEM \, SPELL] \div [NE \, ACT]$ where [SSEM] = [SSEM SPELL]

ii. Then the model finds the SSEM adjustments as follows:

$[SSEM \, ADJ] = [SSEM \, \%] \times [TARIFF \, \%] + (1 - [SSEM \, \%])$

iii. Then the model calculates the adjusted NE unit cost (inclusive of SSEM) only for the HRGs which are eligible for SSEM by filtering field [ELIGIBLE] = 1, otherwise don't apply SSEM adjustment

$[ADJ \, NE \, UC] = [NE \, UC] \div [SSEM \, ADJ]$

iv.   Using the adjusted NE unit cost, the model then calculates the total adjusted NE cost (inclusive of SSEM) as follows:

$$[ADJ\ NE\ TC] = [ADJ\ NE\ UC] \times [NE\ ACT]$$

v.   In addition, the model creates another column [TC CHECK] and returns the value 0 for each HRG

vi.   Once we have calculated the costs, the model finally creates an extra column to show the SSEM cost separately using the eligibility criteria, [ELIGIBLE] = 1 and the banding criteria [band] as follows:

$$[SSEM\_Q] = [SSEM] \div [TARIFF\ \%] \times [ADJ\ NE\ TC]$$

vii.   The above steps create new columns which are stored in a temporary table [Temp.(#02b)]

## 2.11.3   Data used for this modelling step

Input tables used in this model step	Input fields from input table used
[Input.SSEM_Banding]	[Band] [ALoS] [Tariff_%]
[Input.HRGsEligibility]	[HRG Code] [Eligible for SSEM] [Mandatory IP] [SSEM Banding]
[Stage.APC_Unit_Costs]	[SPELL HRG] [NE ACT] [NE UC] [NE TC]
[Input.SSEM_Count]	[SPELL HRG] [SSEM]

2.11.4   Data outputs produced in this model step

Output tables generated by this model step	Output fields generated in output table (copied over)	Output fields generated in output table (calculations)
[Temp.(#02b)]	[HRG] - *[Stage.APC_Unit_Costs].[SPELL HRG]* [ELIGIBLE] - *[Input.HRGsEligibility]. [Eligible for SSEM]* [TARIFF %] - *[Input.HRGsEligibility]. [Tariff_%]* [NE ACT] - *[Stage.APC_Unit_Costs].[NE ACT]* [NE UC] - *[Stage.APC_Unit_Costs].[NE UC]* [NE TC] - *[Stage.APC_Unit_Costs].[NE TC]* [BAND] - *[Input.SSEM_Banding].[Band]* [SSEM] - *[Input.SSEM_Count].[SSEM]*	[RAW NE UC] [SSEM SPELL] [SSEM %] [SSEM ADJ] [ADJ NE UC] [ADJ NE TC] [TC CHECK] [SSEM_Q]

2.12 Inclusion of Clinical Negligence Scheme for Trusts (CNST)

2.12.1   Overview
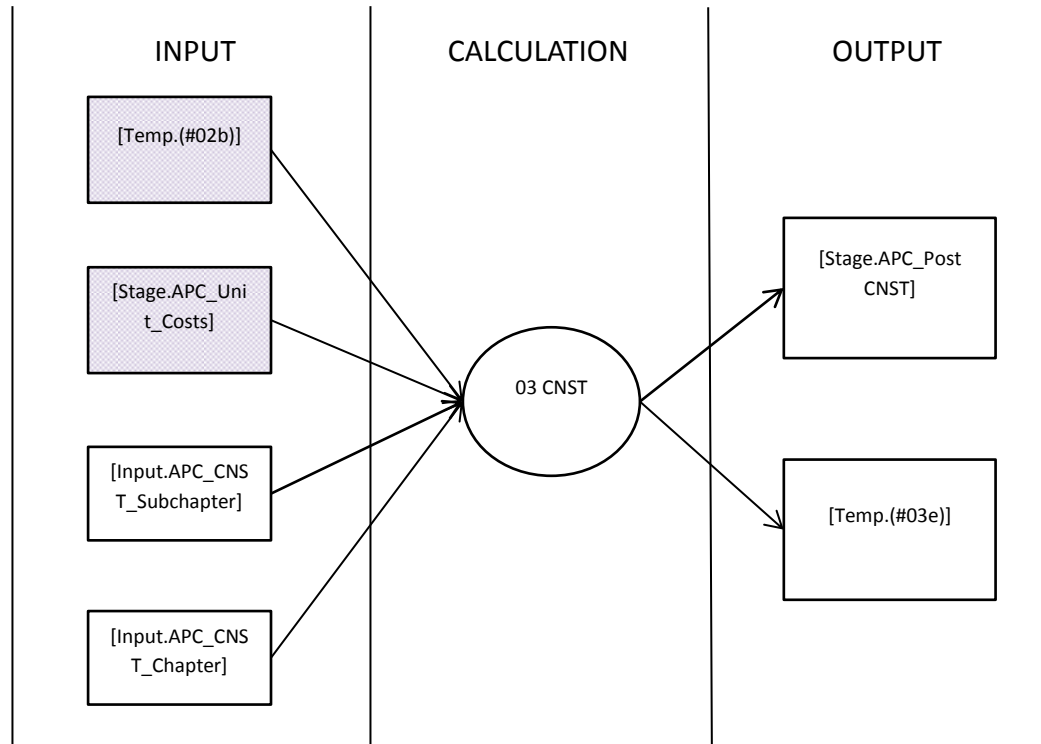
In recent years, we have targeted particular inflationary increases at specific tariff prices, for example taking account of cost pressures arising from NHS contributions to the CNST.

