Independent Hospital Pricing Authority

National Pricing Model 2020–21

Technical Specifications

March 2020

IHPA

National Pricing Model 2020-21 – Technical Specifications – March 2020

Contents

Table of acronyms and abbreviations

Acronym/ abbreviation	Description
ABF	Activity based funding
ABS	Australian Bureau of Statistics
ALOS	Average length of stay
AN-SNAP	Australian national subacute and non-acute patient classification
APC	Admitted patient care
APCP	Admitted patient cost proportion
AR-DRG	Australian refined diagnosis related group
ASGS	Australian statistical geography standard
ASNC	Admitted subacute and non-acute care
COAG	Council of Australian Governments
CSO	Community service obligation
DRG	Diagnosis related group
DSS	Data set specification
ED	Emergency department
HCP	Hospital casemix protocol
ICU	Intensive care unit
IHPA	Independent Hospital Pricing Authority
LHN	Local hospital network
LOS	Length of stay
MAPE	Mean absolute percentage error
MBS	Medicare benefits schedule
MDB	Major diagnostic block, used in URGs
MDC	Major diagnostic category, used in AR-DRGS
MPS	Multi-purpose service
NAPED	Non-admitted patients emergency department
NEC	National efficient cost
NEP	National efficient price
NHCDC	National hospital cost data collection
NHRA	National Health Reform Agreement
NMC	Non-admitted multi-disciplinary clinic
NMDS	National minimum data set
NPHED	National public hospital establishment database
NWAU	National weighted activity unit
OTA	Organ and Tissue Authority
PICU	Paediatric intensive care unit
SA2	Statistical areas level 2
TTR	Teaching, training and research
UDG	Urgency disposition groups
URG	Urgency related groups
WAU	Weighted activity unit

1. Overview

1.1. Purpose

This document has been produced as an accompaniment to the National Efficient Price Determination 2020–21 (NEP20) and the National Efficient Cost Determination 2020–21 (NEC20). It provides the technical specifications for how the Independent Hospital Pricing Authority (IHPA) developed the activity based funding (ABF) models for the service streams to be funded on this basis from 1 July 2020, and provides guidance to hospitals, local hospital networks (LHN), and state and territory health authorities on how to apply these to hospital activity. It also shows how the national efficient cost is determined for hospitals (such as small rural hospitals) funded on a block funded basis.

1.2. Background

The National Health Reform Agreement (NHRA) sets out the intention of the Australian Government, and state and territory governments to work in partnership to improve health outcomes for all Australians. One of the ways in which the NHRA aims to achieve this is through the implementation of national ABF. The NHRA specifies that the central component of ABF is an independently determined NEP and NEC, to be used as a reference for the Commonwealth to determine its funding contribution for Australian public hospital services.

IHPA is a key element of the NHRA, responsible for the national implementation of an ABF system and in determining the annual NEP and NEC for Australian public hospital services. IHPA was established as an independent government agency under Commonwealth legislation on 15 December 2011. It has issued eight NEP Determinations annually since 2012–13 (NEP12) and seven NEC Determinations since 2013–14 (NEC13).

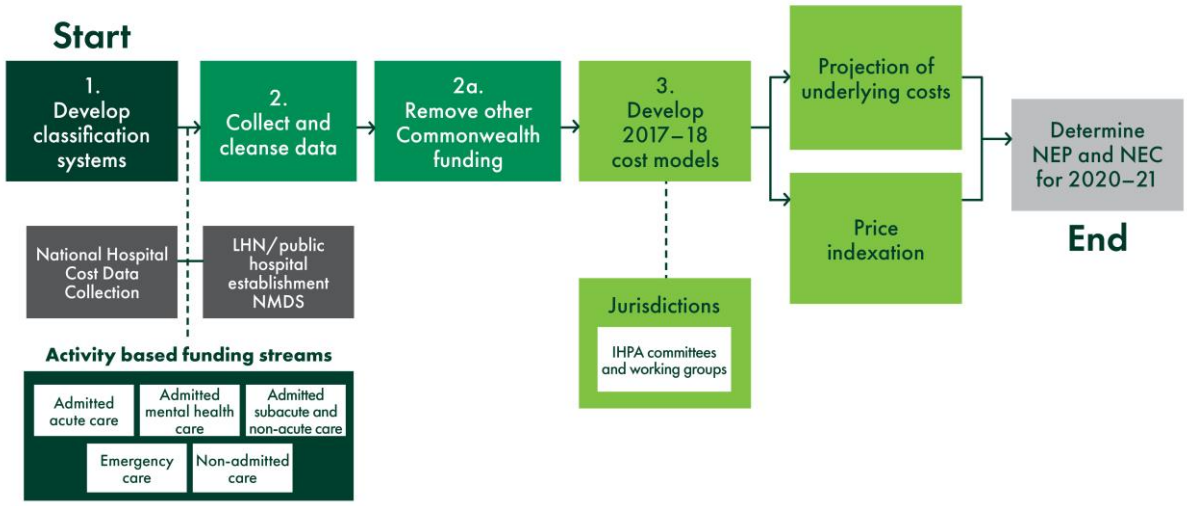
IHPA has now published its ninth NEP and NEC, which sets out the determinations for 2020–21 in relation to each of its legislative functions, namely:

- The NEP for health care services provided by public hospitals where the services are funded on an activity basis.
- The NEC for health care services provided by public hospitals where the services are funded on a block funded basis.
- The development and specification of classification systems for health care and other services provided by public hospitals.
- Adjustments to the NEP to reflect legitimate and unavoidable variations in the costs of delivering health care services.
- Except where otherwise agreed between the Commonwealth and a state or a territory — to determine the public hospital functions that are to be part-funded in that state or territory by the Commonwealth.
- Publication of a report setting out the NEP and NEC for the coming year and any other information that would support the efficient funding of public hospitals.

1.3. National efficient price 2020–21 process

The figure below outlines the NEP20 process from development of classification systems to publishing the NEP and NEC 2020–21 Determinations.

Figure 1: Process to determine the national efficient price 2020–21



1.3.1. Classification systems

One of the first stages is to classify the hospital activity under various systems dependent on the ABF service stream. IHPA has collated activity and cost data for each of the ABF service streams to be funded on an activity basis in 2020–21, as follows:

- Admitted acute
- Admitted mental health care
- Admitted subacute and non-acute
- Emergency care
- Non-admitted.

Classification systems within each service stream are applied uniformly across all available data. Although these systems have been developed in part to explain variation in cost between different outputs within the stream, additional systematic variation still occurs. To account for this, various adjustments are modelled and where justified, implemented into the models. The classification systems for each service stream and the source of its cost and activity data are outlined in **Appendix A**.

1.3.2. Data preparation

An important part of the modelling process is the preliminary preparation of both the costing and activity data. The essential steps in the data preparation process are:

a. A substantial validation process undertaken as the data are received from jurisdictions.

b. Matching mothers with unqualified neonates[1] to ensure costs are properly attributed to the mothers.

[1] See Glossary Item Newborn qualification status (METeOR identifier: 327254)

c. Linking the National Hospital Cost Data Collection (NHCDC) cost file with the admitted patient care activity file at the patient level (which has recorded a success rate of over 95 per cent).

d. Identifying any differences in patient characteristics or operational data recorded across the two data sets and reconciling these where appropriate.

e. Where reported, removing blood costs and/or any identified amounts related to Commonwealth pharmaceutical payments.

The activity and cost data is sourced by IHPA from various national data collections and is supplemented by additional data provided by the states and territories. In consultation with jurisdictions, IHPA has identified 288 hospitals to make up the ABF price model and 408 hospitals designated for block funding. Of the block-funded hospitals:

- 21 are being treated separately as specialist psychiatric establishments.
- 11 are major city hospitals.
- Three do not fit the cost model structure.
- 373 hospitals comprise the block-funded cost model.[2]

Appendix C provides a summary of the NHCDC Round 22 cost data received for 2017–18.

The next stage in the process is to develop the 2017–18 cost models. This process includes deriving the cost profiles, adjustments and relative weights of classes within each service stream. Development of the individual cost models are explained in further detail in the corresponding sections of this document.

1.3.3. Conversion to a pricing model

There are four steps in the transformation of each year's cost model into its associated pricing model, namely:

a. Identification and exclusion of costs and activity regarded under the NHRA as out of scope for the purpose of ABF.

b. Derivation of a reference cost (or standardised mean) used to transform the cost model into a cost weight model.

c. Derivation of an annual indexation rate used to inflate the cost model to a level reflective of the estimated cost of delivering hospital services in the year of the pricing model.

d. Transformation of the cost model to the pricing model using the results of the previous three steps.

This is explained in further detail in Section 7.

[2] For a list of block funded hospitals see **Appendices A** to **D** of the National Efficient Cost Determination 2020–21

2. Admitted acute care cost model

2.1. General issues

2.1.1. Cost unit

An ‘episode of acute patient care’ is the cost unit for admitted acute patients. It is ‘the period of admitted patient care… characterised by only one care type’, and covers the period of care from admission to discharge [see Australian Institute of Health and Welfare’s Metadata Online Registry (METeOR) identifier 268956].

2.1.2. In-scope activity

Admitted acute activity is defined by episodes of care reported as care type acute care, newborn care, or mental health care according to METeOR identifier 584408.

All episodes from all funding sources are included in the calculation of the cost weights. This approach is taken to ensure that the sample used for the development of national weighted activity unit (NWAU) is maximised and reflects the overall costs for the hospital. Only in-scope admitted acute episodes and associated relevant costs are included in the calculation of the national efficient price (NEP), as described in Section 7.

In-scope costs

Factors impacting scope of costs include:

- Costs associated with the admitted episode where a patient is admitted through an emergency department that is within the scope of ABF for emergency care. This component of cost is separated from the acute episode and funded through the emergency care funding model.
- Depreciation and other capital costs[3] (where reported) are removed.
- Indirect costs for teaching, training and research (TTR) are included, but any direct TTR costs are excluded and will be block-funded.
- Identified blood costs and Commonwealth pharmaceutical payments are also removed.

2.1.3. Classification

Australian Refined Diagnosis Related Groups (AR-DRGs) are used to classify admitted acute care. The version applied for pricing in 2020–21 is AR-DRG Version 10.0.

2.2. Analysis of costs to derive NWAU for admitted acute care

This section provides an overview of the steps involved in developing the NWAU for admitted acute care. Detailed information in relation to each of the components of the model is included below. In summary, the steps involved in developing the NWAU for admitted acute care are:

[3] ‘Capital costs are the expenses incurred in acquiring, producing or enhancing non-current (or fixed) assets. They include costs associated with land, buildings, and equipment.’ Page 74, Australian Hospital Patient Costing Standards - Version 3.1.

a. Prepare data, including the removal of other Commonwealth expenditure (in particular the pharmaceutical and blood programs).
b. Incorporate posthumous organ donation activity costs.
c. Incorporate private patient costs where there is evidence they have not been provided as part of the NHCDC.
d. Stratify and weight cost data to activity data.
e. Calculate inlier bounds from activity data.
f. Classify episodes into relevant categories including inliers, short-stay and long-stay outliers, designated same-day AR-DRGs, paediatric status, Indigenous status and remoteness area status, and establishments reporting radiotherapy procedures.
g. Determine cost level for intensive care unit (ICU) adjustment and deduct associated costs.
h. Derive initial parameters for AR-DRG inlier/outlier model and ensure predicted costs align with actual costs by AR-DRG.
i. Derive paediatric adjustment, specialist psychiatric age adjustment (see Section 3, mental health care cost model), Indigenous adjustment, remoteness adjustment, radiotherapy adjustment and dialysis adjustment.
j. Derive private patient service adjustment and private patient accommodation adjustment.
k. Incorporate data trimmed in data preparation process (outlier samples of cost data).
l. Convert price weights and assign NWAU.
m. Apply stabilisation of acute weights.

These steps are described in further detail in the following sections.

2.2.1. Data preparation

The 2017–18 NHCDC data are first adjusted to remove those costs associated with spending under other Commonwealth programs. Costs associated with the Commonwealth's pharmaceutical programs are identified by matching the NHCDC at the patient level with a record of the Commonwealth pharmaceutical payments. The residual unmatched payments are apportioned according to the distribution of costs associated with the matched records. All reported blood costs are removed from the NHCDC. The amounts deducted from the reported costs are identified in Chapter 2 of the National Efficient Price Determination 2020–21.

Table 1 shows the trimming stages and the number of episodes trimmed at each stage of the data preparation process.

Table 1: Number of episodes trimmed at each data preparation stage

Trimming stage	Episodes
(a) Initial activity-level cost sample of admitted acute records	**6,036,444**
Less – Total trimmed episodes	**-31,740**
(b) Patient level cost data trimmed under jurisdictional advice	**0**
(c) Episodes from hospital-DRG combinations with extremely high or low cost-to-price ratios	**-7,263**
(d) Removal of records with total in-scope costs ≤ $23	**-24,084**
(e) Observations with extreme outlier costs	**-60**
(f) Extremely high or low cost ratios removed after deriving the preliminary regression model	**-288**
(g) Multi-day AR-DRG R63Z episodes	**-45**
(h) Resulting sample size of separations used to create AR-DRG cost profiles	**6,004,704**

For the financial year 2017–18:

a. An activity-level cost sample of 6,036,444 admitted acute records (with both the admission and separation dates within this period) were partitioned into two groups for modelling purposes. The first group is evaluated as fit for use to develop AR-DRG cost profiles for the 2017–18 cost model, and a second group identified as not fit for this purpose. The second group is later incorporated into the cost model to calibrate the overall level of costs within the model.

b. No patient level cost data was removed from the sample based on jurisdictional advice. A preliminary model with length of stay and DRG as explanatory variables of patient cost was derived and applied to the remaining sample.

c. The 7,263 hospital-DRG combinations with extremely high or low cost-to-price ratios were also excluded from the patient level modelling.

d. The sample was further reduced by 24,084 episodes as a result of removing records with total in-scope costs of $23 or less.

e. The remaining sample was then analysed by AR-DRG, and observations with extreme outlier costs were identified and removed. This was done by ranking observations by cost and identifying those values that recorded an extreme increase in cost of over 200 per cent (or a decrease in cost of over 75 per cent) from the previous observation. In total, 60 records were removed at this stage.

f. The extreme outlier identification stage was undertaken by first deriving a preliminary regression model using length of stay and DRG, and analysing the resulting cost ratios. Following this, another 288 individual records with extremely high or low cost ratios were removed.

g. In this final stage, multi-day chemotherapy AR-DRG R63Z episodes were trimmed out. The Australian Coding Standards state that the principal diagnosis code Z51.1 – Pharmacotherapy session for neoplasm which informs DRG of R63Z may only be

assigned to same-day episodes. The 44 multi-day episodes with this code were trimmed from the cost model.

h. The resulting sample of 6,004,704 separations were identified for use in creating AR-DRG cost profiles.

2.2.2. Posthumous organ donation activity costs

Posthumous organ donation activity was accounted for in the NEP for the first time in NEP16. This followed advice from the Organ and Tissue Authority (OTA) that funding provided from the OTA to jurisdictions contributes towards the cost of preparing a patient for organ donation, but not for all costs incurred thereafter. This advice from the OTA means that some of the costs of posthumous organ donation are not funded by the Commonwealth and should be in-scope for pricing under the NHRA. This has not changed for NEP20.

IHPA takes the costs reported against donors in 'care type 9' and redistributes these costs to recipient transplant AR-DRGs in the admitted acute model. The total cost associated with each organ procurement is accounted for by inflating the in-scope cost of patients in AR-DRGs, which typically involves the transplant of relevant organs. Note, there is no mechanism to link donors with recipients or to gauge the outcome of a procurement or transplant.

The total cost reported against posthumous organ donors in 2017–18 is $7,003,760. This results in a national cost inflation in the admitted acute stream of 0.024 per cent.

2.2.3. Private patient costs

Private patient episodes in-scope for ABF include those episodes occurring in a public hospital with a funding source of either '09 Private health insurance' or '13 self-funded' in the 2017–18 Admitted Patient Care (APC) data sets. The NHRA requires that in setting NEP20, IHPA must take into account the costs of private patients that are met through alternative funding sources. These alternative sources include medical benefits payments by the Australian Government, private health insurance benefits payments, and payments made by patients.

Since NEP14, the hospital casemix protocol (HCP) dataset, which is reported by private insurance companies, has been used to identify these costs. HCP data identifies both the charges and benefits paid for private patients receiving public hospital services. For NEP20, the private patient records in the HCP dataset were matched with the records in the APC and NHCDC datasets, resulting in a sample of 73.9 per cent match of relevant records. Those private patient records in the NHCDC that were not matched to the HCP data were assumed to have similar characteristics to the matched dataset.

In using the HCP data, a more accurate estimate can be made for the amount of private patient costs not included in the NHCDC costing data and need a correction factor applied. A correction factor of 1.4 per cent was determined for NEP20.

2.2.4. Stratification and weighting

The sample of costed activity from ABF establishments make up 96.3 per cent of all in-scope admitted acute activity (population). To take account of the un-costed activity, IHPA weights the costed sample to the population. Weighting of the costed sample is applied to ensure a true representation of the entire population. This weighting process is performed in two stages, as outlined below.

Stage 1 (episodes admitted on or after 1 July 2017 and separated on or before 30 June 2018)

The first stage of the weighting process stratified and weighted the ABF sample to reflect the population of all 2017–18 ABF admitted acute activity with an admission date *on or after* 1 July 2017. The stratification is based on establishment state/territory, size, location and

paediatric specialty. Establishments are classified by size using 2019–20 admitted acute NWAU, calculated on 2017–18 activity data (that is, NWAU19 calculator applied to 2017–18 data).

Stage 2 (episodes admitted prior to 1 July 2017)

The second stage of the weighting process weights the 2017–18 activity with an admission date *prior* to 1 July 2017, up to all activity with separation dates within 2017–18. This weighting is done by length of stay quartiles within the AR-DRG. Same-day activity received a weight of 1 in this process, as there are no 2017–18 same-day separations with admission dates prior to 1 July 2017.

