2017/18 APC&OPROC Model Handbook

Contents

Disclaimer

This model handbook is published by NHS Improvement for the purposes of the engagement on the proposals for the National Tariff for 2017/18, 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. NHS Improvement shall not accept any responsibility or liability in respect of the contents or use of the model handbook or the draft prices.

Introduction

The model suite used to produce the Admitted Patient Care (APC) and Outpatient Procedure (OPROC) National Tariffs includes

- A number of pre-processing models to prepare input tables/datasets for processing models,
- An APC&OPROC SQL model, and
- An APC& OPROC Excel model.

This document includes two parts. We focus on the APC&OPROC SQL model in the first part followed by the APC&OPROC Excel model in the second part. We describe the model input data, calculation steps and the outputs. The pre-processing models are outside the scope of this handbook.

Part One: APC&OPROC SQL Model

1. Introduction to Admitted Patient Care Tariff Calculation Model

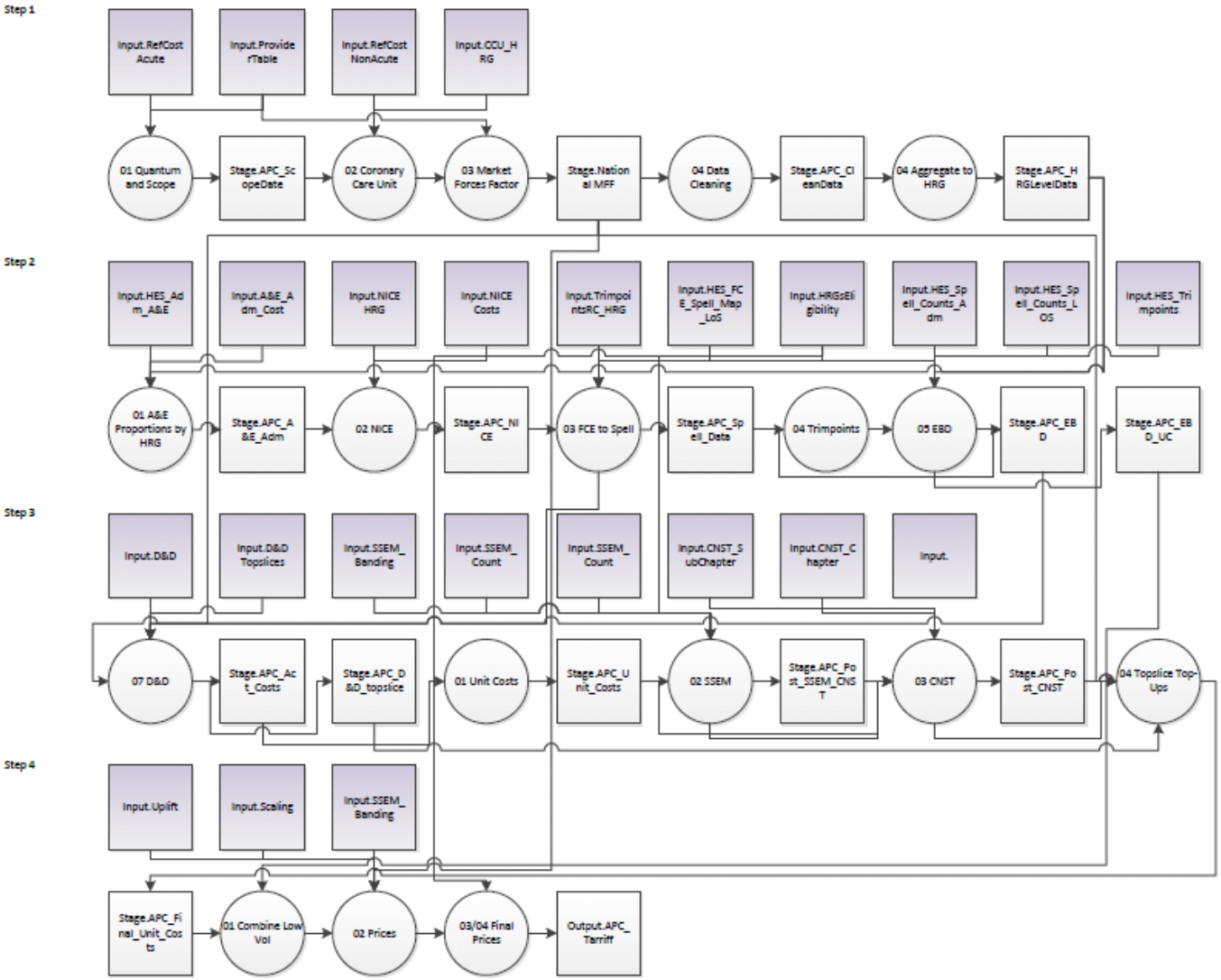
In this part, we focus on the APC&OPROC SQL model describing the input data, processing steps /calculations and the outputs.

The basis for the APC&OPROC SQL model (henceforth "the SQL model") is 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). However, there are a number of changes we have made to the original DH models, so the two are now not fully comparable anymore.

In the remainder of this section we first describe the functionality of the SQL model. We then provide an overview, followed by a detailed description of each of the calculation steps in the model.

Figure 1.1 below provides a high level overview of the APC SQL model. Input data (external to the model) is highlighted in purple, calculation/processing steps in white circles, and final data outputs in white squares.

Figure: 1.1 Data flow diagram: overview of the SQL model

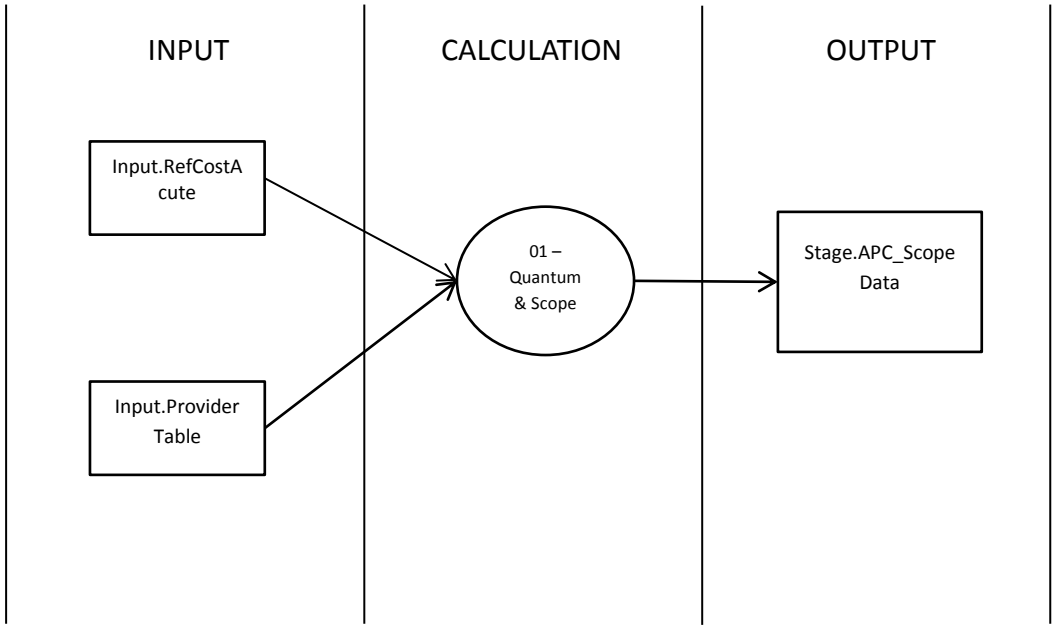


2. Calculation Steps

For each calculation step we provide a graphical overview to show where the step features in the SQL 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



In this first step the tariff model retrieves data from the adjusted (or pre-processed) reference costs (RC) database [Input.RefCostAcute] and using this data, we calculate total inlier costs and total EBD costs by provider and HRG by admission type (i.e. day cases (DC), elective inpatients (EL), non-elective

inpatients (NE)). Reference cost (RC) is provided by the Department of Health (DH)[1]. The RC collects the costs from all NHS foundation trusts (NHSFTs) and NHS trusts (NHSTs)[2].

The RC collected is then aggregated into the level of currency. For the admitted patient care (APC), the currency is commonly known as health resource group (HRG). The HRGs are standard groupings of clinically similar treatments which use comparable levels of healthcare resource. The HRGs are based on a bundled of ICD-10 diagnoses and OPCS-4 procedures[3] that have similar resource implications[4]. Examples of HRGs are:

- AA22C - Cerebrovascular Accident, Nervous System Infections or Encephalopathy, with CC Score 14+
- HC20H - Vertebral Column Injury with Interventions
- VA10B - Multiple trauma diagnoses, score 24 - 32 with no interventions

RC data are based on "Finished Consultant Episode" (FCE), which is an inpatient or day case episode where the patient has completed a period of care under a consultant and is either transferred to another consultant or discharged.

The following data fields in the APC RC database are used for the model: provider code, department code, service code, HRG code, unit cost, and activity (number of FCEs). In particular, there are six department codes: day case care (DC), elective care (EL), non-elective inpatient care (NE), elective EBD (EL_XS), non-elective inpatient long stay EBD (NEL_XS), and non-elective inpatient short stay (NES).

2.1.2 Calculation/process in this model step

In this step we calculate the inlier and EBD costs. The 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) are copied over and derived as follows:

- *Rename [FK_ORGS_PROV_ID] as[PROVIDER]*
- *Rename [Currency] as [HRG]*[5]

[1] Reference costs for 2014/15 can be accessed from the following website - https://www.gov.uk/government/publications/nhs-reference-costs-2014-to-2015. All data relating to services supplied by non-NHS organisations and PMS+ providers are excluded from the reference cost database.
[2] All data relating to services supplied by non-NHS organisations and PMS+ providers are excluded from the reference cost database.
[3] Changes to the procedure classification OPCS-4.7, implemented from 1st April 2014, are incorporated within the HRG4+ design. The detailed information can be found from the following website,
http://www.hscic.gov.uk/media/16738/HRG4-201415-Reference-Costs-Chapter-Summaries/pdf/HRG4__201415_Reference_Costs_Chapter_Summaries_v1.0.pdf.
[4] Source: http://www.hscic.gov.uk/hrg

- *KEEP THE FIRST 2 LETTERS in [Department] rename as [ADMISSION]*
- *SUM UP [FCE] rename as [INLIER ACT]*
- *SUM UP ([Unit Cost (inlier unit cost)] *[FCE]) rename as [INLIER COST]*
- *SUM UP [Excess_Bed_Days_Activity] rename as [EBD ACT]*
- *SUM UP ([Excess_Bed_Days_Unit_Cost]* [Excess_Bed_Days_Activity)] rename as [EBD COST]*

The model then is incorporated with the table [Input].ProviderTable] by using the key variable of the provider ID field ([[input].[RefCostAcute].[FK_ORGS_PROV_ID] =[Input].ProviderTable].[RC Code])and then stored into the tariff model of [Stage.APC_ScopeData]). The purpose of joining these two tables together is to add more information into the dataset for the calculation at next stage. In addition, from [Department] field in the [Input.RefCostAcute], take the first 2 letters is to change all department codes with 'NEL' and 'NES' to 'NE'.