The Clinical Negligence Scheme for Trusts (CNST) is a scheme run by the NHS Litigation Authority (NHSLA) designed to compensate Trusts for any monies they are required to pay out to patients in cases where the trusts are deemed to have treated the patient in question negligently. At this stage

of the calculations, the costs need to reflect CNST premiums between 2011-12 and 2014-15. These are calculated at sub-chapter level (dependent on the speciality) and apportioned across all relevant HRGs as a percentage uplift[7].

The CNST adjustment is now done after the SQL process (in post-processing) and the values at the end of this process are therefore the same at the start of this process.

2.12.2   Calculation / process in this model

The CNST figures in input table [Input.APC_CNST_Subchapter] have been set to 0 resulting in no percentage increase to the costs in the previous section.

2.12.3   Data used for this modelling step

| Input tables used in this model step	Input fields from input table used
[Temp.(#02b)]	[HRG] [ADJ NE TC]
[Stage.APC_Unit_Costs]	[SPELL HRG] [EL TC] [EL ACT] [NE ACT]
[Input.APC_CNST_Subchapter]	[SubChapter] [CNST]
[Input.APC_CNST_Chapter]	[Chapter] [CNST]

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[7] For maternity services, we apply the CNST adjustment to the delivery element of the pathway. For A&E services, we adjust all HRGs excluding VB10Z and VB11Z

2.12.4 Data outputs produced in this model step

Output tables generated by this model step	Output fields generated in output table (copied over)	Output fields generated in output table (calculations)
[Stage.APC_Post CNST]	[SPELL HRG] – *[Stage.APC_Unit_Costs].[SPELL HRG]* [EL ACT] – *[Stage.APC_Unit_Costs].[EL ACT]* [NE ACT] – *[Stage.APC_Unit_Costs].[NE ACT]*	[CHAPTER] [SUB CHAPTER] [EL] [NE] [REV_TC]
[Temp.(#03e)]		[TC] [EL TC] [NE TC]