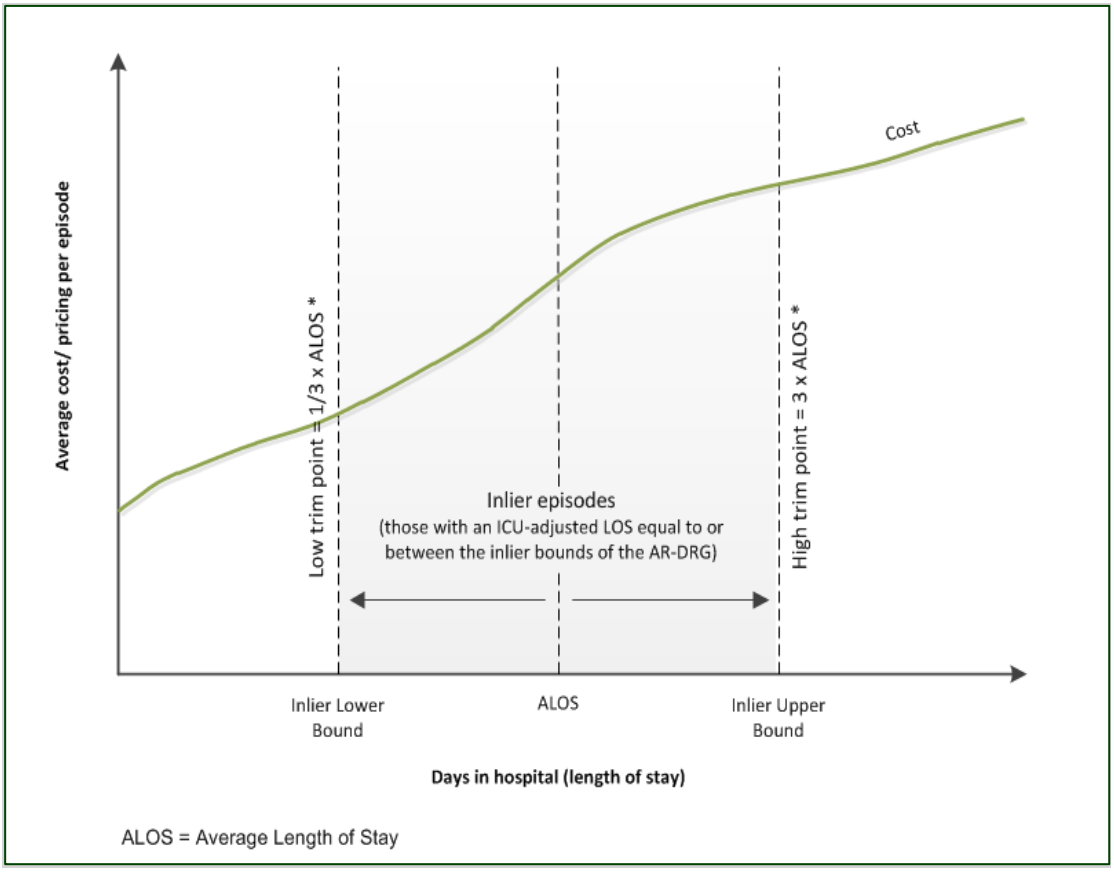
The resulting sample-to-population weights were used throughout all stages of the cost model development.

2.2.5. Inlier bounds

Admitted episodes with length of stay between one-third and three times the average length of stay for a particular AR-DRG are classed as inliers. This methodology is referred to as L3H3, and results in the vast majority of admitted episodes being classed as inliers.

The L3H3 method is applied to the population of in-scope activity from ABF establishments to identify inlier bounds outside of which are short-stay and long-stay outliers. This is illustrated in Figure 2. The method excludes same-day episodes occurring in AR-DRGs designated for a separate same-day payment, and uses length of stay adjusted to remove ICU days for ICU unbundled AR-DRGs.

Figure 2: Inlier bound calculations



The L1.5H1.5 method is used for mental health major diagnostic categories 19 and 20, as well as 13 DRGs that have very high cost long-stay outliers. The list of 13 DRGs where the L1.5H1.5 method is used to determine the inlier bounds is provided in **Appendix D**.

The steps for this process are:

a. Calculate the national average length of stay for each AR-DRG.

b. Calculate the inlier lower bound for each AR-DRG. This is based on the calculation: national average length of stay divided by three (1.5 for mental health and the 13 specified DRGs). The inlier lower bound is equal to average length of stay divided by three.

c. The result is then truncated. This means that it is rounded down to the next lowest integer (for example, if the result was 3.6, the inlier lower bound is set to three).

d. Calculate the inlier upper bound for each AR-DRG. This is based on the calculation: national average length of stay multiplied by three (1.5 for mental health and the 13 specified DRGs).

e. The result was rounded to the nearest integer (for example, 10.2 would result in the upper bound being set to 10, whereas 10.7 would result in the upper bound being set to 11).

f. Episodes with an ICU adjusted length of stay equal to or between the two inlier bounds of the AR-DRG are considered inlier episodes.

Further to the above process, changes to the inlier bounds from the 2016–17 cost model are monitored to ensure they are the result of real change and not due to 'statistical noise'. Wherever an AR-DRG has not been significantly affected by a specific change in methodology, 95 per cent confidence intervals around bounds are used to evaluate whether a change is significant or not. Changes are also evaluated in terms of their materiality (required to affect at least one per cent of an AR-DRG's separations and at least 10 separations).

2.2.6. Classification of patient-level cost data in relevant categories

Prior to analysing costs, episodes are assigned to categories reflecting the relevant adjustments to be made through the 2017–18 cost model. The steps involved are:

a. Assigning one of the following categories to each episode:

- same-day separation from an AR-DRG on the designated same-day payment list
- short-stay outlier
- inlier
- long-stay outlier.

b. Flagging episodes that are eligible for the paediatric adjustment. These are episodes that:

- Occur in establishments identified as delivering specialised paediatric services (listed in **Appendix E** of the National Efficient Price Determination 2020–21).
- Have an AR-DRG which is not within major diagnostic category 15 (newborns and other neonates).
- Have patient age at admission of 17 years or less.

c. Flagging episodes that are eligible for the specialist psychiatric age adjustment. These are episodes that have patient psychiatric care days and fall within the age categories specific to the adjustment (see Section 3, mental health care cost model). Together with all the episodes in major diagnostic categories 19 and 20 (mental diseases and disorders,

and alcohol/drug use and alcohol/drug induced organic mental disorders respectively), these episodes are considered part of the mental health model and are explained in Chapter 3.

d. Flagging episodes that are eligible for the Indigenous adjustment. These are episodes with Indigenous status[4] of Aboriginal and/or Torres Strait Islander origin.

e. Flagging episodes that are eligible for the patient residential remoteness adjustment. These are episodes where the patient's place of usual residence has been assigned to a remoteness area[5] of:

   - RA2 - outer regional Australia
   - RA3 - remote Australia
   - RA4 - very Remote Australia.

   Three flags are used: one for outer regional Australia, one for remote Australia and one for very remote Australia. The remoteness area of a patient's usual residence is determined using the following process:

   i) The patient's Australian Statistical Geography Standard (ASGS) Statistical Areas Level 2 (SA2) code is mapped to remoteness area.

   ii) If the supplied SA2 code is missing or invalid, the patient's postcode of usual residence is used.

   iii) If the postcode is missing or invalid, then the remoteness area of the hospital is used. The remoteness code of the hospital is based on the remoteness area of the Australian Bureau of Statistics (ABS) collection district within which the hospital is located.

f. Flagging episodes that are eligible for the radiotherapy adjustment. These are episodes where the patient is eligible if they have recorded a radiotherapy-related procedure as defined in **Appendix B** of the National Efficient Price Determination 2020–21.

g. Flagging episodes that are eligible for the dialysis adjustment. These are episodes outside the specified dialysis AR-DRGs L61Z and L68Z, and have recorded a dialysis-related procedure as defined in **Appendix C** of the National Efficient Price Determination 2020–21.

h. Flagging episodes that are eligible for the patient treatment remoteness adjustment. These are episodes where the hospital of treatment has a remoteness area of:

   - RA3 - remote Australia
   - RA4 - very remote Australia.

i. Flagging episodes eligible for the ICU adjustment. These are episodes that occur in hospitals identified by IHPA as eligible for ICU adjustment as defined in **Appendix D** of the National Efficient Price Determination 2020–21 and have an AR-DRG not on the bundled ICU list (that is, not from MDC 15 for newborns and other neonates).

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[4] See data element Indigenous status (METeOR identifier: 291036).

[5] Remoteness areas are defined in the Australian Standard Geographic Standard *(ASGS),* which is maintained by the Australian Bureau of Statistics (see: www.abs.gov.au). The 2016 ASGS remoteness area classification was used to classify patients' place of residence and locality of hospitals.

j. Flagging private episodes. These are episodes with a funding source[6] of '09 Private health insurance' or '13 self-funded'.

k. Flagging hospital acquired complications *(*HACs*)*. These are episodes that are identified as having a HAC as specified by the Australian Commission on Safety and Quality in Health Care (ACSQHC) on their website.

2.2.7. Determine ICU adjustment level and deduct associated costs

Patient-level cost data for episodes in hospitals with an eligible ICU or paediatric ICU (PICU) with ICU hours reported are analysed to estimate an average cost per ICU hour. The eligible ICUs and PICUs are those belonging to hospitals that report more than 24,000 ICU hours and have more than 20 per cent of those hours reported with the use of mechanical ventilation. The specified hospitals with eligible ICUs and/or PICUs are listed at **Appendix D** of the National Efficient Price Determination 2020–21. A total sample of 93,381 separations with ICU hours and costs from establishments with eligible ICUs/PICUs were used.

Linear regression by state/territory was used to derive state/territory hourly ICU costs. Difference in Fits (DFFITS) statistics are used to exclude overly influential observations. The weighted mean of the hourly ICU costs taken across states was used to derive a national ICU rate of $220 per hour.

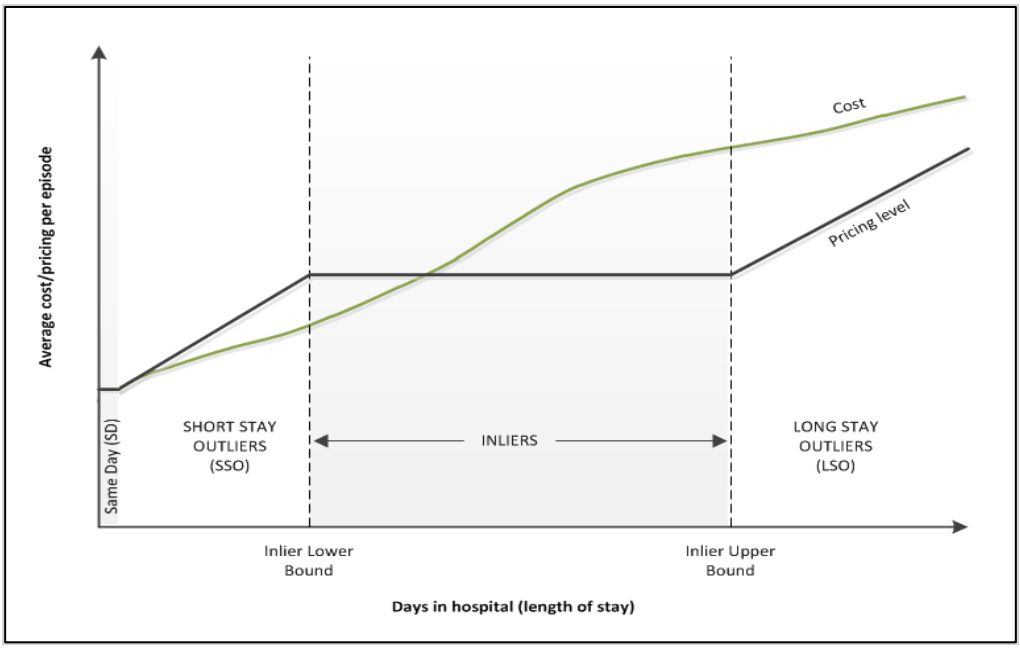
For ICU-eligible episodes, an ICU adjustment is calculated using the estimated ICU cost per hour and the reported number of whole ICU hours. This amount is deducted from the in-scope costs used for modelling the same-day payment AR-DRG, short-stay outlier, inlier and long-stay outlier costs and associated adjustments, but added back in for the ICU adjustment. Whole ICU days are also removed from each eligible episode's length of stay.

2.2.8. DRG inlier/outlier model

Figure 3 illustrates the general form of the cost model within each AR-DRG. However, an AR-DRG's form may differ depending on whether it has a designated same-day separation category, a short-stay outlier category, or a long-stay outlier category.

[6] For activity data before 2012–13 see data element 'Principal source of funding (funding source for hospital patient) (METeOR identifier: 339080), values: 01 Australian Health Care Agreements; 02 private health insurance; 10 Other hospital or public authority (contracted care); 11 reciprocal health care agreements (with other countries); 12 other.

Figure 3: Initial parameters for the assignment of cost weights



Initial parameters are derived for designated same-day payment AR-DRG episodes, short-stay outlier episodes, inlier episodes, and long-stay outlier episodes. The steps involved are as follows:

a. Designated same-day AR-DRG episodes: calculate the mean cost per episode.

b. Inlier episodes: calculate the mean cost per episode.

c. Short-stay outlier episodes: calculate the base cost as the average of total operating room, special procedure suites and prosthesis costs, and then calculate the cost per diem to ensure an even growth in cost to that of the inlier episode.

d. Long-stay outlier episodes: the mean inlier cost is assigned to each episode as a base amount. A per diem for each outlier day is calculated using one of two methods:

- In AR-DRGs where the length of stay profile is adequately wide enough and regular to allow robust regression analysis to be undertaken, the per diem cost is taken as the LOS regression coefficient; this process excludes designated same-day episodes and overly influential observations (as determined by the DFFITS statistical measure).
- In the remaining AR-DRGs, cost buckets are partitioned into ‘fixed’ and ‘variable’ (similar to the short-stay outlier process for surgical AR-DRGs), and the per diem cost is taken as the mean variable cost per patient day.

Where there are fewer than 100 separations in an AR-DRG, 2017–18 separations are combined with those from 2016–17, and indexed appropriately to calculate the cost parameter. All AR-DRG parameters are then uniformly calibrated to ensure the modelled costs are equalised against actual costs.

2.2.9. Calculation of additional adjustments

After the AR-DRG inlier/outlier model is derived, the following five sets of adjustments are calculated based on factors considered to have a material impact on the cost of acute services.

Paediatric adjustment

A paediatric adjustment is derived by AR-DRG. Specialised paediatric patients are identified as being less than or equal to 17 years of age, from an establishment identified as delivering specialised paediatric services (listed in **Appendix E** of the National Efficient Price Determination 2020–21 as specialised children's hospitals), and excluding AR-DRGs from MDC 15 (newborns and other neonates).

The paediatric adjustment for each AR-DRG is:

a. Rounded to the nearest whole per cent.
b. Capped and floored at 2.0 and 0.8 respectively.
c. Set to one (that is, no adjustment) if the adjustment is less than 0.05 either side of one.

Further to this, the paediatric adjustment for the 2017–18 cost model is compared against that of the 2016–17 cost model and changes are stabilised for AR-DRGs where either of the cost data samples (that is, paediatric or non-paediatric) contain fewer than 500 observations. This stabilisation involves taking the average adjustment across the two years.

The cost parameters of each AR-DRG are then calibrated to ensure that the modelled costs, with paediatric adjustment applied, are equal to the actual costs of the AR-DRG.

Specialist psychiatric age adjustment

See Chapter 3 (mental health care cost model).

Indigenous adjustment and patient residential remoteness adjustment

These adjustments are derived by the following process:

a. The remoteness value for each episode is derived from an episode's available geographical information in the following order of preference: SA2, postcode, or the hospital geographical indicator variable.
b. A multivariate least squares weighted regression model is used to estimate the extent to which the variation in the mean cost per weighted episode is explained by each adjustment factor: specialist psychiatric status, Indigenous status, residential remoteness area, and radiotherapy and dialysis status.
c. Episodes are weighted to control the level to which the model already explains costs (that is, through the AR-DRG inlier/outlier model together with the paediatric adjustments). The coefficients estimated from this model indicate the extent to which each factor explains residual variation in costs.
d. The analysis yields an adjustment value for each of the adjustment categories.
e. The Indigenous adjustment taken as the cost-weighted mean of empirical adjustments taken from the admitted acute calculation above, and similar calculations applied to admitted subacute and non-acute, emergency care, and non-admitted code data.
f. The adjustments are additive where more than one adjustment applies, for example, where an Indigenous patient resides in a remote area, an adjustment equal to the addition of the Indigenous and remoteness adjustments is applicable.

Radiotherapy and dialysis adjustment

The dialysis adjustment is derived in the same way and at the same time as the Indigenous and remoteness adjustments, as described above.

Together with the radiotherapy adjustment, the adjustments compensate for the extra costs of dialysis-related and radiotherapy-related procedures, as specified in **Appendices B** and **Appendix C** of the National Efficient Price Determination 2020–21. These two adjustments are additive with the specialist psychiatric age, Indigenous and remoteness adjustments.

Patient treatment remoteness adjustment

The patient treatment remoteness adjustment was introduced in the NEP18 Determination. It is derived using the same methodology as the residential remoteness adjustment, and is designed to explain the residual variation in cost after the other adjustments have been applied. The analysis yields an adjustment for remote and very remote treatment locations.

AR-DRG cost parameters are then uniformly calibrated to ensure cost neutrality of the model (including Indigenous, remoteness, radiotherapy and dialysis adjustments) against actual costs.

2.2.10. Private patient adjustments

Further adjustments are applied to private patients to account for the private benefit received from the Medicare Benefits Schedule (MBS) and private insurers. These adjustments cover the service and accommodation of private patients.

Private patient service adjustment

The HCP data provides a more accurate amount of benefits received from MBS and private insurers for medical hospital services and prostheses than provided by the NHCDC. These benefits are used to calculate the private patient service adjustment. The adjustment is calculated at the AR-DRG level, although for some AR-DRGs with small samples, the adjustment is derived at a more aggregate level.

The following ratio was taken at the AR-DRG level:

$$\text{Private patient service adjustment } (A_{PPS}) = \text{removed costs / total AR-DRG model costs}$$

It should be noted that the AR-DRG model costs referred to in this document exclude the application of any other adjustments. That is, the private patient service adjustment (A_{PPS}) is calculated in such a way that excludes any effect on the paediatric, specialist psychiatric, Indigenous, remoteness, and radiotherapy or dialysis adjustments.

The AR-DRG cost parameters are then uniformly calibrated to ensure cost neutrality of the cost model (including the private patient service adjustment and previously derived adjustments) against actual costs.

Private patient accommodation adjustment

In addition to medical and prostheses costs, insurers are also charged for accommodation. A private patient accommodation adjustment (A_{Acc}) is applied to account for revenue received in relation to these charges. For the purpose of deriving the adjustment associated with NEP20, 2019–20 average default benefits for private health insurers by state/territory are indexed forward one year by 2 per cent (that is, by the Consumer Price Index as required by legislation) to 2020–21.