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

Original department code	Change to admission code
DC	No change
EL	No change
NEL	NE
NES	NE

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

a) It calculates the total inlier cost by provider, HRG and the admission method, using the inlier unit cost [Unit_Cost] multiplied by the number of inlier activity [FCE]:

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

[5] HRGs are the chose currency for acute healthcare in England. More information is presented in the document of A Simple Guide to Payment by Results (Department of Health) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/213150/PbR-Simple-Guide-FINAL.pdf.

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

[EBD Cost]= [Excess_Bed_Days_Unit_Cost] × [Excess_Bed_Days_Activity]

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 re-bundled into the calculation**. However, in 2014/15 Reference cost data, CCU costs are no longer reported separately. Therefore, this step is redundant 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 RC. As there are no costs associated with CCU, 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

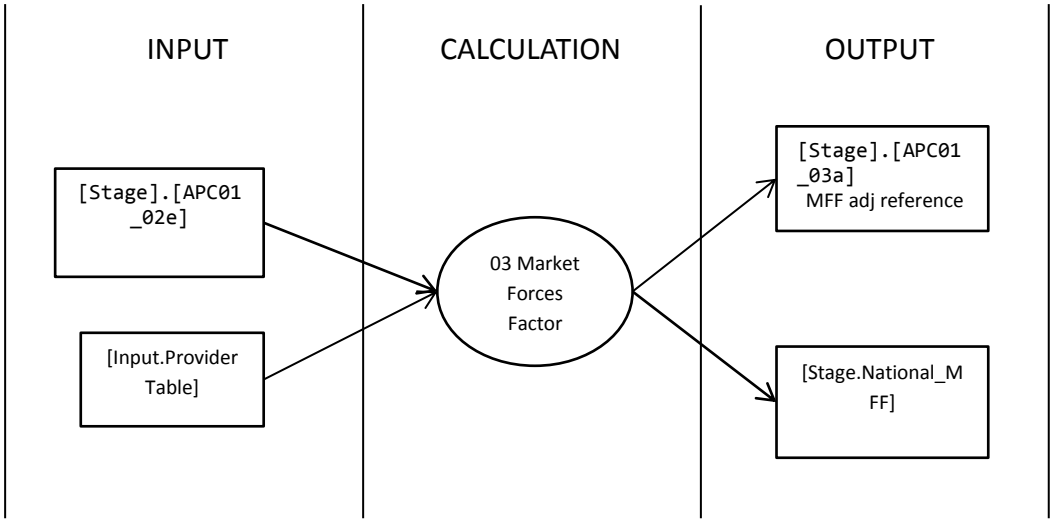
Input tables used in this model step	Input fields from input table used
[Input.RefCostNonAcute]	[FK_ORGS_PROV_ID] [UNIT_COST] [ACTIVITY_P1] [SUPPLIER_TYPE] [SERVICE]
[Stage.APC_ScopeData]	[INLIER COST]
Input.[CCU_HRG]	[CCU HRGs]

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)
[Stage].[APC01_02a]	[input].[RefCostNonAcute] .[PROVIDER] [input].[RefCostNonAcute] .[SERVICE] [input].[RefCostNonAcute] .[HRG] [input].[RefCostNonAcute] .[CCU UC] [input].[RefCostNonAcute].[CCU ACT]	[Stage].[APC01_02a].[CCU COST]
[Stage].[APC01_02b]	[Stage].APC_ScopeData].[PROVIDER]	[Stage].[APC01_02b]].[CCU COST]
[Stage].[APC01_02c]	[Stage].APC_ScopeData].[PROVIDER] [Stage].APC_ScopeData].[HRG] [Stage].APC_ScopeData].[ADMISSION] [Stage].APC_ScopeData].[INLIER ACT] [Stage].[APC01_02b]].[CCU COST]	[Stage].[APC01_02c]].[CCU %]
[Stage].[APC01_02D]	[Stage].[APC01_02a].[PROVIDER] [Stage].[APC01_02c].[HRG] [Stage].[APC01_02c].[ADMISSION]	[Stage].[APC01_02D].[CCU TC]
[Stage].[APC01_02e]	[Stage].APC_ScopeData].[PROVIDER] [Stage].APC_ScopeData].[HRG] [Stage].APC_ScopeData].[ADMISSION] [Stage].APC_ScopeData].[INLIER ACT] [Stage].APC_ScopeData].[EBD ACT] [Stage].APC_ScopeData].[EBD TC]	[Stage].[APC01_02e].[INLIER TC]

2.3 Removing Market Forces Factor (MFF)

2.3.1 Overview



The Market Forces Factor (MFF) is a cost uplift that is added to the prices paid to each provider to account for uncontrollable costs in the provision of healthcare costs relating to the geographical location (e.g. land values, staffing costs and building costs). This ensures that providers are not under-reimbursed for their costs as a result of circumstances beyond their control. The MFF, which is specific for each provider, is calculated by NHS Improvement. There are two versions of the MFF for each provider:

- The Target MFF - this is the provider's MFF and is derived from calculating the unavoidable cost differences of providers and then rebasing so that the lowest MFF value is 1. The MFF in 14/15 RC data ranges between 1.0 and 1.3. The MFF is labelled as Target MFF.

- The Capped MFF - a provider's MFF may change from year to year but the value of target MFF has not been recalculated since 2012/13. Hence, the capped value of the MFF is used to limit the change of the current year to no more than 2 percentage points either higher or lower than the previous year's Target MFF, for example:

  - If the Target MFF for this year is 1.05 and the prior year Target MFF was 1.01 (or was capped at 1.01), then the capped MFF for this year is 1.03.

- If the Target MFF for this year is 1.05 and the prior year Target MFF was 1.04 (or was capped at 1.04), then the capped MFF for this year is 1.05.

By 2017/18 every provider's capped MFF had reached the target MFF value. The capped MFF is 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 unit costs reported in the RC data by providers include non-controllable costs. These additional non-controllable costs need to be removed for the tariff calculation by dividing by the MFF.

In this step the model 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.

- MFF adjusted cost data
- Two national MFF data points

MFF adjusted cost data

Joining the table [stage].[APC01_02e] with the table [Input.ProviderTable] by using the key variable [stage].[APC01_02e].[Provider]= [Input.ProviderTable].[RC code].

Using provider total cost data in the table [stage].[APC01_02e] (as calculated in Step 2.2 - Inclusion of Coronary Care Unit (CCU) data) and MFF data for each provider in the [Input.ProviderTable], the tariff model:

a) Divides the total inlier costs and total excess bed day costs for each provider by the provider's MFF.

$$[\text{Inlier TC (target MFF)}] = [\text{Inlier TC}] \div [\text{Target MFF}]$$

$$[\text{EBD TC (target MFF)}] = [\text{EBD TC}] \div [\text{Target MFF}]$$

b) Divides the total inlier costs for each provider by the provider's capped MFF.

$$[Inlier\ TC\ (payment\ MFF)] = [Inlier\ TC] \div [Capped\ MFF\ 2014/15]$$

c) These calculations create three new columns in the tariff model:

[Inlier TC (Target MFF)]

[EBD TC (Target MFF)]

[Inlier TC (Payment MFF)]

National MFF data points

In this step the tariff model calculates two numbers:

- The National MFF and
- 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 Scheme (ICRS) 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

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

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 2014/15 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.

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

2.3.3 Data used for this modelling step

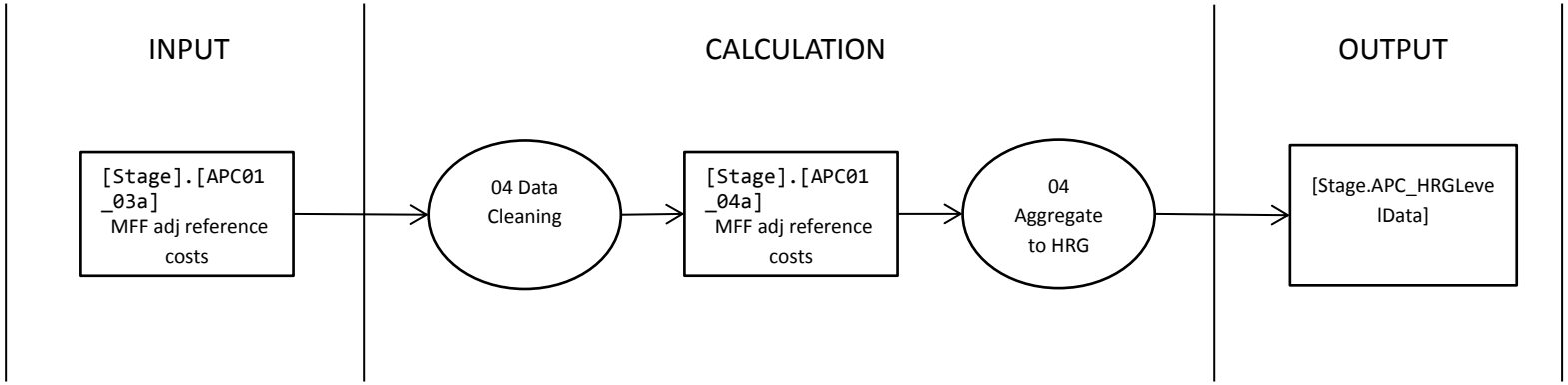
Input tables used in this model step	Input fields from input table used
[stage].[APC01_02e] – from previous step	[INLIER TC] [EBD TC]
[Input.ProviderTable]	[TARGET MFF] [CAPPED MFF 2014/15]

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)
[Stage].[APC01_03a]	Provider – [stage].[APC01_02e].[Provider] Admission - [stage].[APC01_02e].[Admission] HRG - [stage].[APC01_02e].[HRG] Inlier Act - [stage].[APC01_02e].[Inlier ACT] Inlier TC - [stage].[APC01_02e].[Inlier TC] EBD Act - [stage].[APC01_02e].[EBD ACT] EBD TC - [stage].[APC01_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



For RC 2014/15 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 2014 and 31 March 2015. If the number of EBDs reported is 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 data cleaning 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. A more detailed explanation about data cleaning can be found in a separate document.**

2.4.2 Calculation/process in this model step

The model previously flagged each outlier data point with '1'. We flagged all data-points as zero to cancel this effect.

