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Introducing Activity-Based Financing: A Review of Experience in Australia, Denmark, Norway and Sweden

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Introducing activity-based financing: a review of experience in Australia, Denmark, Norway and Sweden

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Abstract

We review and evaluate the international literature on activity-based funding of health services, focussing especially on experience in Australia (Victoria), Denmark, Norway and Sweden. In evaluating this literature we summarise the differences and pros and cons of three different funding arrangements, namely cost-based reimbursement, global budgeting and activity-based financing.

The institutional structures of the four jurisdictions that are the main focus of the review are described, and an outline is provided about how activity-based funding has been introduced in each.

We then turn to the mechanics of activity-based funding and discuss in detail how patients are classified, how prices are set and how other services are funded. Although concentrating on the four jurisdictions, we draw on wider international experience to inform this discussion.

We review evidence of the impact of activity-based funding in the four jurisdictions on efficiency, activity rates, waiting times, quality and overall expenditure. Finally we conclude with a brief commentary of some of the challenges that would have to be faced if implementing activity-based funding.

Contents

1. Introduction

Activity-based funding was first introduced in 1982 in the United States to pay for older patients (age>65) under the Medicare programme. Since then activity-based funding has been adopted in countries around the world. .As well as offering country-specific improvements to previous funding arrangements, the adoption of activity-based funding has been so widespread because of three general strengths:

1. Payments are patient-based. Fundamental to activity-based funding is an accurate description of the type of patients treated (casemix). Most countries have developed their own versions of Diagnosis Related Groups (DRGs), the UK variant being Healthcare Resource Groups (HRGs). HRGs provide a much better way of describing and managing hospital activity than the alternatives of considering each and every patient on individual basis or of aggregating patients into specialty groupings. HRGs are best suited to describing patients requiring acute hospital care, where costs are largely determined by diagnosis and procedure. Descriptors of non-acute care are poorly developed, because many factors influence care requirements.

2. Activity-based funding is a form of "yardstick competition", which is designed to stimulate greater efficiency in contexts where competitive pressure is lacking. This requires that prices reflect the costs of efficient providers.

3. Activity-based funding offers greater transparency in the financing of health care, relating provider revenue directly to workload.

Various claims have been made about what activity-based funding might achieve. For instance, the policy documents put out by the English Department of Health relating to Payment by Results list an array of "key" objectives that the funding reform is designed to achieve (Miraldo et al., 2006). These are listed in table 1.1.

Table 1.1: Stated aims of activity-based funding in England

Increase efficiency in the provision of existing levels of activity
Where needed, encourage expansion of activity
Enhance patient choice
Increase patient satisfaction
Reduce waiting lists
Improve quality
Keep costs under control
Channel funding where it is needed
Shift patterns of service provision away from historical patterns
Encourage the development of new, cost-effective treatment pathways
Introduce fairness and transparency in funding providers
Encourage providers to be responsive to patients and purchasers
Source: (Miraldo et al., 2006)

Of course, if activity-based funding was easily able to achieve all of these objectives, no country would be slow in adopting these funding arrangements. It should also be noted that many other policy initiatives cite a similar list of desirable objectives. As such, relying on policy statements to reveal what activity-based funding might achieve might not be that informative.

This paper is structured in five main parts. In the next section we compare three main funding methods: cost-based reimbursement, global budgeting and activity-based financing. In section three, we describe the institutional structures of the four jurisdictions that are the main focus of the review, and outline how activity-based funding has been introduced in each. We turn to the mechanics of activity-based funding in section four, describing how patients are classified, how prices are set and how other services are funded. Although concentrating on the four jurisdictions, we draw on wider international experience to inform this discussion. Section five reviews evidence of the impact of activity-based funding in the four jurisdictions. Finally we conclude with a brief commentary of some of the challenges that would have to be faced if implementing activity-based funding.

2. The objectives of activity-based funding

2.1 Introduction

In this section we compare three main funding methods: cost-based reimbursement, global budgeting and activity-based financing, by formally specifying their formulation. A summary of the main differences across these payment systems is contained in Table 2.1.

Table 2.1: Main differences across hospital payment systems

System	Description of patients	Activity	Price	Basic formulation of revenue function
Cost-based	Individual	Unrestricted	Item of service	$R^C = Q_i \times c_i$
Global budget	Specialty	Target/ historical	Locally agreed	$R^G = \sum_{s=1}^{S} B_s = \sum_{s=1}^{S} \left[\bar{Q}_s \times p_s \right]$
Activity-based	HRG/DRG	Unrestricted	Fixed prospectively	$R^A = Q_j \times \hat{p}_j$

Table 2.2: Summary of terms used in the equations

Symbol	Description
R^C, R^G, R^A	Hospital revenue under, respectively, cost-based reimbursement (*C*), global budgets (*G*) and activity-funding (*A*)
$\mathbf{Z}^C$, $\mathbf{Z}^G$, $\mathbf{Z}^A$	All sources of non-activity related revenue under cost-based reimbursement, global budgets and activity-funding
Q	Activity
$\bar{Q}$	Target activity
i	Individual patient
s	Specialty
j	HRG/DRG
c	Unit cost
B_s	Specialty contract value
p_s	Locally agreed specialty-level price
$\hat{p}_j$	Prospectively fixed HRG-price
α	Proportion of fixed HRG-price paid for additional activity
W	Number of people on the waiting list

2.2 Cost-based or insurance-based reimbursement

Under cost-based reimbursement, payments to hospitals are based on the cost incurred by each individual patient. The main method of cost control is to specify a price list that details the unit payment for each "item of service" - diagnostic tests, specific operations, medication, etc. This means that hospitals have to provide itemised bills for every patient treated, but they have no incentive to limit what they do – the more diagnostic tests they perform, they more they get paid.

Put formally, under cost based reimbursement, hospital revenue (R^C) amounts to the number of patients treated (Q_i) multiplied by the unit cost of treatment (c_i), where *i* indicates a particular patient:

$$R^C = \left[Q_i \times c_i \right] + \mathbf{Z}^C \qquad (1)$$

$\mathbf{Z}^C$ captures all other forms of revenue that hospitals receive, such as for teaching and research. This reimbursement system operated in the United States during the 1960s and 1970s. This fuelled

escalation in health care costs as hospitals engaged in a “medical arms race”, spending ever more on technologies and facilities so as to attract patients, knowing that they would be able to claim the costs back from health insurance companies and Medicare and Medicaid, the public insurance programmes for the elderly and poor.

2.3 Global budgets

Cost control is the key advantage of global budgets arrangements which, in one form or another, have been common in countries with socialised (as opposed to insurance-based) health systems. A fixed payment is agreed in advance for a target level of activity – often (though not necessarily) specified at specialty-level. Figure 2.1 provides an illustration, where a hospital receives a fixed payment $(\bar{R})$ for treating a pre-specified volume of activity $(\bar{Q})$.

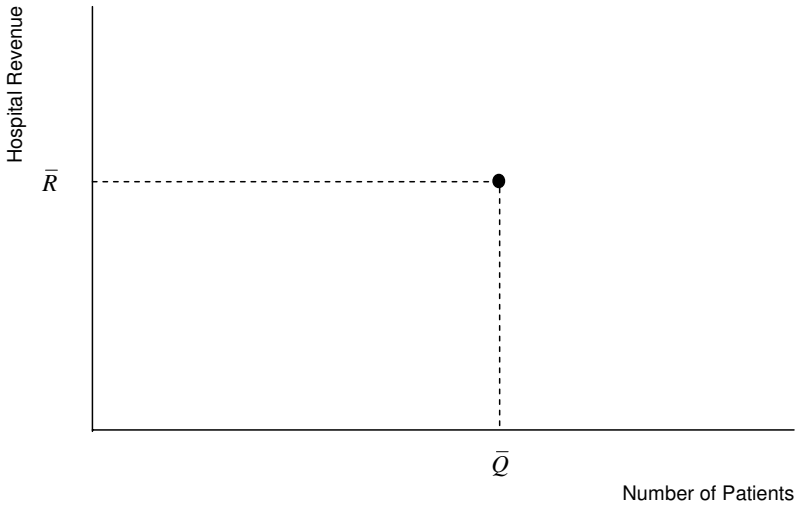


Figure 2.1: Hospital revenue under global budgets

Difficulties arise if there are deviations from the specified volume. Some form of penalty must be imposed if the volume is not achieved. More problematic is how to deal with potential over-performance. Either the funder has to provide extra money when the target volume is exceeded or the hospital will refuse to do extra work, thereby creating waiting lists. (Cost and volume contracts have been developed to deal with these problems, and we return to a form of these shortly.)

Under global budgets in the NHS, it has been usual for arrangements to be made locally (eg between hospitals and local health boards) and to specify activity by specialty. Negotiations between the purchaser and hospital revolve around the monetary value of each specialty-level contract (B_s) and how much activity $(\bar{Q}_s)$ will be provided under this contract (eg the number of patients to be treated in general surgery over the contract period). The local specialty-level price (p_s) is arrived at as the by-product of negotiations about total contract value and the volume of activity. In formal terms, hospital revenue under global budget arrangements amounts to the sum of its contracts across specialties (B_s) and can be specified as:

$$R^G = \sum_{s=1}^{S} B_s + \mathbf{Z}^G = \sum_{s=1}^{S} \left[\bar{Q}_s \times p_s \right] + \mathbf{Z}^G \qquad (2)$$

where $\mathbf{Z}^G$ captures all other forms of revenue that hospitals receive under these funding arrangements.

2.4 Activity-based funding

There are two key features of activity-based funding (ABF). First activity is described using HRGs (or DRGs) rather than specialty. For instance, payment is made for a patient having a hip replacement rather than a patient treated in trauma & orthopaedics. We describe the HRG classification system in section 4.1. Second, the price per HRG is fixed in advance. In many jurisdictions, this fixed price is set nationally rather than locally. We shall describe the price setting process in section 4.3.

We describe three general forms of activity-based funding. Under the most straightforward activity-based payment system, hospital revenue is determined simply by multiplying activity in each HRG (Q_j) by the fixed price per HRG $(\hat{p}_j)$, where *j* indicates HRGs:

$$R^A = \left[Q_j \times \hat{p}_j \right] \tag{3}$$

Under this formulation, hospital revenue increases linearly with activity, as illustrated in figure 2.2. If the hospital treats Q_0 patients it receives revenue amounting to only R_0; if Q_1 patients are treated, revenue increases to R_1. Clearly, then, the revenue consequences of changes in activity are much more transparent than was the case under global budget arrangements.

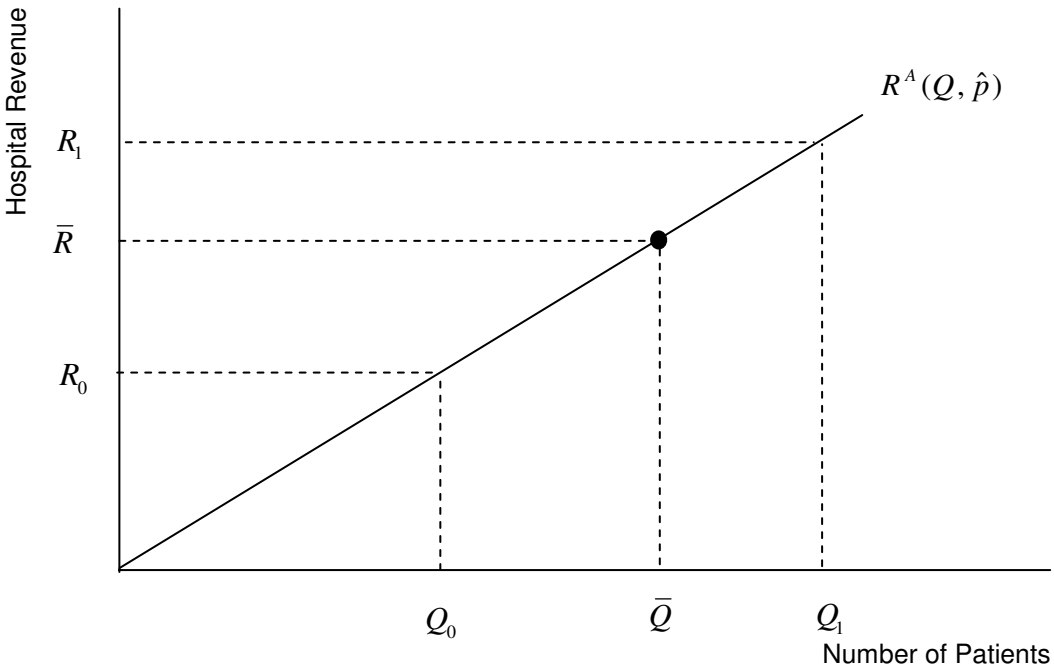


Figure 2.2: Hospital revenue under "pure" activity-based funding

In practice, rarely do countries introduce such a simplistic form of activity-based funding (the exception being the early form of Payment by Results in England for Foundation Trusts). Rather countries adapt this simple formulation in two ways (a) to make payments that are not related to activity levels and (b) in order to accentuate or moderate the revenue incentives associated with different activity levels.

In (almost) all countries that have introduced activity-based funding, hospital revenue is not solely determined by the number of patients treated. Hospitals also receive revenue in other forms – for instance, for teaching and research, to compensate for different locational costs, or to cover some element of the fixed costs of providing services. It has been formally demonstrated that this "mixed" funding system creates better incentives than a system of "pure" activity-based funding (Ellis and McGuire, 1986). The composition of these other revenue forms varies across countries and over time,

as will be described in section 4.4. For the moment, we define $\mathbf{Z}^A$ as capturing all these non-activity related sources of revenue under activity-based funding. Then the revenue function becomes:

$$R^A = \left[Q_j \times \hat{p}_j \right] + \mathbf{Z}^A \qquad (4)$$

Figure 3 shows how this arrangement changes the relationship between revenue and activity. Hospitals receive a fixed amount $\mathbf{Z}^A$ irrespective of the number of patients treated. On top of this, hospitals receive revenue in line with activity – but the unit price ($\hat{p}_j$) will be lower under this "mixed" arrangement than under a "pure" activity-based system. This arrangement has recently been introduced to pay for A&E and minor injuries units in England (Department of Health, 2007).

