National Casemix Office

NHS Digital

Casemix Design Framework

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1. Introduction

1.1 Purpose

The development, maintenance and evolution of a Casemix Classification requires a combination of established rules and principles, specialist expertise and data. The Design Framework details these underlying principles which ensure a consistent approach to govern the development of the Casemix designs by the National Casemix Office (NCO).

The purpose of this document is to inform major stakeholders, including Clinicians, finance and informatics professionals and Policy colleagues at NHS England, of the rules and criteria to be followed when designing classification systems. Its primary use, however, is to provide a framework to guide and assist the NCO's Expert Working Groups (EWGs).

This document may also be of interest to commissioners, coders, Clinicians, and finance colleagues, who wish to understand the method and context of how Healthcare Resource Groups (HRGs - our primary Casemix classification), are developed.

The Design Framework ensures that HRGs and other Casemix classifications are developed in accordance with clear design objectives and editorial rules which promote their functionality, as well as providing a foundation as to how the design should be maintained and developed as part of our annual cycle.

1.2 Background and History

Casemix may be viewed as a system whereby the complexity of the care provided to a patient is reflected in an aggregate secondary healthcare classification. In accordance with the Casemix Classification Principles determined by Fetter and Thompson in the 1960s, Care Resource Groups (HRGs in England):

- Must be clinically meaningful and contain activity with similar expected resource intensity. This not only ensures that HRGs provide a valuable dialogue mechanism between clinical and finance professionals, but that average costs or national tariffs at the HRG level do not systematically under- or over-represent the resource use of the care provided when treating particular groups of patients

- Should use data that is routinely available, to minimise the burden of data collection on the NHS

- Should be manageable in number to cover all patients, ensuring that the administrative burden of processing and evaluating HRG-level data in terms of costing and reimbursement is curtailed.

In the autumn of 2003, an HRG4 Design Group (known as the Casemix Design Authority) was formed. This group informed the HRG4 design rules. These rules became known as the HRG4 Design Framework and superseded their HRG v3.5 counterpart.

These HRG4 design rules were used in the creation, and subsequent development of, the current HRG4+ design which underpins both the national costing and reimbursement systems in the English NHS.

1.3 Governance

The NCO Design Framework is owned by the Casemix Advisory Board (CAB). The role of CAB is one of guidance and advice, with a specific focus on the conceptual, strategic, and operational development of Casemix Classifications and associated methodologies. The ownership of the Design Framework is pivotal to this role.

The Framework enables good governance capable of meeting the requirements of policy within an ever-changing NHS operating environment, whilst understanding the systemic aspects of the 'system'. It also facilitates clinical engagement, classification and coding development, and the technical implementation of Casemix products and services.

The Casemix design is regulated via this Framework, which informs the way that Casemix Classifications, endorsed by EWGs, may be developed for implementation in a released Grouper product.

Implementation of a design change into a specific Grouper release is also subject to agreement via an established, two-stage, internal Change Control Process.

1. **The Quality Review Panel (QRP)**

   Following initial discussions with the appropriate Policy teams, a panel of representatives from NHS England meet with the Casemix team to discuss the impact and implementation of the requirements. The recommendations of this panel are then collated and escalated to a Change Control Panel

2. **The Change Control Panel (CCP)**

   The Change Control Panel convene to sign off the final requirements for each Grouper release (and therefore the appropriate design). Sign-off requires both the key national policy stakeholder leads and the Head of the National Casemix Office to agree. This provides the Authority to Proceed to Build. This process is followed, with agreed steps for mitigation, to a specified deadline leading to the release of all Policy-related Grouper products, namely the Costing Groupers, Payment suite of Groupers and the PS Tools used by the NHS England Specialised Commissioning team.

2. Casemix Design Framework Objectives

2.1 Overview

The NCO has editorial control over the HRG4+ suite of documentation, and responsibility for the development and maintenance of Casemix Classifications. The HRGs produced are used by NHS England to collect national costs from the Service, and as a currency on which to set prices.

To achieve these aims, the Casemix Design Framework is divided into four sections, each with a specific purpose.

- Design Principles
- Design Fundamentals
- Editorial Rules
- Performance Measurement Techniques

Full details are available within the sections below.

2.2 Casemix Design Principles

The Casemix design principles are intended to assist EWG members in the development of a Casemix Classification that is responsive to the needs of a changing national and local healthcare environment. They are specifically tailored to address the benefits of HRG4+ and serve as a guide to the enhancement of Casemix Classifications. HRGs must support the delivery of clinical care and national policy requirements and should be designed with that in mind.

Principles 1 to 5 (below) support:

- An expanded scope beyond acute secondary care into the community and primary care setting, as and when sufficiently robust data are available
- An expansion in the use of alternative nationally mandated datasets and underlying classifications
- The enhanced influence of all relevant diagnosis and procedure information recorded, to support improved identification of specialist services, and differentiate between routine and less complex care
- An extended data quality component linked to improved transparency and clarity of HRG output and content, as well as a reduced tolerance of poor quality data inputs.

Cross-chapter consistency in design approach remains a key priority for an HRG classification that must operate within a national framework, where each component part of the system must interface to form a cohesive whole. This applies equally to the development of existing HRG chapters and the introduction of new service areas into scope, in support of current and future policy objectives, and the needs of an increasingly evolutionary healthcare delivery system.

The Casemix design principles, whilst subject to the influences of policy decisions, are a mandatory aspect of the Casemix Classification that are detailed here for information.

EWGs must consider the appropriateness of requirements in future design iterations. Non-compliance with these design principles must be based on data analysis, in conjunction with clinical opinion, evidenced where available.