2.13 Top-slices

2.13.1 Overview
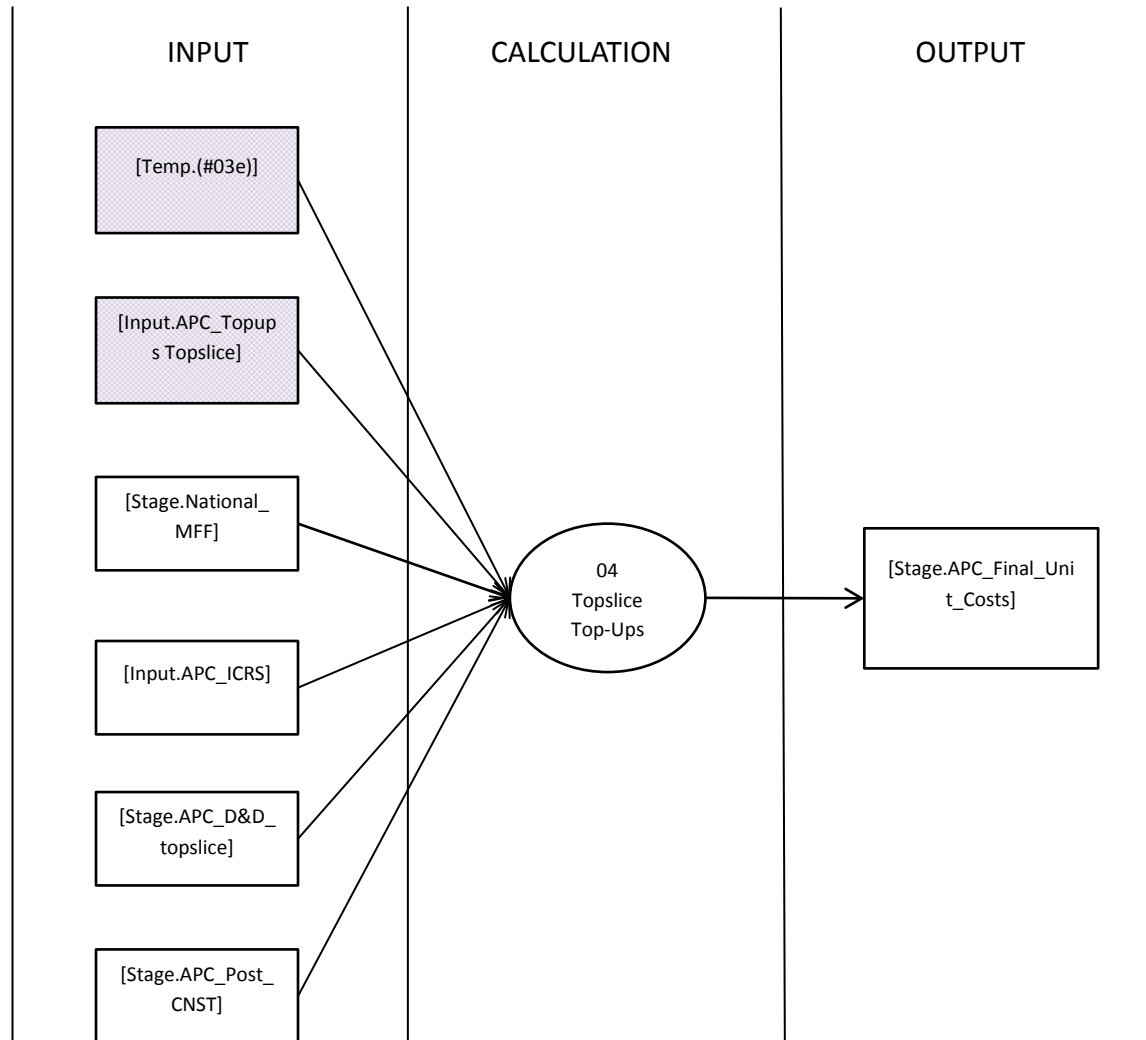
Top slicing is the process of reducing the price of all (or a subset of all) HRGs to compensate for additional costs that have been incurred. The top-slice adjustment is required to keep the total cost quantum at the same level.

Within this model we calculate top-slices to adjust for the following costs:

a. Specialised services – in order to fund the additional payments for specialist top-ups, an estimate was made of the costs to commissioners for this and removed from EL and NE;

b. Injury Cost Recovery Scheme (ICR)[8] – these costs are paid separately through the ICR scheme and so were removed (from NE only), and;

c. D&D exclusions – we calculate these as described in section 2.9 and apply them separately to EL and NE costs.

2.13.2   Calculation / process in this model

Calculating Specialised services top-slice percentage

The model first calculates top-slice percentage for Specialised services top-ups by joining three tables together and retrieving the fields below:

Tables	Fields pulled through
[Temp.(#03e)]	[EL TC] [NE TC]
[Input.APC_Topups Topslice]	[Spec_NE] [Spec_EL] [Spec_DC]
[Stage.National_MFF]	[NAT MFF]

The model then applies a series of calculations steps to calculate two top-slice percentages which include removing the MFF effect, for each admission methods inlier costs, 'NE' and 'EL' as follows:

i.   Calculating the NE top-slice percentage for Specialised services

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[8] More information available at: http://transparency.dh.gov.uk/tag/nhs-icr/

$$[NE\ TS] = \frac{[NE\ TC] - \{[Spec\_NE] \div [NAT\ MFF]\}}{[NE\ TC]}$$

ii.   Calculating the EL top-slice percentage (includes adding up DC & EL costs as these are separate from the input table

$$[EL\ TS] = \frac{[EL\ TC] - \{([Spec\_EL] + [Spec\_DC]) \div [NAT\ MFF]\}}{[EL\ TC]}$$

iii.   The results are then stored in a temporary table [Temp.(#04a)]