2.2.11. Funding adjustment for HACs

The August 2016 Ministerial Direction required IHPA to develop an approach for funding episodes which have a HAC. IHPA developed an additional adjustment to account for a HAC episode included in the calculation of NWAU and is included in the NWAU calculation formula, see Section 2.3.

A detailed explanation of the funding adjustment can be found in the accompanying document Pricing and Funding for Safety and Quality – Risk Adjustment Model for Hospital Acquired Complications on the IHPA website.

2.2.12. Incorporation of outlier samples of cost data

The development of the cost model to this point is based on the sample of patient-level cost data evaluated as fit for use to develop AR-DRG cost profiles. Thus, the sample of patient-level cost data identified as not fit for use at the AR-DRG level have not been used within the cost model.

The following process is used to calibrate the cost model against the entire sample of cost data:

a. The cost model developed to this point, including all adjustments (except the private patient adjustments) is applied to the entire cost data sample. This process results in model costs across the entire sample of cost data.

b. The AR-DRG cost parameters are then uniformly adjusted to ensure the resulting total modelled cost across the entire sample is equalised against the total actual costs of the entire sample.

It should be noted again that sample-to-population weights are used throughout all stages in the development of the cost model.

2.2.13. Price weights and NWAU

The final step in the process involves the conversion of the 2017–18 cost model parameters to cost weight values by dividing the cost parameters by a reference cost.

The reference cost used was the 2016–17 reference cost indexed one year by the growth rate in the consecutive years' cost models, where this growth rate is standardised against the 2017–18 activity data. Specifically, the standardised growth rate was derived by applying the 2016–17 and 2017–18 cost models (excluding private patient adjustments) to the 2017–18 activity data, and calculating the change in total modelled costs between the two models.

For NEP20, the standardised growth rate calculation included an adjustment to the 2017–18 activity data for Victoria to account for their implementation of the additional diagnosis coding standard (VIC0002) in the 2017–18 activity data, which is discussed further in Section 7.3. With the exception of this adjustment, the standardised growth rate calculation follows the same methodology used to calculate the 2016–17 reference cost from the 2015-16 reference cost.

The resulting cost weights are then converted to the price weights that are used to assign NWAU, as explained further in Section 7.

2.2.14. Stabilisation of acute weights

The National Pricing Model Stability Policy (the Stability Policy) states that inlier price weight movements between years will be capped to ±20% for AR-DRGs deemed comparable between years where the impact will be minimal.

Stabilisation of inlier weights is done simultaneously. An adjustment factor is calculated for each cost parameter so that the associated price weight is ±20% of the previous year's price weight.

This adjustment factor is then applied to the same-day, short-stay base, and short-stay outlier per diem weights if they exist. Long-stay outlier per-diem weights are not scaled in this way in order to avoid potential unintended extreme cost ratios for very long-stay outliers. The entire cost model is then recalibrated to ensure that the total actual costs and the total modelled costs are equal across the entire sample.

2.3. Applying the NEP

The price of an ABF activity is calculated using the following formula, with adjustments applied as applicable:

Price of an admitted acute ABF activity

$$= (\{[\mathrm{PW} \times \mathrm{A_{Paed}} \times (1 + \mathrm{A_{SPA}} + \mathrm{A_{Ind}} + \mathrm{A_{Res}} + \mathrm{A_{RT}} + \mathrm{A_{Dia}}) \times (1 + \mathrm{A_{Treat}}) + (\mathrm{A_{ICU}} \times \mathrm{ICU\ hours})] - [(\mathrm{PW} + \mathrm{A_{ICU}} \times \mathrm{ICU\ hours}) \times \mathrm{A_{PPS}} + \mathrm{LOS} \times \mathrm{A_{Acc}}]\} - \mathrm{PW} \times \mathrm{A_{HAC}}) \times \mathrm{NEP}$$

Where:

A_{Paed}	means the paediatric adjustment
A_{SPA}	means the specialist psychiatric age adjustment
A_{Res}	means each or any patient residential remoteness area adjustment
A_{Ind}	means the Indigenous adjustment
A_{RT}	means the radiotherapy adjustment
A_{Dia}	means the dialysis adjustment
A_{Treat}	means the patient treatment remoteness area adjustment
A_{ICU}	means the intensive care unit (ICU) adjustment
A_{PPS}	means the private patient service adjustment
A_{Acc}	means the private patient accommodation adjustment applicable to the state of hospitalisation and length of stay
A_{HAC}	means the hospital acquired complications adjustment
ICU hours	means the number of hours spent by a person within a specified ICU
LOS	means length of stay in hospital (in days)
NEP	national efficient price 2020–21
PW	price weight for an ABF activity as set out at **Appendix H** of the National Efficient Price Determination 2020–21

In the event that the application of the private patient adjustments return a negative NWAU(20) value for a particular patient, the NWAU(20) value is held to be zero; that is, negative NWAU(20) values are not permitted for any patients under the national pricing model.

Table 2 and Table 3 outline the information required to apply the above formula.

Table 2: Dataset and tables required for assignment of NWAU to admitted acute patient data

Input dataset or table	Description
APC NMDS	Dataset based on the 2017–18 Admitted Patient Care National Minimum Data Set (APC NMDS).
ICU Rate and Paediatric Adjustment eligibility table	Table listing establishments with an eligible ICU or PICU, found in the National Efficient Price Determination 2020–21 and Glossary.
Postcode table	Table of postcodes mapped to the 2016 ASGS Remoteness Area classification. Each postcode is mapped to the Remoteness Area category within which the majority of the postcode's population resides. PO Box postcodes are mapped to the Remoteness Area category within which the Post Office is located.
ASGS table	Table of Australian Statistical Geography Standard (ASGS) mapped to the Remoteness Area category within which the majority of the ASGS's population resides.
2020–21 NWAU Price weight table	2020–21 Admitted acute NWAU Price weight table, found in the National Efficient Price Determination 2020–21.
2020–21 NWAU Adjustments	2020–21 Admitted acute NWAU Adjustments, found in the National Efficient Price Determination 2020–21.

Table 3: APC NMDS variables used to calculate 2020–21 admitted acute NWAU.

APC NMDS Variable
State Identifier
Establishment Identifier
Hospital geographical Indicator
Sex
Date of Birth
Date of Admission
Date of Separation
Care Type
Admission Mode
Admission Urgency Status
Number of Qualified Days for Newborns
Total Psychiatric Care Days
Indigenous Status
Funding Source[7]

[7] Data Element Concept *Episode of care—source of funding* (METeOR identifier: 472038)

APC NMDS Variable
Diagnosis Related Group v10.0
Total leave days
Total Hours spent in Intensive Care Unit
Postcode of patient's usual residence
Australian Statistical Geography Standard (ASGS) of Patient's Usual Residence
Either the identifier signifying radiotherapy treatment/planning or the list of patient’s ICD-10-AM procedure codes.
Either the identifier signifying dialysis or the list of patient’s ICD-10-AM procedure codes.
The list of patient’s ICD-10-AM codes, including diagnoses and condition onset flags.

3. Mental health care cost model

3.1. General issues

3.1.1. Cost unit

An 'episode of admitted patient care'[8] is the cost unit for mental health patients. Mental health patients are specifically defined as only those admitted acute patients that have care type 11.

As such, admitted acute mental health patients are a subset of admitted acute patients and are analysed under the admitted acute cost model.

Mental health patients receiving emergency department and non-admitted care services are not differentiated in NEP20 and so receive payments as defined for the relevant ABF product category.

3.1.2. In-scope activity

Mental health admitted care is that provided to patients who undergo a facility's formal admission[9] processes where the clinical intent or treatment goal is the provision of acute care. In-scope hospitals and patients are defined the same way as in the admitted acute model (see Section 2.1.2).

3.1.3. Classification

AR-DRGs are used to classify admitted acute care including the mental health acute patients. The version that applies for funding in 2020–21 is AR-DRG v10.0.

3.2. Analysis of costs to derive NWAU for mental health care

3.2.1. Data preparation

See Section 2.2.1.

3.2.2. Stratification and weighting

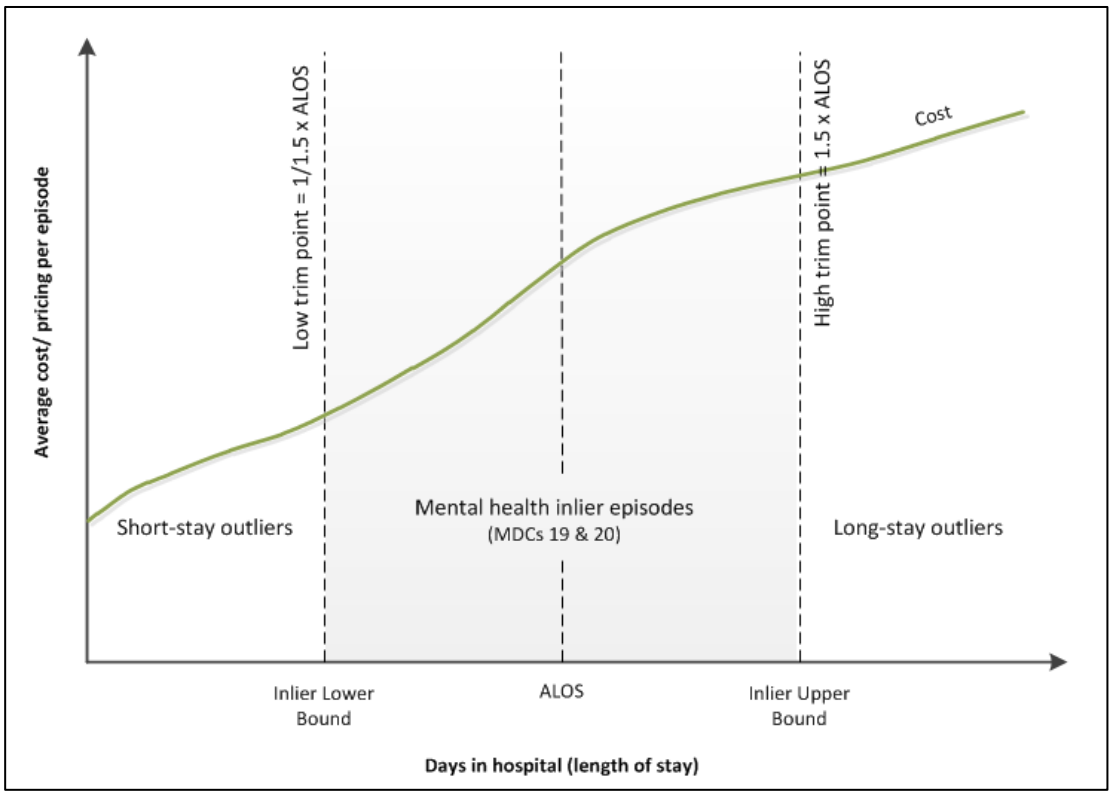
See Section 2.2.4.

3.2.3. Inlier bounds

The inlier bounds for AR-DRGs within major diagnostic categories (MDCs) 19 and 20 were set using the L1.5 H1.5 [10] trimming method, as shown in Figure 4, while the majority of other MDCs in the admitted acute cost model remained at L3H3.

[8] See object class Episode of admitted patient care (METeOR identifier: 268956).
[9] See glossary item Admission (METeOR identifier: 327206).
[10] L1.5H1.5 refers to the trimming method in which the low trim point is the average length of stay (ALOS) divided by 1.5, and the high trim point is 1.5 times the ALOS.

Figure 4: Inlier bound calculations for mental health using the L1.5H1.5 trimming method



These narrower inlier bounds resulted in a lower proportion of inliers and a corresponding higher proportion of short-stay and long-stay outliers, as shown in Table 4.

Table 4: MDCs 19 and 20 (mental health) – activity and cost distribution

	Short-Stay Outlier	Inlier	Long-Stay Outlier
Separations	36%	51%	13%
Patient Days	14%	33%	53%
Actual Costs	17%	34%	48%

Note: Same-day payment separation category has been combined with the short-stay outlier category.

Table 5 illustrates the distribution of activity and costs across the medical AR-DRGs.

Table 5: Medical AR-DRGs excluding MDCs 19 and 20 – activity and cost distribution

	Short-Stay Outlier	Inlier	Long-Stay Outlier
Separations	7%	91%	2%
Patient Days	4%	83%	13%
Actual Costs	5%	85%	10%

Note: Same-day payment separation category has been combined with the short-stay outlier category.

Applying the narrower inlier bounds to MDCs 19 and 20 significantly improves the explanatory power of the AR-DRG inlier/outlier model for mental health patients to a level comparable to the model applied across all other activity.

3.2.4. Cost parameters and adjustments

The cost parameters of the AR-DRG inlier/outlier model that apply to mental health activity is calculated in the same way as those for admitted acute patients. The resulting cost parameters for mental health patients differ to the extent that MDCs 19 and 20 use L1.5H1.5 to define the inlier bounds.

The calculation and application of the adjustments are broadly similar to the admitted acute model, with a number of important differences. Empirical evidence was analysed for a number of mental health specific adjustments on the advice of the IHPA Mental Health Working Group. The cost analysis was undertaken in preparation for NEP15 and the age groups have been modified from those used in NEP14. The age groups adopted in NEP15 have been used in NEP20.

The different adjustments for mental health patients are as follows:

- Patients with registered psychiatric care days are identified and broken into five age groups, with the following two groups exhibiting significantly higher costs, making them eligible for adjustment:
    - Less than or equal to 17 years.
    - Greater than 17 years *and* not in MDCs 19 and 20.
- Patients with age less than or equal to 17 years with registered psychiatric care days are further divided into two groups; those that have received care in one of the nine specialist paediatric hospitals, and those that have not.
- Specialist psychiatric age adjustments are derived from the age categories, as set out in Table 1 of the National Efficient Price Determination 2020–21.
- Mental health patients also accrue other relevant adjustments that apply to admitted acute patients.

3.2.5. Price weights and NWAU

See Section 2.2.13.

3.2.6. Apply the NEP

See Section 2.3.

4. Admitted subacute and non-acute care cost model

4.1. General issues

4.1.1. General issues cost unit

An 'episode of admitted patient care'[11] is the cost unit for admitted subacute and non-acute patients. It is 'the period of admitted patient care… characterised by only one care type' [12], and covers the period of care from admission to separation.

4.1.2. In-scope activity

Admitted subacute and non-acute care is that provided to patients who undergo a facility's formal admission[13] process, where the clinical intent or treatment goal is the provision of subacute or non-acute care.

In-scope hospitals and patients are defined the same way as admitted acute patients, except that the patients are admitted into a care type for subacute or non-acute care.

4.1.3. Classification

Version 4.0 of the Australian National Subacute and Non-Acute Patient Classification (AN-SNAP) is used to classify admitted subacute and non-acute care. Where data required to assign an AN-SNAP classification is not available, the episodes are moved into the admitted acute care cost model.

4.1.4. Outline of methodology for NEP20

- Paediatric palliative care classes 4G01 (palliative care, not terminal phase, age < 1 year), 4G02 (palliative care, stable phase, age >=1 year) and 4G03 (palliative care, unstable or deteriorating phase, age >=1 year) are priced using AN-SNAP classes as sufficient phase level paediatric palliative care data was available. Other paediatric palliative care will continue to be priced using per diems as per NEP19.
- All episodes without a valid AN-SNAP end class have been transferred to the acute care model and paid according to their DRG classification, with the exception of paediatric palliative care episodes which are priced as per the above methodology.
- The stabilisation methodology is consistent with the acute admitted model and is used to ensure any changes in bounds are the result of real change and are not due to statistical noise. To evaluate changes as significant or not, 95 per cent confidence intervals around bounds are used. Changes are also evaluated in terms of their materiality (required to affect at least 1 per cent of AN-SNAP separations and at least 10 separations).
- The Stability Policy has been applied to restrict year-to-year movement to a maximum of 20 per cent when there is no change in inlier bounds and there are less than 1,000 episodes. This policy has been applied to three same-day AN-SNAP weights in the sub-acute model.

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[11] See object class 'episode of admitted patient care' (METeOR identifier: 268956).
[12] Ibid.
[13] See glossary item 'admission' (METeOR identifier: 327206).

4.2. Analysis of costs to derive NWAU for subacute admitted care

The following steps are taken in developing the cost parameters and weights for admitted subacute and non-acute care:

a. Data preparation.
b. Develop sample-to-population weights.
c. Classify AN-SNAP episodes into relevant categories: inliers, short-stay and long-stay outliers using the ABF L1.5H1.5 methodology.
d. Apply Indigenous, radiotherapy, dialysis, and remoteness adjustments inherited from the admitted acute care cost model.
e. Derive private patient service adjustments for each care type.

These steps are described in more detail in the following sections.

4.2.1. Data preparation

The 2017–18 admitted subacute cost sample consists of the following groups in Table 6.

Table 6: Admitted subacute cost sample breakdown

Group	Establishments	Total records	Total days
Total National Hospital Cost Data Collection (NHCDC) sample	239	215,581	2,538,383
AN-SNAP classified data	234	205,857	2,425,016

As in the admitted acute care cost model, HCP data is used to correct for the missing private patient costs in the NHCDC, as well as for subsequent estimates of private patient service adjustments (see Section 2.2.10).

The data is trimmed for extreme outliers using similar methodology to the admitted acute care cost model. The following data was not used to derive the AN-SNAP v4.0 cost profiles:

- Paediatric palliative care records.
- Records that had an in-scope cost of $0.
- Records with an error or ungroupable AN-SNAP Version 4.0 class.
- Non-phase adult palliative care separations.
- Extreme cost outliers within an AN-SNAP Version 4.0 class.

4.2.2. Stratification and weighting

The sample of AN-SNAP classified data is weighted to account for the fact that the used sample excludes all activity with an admission date prior to 1 July 2017.

4.2.3. Determining AN-SNAP Version 4.0 cost parameters

The AN-SNAP cost model parameters comprise the following:

- Same-day price weight: applicable to records within a same-day AN-SNAP class or admitted and discharged on the same-day in a palliative care type.
- Short-stay outlier per diem rate: applicable to records that are not same-day and have a length of stay shorter than the lower bound.
- Inlier episodic rate: applicable to records with a length of stay within the upper and lower bound of the specific AN-SNAP Version 4.0 class.
- Long-stay outlier per diem rate*:* applicable to records with a length of stay longer than the specified upper bound.

4.2.4. Calculation of additional adjustments

The following adjustments are derived within the admitted subacute cost model:

- Private patient service adjustment: This adjustment is calculated by care type in the same way as it is calculated by Australian Refined Diagnosis Related Groups within the admitted acute cost model.
- The following adjustments are derived within the admitted acute cost model and applied in the subacute stream:
    a. Indigenous
    b. residential remoteness
    c. radiotherapy
    d. dialysis
    e. treatment remoteness.