As a default position, the design principles must be met unless it can be proven that to do so would jeopardise any of the Casemix Design Fundamentals, Editorial Rules, or adversely impact upon the performance of the classification as measured by the Performance Management Techniques.

1.	**Minimum Design Criteria** HRGs should be of significant size (*with 5% tolerance*) to enable robust costing and should only be created where three or more providers undertake activity nationally, in a given financial year. When creating an HRG, the expected annual activity and cost thresholds must meet at least one of the following criteria: • 600 cases (episodes, spells, sessions, attendances, etc, dependent on the unit of activity used for a particular setting or service) • 5,000 occupied bed days (for admitted patient care) • A total cost of more than £2.0 million HRGs that fail to meet the above design criteria but can clearly demonstrate intra-HRG differential resource use, and clinical need for patient subsets within them, need to be examined on a case-by-case basis. In these circumstances, if the HRG root (or subset of related HRGs) meets the standard criteria outlined above, and there is more than 25% difference between the expected resource use (measured by length of stay (LoS) or estimated costs) of potential patient subset splits (e.g. CC or age splits), it is appropriate to create HRGs that have an expected annual activity and cost threshold that meets at least one of the following criteria: • 400 cases • 3,000 occupied bed days (for admitted patient care) • A total annual cost of more than £1.3 million These thresholds will be reviewed on a regular basis, to reflect changes in clinical practice, care delivery, and cost. The performance of HRGs will be measured against this set of criteria on an annual basis. Caution should be exercised in the creation of HRGs where small numbers of providers are involved. Where HRGs contain more than 100,000 cases annually, consideration should be given to the creation of sub-groups, with potentially a smaller anticipated cost spread.

2.	**Specialist Activity** i. Multiple Procedures Where evidence identifies that multiple procedures are undertaken on a routine basis for a subset of patients, this must be recognised within the HRG design, such that the HRG derived is other than would have been derived by any of the procedures undertaken in isolation. To combat the potential over-recognition of multiple procedures, care must be taken to minimise the recognition of procedures that are considered intrinsic to the clinical operation undertaken (commonly referred to as 'part and parcel'). Recognition of multiple procedures in the Casemix Classification should: • Be kept within subchapter, to maintain clinical coherence and relevance • Not span subchapters, without the express agreement of all EWGs concerned • Comply with the Design Fundamentals Where HRGs are designed specifically to identify multiple procedures undertaken on a routine basis, this must be made transparent in the HRG label. ii. Multiple Diagnoses Where evidence identifies that multiple diagnoses are present in a patient record(s), and have an increased associated level of resource use, this must be recognised within the HRG design such that the HRG derived is other than would have been derived by consideration of any single diagnosis alone. To combat 'summation creep,' care must be taken in assigning values for addition, so poor or ambiguous coding is not encouraged. • Values should be weighted to discourage the recognition of such diagnoses • Unspecified diagnoses that follow a more specific diagnosis within the same three-digit ICD-10 rubric should carry less summative weight than other ICD-10 codes within that rubric Where HRGs are designed specifically to identify such multiple comorbidities, this must be made transparent in the HRG label. iii. Both Multiple Procedures and Multiple Diagnoses Where evidence identifies that both multiple procedures and multiple diagnoses are an expected component of the care delivered to a patient population subset, both can be considered. This includes the potential for a summative grid / matrix approach where the service identified by the HRGs is sufficiently discrete to do so, though the impact of over-recognition of intrinsic procedures / 'summation creep' must be considered.

	Care must be taken to retain clinical relevance and validity of groupings where a matrix approach to design and HRG derivation is proposed, to ensure that costing, funding, and commissioning requirements regarding transparency of HRG content are met. Where HRGs are designed specifically to identify such multiples, this must be made transparent in the HRG label. <u>iv. Age</u> Special consideration must be given to particular subsets of patients based on patient age. Children, 'infants' or the elderly (however defined), might have different care needs and treatment to other patients with the same underlying condition, or undergoing the same procedure. The age of the patient should be considered when assessing the extent to which activities are specialised, irrespective of whether they are procedure-driven, qualified by diagnoses, or reflect multiple interventions. This may be especially relevant for the care of children and in particular 'infants,' the latter defined generally for the purposes of this Design Framework as children aged under 2 years. Although as a default the age of a child is deemed to be 18 years and under in accordance with the National Service Framework, Specialist Services often reflect age sub-divisions within this broad definition of "child". Where it is clinically advisable to do so, and where evidence supports the differential resource use of treating subsets of the "child" population, age splits within the broad definition of child may be adopted within the Casemix Classification.
3.	**<u>Improved Recognition of Diagnosis</u>** The extent to which Casemix groupings beyond the Admitted Patient Care (APC) setting can be used to influence the HRG derived, is dependent on the availability of robust diagnosis coding using the ICD-10 classification, and the support of relevant national policy. Beyond APC, diagnoses may be used to: • Improve understanding of the reasons for the care provided for a subset of a patient population treated within a clinic setting. For instance, stratification of outpatient activity according to the reason for treatment, could enable ophthalmology attendance activities to differentiate between glaucoma and cataract patients • Identify the reason why a procedure was undertaken in a clinic setting, thereby enabling recognition of resource use linked to differential diagnoses for identical procedures • Generate diagnosis-driven HRGs from clinic activity to support setting-independence, and reflect changes to, or advances in, clinical practice • Enable the linkage of patients between care settings to allow for the creation of pathway-based currencies