Calculating ICRS top-slice percentage

The model then repeats the above two steps for ICRS by also joining three tables together using the key fields below:

Tables	Fields pulled through
[Temp.(#03e)]	[NE TC]
[Input.APC_ICRS]	[ICRS]
[Stage.National_MFF]	[NAT MFF]

It calculates the top-slice percentage for the inlier costs for NE as follows:

i. $[ICRS\ TS] = \frac{[NE\ TC] - \{[ICRS] \div [NAT\ MFF]\}}{[NE\ TC]}$

ii.   The results are then stored in a temporary table [Temp.(#04b)]

Calculating D&D top-slice percentage

The model then repeats the above two steps for D&D using the limiting cost removal of the high cost D&D figure calculated in section 2.9. It joins two tables together using the key fields below:

Tables	Fields pulled through
[Temp.(#03e)]	[TC]
[Stage.APC_D&D_topslice]	[LIMIT TS] [DandD TS]

It then calculates the top-slice percentage for the total inlier costs as follows:

    i. $[ALL] = \dfrac{[TC] - [LIMIT\ TS] - [DandD\ TS]}{[TC]}$

    ii.   The results are then stored in a temporary table [Temp.(#04c)]

Calculating total costs after top-slices

The model then applies the top-slices percentages across each Spell HRG / admission method combination inlier costs. It starts by combining the three tables in the previous steps, [Temp.(#04a)], [Temp.(#04b)] and [Temp.(#04c)] and calculates two figures, 1) NE compound top-slices and; 2) EL compound top-slices:

    i.   Calculating the NE compound top-slices

$$[NE\ Compound\ TS] = [NE\ TS] \times [ICRS\ TS] \times [ALL]$$

    ii.   Calculating the EL compound top-slices

$$[EL\ DC\ Compound\ TS] = [EL\ TS] \times [ALL]$$

    iii.   The results are then stored in a temporary table [Temp.(#04d)]

The model then applies these compound percentages in table [Temp.(#04d)] to each Spell HRG / admission method combination in staging table [Stage.APC_Post_CNST] from the previous section to get the revised inlier total costs for each combination as follows:

    i.   Calculating the revised Spell HRG / NE costs

$$[NE\ TC] = [NE] \times [NE\ Compound\ TS]$$

ii.   Calculating the revised Spell HRG / EL costs

$$[EL\ TC] = [EL] \times [EL\ DC\ Compound\ TS]$$

iii.   The results are then stored in a temporary table [Temp.(#04e)]

Calculating final unit costs

The model ends this stage by calculating the final unit costs after top slice adjustment. At this stage there are no more costs adjustments

The model starts off using the five zero priced HRGs in table [Input.ZeroPriceHRG] by joining table [Temp.(#04e)] with table [Input.ZeroPriceHRG] where fields [SPELL HRG] = [Zero Price HRGs], retaining only records in table [Temp.(#04e)].

For the five HRGs it changes their cost and activity values to 0 (effectively giving them zero prices). The rest of the Spell HRGs / admission method combination unit costs are calculated as follows:

i.   Calculating the revised Spell HRG / NE unit costs

$$[NE\ UC] = \frac{[NE\ TC]}{[NE\ ACT]}$$

ii.   Calculating the revised Spell HRG / EL unit costs

$$[EL\ UC] = \frac{[EL\ TC]}{[EL\ ACT]}$$

iii.   The results are finally stored in the staging table [Stage.APC_Final_Unit_Costs]

2.13.3 Data used for this modelling step

Input tables used in this model step	Input fields from input table used
[Temp.(#03e)]	[TC] [EL TC] [NE TC]
[Input.APC_Topups Topslice]	[Spec_NE] [Spec_EL] [Spec_DC]
[Stage.National_MFF]	[NAT MFF]
[Input.APC_ICRS]	[ICRS]
[Stage.APC_D&D_topslice]	[LIMIT TS] [DandD TS]
[Stage.APC_Post_CNST]	[SPELL RHG] [NE] [EL] [NE ACT] [EL ACT]

2.13.4 Data outputs produced in this model step

Output tables generated by this model step	Output fields generated in output table (copied over)	Output fields generated in output table (calculations)
[Stage.APC_Final_Unit_Costs]	[SPELL HRG] – *[Stage.APC_Post_CNST].[SPELL HRG]* [NE ACT] – *[Stage.APC_Post_CNST].[NE ACT]* [EL ACT] – *[Stage.APC_Post_CNST].[EL ACT]*	[NE UC] [EL UC]