The proportion of NHCDC activity for which the adjustments apply are as follows:

- The Indigenous adjustment applied to 1.7 per cent of subacute activity.
- The residential remoteness adjustment applied to 6.9 per cent of subacute activity.
- The radiotherapy adjustment applied to 0.7 per cent of subacute activity.
- The dialysis adjustment applied to 0.5 per cent of subacute activity.
- The treatment remoteness adjustment applied to 0.2 per cent of subacute activity.
- The private patient adjustments applied to 22.8 per cent of subacute activity.

The cost model (including all adjustments except the private patient adjustments) is then calibrated to ensure model costs are equalised against actual costs.

4.2.5. Calculation of paediatric care type per diem

As outlined in Section 4.1.4, the paediatric palliative care type (excluding AN-SNAP classes 4G01, 4G02 and 4G03) has a single rate due to insufficient data being available to determine prices at the AN-SNAP class level. This rate is determined by dividing the average cost by the average LOS for episodes in the remaining paediatric palliative care AN-SNAP classes.

4.2.6. Subacute and non-acute stabilisation

Refer to Section 2.2.14 for information about the stabilisation process. The same methodology has been applied to the admitted subacute and non-acute cost model.

4.2.7. Price weights and NWAU

The conversion of cost parameters to price weights involves dividing the dollar-valued cost parameters by the reference cost (from the admitted acute care cost model) to obtain cost weights. The same reference cost is used across all streams of activity and is discussed in Chapter 7.

4.2.8. Applying the NEP

As set out in the National Efficient Price Determination 2020–21, the price of an ABF admitted subacute activity is calculated using the following formula, with adjustments applied as applicable:

Price of an admitted subacute ABF activity

$$= \{[\mathrm{PW} \times (1 + \mathrm{A_{Ind}} + \mathrm{A_{Res}} + \mathrm{A_{RT}} + \mathrm{A_{Dia}}) \times (1 + \mathrm{A_{Treat}})] - [\mathrm{PW} \times \mathrm{A_{PPS}} + \mathrm{LOS} \times \mathrm{A_{Acc}}]\} \times \mathrm{NEP}$$

Where:

A_{Ind}	means the Indigenous adjustment
A_{Res}	means each or any patient residential remoteness area adjustment
A_{RT}	means the radiotherapy adjustment
A_{Dia}	means the dialysis adjustment
A_{Treat}	means the patient treatment remoteness area adjustment
A_{PPS}	means the private patient service adjustment
A_{Acc}	means the private patient accommodation adjustment applicable to the state of hospitalisation and length of stay
LOS	means length of stay in hospital (in days)
NEP	national efficient price 2020–21
PW	means the price weight for an ABF activity as set out in **Appendix I** and **Appendix J** of the National Efficient Price Determination 2020–21

In the event that the application of the private patient accommodation adjustment and the private patient service adjustment returns a negative NWAU value for a patient, the NWAU value is held to be zero, as negative NWAU values are not permitted for any patients under the national pricing model.

Table 7 outlines the required information in order to apply the above formula.

Table 7: Datasets and tables used for assignment of NWAU to admitted subacute patient data

Input dataset or table	Description
APC NMDS and ASNHC DSS	Dataset based on the Admitted Patient Care National Minimum Data Set (APC NMDS), with extra AN-SNAP information from the Admitted Subacute and Non-acute hospital care DSS (ASNHC DSS), where available. Dataset specifications are located on the IHPA website.
Postcode table	Table of postcodes mapped to the 2016 Australian Statistical Geography Standard (ASGS) remoteness area classification. Each postcode is mapped to the remoteness area category within which the majority of the postcode's population reside. PO Box postcodes are mapped to the remoteness area category within which the Post Office is located.
ASGS table	Table of ASGS' mapped to the remoteness area category within which the majority of the ASGS's population resides.
2020–21 NWAU price weight tables	2020–21 NWAU admitted subacute and non-acute AN-SNAP and care type same-day and overnight per diem price weight tables, found in the National Efficient Price Determination 2020–21.
2020–21 NWAU adjustments	2020–21 NWAU admitted subacute and non-acute adjustments, found in the National Efficient Price Determination 2020–21.

Fifteen variables are required to form the input APC dataset. These variables form part of the APC NMDS and the ASNHC DSS are on the IHPA website and are listed in Table 8 below.

Table 8: APC and ASNHC DSS variables used to calculate 2020–21 admitted subacute NWAU

Dataset	Variable
APC NMDS	State identifier
	Hospital geographical indicator
	Date of birth
	Date of admission
	Date of separation
	Care type
	Indigenous status
	Funding source
	Total leave days
	Postcode of patient's usual residence
	Australian Statistical Geography Standard (ASGS) of patient's usual residence
ASNHC DSS	AN-SNAP class (Version 4.0)
	Palliative phase of care start date
	Palliative phase of care end date

5. Emergency care cost model

5.1. General issues

5.1.1. Cost unit

The cost unit for ABF for emergency care is an 'emergency department stay'[14] or presentation. It includes stays for patients who are treated and go home, and ones who are subsequently admitted to hospital or transferred to another facility for further care.

5.1.2. Scope

Emergency care is that provided to patients registered for care in an emergency department within a selected public hospital. Patients declared dead on arrival are considered in-scope if the death is certified by an emergency care clinician. Patients who leave emergency care after being triaged and advised of alternative treatment options, are also considered in-scope. All patients in the ABF emergency services care (ESC) data set specification (ABF ESC DSS) are in-scope.

Patients being treated in emergency departments may subsequently undergo a formal admission process. All patients remain in-scope for ABF for emergency care until they are recorded as having physically departed the emergency department, regardless of whether they have been admitted.

5.1.3. Classification

Two systems are used to classify emergency care for the purposes of ABF of these services from 1 July 2014: Urgency Related Groups (URGs) Version 1.4 and Urgency Disposition Groups (UDGs) Version 1.3. The former applies to level 3B to six emergency departments, and the latter to all others (that is, levels 1 to 3A). The levels are defined in the National Efficient Price Determination 2020–21 – Online Glossary.

5.2. Analysis of costs to derive NWAU for emergency care

5.2.1. Data preparation

NHCDC Round 22 reported 7,546,565 presentations in 198 ABF establishments with patient-level cost data. This represents 96 per cent of the total emergency care population as reported in the ABF DSS datasets and NHCDC.

IHPA undertook an initial data preparation processes in line with that employed for NEP19. The cleansed data is episode level data grouped by URG or UDG. The following data were not used in deriving relativities across URGs and UDGs, but was used to calibrate the overall cost level of the model:

- Presentations that grouped to error URGs due to missing or invalid data fields.
- Presentations that were less than $5.
- Extreme cost outliers within each UDG class.
- Presentations at establishments with an extreme cost ratio.

[14] See emergency care stay – presentation date, DDMMYYYY (METeOR identifier: 471886).

5.2.2. Sample weights

The NHCDC provides a sample of emergency care activity in public hospitals. To ensure the resulting calculations for the NWAU are appropriate for the full population of emergency care activity, observations from the NHCDC are weighted up to reflect the entire population of emergency care activity by state or territory.

5.2.3. Cost parameters and adjustments

Data enters the cost model in three levels, by presentation at the URG level and UDG level, and at an aggregate UDG level. It is possible for an episode to have an URG and a UDG associated to it. The URG data is combined, and price weights are calculated. The same process is used for UDGs. Price weights are calibrated to ensure that URG and UDG cost models return total actual costs at a national level.

The approach to pricing emergency care services incorporates an adjustment for patient age, Indigenous status, patient remoteness, and treatment remoteness. The Indigenous adjustment has been inherited from the admitted acute cost model. The patient residential area remoteness adjustment is a single adjustment derived and applied to patients assigned to remote and very remote locations, and the patient treatment remoteness area adjustment is calculated and applied in a similar manner. A discrete age adjustment is calculated and applied to emergency service patients aged 65 to 79 years inclusive and over 79 years.

The Stability Policy requires that the year to year movements in price weights are capped at 20 per cent. For NEP20, there are no price weights that meet this threshold. Subsequently, no price weights are stabilised for NEP20.

5.2.4. Price weights and NWAU

The final step of the process involves the conversion of cost parameters to cost weights. This is done by dividing the URG and UDG cost parameters by the reference cost for the admitted acute cost model. These cost weights are then converted to the price weights used to calculate the NWAU.

Similar to the National Efficient Price Determination 2020–21, the price of an emergency care ABF activity is calculated using the following formula with adjustments as applicable.

Price of an emergency care or emergency service ABF activity

$$= \{\mathrm{PW} \times (1 + \mathrm{A_{Ind}} + \mathrm{A_{Res}} + \mathrm{A_{ECA}}) \times (1 + \mathrm{A_{Treat}})\} \times \mathrm{NEP}$$

Where:

A_{Ind}	means the Indigenous adjustment
A_{ECA}	means the emergency care age adjustment
A_{Res}	means the patient residential remoteness area adjustment
A_{Treat}	means the patient treatment remoteness area adjustment
NEP	national efficient price 2020–21
PW	means the price weight for an ABF activity as set out in **Appendix L** (for emergency care) or **Appendix M** (for emergency service) of the National Efficient Price Determination 2020–21.

Table 9 outlines the required information in order to apply the above formula.

Table 9: Dataset and tables required for assignment of NWAU to emergency department patient data

Input dataset or table	Description
NAPEDC NMDS	Non-admitted patient emergency department care national minimum data set (NAP EDC NMDS).
2020–21 NWAU price weight tables	2020–21 emergency care NWAU URG and UDG price weight tables, found in the National Efficient Price Determination 2020–21.
2020–21 NWAU adjustments	2020–21 emergency care NWAU adjustments, found in the National Efficient Price Determination 2020–21.

The following variables are required to form the input emergency care dataset:

- establishment identifier
- hospital geographical indicator
- postcode of patient's usual residence
- ASGS of patient's usual residence
- Indigenous status
- date of admission
- date of birth
- episode end status
- type of visit to emergency care
- triage category
- URG (Version 1.4) or UDG (Version 1.3).

These variables form part of the NAPEDC NMDS on the IHPA website.

6. Non-admitted care cost model

6.1. Overview

6.1.1. Cost unit

The cost unit for non-admitted care is a non-admitted patient service event. This is 'an interaction between one or more healthcare provider(s) with one non-admitted patient, which must contain therapeutic/clinical content and result in a dated entry in the patient's medical record.' [15]

6.1.2. Scope

The scope of non-admitted care includes service events occurring in outpatient clinics in activity based funding (ABF) hospitals and in the community (by ABF hospitals).

6.1.3. Classification

The Tier 2 Non-admitted Care Services Classification Version 5.0 is used to classify non-admitted care for the purposes of ABF.

6.2. Analysis of costs to derive NWAU for non-admitted care

This section provides an overview of the steps involved in developing the NWAU for non-admitted (outpatient) care. The steps are included below.

6.2.1. Adoption of the NHCDC

Historically, the non-admitted cost model relied heavily on the 2012 Ernst and Young Non-admitted and Subacute Care Costing Study (the EY Costing Study) due to the limited quality and stability of NHCDC reporting. With the improvement in reporting and quality of the NHCDC, the cost weights from NEP17 onwards have shifted to adopt the NHCDC.

The table below illustrates the shift in hierarchy for non-admitted cost weight selection.

Table 10: Non-admitted cost weight selection hierarchy

Cost weight selection hierarchy			
	NEP16	**NEP17**	**NEP18, NEP19 and NEP20**
Stage 1	Logical links to acute clinics or other clinics	Logical links to acute clinics	Logical links to acute clinics
Stage 2	Adopt EY Costing Study or other Costing studies	Adopt NHCDC (provided adequate sample and stable across two years)	Adopt NHCDC (provided adequate sample and stable across three years)
Stage 3	Adopt NHCDC	Adopt EY Costing Study or other costing studies	Adopt EY Costing Study or other Costing studies

Table 11 provides a breakdown for each clinic by the source data.

[15] See object class Non-admitted patient service event (METeOR identifier: 652089).

Table 11: Non-admitted data source breakdown

Source	Number of clinics for NEP19	Number of clinics for NEP20
Victorian radiotherapy costs	1	1
EY Costing Study	26	15
Home Enteral Nutrition, Total Parenteral Nutrition and Home Ventilation Services Costing Study	4	4
NHCDC Round 21 and 22	91	102
Harmonised with admitted acute	2	2
Manual treatment	1	1
Total	**125**	**125**

The non-admitted model imposes a three-year time period for the evaluation of stability. The determination of stability in the NHCDC now necessitates the difference in average clinic price between the current data period and previous data collection to be within the 20 per cent threshold, as well as the difference in average price between the last data period and two years ago.

In NEP20, 11 clinics transitioned from being priced using the EY Costing Study to being priced using the NHCDC.

Additionally, the Stability Policy requires that the year-to-year movement in price weights be restricted to a maximum of 20 per cent. In NEP20, this restriction will not apply to eight clinics with identified year-to-year price weight movements greater than 20 per cent as these clinics are transitioning from being priced using the EY Costing Study to the NHCDC.

A further five clinics will also be exempt from the Stability Policy. These identified clinics moved from the EY Costing Study to the NHCDC in prior years and have been subsequently stabilised thereafter.

In NEP20, a total of four clinics were stabilised in adherence to the Stability Policy. Table 12 provides the stabilised clinics broken down to a series level.

Table 12: Non-admitted stabilised clinics by series

Series	Number of stabilised clinics
10: Procedure	2
20: Medical	2
40: Allied	0

6.2.2. Data preparation

Non-admitted patient cost data was received for eight jurisdictions. NHCDC Round 22 (2017–18) included non-admitted data for 238 ABF establishments and 139 Tier 2 classes, compared to 224 ABF establishments and 140 Tier 2 classes in NHCDC Round 21 (2016–17).

In NEP20, the cost weights for some clinics were determined using the 2012 EY Costing Study. The direct costs collected were inflated to 2017–18 in-scope costs using a combination of an historical inflation factor of 1.25 to account for overheads, and the current NEP indexation rate.

Establishment and clinic combinations were excluded based on jurisdictional advice and cost ratios being significantly different from the population.

Clinic specific outlier exclusion rules developed for NEP18 were again included in the NEP20 model. Whole establishments were excluded if their cost ratios across clinics remained consistently high. At the service event level, conservative record level trimming within clinics was undertaken to exclude records with:

- Costs less than $5.
- Events with high-cost thresholds after ranking of events by cost.
- Cost ratios being significantly different from the population.

For clinic 40.43 (hepatobiliary) a targeted approach was used to remove costs associated with Commonwealth pharmaceutical programs. The cost of new medicines introduced in March 2016 (used in the hepatobiliary clinic) were found to not be accurately excluded in IHPA's pharmaceutical claim linking process. Consequently, the direct pharmacy cost bucket values for episodes separated after March 2016 were adjusted to align with the pre-March 2016 average cost of $118 (adjusted for inflation).

6.2.3. Adjustments

An additional adjustment was introduced for NEP20, that is, the paediatric adjustment for Tier 2 classes priced using the NHCDC only. Adjustments in the non-admitted model are calculated following the admitted acute methodology described in Section 2.2.9.

The application of the paediatric adjustment mirrors the methodology of the acute model as follows:

a. specialist paediatric patients are identified as being less than or equal to 17 years of age, from an establishment identified as delivering specialised paediatric services (listed in **Appendix E** of the National Efficient Price Determination 2020-21 as specialised children's hospitals).

b. The paediatric adjustment for each Tier 2 class is:
    - Rounded to the nearest whole per cent.
    - Capped and floored at 2.0 and 0.8 respectively.
    - Set to one (that is, no adjustment) if the adjustment was less than 0.05 either side of one.

c. The cost parameters of each Tier 2 class are then calibrated to ensure that the modelled costs, with the paediatric adjustment applied, are equal to the actual costs of the Tier 2 class.

The new adjustment methodology calculates the empirical values for the non-admitted multi-disciplinary clinic (NMC) adjustment, patient residential remoteness area adjustment and Indigenous adjustment in a single step.

Consistent with NEP19, the raw NMC value was calculated from a generalised linear model and averaged across three years of empirical values, in accordance with IHPA's Stability Policy, to produce the final NMC adjustment.

The Indigenous adjustment value is a cost-weighted average value based on all stream data.

The patient residential remoteness and patient treatment remoteness values are adopted from the corresponding adjustments in the admitted acute model.

The application of the adjustment parameters mirror the methodology of the acute model as follows:

a. The stabilised NMC adjustment is applied to all multi-disciplinary clinic records, and concurrently, the Indigenous adjustment and patient remoteness adjustment are applied to all Indigenous and/or regional patient records; the clinic means are then calibrated.

b. The patient treatment remoteness adjustment is applied to all regional patient records and then clinic means are calibrated.

6.2.4. Price weights and NWAU

Price of a non-admitted ABF activity

$$= \{\mathrm{PW} \times \mathrm{A_{Paed}} \times (1 + \mathrm{A_{NMC}} + \mathrm{A_{Ind}} + \mathrm{A_{Res}}) \times (1 + \mathrm{A_{Treat}})\} \times \mathrm{NEP}$$

Where:

A_{Paed}	means the paediatric adjustment
A_{NMC}	means the non-admitted multi-disciplinary clinic adjustment
A_{Ind}	means the Indigenous adjustment
A_{Res}	means the patient residential remoteness area adjustment
A_{Treat}	means the patient treatment remoteness area adjustment
NEP	national efficient price 2020–21
PW	means the price weight for an ABF activity as set out in **Appendix K** of the accompanying National Efficient Price Determination 2020–21

Table 13 outlines the required information in order to apply the above formula.

Table 13: Dataset and tables required for assignment of NWAU to non-admitted patient data

Input dataset or table	Description
Non-admitted patient ABF DSS	Dataset based on the 2020–21 non-admitted patient activity based funding data set specifications (located on the IHPA website)
2020–21 NWAU price weight table	2020–21 non-admitted national weighted activity unit price weight table (found in the National Efficient Price Determination 2020–21)
2020–21 NWAU adjustments	2020–21 non-admitted national weighted activity unit adjustments (found in the National Efficient Price Determination 2020–21)

Ten variables are required to form the input non-admitted dataset:

- establishment identifier
- indigenous status
- date of birth
- non-admitted patient service event – service date
- multiple healthcare provider indicator (see National Efficient Price Determination 2020–21)
- outpatient clinic type Tier 2 (Version 5.0)

- postcode of patient's usual residence
- ASGS of patient’s usual residence
- hospital geographical indicator
- funding source.

These variables form part of the non-admitted patient ABF data set specifications on the IHPA website.