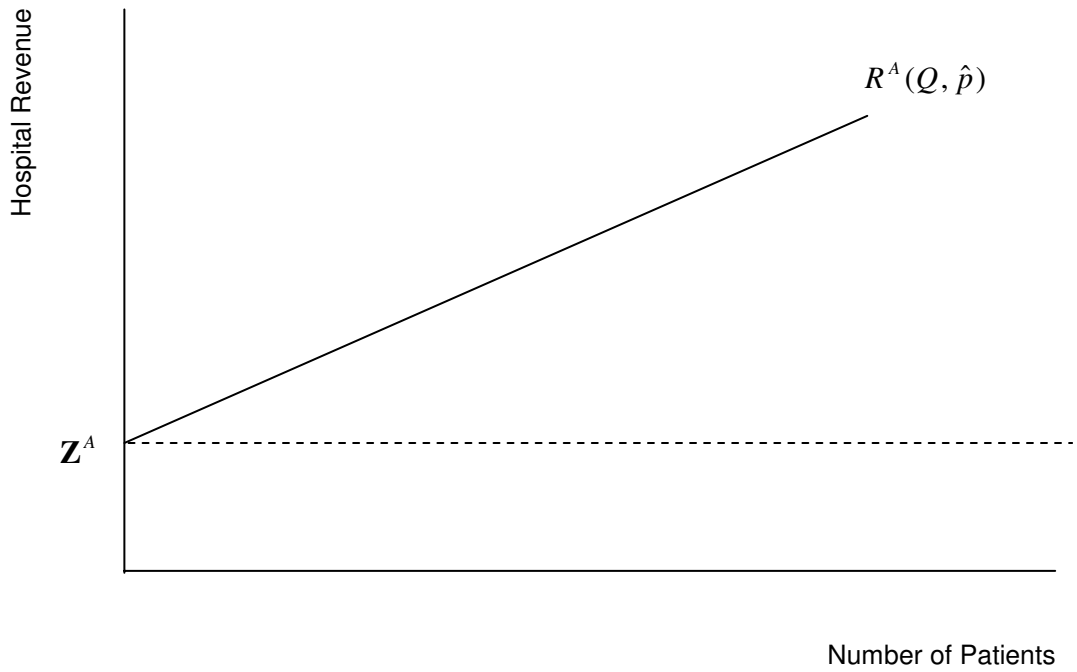


Figure 2.3: Hospital revenue under "mixed" activity-based funding

The final general form of activity-based funding is one that allows incentives to be moderated according to the amount of activity provided. Quite often, policy-makers have introduced activity-based funding in order to stimulate activity beyond existing levels. But there are reasons why they may not wish for "unconstrained" growth in activity. First, they need to maintain control over global expenditure – under the simple formulation (equation 3), expenditure will simply keep rising in line with activity. Second, policy-makers may believe that hospitals are able to expand activity at low "marginal" cost – perhaps because they have under-utilised resources available. If so, there is an argument for reducing the unit price for additional activity.

The resulting arrangements are akin to "cost & volume" contracts – though specified by HRG than by specialty. There are two policy decisions that need to be made if implementing such arrangements. First, a "target" level of activity $(\bar{Q}_j)$ needs to be defined for each hospital. In some countries, this is based on historical activity. This is reasonably straightforward if hospitals receive most of their funding from a single source (as is generally the case in the countries that are the focus of our review) but is more difficult where there is decentralised purchasing, such as in England, because the "target" has to be agreed between each purchaser and provider. Second, a decision must be made about what price should be paid for additional activity beyond the target level – this is usually defined as some proportion (α) of the price up to the target level. Formally the revenue function can be expressed as:

$$R^A = \left[\bar{Q}_j \times \hat{p}_j\right] + \left[\left(Q_j - \bar{Q}_j\right) \times \alpha \hat{p}_j\right] + \mathbf{Z}^A \quad (5)$$

where $\left(Q_j - \bar{Q}_j\right)$ amounts to additional activity above the target and $\alpha \hat{p}_j$ is the price paid per unit of additional activity. If $\alpha = 0.5$, the price for additional activity is 50% of that paid for activity up to the target; if $\alpha = 1$ the same price is paid (in which case equations 4 and 5 are equivalent); if $\alpha = 0$, the price is zero, so there is no incentive for hospitals to undertake more activity; and if $\alpha > 1$ payments are higher than the previous price, which creates very strong incentives to undertake additional work. This may be justified if marginal costs are high, perhaps because resources are already being used at full capacity, so any expansions in activity requires additional investments to be made.

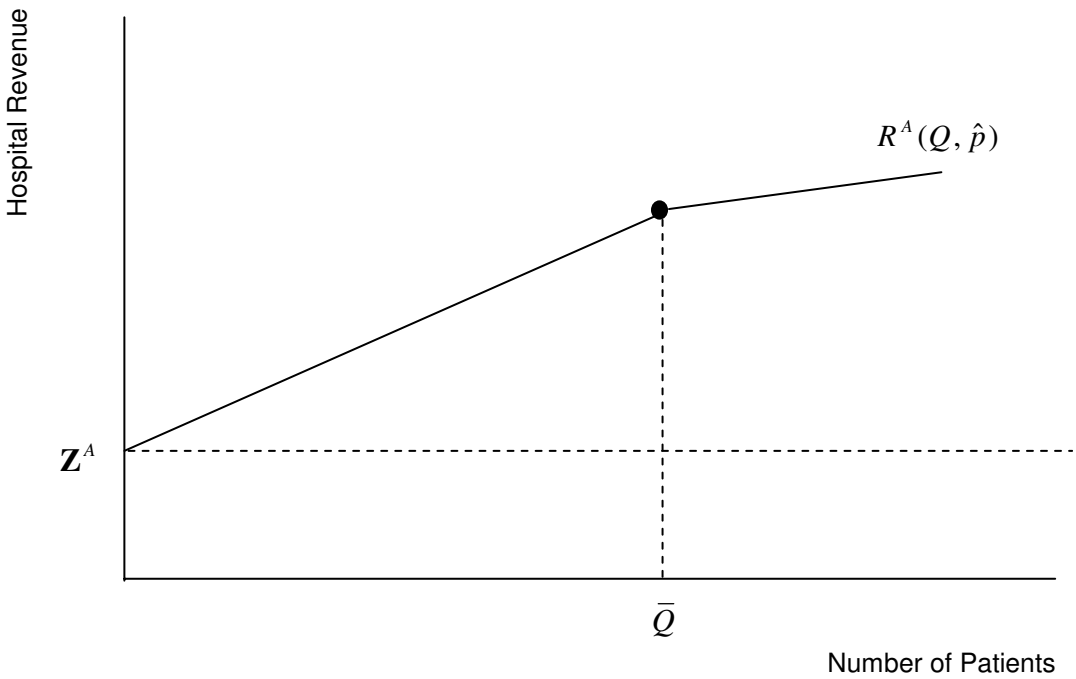


Figure 2.4: Hospital revenue under "mixed" activity-based funding with marginal pricing

Figure 2.4 shows how revenue changes under this arrangement, when the marginal price for additional activity is below the price for activity up to the target ie $0 < \alpha < 1$. This results in a "kinked" revenue function. A slightly more sophisticated version of this formulation was introduced in Australia (Victoria) in the early 1990s, as will be described in section 5.

3. Comparison of main countries in the review

3.1 Introduction

In this section we provide details of the institutional structure of the four jurisdictions that are the main focus of our review, and of the form in which activity-based funding has been introduced in each place. All four jurisdictions are (predominantly) tax-financed health systems, with the majority of health care facilities under public ownership. Summary details of the nature of the nature of the hospital sector, to which activity-based funding applies, are provided in table 3.1.

Table 3.1: Composition of hospital sector

Jurisdiction	Hospital type		
Denmark - 2003	Acute (somatic), of which 5 specialist *k*=52; *i*=21,000	Psychiatric *k*=13; *i*=2,850	
Norway – 2007	Regional hospitals, *k*=5	Central and specialised hospitals *k*=30	Local hospitals *k*=24
Sweden -2007	Regional (specialist) *k*=8	Central (general, with 15-20 specialties, including psychiatry) *k*=20	District with a minimum of 4 specialties (internal medicine, general surgery, radiology, anaesthesiology) *k*=40
Victoria (Australia) - 1994	Teaching and specialist hospitals *k*=16; *i*=27,000	Base hospitals *k*=51, *i*=8,000	Rural/isolated hospitals *k*=75; *i*=1,000
note *k*: number of hospitals; *i*: average number of patients per hospital			

3.2 Australia (Victoria)

3.2.1 Institutional structure

All Australians are guaranteed access to health services through the tax financed Medicare Scheme introduced in 1984. Financial and administrative responsibility for Medicare is shared between the federal (Commonwealth) government and the six state governments, with their separate functions negotiated every five years between the federal and state governments. Although their funding is derived from both federal and state sources, public hospital revenue is allocated directly by state governments. State governments regulate public and private hospitals. In the State of Victoria, public hospital boards are appointed by the Minister of Health, but function relatively autonomously.

In the early 1990s, 25% of all Australians lived in the state of Victoria, which had a population of 4.2 million. The Victorian Department of Health and Community Services (DHCS) had an annual budget of $A4 billion (£1.85 billion), 56% of which was spent on acute hospital services.

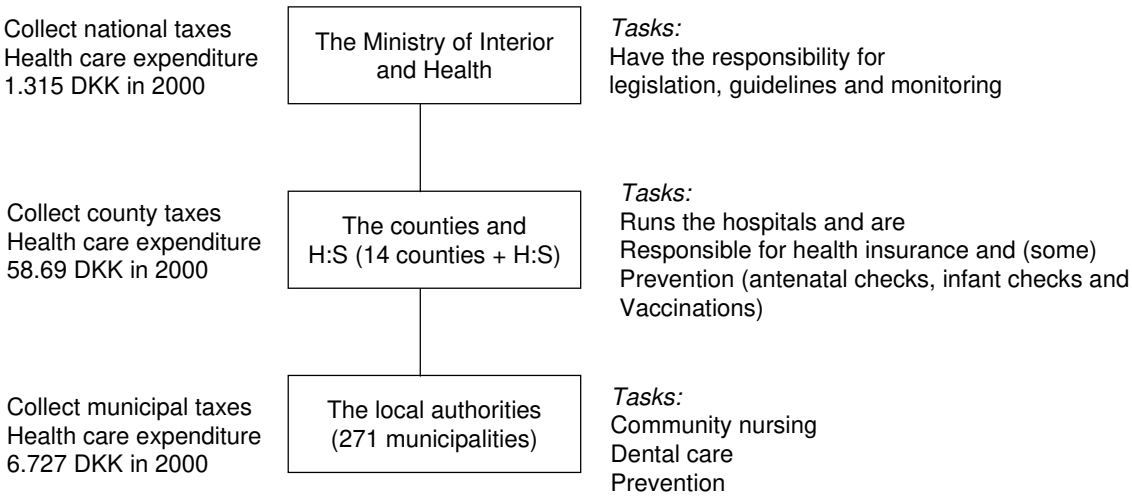
3.2.2 Activity-based funding in Victoria

Activity-based funding ("casemix funding") was introduced in Victoria in July 1993. This replaced funding of public hospitals predominantly on an historical basis (http://www.health.vic.gov.au/casemix/about.htm accessed May 2007). When first introduced activity-based funding accounted for around 25% of hospital revenue. By 2001, this proportion had increased to around 70%. The principles of activity-based funding have also been extended to support rehabilitation patients and outpatient services (Brook, 2007). A detailed description of the funding arrangements is given in section 5.3.

3.3 Denmark

3.3.1 Institutional structure

Health care services in Denmark are public, tax financed and decentralized (Ministry of the Interior and Health, 2000, Ministry of the Interior and Health, 2002b, Vallgårda et al., 2001). The health system (prior to a re-organisation in 2007) is split into three administrative levels as depicted in figure 3.1: the state level, the regional level (14 counties and the municipalities of Copenhagen and Frederiksberg) and the local level (271 municipalities) (Ministry of the Interior and Health, 2002a). Citizens pay state, regional and local taxes, none of which are specifically earmarked to pay for health care services; and each administrative level has control of part of the total health care budget.



Source: (Ministry of the Interior and Health, 2002a)
http://www.im.dk/publikationer/sundhedssektorUK/rapport.pdf accessed May 2007

Figure 3.1: Institutional arrangements in Denmark (prior to 2007)

The counties and the Copenhagen Hospital Cooperation (H:S) are responsible for running hospitals, with H:S managing the hospitals in Copenhagen and Frederiksberg. The counties and H:S are also responsible for services under the Health Care Reimbursement Scheme (public health insurance), including general practitioners, specialists, pharmacies and dentists. The counties and H:S are responsible for individual health care services such as antenatal checks, infant checks and vaccinations. The municipalities are responsible for community nursing, preventive health care services for children and young people and dental care for children and special groups of disabled persons.

Direct user-payments amount to approximately 18% of total health care expenditure, mainly for dentist services and medicine. The GP acts as a gatekeeper to hospital services and visits to most specialists (with the exception of dentists and eye specialists). GP services are free at point of use, as are inpatient and outpatient hospital services. The Public Health Care Reimbursement Scheme pays for all or part of treatment given by specialists and dentists.

Services under the Health Care Reimbursement Scheme are provided by independent professionals such as GPs, specialists, dentists, physiotherapists etc. GPs are paid partly on a capitation basis and partly by fee-for-service. Specialists, dentists, and other professional groups providing services under the reimbursement scheme are all paid on a fee-for-service basis.