	Nevertheless: The approach adopted must be consistent across the subchapter and be clinically endorsed. It is also recognised that the utilisation of diagnoses beyond APC will be largely reflective of the service type and specialisms provided. Where the administrative burden of diagnoses collection on the NHS is not perceived to provide any additional benefit, or where diagnoses codes within an outpatient clinic setting are so vague as to provide no added clinical value beyond that provided by the mandated Treatment Function Code (TFC), the use of diagnosis outside of APC should be avoided.
4.	**Quality** The quality considerations of the Casemix Classification are three-fold and require EWG recognition and implementation of the following: • The contextual validation of input data: *for example, to what extent particular activities are 'impossible' in specific care settings, and whether such activities should be grouped as unclassified* • Improved handling of poor or ambiguous coding: *unless there is a clinical requirement and analytical evidence to support a contrary approach* • Consistency of application of Editorial Rules: *especially regarding HRG numbering and naming conventions (see also #19)*
5.	**Alternative Underlying Classifications and Other Datasets & Sources** When nationally mandated datasets become available, for example Community Services or Emergency Medicine, they should be investigated as a source of additional or alternative information for the derivation of appropriate Casemix Classifications. This includes the use of alternative underlying classifications in existing datasets e.g., SNOMED-CT. When developing a classification using new or alternative information, the existing design fundamentals should be adhered to where appropriate (i.e., iso-resource, clinically relevant and manageable in number). New classifications should also take into consideration the following: • International research: *how the new service area is classified in other countries with similar funding mechanisms* • Expert clinical input: *how providers deliver the service, and how this is recognised by the alternative dataset* • Collection of data: *how comprehensive/valid is the population of required fields within the alternative dataset* • Best practice: *are there service providers who are already capturing data at a local / regional level*

2.3 Casemix Design Fundamentals

The Casemix design fundamentals outline the key principles that are intrinsic to any casemix classification and draw heavily from those utilised in the development of previous NCO Casemix Classifications. The 15 Fundamentals (see 6 to 20 below) are intended to assist EWG members in the assessment and interpretation of data and outline the preferred strategic foundation and aims for the classification.

Advice is provided to ensure cross-chapter consistency in the underlying design. Whilst this advice must be duly considered, exceptions may be appropriate where there is a sound clinical reason to do so.

6.	**Setting-independent / Dependent** HRGs will describe care based on the care delivered, rather than the care setting in which it is undertaken. Patients that can be appropriately treated in more than one setting should be grouped to the same HRG, subject to any requirement to identify the specific care setting for healthcare delivery. Setting-independent currently means that where a procedure can be performed across different care settings, the same HRG may be derived. For example, an endoscopy should generate the same HRG regardless of whether it was performed as an outpatient, day case or inpatient procedure. At present, setting-independence applies only to procedure-driven HRGs. It does not apply to diagnosis-driven HRGs, nor HRGs that are derived from data items other than the procedure (OPCS-4) primary classification. Care that may only be delivered in a single setting (for example, community care delivered in a patient's home) which is reliant on a data set specific to that setting will be setting-dependent. Examples include the Critical Care Minimum Data Sets, the Emergency Care Data Set, the National Renal Dataset, and the Community Services Data Set. When considering setting-independence, care should be taken to understand any limitations of each individual setting-specific data set, for example, utilising data fields only available in an APC setting when grouping outpatient data. Specific attention should be given to grouping processes where fields that cannot be checked by design logic in a particular data set are expected to be processed in another. As a general principle, cross-utilisation of data fields that exist only in setting-specific data sets should be avoided.
7.	**Iso-resource** The EWG will assess the resource use associated with an HRG by considering LoS, and national costing data, where available. EWGs should also use their clinical knowledge of theatre usage, nursing dependency, acuity and specialism, drugs, prostheses etc. Local cost differences, or non-typical service delivery models, should not be permitted to influence the development of HRGs. HRGs that have instances of bi-modal and irregular resource distributions should be kept to a minimum, and only be retained where clinically appropriate to do so. HRG splits based on LoS should be kept to a necessary minimum, and only used where a viable alternative (such as age, interactive CCs) is neither available nor clinically sound. (*See also #13*)

8.	**Complications and Comorbidities** Each EWG will be required to consider the resource impact of Complications and Comorbidities (CCs) for all HRGs within a subchapter. This includes consideration of multiple CCs that may interact to have an increased impact on expected resource use. CCs are applicable at the subchapter level, and CC lists cannot in principle be applicable to only a single HRG, unless clinically necessary to do so. Where it is necessary to reflect the impact of different CCs on subsets of HRGs, it may be appropriate to see if these subset HRGs are different enough to be transferred into a new HRG subchapter, within the relevant HRG chapter. HRGs should recognise CCs and/or multiple CCs where clinically and statistically appropriate to do so. HRGs that utilise maximum adjusted LoS checks should not warrant the use of CC splits. Interactive CCs are based on summed scores and more appropriately reflect the expected additional resource use of treating patients with multiple complications and comorbidities. The HRG is determined by the summed 'score' of all unique secondary diagnoses which appear on the subchapter-specific CC lists. These should: • Contain ICD-10 diagnosis codes with either a value of 1 (intermediate) or 2 (major) CC as clinically appropriate • Be at the subchapter level (noting that an HRG chapter may comprise of a single subchapter) Further information about list content is provided in Annex 1.
9.	**HRG Coverage** HRGs must be comprehensive, and include all areas covered by policy requirements. This will necessitate the inclusion of poorly defined cases and ensure that all activity is placed in an appropriate grouping.
10.	**HRG Content** In some HRG chapters it is necessary to have HRGs for "other" diagnoses or procedures that do not fit into a more-specific HRG. These HRGs must be kept to a minimum and ideally be time limited, until improvements to underlying coding can be made. Where an HRG contains high volumes of activity with a "signs and symptoms" primary diagnosis (ICD-10 Chapter XVIII), this activity should be separately identified, and may require a separate HRG. This enables potentially significantly-different resource use to be evidenced appropriately.
11.	**Unbundling** To improve the performance of HRGs and better represent activity and costs, some significant elements of cost and activity are identified separately, or "unbundled" from the core HRGs that reflect the primary reason for a patient admission or treatment. These unbundled HRGs can better describe the elements

