

chapter twelve

England: The Healthcare Resource Group system

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12.1 Hospital services and the role of DRGs

12.1.1 The English health care system

The United Kingdom spends about 8 per cent of its gross domestic product (GDP) on health, and 87 per cent of expenditure comes from the public sector (Hawe, 2009). The National Health Service (NHS) is funded by general taxation (80.3 per cent), national insurance contributions (18.4 per cent) and patients' out-of-pocket payments for prescriptions, dental and optometry services (1.3 per cent). Private expenditure constitutes about 13 per cent of total health care expenditure, which is lower than the average (23 per cent) for the countries belonging to the European Union prior to May 2004 (EU15) (Hawe, 2009).

In England, the Department of Health has overall responsibility for the NHS and is under the direction of a politician – the Secretary of State for Health. In 2010, 10 Strategic Health Authorities managed the local NHS, overseeing provision, capacity and quality on behalf of the Secretary of State. Special health authorities, such as the National Blood Authority and the National Institute for Health and Clinical Excellence (NICE), provided national services for the English NHS.

Most NHS services are delivered by public providers. In the primary care sector, general practitioners (GPs) typically work in group practices. Although their income originates from public funds, GPs are effectively self-employed and their practices employ nurses, health visitors and administrative staff. The GP contract was revised in 2004 and pays GPs for the provision of basic services, as well as rewarding GP practices for the achievement of specific 'quality' targets. Some practices also act as purchasers ('Practice-based Commissioners').

In secondary care, hospitals are grouped into legal bodies known as NHS Trusts. These are mostly acute trusts (168) but there are also 73 mental health trusts. These trusts cover around 1600 hospitals and specialist centres.² There are also 10 ‘care trusts’ that provide health and social care, and 12 ambulance trusts, which provide emergency and non-emergency patient transport.

12.1.2 Hospital services in England

The number of NHS hospital beds by provider type available in England in 2008/2009 is summarized in Table 12.1. Statistics on the number of beds available in the private sector are not available at a national level.

Acute trusts provide elective and non-elective care, surgical and diagnostic procedures, Accident & Emergency (A&E) services, and some maternity services. Inpatient and outpatient psychiatric services are mostly provided by mental health trusts. Some NHS patients are treated in Independent Sector Treatment Centres, although this amounts to less than 1.5 per cent of elective care patients (Mason et al., 2009).

In 2010, most NHS hospital care was purchased by 152 Primary Care Trusts (PCTs), each of which covered populations of between 300 000 and 350 000 individuals. PCTs can purchase elective services from any hospital or treatment centre in England, including private providers. For services covered by the prospective payment system, known as ‘Payment by Results’ (PbR), PCTs pay hospitals a fixed price (tariff) for each patient treated. For services not covered by PbR, such as mental health care and high-cost pharmaceuticals, volume-based contracts are agreed between PCTs and hospitals and prices are negotiated locally.

Information on English NHS hospital services originates from two main databases; in both, data relate to a financial year which ends on the last day of the month of March. First, the Hospital Episode Statistics (HES) database comprises activity data, including individual patient records for all inpatient

Table 12.1 Average daily number of available and occupied beds, 2008/2009

| <i>Sector</i> | <i>Available beds (share (%))</i> | <i>Occupied beds (share (%))</i> | <i>Occupancy (%)</i> |
|---------------------------------------|---------------------------------------|--------------------------------------|----------------------|
| All ward types | 160 254 | 136 860 | 85.4 |
| General and acute (acute + geriatric) | 122 538 | 106 142 | 86.6 |
| – Acute | 101 520 | 86 779 | 85.6 |
| – Geriatric | 21 018 | 19 363 | 92.1 |
| Mental illness | 26 448 | 22 793 | 86.2 |
| Learning disabilities | 2 882 | 2 393 | 83.0 |
| Maternity | 8 386 | 5 532 | 66.0 |
| <i>NHS organizations</i> | | | |
| Acute trusts | 121 448 (76) | 103 407 (76) | 85 |
| Mental health trusts | 29 512 (18) | 25 465 (19) | 86 |
| PCTs | 8 737 (5.0) | 7 492 (5.0) | 86 |
| Care trusts | 116 (0.1) | 92 (0.1) | 80 |

Source: Department of Health, 2009a.

admissions, outpatient appointments and A&E attendances. England is unusual in that the recording 'unit' in the HES refers to the time spent under the care of each consultant during the hospital stay. However, these records can be linked to construct a 'provider spell', which corresponds to the usual measure of an inpatient stay, defined as the period between admission and discharge. Second, the NHS Reference Cost database contains provider costs for inpatient spells, outpatient and A&E attendances, psychiatric care, and critical care amongst other specialist services. Reference costs are used as the basis for the PbR tariff (Street & Maynard, 2007b).

Healthcare Resource Groups (HRGs), an English version of diagnosis-related groups (DRGs) are the unit of analysis both for activity and cost. The main focus of this chapter is on HRGs, the classification system used to describe patients admitted to hospital. We outline their development and construction; the uses to which they have been put; how costs are calculated for each HRG; and the use of HRGs for reimbursement. Recent years have also seen the development of classification systems for patients treated in other hospital settings – notably outpatient and A&E departments – and these are addressed briefly.

12.1.3 Purpose of the DRG system

In most countries, the purpose of the DRG system has evolved from benchmarking to reimbursement. The evolution has been similar in England and by the mid-1990s HRGs were being used for three main purposes (Sanderson, 1995).

First, HRGs were used for benchmarking, providing the basis for comparative performance assessment. The (then) National Casemix Office constructed an interactive national database that hospitals could use to assess the average length of stay for their patients compared to the national average or compared to a selective set of hospitals for each HRG. The database could also be used to identify patients with excessive lengths of stay (so-called 'outliers') and to produce specialty-level and hospital-level comparisons.

Second, hospitals were encouraged to use HRGs to assist with internal resource management. HRGs were used to assess the budgetary impact of anticipated changes in the volume and casemix of patients within specialties or clinical directorates, as well as to monitor actual versus expected expenditure.

Third, HRGs were used to inform the contracting process. In the 1990s, hospitals received their income via three main types of contractual arrangement. Block contracts specified payment for a fixed volume of activity; cost-and-volume contracts allowed for payments to be withheld (or made) if volumes fell below (or surpassed) expectations; and cost-per-case contracts involved patient-specific payments. Originally, contracts distinguished patients according to the specialty in which they were treated but, from 1994 onward, increasingly more contracts were specified using HRGs. This required hospitals to undertake HRG-level costing, applying a standardized method of cost allocation (see section 12.4).