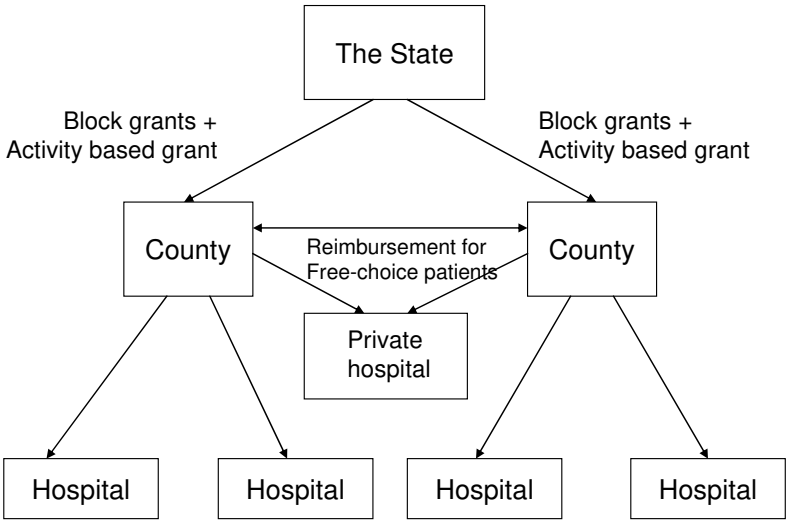
In January 1st 2007 a local government reform was introduced (Ministry of the Interior and Health, 2005b). The number of municipalities has been reduced from 271 to 98. The counties no longer exist,

being replaced by five regions. The regions run the hospitals, but the regional taxes have been abolished. Instead regions are financed partly by the state and partly by the municipalities. Municipalities have taken responsibility for preventive treatment, care and rehabilitation that does not take place in hospitals. The regions and the municipalities will have to enter into binding partnerships (via health coordination committees) to ensure coordination of treatment, rehabilitation, preventive treatment and care.

3.3.2 Activity-based funding in Denmark

Although the health care systems of Sweden, Norway and Denmark share some common features, DRG-development has been very different in each country. In the 1980s and 1990s Danish hospitals were managed by global budgets. In the 1990s the global budgets were gradually supplemented by specific targets, often in relation to specific areas with high priority (surgical procedures with a waiting list). In 2000 activity-based funding was first introduced.

Figure 3.2 depicts the form of financial flows between the state, the counties and the hospitals.



Source: (Ministry of Finance, 2006)

Figure 3.2: Funding arrangements in Denmark (prior to 2007)

Four major initiatives with ABF have been introduced in Denmark over the years, as shown in figure 3.3.

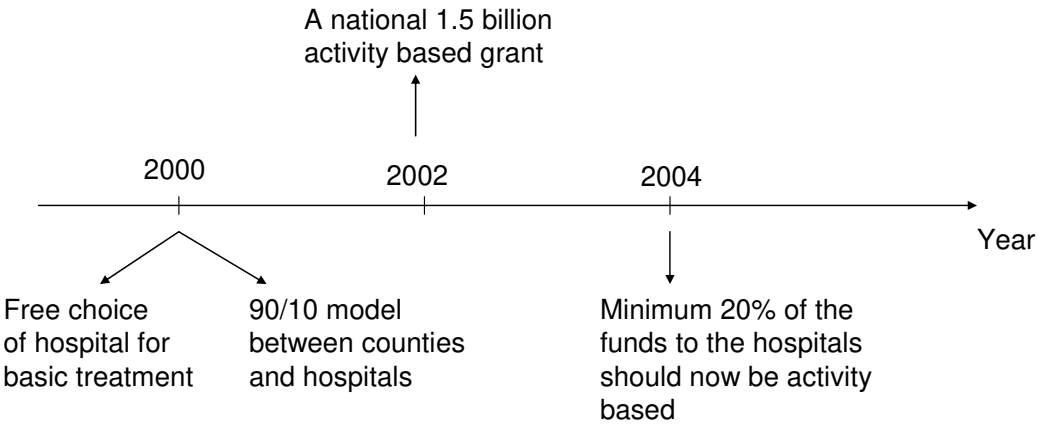


Figure 3.3: Overview of main ABF initiatives in Denmark

The first initiative was introduced in 2000 and it only included the patients who chose to have treatment across county borders (i.e. to have treatment at a hospital outside their residential county) (Ministry of the Interior and Health, 1999, Ministry of the Interior and Health, 2001). In 1993 free choice of hospital for basic treatment (not specialist) was introduced. In 2002 freedom of choice was extended to include patients where the waiting time exceeded two months. These patients were also offered the option of treatment at either a private hospital or a hospital abroad. The costs of these treatments are covered by the counties in which the patients live. The reimbursement of patients choosing a hospital outside their area of residence is 100% of the DRG-price whereas the reimbursement of patients being treated abroad or at private hospitals is based on negotiated prices between the counties and the private hospitals.

In case of specialised treatment across counties, special bed day charges and procedure charges are used. Some counties have negotiated special deals with the specific specialist hospitals. Not all counties have their own specialist hospital and therefore have more patients treated in other counties.

The second initiative was the introduction of the so-called "90/10 model" in 2000 for reimbursement *between the counties and the hospitals* (Ministry of the Interior and Health, 2001). This model combined the global budgets (90%) with activity-based financing (10%). The objective was to create incentives for increased activity and enhanced efficiency. It was up to the counties as to how they would implement the initiative. Only activity above a negotiated target volume was reimbursed, and usually only by a small percentage of the DRG-rate (typically 10-20%). In some counties the initiative was restricted to selective patient groups, typically for patients requiring elective surgery for which waiting times were long.

An evaluation in 2005 revealed that the activity-based funding only covered approximately 1% of the total running costs in the counties (Ministry of the Interior and Health, 2005a). If costs for patients who chose to have treatment in other counties were included, then ABF covered approximately 15% of the total costs in the year 2000 and 2001. Some counties used ABF to finance marginal activity by specifying payments for activity beyond baseline volumes and placing a ceiling on the amount of money to be made available for additional activity in order to control overall expenditure.

In 2002 a third initiative, a partial activity-based funding model *between the state and the counties*, was introduced (the government changed from a social democratic to a right wing government) (Ministry of the Interior and Health, 2005a). For each year from 2002-2006, an extra 1.5 billion DKK fund was made available by the state in order to increase hospital productivity. In order for the counties to get any part of this fund, the counties had to document increased activity above an agreed baseline activity. The negotiated baseline activity level was based on the previous year's activity supplemented by a target of a 1.5% increase in productivity. All acute activity (except telephone consultations, sterilisations and alcohol treatment) was covered by this national activity fund. The counties were supposed to ensure that the available funds were allocated to where the surplus activity was produced. Activity above the negotiated baseline level was reimbursed by 70% of the DRG-price and for outpatient visits 70% of the DAGS-price (outpatient DRG-price).

In 2004 the fourth initiative with activity-based funding was introduced *between the counties and the hospitals,* where minimum 20% of the funds from the counties to the hospitals should be activity-based (Ministry of the Interior and Health, 2005a). The objective was to ensure an even more direct relation between activity and financing.

An *evaluation* in 2005 revealed that the counties use activity-based funding for between 39 and 52% of the total funding of hospitals. The evaluation also showed that the introduction of the activity-based funding contributed to increased activity as well as decreased waiting times. However, there were complaints that it introduced greater uncertainty in the budgetary process (Vallgårda et al., 2001).

3.4 Norway

3.4.1 Institutional structure

The Norwegian health care system is organized on three levels (national, regional and county/local) as depicted in figure 3.4. The Norwegian health care system is funded primarily from taxes and transfers from the national government. The municipalities have the right to levy taxes on their

respective population which, together with the government transfer, provide funding for primary health care. Regional health authorities are funded entirely from national government transfers and do not have the right to levy taxes. There is an element of out-of-pocket payments, but these are mainly subsidized by the National Insurance Scheme (Johnsen and Roth, 2006).

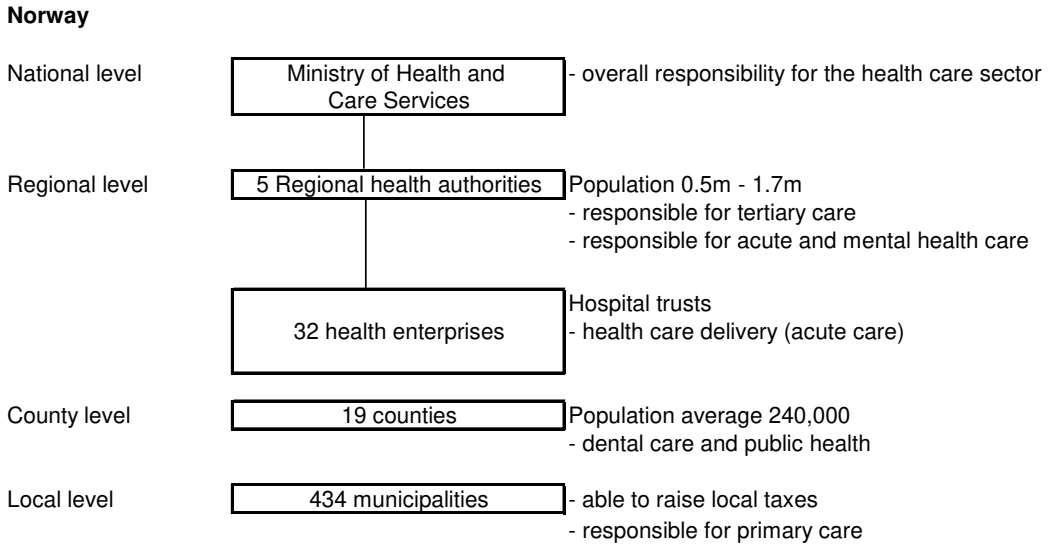


Figure 3.4: Structure of Norwegian health system

Overall responsibility for the health care sector rests at the national level, with the Ministry of Health and Care Services.

The regional level comprises five regional health authorities, with the size varying between 462 000 – 1.7 million inhabitants. The regional health authorities are responsible for the provision of specialized care. This includes both acute (somatic) and mental health institutions, as well as other specialized medical services, such as laboratory, radiology and ambulatory services, special care for persons with drug and alcohol addictions.

The regions have two roles, the authority role and the enterprise role. In their principal role regions have a “care role” in providing the population with specialized health care services; the other is as a supplier and producer of specialized health care, since regions own “health enterprises” which are akin to local hospital trusts. The organization of the regional health authorities and the “health enterprises” is unique to Norway.

Each region is responsible for its own regional health enterprises, which in turn own the hospitals in that area. Following a restructuring in 2003, the number of health enterprises was reduced from 43 at the end of 2002 to 31 at the end of 2003. At present (2007), there are 50 hospitals organised as 26 health enterprises under the five regional health authorities. In addition, 9 private hospitals have contracts with regional health authorities in South, East and West. Regional health authorities also cooperate with other private hospitals. Each health region has at least one university hospital, there being a total of 10 in Norway.

The local level consists of 19 counties and 434 municipalities. The counties have some limited responsibility for organising dental services and some public health services, but have very little influence on the health care system, especially since their previous responsibility for specialist health care was transferred to regions in 2002. Municipalities have responsibility for the provision and funding of primary health care and social services (including nursing care). The municipalities have a great deal of freedom in organizing primary health services. The funding system was changed in 1986 giving the municipalities a greater degree of autonomy in the global transfer from the state. The earmarked funding system from the state to the municipalities is considered to be an effective tool to increase resources in certain areas as well as improving quality standards (Johnsen and Roth, 2006).

3.4.2 Activity-based funding in Norway

Activity-based funding of hospitals was introduced in July 1997. The implementation of this reform changed hospital financing from block grants to a combination of block grants and activity-based reimbursements based on Diagnosis Related Group (DRG) prices. This meant that a fraction of the old block grant from the national government to regions was replaced by a matching grant dependent upon the number of patients treated, the patients' DRGs, and a national standardized cost per treatment.

In practice ABF operates as an arrangement between national government and the regional health authorities. The share of ABF is decided by parliament. Since its introduction in 1997 the share has oscillated from 35% activity-based funding and 65% block grants to 60% activity-based funding and 40% block grants in 2005, and since 2006 the situation was 40% activity-based funding and 60% block grants.

It is left to each region to decide how to fund its health enterprises (hospitals). These allocations are not transparent, but it has been shown that the regional health authorities have increased funding to their health enterprises in line with the age structure of the population served – suggesting some needs-adjustment to ABF-funding.

So, in summary, ABF guides allocations between central government and regional health authorities, but is not necessarily the sole basis on which hospital funding is determined.

3.5 Sweden

3.5.1 Institutional structure

The institutional structure of the Swedish health care system is depicted in Figure 3.5. The system is organized into three levels: national, regional and local system. Although overall responsibility for the health care sector rests, at the national level, with the Ministry of Health and Social Affairs, the regional level (operating through county councils) is of most significance (Glenngård et al., 2005).

The funding of the Swedish health care system is primarily through national and local taxes. Both the county councils and the municipalities have the right to levy proportional income taxes on their respective populations, and these account for the majority (more than 70%) of health care funding. The financing of health care services by local taxes is supplemented by the central government grants and (limited) user charges. Central government grants are partly based on a resource-allocation formula that based on socio-demographic characteristics of the local population.