7. Conversion to a pricing model

7.1. Overview

The 2020–21 national pricing model is the ninth annual pricing model that IHPA has produced. Each pricing model comprises an NEP, price weights and adjustments, and each is based on cost and activity data from three years prior; the 2020–21 pricing model is based on 2017–18 cost and activity data.

The cost and activity data for each of the historical years are used to derive a cost model for that year, with only those costs and activity from ABF establishments being used. The cost model is designed to ensure that the total modelled costs are equalised with the estimated total actual costs across the ABF establishments.

The cost model is made up of cost parameters and adjustments, including the paediatric adjustment, specialist mental health age adjustment, Indigenous adjustment, remoteness area adjustment and intensive care unit adjustment, but it excludes the private patient service adjustment and private patient accommodation adjustment. The latter two adjustments are introduced in the pricing model to remove out-of-scope patient costs associated with private patients (see Section 2.2.3 and 2.2.10).

There are four steps in the transformation of each year's cost model into its associated pricing model, namely:

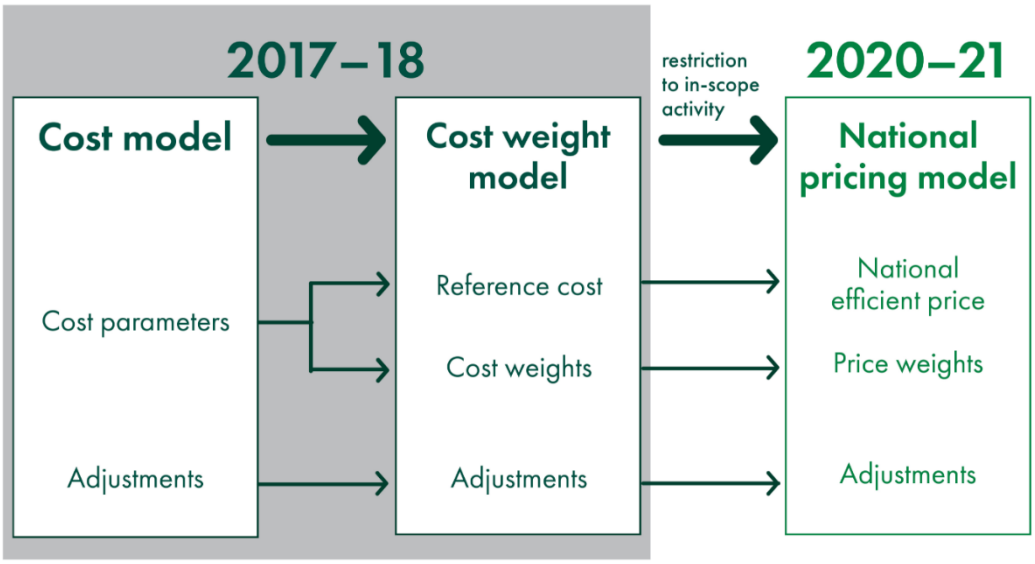
a. Identification and exclusion of costs and activity regarded under the NHRA as out-of-scope for the purpose of ABF.

b. Derivation of a reference cost (or standardised mean) used to transform the cost model into a cost weight model.

c. Derivation of an annual indexation rate used to inflate the cost model to a level reflective of the estimated cost of delivering hospital services in the year of the pricing model.

d. Transformation of the cost model to the pricing model using the results of the previous three steps.

Figure 5: Process of transforming the 2017–18 cost model to the 2020–21 national pricing model



7.2. Identification of out-of-scope costs

The first step in the process of transforming cost model to pricing model involves the identification of costs, such as those associated with programs covered entirely, or in part, by other funding sources (for example, Commonwealth or private health insurance). These are referred to as out-of-scope costs, and can be separated into three groups:

- Group 1 – activity funded by other sources. For example:
    - Private patient episodes in private hospitals.
    - Department of Veterans' Affairs, defence and compensable episodes.
    - Activity which does not meet the criteria on the General List of In-scope Services (the General List), as defined in the National Efficient Price Determination 2020–21, such as Tier 2 class not listed in Category A or Category B of the General List.
- Group 2 – those proportions of costs associated with private patients that are offset by non-government and Commonwealth revenue.
- Group 3 – costs associated with other Commonwealth programs that are inherent within the cost data such as the Highly Specialised Drugs Program and Pharmacy Reform Agreements.

Exclusion of these costs from the cost model is undertaken as follows:

- Group 1 – costs are excluded by restricting the cost model to in-scope activity.
- Group 2 – costs are excluded through the implementation of the private patient service adjustment and private patient accommodation adjustment within the pricing model (Section 2.2.10).
- Group 3 – costs are excluded by matching at the patient level where possible, otherwise by first calculating the costs as a percentage of estimated total costs, and then deflating the cost model by this percentage.

7.3. Derivation of a reference cost

The second step in the transformation of cost model to pricing model is the derivation of a reference cost (or a mean standardised to ensure the measure of an NWAU remains constant over time) that is used to convert the cost model into a cost weight model. Put simply, the parameters of the cost model are divided by this reference cost, converting the parameters to cost weights.

A separate reference cost is derived for each year's cost model based on the modelled costs of admitted acute activity in-scope for ABF. In particular, this activity excludes the Group 1 out-of-scope costs discussed in Section 7.2.

The 2009–10 reference cost associated with IHPA's first national pricing model is defined as the mean model cost taken across all 2009–10 admitted acute activity in-scope for ABF. This mean model cost is $4,260.

From 2010–11 onward, the reference cost is defined so that change in the reference cost over time reflects change in unit costs, excluding any influence of underlying changes in activity profiles between years (that is, casemix change). So, the 2010–11 reference cost is defined so that the change from the 2009-10 reference cost represents change in unit costs of an NWAU between the 2009–10 and 2010–11 cost models, excluding the effect of any changes in casemix between 2009–10 and 2010–11. Similarly, the 2017–18 reference cost represents the change in unit cost between the 2016–17 and 2017–18 cost models, excluding the effect of any changes in casemix between 2016–17 and 2017–18.

To exclude the external effects of casemix change between years, the two cost models are compared by first applying them to a common set of activity, namely 2017–18 admitted acute activity in-scope for ABF. Once applied to this activity, the resulting pair of mean model costs is calculated, and the change between the two cost models is defined as the change in these two mean values, as shown in Table 14. This is referred to as the standardised change in cost models, with the associated growth referred to as the standardised growth rate. In other words, the growth between the 2016–17 and 2017–18 cost models is standardised against 2017–18 activity.

Note that Victoria implemented the VIC0002 guideline in 2017–18, which limited which International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification codes could be reported in the 2017–18 activity data. This leads to a greater than trend standardised growth rate between the 2016–17 and 2017–18 cost models. As part of the 2017–18 funding reconciliation process, the Administrator of the National Health Funding Pool applied Victoria's activity data in order to account for the implementation of VIC0002, so that the change in activity between the two years could be measured on a like-with-like basis.

The Administrator's decision has been reflected when calculating the 2017–18 reference cost for NEP20 by incorporating the same adjustment for the purposes of comparing the 2016–17 cost model and the 2017–18 cost model.

Table 14 shows the mean model costs of each model based on their application to the 2017–18 ABF activity along with the resulting standardised growth rate.

Table 14: Mean model costs when each cost model is applied to 2017–18 in-scope admitted acute activity data, and resulting standardised growth rate

2016–17 cost model	2017–18 cost model	Standardised growth rate
$4,729	$4,857	2.70%

Finally, the 2017–18 reference cost is defined as the 2016–17 reference cost indexed by the standardised growth rate; that is, the 2017–18 reference cost:

= (2016–17 reference cost) × (standardised growth rate)

= $4,866 × 102.70%

= $4,998

Both 2016–17 and 2017–18 reference costs are given in Table 15.

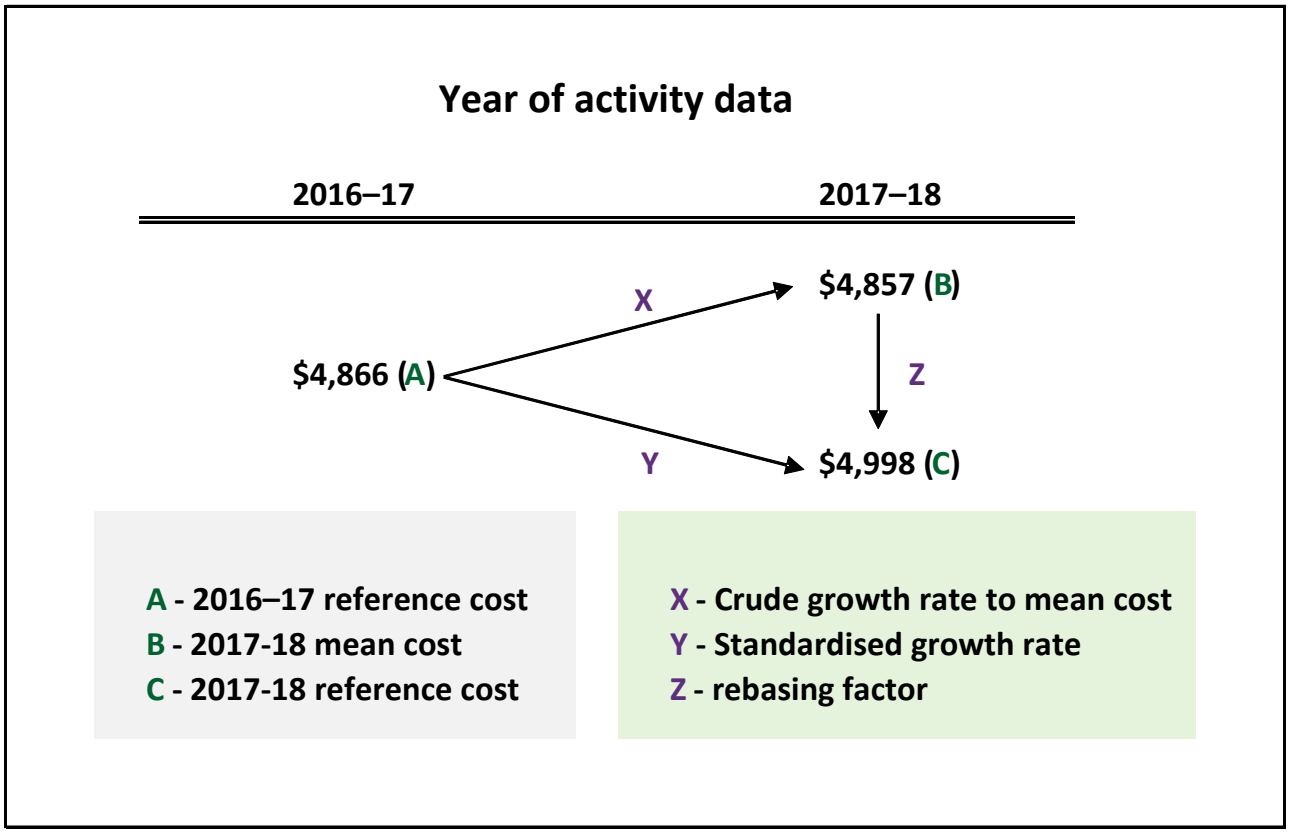
Table 15: Reference costs for 2015–16 and 2016–17 cost models.

2016–17 cost model	2017–18 cost model
$4,866	$4,998

The conversion of the 2017–18 unadjusted mean model cost given in Table 14 to the 2017–18 reference cost given in Table 15 (that is, $4,866 → $4,998) referred to as ‘rebasing’.

Figure 6 illustrates this rebasing process in the context of the derivation of the 2017–18 reference cost.

Figure 6: Derivation of 2017–18 reference cost



There are two intended consequences of the selection of the reference costs:

a. The change in reference costs represents change in unit costs excluding the effect of any changes in casemix.

b. The 2016-17 and 2017–18 cost weight models give the same total weighted volume when applied to the 2017–18 activity data on which the standardised growth rate is derived.

7.4. Indexation

The final step in the transformation of the cost model to pricing model is the indexation of costs to estimate those in the year of the pricing model. Describing the methodology in the context of the 2020–21 pricing model, the objective is to derive an annual indexation rate that is used to inflate the 2017–18 cost model over three years to a level reflective of estimated 2020–21 costs.

To derive this rate, the 2017–18 cost model is applied retrospectively to the five years of patient costed admitted acute activity data[16] prior to 2017–18, and comparisons are made between actual and modelled costs to determine the scaling of the 2017–18 cost model required to equalise each year's modelled costs and actual costs. The trend of these scaling factors from 2011–12 to 2017–18 is then projected to model the indexation rate for the following three years.

[16] That is, activity from patient costed sites within the National Hospital Cost Data Collection.

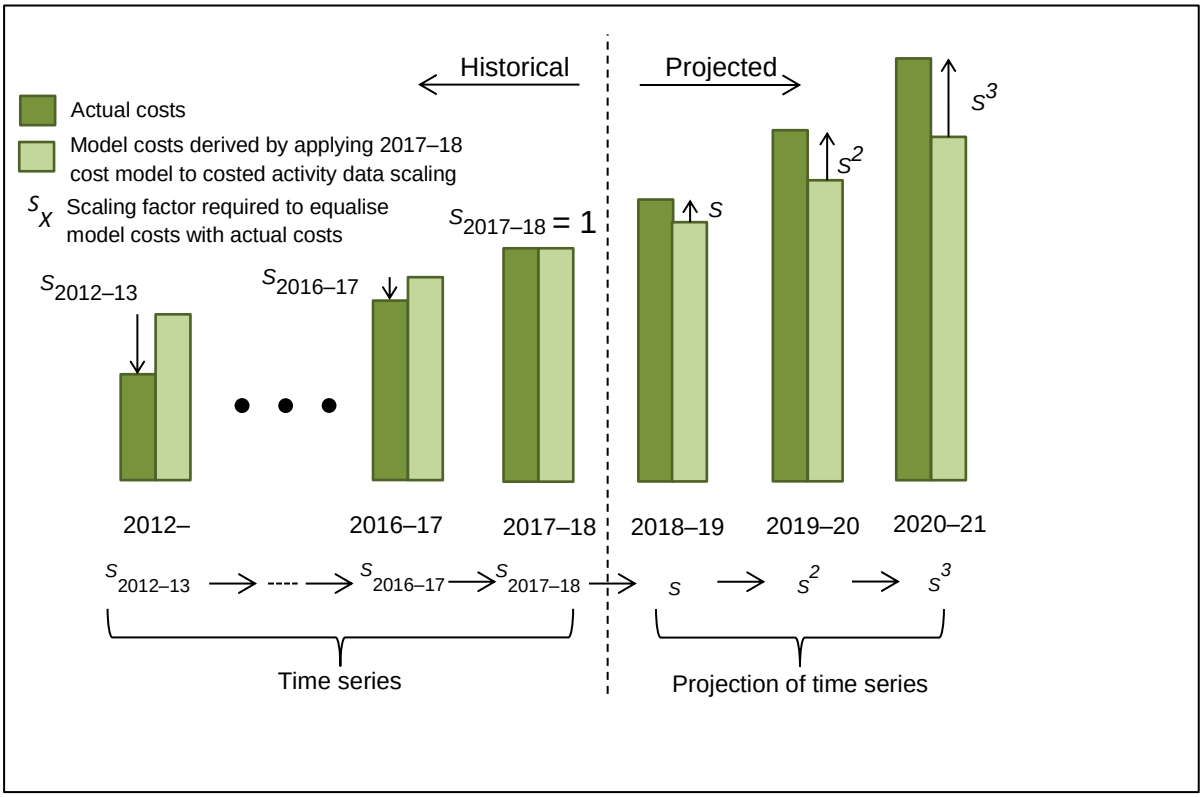
Figure 7 illustrates the 2017–18 cost model applied to patient costed admitted acute activity data and shows the scaling factors required to ensure the model costs are equalised with actual costs. Since the 2017–18 cost model itself is equalised against 2017–18 actual costs, the scaling factor for 2017–18 is equal to 1 (that is, no scaling is required). Going back through the prior five years of cost data, scaling factors of less than one are required to deflate the modelled costs down to the level of the actual costs. This time series of scaling factors is given by:

$$S_{2012-13} \rightarrow \cdots \rightarrow S_{2017-18},$$

This is then used to model an annual scaling factor, denoted **s**, which would inflate the 2017–18 cost model up to 2020–21 projected actual costs. The indexation rate is then based on this annual scaling factor.

Figure 7 also illustrates the projected annual scaling factor, *s,* together with projected actual and model costs. The 2020–21 projected scaling factor of s^3 is pictured alongside projected actual and model costs to illustrate that the 2017–18 cost model would require scaling by s^3 to ensure that the resulting 's^3-scaled 2017–18 cost model', when applied to 2020–21 patient costed activity, would estimate the actual costs of the activity.

Figure 7: Illustration of scaling factors required to equalise model and actual costs



Denoting the historical total actual costs of the activity by:

$$C_{2012-13}, \ldots, C_{2017-18},$$

And denoting the total model costs associated with the 2017–18 cost model applied to each year's costed activity by:

$$M_{2012-13}, \ldots, M_{2017-18},$$

Each year's scaling factor s_x is given by:

$$S_x = C_x / M_x$$

This ratio is referred to as the 'cost ratio'.

It is worth noting that multiplying each year's cost ratio by the 2017–18 reference cost of $4,998 converts the $\{s_x\}$ time series to the time series of costs per weighted separation, where the weighted separations are determined by 2017–18 cost weight model.

A crucial requirement of the cost ratio time series is comparability over time. One way to ensure this occurs is to restrict the data on which the ratios are calculated to the set of establishments for which data is present across all five years (that is, to ensure that all five ratios are calculated across a common set of establishments). While this approach ensures comparability over time, it places significant restrictions on the sample of data.

Instead, an alternate method is used that greatly increases the data sample while maintaining comparability of the ratios over time. This method relies on the fact that any time series of ratios can be equivalently represented as the time series of year to year changes in ratios together with a single value of the time series (in this case, the 2016–17 to 2017–18 change in cost ratio of 3.3 per cent). This method only requires that each year-to-year comparison uses a common set of establishments (rather than requiring the establishments to be common across all five years).

The indexation rate relies on the 2017–18 admitted acute cost model only, which is based on AR-DRG Version 10.0. As the complexity assignment under AR-DRG Version 10.0 is not impacted by VIC0002, the adjustment to account for the Administrator's decision discussed in Section 7.3 is not required for the indexation calculation.

Table 16 shows the year-to-year changes in cost ratio, calculated by applying the 2017–18 cost model to pairs of consecutive years' cost data, ensuring a common set of establishments are present in each pairwise comparison.