In 1997, the incoming Labour Government announced that they would be developing a national schedule of 'reference costs' itemizing the cost of HRGs across the NHS (NHS Executive, 1997). It was intended that, by benchmarking costs in a standardized manner, purchasers would be able to identify and address inefficiency. However, the provision of benchmarking information

alone probably did not provide sufficient incentive for hospitals to address cost differentials (Dawson & Street, 2000). In 2002, therefore, the Government published proposals to introduce a prospective payment system, with hospitals receiving a fixed national payment per patient according to the HRG to which they are allocated (Department of Health, 2002). PbR – as these reimbursement arrangements have been called – was introduced for a small number of HRGs in 2003, and coverage has gradually expanded to other HRGs.

12.2 Development and updates of the DRG system

12.2.1 The current DRG system at a glance

All patients admitted to hospital are classified by HRGs, which are clinically similar and resource homogeneous (Anthony, 1993). Allocation is carried out according to which (if any) procedures are received, primary diagnosis, age and level of complications. The current system, known as HRG4 contains about 1400 groups (in 22 ‘chapters’).

Psychiatric inpatient care is not currently covered by HRG4, but the intention is that it will be incorporated in future (Mason & Goddard, 2009). There are also plans to extend the tariff system to a number of other types of care (see subsection 12.8.2). Figure 12.1 provides an overview of HRG4 and Table 12.4 details how HRG4 is used to reimburse inpatient and day-case activity.

Patient-level outpatient activity data have been collected within the HES since 2003/2004 (NHS Information Centre for Health and Social Care, 2009). Attendances are classed by specialty, subdivided by first or subsequent appointment, primary diagnosis, main procedures and interventions, as well as by hospital provider. However, providers are not obliged to submit outpatient data or to code procedures and diagnoses, and data quality is consequently poor (NHS Information Centre for Health and Social Care, 2009). HRGs are used only for outpatient procedures, with other classifications based on specialty. Reimbursement of outpatient activity is not based on HRGs, but differentiated according to whether attendance is a first or follow-up appointment, the number of clinicians seen and by specialty.

Patient-level data on A&E activity were first collected in 2007/2008 and cover attendances at major A&E departments, single-specialty departments, minor injury units and walk-in centres. However, as the submission of records is not mandatory for all providers, the data quality is sometimes poor, as already mentioned in the context of outpatient activity data. In 2009/10 there were 12 tariffs for A&E reimbursement that varied by investigation or procedure cost.

12.2.2 Development of the DRG system

Development of an English version of DRGs first commenced in 1981 when the Department of Health funded a research project to assess the ability of the contemporary version of DRGs in the United States to explain variation in the length of stay of English patients (Coles, 1993). Further research eventually led

to the development of the United Kingdom's own categorization system of HRGs, launched in 1991. While DRGs were based on major diagnostic categories (MDCs) that correspond to a single organ system, HRGs were (and remain) more directly related to specialties. They also differ from (historical) DRGs in using local procedure codes, developed by the Office of Population Censuses and Surveys (OPCS), in addition to the International Classification of Diseases (ICD) codes for diagnoses.

As shown in Table 12.2, the first version comprised 534 categories (including 12 undefined categories) but did not cover all acute activity, lacking groups for psychiatry, radiotherapy and oncology (Anthony, 1993). HRG version 2 was released in 1994, with a reduction in the number of categories to 533, including 6 undefined ('U') groups, but also including psychiatric HRGs. Further refinements led to the release of HRG3.1 in 1997, comprising 572 groups and including chemotherapy (Benton et al., 1998). This version remained in use for a number of years, becoming the basis for the reporting and benchmarking of hospital 'reference' cost data (Street & Dawson, 2002). A less-dramatic revision appeared with the release of HRG3.5 in 2003, expanding the number of groups to 610. It was this version that was in place when the Government started to use HRGs explicitly for reimbursement purposes, with the phased introduction of PbR (Department of Health, 2002), which commenced in 2003/2004.

The HRG4 design represents a major development from HRG3.5, and uses ICD-10 (10th revision) diagnoses and OPCS-4.5 procedure codes. It was first used in the 2006/2007 reference cost collection exercise and replaced HRG3.5 as the basis for reimbursement in 2009/2010 (Information Standards Board for Health and Social Care, 2009). HRG4 is designed to evolve year on year, so the number of categories is not constant, containing approximately 1400 groups, only one of which is an undefined category.

HRG4 differs from the previous version in various respects (NHS Information Centre for Health and Social Care, 2008a), as detailed here.

1. HRG3.5 covered only inpatient and day-case activity, but HRG4 covers non-admitted (outpatient) care, emergency medicine and some specialty areas not covered by HRG3.5, such as critical care (NHS Health and Social Care, 2008a).
2. Under HRG3.5, each episode of care generated a single HRG and all elements of treatment were subsumed under this base- (core) HRG. Under HRG4, some (high-cost) elements of treatment are separated from the base-HRG, generating unbundled HRGs that can be reimbursed as additions to base-HRGs. Therefore, one patient can have several HRGs. To qualify for unbundling, there must be at least 600 cases expected annually, or the total annual cost must be at least £1.5 million.
3. HRG4 refines the classification of complications and co-morbidities (CCs) to better reflect variations in severity.
4. This latest version also provides spell-based HRGs that cover the whole stay from admission to discharge (including one or more episodes) to make reimbursement 'fairer'.

Table 12.2 and Figure 12.1 provide an overview of the evolution of the English DRG system.