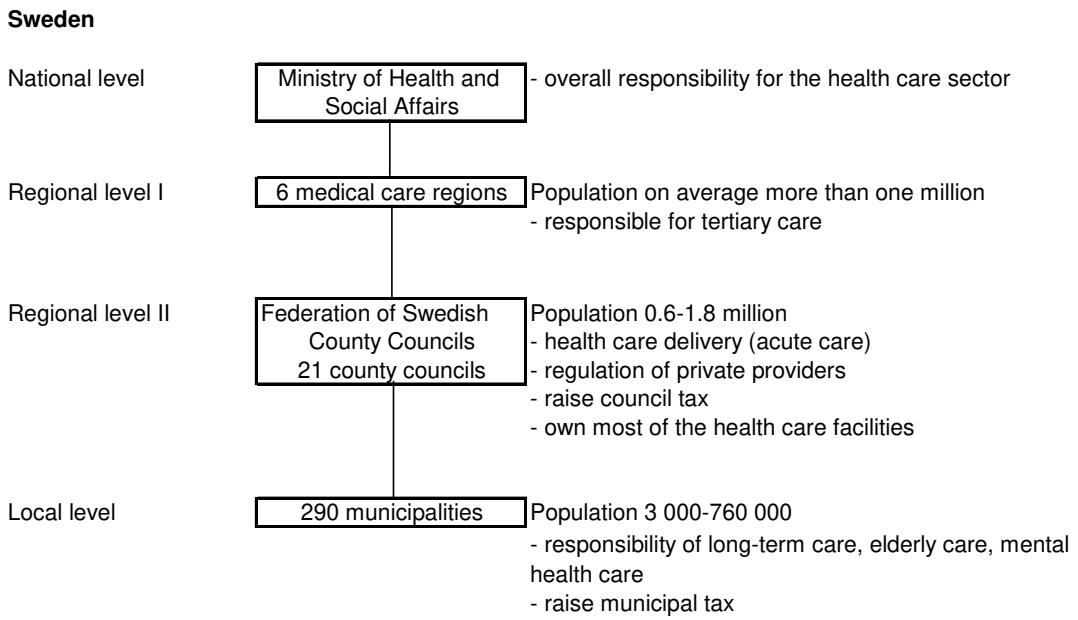


Figure 3.5: Structure of Swedish health system

Of most significance is the importance of county councils in the Swedish system. County councils are political assemblies, with members directly elected by the local population. The county councils are grouped into six medical care regions, established to facilitate cooperation in tertiary care among the county councils. Each region serves a population averaging more than million people.

Councils have considerably local autonomy and are able to impose direct taxation. They have overall responsibility for the delivery of health care, including authority over (and often ownership of) the public hospitals in their geographical areas and the form by which they are reimbursed.

In the early 1990s, most county councils introduced some form of purchaser–provider model, whereby the traditional system of fixed annual allocations to hospitals and primary care services was, to some extent, abandoned. Instead, payment was made according to the volume of activities. By 1994, 14 out of (at the time) 26 county councils had introduced purchasing–provider models. The purchasing organizations negotiate with hospital health care providers and establish financial and activity contracts. These contracts are often based on fixed prospective per-case payments (based on diagnosis-related groups) and complemented with price or volume ceilings and quality components. The use of diagnosis-related groups and other classification systems, however, varies among regions and county councils. In about half of the county councils, payments to both hospitals and primary care centres are based on global budgets (Glenngård et al., 2005).

At the local level, there are 290 municipalities, serving populations varying from less than 3000 to approximately 760,000 individuals. The municipalities operate public nursing homes and home care. Patients who have been discharged from acute care or geriatric hospitals also fall within the remit of the municipalities.

3.5.2 Activity-based funding in Sweden

In considering activity-based funding in Sweden, it is inappropriate to look at the country as a whole. Rather, each county has to be considered separately. The diversity across Swedish counties in their use of DRGs is tabulated in table 3.6 and 3.7. There are four key areas of note.

- A wide range of funding bases are used across counties, with different methods used to fund care provided by local hospitals, care provided to residents of other counties, and specialist hospitals; and for inpatient, day surgery and outpatients. Often DRGs are used as the basis for paying for care provided by hospitals in other counties, but only in Stockholm has activity-based funding been adopted on a comprehensive basis. About half of councils fund hospitals using global budgets (Federation of Swedish County Councils, 2004).
- A standard system of classifying patients has not been adopted across all counties, although more have been adopting the NordDRG system (which is also used in Denmark and Norway). Some counties continue to use the HCFA and AP classification systems developed in the United States.
- These classification systems are used for three different purposes: for management; for funding of activity provided to the local population (ie activity-based funding); and for billing for care provided to patients that are residents in other counties.
- For those counties that have adopted activity-based funding, there is variation in the proportion of inpatient or outpatient costs that are reimbursed through this mechanism.

For non-acute care, there is a wide diversity of funding arrangements across Swedish counties (Lundberg and Rydnert, 2003). Table 3.8 provides information on the arrangements in place to pay for outpatients, psychiatric care, geriatric care and primary care.

Table 3.6: Funding arrangements for hospital care, by Swedish county

County's way to reimburse medical care 1999

SAMVERKANSNÄMNDEN Sydöstra sjukvårdsregionen

	County's reimbursement for hospitals			Hospital's charging of out-county med care			Hospital's charging of highly specialised care			DRGs as definitional instrument
	Inpatient	Daysurgery	Outpatient	Inpatient	Daysurgery	Outpatient	Inpatient	Daysurgery	Outpatient	
1 Stockholms läns landsting	AP-DRG and NordDRDRG		Köks/Köms	NordDRG	NordDRG	Köks/Köms	NordDRG + special pricelist		Köks/Köms	Yes
2 Gotlands kommun	Allowance	Allowance	Allowance	NordDRG	NordDRG	Agreement	-	-	-	Yes
3 Uppsala läns landsting	Subscription/best.boards(3st)			Agreement (packet price/subscription)			Agreement (packet price/subscription)			Yes
4 Landstinget Sörmland	Billing system			Price list/DRG for SI surgery			Price list/DRG for SI surgery			Only surg
5 Landstinget i Värmland	Allowance	Allowance	Allowance	Price list, with exception for bills for Säffle hospital						Yes partly
6 Örebro läns landsting	Per output with ceiling/year			Pat.rel+fixed price	Fixed sum/visit		Diagnosis/procedure based payments			Yes
7 Landstinget i Västmanland	Billing system			Price list based on actual costs			Price list based on actual costs			No
8 Landstinget Dalarna	Billing system			Price list based on actual costs			Price list based on actual costs			No
9 Landstinget Gävleborg	Billing system			Price list based on actual costs			Price list based on actual costs			Yes
10 Landstinget i Östergötland	Contract	Contract	Contract	PBE & DRG	PBE & DRG	Regional price list	PBE	PBE	PBE	Yes
11 Landstinget i Jönköpings län	Allowance	Allowance	Allowance	DRG	DRG	Regional price list	-	-	-	Yes
12 Landstinget i Kalmar	Allowance	Allowance	Allowance	DRG	DRG	Regional price list	-	-	-	Yes
13 Landstinget Skåne	Needs based allowance			AP-DRG	AP-DRG	Regional price list	AP-DRG/patient spec		Pat spec/agreement	Yes
14 Landstinget Blekinge	Allowance	Allowance	Allowance	AP-DRG	AP-DRG	Regional price list	-	-	-	Yes partly
15 Landstinget Halland, södra	Frame budget	Frame budget	Frame budget	HCFA-DRG	Regional price list	Visit based reimb	-	-	-	-
16 Landstinget Kronoberg	Allowance	Allowance	Allowance	AP-DRG	AP-DRG	Regional price list	Per vd	-	-	Yes
17 Västra Götaland	Performance reimbursement and allowance			DRG	Performance reimbursement		Pat spec reimb	Performance reimbursement		Yes
18 Västerbottens läns landsting	Allowance	Allowance	Allowance	AP-DRG	Prest ers	Base cost/visit	AP-DRG	Perf reimb	Base cost/visit	AP-DRG
19 Landstinget i Västernorrland	Frame budget	Frame budget	Frame budget	Agreement	Agreement	Agreement	Per vd	-	-	Yes
20 Jämtlands läns landsting	Allowance	Allowance	Allowance	Agreement	Agreement	Agreement	Regional price list/ special ö k			No
21 Norrbottens läns landsting	Frame budget	Frame budget	Frame budget	Regional price list	Regional price list	Regional price list	-	-	-	No

KÖKS= importance list which takes into account the resource use of different treatments
PBE = county's special definitionsystem

Table 3.7: Use of NordDRGs, by Swedish county

U = management instrument
B = Budget instrument
D = billing instrument

OP= outpatient
SI = somatic inpatient OC =out-county pat IC = in-county pat

		NordDRG			HCFA			AP			
		U	B	D	U	B	D	U	B	D	
AB	**Stockholms läns landsting**	X	X	X							NordDRG SI, Daysurg & certain day care. Reimbursement level=100% for OC and 50% IC.
C	**Landstinget i Uppsala län**	X		X							Both SI och OP. Charging IC, 20%.
D	**Landstinget Sörmland**	X		X							Only clinics SI. Charging only OC.
E	**Landstinget i Östergötland**	X	X	X							SI & OP. University hospital in Linköping has NordDRG for management, except orthopaedics- and acute clinics which also reimburse with NordDRG. For other hospitals reimbursement level=100% for OC, 30% for IC.
F	**Landstinget i Jönköpings län**	X		X							SI. Charging OC both SI och OP.
G	**Landstinget Kronoberg**	X		X							SI & OP. Charging OC except SI.
H	**Landstinget i Kalmar län**	X		X							SI. Charging both OC & IC.
K	**Landstinget Blekinge**			X							Charging OC SI.
M	**Region Skåne**	X	X	X							SI & Daysurg. Reimbursement level=100% for IC in Helsingborg & Ängelholm. In other hospitals is used in charging specialist medical care and county medical care. Reimbursement level=100% for OC.
N	**Landstinget Halland**	X	X	X							SI & Daysurg. Reimbursement level=100% for OC and IC daysurg as well as 50% for IC SI.
O	**Västra Götalandsregionen**	X		X							SI as well as some daysurgery. Reimbursement level=100% for OC, 50% for IC.
S	**Landstinget i Värmland**										Does not use DRG.
T	**Örebro läns landsting**	X	X	X							SI. Charging OC.
U	**Landstinget Västmanland**										Does not use DRG.
W	**Landstinget Dalarna**										Does not use DRG.
X	**Landstinget Gävleborg**	X	X	X							SI. Charging OC.
Y	**Landstinget Västernorrland**	X									SI.
Z	**Jämtlands läns landsting**										Does not use DRG.
AC	**Västerbottens läns landsting**							X		X	SI in 1 out of 3 hospitals. Charging only OC. Plans to introduce NordDRG
BD	**Norrbottens läns landsting**				X		X				Supplementary management system for SI in some clinics. Charging OC.
I	**Gotlands kommun**			X							Charging OC SI & daysurg.

Table 3.8: Funding arrangements for non-acute care, by Swedish county

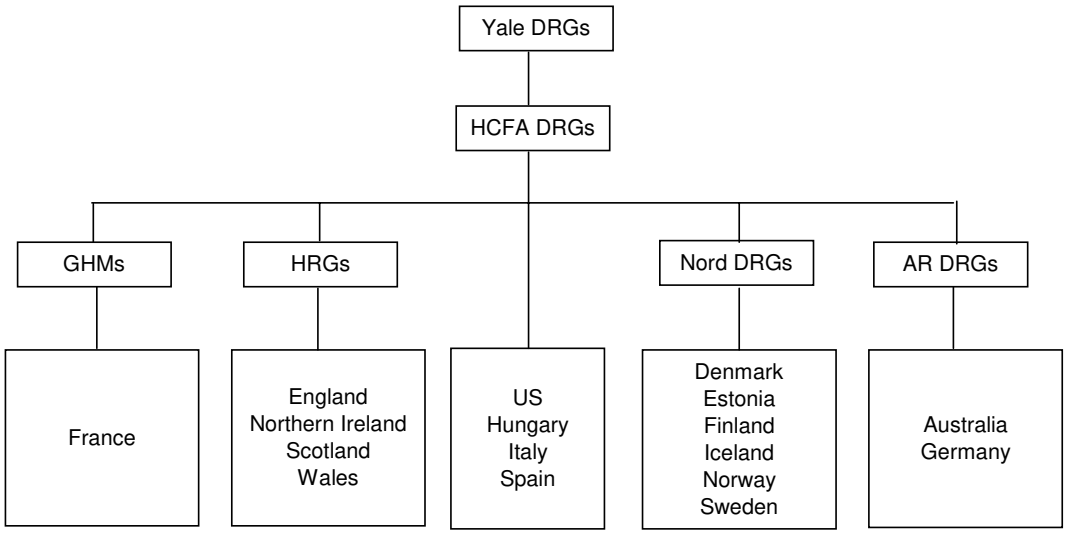
	Outpatient	Psychiatric care	Geriatric care	Primary care
1 Stockholms läns landsting	KÖKS	allowance with ceiling	DRG or fixed reimb (inpat), KÖKS, visit of fixed reimb (outpat)	Capitation 50%, performance reimb 25%, allowance 25%
2 Gotlands kommun				Capitation 80%, visit 20%
3 Uppsala läns landsting	visit + packet price	Per specialty based on admissions, bed days, visit and packet price for certain		
4 Landstinget Sörmland				Certain performance reimb
5 Landstinget i Värmland				
6 Örebro läns landsting				Fixed reimb, patient fees
7 Landstinget i Västmanland				Capitation 83%, visit 17%
8 Landstinget Dalarna				
9 Landstinget Gävleborg	visit and specialty	bed days in inpat, visit and specialty in outpat	bed days (inpat), visit and specialty (outpat)	Capitation, treatment activity and allowance
10 Landstinget i Östergötland	PBE (based on visit)			Capitation 70%, allowance 30%
11 Landstinget i Jönköpings län				
12 Landstinget i Kalmar				Capitation
13 Landstinget Skåne	visit	bed days	bed days (inpat), visit (outpat)	Mainly capitation, partly visit
14 Landstinget Blekinge				
15 Landstinget Halland, södra	subsciption			Capitation
16 Landstinget Kronoberg				
17 Västra Götaland	visit	admission in inpat care, visit in outpat	admissions, bed days or DRG (inpat), visit (outpat)	Capitation 70-80%, treatment activity 20-30%
18 Västerbottens läns landsting				Capitation 45%, allowance 55%
19 Landstinget i Västernorrland				
20 Jämtlands läns landsting				
21 Norrbottens läns landsting				

KÖKS= importance list which takes into account the resource use of different treatments
PBE = county's special definition system

4. The mechanics of activity-based funding

4.1 What are Healthcare Resource Groups?

Fundamental to activity-based funding is an accurate description of activity. Diagnosis Related Groups (DRGs), first developed at Yale University, were designed as a means to categorise patients into groups with similar resource requirements (Fetter et al., 1980). These Yale DRGs were subsequently refined by the (then) Health Care Financing Administration (HCFA) in the United States for use in funding Medicare patients. This system of HCFA DRGs has subsequently been adopted in countries around the world, often after local modification (Schreyögg et al., 2006). Figure 4.1 provides an indication of the main versions of DRGs currently in use in different countries.