2.14 Combining low volume activity

2.14.1 Overview
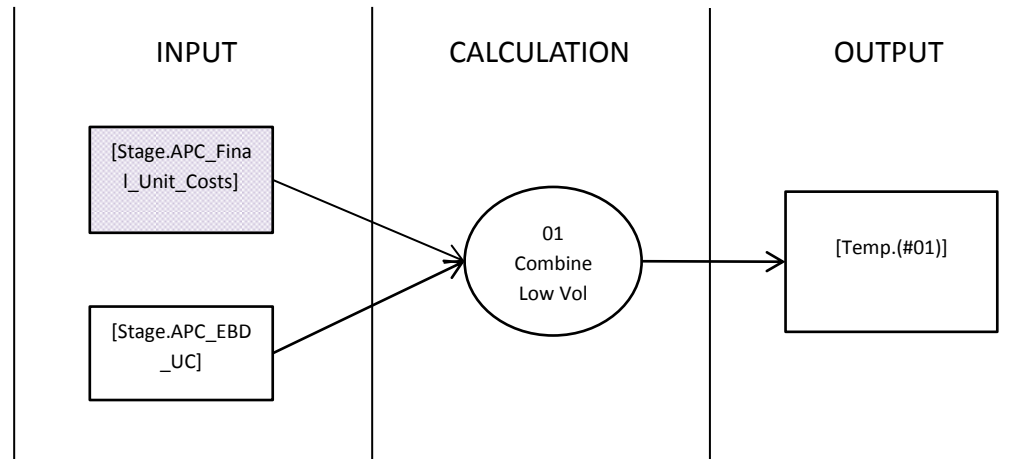
Some HRGs have very low activity or no activity associated with them. In the cases where there are no activities for a particular HRG / admission method combination, we combine the costs with the other respective HRGs / admission methods to produce a single HRG / admission method price. This approach avoids prices being calculated on very small (or non-existent) datasets which are very likely to result in incorrect prices.

2.14.2 Calculation / process in this model

Earlier in section 2.8 'Calculating trim points', the model had an output table [Stage.APC_EBD_UC]. This table had the chapter level capped EBD unit costs for each HRG. The model starts off by joining this table with table [Stage.APC_Final_Unit_Costs] in the previous section where field [SPELL HRG] = [HRG], retaining only records in table [Stage.APC_Final_Unit_Costs].

The model then flags each Spell HRG with value '1' when either the total activities [TOTAL ACT], or the elective activities [EL ACT], or the non-elective activities [NE ACT] have the value 'NULL' from the table [Stage.APC_Final_Unit_Costs]. Otherwise the model flags the Spell HRG with value '0'. A new column [COMBINE] is created.

The model then calculates the total number of EL and NE activities and the total cost of EL and NE inlier costs by multiplying the unit costs by the number of activities as follows:

i. Total inlier EL costs

$$[EL\ TC] = [EL\ UC] \times [EL\ ACT]$$

ii. Total inlier NE costs

$$[NE\ TC] = [NE\ UC] \times [NE\ ACT]$$

iii. Total inlier costs

$$[TC] = [EL\ TC] + [NE\ TC]$$

iv. Total activities

$$[TOTAL\ ACT] = [EL\ ACT] + [NE\ ACT]$$

For each Spell HRG with [COMBINE] = 1, the model applies series of calculation steps and criteria to calculate which HRGs admission methods are to be combined.

i. Calculating the EL combined total costs as follows;

$$[EL\ COMB\ TC] = \frac{TC}{2}$$

ii. Calculating the EL combined unit costs as follows – if [TOTAL ACT] = NULL, or [TOTAL ACT] = 0, then

$$[EL\ COMB\ UC] = \frac{TC}{[TOTAL\ ACT]}, \text{ else}$$

$$[EL\ COMB\ UC] = [EL\ UC]$$

iii. Calculating the NE combined total costs as follows;

$$[NE\ COMB\ TC] = \frac{TC}{2}$$

iv. Calculating the NE combined unit costs as follows – if [TOTAL ACT] = NULL, or [TOTAL ACT] = 0, then

$$[NE\ COMB\ UC] = \frac{TC}{[TOTAL\ ACT]},\ \text{else}$$

$$[NE\ COMB\ UC] = [NE\ UC]$$

    v.   Calculating the excess bed day unit costs as follows – if [HRG] = 'UZ01Z', or [HRG] = 'PB03Z', or [HRG] = 'NULL' (these are HRGs that have a mandatory tariff of zero pounds (£0) and there should be no payment for this activity), then

$$[EBD\ UC] = 0,\ \text{else}$$

$$[EBD\ UC] = [FCE\ EBD\ UC\ CAPPED]$$

    vi.   The above steps result to a number of new columns and these are stored in a temporary table [Temp.(#01)]