202 Diagnosis-Related Groups in Europe

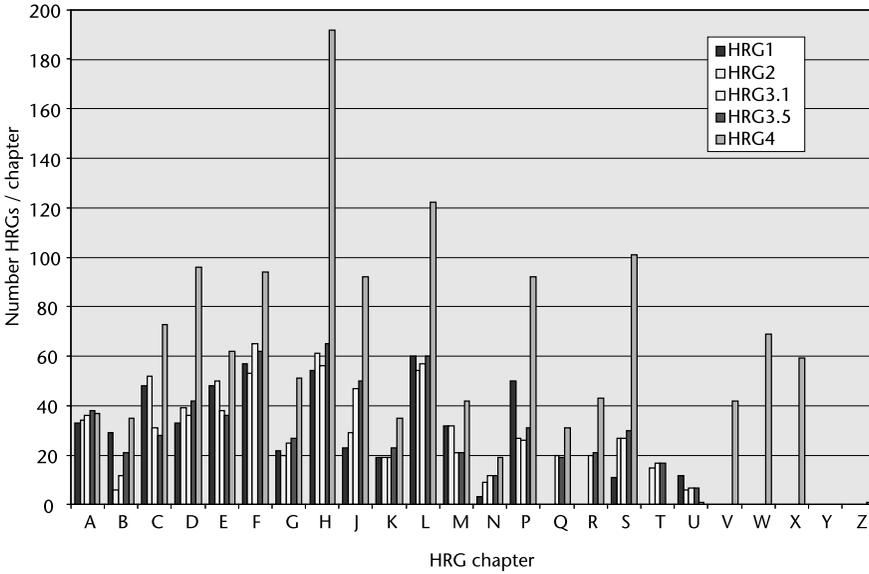


Figure 12.1 Overview of previous and current DRG systems

Sources: Anthony, 2993; Sanderson et al., 1995; NHS Information Centre for Health and Social Care, 2006a, b, 2008b.

Notes:

| HRG4 CHAPTERS DEFINITIONS | | | |
|----------------------------------|--|---|---|
| A | Nervous system | N | Obstetrics |
| B | Eyes and periorbita | P | Diseases of childhood and neonates |
| C | Mouth, head, neck and ears | Q | Vascular system |
| D | Respiratory system | R | Diagnostic imaging and interventional radiology |
| E | Cardiac surgery and primary cardiac condition | S | Haematology, chemotherapy, radiotherapy and specialist palliative care |
| F | Digestive system | T | Reserved for mental health currencies |
| G | Hepatobiliary and pancreatic system | U | Undefined groups |
| H | Musculoskeletal system | V | Multiple trauma, emergency and urgent care, and rehabilitation |
| J | Skin, breast and burns | W | Immunology, infectious diseases and other contacts with health services |
| K | Endocrine and metabolic system | X | Critical care, high-cost drugs and devices |
| L | Urinary tract and male reproductive system | Y | Empty |
| M | Female reproductive system and assisted reproduction | Z | Unbundled |

Table 12.2 Evolution of the English DRG system

| | <i>1st DRG version</i> | <i>2nd DRG version</i> | <i>3rd DRG version</i> | <i>4th DRG version</i> | <i>5th DRG version</i> |
|----------------------------------|----------------------------------|----------------------------|--|--|--|
| Date of introduction | May 1992 | August 1994 | June 1997 | October 2003 | In transition ^a |
| (Main) Purpose | Patient classification | Patient classification | Patient classification | Patient classification | Patient classification |
| DRG system | HRG1 | HRG2 | HRG3.1 | HRG3.5 | HRG4 |
| Data used for development | Adaptation of United States DRGs | Data analysis of groupings | Clinical review to refine for ICD-10. Statistical analysis | Clinical Working Groups refined categories. Statistical analysis | Expert working groups' micro-costing data |
| Number of DRGs Applied to | 534 Public hospitals | 533 Public hospitals | 572 Public hospitals | 610 Public hospitals / private hospitals or treatment centres treating NHS patients | 1389 Public hospitals / private hospitals or treatment centres treating NHS patients Acute admissions Outpatients |

^a The version shown is for 2007/2008.

In evaluating alternative arrangements for the classification architecture, performance has always been judged by considering reductions in variance in length of stay, this being the primary definition of ‘resource’ for grouping purposes. This reflects the fact that patient-level cost data are not available in England (see section 12.4).

12.3 The current patient classification system

12.3.1 Information used to classify patients

HRGs are standard groupings of clinically similar treatments that use comparable levels of health care resources (NHS Information Centre for Health and Social Care, 2007a). Developed under the auspices of 33 Clinical Working Groups, HRG4 was devised by clinicians, finance specialists, statisticians, health economists, users, as well as the PbR (reimbursement) team and casemix experts.

HRG4 uses a five-character code structure (AANNA). The first two characters represent the chapter/sub-chapter (for example, *BZ* = Eyes and Periorbita Procedures and Disorders). The next two numeric characters represent the HRG number within the chapter (for example, *BZ06A* = Oculoplastics category 2: 19 years and over). The final character (*BZ06A*) signifies the ‘split’ level applicable to the episode (for example, an age split or a severity split). In general, ‘A’ codes signify greater resource use than ‘B’ codes, which in turn signify greater resource use than ‘C’ codes. An HRG ending with Z indicates that no splits are applied to that HRG. Episodes that cannot be grouped because of data insufficiency or data validation issues are allocated to an ‘uncoded’ HRG (for example, *UZ01Z*).

Of the 1390 HRGs within HRG4 (2007/2008 version), 511 are not adjusted by age, gender or any other modifier. Patients are classified within HRGs based on clinical data (diagnoses (ICD-10), procedures (OPCS) and severity (presence and level of CCs)); demographic data (age, gender); and resource use (length of stay). HRGs are not defined by patient weight or by disease stage.

HRG4 uses the latest procedure codes (currently OPCS-4.5) to ensure better specificity of grouping than OPCS-4.2/HRG3.5. The OPCS-4 classification, which was fully implemented across the NHS in 1990, is based on a statistical classification of surgical operations first introduced in the United Kingdom in 1944. The OPCS system is updated annually to reflect modern clinical practice (NHS Information Centre for Health and Social Care, 2007a). HRG4 uses an improved mapping of CCs that modifies HRG assignment to reflect the additional cost of more complex cases. For many HRGs there are three splits to reflect the scale of complexity: ‘Without CC’, ‘Intermediate CC’ and ‘Major CC’. Where no relevant secondary diagnoses are recorded, the activity will group to the ‘Without CC’ variant of the relevant HRG, designed to be the lowest resource use category.

12.3.2 Classification algorithm

Clinical Working Groups make judgements on resource homogeneity within HRGs, which are tested on patient-level data. The principal data source is the HES database. The HES comprises individual patient records and all NHS trusts

in England routinely provide HES data for every inpatient and day-case patient they treat, so the full dataset comprises about 15 million records each year. Each patient record includes a number of variables containing demographic data (such as age, gender); clinical information (such as diagnosis, procedures performed); type of admission (such as elective, non-elective, day case); and length of stay, which is used as a primary measure of resource use.