Source: adapted and extended from (Schreyögg et al., 2006)

Figure 4.1: DRG classification systems used in different countries

- The US uses HCFA DRGs, which have been continuously refined since their first introduction. Hungary, Italy and Spain also use this categorisation system, subject to minor local modifications.
- France developed Groupes Homogénes de Malades in the mid-80s.
- In the UK, the first version of Healthcare Resource Groups was released in the early 1990s, and version 3.5 is currently in use.
- The Nordic countries have developed a system of Nord DRGs (see table 4.1).
- Australian Refined (AR) DRGs have been under progressive development since the 1980s, and form the basis for activity-based funding in some Australian states and in Germany.

In the UK, HRGs comprise groups of finished consultant episodes (FCEs) which are supposed to have similar health care resource requirements. Version 3.5 comprises 603 HRGs (NHS Information Authority, 2003). The main criteria for local modification and subsequent refinement of HRGs are:

- based on routine data items in the Admitted Patient Care Minimum Dataset, which covers all inpatients and day cases;
- clinical meaningfulness;
- similar resource use;
- relatively few (not more than fifty per specialty).

Table 4.1: NordDRGs

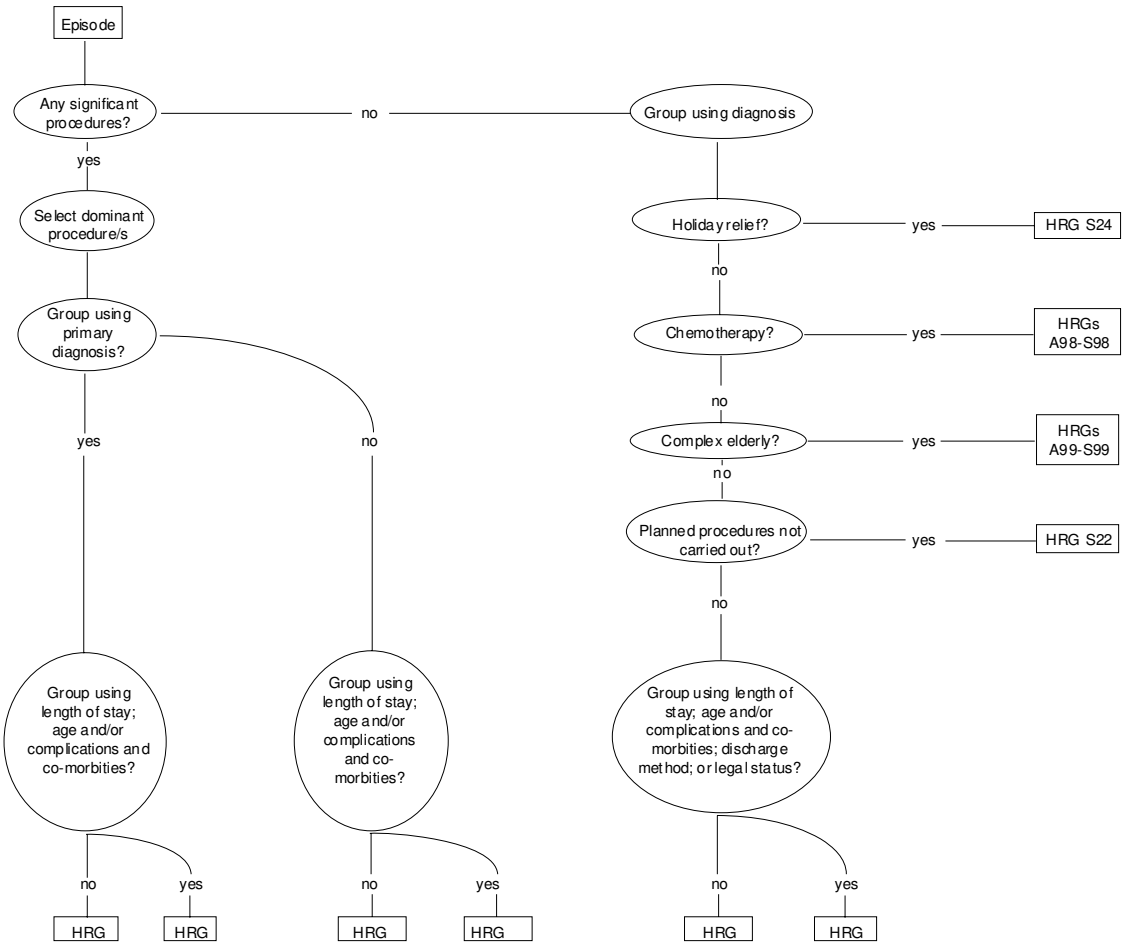
"NordDRG is a DRG grouper which emulates HCFA-DRG version 12 using definitions based on ICD-10 and NCSP (the NOMESCO Classification of Surgical Procedures). The first grouper was completed in 1996. The grouper is updated yearly according to the NordDRG maintenance process. The NordDRG system definitions are produced in national versions for Denmark, Finland, Norway, Sweden and Estonia (2003). There is also an English language NordDRG version based on the common Nordic components of ICD-10 and NCSP. This version is used in Iceland. In 2003, an extended NordDRG version was developed that also includes national modifications to the logic using national codes that are unique to some of the countries (NCSP+). NordDRG is currently in use nationwide in hospitals in Norway and in the majority of the regional health care administrations in Finland and Sweden. The system has also been introduced for trial in Iceland. Denmark has developed a modified DRG system (DkDRG) based on NordDRG that was introduced in 2002."
Source: http://www.nordclass.uu.se/verksam/norddrge.htm accessed 17/05/07

The Minimum Dataset (in Wales - the Patient Episode Database for Wales) is crucial to understanding the particular form that the HRG system has taken in the UK. Hospitals are obliged to compile a record for every NHS patient they treat, including details about patient characteristics, the reason for admission, diagnoses, the procedures undertaken, and discharge arrangements. Each patient record in the dataset is grouped to a single HRG based on the data contained in the record, including procedures, diagnoses and age. Table 4.2 provides details about the Minimum Dataset used for grouping to HRG with Figure 4.2 depicting the process by which a patient is assigned to a HRG (updated from (Street and Dawson, 2002)). Where information in any field required for grouping is missing or invalid the patient is assigned to one of seven 'undefined' groups.

Table 4.2: Information used for HRG classification

Primary and secondary ***procedures*** (coded using the Office of Population Censuses and Surveys, Version 4). The overall cost of a treatment episode is influenced by whether or not surgical procedures are conducted. The grouping process starts by determining whether a major surgical procedure has been undertaken, allowing records to be divided into surgical and medical groupings. If more than one procedure appears (up to four procedures can be recorded), assignment is determined according to a procedure hierarchy, which assigns a rank (from 0 to 7) to all procedures according to clinical knowledge and the relationship with post-operative length of stay.
Primary, subsidiary and secondary ***diagnoses*** (coded using the International Classification of Diseases, volume 10). Where only minor procedures (ranked 0 or 1) or no procedures are recorded, the primary diagnosis is used to determine assignment to HRG. The primary diagnosis may be overridden in the event of holiday relief care, chemotherapy, complex elderly cases (defined as patients over 69 with two or more major diagnoses but no significant procedures), and when planned procedures have not been performed. If a record indicates more than one of these events assignment is based on the strict hierarchy depicted in the figure.
In some instances, generally where minor procedures are recorded, ***length of stay*** is also used as a grouping variable to distinguish patients admitted for only a minor procedure from those having the procedure as part of a wider treatment course.
Age is used to separate older from younger patients, although a three way split is applied occasionally. The age groups are divided at 17, 50 or 70 years. Sometimes ***gender*** is used.
Secondary diagnoses are used to identify the presence of ***complications and co-morbidities***, this information being invoked, often in conjunction with age splits, to subdivide 130 HRGs.
Discharge method (alive or dead) which is used only when grouping neonates and pulmonary embolus; and
Legal status, which indicates whether patients admitted to a psychiatric facility were compulsorily detained and is used to subdivide three psychiatric groupings (schizophreniform psychoses; mania; and depression).
Source: updated from (Street and Dawson, 2002)

The creation and subsequent refinement of HRGs has been undertaken in collaboration with clinical representatives participating in eighteen Clinical Working Groups. Refinements to HRGs are made periodically to reflect changes in clinical practice and to reduce within-HRG variation in resource use. Version 4 HRGs are in the pipeline.



Source: updated from (Street and Dawson, 2002)

Figure 4.2: HRG Classification flow chart

Despite their widespread adoption, there are two problems with using HRGs/DRGs as a basis for activity-based funding of health care.

First, HRGs/DRGs are designed to describe the care requirements of patients admitted to hospital on an inpatient or day case basis. Attempts have been made to categorise patients seen in other settings, such as in outpatient departments, or those that require non-acute and long-term care. For instance, in Denmark the Danish Ambulatory Casemix System (DAGS) is used to classify and pay for ambulatory and outpatient activity. If no categorisation system is available, other payment arrangements must be made for such services. We shall consider these in due course.

Second, no categorisation system can perfectly group patients together on the basis of their expected resource requirements. Much health care is highly individualised so defining a “standardised package of care” is not straightforward. Categorisation is easier for some conditions than others. For instance, HRG B13 categorises all patients undergoing cataract extraction and insertion of lens, all of whom are recorded by the single operation code (OPCS C712). In contrast, HRG E03 (cardiac valve procedures) classifies patients having 48 different types of operation into a single HRG, while HRG E04 (coronary bypass) covers 52 different procedures. This wide range of procedures may contribute to a high degree within-HRG variation in expected resource use. This may be important for activity-

based funding if some hospitals systematically attract patients requiring more complex procedures, even though they are coded to the same HRG. Such claims are often made by hospitals that provide specialised care, and policy responses to these claims will be considered later in the report.

4.2 How are costs per HRG calculated?

4.2.1 Costing in the NHS – top down costing

The NHS lags behind many other countries in terms of the routine cost data collected by health care providers. This reflects the loose historical relationship between hospital budgets and activity and the absence of a substantial private insurance sector requiring a detailed itemisation of resource use for billing purposes.

Since 1998 in England, NHS hospitals have been required to report their costs by HRG on an annual basis – these forming the so-called "Reference Costs" (NHS Executive, 1998). But no routine cost data on individual patients are available. This means that most NHS hospitals continue to cost most of their activities on the basis of top-down allocations.

The top down process of allocating costs is depicted in figure 4.3 and starts with spending on broad types of "inputs", such as electricity, maintenance of buildings, catering, drugs, salaries, etc. This expenditure is then reallocated to "patient treatment services": wards, operating theatre, pharmacy, etc. This reallocation may be direct, such as wages for the number of nurses normally staffing a particular ward; or indirect, for example operating theatres may be allocated a proportion of the cost of hospital cleaning corresponding to their share of total hospital area.

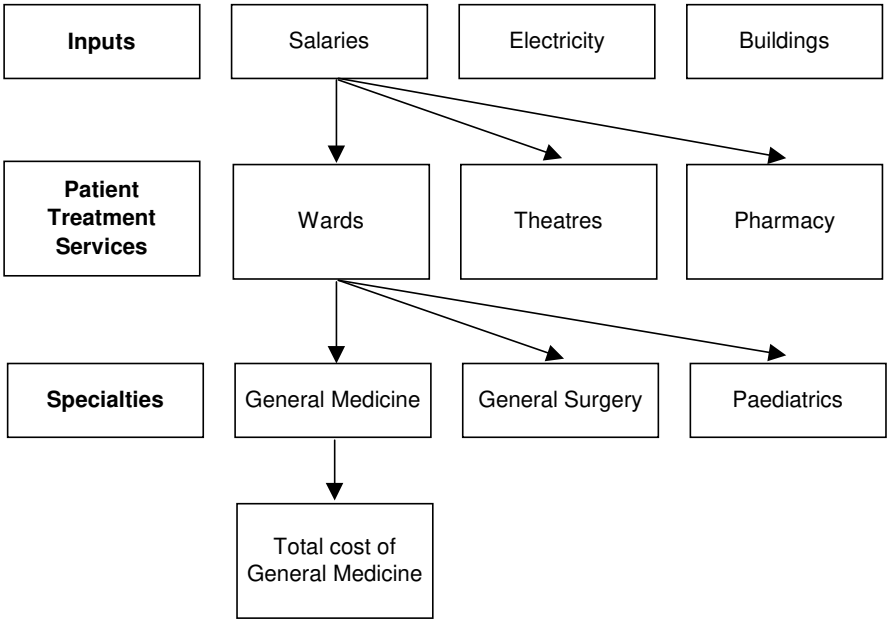


Figure 4.3: Top-down accounting process

These costs, once allocated to patient treatment services, are then reallocated to specialties: paediatrics, general medicine, general surgery, etc. Again, this reallocation may be direct, as where a ward houses patients in only one specialty, or indirect, where the proportion of operating theatre time booked by a specialty is used to determine the share of operating theatre costs apportioned to that specialty.