Table 16: Year-to-year changes in cost ratio

2012–13 to 2013–14	2013–14 to 2014–15	2014–15 to 2015–16	2015–16 to 2016–17	2016–17 to 2017–18
0.1%	2.2%	1.7%	1.8%	3.3%

Table 17 shows the resulting cost ratio time series derived by back-casting the 2017–18 cost ratio of 1.000 using the inverse of the year-to-year changes given in Table 16. Table 17 also shows the equivalent cost per weighted separation time series, and Figure 8 illustrates the two-time series graphically.

Table 17: Cost ratios and costs per weighted separation time series derived by applying the 2017–18 cost model and cost weight model to historical patient costed activity data

	2012–13	2013–14	2014–15	2015-16	2016–17	2017–18
Cost ratio	0.913	0.9145	0.9348	0.9511	0.9683	1.0000
Cost per weighted separation	$4,564	$4,571	$4,672	$4,754	$4,840	$4,998

The next step in the process of deriving an annual indexation rate is to model a line of best fit against the time series of cost ratios (or equivalently, against the time series of costs per weighted separation). This line of best fit is used to estimate the projected annual inflation factor, *s,* shown in Figure 7.

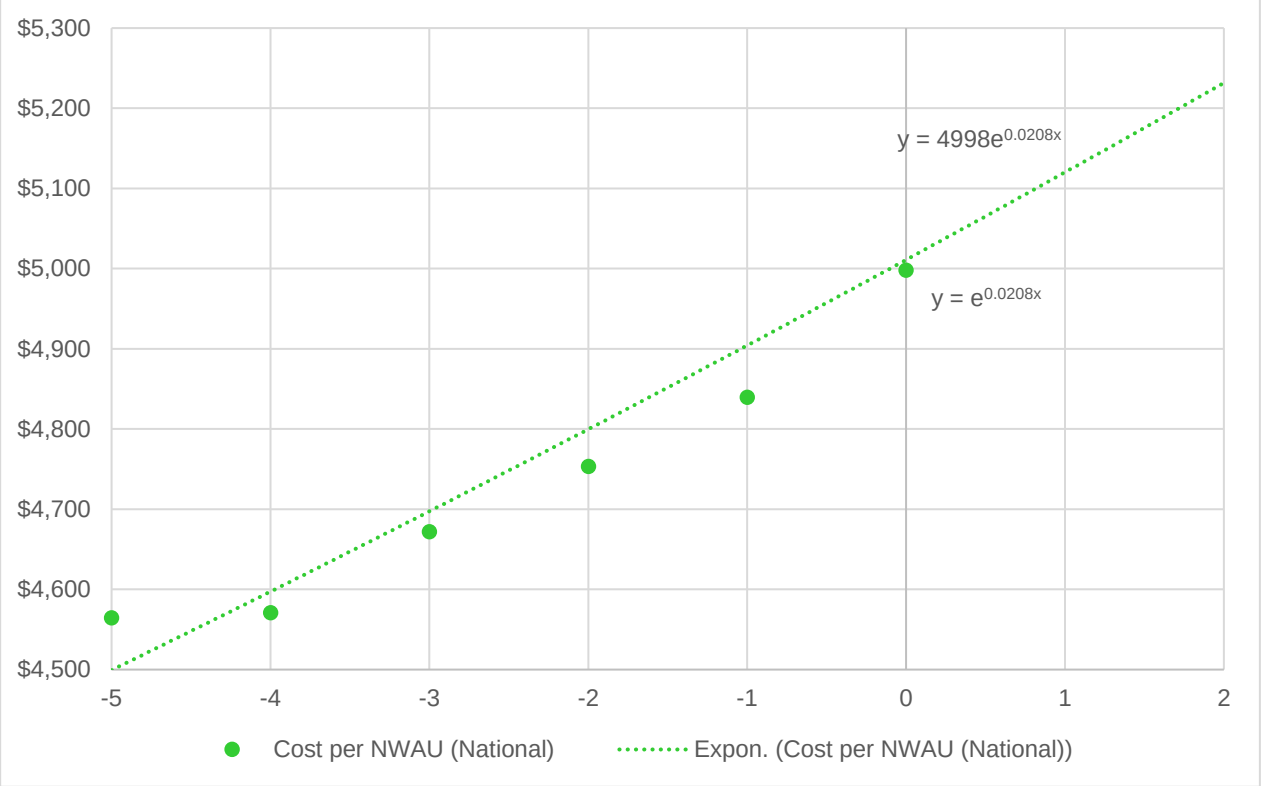
Given that the inflation factor, *s,* being modelled is an annual growth rate (that is, $s \approx s_{x+1} / s_x$) as opposed to an arithmetic change each year (that is, $s_{x+1} - s_x$), the line of best fit is taken to have an exponential form. In other words, an exponential form is chosen because exponential functions Ae^{Bx} have the characteristic that their annual growth rate is constant:

$$Ae^{B(x+1)} / Ae^{Bx} = e^{B} = constant$$

The exponential line of best fit is also modelled so that it passes through the 2017–18 observation to ensure that the resulting annual scaling factor applies to the 2017–18 cost ratio of 1 (or equivalently, to the 2017–18 reference cost of $4,998).

The time series and associated exponential line of best fit are shown in Figure 8. The two equations displayed in Figure 8 represent the exponential line expressed in terms of the cost ratio time series and the cost per weighted separation time series.

Figure 8: Time series of cost ratio and cost per weighted separation with exponential line of best fit



Note: that although the two equations in Figure 8 have different coefficients multiplying the exponential function (that is, one and $4,998), both have precisely the same coefficient inside the exponential function (that is, 0.0208). The two different coefficients multiplying the exponential function represent the estimated cost ratio and cost per weighted separation in 'year zero' (that is, x = 0), which is 2017–18. That is, the regression modelled cost ratio for 2017–18 is 1.000 and the modelled cost per weighted separation for 2017–18 is $4,998.

The regression modelled estimates of cost ratio and cost per weighted separation for each of the years from 2012–13 to 2017–18 are given by substituting x = -5…0 into the equations.

For example, substituting x = 0 into the equations results in the 2017–18 cost ratio and cost per weighted separation:

$$\begin{aligned} 2017-18 \text{ cost ratio} &= 1.000 \times e^{(0.0208 \times 0)} \\ &= 1.000e^{0} \\ &= 1.000 \end{aligned}$$

And,

$$\begin{aligned} 2017-18 \text{ cost per weighted separation} &= \$4{,}998 \times e^{(0.0208 \times 0)} \\ &= \$4{,}998e^{0} \\ &= \$4{,}998 \end{aligned}$$

Finally, the annual scaling factor (that is, *s* in Figure 7) is then defined as the annual rate of change associated with the exponential line of best fit, and the indexation rate is the growth rate of this annual scaling factor. The annual rate of change of the exponential line is $s = e^{0.0208}$, which is equal to 1.021, or 1021 per cent. Therefore, the indexation rate is 2.1 per cent.

7.5. Transformation of cost model to pricing model

The final step in the process of developing the pricing models uses the three steps detailed in the previous sections to transform each cost model to the corresponding pricing model.

Each year's pricing model is designed to reflect estimated total in-scope costs associated ABF activity in the year of the pricing model. The pricing model is therefore given by the inflated cost model defined in Section 7.4 with those out of scope costs defined in Section 2 removed. However, the pricing model is represented by the NEP together with price weights and adjustments. This splitting of prices into an NEP component and a price weight component is where the reference cost defined in Section 7.3 plays its role.

To describe the process in the context of the 2020–21 national pricing model, first the 2017–18 cost model is transformed into a cost weight model by dividing it through by the 2017–18 reference cost of $4,998 (see Section 7.3). The 2017–18 cost model is then represented by a reference cost, cost weights and adjustments.

The inflation of the 2017–18 cost model to estimated 2020–21 costs is then undertaken by inflating the 2017–18 reference cost by the annual indexation rate (defined in Section 7.4) and keeping the cost weights and adjustments fixed. The indexed 2017–18 reference cost is $5,320.

The indexed 2017–18 reference cost, together with the 2017–18 cost weights and adjustments, then represents the estimated 2020–21 cost model. The following example demonstrates how the process of indexing the reference cost and keeping the cost weights fixed, has the same effect as indexing the entire cost model.

For example, there are two equivalent methods to derive estimated 2020–21 costs for same-day episodes for AR-DRG E42B - bronchoscopy, intermediate complexity.

The 2017–18 same-day cost parameter associated with E42B is $2,782.66. Applying the annual indexation rate of 2.1 per cent to the 2017–18 cost, the estimated same-day cost of E42B in 2020–21 is given by:

$$\begin{aligned}\text{2020–21 estimated same-day cost of E42B} &= (\text{2017–18 estimated cost}) \times (\text{indexation}) \\ &= \$2{,}782.66 \times (102.1\%)^{3} \\ &= \$2{,}961.67\end{aligned}$$

On the other hand, the same-day cost weight associated with E42B is 0.5568 (= $2,782.66/ $4,998). Applying the annual indexation rate to the 2017–18 reference cost, the resulting estimated cost of a same-day episode in E42B in 2020–21 is given by:

$$\begin{aligned}\text{2020–21 estimated same-day cost of E42B} &= (\text{2017–18 cost weight}) \times (\text{indexed reference cost}) \\ &= 0.5568 \times (\$4{,}998 \times (102.1\%)^{3}) \\ &= 0.5568 \times \$5{,}320 \\ &= \$2{,}962.18\end{aligned}$$

Note there is a minor difference in final cost due to rounding of the price weight.

7.6. Back-casting for ABF

Back-casting is the process by which the effect of significant changes to the ABF classification systems or costing methodologies are reflected in the pricing model the year prior to implementation, for the purpose of the calculation of the Commonwealth's funding for each ABF service category.

In accordance with Clauses A34(b) and A40 of the NHRA, the Pricing Authority has applied the methodological changes made in NEP20 to NEP19 to determine the back-cast NEP19 for the purposes of determining Commonwealth growth funding between 2019–20 and 2020–21. The back-cast amount for NEP19 is provided in Chapter 9 of the National Efficient Price Determination 2020–21.

7.6.1. Back-casting ABF volume

IHPA has also estimated the volume impact of methodological changes between NEP19 and NEP20, which can be used for the purpose of estimating movements in volume between NEP19 and NEP20. This is useful for relating NWAU19 activity to NWAU20 targets, and for estimating Commonwealth growth funding prior to actual 2020–21 activity data being available.

The volume multipliers (VM) are calculated for each jurisdiction for each particular ABF service category stream and are provided in Chapter 9 of the National Efficient Price Determination 2020–21. The back-cast volume multipliers for each jurisdiction (for each ABF product category) are calculated from the most recently reported activity data, namely 2018–19, as:

$$\mathrm{VM} = \frac{\text{NWAUs delivered by backcast model (NWAU20 calculator)}}{\text{NWAUs delivered by original cost model (NWAU19 calculator)}}$$

The volume multipliers can be applied to estimates of an NWAU count for 2020–21 if actual data is not available.

8. Block-funded hospitals

8.1. General issues

8.1.1. Cost unit

The cost unit is a hospital.

8.1.2. Scope

Hospitals are in-scope if they have been nominated by a jurisdiction and meet the criteria for block-funded hospitals. The criteria that defines a block-funded hospital is less than 3,500 total NWAU per annum for rural hospitals and less than 1,800 admitted acute NWAU per annum for city hospitals.

8.1.3. Classification

The cost model for National Efficient Cost Determination 2020–21 (NEC20) comprises of 373 small rural hospitals, one more than NEC19. Of these, 368 were used in the modelling, while another five hospitals were manually added after being excluded from modelling due to incomplete data or high-outlier status. There are 11 major city hospitals, 21 specialist psychiatric and three other hospitals that are block funded on a separate basis. The initial data preparation of the NEC20 model remains largely unchanged from NEC19, involving the estimation of in-scope activity and expenditure within the admitted, emergency and non-admitted streams.

The NEC20 cost model has changed, primarily through the removal of hospital size and type groups, which has allowed implementation of a continuous regression model based on NWAU. The intercept of the initial regression is used to identify low-outlier establishments which report little activity but demonstrate high cost variability. The threshold for low-outliers is the activity level (NWAU) corresponding to a variable component equating to half the initial intercept. In NEC20, there were 59 low-outlier hospitals, with the remaining 309 hospitals used to develop the cost model. The fixed-plus-variable model, includes a:

- Variable component, which is dependent on the hospitals total activity level and calculated using a dollars-per-NWAU rate based on the corresponding years NEP. For NEC20 this was $4,998 per-NWAU.
- Fixed component, which represents the fixed costs of the hospital where they are not suitably covered through the variable component. The fixed component is dampened based on hospital size: smaller hospitals receive a greater fixed component while the large NEC hospitals, close to the block-funding eligibility threshold of 3,500 NWAU, receive a smaller fixed component.

The modelled cost under the fixed-plus-variable model is the sum of the fixed and variable components. Hospitals identified as low-outliers have their modelled cost set at the fixed component with no dampening or remoteness adjustment applied.

The fixed-plus-variable model continues to recognise two levels of remoteness in the form of:

- remoteness category 1: inner regional, outer regional, remote
- remoteness category 2: very remote.

A remoteness adjustment of 39.1 per cent is applied to the fixed component of very remote hospitals.

8.2. Analysis of costs

8.2.1. Data preparation

The methodology for NEC20 has been maintained since the data preparation process was updated in NEC17 in line with an update to the national public hospital establishment database (NPHED) in 2014–15. The process involves:

- Extraction of activity data from the IHPA ABF DSS for each block-funded hospital and conversion of that data into in-scope NWAUs.
- Extraction of in-scope establishment expenditure data from the NPHED.

The establishment data required to populate the 2017–18 cost model table are:

- Total in-scope NWAU per annum for 2017–18.
- Total in-scope establishment expenditure in 2017–18.

This differs slightly from NEC19 and earlier models, as only a single year of activity data is used. This has been done to provide greater model responsiveness and remove the memory effect of a rolling three-year average.

The eligibility of hospitals for block-funding is determined by ensuring that the latest years total NWAU is less than 3,500 NWAU per annum for rural hospitals, and the admitted acute activity for city hospitals is less than 1,800 NWAU per annum.

The NWAU activity measure is calculated first and then the best estimate of 2017–18 in-scope expenditure is derived, as set out below. A guide to the process used to prepare data for NEC20 is set out in **Appendix E**.

8.2.2. In-scope activity

Admitted acute and subacute NWAU

Patient-level admitted data was available from approximately 96 per cent of hospitals in the APC stream.

The patient-level admitted data has been fed through the NEP19 NWAU calculator to calculate the in-scope NWAU and public patient equivalent NWAU of all in-scope hospital activity. A slightly modified version of the calculator is used for episodes with an admission date prior to 1 July 2017 in order to determine the NWAU associated to the portion of the episodes occurring in 2017–18. This is discussed further under the ‘work-in-progress episodes’ section below.

For the few hospitals that do not supply patient level admitted data, admitted NWAU is estimated based on the sum of the reported in-scope admitted acute, subacute, other admitted and mental health care expenditure from the NPHED. The number of admitted NWAU is calculated by multiplying the total reported admitted expenditure by 0.000123.

The admitted multiplier is the parameter estimate from a linear regression of NWAU (using the NEP19 NWAU calculator) versus total admitted expenditure for small hospitals (total public patient equivalent NWAU less than 5,000) that have admitted activity data. Due to known issues in separating admitted and emergency expenditure in Victorian block-funded hospital data, establishments from Victoria were excluded as reference data for this modelling process.

Work-in-progress episodes

The block-funded cost model is used to calculate the expected in-scope cost of a block-funded hospital for a single financial year. The patient-level admitted activity data contains episodes separated in the financial year, in some cases having been admitted up to 15 years prior.

Using the NWAU calculator as it stands would assign 15 years of activity to this single patient, resulting in incomparable cost and activity calculations. On the other hand, there may be episodes admitted during the financial year that have not yet been discharged, and thus do not appear in the activity data. Episodes admitted before the beginning of the financial year or separated after the financial year are referred to as 'work-in-progress' (WIP) patients.

To address this issue, WIP patients who have been separated during the financial year have their total weighted activity reduced so that only NWAU associated to the current financial year are included. To account for WIP patients not yet discharged, each establishment's total NWAU is scaled up based on state-level ratios calculated over three years of data. The ratios used for NEC20 are shown in Table 18.

Table 18: State-level admitted WIP ratios

State	WIP adjustment
NSW	1.7%
Vic	2.7%
Qld	1.9%
SA	2.3%
WA	1.4%
Tas	2.7%

Emergency care NWAU

Approximately 46 per cent of block-funded hospitals reported emergency activity at the patient level, and 53 per cent report aggregate presentation information at the UDG level. Also, 16 per cent of block-funded establishments reported basic summary counts and activity estimates. Where available, these data are used to determine NWAU values utilising the NEP19 price weights.

For hospitals that do not supply emergency activity data, emergency NWAU is estimated based on the reported emergency expenditure from the NPHED. The number of emergency NWAU is calculated by multiplying the total reported emergency expenditure by 0.000173.

The emergency multiplier is the parameter estimate from a linear regression of NWAU (using the NEP19 NWAU calculator) versus total emergency expenditure for small hospitals (total public patient equivalent NWAU less than 5,000) that have emergency activity data. Due to data quality issues, all establishments from Victoria were excluded as reference data for the modelling process.

Non-admitted NWAU

Approximately 45 per cent of block-funded hospitals reported non-admitted activity at the patient level, and 86 per cent reported aggregate service event information at the clinic level. Where available, these data are used to determine NWAU values utilising the NEP19 price weights.

For the hospitals that do not supply non-admitted activity, non-admitted NWAU is estimated based on reported in-scope non-admitted expenditure from the NPHED. The number of non-admitted NWAU is calculated by multiplying the total reported in-scope non-admitted expenditure by 0.000095.

The non-admitted multiplier is the parameter estimate from a linear regression of NWAU (using the NEP19 NWAU calculator) versus total in-scope non-admitted expenditure for small hospitals (total public patient equivalent NWAU less than 5,000) that have non-admitted activity data. Due to data quality issues, two establishments from Victoria were excluded as reference data for the modelling process.

8.2.3. Out-of-scope expenditure

- Depreciation is excluded from the NPHED reports of expenditure.
- Multi-purpose service (MPS) payments are excluded from the NPHED total expenditure except where jurisdictions have advised that MPS amounts were already excluded in the NPHED reported expenditure.

8.2.4. Calculation of cost parameters

Application of the fixed-plus-variable model and consideration of the low outlier hospitals provided the cost parameters shown in Table 19.