2.4.3 Data used for this modelling step

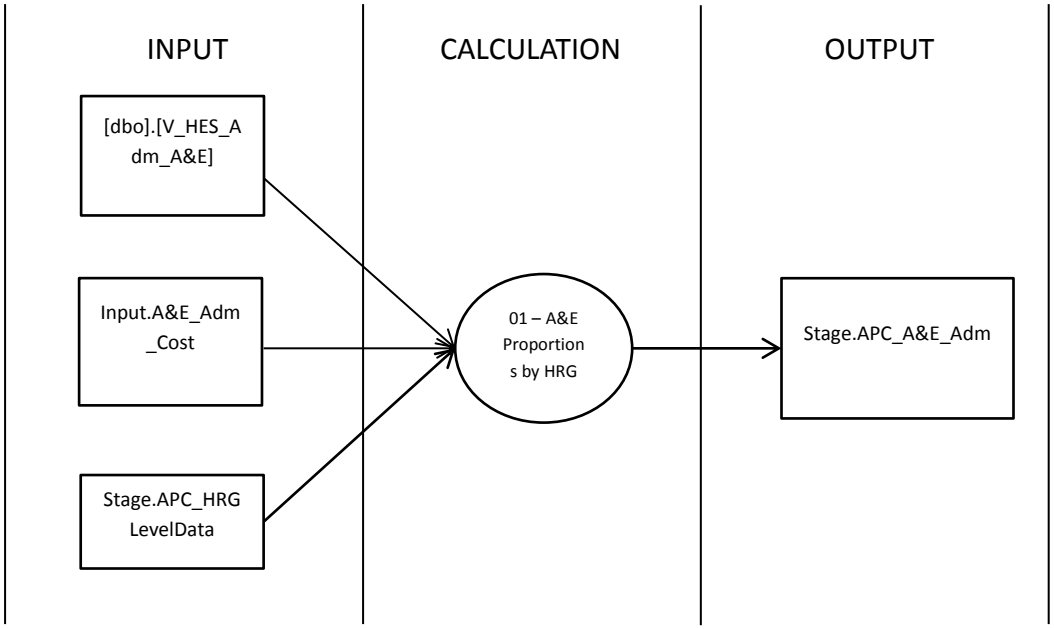
Input tables used in this model step	Input fields from input table used
[Stage].[APC01_03a] – from previous step	[INLIER ACT] [INLIER TC (Target MFF)] [EBD ACT] [EBD TC (Target MFF)]

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] – [Stage.APC_HRGLevelData].[HRG] [ADMISSION] – [Stage.APC_HRGLevelData].ADMISSION]	[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



The APC tariff model includes all attendances leading to admission. This contains 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 a fully and accurate 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[6].

[6] The A&E model will be published along with other models such as APC&OPROC when national tariffs are to be published.

2.5.2 Calculation/process in this model step

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 in the table [Stage].[APC_HRGLevelData], created in the previous step.

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 HRG from table [dbo].[V_HES_Adm_A&E] as follows:

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

The results are stored in a table [stage].[APC02_01a].

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

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

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

b) Both results are stored in a table [stage].[APC02_01b] and [stage].[APC02_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 HRG / NE admission combination. Once we have calculated these weightings, we apply them to the total cost of A&E leading to admissions ([A&E AD TC]) in the table [input].[A&E_Adm_Cost] to calculate the final cost allocation.

The model first joins tables [stage].[APC02_01c],[Input.A&E_Adm_Cost] and [Stage.APC_HRGLevelData] using fields [SPELL HRG] = [HRG] and [ADMISSION] = [ADMISSION], retaining only records in a table [Stage.APC_HRGLevelData]. The key fields used are listed below:

Tables	Fields pulled through
[stage].[APC02_01b]	[HRG] [ADMISSION] [A&E TC]
[stage].[APC02_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:

a) Calculating the revised inlier TC including A&E costs for each HRG and 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

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

b) Finally, the revised total costs are calculated as follows

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

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

2.5.3 Data used for this modelling step

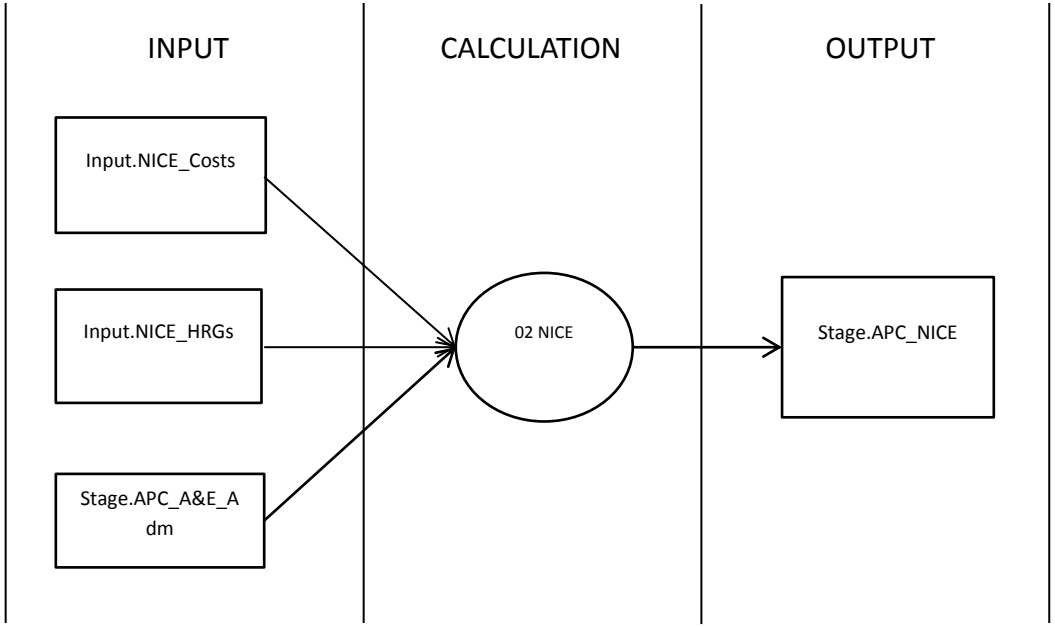
Input tables used in this model step	Input fields from input table used
[dbo].[V_HES_Adm_A&E]	[FCE HRG] [NE FCE] [A&E FCE]
[Input.A&E_Adm_Cost]	[A&E AD TC]
[Stage.APC_HRGLevelData]	[HRG] [ADMISSION] [CLEAN_INLIER_TC] [CLEAN_EBD_TC]

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 2017/18 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. The output table (see the table 2.6.4) will be used in the data process at next stage.

2.6.3 Data used for this modelling step

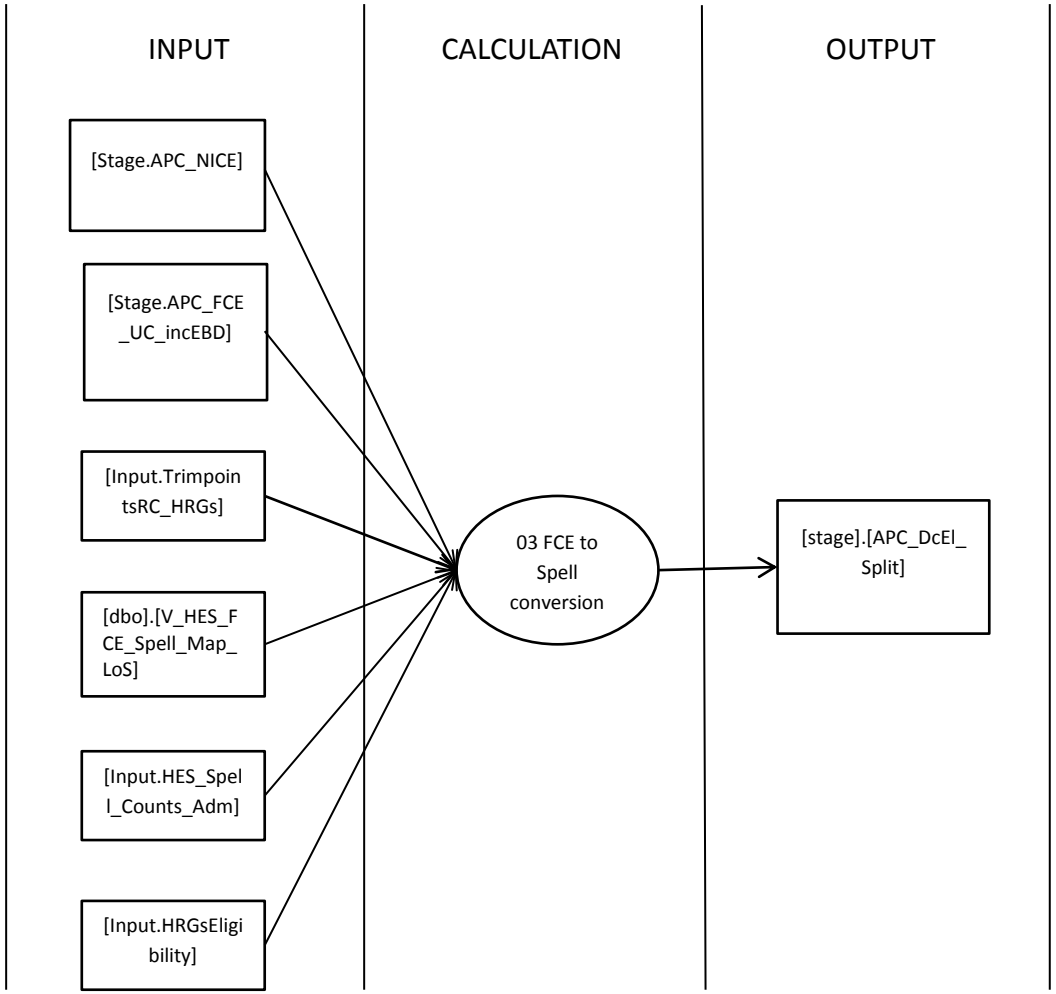
Input tables used in this model step	Input fields from input table used
[Input.NICE_HRGs]	[HRG] [TYPE]
[Input.NICE_Costs]	[TYPE] [INCLUSION]
[Stage.APC_A&E-Adm]	[HRG] [ADMISSION] [CLEAN INLIER ACT] [CLEAN INLIER TC WITH A&E] [CLEAN EBD TC] [CLEAN TC]

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



A spell is the period that the patient spends from admission to discharge in a hospital. Whilst 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). Because prices in the National Tariff are based on Spell unit costs, a transformation from FCE based costs to spell based costs is requested. FCEs (reported by providers) 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.