	of care that comprise the patient pathway within a hospital admission or outpatient attendance. Unbundled HRGs are generated consistently and independent of any and all core HRGs, across all chapters and subchapters within the APC and OP data sets. As a general principle, unbundled HRGs reflect care that is discrete for a particular service, which can be delivered in different settings or at different times, but not usually accessed by all patients. Unbundled HRGs may be event or duration-based, in line with clinical requirements and / or data availability and service design.
12	**Grouping Logic** When a spell contains multiple finished consultant episodes (FCEs), the spell should generate an HRG based on all care delivered within that spell, from patient admission to discharge, within a single provider. HRG4+ follows a standardised sequence of grouping, which can be found in The Casemix Companion, with logic specifics available in the Code to Group Excel workbook that accompanies each Grouper release. Changes to this sequence cannot be made without the express consideration and permission of CAB.
13.	**Procedure Dominance, Incidental Procedures and Hybrids** In general, significant procedures take precedence over diagnoses in grouping logic, when determining the HRG. Where procedures can be undertaken incidentally to the reason for admission, as well as being the reason for admission, EWGs should consider including LoS checks on such procedures, to ensure that the resultant HRG generated is appropriate in terms of clinical resource use. As these procedures may not be the main resource driver for patients with a long LoS, EWGs should consider utilising grouping methodology that ignores such ‘incidental’ procedures (or Interventions) for long-stay patients, and instead generate HRGs using the patient’s primary diagnosis, as the main resource driver is the underlying medical condition. When this occurs, the EWGs should review the resource implications of the Interventions and determine whether the diagnosis-driven HRGs should take account of them. Where this is the case, the differentiation of ‘with’ / ‘with multiple’ / ‘without’ Interventions must be made explicit in the (diagnosis-driven) HRG label. Procedure codes that have maximum LoS check logic must be included on the “Interventions” list, which is globally used to take account of relatively minor interventions during longer medical stays. No other procedures, (such as those insignificant for grouping purposes or those without a LoS check,) are permitted on this list. Hybrid HRGs (that can be reached either via a dominant procedure or primary diagnosis) are to be avoided.

14.	**Multiple Procedure Logic** When considering recognition of multiple procedures within the Casemix design, EWG members should attempt to use existing Grouper logic wherever possible to acknowledge this, rather than inventing new means of recognition. The proposed implementation of multiple procedure logic, by whatever means (standard, summation & matrix), at the chapter or subchapter level must be supported by standard baseline analysis prior to implementation. A brief overview of the multiple procedure logics employed within the current Casemix Classification can be found in Annex 2 of this document.
15.	**Diagnosis Hierarchies** Each APC FCE will have a primary diagnosis recorded, reflecting the primary reason for care, and as determined by the clinical record for the patient. Each diagnosis that is valid as a primary diagnosis is assigned a diagnosis hierarchy (DH) associated with its expected resource consequences. Where a patient has a multi-episode spell which has more than one primary diagnosis, it is necessary to determine the primary diagnosis of the spell before the spell can derive an appropriate spell-level HRG. More details on how the DHs are used in these circumstances can be found in The Casemix Companion. Diagnosis hierarchies should sit in a range from 5 to 27 with 5 being lowest expected resource usage. A DH of 0 is assigned to ICD-10 codes not valid for grouping (i.e., fails to meet national coding standards). Diagnosis hierarchies are created on the basis of an estimated 20% resource difference between each band on a logarithmic scale, with DH values assigned based on expected resource usage. Particular care should be taken when remapping codes between HRGs, to ensure that the DH remains relevant. A review of diagnosis hierarchies should be undertaken every three years.
16.	**Procedure Hierarchies** Where a patient has more than one procedure recorded in either the APC or OP data set, the dominant (highest expected resource use) procedure will be used to derive the HRG. All procedure codes are assigned a procedure hierarchy (PH) value associated with their expected resource consequences. Procedure hierarchies should sit in a range from 0 to 42 with bands 0 to 4 reserved as follows: • 0 - OPCS codes not valid for grouping (such as approach codes and site of operation codes as the only procedures) or poorly coded for Casemix grouping purposes (where the dominant procedure is too vague to generate a clinically meaningful HRG): *where this is the dominant procedure in the patient record the HRG generated will be unclassified in both the APC and OP setting* • 1 - Non-operative procedures with minimal resource (such as fitting a sling or administering an injection), which are ignored for Casemix grouping purposes; *where this is the dominant procedure in the patient record the*