2.14.3   Data used for this modelling step

Input tables used in this model step	Input fields from input table used
[Stage.APC_Final_Unit_Costs]	[SPELL HRG] [NE ACT] [EL ACT] [NE UC] [EL UC]
[Stage.APC_EBD_UC]	[HRG] [FCE EBD UC CAPPED]

2.14.4 Data outputs produced in this model step

Output tables generated by this model step	Output fields generated in output table (copied over)	Output fields generated in output table (calculations)
[Temp.(#01)]	[SPELL HRG] – *[Stage.APC_Final_Unit_Costs].[SPELL HRG]* [NE ACT] – *[Stage.APC_Final_Unit_Costs].[NE ACT]* [EL ACT] – *[Stage.APC_Final_Unit_Costs].[EL ACT]* [EL UC] – *[Stage.APC_Final_Unit_Costs].[EL UC]* [NE UC] – *[Stage.APC_Final_Unit_Costs].[NE UC]* [HRG] – *[Stage.APC_EBD_UC].[HRG]* [FCE EBD UC CAPPED] – *[Stage.APC_EBD_UC].[FCE EBD UC CAPPED]*	[TOTAL ACT] [EL TC] [NE TC] [TC] [COMBINE] [EL COMB TC] [NE COMB TC] [EL COMB UC] [NE COMB UC] [EBD UC]

2.15 Calculating final prices

2.15.1   Overview
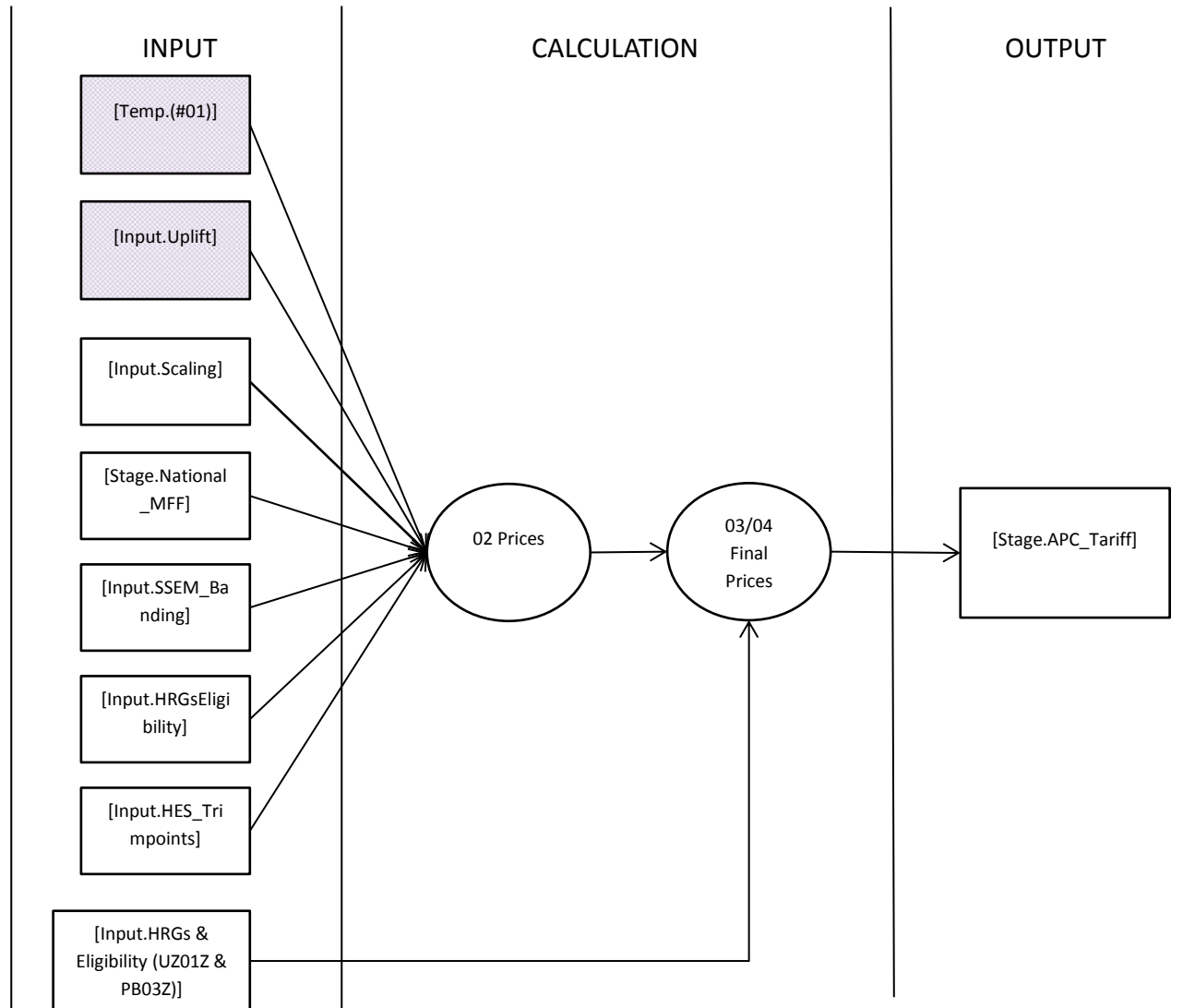
The last stage of the SQL modelling process is to finalise the tariffs. This includes making a number of adjustments to produce separate costs for EL, NE and Longstay payments. Trim points are also set and the model ends with a tariff price for each HRG combination.