A variety of statistical techniques are employed to assist in the optimal design of groupings and to measure statistical coherence. The main analytical approach to the design of HRGs employs Classification and Regression Trees (CARTs) (NHS Information Centre for Health and Social Care, 2007a). This is a non-parametric analysis technique that makes no assumptions about the underlying distribution of values of the predictor variables (length of stay). Thus, CARTs can handle numerical data that are highly skewed. CARTs will use variables contained in the HES, such as procedures, diagnoses, age and so on, to identify HRGs that best differentiate between cases with long or short lengths of stay. These CART analyses are undertaken to support the Clinical Working Groups whenever there is a major review of the HRG system.

Patients are grouped to a single HRG on the basis of several data elements. If these data are missing or invalid, the patient is allocated to an 'uncoded' HRG (UZ01Z). The stages of the algorithm are shown in Figure 12.2 and described in more detail in the remainder of the chapter.

Unbundling is the first step in the grouping process (NHS Information Centre for Health and Social Care, 2007b). Unbundled activity is identified and removed as separate 'unbundled' HRGs (see Figure 12.3). The grouper then ignores these unbundled components when deriving the core HRG for an episode or spell.

Second, a new mechanism has been defined to identify high-resource, complex treatments associated with *multiple trauma* sites. This dominates all other procedure hierarchies and so follows the unbundling step shown at the top of Figure 12.2.

The third step in the grouping process concerns *procedures*. In HRG4, procedures are ranked using a hierarchy based on cost data and clinical knowledge. When several procedures are recorded, a procedure hierarchy list is used to decide which procedure is dominant and should be used to assign the HRG. The procedure hierarchy used for HRG version 3.5 has been extensively updated for HRG4 and now contains 11 bands (from 2 (lowest resource use) to 12 (highest resource use)). In addition, Band 0 identifies procedures that are not valid for HRG assignment (for example, site-of-operation codes) and Band 1 identifies minimal resource-use codes for non-operative procedures (such as injections). If procedures are planned but not carried out, patients are allocated to a bespoke HRG (WA14).

If no procedure is recorded, HRG is assigned by the primary *diagnosis*. This includes respite or convalescent stays, and mental health diagnoses treated by providers not strictly in the mental health care sector. In the 2009 version of HRG4, there are just three mental health HRGs that are differentiated only by age group.

CC splits are a way of incorporating variations in severity and complexity within HRGs. Lists of CC splits are specific to each HRG chapter and are particularly important for the medical HRGs (as these are driven by primary

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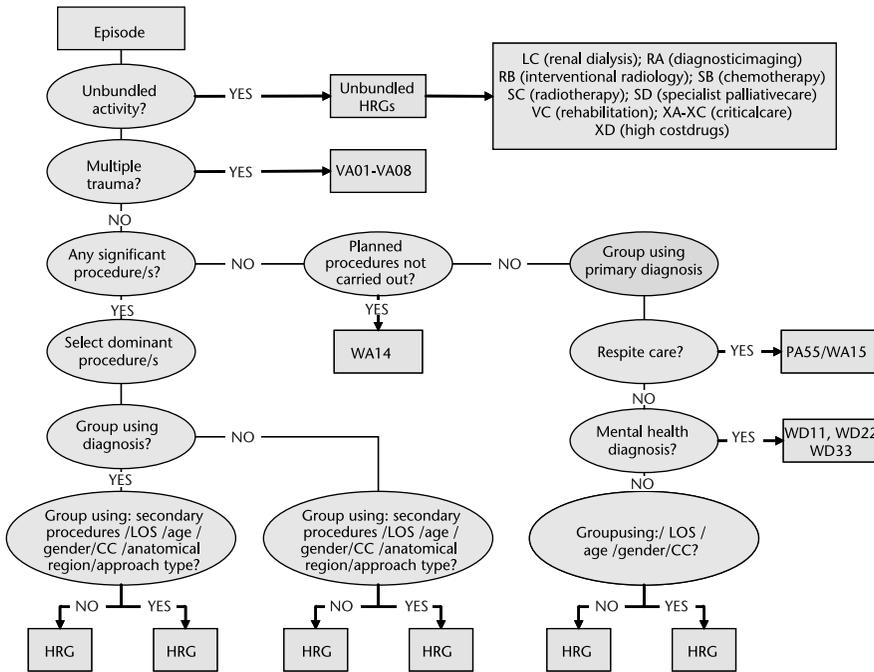


Figure 12.2 HRG4 – Classification flow chart for inpatients

Sources: Dawson & Street, 1998; NHS Information Centre for Health and Social Care, 2007a, b, 2008a.

diagnosis). However, secondary diagnoses can be considered as CCs for both surgical and medical episodes. Depending on their explanatory power in terms of explaining cost variation, some HRGs are also split by secondary procedures, age, gender, length of stay, anatomical region (for digestive system diagnoses or procedures) or approach type (for example, laparoscopic surgery).

12.3.3 Data quality and plausibility checks

HRG4 is updated annually to meet clinical and costing requirements. Continuing formal engagement with clinicians is ensured through the Expert Working Groups and the Clinical Advisory Panel.

Since 2006, all acute trusts in England have received an external clinical coding audit by the Audit Commission, an independent public body responsible for ensuring value for money in the public sector (Audit Commission, 2006). The audit process involves comparing a random sample of patients' case notes with the trust's actual coding (Audit Commission, 2010). The Audit Commission assesses coding accuracy and adherence to national standards for coding and data definitions. An online national benchmarking tool is available to PCTs and trusts so that organizations can compare their performance and identify areas for further investigation.