	patient record will group off the primary diagnosis in an APC setting / generate a default WF HRG in an OP setting* • 2 - Procedures that will generate unbundled HRG(s) in both the APC and OP setting. As PH are not used to determine event-based unbundled HRGs, every instance of a procedure generates an unbundled HRG. This hierarchy value is therefore used only for completeness: *where all procedures in a patient record have been "unbundled," the HRG generated may be diagnosis-driven in an APC setting, or a WF* HRG in an OP setting* • 3 and 4 - Procedures relating to subchapter WF, Non-admitted Consultations (uni-professional/disciplinary and multi-professional/disciplinary assessments): *only relevant in the OP care setting* Band 5 is the lowest expected resource usage of all other procedures recorded using OPCS codes. More details on how the PHs are utilised in grouping can be found in The Casemix Companion. Procedure hierarchies are created on the basis of an estimated 20% resource difference between each band on a logarithmic scale, and PH values should be assigned based on expected resource usage. Particular care should be taken when remapping codes between HRGs, to ensure that the PH remains relevant A review of procedure hierarchies should be undertaken every three years.
17.	**Procedure Combination Codes** (*see also #24*) Procedure combination codes are used where no viable alternative is available, such that multiple OPCS codes are required to identify a single 'procedure'. They are typically used where there is not an existing OPCS-4 procedure code to identify the procedure specific enough to enable the procedure(s) it represents to be mapped to an HRG different to where the driving procedure is recorded on its own. A procedure combination code is thus defined as a combination of more than one OPCS-4 code which is treated for grouping purposes as though it were a single 'procedure'. They are formed using a driving procedure (a valid main body system OPCS-4 code) and additional procedure(s). In most circumstances these will be subsidiary OPCS-4 codes. Most combination codes are formed using two OPCS-4 codes - a driving procedure code, which becomes the first half of the code, "+" either: • A single subsidiary OPCS-4 approach or site code, represented after the "+" as the code itself e.g., +***Y032 Renewal of prosthesis in organ NOC***, +***Z342 Aortic arch*** • Subsidiary OPCS-4 site or approach codes from the same OPCS-4 code category, represented after the "+" as the 3-digit category code e.g., +**Y18 Release of organ**, +**Y22 Drainage of lesion of organ** • Subsidiary OPCS-4 site or approach codes, from different OPCS-4 code categories, represented after the "+" using a word or acronym to summarise the type of approach or site e.g., +**RFA** (contains OPCS-4 codes relating to radiofrequency ablation), +**KNEE** (contains OPCS-4 codes representing sites of the knee).

	In addition, combination codes can be constructed from more than two OPCS-4 codes, either specific codes, or a selection of codes from specific code categories or lists. For example: • **G345+Y763+Y032 Endoscopic renewal of gastrostomy tub**e – formed using ***G34.5 Attention to gastrostomy tube*** with subsidiary ***Y76.3 Endoscopic approach to other body cavity*** and subsidiary ***Y03.2 Renewal of prosthesis in organ NOC***, or • **W768+Y223+ELBOW Irrigation of ligament of elbow** – formed using ***W76.8 Other specified other operations on ligament*** with subsidiary ***Y22.3 Irrigation of organ NOC*** and subsidiary code from list **CL_Elbow** (which contains several OPCS-4 site codes such as ***Z71.1 Olecranon process of ulna, Z81.5 Elbow joint***) For these three OPCS-4 code combination codes the actual sequencing of the subsidiary codes in the record does not matter, both codes need to be subsidiary to the driving procedure. Combination codes are an alternative to flag logic, where there is a requirement for the combination code to have a different PH value than the driving OPCS-4 code. The combination code may be mapped to a different HRG and may have different PH values. Combination codes may be created in support of NICE guidance, for example, to identify specialised procedures coded using ***.8 other specified*** OPCS-4 codes plus additional approach and/or site codes, and which may require mapping to a higher expected resource HRG than the ***.8 other specified*** OPCS-4 code used alone. Procedure combination codes should be reviewed annually to ensure that they remain necessary in light of clinical practice, or where the OPCS Classification has been updated.
18.	**<u>Subsidiary Procedure Qualification</u>** Subsidiary OPCS-4 codes i.e., approach and site codes, may be used as effective care qualifiers. This means that an additional OPCS-4 subsidiary code enhances the information provided in the preceding OPCS-4 code from the individual body system (in the main OPCS-4 classification), to determine the appropriate HRG. This may include differentiating on site e.g., mapping bilateral operations to a different HRG than the equivalent unilateral operation, or differentiating on approach e.g., mapping laparoscopic operations to a different HRG than the equivalent open operation, using the presence of the appropriate subsidiary site codes from a specified list. The use of subsidiary procedure qualification assumes that coding follows the “PYZ assumption” in that the relevant subsidiary procedure codes follow each main body system code, thus it can be assumed that the approach or site subsidiary codes are associated with the particular preceding main body system OPCS procedure code.

19.	**Diagnosis Qualification** Where clinical opinion and empirical evidence supports the proposal that resource associated with specific disorders or procedure/(s) differ, dependent upon the presence of specific diagnoses (as primary diagnosis or anywhere in the record), the HRG design should reflect the expected resource use of differential diagnoses, for the same procedures. This means that the ICD-10 code reported within the patient record will influence the HRG that is derived. This concept ensures that the HRG captures the additional expected resource associated with the patient's diagnoses for a procedure, where it is deemed to be a clinically important resource factor.
20.	**.8 Other Specified and .9 Unspecified Procedure Codes** As a result of the nature of the OPCS-4 classification, within each OPCS code category there is a .***8 other specified*** and .***9 unspecified*** code that completes the category. It may be difficult to determine the actual procedure performed due to the generic nature of these codes, and thus the associated resource usage of these codes, although there are a small number of .***8*** and ***.9*** codes that have specific coding guidance which directs the use of certain of these codes. Procedure combination codes should be considered particularly for ***.8 other specified*** procedure codes, where the subsidiary procedure codes can be used to better identify the particular procedure and associated expected resource usage. Where a ***.8 other specified*** code cannot be further qualified through the use of subsidiary codes, it should be mapped to the equivalent base HRG root as the lowest resource code in the same category, unless there is strong evidence and clinical support to do otherwise. It may be appropriate for some ***.9 unspeci***fied codes to map to a U group unclassified HRG if resource usage cannot be determined. Otherwise, the ***.9*** code should be mapped to the equivalent, or lower base HRG root as the lowest resource code in the same OPCS three-digit category.