Table 19: Cost parameters of the fixed-plus-variable model and low-outlier establishments

Cost parameter	Value
National efficient price 2020–21	$4,998 per NWAU
Initial intercept	$1,760,851
Low-outlier threshold	176 NWAU
Low-outlier hospitals	59
Fixed cost base (inner regional, outer regional and remote)	$1,792,710
Fixed cost base (very remote)	$2,493,791
Fixed cost dampening rate	0.029% per NWAU
National efficient cost 2020–21 very remote adjustment	39.1%

The NEC very remote adjustment and dampening only apply to the fixed component and not the variable component or low-outlier hospitals.

The dampening rate is calculated such that the fixed component is fully applied at zero NWAU and is completely dampened at 3,500 NWAU, which marks the transition point between block funding and ABF. The purpose of dampening is to gradually reduce the contribution of the fixed component to the overall modelled cost of individual establishments as their activity increases and their variable component, based on the NEP, increases. This is implemented via the use of a multiplier applied to the base fixed component amount:

$$\text{Dampening factor} = \begin{cases} \dfrac{3500 - \text{Total NWAU}}{3500}, & \text{where Total NWAU} \leq 3{,}500 \text{ NWAU} \\ 0, & \text{where Total NWAU} > 3{,}500 \text{ NWAU} \end{cases}$$

For NEC20, 373 small rural hospitals have been designated as block funded including the low-outlier hospitals and establishments excluded from the development of the model. These hospitals were categorised by remoteness to determine NEC20.

8.3. Calculation of national efficient cost

The efficient cost of a small rural hospital is the sum of the fixed cost component and variable cost component.

8.3.1. Calculation of the efficient cost for a particular hospital

The efficient cost of an inlier, in-scope block-funded hospital is given according to:

$$\text{Modelled cost} = \text{Base fixed component} \times \text{Dampening factor} \times (1 + \text{Very remote adjustment}) + \text{NEP20 reference cost} \times \text{Total NWAU}$$

Where "Total NWAU" is a measure of total in-scope activity by the establishment, and all other terms are as defined in Section 8.2.2. Non-routine hospitals included:

(a) Low outliers

- The fixed-plus-variable model is not applied to low-outlier hospitals which have activity below a calculated activity threshold of 176 NWAU.
- The efficient cost of these hospitals is determined as the fixed component with no dampening or very remote adjustment applied.

(b) High outliers

- Two hospitals exhibited notably higher costs when compared to similarly sized hospitals, whilst also being much larger than hospitals in the low outlier set described above.
- These two hospitals had a disproportionate impact on model parameters, and thus they were removed from the NEC20 model development.
- The efficient cost of these hospitals is determined using the fixed-plus-variable model.

(c) Hospitals with missing data

Jurisdictional advice was sought on hospitals with missing activity or cost data. Where appropriate, new data received from jurisdictions was incorporated into existing datasets for these hospitals. They are then treated in the same way as hospitals reporting adequate data for the purposes of determining the 2017–18 average cost and NEC20.

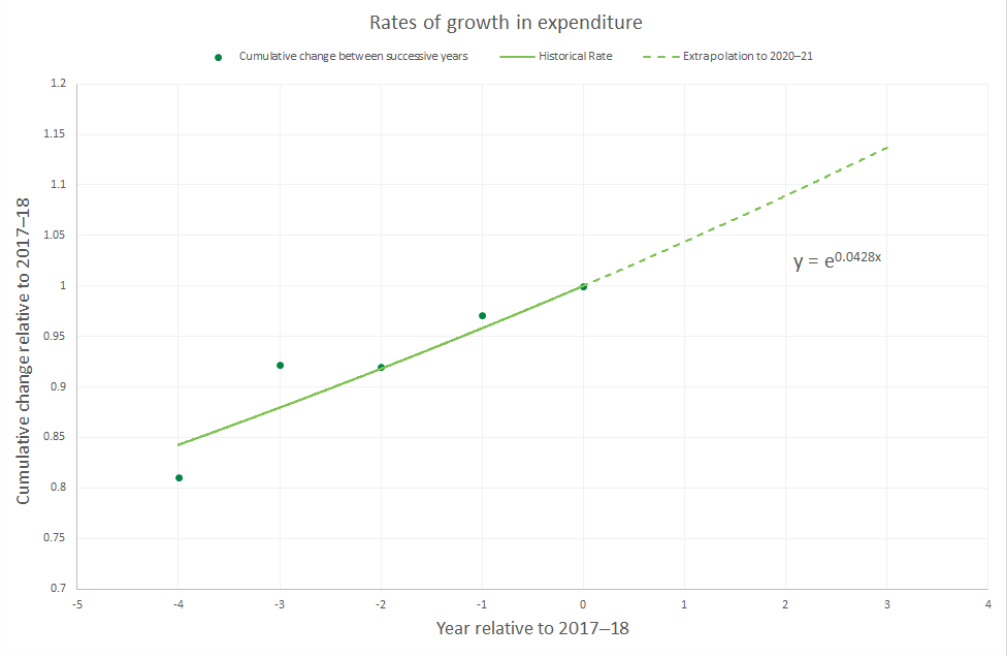
In addition to the above, standalone hospitals including specialist psychiatric and major city hospitals are treated separately and are addressed further below.

8.4. Indexation of the 2017–18 model

Due to the three-year time lag in data collection, cost model results for 2017–18 were indexed over three years to give a price model for 2020–21. The indexation of the model is based on the growth of in-scope expenditure for block-funded hospitals.

Figure 9 illustrates that the indexation rate is given by the slope of the exponential line of best-fit across five years. The overall 2017–18 model average-spend was projected to 2020–21 using the annual indexation factor of 4.4 per cent per annum, as specified in the National Efficient Cost Determination 2020–21.

Figure 9: NEC20 Indexation



8.5. Back-casting for block-funded hospitals

In accordance with the guiding principles of the NEC cost model, the Pricing Authority has applied the methodological changes made in NEC20 to NEC19 to determine the back-cast NEC19 for the purposes of determining Commonwealth growth funding between 2019–20 and 2020–21. The back-cast multiplier for NEC19 is provided in Chapter 7 of the National Efficient Cost Determination 2020–21.

$$\text{Back-cast multiplier} = \frac{\text{Predicted cost for 2019–20 based on NEC20 modelled cost}}{\text{Predicted cost for 2019–20 based on NEC19 modelled cost}}$$

A back-cast NEC19 is calculated to estimate growth between 2019–20 and 2020–21. The back-cast NEC19 is calculated by taking the in-scope cost for NEC20 and indexing it forward two years based on the latest indexation methodology.

8.5.1. Calculation of the efficient cost of specialist psychiatric and major city hospitals

Specialist mental health hospitals are excluded from the model from the outset. These hospitals are assigned model costs based on advice from jurisdictions. Where advice was not received from jurisdictions, reported 2017–18 NPHED data or the NEC19 efficient cost has been escalated by the NEC20 indexation rate to become the NEC20 efficient cost for each of these hospitals.

For the purposes of NEC20, these hospitals are priced after consultation with jurisdictions. Subject to this advice, their prices are set at their actual cost for 2017–18, and are indexed at the same rate applied to the in-scope hospitals in the 2017–18 cost model for NEC20. Indexation is described in further detail in Section 8.4.

The 2020–21 efficient costs for the 11 major city hospitals, as well as the three other standalone hospitals, will be determined separately in a similar way, following consultation with jurisdictions.

Appendices

Appendix A: Reference tables

Table 20: Sections of the NEP20 and NEC20 Determinations

Component	Section of Determination
National efficient price	**Chapter 2**
Admitted acute services - NEP20	
AR-DRG inlier bounds, flags for designated same-day payment AR-DRG and unbundled ICU AR-DRG, national weighted activity unit weights for same-day payment AR-DRGs, short-stay outliers (base and per diem), inliers, long-stay outliers (per diem), intensive care unit rates per hour	**Appendix H**
Adjustments to price weights	**Chapter 5**
List of radiotherapy ICD-10-AM codes	**Appendix B**
List of dialysis ICD-10-AM codes	**Appendix C**
Specified intensive care units	**Appendix D**
Specialised children's hospitals	**Appendix E**
Private patient adjustments	**Appendix F**
Provisional weights for very long-stay patients	**Appendix G**
Funding adjustments for hospital acquired complications	**Appendix N**
Definition of an eligible ICU or paediatric ICU	**Glossary**
Emergency department services - NEP20	
Urgency Related Groups Version 1.4 classification and NWAU weights	**Appendix L**
Urgency Disposition Groups Version 1.3 classification and NWAU weights	**Appendix M**
Emergency care in-scope for ABF	**Online Glossary**
Definitions of emergency care role levels	**Online Glossary**
Non-admitted services - NEP20	
Tier 2 Non-Admitted Services Classification Version 5.0 weights, paediatric adjustments	**Appendix K**
Definition of Tier 2 list of non-admitted services classifications Version 5.0	**Online Glossary**
Subacute and non-acute services - NEP20	
AN-SNAP Version 4.0 weights	**Appendix I**
Paediatric per diem price weights	**Appendix J**
Definitions of AN-SNAP Version 4.0	**Online Glossary**
Mental health services - NEP20	
AR-DRG-based inlier bounds, NWAU and adjustment weights	**Appendix H**

Component	Section of Determination
Mental health age adjustments	**Chapter 5**
Block-funded hospital services - NEC20	
NEC efficient costs for each block-funded hospital	**Chapter 3**

Table 21: Summary of classification systems and sources of cost

Service stream	Classification[17]	Cost data	Activity data
Admitted acute care	Australian Refined Diagnosis Related Groups Version 10.0	National Hospital Cost Data Collection (NHCDC) Round 22 (2017–18).	Admitted patient care national minimum data set
Emergency care	Urgency Related Groups Version 1.4 Urgency Disposition Groups Version 1.3	NHCDC Round 22 (2017–18 financial year)	Level 3B to 6 emergency care: non-admitted patient emergency department care NMDS Level 1 to 3A emergency care: emergency services ABF DSS
Non-admitted care	Tier 2 Outpatient Clinic Definitions Version 5.0	NHCDC Round 22 (2017–18)	Non-admitted patient NMDS and aggregate DSS[18]
Subacute care (and non-acute)	AN-SNAP Version 4.0 care type	NHCDC Round 22 (2017–18)	APC NMDS and admitted subacute and non-acute hospital care DSS
Block-funded services	IHPA-defined size and Australian Statistical Geography Standards location categorisation on total NWAU for hospital	Expenditure data from the national public hospital establishments database (2017–18 financial year) NHCDC Round 22 (2017–18 financial year)	APC NMDS, NAPEDC NMDS, ABF ES DSS, NPHED and aggregate DSS.

[17] Details of each of the classifications are available from: http://www.ihpa.gov.au/internet/ihpa/publishing.nsf/Content/Classifications
[18] Dataset specification

Appendix B: Application of NWAU variables

Table 22: Acute admitted patients: variable definitions

Variable	Name	Description	Definition
A00	_pat_radiotherapy_flag	Radiotherapy eligible separation. Either supplied in the input dataset or derived from the list of supplied procedure codes.	1 if patient had radiotherapy related treatment or planning procedure; else 0.
A01	_pat_dialysis_flag	Dialysis eligible separation. Either supplied in the input dataset or derived from the list of supplied procedure codes.	1 if patient had a dialysis procedure and is not in AR-DRG L61Z or L68Z; else 0.
A02	est_eligible_paed_flag	Paediatric adjustment eligible establishment, derived from ICU paediatric eligibility table	1 if establishment is designated as eligible for paediatric adjustment; else 0.
A03	est_eligible_icu_flag	ICU rate adjustment eligible establishment, derived from ICU and paediatric eligibility table	1 if establishment is designated as eligible for ICU rate adjustment; else 0.
A04	_pat_remoteness	Patient residential remoteness Area	2016 ASGS remoteness area category of the patient location taken from the episode's geographical information in ranked order of preference: SA2, postcode or the hospital geographical indicator variable where: 0 = major city 1 = inner regional 2 = outer regional 3 = remote 4 = very remote.
A05	_treat_remoteness	Patient treatment remoteness Area	2016 ASGS remoteness area category of the patient treatment location taken from the hospitals geographic location information, where: 0 = major city 1 = inner regional 2 = outer regional 3 = remote 4 = very remote.
A06	_pat_acute_flag	Acute patient flag	1 if (care type = 1 or 11) or (care type = 7 and number of qualified days for newborns > 0); else 0.
A07	_pat_los	Length of stay	Max (1, (date of separation) - (date of admission) - (total leave days)) if care type = 1; else total qualified days if care type = 7.
A08	_pat_same-day_flag	Same-day flag	1 if date of admission = date of separation; else 0.
A09	_pat_age_years	Age at admission (in years)	Total whole years from date of birth to date of admission.
A10	_pat_eligible_paed_flag	Paediatric adjustment eligible patient	1 if (_pat_age_years between 0 and 17) and (est_eligible_paed_flag=1); else 0.

Variable	Name	Description	Definition
A11	_pat_ind_flag	Indigenous patient flag	1 if patient Indigenous status = 1, 2 or 3; else 0.
A12	_pat_private_flag	Private patient flag	1 if funding source = 9 or 13 for 2012-13 data and later.[19]
A13	_pat_public_flag	Public patient flag	1 if funding source = 1, 2 or 8 for 2012-13 data and later.[20]
A14	_pat_spa_category	Patient specialist psychiatric category. All patients classified have positive psychiatric care days.	• 0: if not a specialist psychiatric patient • 1.1: if 0 to 17 years from establishment not eligible for paediatric adjustment and in MDC 19 or 20 • 1.2: : 0 to 17 years from establishment eligible for paediatric adjustment and in MDC 19 or 20 • 2.1: if 0 to 17 years from establishment not eligible for paediatric adjustment and not in MDC 19 or 20 • 2.2: : 0 to 17 years from establishment eligible for Paediatric Adjustment and not in MDC 19 or 20 • 3: : greater than 17 years not in MDC 19 or 20
A15	drg_same-daylist_flag	Same-day price list flag	1 if same-day price list variable from joined NWAU AR-DRG price weight table equals 'Yes'; else 0.
A16	drg_bundled_icu_flag	Bundled ICU flag	1 if bundled ICU variable from joined NWAU AR-DRG price weight table equals 'Yes'; else 0.
A17	drg_inlier_lb	Inlier lower bound	Inlier lower bound from NWAU AR-DRG price weight table.
A18	drg_inlier_ub	Inlier upper bound	Inlier upper bound from NWAU AR-DRG price weight table.
A19	drg_pw_sd	Same-day price weight	Same-day price weight from joined NWAU AR-DRG price weight table if not missing; else 0.
A20	drg_pw_sso_base	Short-stay outlier base price weight	Short-stay outlier base price weight from joined NWAU AR-DRG price weight table if not missing; else 0.
A21	drg_pw_sso_perdiem	Short-stay outlier per diem price weight	Short-stay outlier per diem price weight from joined NWAU AR-DRG price weight table if not missing; else 0.
A22	drg_pw_inlier	Inlier price weight	Inlier price weight from joined NWAU AR-DRG price weight table.
A23	drg_pw_lso_perdiem	Long-stay outlier per diem price weight	Long-stay outlier per diem price weight from joined NWAU AR-DRG price weight table if not missing; else 0.
A24	drg_adj_paed	Paediatric adjustment	Paediatric adjustment from joined NWAU AR-DRG price weight table.
A25	drg_adj_privpat_serv	Private patient service adjustment	Private patient service adjustment from joined NWAU AR-DRG price weight table.
A26	_drg_inscope_flag	DRG in-scope flag	1 if DRG is in-scope; else 0.

[19] Or 1 if funding source = 2 or 3 for 2011-12 data or earlier.
[20] Or 1 if funding source = 1, 10 or 11 for 2011-12 data or earlier.

Variable	Name	Description	Definition
A27	adj_spa	See definition	Specialist psychiatric age adjustment
A28	adj_indigenous	See definition	Indigenous adjustment.
A29	adj_remoteness	See definition	Remoteness adjustment.
A30	adj_treat_remoteness	See definition	Patient treatment remoteness adjustment.
A31	adj_radiotherapy	See definition	Radiotherapy adjustment.
A32	adj_dialysis	See definition	Dialysis adjustment.
A33	state_adj_privpat_accomm_sd	See definition	Private patient accommodation adjustment: same-day rate (state-specific adjustment).
A34	state_adj_privpat_accomm_on	See definition	Private patient accommodation adjustment: overnight per diem rate (state-specific adjustment).
A35	_pat_eligible_icu_hours	Whole eligible hours spent in ICU	Total whole hours spent in intensive care unit if hours are greater than or equal to 1; else 0, for unbundled DRGs and eligible establishments
A36	_pat_lost_icu_removed	See definition	Patient length of stay with ICU hours removed
A37	_pat_separation_category	See definition	Patient separation category: 1: Same-day patients 2: Short-stay outlier patients 3: Inlier patients 4: Long-stay outlier patients
A38	_w01	DRG by inlier/outlier weight	Based off _pat_separation_category: 1: drg_pw_sd 2: drg_pw_sso_base + drg_pw_sso_perdiem * pat_los_icu_removed 3: drg_pw_inlier 4: drg_pw_inlier + (pat_los_icu_removed - drg_inlier_ub) * drg_pw_lso_perdiem
A39	_w02	Application of the paediatric adjustment	_w01 * (1 + _pat_eligible_paed_flag * (drg_adj_paed - 1))
A40	_w03	Application of the specialist psychiatric age adjustment	_w02 * (1 + adj_spa + adj_indigenous + adj_remoteness + adj_radiotherapy + adj_dialysis) * (1 + adj_treat_remoteness)
A41	_adj_icu	Application of the ICU rate adjustment	_pat_eligible_icu_hours * icu_rate.
A42	An10mdc_ra	MDC v10.0	Major Diagnostic Category v10.0
A43-A80	catXXpY	HAC Categories and subcategory flags	e.g. cat01p1 = HAC 1.1 = Stage III Pressure Injury
A81	DRG10_Type	AR-DRG v10.0 Type	Intervention or Medical

Variable	Name	Description	Definition
A82	agegroupc	Age Group	Age group in 5 year bands (e.g. Age 20-24)
A83	flag_ICUHours	See definition.	1 if episode has ICU Hours; else 0.
A84	flag_AdmTransfer	See definition	1 if episode is has admission mode = 'transfer'; else 0.
A85	Charlson_score	See definition.	Charlson Score
A86	Instrument_use_flag	See definition.	Instrument used during delivery
A87	Primiparity_flag	See definition	First pregnancy for woman under age of 16 or over 35
A88	PPOP_flag	See definition.	Persistent posterior occiput position of fetus
A89	Foetal_distress_flag	See definition.	Foetal distress during delivery
A90	Flag_emergency	See definition.	1 if episode has emergency admission urgency; else 0.
A91-A105	age_XXg	Age group for HACXX	The age group relevant for risk adjustment of HACXX.
A106-A120	mdc_XXg	MDC group for HACXX	The MDC group relevant for risk adjustment of HACXX.
A121-A134	cc_XXg	Charlson Comorbidity group for HACXX	The Charlson Comorbidity score group relevant for risk adjustment of HACXX.
A135-A149	pointsXX	See definition	Total complexity score for HACXX.
A150-A164	groupXX	See definition	Complexity group relevant to HACXX.
A165-A179	riskadj_XX	See definition	Funding adjustment relative to HACXX.
A180	HAC_adj	Adopted funding adjustment	Max(riskadj_01 – riskadj_14)
A181	Error_Code	See definition	Outlines Errors in calculations
A182	hacflag	See definition	1 if episode has a HAC; else 0.
A183	hacgroup	See definition	HAC group adopted for funding adjustment.
A184	complexity	See definition	Complexity score associated to A176
A185	complexityGroup	See definition	Complexity group associated to A176 and A177
A186	GWAU20	Gross weighted Activity Unit	_w04 + _adj_icu
A187	_adj_privpat_serv	Private patient service adjustment	_pat_private_flag * drg_adj_privapat_serv*(_w01+_adj_icu)
A188	_adj_privpat_accom	Private Patient Accommodation adjustment	_pat_private_flag*(_pat_same-day_flag*state_adj_private_accom_sd+ (1-_pat_same-day_flag)*_pat_los*state_adj_privpat_accomm_on)
A189	riskAdjustment	NWAU deduction from HAC	A38*A173

Variable	Name	Description	Definition
A190	NWAU20	National Weighted Activity Unit	Max(0,A179-A180-A181-A182) for only in-scope funding sources, set as necessary in the template.