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 the 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:

a) Calculating inlier unit costs

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

b) Calculating EBD unit costs

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

c) Calculating total unit costs

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

d) 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 the tables using fields [FCE HRG] = [HRG] and [ADM] = [ADMISSION], retaining records where the HRGs appears in tables [Input.TrimpointsRC_HRGs], [dbo].[V_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]
[dbo].[V_HES_FCE_Spell_Map_LoS]	[FCE HRG] [SPELL HRG] [ADM] [EPI_LOS] [FCE ACTIVITY]
[Input.TrimpointsRC_HRGs]	[HRG] [FCE_trim]

With every combination of FCE HRG and Spell HRG stored in the input table [dbo].[V_HES_FCE_Spell_Map_LoS][7], 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:

a) Excludes HRG = 'UX'[8]

b) Calculating spell inlier costs

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

[7] This table has the FCE to Spell mapping from HES data.
[8] "UX" stands for those unknown HRGs.

c) Calculating EBD costs

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

$$[HES\ FCE\ EBD] = \{[EPI\_LoS] - [FCE\_trim]\}^{9} \times [FCE\ ACTIVITY]^{10} \times [EBD\_UC]$$

Otherwise

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

The results are then stored in a table [stage].[APC02_03b].

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'. The results are saved in a table [stage].[APC02_03C].

In the final steps of this section, we calculate the total spell costs and activity and then aggregated by HRG and admission.

a) The model joins the tables [stage].[APC02_03b] with the table [Input.HRGEligibility] and the table [dbo].[V_HES_Spell_Counts_Adm] by using the key variables of currency [HRG] and admission [ADM]. It retains all HRGs with mandatory tariffs (where the field [Mandatory IP] = 1) based on 2017/18 currency designing in [Input.HRGEligibility].

It then calculates the spell total cost and activities ([dbo].[V_HES_Spell_Counts_Adm].[SPELLFLAG])[11] for each HRG and admission method combination where 'DC' and 'EL are combined:

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

$$[SPELL\ ACT] = \sum[SPELLFLAG]$$

[9] This calculation gives the excess bed days

[10] RC dataset providers the number of activity in FCE level. This section presents the process of calculation of how activity at the FCE level to spell level. [FCE activity] means the number of activities at FCE level.

[11] The derivation of the SpellFlag field in v_HES_Count_Spell_LOS contains the number of Spells that have the LoS specified in the field SpellLos_1YR, which means the number of activities at the spell level.

The results are then stored in the table [stage].[APC_DcEl_Split], which is the first table created to contain the total cost and total activity at spell level.

2.7.4 Data used for this modelling step

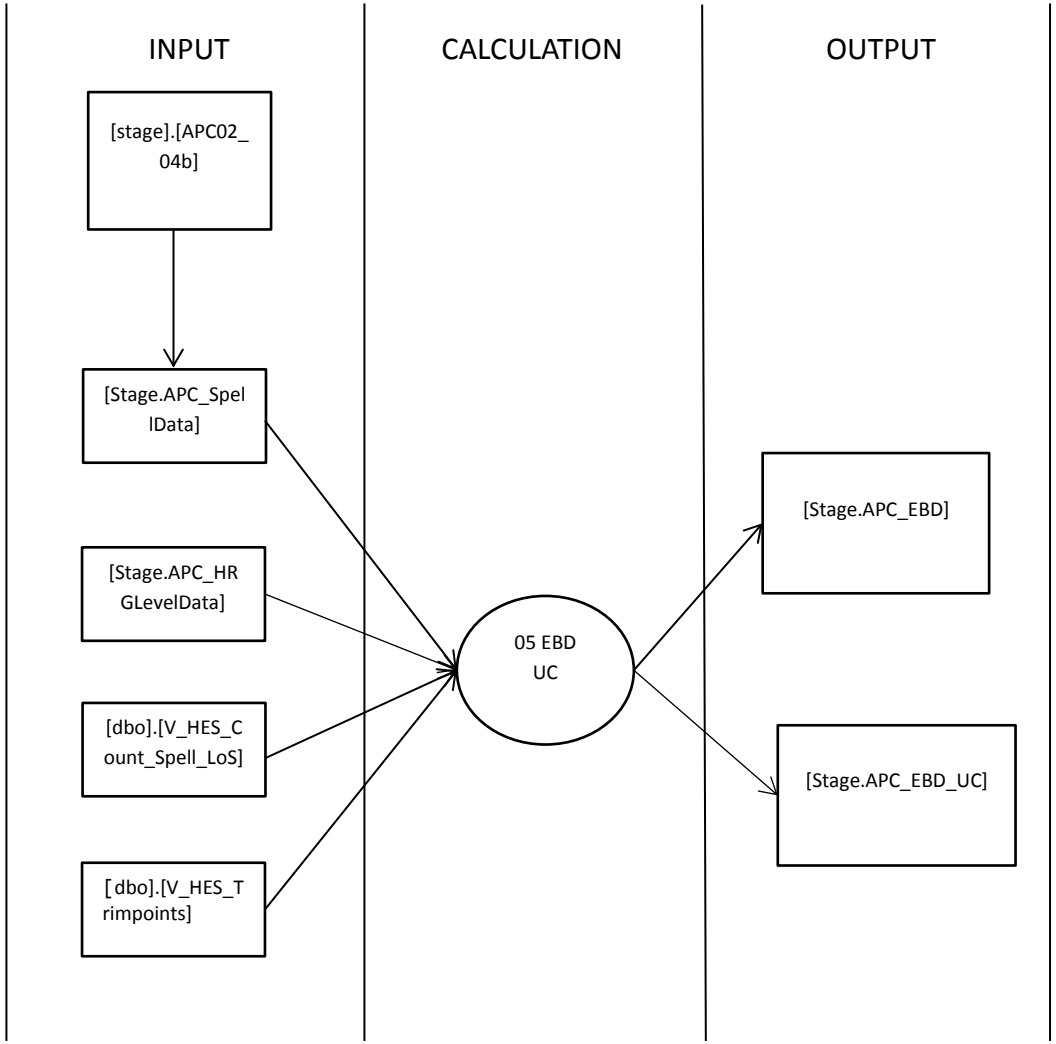
Input tables used in this model step	Input fields from input table used
[Stage.APC_NICE]	[CLEAN INLIER ACT] [CLEAN INLIER TC WITH NICE] [CLEAN EBD TC] [CLEAN TC] [ADMISSION] [HRG]
[Input.TrimpointsRC_HRGs]	[HRG] [FCE_Trim]
[Input.HES_FCE_Spell_Map_LoS]	[SPELL HRG] [ADM] [EPI_LoS] [FCE ACTIVITY]
[Input.HES_Spell_Counts_Adm]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

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)
[stage].[APC_DcEl_Split]	[SPELL HRG] - [dbo].[V_HES_FCE_Spell_Map_LoS].[SPELL HRG] [ADM] - [dbo].[V_HES_FCE_Spell_Map_LoS].[ADM]	[SPELL TC] [SPELL ACT]

2.8 Removal of Costs Associated with Excess Bed Days

2.8.1 Overview



In this stage, we move the costs of EBDs, the costs for the number of days in the length of stay (LoS) above the long stay trim point, from the total spell cost for each HRG. 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. Trim points 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 by copying the data (columns) from [stage].[APC02_03C] from the previous section. It then 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 table [stage].[APC02_04b].

The next step of this stage aims to flag low volume HRGs. This flag is needed to ascertain which trim point value should be associated with each HRG. The model starts off by creating a flagging column [COMBINE] for every HRG in a table [stage].[APC02_04b]using the following rules:

a) If the number of activities of elective (admission method = 'EL') is less than 50, then

$$[COMBINE] = '1'$$

b) Or if the number of activities of non-elective (admission method = 'NE') is less than 50, then

$$[COMBINE] = '1'$$

c) Or if the number of activities of both EL and NE (admission method 'EL' + 'NE') is less than 150, then

$$[COMBINE] = '1'$$

Otherwise

$$[COMBINE] = 0$$

The results are then stored in another table [stage].[APC02_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][12]

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

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

b) 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

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

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

Otherwise

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

Three new columns are created, [CHAPTER], [FCE EBD UC] and [FCE EBD UC CAPPED] and are then stored in another table [stage].[APC02_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], retaining only records with HRGs that appear in all three tables. The tables and key fields used are listed below:

[12] The process of calculating long stay payment (LSPs) is not in the processing stage by using SQL codes. It has been moved to post-processing stage by using Excel. The details of the description is presented in the second part of the document at page 72.

Tables	Fields pulled through
[stage].[APC02_04c]	[SPELL HRG] [COMBINE]
[dbo].[V_HES_Count_Spell_LoS]	[SPELL HRG] [ADM] [SpellLoS_1YR] [SPELL FLAG]
[dbo].[V_HES_Trimpoints]	[HRG] [DC/EL] [NE] [DC/EL/NE]

- It then needs to select the correct value for the trim point ([TP]) which would be the cut-off point for the inlier and excess bed days.
- By excluding all admission types of 'DC' and 'UX'[13], the model selects the trim points values by applying the following criteria:

If [Combine] = 1 from [stage].[APC02_04c], then use the HES trim point value from [dbo].[V_HES_Trimpoints], field [DC/EL/NE]

Otherwise, if [ADM] = 'EL' from [dbo].[V_HES_Trimpoints] table, then use this trim point value from field [DC/EL]

Otherwise, use [NE] trim point value from [dbo].[V_HES_Trimpoints] table.

The appropriate trim points are then stored in a new data column [TP].

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

If length of stay [SpellLos_1YR] is greater than [TP] then,

[13] "UX" stands for those unknown admission types.

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

Otherwise

$$[EBDs] = 0$$

The results are stored in another table [stage].[APC02_05B] showing the [SPELL HRG], chapter level [Chapter], admission [ADM], trim point [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 the table [stage].[APC02_05B], the model calculates the EBD total cost [EBD TC] by multiplying the capped EBD unit costs by the EBDs from [stage].[APC02_05B] where the chapter level is the same in both tables as follows:

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

This is stored in a table [stage].[APC02_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 [stage].[APC02_05C] and [Stage.APC_SpellData] using fields [SPELL HRG] = [SPELL HRG] and [ADM] = [ADM] retaining only records in the table [stage].[APC02_05C].

The model then subtracts the EBD total cost [EBD TC] in [stage].[APC02_05C], from [SPELL TC] in [Stage.APC_SpellData] to produce the spell inlier total costs for each HRG / admission method combination.

$$[INLIER\ TC] = [SPELL\ TC] - [EBD\ TC]$$

The results are stored in a 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 the table [stage].[APC02_05A] based on all the HRGs in [stage].[APC02_05B] and stores the final results in the table [Stage.APC_EBD_UC].