2.4 Casemix Editorial Rules

The four editorial rules (see 21-24 below) primarily relate to the style, terminology and consistency used when designing the classification. They should be regarded as mandatory, with exceptions only normally allowed if endorsed by CAB, when compelling clinical, financial and/or political evidence requires a deviation from current processes. All such exceptions require approval by the Head of the NCO prior to implementation in a national Grouper product.

The following editorial rules exist to ensure that there is consistency in the Casemix Classification and to improve transparency.

21. **HRG Terminology**

To ensure consistency of editorial terminology and structure across chapters in conjunction with the EWGs, Steering Groups and Expert Advisory Groups.

HRGs are identified by a five character code structure:

Chapter/Subchapter	HRG Number	Split
AA	NN	A

- The first alphabetical character **(A)** represents the **HRG Chapter**
- The first two alphabetical characters **together (AA)** represent the **HRG Subchapter**
- The next two numeric characters **(NN)** represent the **HRG Number** within the subchapter
- The final alphabetical character **(A)** signifies the **Split** applicable to the HRG

In addition:

- The first four codes are classed as the **HRG root**.
- The final (split) character within the HRG code structure is a single character code which further describes activity, such as patient age, length of stay or complications/comorbidities. Other than the value of 'Z,' indicating that no split is present, split characters are not standardised across the HRG design

When creating new chapters or subchapters, HRGs must conform to specific ordering within the chapter or subchapter, with the highest resource HRG at the beginning (with the lowest HRG number). It is accepted that it may not be possible to maintain this ordering within subchapters when revising the design unless that redesign necessitates a new HRG subchapter.

The naming of types of categories must be consistent across all chapters (for example Minimal, Minor, Intermediate, Major, Very Major, Complex and Very Complex).

The use of levels or category numbers should be avoided wherever possible in the interests of clarity of HRG content, due to the inherent ambiguity of their inter-HRG relationship.

	HRG labels should be transparent enough to reflect the content of the HRG, without being so specific that they become unintelligible for costing, funding, or commissioning purposes. The use of ambiguous terms should be avoided unless the HRG is intended to act as a "catch-all" to comply with the requirements of HRG coverage and content (*see #9 and #10*). Obsolete HRG numbers cannot be re-used unless the HRG content is fundamentally the same as the previously-deleted HRG. If there is a significant change to the content of an HRG, a new HRG must be created. A new HRG will not be required where there is a label change to clarify the HRG content.
22.	**HRG Chapter Structure** HRG activity cannot be moved between chapters or subchapters without the express agreement of EWG chairs of all chapters / subchapters concerned. In cases of dispute, the Clinical Chair of the EWGs will act as arbitrator. HRG subchapters should ideally differentiate between 'surgical' (procedure-driven) and 'medical' (diagnosis-driven) activities within the same chapter. This supports the improved differentiation of care and enables CC considerations to be more responsive to the type of care delivered. If an HRG subchapter has reached capacity, it is appropriate to split it into new relevant subchapters based on the appropriate subset of HRGs e.g., type of treatment etc. If essentially 'moving' HRGs to a new subchapter, it may be appropriate to keep either the HRG numbers or labels the same, to enable easy cross-mapping between iterative versions of the Casemix Classification, wherever possible. When creating new subchapters, it is appropriate to take the opportunity to split HRG subchapters into surgical and medical components, and to reorder HRGs into more relevant sequences e.g., with the highest resource HRG at the start of the subchapter, with the lowest HRG number.
23.	**HRG Currencies** The unit of activity of an HRG will depend upon the services to which it applies. These HRG currencies may be duration- or event-based. They may include: • Episodes and spells for admitted patient care • Bed days for critical care, rehabilitation, and specialist palliative care, for unbundled HRGs • Events such as renal dialysis sessions, delivery of chemotherapy, high cost drugs, for unbundled HRGs • Attendances for Outpatients and Emergency Medicine • Contacts for community services Requests for changes to existing units of activity, or the introduction of new currencies, will be reviewed by the CAB in line with required governance procedures.

24.	**Procedure Combination Codes** (*see also #17*) The first code of the combination code should be a single identifiable OPCS-4 code. Where the second/third (etc.) codes in the combination code are specific identifiable OPCS-4 codes, it is appropriate for the combination code to specify the individual code/(s), with a "+" between each code. Where the combination includes multiple OPCS-4 codes, code substitutes may be used. The code substitute should be as explicable as possible as to the content of the list, without using too many characters. For example, if the list is all 4-character codes within a category, it is appropriate to use the 3-character OPCS category for the code substitute. Alternatively, a list may be referenced which contains all codes relating to a certain body site, e.g., for all sites applicable to "knee" it would be appropriate to use **KNEE** as the code substitute. The label description should be a combination of the individual code labels joined by "and," accepting that it may be appropriate to remove superfluous text that adds no additional clarification. When using code substitute/(s), the label description of the combination codes should be specific enough to understand its content.

2.5 Casemix Performance Measurement

The performance of the HRGs is analysed and assessed on an ongoing basis. At the start of the cycle which considers design changes, be they small or represent significant change, appropriate data is used to assess both the impact of the change as well as considering the performance of the existing design. This process of reflect and review is pivotal to the work of the NCO and extends similarly to our published web pages and documentation suite.