| Unbundled activity | HRG Chapter | Examples |
|----------------------------|-------------|--|
| Renal dialysis | LC | LC01A Haemodialysis/filtration on patient with Hepatitis B 19 years and over |
| | | LC03A Peritoneal dialysis on patient with Hepatitis B 19 years and over |
| | | LC04B Peritoneal dialysis, 18 years and under |
| Diagnostic imaging | RA | RA01Z MRI scan, one area, no contrast |
| | | RA08Z CT scan, one area, no contrast |
| | | RA24Z Ultrasound scan more than 20 minutes |
| Interventional radiology | RB | RB01Z Interventional radiology – category 10 |
| | | RB02Z Interventional radiology – category 9 |
| | | RB03Z Interventional radiology – category 8 |
| Chemotherapy | SB | SB01Z Procure chemotherapy drugs for regimens in Band 1 |
| | | SB11Z Deliver exclusively Oral Chemotherapy |
| | | SB15Z Deliver subsequent elements of a chemotherapy cycle |
| Radiotherapy | SC | SC01Z Define volume for SXR, DXR, electron or Megavoltage radiotherapy without imaging and with simple calculation |
| | | SC09Z Prepare for interstitial radiotherapy |
| | | SC29Z Other radiotherapy treatment |
| Specialist palliative care | SD | SD01A Inpatient specialist palliative care, 19 years and over |
| | | SD03A Hospital specialist palliative care support, 19 years and over |
| | | SD05B Non-medical specialist palliative care attendance, 18 years and under |
| Rehabilitation | VC | VC01Z Assessment for rehabilitation (unidisciplinary) |
| | | VC18Z Rehabilitation for joint replacement (without treatment episode) |
| | | VC42Z Rehabilitation for other disorders (without treatment episode) |
| Critical care (neonatal) | XA | XA01Z Neonatal critical care intensive care |
| | | XA03Z Neonatal critical care special care without external carer |
| | | XA06Z Neonatal critical care transportation |
| Critical care (paediatric) | XB | XB01Z Paediatric critical care intensive care – ECMO/ECLS |
| | | XB04Z Paediatric Critical Care Intensive Care Basic Enhanced |
| | | XB08Z Paediatric critical care transportation |
| Critical care (adult) | XC | XC01Z Adult critical care – 6 organs supported |
| | | XC04Z Adult critical care – 3 organs supported |
| | | XC07Z Adult critical care – 0 organs supported |
| High-cost drugs | XD | XD01Z Primary pulmonary hypertension drugs band 1 |
| | | XD18Z Bone metabolism drugs band 1 |
| | | XD38Z Antiviral drugs band 1 |

Figure 12.3 Unbundled activity: Components for unbundled HRGs

Source: Information Centre for Health and Social Care, 2007b.

Notes: ECMO: extracorporeal membrane oxygenation; ECLS: extracorporeal life support.

12.4 Cost accounting within hospitals

12.4.1 Regulation

The *NHS Costing Manual* sets out the mandatory practice of costing to be applied in NHS hospitals (Department of Health, 2009b). Introduced in 1999,

it brings a degree of consistency to the production and collection of cost information.

The Clinical Costing Standards Association of England (CCSAE), a working group of costing experts was established to develop clinical costing standards for the acute care sector, while also supporting the implementation of Patient-Level Information and Costing Systems (PLICS) within the NHS. The implementation of PLICS is currently not mandatory.

12.4.2 Main characteristics of the cost-accounting system(s)

All NHS hospitals are required to report their activity and unit costs annually to the Department of Health (Department of Health, 2009b). Unit costs reflect the full cost of provision and include all operating expenses, staff costs and capital costs (both interest and principal), but exclude the costs of teaching and research. Total costs are reconciled to the financial costs of the provider for the previous financial year.

As data on itemized resource use by individual patients are not collected in England, costs are estimated using a top-down approach. Figure 12.4 illustrates the initial and Figure 12.5 the latter stages of this costing exercise (Department of Health, 2009b). The starting point for the costing process is the general ledger. Here, total costs or 'high-level control totals' are established. Costs are calculated on a full absorption basis; that is, all costs are allocated to the services delivered. These costs are allocated and apportioned by maximizing direct charging and, where this is not possible, using standard methods of apportionment matched to the services that generate them.

Aggregate costing figures are then divided into one of three cost categories – direct (D), indirect (I) and overhead (O) costs. Direct costs are those which can be directly attributed to the service(s) that generated them. For instance, the type and amount of nursing staff working in a particular specialty can be estimated with reasonable precision. Costs that cannot be attributed directly must be apportioned by other means. Indirect and overhead costs are pooled in order to do this. These 'cost pools' bring together costs into identifiable groups (for example, wards, pharmacies, theatres) and allow them to be apportioned to the relevant services. Each type of cost pool can be identified as being fixed, semi-fixed or variable. The pooling of costs allows for the calculation of units of activity (for fixed and semi-fixed pools) and time (for variable pools). Within each costing pool, key cost drivers are established. These may include length of stay for time-based ward costs, or event-based costs, such as the number of prostheses used.

For all services not directly attributed to patients, the high-level control totals are analysed by setting, indicating whether the patient was treated as a day case or as an inpatient (elective or non-elective), whether (s)he underwent an outpatient procedure, or was treated in 'other' settings (Figure 12.5).³ For inpatient and day-case activity, as well as outpatient procedures, costs are further disaggregated into HRGs. To do this, the main HRGs used by the provider are identified within each specialty. These key HRGs should cover at least 80 per cent of cost and activity within each setting. The main conditions

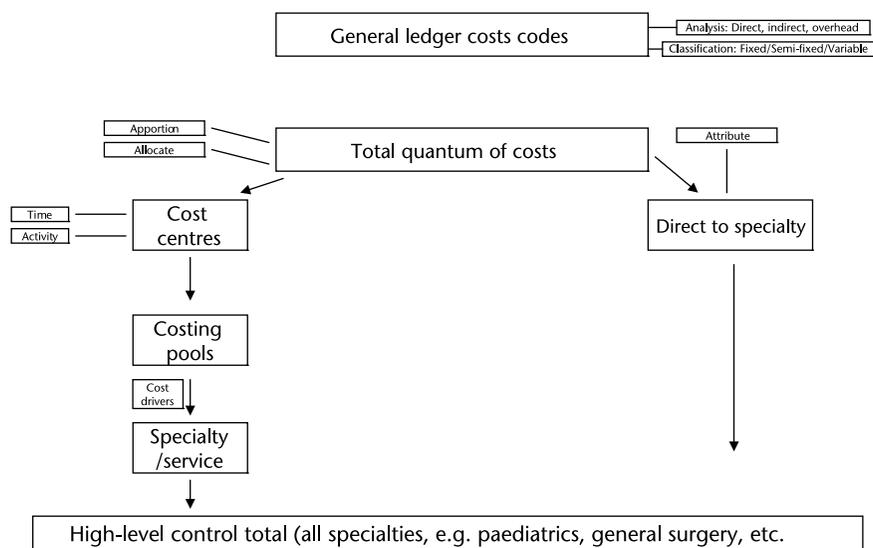


Figure 12.4 English cost-accounting system: Initial stages

Source: Based on Department of Health, 2009b.

or procedures of the provider are then identified within each HRG. A weighted average cost of each HRG is then calculated by:

- multiplying each diagnosis/procedure in a given HRG by the total number of patients for that diagnosis/procedure;
- adding up all the costs of the diagnosis/procedure;
- dividing this total cost by the total number of patients in the HRG.