2.8.3 Data used for this modelling step

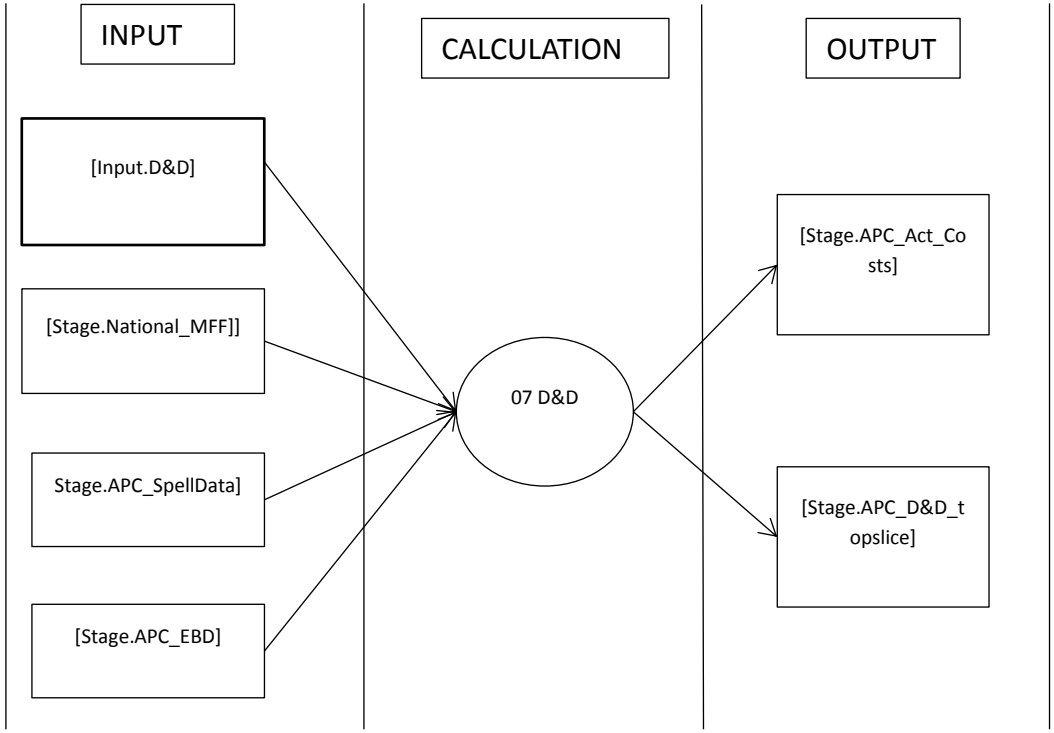
Input tables used in this model step	Input fields from input table used
[stage].[APC02_04b]	[SPELL HRG] [ADM] [SPELL TC] [SPELL ACT]
[Stage.APC_SpellData]	[SPELL HRG] [ADM] [SPELL TC] [SPELL ACT]
[Stage.APC_HRGLevelData]	[HRG] [CLEAN_EBD_ACT] [CLEAN_EBD_TC]
[dbo].[V_HES_Count_Spell_LoS]	[SPELL HRG] [ADM] [SpellLoS_1YR] [SPELLFLAG]
[dbo].[V_HES_Trimpoints]	[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] - [stage].[APC02_05B].[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 costs 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 top slicing 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 the 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:

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

The results are saved in a table `[stage].[APC02_07a]`.

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 of 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 table [stage].[APC02_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.

Tables	Fields pulled through
[stage].[APC02_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 starts this restriction by joining the table [Stage.APC_SpellData] with other two tables of [stage].[APC02_07b]and [Stage.APC_EBD] by using key variables of currency ([SPELL HRG]=[HRG code] and admission [ADM].

The model then calculates the amount of total cost restriction by: i) dividing the spell total cost in the 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 the table [stage].[APC02_07b] from the inlier total cost [INLIER TC] in a table [Stage.APC_EBD]

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

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

a) 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].[14]

[14] According to the method inherited from NHSE, a general guideline is applied that no more than 50% of the total cost of each spell-based HRG (by admission method) could be removed for both EBDs and D&D exclusions. This was to prevent a HRG, particularly those with low activity, being disproportionately affected.

If [ADM] = 'OP', then return value [TC exc D&D]

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

Otherwise, return value [TC exc D&D]

b) 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 table [stage].[APC02_07c].

c) The model then moves the four data columns from the table [stage].[APC02_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[15]. To do this the model calculates the total amount of D&D limited slice amount [D&D Limit Slice] using the fields below from `[stage].[APC02_07c]` and returns a single value as follows:

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

The results are stored in a table [stage].[APC02_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
[stage].[APC02_07e]	[D&D LimitSlice]
[Input.D&D_topslice]	[TOTAL]
[Stage.National_MFF]	[NAT MFF]

[15] More detailed explanation of top-slice in the section 2.13.

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:

$$[DandD\ TS] = \frac{[Total]}{[NAT\ MFF]}$$
$$[LIMIT\ TS] = [D\&D\ Limit\ Slice]$$

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

2.9.3 Data used for this modelling step

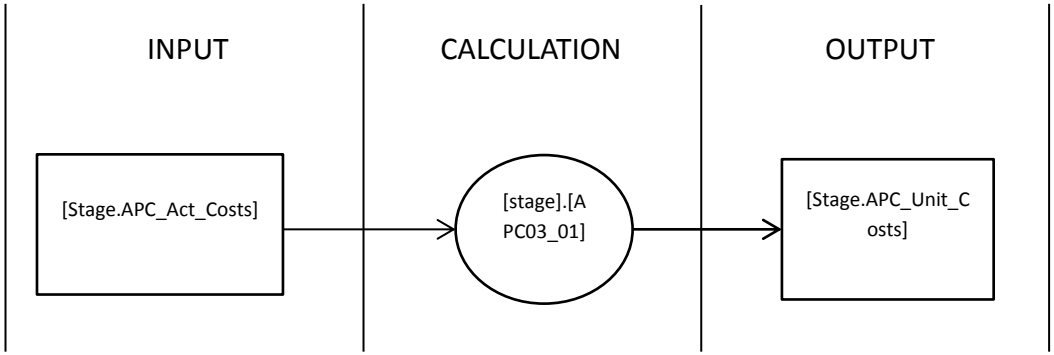
Input tables used in this model step	Input fields from input table used
[Input.D&D]	[HRG CODE] [ADMISSION] [DandD Total]
[Stage.National_MFF]	[NAT MFF]
[Stage.APC_SpellData]	[SPELL HRG] [ADM] [SPELL TC] [SPELL ACT]
[Stage.APC_EBD]	[SPELL HRG] [ADM] [EBD TC] [INLIER TC]

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 D&D 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 pivot tables showing the total cost [REVISED TC] (the inlier total costs) and number of activities [SPELL ACT] for each spell HRG and admission method combination by using all the data columns in the table [Stage.APC_Act_Costs] from the previous step – Removal of costs associated with D&D.

a) The first table has the following calculations:

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

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

The results are stored in a table [stage].[APC03_01A].

b) The second table has the following calculations:

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

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

The results are stored in a table [stage].[APC03_01B].

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

It starts off renaming EL and NE in [stage].[APC03_01A] to 'EL ACT' and 'NE ACT' respectively and renames 'EL' and 'NE' in [stage].[APC03_01B] to 'EL TC' and 'NE TC' respectively

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

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

d) The results are then stored in a table [Stage.APC_Unit_Costs]

2.10.3 Data used for this modelling step

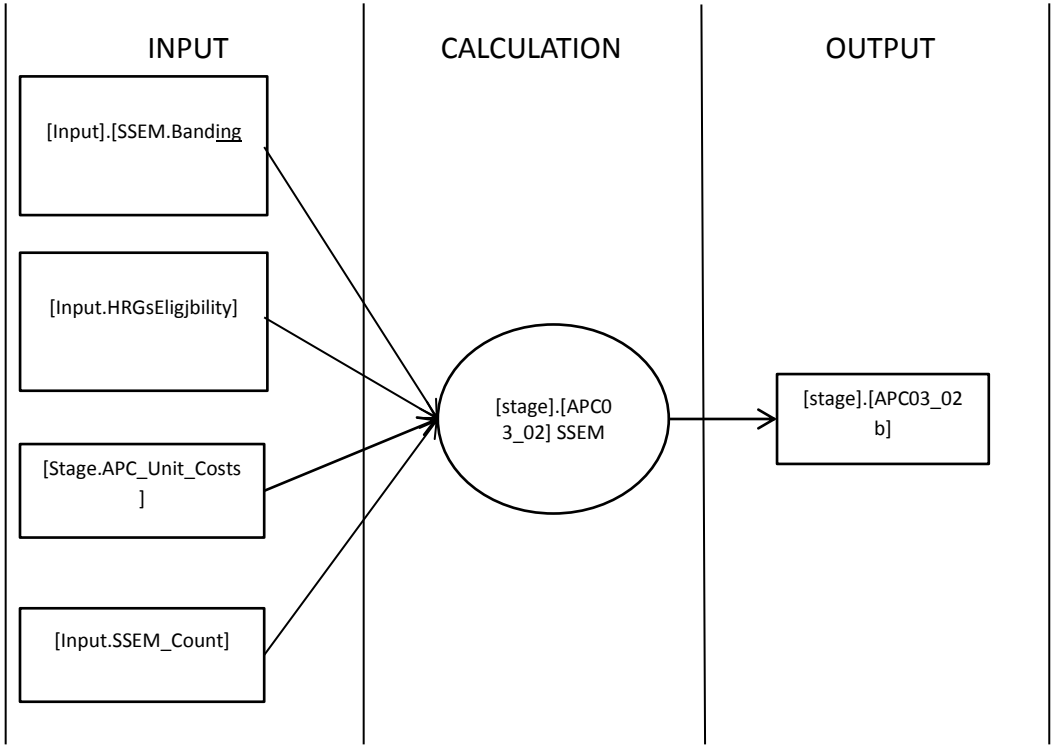
Input tables used in this model step	Input fields from input table used
[Stage.APC_Act_Costs]	[SPELL HRG] [ADM] [SPELL ACT] [REVISED TC]

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 two 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:

- the proportion of NE spells that attract the short stay adjustment
- the short stay banding of the HRG

The model starts off by using these percentages from an input table [Input.SSEM_Banding] shown below:

SSEM Banding in 2017/18 national tariffs

Band	ALoS	Tariff_%
1	0 to 1	100
2	2	75
3	3 to 4	50
4	>5	30

Allocating banding for each eligible HRG

a) The model joins tables [Input.SSEM_Banding] and [Input.HRGsEligibility] using fields [SSEM Banding] = [Band], retaining HRGs in the table [Input.HRGsEligibility] where field [Mandatory IP] =1. Key data fields used from the table [Input.SSEM_Banding] are: [Band], [ALoS][16] and [Tariff_%] and key data fields used from the table [Input.HRGsEligibility] are: [HRG Code], [SSEM Banding], [Eligible for SSEM] and [Mandatory IP]

b) The model then renames the following fields as follows:

[HRG Code] = [HRG]
[Eligible for SSEM] = [ELIGIBLE]
[Mandatory IP] = [MAND IP]
[Band] = [BAND]

[16] ALoS stands for average length of stay.