Reports including FCE / spell counts, summary statistics (mean, median and percentiles) for each HRG by provider, admitype and both adjusted and unadjusted LoS distribution, for each HRG are produced to identify HRGs with unexpected length of stays, for example bimodal or irregular distributions, or those with a higher than expected proportion of outliers.

The four performance measurements (see 25-28 below) detail the methods by which Casemix grouping performance can be measured and monitored, between versions, chapters and HRGs. Results will be made available to the CAB and other parties on request, or at such regular intervals as determined by the CAB.

25.	HRG designs will be analysed by the NCO using appropriate statistical methods. Results of these analyses may be shared with appropriate stakeholders for discussion. Appropriate statistical techniques for inter-version and intra-chapter HRG comparison may include, but are not limited to: • Reduction in Variance (RIV) • Coefficient of Variation (CV) • Identification of outlier LoS variability • Measurement of intra-HRG cost variation • Quartile Coefficient of Dispersion • Data Variation Index Brief definitions of these statistical techniques can be found in Annex 3 to this document.
26.	Where groupings consistently fail to meet minimum design criteria in terms of significant size (see #1), EWG members may review and amend current designs to maintain required standards and improve statistical performance. As some HRGs may be created to allow for the appropriate capture of new technologies that increase in frequency over time, an HRG can be retained for a period of three years before being reviewed.
27.	The performance of HRGs is also measured in terms of the expected relativities between HRGs. For example, ‘Major’ HRGs should have a higher resource usage than their respective ‘Intermediate’ HRGs; or where an HRG root has three levels of CC splits, the higher the CC score, the higher the expected resource usage. When the resource usage is not as expected, these are known as “illogical relativities.” The expected relativity hierarchical relationship is assigned on creation of the HRGs. Where illogical relativities are found, these are to be investigated

	further as to the cause. If illogical relativities persist for a period of three years, a thorough review should be undertaken.
28.	As HRGs are expected to be iso-resource there are certain HRGs, such as those for complex treatments, that are unlikely to take place in outpatient or day case settings. Conversely, there are HRGs for very simple treatments that would be unlikely to require the patient to be admitted. Where HRGs are derived in a setting in which they are not expected to take place, e.g., heart transplant in an outpatient care setting, they are deemed "improbable HRGs" from a Casemix design perspective. Where HRGs are deemed improbable, further investigation should take place.

Annex 1. Complications and Comorbidities (CC) List Inclusion Principles

The following is a list of inclusion/ exclusion principles across all subchapter CC lists:

- The inclusion of ***Unspecified codes*** on CC lists should be avoided unless there is strong evidence and clinical support for their inclusion. Where an unspecific code is used to acknowledge CCs, the more-specific ICD-10 codes within the three digit rubric must also be included.

  In addition:

  - Unspecified codes must have an equal or lower value than more specific codes within the same three-digit category. Note that *not all "unspecified" ICD diagnosis codes are **.9s** and not all **.9s** are unspecified ICD diagnosis codes*
- Open ***fractures*** must have an equal or greater value than closed fracture codes related to the same bone site:
  - The principle that a multiple injury must have an equal or greater value than single injuries within the same three-digit category is based on the assumption that multiple injuries will usually consume at least the same resource as single injuries
- ***Superficial conditions*** are restricted to a maximum value 1:
  - This is based on the supposition that if a condition has been stated to be superficial, it cannot be said to have a significant impact on resource usage
- ***Moderate/minor degree*** are restricted to the same or lower value than severe degree for the same condition:
  - This relates to the principle that severe degrees of a disease will consume greater resource than moderate or mild forms of the disease
- ***Bilateral conditions*** must have an equal or greater value than unilateral conditions:
  - This principle considers the use of CC rankings for bilateral/unilateral disorders. Although a patient may have a bilateral condition and receives treatment for one side alone, the principle that a bilateral condition should at least receive an equal ranking to that assigned to a unilateral condition holds
- ***Signs and symptoms ICD diagnoses codes*** should only be added to CC lists where the symptom would be a condition requiring treatment or investigation in its own right and hence, increasing the expected length of stay (LoS):
  - *This does not mean that signs and symptoms should not appear on CC lists. Under some circumstances, signs and symptoms codes have to be used and do need investigation or treatment. For a full explanation of when to use signs and symptoms codes, please refer to the ICD-10 Clinical Coding Instruction Manual.*
  - *Diagnosis codes inappropriate to use as primary diagnoses should only be applicable for complications and comorbidities (i.e., within CC lists) where there is a clinical requirement and analytical evidence that supports this premise*

Annex 2. Multiple Procedure Logic

Standard Multiple Procedure Logic

Where lists of procedures of a similar resource usage can be used, standard flags may be used to derive the HRG dependent on what other procedures are recorded alongside the dominant procedure.

Summation Logic

Summation logic tends to be applied at subchapter level and has lists of procedures within the subchapter that are given a set value. Flags are then used to check for a summed score of all relevant procedures and derive the appropriate resource HRG, e.g. Subchapter **BZ Eyes and Periorbita Procedures and Disorders**

Matrix (Multiple Diagnosis and Procedure Assessment)

A matrix grid structure such as that used within Subchapter **VA Multiple Trauma** is an efficient way of assessing the resource implications of treating increasingly complex patients. Some patients will require little or no surgical intervention while others may require complex and repeated surgery within the same FCE or Spell; these interventions being represented by a number of OPCS-4 codes. Equally some patients will have a sole diagnosis for which they are monitored or treated, while some will have multiple diagnoses, or carry a series of pre-existing conditions (comorbidities), that are captured using ICD-10 codes.