Concerns have been raised about the accuracy of these apportionments, with inaccuracies arising particularly in the case of shared resources. For example, some consultants work across specialties

but their salary costs may not be apportioned accordingly. If so, costs will appear higher in the specialty to which costs are allocated and lower in the specialty when the input of the consultant is not accounted for. This appears especially problematic in general surgery and urology; obstetrics and gynaecology; and plastic surgery and dermatology (Posnett et al., 1999).

For medical specialties, total specialty expenditure is divided by the number of bed days occupied by patients coded to that specialty. In moving from the allocation of hospital costs by speciality to the sub-division of speciality costs by HRG, a "care profile" may be constructed by a working group made up of clinicians, nurses and clinical managers. The care profile describes the resources expected for a typical patient and might include estimates of items such consultant time, significant drugs and consumables.

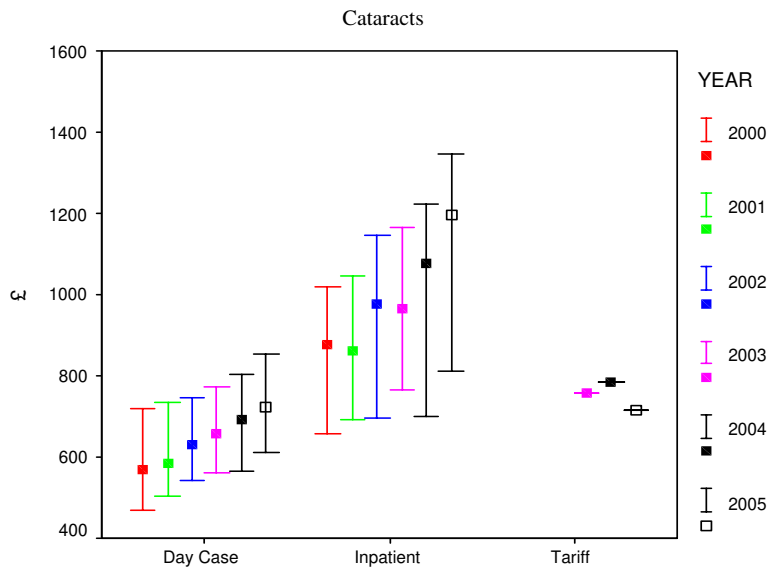
The calculation of costs for patients undergoing procedures is not based on bed days alone, but includes costs related to the procedure, such as theatre use. An illustrative example is provided in table 4.4, where allowance is made for theatre time and prostheses in calculating the cost of a primary hip replacement (Epstein and Mason, 2006).

Table 4.4: Illustrative costing of surgical HRGs

Cost pool	Measure	Units	Unit cost £	Total cost £
Ward	Bed days	8.81	120	1,057
Theatre	Theatre hours	1.33	600	798
Prosthesis	Number used	1	2,889	2,889
Total				4,744

Source: (Epstein and Mason, 2006)

Costing in the NHS has probably become more sophisticated over time, partly because of the publication of improved costing guidance and because (English) hospitals are becoming increasing aware of the importance of costing under Payment by Results. Nevertheless, there remains very large variation in the average costs of HRGs reported by English hospitals The Reference Costs reported for cataract extraction on a daycase and inpatient basis are a typical example (figure 4.4). The first set of six vertical lines in figure 4.4 shows the average and interquartile range in reference costs for cataracts undertaken on a day case basis, as reported by all English acute hospitals for each year from 2000 to 2005. The second set of six vertical lines presents equivalent information for elective inpatients. The interquartile range (showing the range in costs for 50% of hospitals) is wide and this difference has not narrowed over time. It may be that variations in reported costs are not solely due to inefficiency. At least some of the variation may be due to differences in accounting practices



Source: (Street and Miraldo, 2006)

Figure 4.4: Reference costs and tariffs for cataracts in England

4.2.2 Costing in Australia – bottom up costing

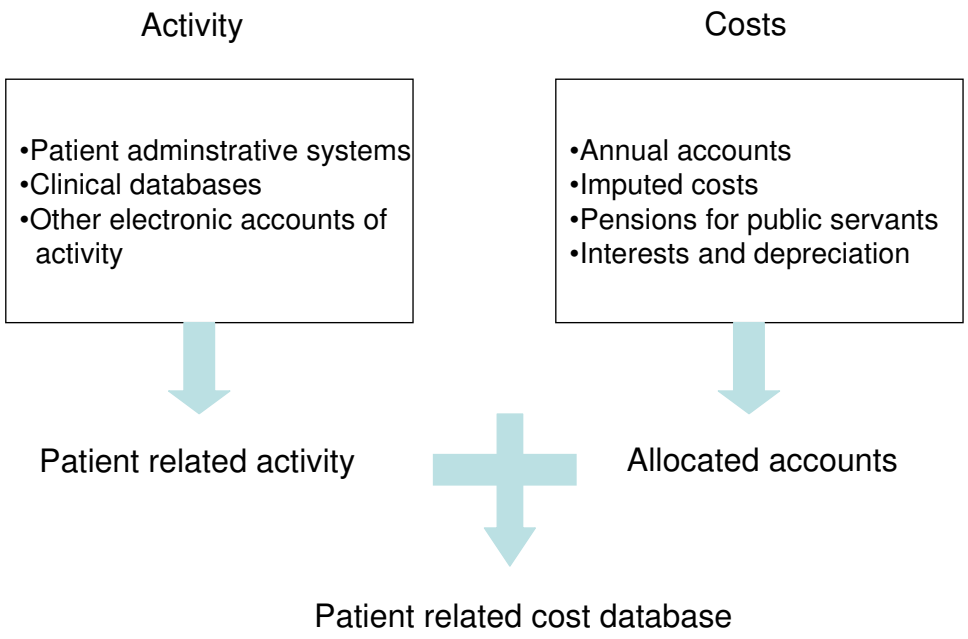
Costs in Australia are compiled on a "bottom-up" basis from analysis of patient level data compiled by hospitals with a clinical costing system (Jackson, 2001). These systems aggregate information from specialty-level cost centres which collect comprehensive patient level data about the intermediate products - the diagnostic tests, radiology, nursing care, operating room procedures, etc - provided during the admission. There are three steps involved in attributing costs to patients.

1. Indirect costs (hospital and departmental overheads) are allocated to direct care cost centres, subject to allocation rules. For instance, overheads such as infection control, sterile supply and domestic services are allocated to cost centres using step down methods or simultaneous equations
2. For each direct cost centre, "intermediate products" of care are defined. Each product has an associated cost weight, assigned according to Relative Value Unit scales, most of which derive from studies undertaken in each hospital. For example, in many hospitals nursing costs are calculated using ward-specific patient-level dependency systems, which use the results of time and motion studies to detail the amount and type of nursing time required by patients during each shift. Costs are then assigned to individual patients according to the number of shifts spent at each dependency level on a particular ward.
3. Intermediate products are attributed to individual patients receiving services, and combined with information about the specific resources used by each patient, such as the number of X-rays, blood tests, and time in theatre.

These patient-level allocations are reconciled with overall hospital expenditure. Although all costing systems rely on some degree of modelling, by recording actual resource consumption on a patient-by-patient basis a higher degree of accuracy can be approached than if costs were assigned assuming average resource use for patients grouped together in some way or by relying on length of stay as a proxy for cost.

4.2.3 Costing in Denmark – a mix of top-down and bottom-up

The Danish Cost Database is the basis of the Danish case-mix system and comprises bottom-up measures of patient level costs (Ankjær-Jensen et al., 2006). Patient level costs are estimated by aggregating the costs of individual services – such as x-rays and laboratory tests - used by the patient during their hospital stay. Information about service use is drawn from departmental "feeder" systems. The costs of these services are calculated by applying nationally-defined top-down accounting guidelines and, for ancillary services, by applying a national set of relative service weights (Ankjær-Jensen et al., 2006).



Source: (National Board of Health, 2005)

Figure 4.5: Information used to generate patient-level costs in Denmark

The calculation of the DRG-prices is based upon local registers at the hospitals with information about the activity and resources used (such as x-ray, use of intensive care etc.) and the costs via the local accounting systems. For some part the activity is registered at patient level. In other cases - where patient level data is not available – it is top-down allocated to the different departments and then further to the specific patients meaning if there is no patient related registrations on e.g. blood from the local blood bank, then all patients will bear a share of first the activities (and then also the costs) no matter whether they have actually got any blood or not. In figure 4.5 the method is described as to how patient level costs are calculated. The unit costs for the different activities are calculated through the annual accounts etc. For some part it is possible to relate the costs directly (bottom-up costing), and in other cases the costs are allocated top-down. These unit costs are then combined with the activities.

4.3 How are prices per HRG calculated?

Although in every country the price per DRG/HRG is related to the cost per DRG, countries differ in how they calculate prices. The main sources of difference are the following:

- The source of cost data
- How "outliers" are defined
- Whether costs are converted directly into prices or into cost weights

4.3.1 Source of data

As table 4.5 shows, England is unique in having mandated cost collection from all public hospitals (Schreyögg et al., 2006). In other countries, the price-setting authorities cannot legally oblige hospitals to provide information. Instead, authorities rely on a "data sample" consisting of hospitals that co-operate on a voluntary basis. Emphasis is placed on acquiring high quality cost information, usually drawn from hospitals with good accounting systems (Jackson, 2001, Schreyögg et al., 2006). This is the case in Australia (Victoria) and, most starkly, in Italy, where DRG tariffs have been set on the basis of data provided by just 8 hospitals – which are probably not representative of all Italian hospitals. In Norway, DRG Prices are based on cost data provided by a representative group of hospitals on a yearly basis. In 2007, DRG cost weights are based on data from 23 hospitals. In order to ensure that the data is representative, hospitals with different functions and sizes are included in the sample. These 23 hospitals contain 4 regional hospitals, 11 central hospitals, 5 local hospitals and 3 specialised hospitals (Directorate for Health and Social Affairs, 2007).

If hospitals complain about non-representativeness, presumably policy-makers can invite complainants to provide cost data if they wish to be included in the sample.

Table 4.5: Hospitals providing cost information to inform DRG-prices

Country	Total hospitals to which prices apply	Hospitals in sample (%)
Australia (Victoria) – 1997	141	15 (11%)
Denmark	52	43 (83%)
England	300	300 (100%)
France	1564	52 (3%)
Germany	1779	214 (12%)
Hungary	160	30 (18%)
Italy	761	8 (1%)
Norway	59	23 (39%)

4.3.2 Identifying "outliers"

Although HRGs are designed to be "resource homogenous", this does not mean that all patients within the same HRG have exactly the same cost or length of stay (LoS). Every HRG contains patients whose costs differ from one another and, sometimes, individual patients may have much lower or higher costs than others grouped to the same HRG. Figure 4.6 shows an hypothetical distribution of the costs of patients within a HRG. This distribution is positively skewed, which is a common feature of cost data in the health system. A positively skewed distribution means that (a) the mean cost takes a higher value than the median cost and (b) there are more patients at the upper end

of the distribution (with very high costs) than at the lower end of the distribution (with relatively low costs). Patients at these upper and lower extreme ends of the distribution are termed “outliers”.

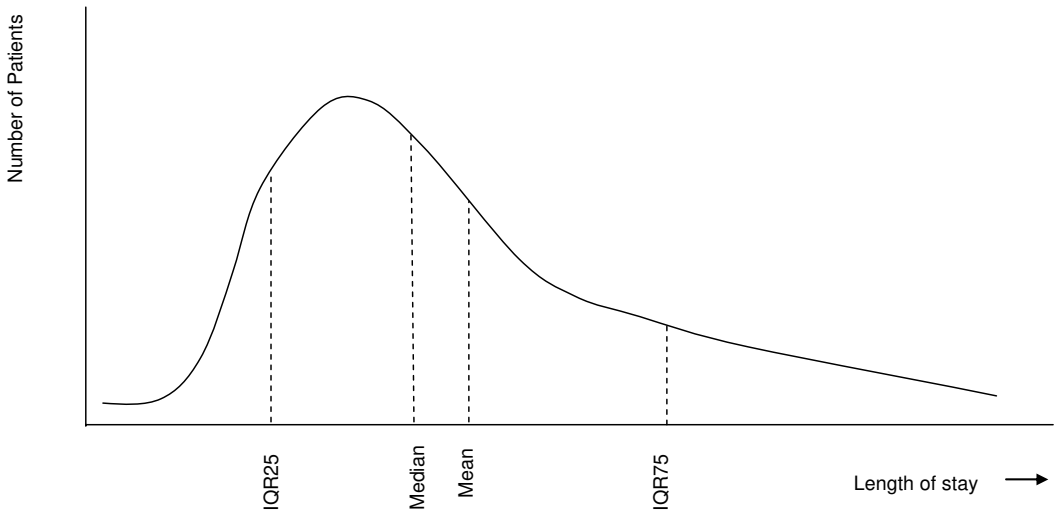


Figure 4.6: Distribution of length of stay

Identifying these outliers is important for tariff-based funding for two reasons (Schreyögg et al., 2006). First, outlier patients may exert undue influence on the value of the “average” cost of treating this type of patient. Taking account of this influence may be important when converting cost information into prices. Second, patients that incur high costs or have excessive lengths of stay may do so for reasons beyond the control of the hospital. Most countries allow for some form of risk-sharing between the hospital and the funder when paying for these excess costs, by allowing for extra payments on top of the HRG tariff for patients classified as outliers.

In all countries except the United States, outliers are defined in terms of length of stay rather than costs, but countries differ in where they set the “trimpoints” to identify outliers. There are two main forms of difference. Firstly, while all countries set upper trimpoints, few (Australia, France and Germany) set lower trimpoints.