2.15.2 Calculation / process in this model

Calculating tariffs and trim points

The model starts off by joining numerous tables using various matching fields to table [Temp.(#01)] produced in the previous section, retaining only records in this table.

The model then calculates the following tariffs by multiplying the unit costs by:

a) an uplift factor showing the residual of inflation and efficiency;

b) MFF rebase calculated in section 2.3 which accounts for the difference between the non MFF costs and the non capped MFF costs; and

c) the scaling factor.

The MFF rebase is 1 as described in section [MFF] and the scaling factor is no longer used in the SQL model and has also been set to 1. The calculations steps are as follows:

i. Calculating the EL tariff as follows;

$$[EL\ Tariff] = [EL\ COMB\ UC] \times [UPLIFT] \times [EL\_SCALE] \times [MFF\ REBASE]$$

ii. Calculating the NE tariff as follows;

$$[NE\ Tariff] = [NE\ COMB\ UC] \times [UPLIFT] \times [NE\_SCALE] \times [MFF\ REBASE]$$

SSEM tariff is also calculated which only applies to NE admission method. The model starts this calculation by flagging which HRGs are entitled to SSEM tariff and then multiplies the unit costs of those HRGs by:

a. an uplift factor;

b. MFF rebase;

    c. the scaling factor; and

    d. the tariff percentage to apply to the respective banding category.

The calculations steps are carried out as follows:

    i. If [Eligible for SSEM] = 1 and [Band] > 1, then return value 'Yes', otherwise return value 'No' in a new column [SSEM Eligible]

    ii. If [SSEM Eligible] = 'Yes' then

$$[SSEM\ Tariff] = [NE\ COMB\ UC] \times [UPLIFT] \times [NE\_SCALE] \times [MFF\ REBASE] \times [Tariff\_\%]$$

otherwise

$$[SSEM\ Tariff] = 0$$

A Longstay payment tariff is also calculated which represents the cost of staying longer than the recommended bed days (past the trim point). The model starts this calculation by excluding three HRGs, 'LA08E', 'SB97Z' and 'SC97Z' from the calculation by setting their respective values to '0'. These are HRGs that have a mandatory tariff of zero pounds (£0) and there should be no payment for this activity. The model then multiplies the unit costs of the remaining HRGs by the uplift factor as follows:

    i. Calculating Longstay payment

$$[Longstay\ Payment] = [EBD\ UC] \times [UPLIFT]$$

Finally, the model works out the respective trimpoints which represent the length of stay associated with that particular HRG / admission method combination. The model applies a series of criterion to ascertain the correct trimpoints as follows:

    i. Calculating the EL trimpoints as follows;

$$[EL\ Trim] = if\ \{[Combine] = 1\ then\ [DC/EL/NE]\ otherwise\ [DC/EL]\} < 0, then\ 5$$

otherwise

$$[EL\ Trim] = [Combine] = 1\ then\ [DC/EL/NE]\ otherwise\ [DC/EL]$$

ii. Calculating the NE trimpoints as follows;

$$[NE\ Trim] = if\ \{[Combine] = 1\ then\ [DC/EL/NE]\ otherwise\ [NE]\} < 0, then\ 5$$

otherwise

$$[NE\ Trim] = [Combine] = 1\ then\ [DC/EL/NE]\ otherwise\ [NE]$$

All the prices calculated in this step are rounded up to the nearest whole number and these are stored in a temporary table [Temp.(#02)].