For each HRG there will be a small number of cases which have an abnormally long length of stay. An upper trim-point is calculated for each HRG: the upper quartile of the length of stay distribution for that HRG plus 1.5 times the interquartile range (Schreyögg et al., 2006). Instead of excluding outlier cases, only excess bed days beyond the upper trim-point are excluded, and a cost per excess bed day is calculated. For clarity, the process of allocating HRGs to elective inpatient activity is illustrated.

The outcome of this cost-allocation process is a cost per HRG ($i=1\dots I$) according to the treatment setting ($j=1\dots 5$) and type of admission. The formula for the cost per HRG in each setting (c_{ij}) is

$$c_{ij} = D_{ij} + \gamma_{ij}I + \phi_{ij}O, \quad i = 1\dots I, \quad j = 1\dots 5 \quad (1)$$

where D_{ij} indicates the direct costs attributable to the HRG, and γ_{ij} and ϕ_{ij} represent, respectively, the shares of indirect and overhead costs attributed to the HRG.

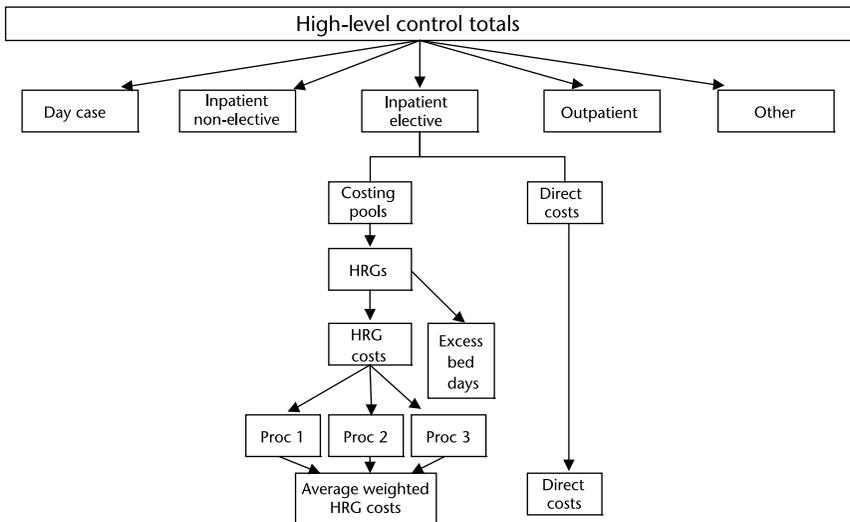


Figure 12.5 English cost-accounting system: Latter stages

Source: Based on Department of Health, 2009b.

12.5 DRGs for hospital payment

12.5.1 Range of services and costs included in DRG-based hospital payments

Phased in since 2003, almost all hospital care in England is reimbursed under the PbR system. PbR tariffs are based on average hospital costs, and include labour, equipment and capital costs. In 2009/2010, HRG4 replaced HRG3.5 as the system underpinning the PbR tariff (with the exception of payment for A&E services). Clinical activity can now be coded more specifically and the increased number of HRGs means that providers can be more fairly reimbursed for the activities they carry out. HRG4 also allows for 'unbundling'. This means that some services now can be priced separately (Figure 12.3).

In 2009/2010, the national PbR tariff was payable for inpatient care (involving admission to hospital), outpatient care and A&E services, and covers almost all hospital activity. Services not covered by PbR included primary care services, community services, mental health services and ambulance services. A full list of exclusions from the tariff is available from the Department of Health web site (Department of Health, 2009c). Although there are no published tariffs for services that are not covered under PbR, prices have been disclosed to support and guide local negotiations (Department of Health, 2009c).

12.5.2 Calculation of DRG prices

The HRG price (tariff) is determined for the year ahead by the Department of Health according to a standard methodology (Department of Health, 2009c).

Details of the tariffs for admitted patients, outpatients and A&E attendances are summarized in Table 12.3. Prices are set based on the average of the costs calculated by all hospitals for each of their HRGs, as detailed earlier in equation 1. The tariff for each HRG and admission type for a given year t , p_{ijt} , is calculated as:

$$p_{ijt} = \pi_i \bar{c}_{ij,t-3} \quad (2)$$

where \bar{c}_{ij} is the average cost for each HRG by admission type across all hospitals. There is a three-year⁴ delay between hospitals submitting cost data and these data being converted into prices, hence the $t - 3$ subscript attached to these average costs. To take account of this delay, an inflationary adjustment π_i is made to each HRG. This adjustment is HRG-specific, allowing for inflationary impacts such as clinical guidance and technology appraisals (issued by NICE) that may have occurred in the intervening period.

12.5.3 DRGs in actual hospital payment

Originally, a single tariff was applied to elective patients treated on a day-case and inpatient basis, to encourage providers to move patients to cheaper day-case settings (Street & Maynard, 2007b). From 2009/2010 the same tariff no longer applies to inpatient and day-case care.

A single PbR tariff applies to all providers regardless of geographical location. However, it is argued there are some costs outside the control of hospitals that mean they face higher-than-average overall costs, irrespective of how efficient they are. Thus, to reflect unavoidable cost variations in factor prices, the Department of Health (DH) makes a payment directly to providers based on a single index known as the Market Forces Factor (MFF). This single MFF index is based on three sub-indices – labour, land and buildings. Labour costs for each hospital are based on local variation in wages in the private sector for analogous service sector jobs. The land index is calculated for each hospital in the NHS using data from the Valuation Office on the NHS estate in 2004, and the building index is based on a rolling average of tender prices for all public and private contracts (Miraldo et al., 2008).

The MFF is adjusted periodically by the Department of Health in order to ensure it relates to current, unavoidable cost variations. In 2009, following a review of the staff component of the MFF by the Advisory Committee on Resource Allocation (ACRA), there were changes to how the MFF index was calculated and how it was paid (Department of Health, 2009c). PCTs now pay the MFF payment to providers at the same time as activity payments, whereas the MFF was previously paid directly by the Department of Health. To smooth the impact of this change on provider income, the new index was capped at plus or minus 2 per cent (Department of Health, 2009c).

The MFF can be represented as a hospital-specific adjustment to the tariff, so that, in effect, the price paid per HRG is unique to each hospital k , with:

$$p_{ijk t} = \delta_{kt} p_{ijt} \quad (3)$$

where δ_{kt} is the MFF adjustment applying to hospital k at time t .