Table 4.6: Lower trimpoints

Country	**Lower LoS threshold for each DRG (*j*)**
Australia (Victoria)	$ALoS_j/3$
France	If $ALoS_j$>8 days $\min\left[ALoS_j/2.5;7;(modeLoS-1)\right]$
Germany	$round\left[\min\left(2;ALoS_j/3\right)\right]$
Sources: (Duckett, 1994, Schreyögg et al., 2006)	

However, in Denmark, there is a special charge for the so-called “grey zone” patients. These patients may be treated as either outpatients or by being hospitalized. In order to create the right incentives to treat the patients as outpatients if possible, a special charge is calculated that is higher than the outpatient charge but lower than the DRG tariff if the patient is admitted.

In Norway, DRG-reimbursements are made only for patients who stay in hospital for more than 24 hours. For hospital stays of less than 5 hours no DRG-reimbursement is given, instead the reimbursement is based on policlinic consultation prices. For elective and acute treatments lasting more than 5 hours but less than a day, a reduced DRG-reimbursement is made, with the reductions specific to each treatment. In 1999, day surgery was also included in the reimbursement system based on DRG prices.

Table 4.7: Upper trimpoints

Country	Upper LoS threshold for each DRG (*j*)
Australia (Victoria)	$3 \times ALoS_j$
Denmark	$Q75_j + (Q75_j - Q25_j) \times 1.5$
England	$Q75_j + (Q75_j - Q25_j) \times 1.5$
France	If $ALoS_j$>8 days $\min\left[2.5 \times ALoS_j ; \exp^{mean\left[\log(LoS_j)\right] + SD\left[\log(LoS_j)\right] + Q95_j - median\left[\log(LoS_j)\right]}\right]$ If $ALoS_j$>8 days $\min\left[15; \exp^{mean\left[\log(LoS_j)\right] + SD\left[\log(LoS_j)\right] + Q95_j - median\left[\log(LoS_j)\right]}\right]$
Germany	$round\left[\min\left(ALoS_j + 2 \times SD_j\right); ALoS_j + 17\right]$
Italy	$\left[\sqrt[3]{Q75_j} + \left(\sqrt[3]{Q75_j} - \sqrt[3]{Q25_j}\right)\right]^3$
Norway	$Q75_j + (Q75_j - Q25_j) \times 1.5$
Sweden	$Q75_j + (Q75_j - Q25_j) \times 1.5$
United States (1997)	$\min(geomeanLoS_j + 17; geomeanLoS_j \times \exp^{(1.94 \times SD_j)})$ or: $\max(c; 2 \times drgrate_j)$ where *c* is a policy determined cost cut-off.
Sources: updated and adapted from (Schreyögg et al., 2006, Keeler et al., 1988, Duckett, 1994)	

Secondly, the statistical basis for trimming varies from country to country – as tables 4.6 and 4.7 demonstrate. Broadly speaking, two types of formula have been adopted (Cots et al., 2003). Most countries define outliers in relation to the interquartile range (which contains 50% of observations). The location of the 25th, 50th (median) and 75th quartile are defined by the number of observations not their actual values, which limits the influence that outliers have over these summary statistics. Use of quartile values for trimming means that the formula can be applied generally across all HRGs, irrespective of the skewness of the underlying distribution of length of stay. Interestingly, this formula was originally applied in Victoria, but a simpler and more stable formula was adopted in the second year of the policy (Victorian Government Department of Health and Community Services, 1994). This is described as the L3H3 method: the low trim point is a third of average length of stay, the high trimpoint is three times the average length of stay (Duckett, 1998).

France, Germany and the US appeal to the mean and standard deviation in setting trimming criteria. The resulting formulae are more complex, not least because the actual value of the trimpoint will be sensitive to whether the underlying data are normally distributed or skewed. The formulations in these countries attempt to get around this sensitivity by selecting the minimum value from a choice of (usually) two values, one of which is set independently of the HRG-specific data.

4.3.3 Converting cost information into prices

Countries can be subdivided according to how cost information is converted into prices (figure 4.7). In England, France and the United States, the cost information is converted (more or less) directly into prices. This means that any general cost inflation will automatically feed into future prices.

In England and France prices reflect average cost. Although the prices might include an across-the-board adjustment for efficiency improvements, they encourage providers to become “average” rather than to improve their performance more dramatically (Llewellyn and Northcott, 2005). While high cost hospitals strive to be more efficient and reduce their costs, these gains may be offset by the low cost hospitals increasing capacity or making investments that fail to generate sufficient revenue to cover the cost of these investments. In the US a more challenging benchmark is established, so all hospitals have an incentive to improve their performance (Duckett, 2000). For example, rather than basing

prices on the average cost in the sample, the benchmark price might be set on the basis of the costs achieved by the 10% lowest cost providers.

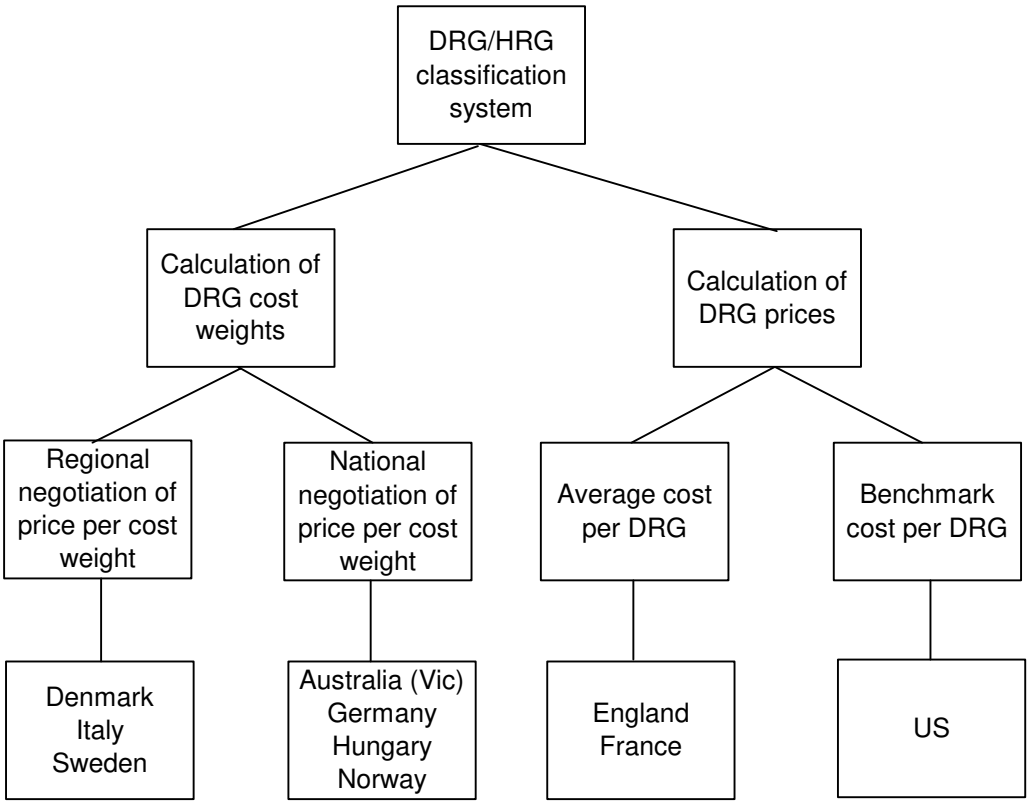


Figure 4.7: Options for converting costs into prices

Another feature of international policy is a deliberate separation between prices and the underlying cost information on which they are based. Instead of reporting price in monetary units, cost information is converted into a system of cost weights. This works like a points system, whereby a benchmark treatment is assigned a score of (say) 100 points, with more points for more costly procedures (Jackson, 2001, Kjerstad, 2003, Schreyögg et al., 2006). National and, in some countries, local policy-makers then decide how much to pay per point and, if necessary, can adjust this monetary value periodically to control global expenditure (Kjerstad, 2003).

In Denmark, the National Board of Health sets the DRG-prices based on cost data. The number of hospitals that provided these data has increased from three in 2000 to 43 in 2004. The DRG-prices are recalculated every year based on last year's activity and annual accounts. The hospitals report to the National Board of Health which then combines the information about activity and costs in order to calculate the DRG-prices. The DRG-price is an average price for all patients in the individual DRGs, meaning some hospitals will experience higher or lower costs when treating a patient within each DRG.

In Norway, DRG weights are also equal for all hospitals irrespective of the hospital's particular cost structure, size and the type of hospital. A national set of cost weights is estimated on the basis of costs in selected hospitals. The price of a DRG point is equal throughout the country and, hence, reimbursement to regional health authorities is also equal. But the regional health authorities are allowed to alter these reimbursement rates when allocating funds to their health enterprises.

4.4 Funding of other activities

4.4.1 Introduction

As mentioned in section 2.1.3, rarely do countries pay hospitals solely on the basis of activity that can be classified into HRGs/DRGs. Rather, hospitals receive funding based on a variety of other characteristics, summarised as $\mathbf{Z}^A$ in equations 4 and 5. The proportionate split between activity-related payments and these other funds varies across countries and over time, as summarised in Table 4.8 below. This shows the proportion of hospital revenue that is activity-based, for selected countries, from the year that activity-based funding was first introduced. So, for instance, Portugal first introduced activity-based funding in 1990, when it accounted for only 10% of revenue for the average hospital, the remainder allocated in the form of block grants. This proportion has slowly increased over time, accounting for 50% of revenue after 2002.

It is notable that the proportionate share of activity-based funding has not always increased over time. In Stockholm, all revenue was allocated on this basis from 1992-4, but subsequently block grants were introduced, with activity-based reduced to 70% of revenue. The proportionate share has also oscillated in Norway.

Table 4.8: Approximate proportionate share of hospital revenue that is activity-based

Country / Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Portugal	10								20	30			50					
Sweden (Stockholm)			100			70												
Ireland				20														50
Australia (Victoria)				26	41						70							
Norway								35								60	40	
Spain (Catalunya)									30									
Denmark											10	15			20	45		
Germany											100							

Source: updated and expanded from (Wiley, 2004)

The composition of these payments also varies from place to place and over time. As an example, details of the composition of total hospital revenue in Australia (Victoria) for the first five years of activity-based funding are provided in table 4.9.

In general, there are three grounds on which non-activity-based payments are justified:

1. Payments are made for services provided to patients for whom no satisfactory classification system is available, such as outpatients, mental health, and rehabilitation. An example is the grant for “non-admitted patients” to hospitals in Victoria. This grant has since been replaced by activity-related payments, as classifications have been developed for outpatients.

2. Payments are made for non-patient related activities that hospitals undertake, such as teaching and research.

3. Payments are made for costs that hospitals incur because of the environment in which they are located or the constraints they have on the organisational structure. These costs are considered out of the hospital’s control. Examples are the payments made to rural and isolated hospitals in Australia. Another example are the payments made in England to account for the differential prices that hospitals have to pay for staff, land and buildings, which are compensated through the so-called Market Forces Factor. The overhead grant paid in Australia is another example, justified because some hospitals will not be able to attain “economies of scale” because they will not be secure a sufficiently large activity base. This type of payment is akin to paying a premium to maintain access for small communities.

Table 4.9: Composition of hospital revenue in Victoria, Australia

Payment type	Justification and description	% of funding				
		1993	94	95	96	97
Activity-based funding		26	41	39	41	41
Performance enhancement programme				1	1	1
Training & development grant	Not part of patient services. Allowance for cost of health professionals with T&R responsibilities; and grant for providing undergraduate education	8	8	8	6	6
Overhead grant	Annual fixed grant to related to hospital size	27	26	25	23	23
Non admitted patients	Payments for outpatients and A&E	18	17	18	16	16
Specified grants	For dialysis, rehabilitation, non-English speaking patients, accreditation	6	8	9	11	13
Public medical payment	For differences in public/private mix of patients	0.5				
Rural/isolated payment	Allowance for additional cost of ambulance services, and minimum operating grant	0.1				
Nursing home type patients payment	Per diem payments for patients with non-acute patients with LoS>35 days	7				
Capital	Allowance for equipment costs and annual block grant	n/a	n/a	n/a	n/a	n/a
Compensation grant	Transitional payment for first year only	8	0	0	0	0

Source: (Victorian Government Department of Health and Community Services, 1993a, Victorian Government Department of Health and Community Services, 1994) http://metrohealth.dhs.vic.gov.au/ahs/archive/pfg9798/2.htm accessed May 2007

4.4.2 Outpatient (ambulatory) activity

In Sweden, outpatient (ambulatory) care is generally funded through block grants, while in Norway it is financed by a combination of block grants, tariff reimbursements (fee-for-service) and a small fraction of out=of-pocket payments.

In both Norway and Denmark attempts have been made to introduce activity-based funding arrangements for these activities. Key to this is a means of classifying outpatients into groups with similar care requirements, analogous to DRGs for acute care. Prior to 2002, in Denmark there a single payment associated with each outpatient attendance. Replacing this, the Danish ambulatory case-mix system (DAGS) was introduced on January 1st 2002. The system is inspired by the American Ambulatory Patient Group-system (APG). In 2003 the DAGS itemised 55 different categories, including: 51 procedures, visits for cancer and diabetes patients, a “traditional” outpatient visit and an emergency room visit. As with the DRG-prices the DAGS prices are based upon cost studies from a number of hospitals (54 hospitals in 2003).