Add HRGs to tariff prices

There are two additional zero price HRGs which need to be added back to the prices. These are 'UZ01Z & PB03Z. The model adds these HRGs by joining [Temp.(#02)] to [Input.HRGs & Eligibility (UZ01z) & (PB03Z)] and storing the results in another temporary table [Temp.(#03)].

Final Prices including Specialist Top-ups

The last stage of whole APC process is to produce the final output tariff prices. The model joins tables [Temp.(#03)] and [Input.HRGsEligibility] using field [SPELL HRG] = [HRG code], retaining only records in table [Temp.(#03)].

The model creates another data column [SSNDS Eligible] and flags each HRG with 'No' when field [Eligible for Specialist Top-ups] = 0, otherwise flag as 'Yes'.

The final output table [Stage.APC_Tariff] created has the HRG tariff prices.

2.15.3 Data used for this modelling step

Input tables used in this model step	Input fields from input table used
[Temp.(#01)]	[SPELL HRG] [EL COMB UC] [NE COMB UC] [EBD UC] [COMBINE]
[Input.Uplift]	[UPLIFT]
[Input.Scaling]	[EL_SCALE] [NE_SCALE]
[Stage.National_MFF]	[MFF REBASE]
[Input.SSEM_Banding]	[Band] [Tariff_%]
[Input.HRGsEligibility]	[HRG Code] [Eligible for SSEM] [SSEM Banding] [Eligible for Specialist Top-ups] [HRG Name]
[Input.HES_Trimpoints]	[HRG] [DC/EL] [NE] [DC/EL/NE]
[Input.HRGs & Eligibility (UZ01Z & PB03Z)]	[SpellHRG] [EL_Tariff] [EL_Trim] [NE_Tariff] [NE_Trim] [Longstay Payment] [SSEL Eligible] [SSEM Eligible] [SSEM Tariff]

2.15.4   Data outputs produced in this model step

Output tables generated by this model step	Output fields generated in output table (copied over)	Output fields generated in output table (calculations)
[Stage.APC_Tariff]	[SPELL HRG] – *[Stage.APC_Final_Unit_Costs].[SPELL HRG]* [HRG Name] – *[Input.HRGsEligibility].[HRG Name]*	[EL Tariff] [EL Trim] [NE Tariff] [NE Trim] [Longstay Payment] [SSEM Eligible] [SSEM Tariff] [SSNDS Eligible]

Glossary

Abbreviation	Meaning
A&E	Accident & Emergency
ACT	Activity
ADM	Admitted
APC	Admitted Patient Care
BPT	Best Practice Tariff
CC	Complications & Co-morbidities
CCU	Coronary Care Unit
CNST	Clinical Negligence Scheme for Trusts
D&D	Drugs & Devices
DC	Daycase
EBD	Excess Bed Days
EL	Elective
EPI	Episode
FCE	Finished Consultant Episode
FT	Foundation Trust
HES	Hospital Episode Statistics
HRG	Healthcare Resource Group
HSCIC	Health and Social Care Information Centre
ICR	Injury Cost Recovery (Scheme)
LoS	Length of Stay
MFF	Market Forces Factor
NE	Non-Elective
NEI_L	Non-Elective Inpatient - Long Stay
NEI_L_XS	Non-Elective Inpatient - Long Stay Excess Bed Days
NEI_S	Non-Elective Inpatient - Short Stay
NHSLA	NHS Litigation Authority

NHST	NHS Trust
NICE	National Institute for Health and Clinical Excellence
OPATT	Outpatient Attendance
OPROC	Outpatient Procedure
PbR	Payment by Results
PLICS	Patient Level Information and Costing Systems
PMS+	Personal Medical Services Providers
RC	Reference Costs
SPSS	Statistical Package for the Social Sciences
SQL	SQL Server (a Microsoft application for manipulating large sets of data)
SSEM	Short Stay Emergency Tariff
TC	Total Cost
TFC	Treatment Function Code
TP	Trimpoint
UC	Unit Cost