[Tariff_%] = [TARIFF %]

The results are stored in a table `[stage].[APC03_02a]`.

Applying the SSEM reductions

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

Tables	Fields pulled through
[Stage.APC_Unit_Costs]	[SPELL HRG] [NE ACT] [NE UC] [NE TC]
[Input.SSEM_Count]	[SPELL HRG] [SSEM]
[stage].[APC03_02a]	[HRG] [BAND] [ELIGIBLE] [TARIFF %]

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

a) 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]

b) Then the model finds the SSEM adjustments as follows:

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

c) 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

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

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

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

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

f) 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] >1 as follows:

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

The above steps create new columns which are stored in a table [stage].[APC03_02b].

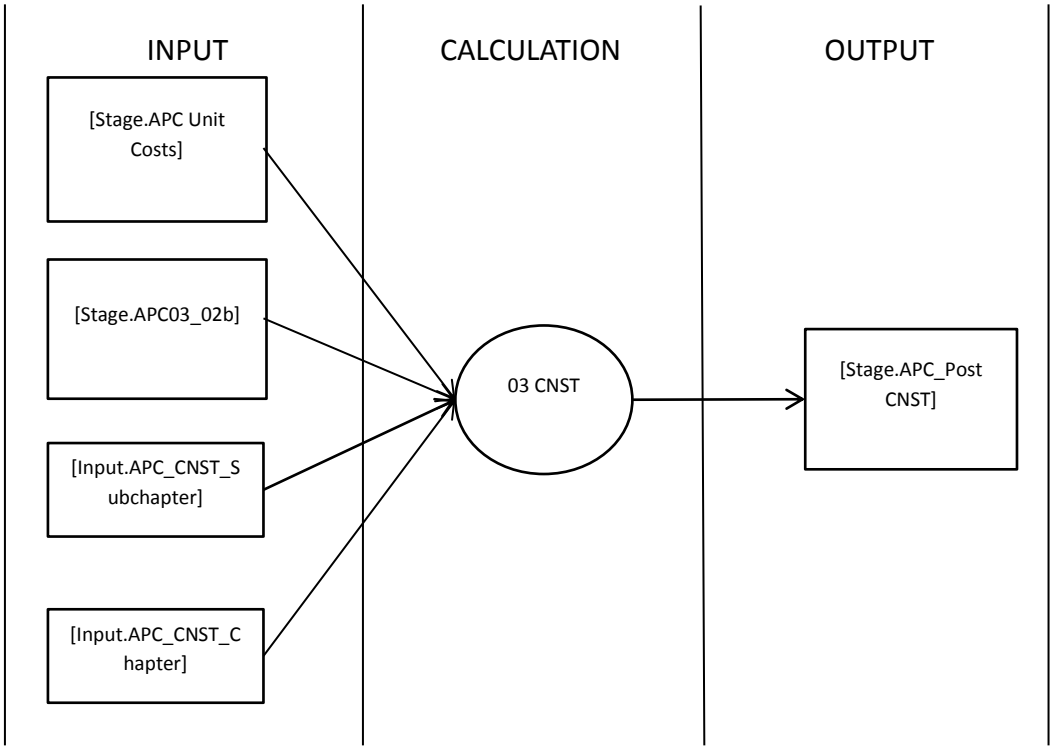
2.11.3 Data used for this modelling step

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)
[stage].[APC03_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

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 2014-15 and 2017-18. These are calculated at sub-chapter level (dependent on the speciality) and apportioned across all relevant HRGs as percentage uplift.

The CNST adjustment is now done in the post processing (Excel Model) and the values at the end of this process are therefore the same at the start of this process. The detail of the method is presented in a separate document.

2.12.2 Calculation / process in this model

The CNST figures in an 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

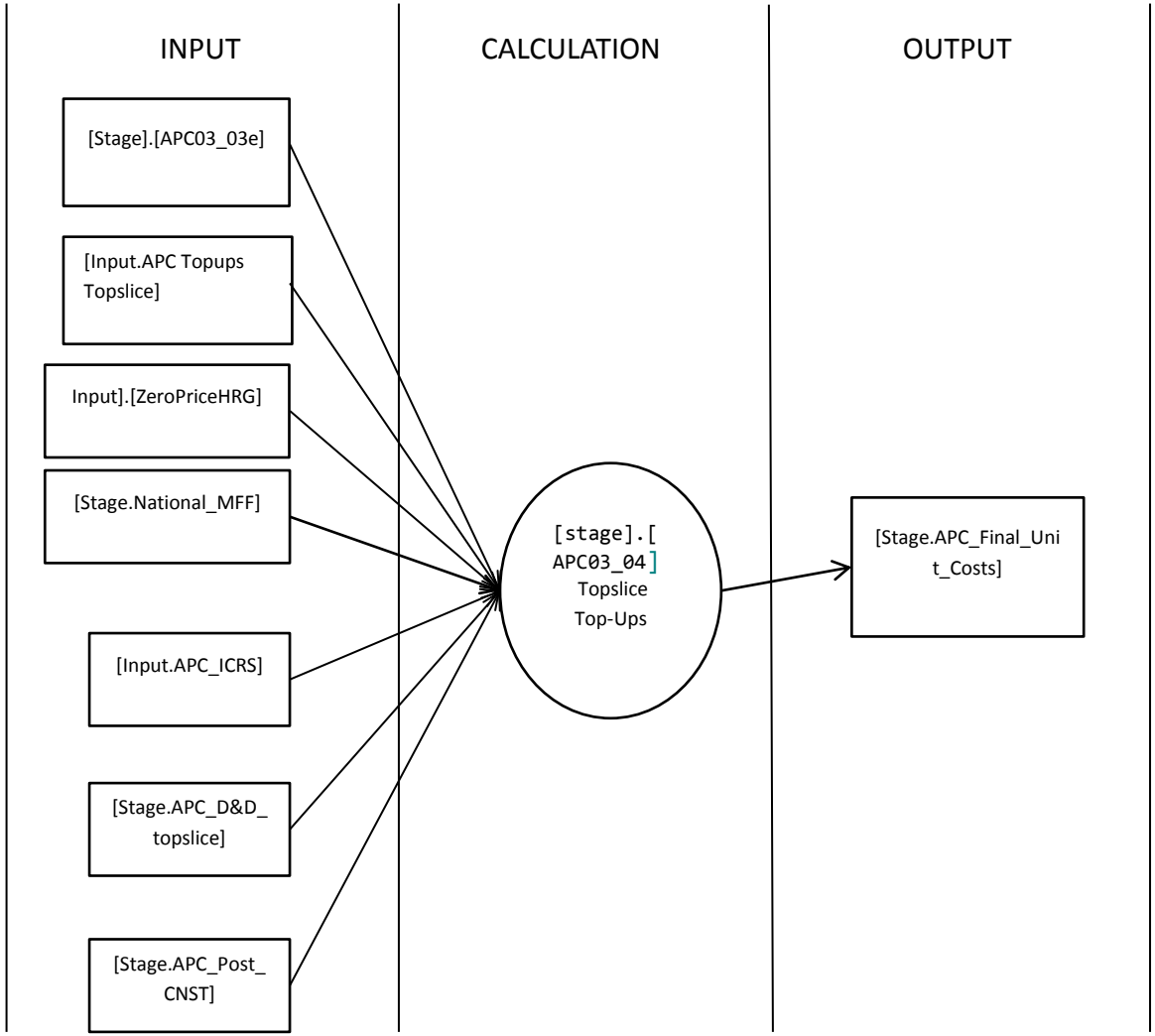
Input tables used in this model step	Input fields from input table used
[Stage.APC03_02b]	[HRG] [ADJ NE TC]
[Stage.APC_Unit_Costs]	[SPELL HRG] [EL TC] [EL ACT] [NE ACT]
[Input.APC_CNST_Subchapter]	[SubChapter] [CNST]
[Input.APC_CNST_Chapter]	[Chapter] [CNST]

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]
[stage].[APC03_03e]	[Stage].[APC_Post CNST]	[TC] [EL TC] [NE TC]

2.13 Top-slices

2.13.1 Overview



The removal of costs associated with drugs and devices (D&D) conducted in the previous step targets on those high costs at HRG level. However, some of the costs for drugs and devices could not be targeted to specific HRGs. Therefore, they are removed from all HRGs as a top slice. At this step, a top-slice is adjusted across all HRGs at a national level. The purpose of the top-slice adjustment is to remove a proportional fund to the total cost of the service.

Within this model we calculate top-slices to adjust for the following costs[17]:

- Specialised services – in order to fund the additional payments for specialist top-ups, an estimate is made of the costs to commissioners for this and removed from EL and NE. We are currently working on this estimate and, therefore, the current figure is set to zero;
- Injury Cost Recovery Scheme (ICRS)[18] – these costs are paid separately so were removed (from NE only), and;
- D&D exclusions – we calculate these as described in section 0 and apply them separately to EL and NE costs.

2.13.2 Calculation / process in this model

Calculating Specialised services top-slice percentage

a) 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
[stage].[APC03_03e]	[EL TC] [NE TC]
[Input.APC_Topups Topslice]	[Spec_NE] [Spec_EL] [Spec_DC]
[Stage.National_MFF]	[NAT MFF]

[17] Department of Health (2014) Payment by Results, Step-by-step Guild: Calculating the 2013-14 national Tariffs. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/214905/Step-by-step-guide-to-calculating-the-2013-14-national-tariff.pdf.
[18] More information available at: https://www.gov.uk/government/publications/nhs-injury-costs-recovery-scheme-april-2014-march-2015

b) 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:

c) Calculating the NE top-slice percentage for Specialised services

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

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

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

The results are then stored in a table [stage].[APC03_04a].

Calculating ICRS top-slice percentage

a) 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
[stage].[APC03_03e]	[NE TC]
[Input.APC_ICRS]	[ICRS]
[Stage.National_MFF]	[NAT MFF]

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

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

The results are then stored in a table [stage].[APC03_04B].

Calculating D&D top-slice percentage

a) 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 0. It joins two tables together using the key fields below:

Tables	Fields pulled through
[stage].[APC03_03e]	[TC]
[Stage.APC_D&D_topslice]	[LIMIT TS] [DandD TS]

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

$$[ALL] = \frac{[TC] - [LIMIT\ TS] - [DandD\ TS]}{[TC]}$$

The results are then stored in a table [stage].[APC03_04B].