There is an expectation that as the resource requirements of a patient increases, so too does the complexity of coding for this patient. Within Multiple Trauma, a score value based on all the diagnoses and procedures within an FCE or spell for each patient is calculated, with a grid system then allocating that patient to an HRG. This reflects the complexity of patients in terms of both medical and surgical treatment, with the derived HRG representing the overall aspects of both elements of care.

The use of matrix grids should be limited to where any of the above multiple procedure logic methods cannot be used, and where the service that is identified by the HRGs is sufficiently discrete to do so.

Annex 3. Statistical Analysis

Identification of outlier LoS variability

A report including FCE / spell counts, summary statistics (mean, median and percentiles) for each HRG by provider and LoS distribution for each HRG may be produced in order to identify HRGs with unusual LoS distributions, for example bimodal or irregular distributions, or those with a higher than expected proportion of outliers.

Measurement of intra-HRG cost variability

HRG design may be analysed using appropriate statistical methods applied to nationally collected cost data in order to determine the degree of cost variation both between and within HRGs.

Determining HRGs with disproportionate numbers of outliers

An outlier is defined as an observation that is numerically distant from the rest of the data. In HRG terms it is a FCE or spell with LoS greater than the trimpoint. The proportion of episodes that are outliers for either LoS or cost can be determined for each HRG after calculating the HRG's upper trimpoint / national average cost profile.

Reduction in Variance (RIV) - Inter Group Variation

The RIV statistic is used to measure the explanatory power of Casemix systems, i.e., the proportion of total LoS variation explained by the 'groups'. A value of 0% means that the classification explains none of the variance in the dependent variable (e.g., LoS or cost), whilst 100% means it explains all of the variance. 100%, whilst theoretically possible, would suggest that all the data in each group have the same LoS/cost. Typical results for LoS for inpatients would be 30-40% whilst cost would be 60-70%.

The RIV, often expressed as R^2 to describe the predictive validity of the classifications, is calculated to describe the explanatory power of the grouping classifications. The unadjusted form of the calculation of RIV is the inverse of the ratio of the whole sum of squares (WSS) and the total sum of squares (TSS), expressed as a percentage.

$$R^2 = 1 - \frac{WSS}{TSS}$$

Where WSS = whole sum of squares
TSS = total Sum of squares

$$WSS = \sum_{j=1}^{k} \sum_{i=1}^{n_j} (x_{ij} - \bar{x}_j)^2 \qquad TSS = \sum_{j=1}^{k} \sum_{i=1}^{n_j} (x_{ij} - \bar{x})^2$$

Where k = the number of groups
n_j = the number of cases in group j
x_{ij} = value of case i in group j
$\bar{x}_j$ = mean of group j
$\bar{x}$ = overall mean

Coefficient of Variation – Intra group variation

Whilst the RIV statistic gives a result to be applied across groups, a statistic is required to measure the within-group variability or homogeneity. The ratio of standard deviation (SD) to the arithmetic mean of a group, or CV gives a measure of the relative variability within a single group.

$$CV = \frac{SD}{\bar{x}} = \frac{\sqrt{\sum_{i=1}^{n} (x_i - \bar{x})^2 / n}}{\bar{x}}$$

Where SD = standard deviation of the group
$\bar{x}$ = mean of group
x_i = value of case i in the group
n = the number of cases in the group

The CV is reported for a group to describe its homogeneity. A value of 0 would indicate that a group has no variance from the mean (i.e., standard deviation is equal to 0), whilst a CV value for a group above 1.00 would indicate heterogeneity within the group, where the standard deviation is greater than the mean. The more homogenous an HRG is, the more likely it is that the underlying HRG design is robust.

Caution should be used when the mean is close to zero as CV may be sensitive to small changes in the mean.

Quartile Coefficient of Dispersion

The quartile coefficient of dispersion is a descriptive statistic which measures dispersion, and which is used to make comparisons within and between data sets. The statistic is easily

computed using the first (Q_1) and third (Q_3) quartiles for each data set. The quartile coefficient of dispersion is:

$$\frac{Q_3 - Q_1}{Q_3 + Q_1}.$$

The Reference Costs schedules routinely published the upper and lower quartile costs for all settings and so the Coefficient of Dispersion (CD) could be readily calculated.

However, CD for length of stay data could also be calculated from Hospital Episode Statistics (HES) or Secondary Uses Service (SUS) monthly freeze data. This would be more useful, as running the same year's data through different Groupers would remove any 'noise' from differences in the underlying data, enabling robust comparison of the design alone, between years.

Data Variation Index

The Data Variation Index (DVI) for a provider of the format below, describes an average of the absolute percentage deviations for each individual HRG from the national average for that HRG.

$$DVI = \frac{\sum_{i=1}^{n}\left(\frac{|R_i - A_i|}{A_i} * 100\right)}{n}$$

Where R_i is the provider average cost for HRG i
A_i is the national average cost for HRG i
And i is the list of n total HRGs

This aims to describe the provider's difference relative to the mean.
Lower DVIs at provider-level might imply better-defined costs. A systematic decrease in all DVIs across all Trusts may be expected, as well as more homogenous DVIs within groups of 'similar' Trusts.

While this is a relatively simple calculation, it has the drawback of providing a headline figure only. This measure would also be strongly influenced by data such as extreme outliers that may lead to an inflated mean cost if they are not excluded from calculations.