Table 23: Sub-acute admitted patients: variable definitions

Variable	Name	Description	Definition
S01	_pat_remoteness	Patient remoteness area	2016 ASGS remoteness area category of the patient location taken from the episode's geographical information in ranked order of preference: SA2, postcode, or the hospital geographical indicator variable where: 0 = major city 1 = inner regional 2 = outer regional 3 = remote 4 = very remote.
S02	_treat_remoteness	Patient treatment remoteness area	2016 ASGS remoteness area category of the patient treatment location taken from the hospitals geographic location information, where: 0 = major city 1 = inner regional 2 = outer regional 3 = remote 4 = very remote.
sS03	_pat_subacute_flag	Subacute and non-acute patient flag	1 if care type = 2, 3, 4, 5 or 6, else 0.
S04	_pat_los	Length of stay	Max (1, (date of Separation) - (date of admission) - (total leave days)).
S05	_pat_same-day_flag	Patient same-day flag	1 if date of admission = date of separation; else 0.
S06	_pat_age_years	Age at admission (in years)	Total whole years from date of Birth to date of admission.
S07	_pat_eligible_paed_flag	Paediatric Adjustment eligible patient	Patients with age less than or equal to 17 and in a palliative care type.
S08	_pat_ind_flag	Indigenous patient flag	1 if patient Indigenous status = 1, 2 or 3; else 0.
S09	pat_private_flag	Private patient flag	1 if funding source = 9 or 13 for 2013-14 data and later.[21]

[21] Or 1 if funding source = 2 or 3 for 2011-12 data or earlier.

Variable	Name	Description	Definition
S10	pat_public_flag	Public patient flag	1 if funding source = 1, 2, 3 or 8 for 2013-14 data and later.[22]
S11	ansnap_type	See definition	AN-SNAP class type, as set out in **Appendix I** of the *National Efficient Price Determination 2020–21.*
S12	ansnap_same-daylist_flag	Same-day price list flag	1 if same-day price list variable from joined NWAU AN-SNAP price weight table equals 'Yes'; else 0.
S13	_pat_radiotherapy_flag	Radiotherapy eligible separation. Either supplied in the input dataset or derived from the list of supplied procedure codes.	1 if patient had radiotherapy related treatment or planning procedure; else 0.
S14	_pat_dialysis_flag	Dialysis eligible separation. Either supplied in the input dataset or derived from the list of supplied procedure codes.	1 if patient had a dialysis procedure; else 0.
S15	ansnap_inlier_lb	Inlier lower bound	Inlier lower bound from NWAU AN-SNAP price weight table.
S16	ansnap_inlier_ub	Inlier upper bound	Inlier upper bound from NWAU AN-SNAP price weight table.
S17	ansnap_pw_sd	Same-day price Weight	Same-day price weight from joined NWAU AN-SNAP price weight table. If not missing; else missing.
S18	ansnap_sso_perdiem	Short-stay outlier per diem price weight	Short-stay outlier price weight from joined NWAU AN-SNAP price weight table. If not missing; else missing.
S19	ansnap_pw_inlier	Inlier price weight	Inlier price weight from joined NWAU AN-SNAP price weight table. If not missing; else missing.
S20	ansnap_pw_lso_perdiem	Long-stay outlier per diem price weight	Long-stay outlier price weight from joined NWAU AN-SNAP price weight table. If not missing; else missing.

[22] Or 1 if funding source = 1, 10 or 11 for 2011-12 data or earlier.

Variable	Name	Description	Definition
S21	paed_pw_same-day	Same-day price weight for paediatric patients	Paediatric same-day price weight from joined care type price weight table. if not missing; else missing.
S22	paed_overnight_perdiem	Overnight price weight for paediatric patients	Paediatric overnight price weight from joined care type price weight table. If not missing; else 0.
S23	adj_indigenous	See definition	Indigenous adjustment.
S24	adj_remoteness	See definition	Remoteness adjustment.
S25	caretype_adj_privpat_serv	See definition	Private patient service adjustment (care type specific adjustment).
S26	state_adj_privpat_accomm_sd	See definition	Private patient accommodation adjustment: same-day rate (state-specific adjustment).
S27	state_adj_privpat_accomm_on	See definition	Private patient accommodation adjustment: overnight per diem rate (state-specific adjustment)
S28	Error_code	See definition	Outlines errors in calculations
S29	_pat_separation_category	See definition	Patient separation category: 0: Valid paediatric patients 1: Same-day patients 2: Short-stay outlier patients 3: Inlier patients 4: Long-stay outlier patients
S30	_w01	AN-SNAP inlier/outlier weight	Based off _pat_separation_category: 0: _pat_same-day_flag*paed_pw_same-day+(1-_pat_same-day_flag)*_pat_los*paed_ overnight_perdiem 1: ansnap_pw_sd 2: ansnap_pw_sso_perdiem * pat_los 3: ansnap_pw_inlier 4: ansnap_pw_inlier + (pat_los - ansnap_inlier_ub) * ansnap_pw_lso_perdiem
S31	GWAU20	Gross weighted activity unit	_w01*(1+adj_indigenous+adj_remoteness+adj_radiotherapy+adj_dialysis)* (1+adj_treat_remoteness)
S32	_adj_privpat_serv	Private patient service adjustment	_pat_private_flag *caretype_adj_privpat_serv*(_w01)

Variable	Name	Description	Definition
S33	_adj_privpat_accom	Private patient accommodation adjustment	_pat_private_flag*(_pat_same-day_flag*state_adj_private_accom_sd+ (1-_pat_same-day_flag)*_pat_los*state_adj_privpat_accomm_on)
S34	adj_radiotherapy	See definition	Radiotherapy adjustment
S35	adj_dialysis	See definition	Dialysis adjustment
S36	adj_treat_remoteness	See definition	Patient treatment remoteness adjustment
S37	NWAU20	National weighted activity unit	Max(0, GWAU20- _adj_privpat_serv-_adj_privpat_accomm) for only in-scope funding sources, set as necessary in the template.

Table 24: Emergency department: variable definitions

Variable	Name	Description	Definition
E01	_UDG	UDG Version 1.3	Either supplied directly or derived from DSS variables: type of visit to emergency care, triage category, and episode end status. See IHPA website for details.
E02	_pat_ind_flag	Indigenous patient flag	1 if patient Indigenous status = 1, 2 or 3; else 0.
E03	_pat_remoteness	Patient Remoteness Area	2016 ASGS remoteness area category of the establishment location taken from patient postcode, ASGS, or the hospital geographical indicator variable, where: 0 = major city 1 = inner regional 2 = outer regional 3 = remote 4 = very remote.
E03	_treat_remoteness	Patient treatment remoteness area	2016 ASGS remoteness area category of the patient treatment location taken from the hospitals geographic location information, where: 0 = major city 1 = inner regional 2 = outer regional 3 = remote 4 = very remote.
E05	_pat_age_years	Age at admission (in years)	Total whole years from date of birth to date of admission.

Variable	Name	Description	Definition
E06	_pat_age_grp	See definition	If _pat_age_years less than 65 then group = 0; else if _pat_age_years less than or equal to 79 then group = 1; else if _pat_age_years greater than or equal to 80 then group = 2; else if missing (_pat_age_years) equals 1 the group =0
E07a	UDG_PW	Price weight depending on choice of classification	UDG price weight, taken from NEP20 price weight table.
E07b	URG_PW		URG price weight, taken from NEP price weight table.
E07c	AECC_PW		Shadow Australian Emergency Care Classification Version 1.0 price weight, taken from NEP shadow price weight table.
E08	adj_indigenous	See definition	Indigenous adjustment from NEP adjustment table.
E09	adj_remoteness	See definition	Remoteness adjustment.
E10	adj_treat_remoteness	See definition	Patient treatment remoteness adjustment.
E11	adj_age	See definition	Age adjustment from NEP Adjustment table.
E12	Error_Code	See definition	Outlines errors in calculations.
E13	_w01	Base predicted	Adopt UDG_PW, URG_PW, or AECC_PW depending on classification selection.
E14	GWAU20	Gross weighted activity unit	_w01*(1+adj_indigenous+adj_remoteness + adj_age)*(1+adj_treat_remoteness).
E15	NWAU20	National weighted activity unit	GWAU20 for in-scope patients only (that is, non Department of Veterans' Affairs and compensable patients).

Table 25: Non-admitted: variable definitions

Variable	Name	Description	Definition
N01	_pat_remoteness	Patient residential remoteness area	2016 ASGS remoteness area category of the patient location taken from the episode's geographical information in ranked order of preference: SA2, postcode, or the hospital geographical indicator variable where: 0 = major city 1 = inner regional 2 = outer regional 3 = remote 4 = very remote.

Variable	Name	Description	Definition
N02	_treat_remoteness	Patient treatment remoteness area	2016 ASGS remoteness area category of the patient treatment location taken from the hospitals geographic location information, where: 0 = major city 1 = inner regional 2 = outer regional 3 = remote 4 = very remote.
N03	_est_eligible_paed_flag	Specialist paediatric flag	1 if the hospital is on the specialist paediatric list, as per the NEP Determination, else 0.
N04	_pat_ind_flag	Indigenous patient flag	1 if patient indigenous status = 1, 2 or 3; else 0.
N05	_pat_eligible_paed_flag	Patient paediatric flag	1 if N03 is 1 and patient age < 18, else 0.
N06	clinic_pw	See definition	Tier 2 class price weight, taken from NWAU price weight table.
N07	tier2_adj_paed	Paediatric loading	Tier 2 class paediatric loading based on NEP Determination price weight table.
N08	adj_indigenous	See definition	Indigenous adjustment from NWAU Adjustment table.
N09	adj_remoteness	See definition	Remoteness adjustment.
N10	adj_treat_remoteness	See definition	Patient treatment remoteness adjustment.
N11	Error_code	See definition	Outlines errors in calculations.
N12	GWAU20	Gross weighted activity unit	clinic_pw*tier2_adj_paed*(1 + adj_indigenous + adj_remoteness + adj_multiprov)*(1 + adj_treat_remoteness) Where tier2_adj_paed only applies when N05 = 1, and adj_multiprov only applies when event has multiprovider indicator.
N13	NWAU20	National weighted activity unit	GWAU20 for in-scope funding sources set as necessary in the template.

Appendix C: Summary of input data

Table 26: Summary of 2016–17 and 2017–18 patient-costed NHCDC data (ABF hospitals)

	Establishments			(Separations/episodes)			Total reported in-scope cost		
	2016–17	2017–18	% Change	2016–17	2017–18	% Change	2016–17	2017–18	% Change
Acute	253	245	-3.2%	5.8M	5.9M	2.7%	$28.4B	$28.1B	-0.9%
Emergency	192	191	-0.5%	7.3M	7.5M	3.1%	$4.7B	$5.1B	8.5%
Non-admitted	224	238	6.3%	18.3M	21.2M	15.7%	$5.5B	$6.4B	18.0%
Subacute	241	238	-1.2%	174.3K	168.3K	-3.5%	$2.4B	$2.4B	2.2%

Note: Only the NHCDC activity is used in the non-admitted cost model.

Table 27: Summary of 2016–17 and 2017–18 population data (ABF hospitals)

	Establishments			Activity (separations/episodes)		
	2016–17	2017–18	% Change	2016–17	2017–18	% Change
Admitted acute	267	273	2.3%	5.8M	6.2M	6.7%
Emergency	193	194	0.5%	7.5M	7.8M	4.2%
Non-admitted						
Subacute	255	252	-1.2%	186.2K	188.4K	1.2%

Table 28: Costed (NHCDC) sample as proportion of total population

	Establishments		Activity (separations)	
	2016–17	2017–18	2016–17	2017–18
Admitted acute	94.8%	90.1%	99.1%	95.4%
Emergency	97.4%	95.9%	97.0%	94.0%
Non-admitted				
Subacute	92.2%	92.5%	83.2%	80.0%

Note: Only the NHCDC activity is used in the non-admitted cost model.

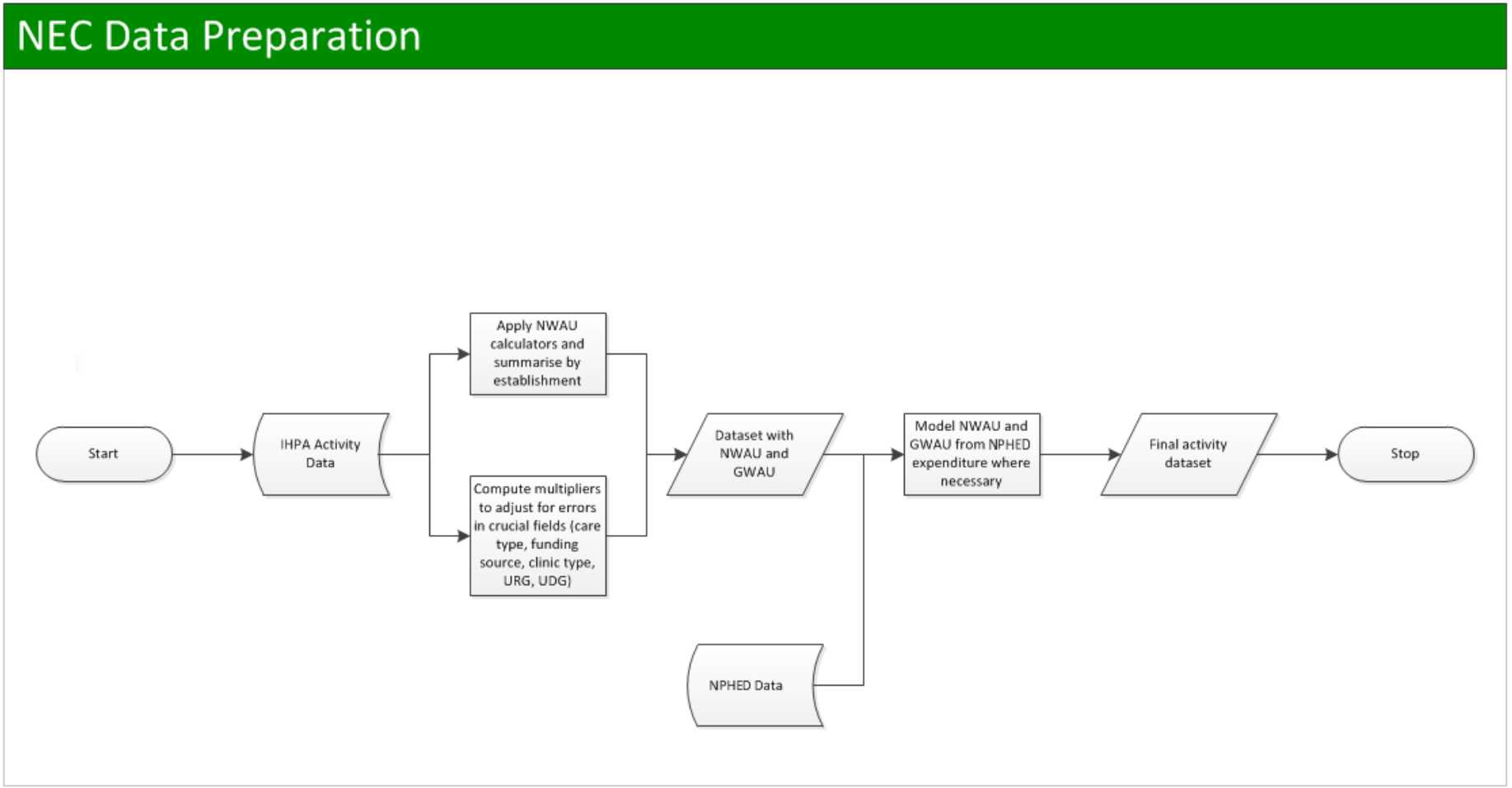
Appendix D: List of DRGs adopting the L1.5 H1.5 methodology

Table 29: List of DRGs adopting the L1.5 H1.5 methodology

DRG	DRG description
801A	GIs unrelated to principal diagnosis, major complexity
B83A	Acute paraplegia and quadriplegia and spinal cord conditions, major complexity
E01A	Major chest interventions, major complexity
I01A	Bilateral and multiple major joint interventions of lower limb, major complexity
I02A	Microvascular tissue transfers or skin grafts, excluding hand, major complexity
P06A	Neonate, AdmWt >= 2500g with significant GI/vent >= 96 hrs, major complexity
P06B	Neonate, AdmWt >= 2500g with significant GI/vent >= 96 hrs, minor complexity
P67A	Neonate, AdmWt >= 2500g without significant GI/vent >= 96 hrs, < 37 Comp Wks gest, Ext. complexity
R03A	Lymphoma and leukaemia with other GIs, major complexity
R05A	Allogeneic bone marrow transplant, age <= 16 years or major complexity
W04A	Multiple significant trauma with other GIs, major complexity
X02A	Microvascular tissue transfer and skin grafts for injuries to hand, major complexity
X07A	Skin grafts for injuries excluding hand, major complexity

Appendix E: NEC20 data preparation

Table 30: National Efficient Cost 2020-21 data preparation



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