Calculating total costs after top-slices

The model then applies the top-slices percentages across each spell HRG and admission method combination inlier costs. It starts by combining the three tables in the previous steps [stage].[APC03_04A], [stage].[APC03_04B] and [stage].[APC03_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

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

The results are then stored in a table [stage].[APC03_04D].

a) The model then applies these compound percentages in the table [stage].[APC03_04D]to each spell HRG and admission method combination in the table [Stage.APC_Post_CNST] from the previous section to get the revised inlier total costs for each combination as follows:

b) Calculating the revised Spell HRG / NE costs

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

c) Calculating the revised Spell HRG / EL costs

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

The results are then stored in a table [stage].[APC03_04E].

Calculating final unit costs

a) 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 the table [Input.ZeroPriceHRG] by joining the table [stage].[APC03_04] with the table [Input.ZeroPriceHRG] where fields [SPELL HRG] = [Zero Price HRGs], retaining only records in the table [stage].[APC03_04e].

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

c) Calculating the revised Spell HRG / NE unit costs

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

d) Calculating the revised Spell HRG / EL unit costs

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

e) The results are finally stored in the table [Stage.APC_Final_Unit_Costs]

2.13.3 Data used for this modelling step

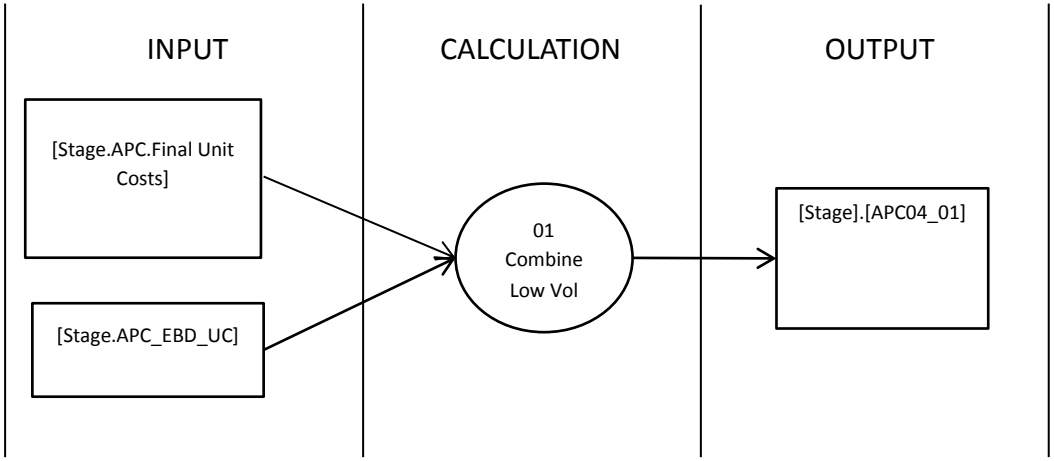
Input tables used in this model step	Input fields from input table used
[stage].[APC03_03e].	[TC] [EL TC] [NE TC]
[Input.APC_Topups Topslice]	[Spec_NE] [Spec_EL] [Spec_DC]
[Stage.National_MFF]	[NAT MFF]
[Input.APC_ICRS]	[ICRS]
[Stage.APC_D&D_topslice]	[LIMIT TS] [DandD TS]
[Stage.APC_Post_CNST]	[SPELL RHG] [NE] [EL] [NE ACT] [EL ACT]
[Input].[ZeroPriceHRG]	[Zero Price HRGs]

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 spell HRG and admission method combination, we combine the costs with the other respective spell HRGs and admission methods to produce a single HRG and 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

The details of the calculation are as follows:

a) The model starts off by joining this table with the table [Stage.APC_Final_Unit_Costs] in the previous section where field [SPELL HRG] = [HRG], retaining only records in the table [Stage.APC_Final_Unit_Costs].

b) 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.

c) 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:

d) Total inlier EL costs

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

e) Total inlier NE costs

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

f) Total inlier costs

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

g) Total activities

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

h) 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;

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

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

k) else

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

$[EL\ COMB\ UC] = [EL\ UC]$ (If [COMBINE <> 1)

l) Calculating the NE combined total costs as follows;

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

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

Else

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

Else (If [COMBINE <> 1)

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

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

$[EBD\ UC] = 0$, else

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

The above steps result to a number of new columns and these are stored in a table [Stage].[APC04_03].

2.14.3 Data used for this modelling step

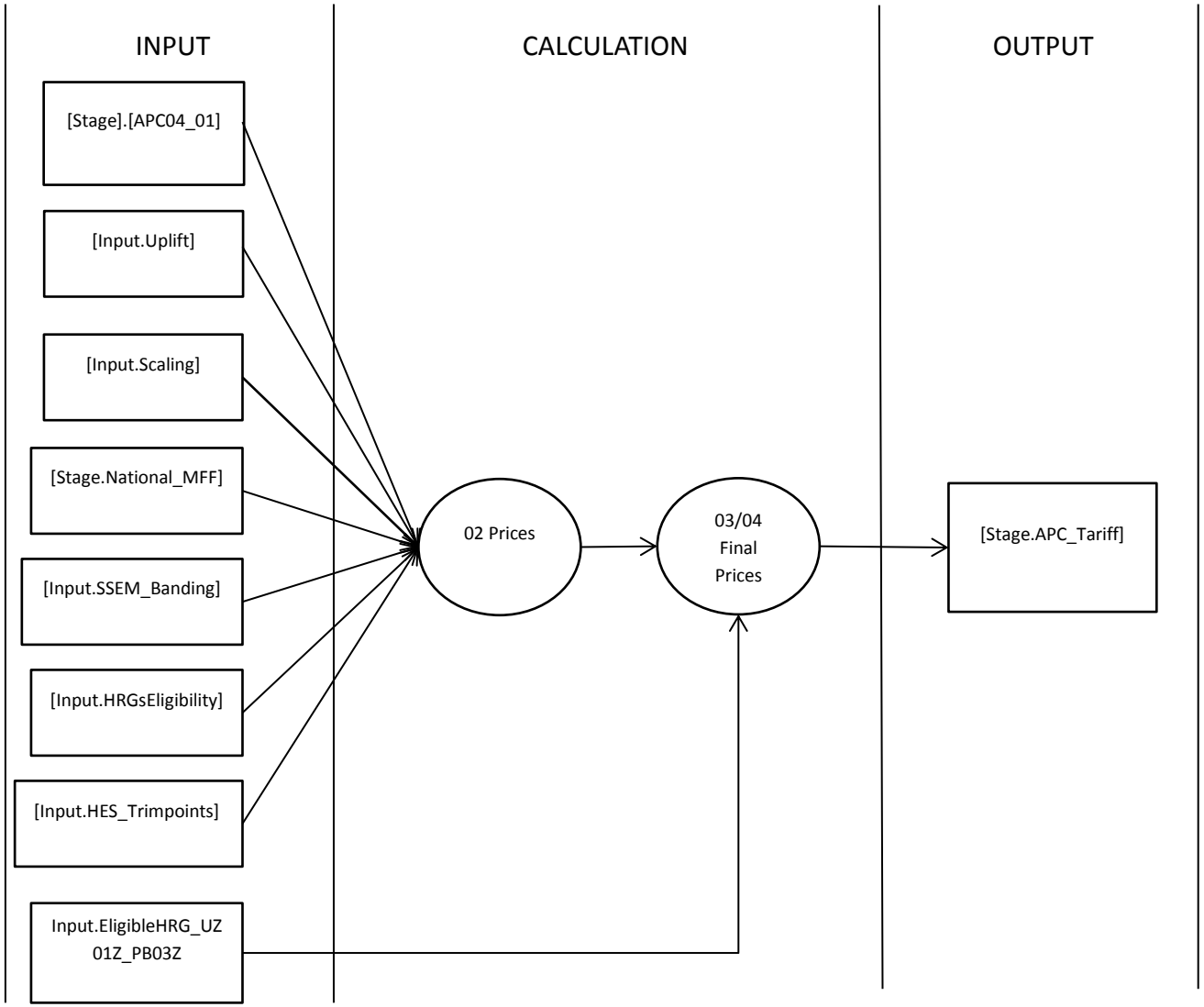
Input tables used in this model step	Input fields from input table used
[Stage.APC_Final_Unit_Costs]	[SPELL HRG] [NE ACT] [EL ACT] [NE UC] [EL UC]
[Stage.APC_EBD_UC]	[HRG] [FCE EBD UC CAPPED]

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)
[Stage].[APC04_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 estimate the tariffs. This includes making a number of adjustments to produce separate costs for EL, NE and long stay payments. Trim points are also set and the model ends with a tariff price for each spell 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 the table [Stage].[APC04_01] produced in the previous section, retaining only records in this table.

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

   i. an uplift factor showing the residual of inflation and efficiency[19];

   ii. an MFF rebase calculated in section 2.3 which accounts for the difference between the non MFF costs and the non-capped MFF costs; and

   iii. a scaling factor.

b) The MFF rebase is 1 and the scaling factor is no longer used in the SQL model and has also been set to 1 as well as efficiency and inflation factors are 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 EL tariff as follows;

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

c) 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:

[19] The calculations of uplift factors are moved to post-processing stage in the Excel model.

i. an uplift factor;

ii. MFF rebase;

iii. the scaling factor; and

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

d) 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

$$[SSEM\ Tariff] = 0$$

Calculating long stay payments

A long stay payment tariff is also calculated which represents the cost of staying longer than the recommended bed days (past the trim point).

a) 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:

b) Calculating Long stay payment by using the unit cost of EBD[20] and the figure of uplift in the table [Input].[Uplift]. It is worth noting that because the uplift adjustment is currently conducted in the post processing stage, the figure of uplift is set as the value of one in the table of [Input].[Uplift].

$$[Longstay\ Payment] = [EBD\ UC] \times [[UPLIFT]$$[21]

c) Finally, the model works out the respective trim points 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 trim points as follows:[22]

i. Calculating the EL trim points 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 trim points as follows;

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

Otherwise

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

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 [Stage].[APC04_02] to [Input.HRGs & Eligibility (UZ01Z) & (PB03Z)] and storing the results in another table [Stage].[APC04_03].

[20] The cost of the extended bed day (EBD) is one of variables in the reference cost dataset, which is used in the calculation of long stay payment. A more detailed explanation is presented in the document of A Simple Guide to Payment by Results (Department of Health) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/213150/PbR-Simple-Guide-FINAL.pdf.

[21] The calculation of long stay payment is moved to post-processing stage in the Excel model.

[22] According to the policy inherited from NHSE, the minimum value of trim point is 5.