Table 12.3 HRG prices, 2009/2010

| | <i>Admitted patients</i> | <i>Outpatients</i> | <i>A&E</i> |
|--|--|---|--|
| Currency | HRG spell | Attendance by specialty (for procedures: HRGs) | Attendance |
| Structure | <p>Tariffs for:</p> <ul style="list-style-type: none"> • electives • non-electives • planned same-day activity (day cases only in 2009/2010) • short-stay elective • short-stay emergencies | <p>Tariffs for:</p> <ul style="list-style-type: none"> • first attendance • follow-up attendance • multi-professional as well as single professional appointments, for treatment function codes where data are available • Procedures carried out in outpatient setting subject to non-mandatory tariff based on HRGs, with the intention that this activity is covered by the mandatory 'Planned Same Day' tariff in future years • Non-mandatory tariff for outpatient appointments not carried out face to face • Exclusions | <p>Tariffs for:</p> <ul style="list-style-type: none"> • High-cost attendance • Standard attendance • Combined Minor A&E/Minor Injuries Unit attendance |
| Specialized service adjustments | <ul style="list-style-type: none"> • Top-up payment for specialized services for children and orthopaedic activity • Exclusions | | <ul style="list-style-type: none"> • Not applicable |
| Outliers | <ul style="list-style-type: none"> • Long-stay outlier payment triggered at predetermined length of stay (dependent on HRG). Daily rate specific to HRG | <ul style="list-style-type: none"> • No outlier policy | <ul style="list-style-type: none"> • No outlier policy |
| Flexibilities | <ul style="list-style-type: none"> • Unbundling of care pathway subject to local agreement • Local 'pass through' payments for new technology • Emergency readmissions: local arrangements for determining appropriate reimbursement and criteria | <ul style="list-style-type: none"> • Unbundling of care pathway subject to local agreement • Local 'pass through' payments for new technology | <ul style="list-style-type: none"> • Local flexibilities could be applied to support service redesign |

Source: Department of Health, 2009c.

Note: Teaching and research are funded entirely separately, and their costs are not included in PBR.

12.5.4 Quality-related adjustments

Following recommendations in *High-quality care for all* (Darzi & Department of Health, 2008), from 2009/2010 all acute trusts publish 'quality accounts' alongside their financial accounts. The Commissioning for Quality and Innovation (CQUIN) payment framework came into effect in April 2009. It allows PCTs to link a specific, modest proportion of providers' income (agreed nationally) to the achievement of realistic locally agreed goals. In 2009/2010, the CQUIN payment framework covered 0.5 per cent of a provider's annual contract income (Department of Health, 2008), increasing to 1.5 per cent in 2010/2011. CQUIN payments are made at monthly intervals, alongside payment of regular income, and adjusted to reflect achievement against contractual goals. The CQUIN framework applies to all patient-related activity, including activity reimbursed as part of the PbR system.

12.5.5 Main incentives for hospitals

The principal aims of PbR are to increase 'throughput' (activity), reduce waiting times, support patient choice and improve efficiency, as well as increasing patient satisfaction while at the same time keeping costs under control (Miraldo et al., 2006). Because hospitals are given a fixed tariff per HRG for the work they carry out, PbR encourages them to cut costs and reduce lengths of stay, thus freeing up capacity to treat more patients. Increasing activity means that patients are treated more quickly, improving access to health care for patients on waiting lists (Mannion et al., 2008). PbR also facilitates choice by encouraging new providers into the market, increasing competition in the field, and improving the mix of care provided by hospitals (Miraldo et al., 2006).

International empirical evidence suggests that the introduction of a prospective payment system can offer providers perverse incentives to improve their financial position. For example, hospitals can engage in 'DRG drift', up-coding patients to more expensive DRGs and resulting in over-reimbursement.

PbR may encourage providers to 'cream-skim' (select less complicated cases) in order to reduce costs. However, the Audit Commission – which now regularly monitors and audits coding performance in English hospitals – found little evidence of systemic gaming or deliberate up-coding: observed coding errors were associated with both positive and negative financial consequences (Audit Commission, 2008).

12.6 New/innovative technologies

12.6.1 Steps required prior to introduction in hospitals

While adoption decisions for most new technologies are made by individual hospitals, NICE also provides guidance to the NHS on health care technologies, public health and clinical practice. The overall aim is to promote good health and prevent and treat ill health (NICE, 2007).

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NICE assesses selected new and existing medicines. Almost all newly licensed cancer drugs are appraised by NICE before they are made available routinely to patients by the NHS. The appraisal process can introduce significant delays in patient access, partly due to the assessment process, but also because of stakeholder appeals against NICE's preliminary decisions.

Since January 2002, the NHS has been legally obliged to provide funding and resources in England and Wales for medicines and treatments recommended by NICE's technology appraisal process. This means that when NICE recommends a medicine, the NHS must ensure it is publicly available within three months of the guidance being issued. If a new medicine is not recommended by NICE (perhaps because other options are more cost-effective), it should not be provided routinely by the NHS. However, the Richards report recommended that patients be allowed to pay privately for medicines not funded by the NHS, without losing their entitlement to NHS care that they would otherwise receive (Richards, 2008).

12.6.2 Payment mechanisms

'Pass through' payments are used to fund new and innovative technologies. These apply to new devices, drugs, treatments and technologies or a new application of an existing technology. They give the purchaser the flexibility to make additional payments for higher quality care than the standard care covered by the national tariff. Any such arrangement between a provider and purchaser should be fixed for a maximum of three years, and the price should be agreed in advance and be directly related to the additional cost of the new technology.

Some activity, including some high-cost drugs, devices and procedures are excluded from the PbR tariff, such as magnetic resonance imaging (MRI) scans, cochlear implants, orthopaedic prostheses and chemotherapy. Instead, purchasers and providers agree local prices and local arrangements for monitoring activity.

12.6.3 (Dis-)incentives for hospitals to use new technologies

The financial incentive to the provider to innovate depends on the impact on provider costs, and on whether the innovation improves patient outcomes but increases provider costs (Boyle et al., 2007).

If the innovation is cost-saving in nature, there is a clear incentive to adopt it. If the innovation is more expensive and more effective, the provider may be reluctant to adopt the new technology. To address this disincentive, the price under prospective funding must be adjusted to compensate providers for the additional cost. Technology lags also result in higher costs for providers. When new technologies enter the market, the HRG system will not reflect the costs of adopting them, which is why pass-through payments are used. However, creating economic incentives for health care providers to adopt innovative technologies can lead to a sharp rise in expenditure, diverting resources from

other parts of the health system where they might be used to deliver greater health benefits (Schreyögg et al., 2009).