Final Prices including Specialist Top-ups

The last stage is to produce the final output tariff prices. The model joins tables [Stage].[APC04_03] and [Input.HRGsEligibility] using field [SPELL HRG] = [HRG code], retaining only records in the table [Stage].[APC04_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
[Stage].[APC04_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.EligibleHRG_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]

Part Two: APC&OPROC Excel Model

In this section, we explain the APC&OPROC Excel model (referred to as "APROC Excel model" from here on). We summarise the inputs used, the calculation steps to calculate prices and the outputs produced.

1. Model Inputs

Model inputs for the APROC Excel model are grouped into the two following categories:

- SQL Model inputs which are tables produced in the SQL model (see the previous section of this document).
- Various other Non-SQL inputs

The full list of inputs and their descriptions has been summarised in the Cover Sheet of the APROC Excel model (see tab "cover sheet").

2. Steps to Calculate Tariff Prices

The APROC Excel model performs the following adjustments to produce final prices[23] (*see the tab named "STEP BY STEP OP-DC-EL-NE" in the APROC Excel model):*

- **SQL Output** – *This is the starting point which incorporates the SQL outputs (see previous section of this document) See columns [K] – [N] in the tab "[STEP BY STEP OP-DC-EL-NE]" in the APROC Excel model*)

- **Reference costs quantum reconciliation factor (QR1)** – *At this stage, the modelled cost quantum is equalised with the reference costs quantum used to generate the SQL prices. The modelled cost quantum estimation can be found in the APROC Excel model (see Cell AC95 in tab "[QUANTUM RECONCILIATION BY SC]". The reference costs target quantum is calculated in an external model, QR1 is calculated as follows:*

$$\boldsymbol{QR1} = \left(\frac{Reference\ Costs\ target\ quantum}{Model\ quantum} - 1\right) * 100\%$$

[23] That is prices for OPROC, DC, EL and NE, but not Short Stay Emergency Tariffs (SSEM), Trim points and Long Stay Payments (LSP)

*Then, QR1 is uniformly applied to all **SQL Output** (1) prices (see columns [O] – [S] in the tab "[STEP BY STEP OP-DC-EL-NE]" in the* APROC Excel model).

- **Cost Base Adjustment (CB)** – In this step *a cost based adjustment **(CB)** is applied to the prices to account for costs that are not considered to be part of the tariff. This functionality is currently not used. (see columns [T] – [X] in the tab "[STEP BY STEP OP-DC-EL-NE]" in the* APROC Excel model)

- **Indexation Adjustments into the financial year prior to the tariff year** – We apply the following adjustments: *Inflation, Efficiency and clinical negligence scheme for trusts CNST for the period between the year before the tariff year and the year in which the reference cost dataset was collected. (see columns [Y] – [AB] in the tab "[STEP BY STEP OP-DC-EL-NE]" in the* APROC Excel model)

- **Manual Adjustments** – Prices are in some cases adjusted following feedback from stakeholders. *(see columns [AC] – [AF] in the tab "[STEP BY STEP OP-DC-EL-NE]" in the* APROC Excel model)

- **Manual adjustments quantum reconciliation factor (QR2)** – Any impact on the overall quantum reimbursed under the national tariff due to **Manual Adjustments** (see previous step) are offset automatically by applying a **QR2** factor which brings the quantum back to its pre **Manual Adjustments** level. QR2 is calculated as follows (*see columns [BO] – [BQ] in the tab "[QUANTUM RECONCILIATION BY SC]" in the* APROC Excel model):

$$QR2 = \left(\frac{Modelled\ prices\ quantum\ post\ QR1}{Prices\ after\ manual\ adjustment\ quantum} - 1\right) * 100\%$$

QR2 is applied on a chapter level basis, with the exception of subchapter HD which is treated as if it were a separate chapter from H. See columns AK-AO for the effect on prices.

- **Smoothing Factors** – *Model prices are adjusted by a smoothing factor. This is intended to adjust prices within specific sub-chapters to limit initial estimated losses compared to previous tariffs. This is funded by reducing prices outside of these sub-chapters by a consistent percentage so that the change does not affect the overall cost of the tariff. (see columns [AP] – [AT] in the tab "[STEP BY STEP OP-DC-EL-NE]" in the* APROC Excel model).
- **Scaling Factor (SCF)** – Model prices are further adjusted by applying a scaling factor which 'scales' prices so that the tariff quantum reimbursed is the same as the quantum reimbursed using the previous tariff (and using the same activity dataset). The calculation of the scaling factor itself is performed in a separate model by using the formula below. The SCF adjusted prices are calculated in the APROC Excel model (*(see columns [AZ] – [BD] in the tab "[STEP BY STEP OP-DC-EL-NE]"*):

$$SF = \left(\frac{Payment\ Quantum\ 2016/17}{Payment\ Quantum\ 2017/18} - 1 \right) * 100\%$$

- **Indexation Adjustments (IA) into the tariff year** – Finally, prices are adjusted for forward looking Inflation, efficiency and CNST for the relevant tariff year. The adjustments are for efficiency, inflation (including service development) and CNST. This is done using the following formula (*see columns [BE] – [BS] in the tab "[STEP BY STEP OP-DC-EL-NE]" in the APROC Excel model)*:

$$PA = price * [(1 + inflation) * (1 + efficiency) - 1] * (1 + CNST)$$

3. Calculation of Long Stay Payments (LSPs)

Long Stay Payments are calculated using Excess Bed Day activity and cost data taken from SQL Model (*(see columns [A] – [M] in the tab "[Long Stay Payments]" in the* APROC Excel model). The calculation is as follows:

- **Chapter Level Unit Cost split between Paediatric and Adult HRGs –** First, the model calculates two separate LSP initial prices, one for Paediatrics and one for Adult HRGs within each chapter. This is done by dividing the total cleansed SQL Tariff LSP cost by its corresponding activity for each HRG and age group *(see columns [A] – [J] in the tab "[Long Stay Payments]" in the* APROC Excel model):

$$\text{Chapter Level Initial Children LSP} = \frac{Chapter\ Level\ Total\ Children\ LSP\ Cost}{Chapter\ Level\ Total\ Children\ LSP\ Activity}$$

$$\text{Chapter Level Initial Adult LSP } = \frac{Chapter\ Level\ Total\ Adult\ LSP\ Cost}{Chapter\ Level\ Total\ Adult\ LSP\ Activity}$$

- **LSP Capping –** Next, the model caps LSP payments to a minimum of £100 and a maximum of £500. *See columns [K] in the tab "[Long Stay Payments]" in the* APROC Excel model.

- **Zero Pound priced LSP –** At this stage, any long stay payments for zero Pound priced HRGs are set to zero Pounds. *See columns [L] – [M] in the tab "[Long Stay Payments]" in the* APROC Excel model.

- **LSP Finalisation** – From this point on Long Stay Payments follow the same calculation process as their corresponding Tariff Prices[24] and undergo the following adjustments: QR1, Cost Base, 2016/17 Indexation, QR2, Smoothing, Scaling and Indexation Adjustments. Please refer to *'Steps to calculate tariff prices'* for more details. *See columns [P] – [X] in the tab "[STEP BY STEP TRIMPOINT and LSP]" in the* APROC Excel model.

4. Trim Points

A trim point is the number of days in a health resource group (HRG) after which a provider is eligible for an excess-bed day top-up for long-stay patients[25]. Trim points only affect the admitted patient care model (APC) of the national tariff.[26]

The initial data on trim points is generated through the SQL processing and shown in *columns [E] – [G] in the tab "[STEP BY STEP TRIMPOINT and LSP]" in the* APROC Excel model. The APROC Excel model applies the following steps:

- **Trim point Selection** – In this step the model selects the relevant trim points from SQL output table containing elective and non-elective initial trim points.

- **Day Rule** – Next, any trim points of 4 days or less day are set to 5 days. See *columns [H] – [I] in the tab "[STEP BY STEP TRIMPOINT and LSP]" in the* APROC Excel model.

[24] Please note that LSPs do not currently undergo manual adjustments
[25] Source: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/285988/Evaluation_Report_-_Full_Report_FINAL.pdf
[26] The HRG are standard groupings of clinically similar treatments which use comparable levels of healthcare resource. The HRGs are based on a bundled of ICD-10 diagnoses and OPCS-4 procedures that have similar resource implications. The Healthcare and Social Care Information Centre (HSCIC) provides a detailed explanation of HRGs and how they are generated: http://www.hscic.gov.uk/hrg

- **Trim point Manual Adjustments** – Finally, trim points for tariffs that have been equalised across settings as part of manual adjustment process are set to a combined trim point, which is calculated in *columns [L] – [M] in the tab "[STEP BY STEP TRIMPOINT and LSP]" in the* APROC Excel model by the Trim point Model. Furthermore any other manual adjustments to trim points are done in this part of the APROC Excel model (*See columns [J] – [K] in the tab "[STEP BY STEP TRIMPOINT and LSP]" in the* APROC Excel model).

- The final results are presented in *columns [N] and [O] in the tab "[STEP BY STEP TRIMPOINT and LSP]" in the* APROC Excel model.

5. Model Outputs

Finally, the APROC Excel produces three key outputs:

- **2017-18 Tariffs - admitted patient care & outpatient procedures** – A complete set of **APC and OPROC** prices (as shown in the national tariff information sheet). *See columns [A] – [M] in the tab "[Linked sheet]" in the* APROC Excel model.)

- **Output for BPT** – A worksheet containing final **APC OPROC** prices and activity data used as for the Best Practice Tariff (BPT) tariff calculation model. *See columns [A] – [Q] in the tab "[APC Output for BPT]" in the* APROC Excel model.

Glossary

Abbreviation	Meaning
A&E	Accident & Emergency
ACT	Activity
ADM	Admission Method
APC	Admitted Patient Care
CC	Complications & Co-morbidities
CCU	Coronary Care Unit
CNST	Clinical Negligence Scheme for Trusts
D&D	Drugs & Devices
DC	Day case
EBD	Excess Bed Days
EL	Elective
EL_XS	Elective Inpatients- Excess Bed Day
EPI	Episode
FCE	Finished Consultant Episode
FT	Foundation Trust
HES	Hospital Episode Statistics
HRG	Healthcare Resource Group
HSCIC	Health and Social Care Information Centre
ICRS	Injury Cost Recovery Scheme
LoS	Length of Stay
MFF	Market Forces Factor
NE	Non-Elective

NEL	Non-Elective Inpatient - Long Stay
NEL_XS	Non-Elective Inpatient - Long Stay Excess Bed Days
NES	Non-Elective Inpatient - Short Stay
NHSLA	NHS Litigation Authority
NHST	NHS Trust
NICE	National Institute for Health and Care Excellence
PbR	Payment by Results
RC	Reference Costs
SPSS	Statistical Package for the Social Sciences
SQL	Structured Query Language: (a Microsoft application for manipulating large sets of data)
SSEM	Short Stay Emergency Tariff
TC	Total Cost
TP	Trim point
UC	Unit Cost