12.7 Evaluation of the DRG system in England

12.7.1 Official evaluation

Since its inception in 2004, various aspects of PbR have been studied, such as the benefits and costs of the policy (Marini & Street, 2006; Miraldo et al., 2006) and its incentives and disincentives (Mannion et al., 2008). The evidence suggests that PbR has generally had a positive impact on hospital activity and efficiency, with no deterioration in the quality of care provided (Table 12.4).

A national evaluation of PbR used mixed methods to assess the effects on hospital behaviour (Farrar et al., 2007). This included the exploration of an appropriate theoretical framework, a series of semi-structured interviews, and an econometric analysis of routine data. The theoretical framework hypothesized that a fixed national tariff would lower unit costs. The interviews revealed positive attitudes toward PbR, despite some scepticism as to whether it would achieve its objectives. The econometric analysis found that unit costs fell with the introduction of PbR, with no adverse effect on the quality of care, suggesting that lower unit costs were the result of efficiency savings. Meanwhile, volume of activity increased, while there was little evidence of a change in coding patterns.

The Audit Commission's evaluation of PbR (Audit Commission, 2008) found broadly similar findings to those of the national evaluation. PbR was associated with increased activity and efficiency in elective care, although PbR itself was not considered to be the principal driver behind these changes. Findings on quality of care were similar to those reported in the national study. The Audit Commission made a number of recommendations on the future development of PbR, including (1) strengthening of the information infrastructure so that providers are more accurately reimbursed for activity carried out; (2) greater flexibility in the national tariff, with a greater scope for unbundling tariff prices into separate components; (3) greater consideration given to the possibility of separate funding streams for capital and quality; and (4) the introduction of some normative tariffs for selected HRGs, whereby the tariff would be based not on average prices but on the costs of higher performing providers (a view also shared by others) (Street & Maynard, 2007a).

12.7.2 Authors' assessment

Despite implementation difficulties (Department of Health & Lawlor, 2006), PbR has been rolled out as the funding mechanism that covers almost all NHS inpatient care in England. Concerns regarding unintended consequences and up-coding have proved largely unfounded and large increases in tariff-funded hospital activity have not materialized. This implies that PbR has not led to widespread financial instability among purchasers (PCTs). This may be because

Table 12.4 Impacts of PbR: Overview of evidence

| | <i>Impact of PbR</i> | <i>Study</i> |
|--|--|-------------------|
| Activity | Proportion of elective care provided as day cases has increased | 2007 ^a |
| | 'PbR has had a positive effect on activity in elective care. Day cases have increased and the LOS for elective inpatients has fallen.' | 2008 ^b |
| | 'Other policies have also encouraged increases in activity. We consider that PbR has at most contributed to these positive trends rather than driven them.' | |
| Unit costs | Unit costs have fallen more quickly where PbR was implemented | 2007 ^a |
| Volume of spells | Both Foundation Trusts and non-Foundation Trusts have increased volumes, although these may be linked to other initiatives, such as waiting-time targets, which have also affected the volume of care provided | 2007 ^a |
| Efficiency | Improved efficiency through reduction in unit costs with no reduction in quality | 2007 ^a |
| Quality | Little change in quality | 2007 ^a |
| | The negative impact on quality which some feared has not materialized | 2008 ^b |
| DRG coding | Very limited evidence of a change in the pattern of coding | 2007 ^a |
| Financial management and information systems | Have encouraged commissioners and providers to strengthen their systems as well as their overall planning | 2008 ^b |
| Administrative costs | Estimated to have increased in both hospital trusts and PCTs | 2006 ^c |

Sources: ^aFarrar et al., 2007; ^bAudit Commission, 2008; ^cMarini & Street, 2006.

PCTs have improved their monitoring of provider activity and performance; some have tried to manage demand by investing in initiatives to reduce avoidable hospital admissions (Audit Commission, 2008). However, they have been less successful at restraining the strong incentives that motivate hospitals to undertake more elective activity (Mannion et al., 2008).

HRG4 – the new classification system underpinning the 2009/2010 tariff – has potential for improving the fairness of the payment system. The role of 'unbundling' has been enhanced, and the increased number of categories and greater separation of patients by different complexity levels should, in principle, help to ensure that payments better reflect casemix differences. However, there is a risk that unbundling could lead to increased pressure on budgets, as activities that were previously paid for by a single tariff are now funded separately.

12.8 Outlook

12.8.1 Trends in hospital service or general care delivery

Historically, there has been a trend toward reduced use of inpatient care and toward treating more patients on a day-case basis or in outpatient departments. The development of HRG4 allows greater scope for ‘unbundling’ elements of care from the base-HRG so that services can be provided in non-inpatient settings where appropriate.

12.8.2 Trends in DRG application/coverage

PbR drives the refinement of HRGs and the development of classification systems in non-hospital settings. The Department of Health has progressively been extending the scope of PbR to cover adult mental health, long-term conditions, preventative services, sexual health, community services, ambulance services and out-of-hours primary care (Department of Health, 2007). In some of these areas, pilot work is under way locally to determine the appropriate units of activity (‘categories’). The NHS reference costs already collect cost data for most of these areas, but local costing exercises are also being carried out to test whether the use of tariffs for these ‘de novo’ categories is feasible, particularly for mental health services (Mason & Goddard, 2009).

Perhaps the most important initiative is the development of ‘best practice’ tariffs for high-volume areas, with significant unexplained variation in quality of clinical practice and clear evidence of what constitutes best practice (Department of Health, 2009d). In 2010, prices for cholecystectomy, fragility hip fracture, cataracts and stroke were based on the most efficient cost rather than average cost. From 2011/2012, best practice tariffs are to be extended to adult renal dialysis, interventional radiology, transient ischaemic attack, and paediatric diabetes (Department of Health, 2011). This means that DRGs have progressed gradually from a means of classifying activity, then to paying for activity, and now to incentivizing quality and better outcomes for patients. This welcome direction of travel represents the next challenge for policy development and evaluation over the coming decade.

12.9 Notes

- 1 The authors thank Martine Bellanger (EHESP) and Alexander Geissler (TUB) for helpful comments on an earlier draft. We are responsible for all remaining errors and omissions.
- 2 More information is available at the NHS Choices web site (<http://www.nhs.uk/NHSEngland/thenhs/about/Pages/nhsstructure.aspx>, accessed 29 June 2011).
- 3 ‘Other’ here refers to all other hospital costs that are not part of day-case, inpatient or outpatient activity. It includes community services, critical care services, A&E medicine, radiotherapy and chemotherapy, renal dialysis, and kidney and bone marrow transplantation, for example.

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