In Victoria, prior to 1997, outpatient grants were historically based (http://www.health.vic.gov.au/vacs/index.htm access May 2007). The lack of links between activities and funding provided perverse incentives in the provision of services. From 1 July 1997, Victoria introduced the Victorian Ambulatory Classification and Funding System (VACS) to the 19 major hospitals. Unlike inpatient services, there was no agreed international, national or local classification system comparable to the inpatient diagnosis codes, so an outpatient classification system was developed so that hospitals could be funded on the basis of patient encounters. The encounter is

defined as the clinic visit, plus all ancillary services (pathology, radiology and pharmacy) provided within the 30 days either side of the clinic visit. The 30-day window has been chosen to encompass the majority of services associated with a particular visit and to enable a reasonable and practical time period for reporting and funding. This approach more closely reflects patterns of clinical care and provides better resource utilisation and controls than the "unbundled" fee-for-service or occasions of service systems. Clinical specialties form the basis of the VACS system. There are 47 categories, all of which are weighted, except for allied health and emergency medicine.

4.4.3 Visits to emergency wards

For many patients, the first point of contact with the hospital is the emergency ward. Some of these patients are subsequently admitted to hospital; the others are cared for in the emergency ward and then discharged. Countries that have introduced activity-based funding differ in the way that these emergency wards are financed.

The majority of countries make different payments according to whether or not the patient was admitted (Table 4.10). If the patient is admitted, it is usual for the standard DRG tariff to apply – in effect the fact that the patient was admitted through the emergency ward is deemed immaterial to the overall cost of their care.

	Emergency visit + inpatient admission	*Emergency visit without inpatient admission*
Austria	Included in the DRG tariff	Payment per visit / item of service
Denmark	Included in the DRG tariff	Outpatient DRG (DAGS)
Germany	Discount to the base DRG tariff	No specific financing mechanism
Italy	Included in the DRG tariff	Payment per visit / item of service
Norway	Included in the DRG tariff	Payment per visit / item of service
Romania	Included in the DRG tariff	Budget devoted to emergency wards
Spain (Catalonia)	Included in the DRG tariff	Fixed grant by hospital type
State Victoria	Included in the DRG tariff	Fixed grant for non-admitted emergency services
Sweden	Included in the DRG tariff	Payment per visit *)
Switzerland	Included in the DRG tariff**)	TARMED tariff
United Kingdom	Separate HRG tariff for non-elective admission	80:20 model for A&E departments

*) From 2006 onwards it has become possible to use the new DRG groups created in the NordDRG system to reimburse outpatient care

**) Higher tariffs for hospitals with an emergency ward.

Source: summarised from www.sante.gouv.fr/htm/dossiers/t2a/doc_pdf/**emergency**.pdf accessed May 2007

Table 4.10: The financing of emergency wards

To cover the costs of patients that are not admitted, two broad approaches have been adopted:

1. Payments are made according to workload, which might be based on the number of visits, items of service (consultations, x-rays, etc) or a a DRG-equivalent classification of patients;
2. A global budget / grant is awarded to cover the fixed costs of the emergency ward, on top of which there may be some adjustment for workload.

Funding arrangements are different in England, because the NHS organises wards around specific specialties and does not have "emergency wards" akin to those in other countries. In England, the route of admission into hospital does impact on the HRG tariff payment – separate prices are set for elective and non-elective patients, even though they are grouped to the same HRG, and the non-elective payment tends to be higher.

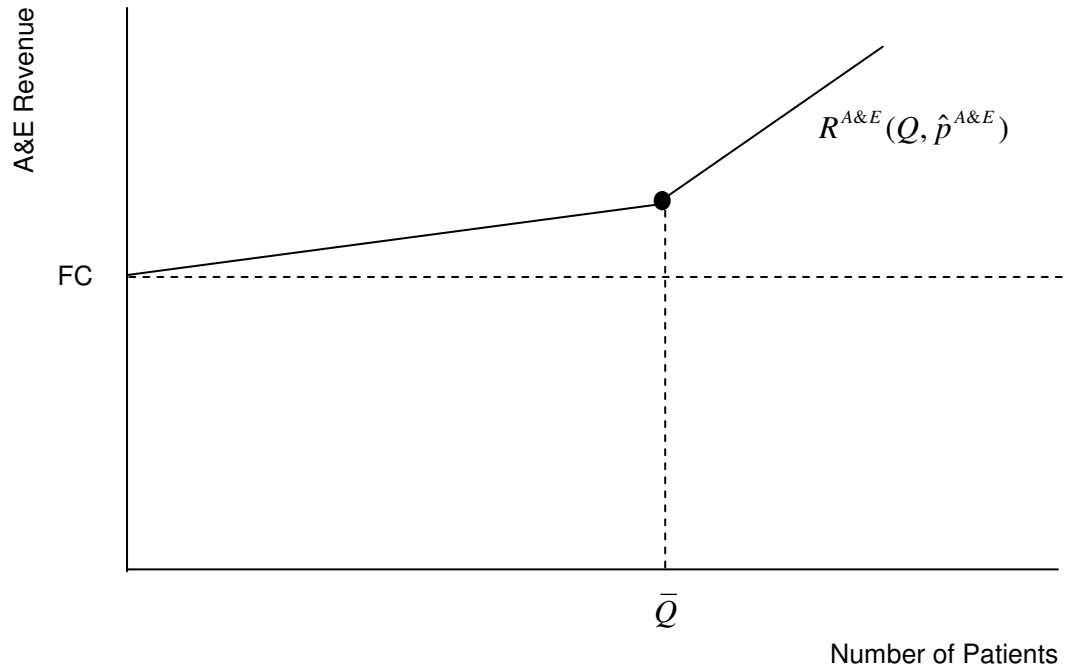


Figure 4.8: Revenue function for English A&E departments

Funding of accident & emergency departments (and minor injuries units) in England has evolved over time, and the current plan is to apply an 80:20 fixed:variable funding model, in which a grant covers 80% of (fixed) costs and 20% of revenue is related to (variable) activity up to a planned level (Department of Health, 2007). Above the planned level, the A&E department is paid the full A&E tariff. The revenue function for A&E departments takes the form:

$$R^{A\&E} = FC + \left[\alpha_1 \hat{p}^{A\&E} \times \bar{Q}\right] + \left[\alpha_2 \hat{p}^{A\&E} \times \left(Q - \bar{Q}\right)\right] \quad (5)$$

where *FC* corresponds to the fixed grant, and $\hat{p}^{A\&E}$ is the national A&E tariff. Under the English formulation, $\alpha_1 = 0.2$ - only 20% of the tariff is planned up to the level of planned activity $\bar{Q}$, and $\alpha_2 = 1.0$ - the full tariff is paid for activity beyond that planned. The revenue function is depicted in figure 4.8, which shows an upward kink beyond the planned level of activity. Clearly, if it is in their power to do so, there are strong financial incentives for A&E departments to increase activity beyond the planned level.

4.4.4 Rehabilitation

In Norway, the regional health authorities are obliged to coordinate rehabilitation activity. Rehabilitation services are conducted at the specialist health care level in special rehabilitation hospitals, in ordinary hospitals and in other institutions. Most hospitals have organized rehabilitation as part of their medical departments and in special departments, and are financed partly by activity-based funding. Rehabilitation is also conducted in private institutions, especially post-operative rehabilitation, and following GP referral. These private institutions are funded by the regional health authorities.

In Denmark, special charges for rehabilitation were introduced, based on local cost studies, from January 1st 2007. Activity-based payments are made under five groups for rehabilitation of hospitalised patients (varies from approximately £68 to £1,000) and three groups for outpatient rehabilitation (varies from approximately £6 to £128).

Prior to 1999 funding for rehabilitation in Victoria was made through a per diem block grant to designated rehabilitation units (http://www.dhs.vic.gov.au/ahs/archive/pfg9920/4.htm accessed May 2007). For those hospital services not designated as rehabilitation units, payment was made through

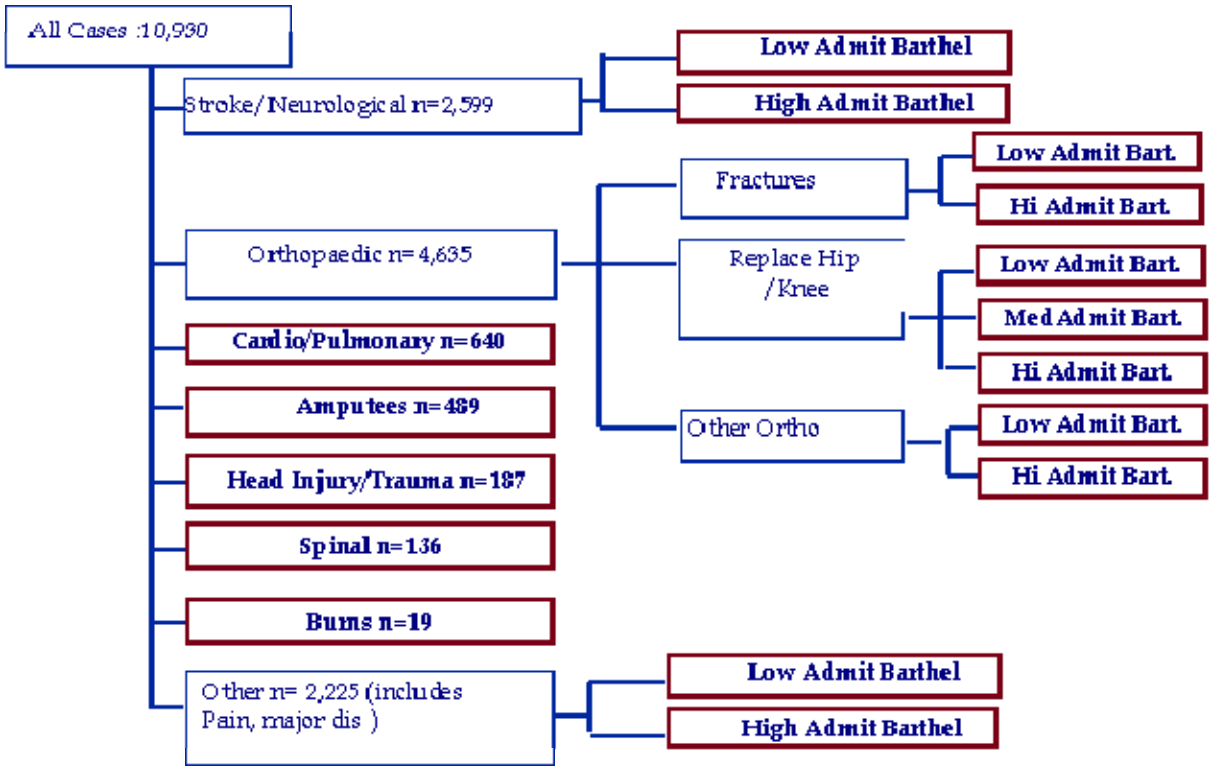
a single AN-DRG payment. Payment was based on a per diem rate at two levels reflecting the rehabilitation type:

- Level 1, spinal, amputation and head injury (where the rehabilitation episode follows the acute care episode in which the injury is the principal diagnosis);
- Level 2, stroke, orthopaedic, neurological, and other rehabilitation services.

After 1999, the VicRehab funding model was introduced, based on the Casemix Rehabilitation and Funding Tree (CRAFT) classification (figure 4.9). This CRAFT Classification has been designed to ensure:

- Clinical similarity within groups;
- Resource homogeneity within groups;
- Administrative ease (in the collection and integrity of data); and
- Suitability for funding agencies, i.e. ease of implementation and application.

The tree shows the primary split into major clinical groups and sub-splits show the sub clinical groups, totalling 16 classes in all. The final 16 categories are highlighted in bold (e.g. orthopaedic fractures with high admission Barthel scores, all persons with spinal injuries undergoing rehabilitation).



Source: http://www.dhs.vic.gov.au/ahs/archive/pfg9920/4.htm accessed May 2007

Figure 4.9: Classification of rehabilitation patients in Victoria

4.4.5 Mental health services

Mental health services in Norway are financed by block transfers from the state to the regional health authorities and by earmarked means as part of the Escalation Plan for Mental Health. So far there is no activity-based funding in place for this area, although there are some fee-for-service arrangements established for mental health care services provided as part of ambulatory care. The Norwegian

Ministry of Health and Care Services has begun developing patient classification systems for health services including psychiatry, substance abuse care, rehabilitation, highly specialized acute services and a unified system for laboratory tests. A patient classification system for psychiatry is a high priority. A joint patient classification system for all types of acute treatment, including ambulatory care, was introduced in 2006 and the plan is to introduce an extended version of the activity-based funding in 2007.

In Denmark, global budgets from the counties are currently used for mental hospitals. When patients are treated at hospitals outside their residential county then bed day charges or an outpatient charge per visit is used. The development of this system is time consuming, and there is a plan to introduce a new system in about three to five years. Currently the clinical societies and the National Board of Health is working on developing DRG-groups for mental health care. 42 groups have been suggested based mainly on the main diagnosis, other complicating diagnoses or other complicating factors and the age of the patient.

In Victoria, clinical mental health services are funded through a combination of block grants and per diem payments, while from 2005/6 an output based pricing model was introduced for the majority of psychiatric rehabilitation and support services, which are defined mainly in terms of client contact hours (http://www.health.vic.gov.au/pfg/pfg0607/pfg0607.pdf accessed May 2007).

4.4.6 Teaching and research

In Sweden medical research is mostly financed by government funds, but the county councils also provide resources for clinical research that is closely connected with patient care. According to the Health and Medical Services Act, the county councils and the municipalities have a duty to assist in the financing and planning, as well as in the actual research within health and health care services. The local authorities also have to cooperate with each other and with universities involved in research in this area. Of the eight regional hospitals in Sweden, seven are affiliated to a medical school and also function as research and teaching hospitals. The central government finances the hospitals for those costs associated with teaching and research.

Research funding has become more dependent on nongovernmental contributions during the last 10 years. Nongovernmental funds for research increased steadily, whereas government funds fell during the period 1994–2003 (Swedish Research Council 2003).

The main settings for Norwegian research are universities, the clinical sector (hospitals) and the research institute sector. In 2004, a grant for research, education and national medicine competence centres was established giving the regional health authorities a greater responsibility for research. The regional health authorities receive the grant from the state based on the degree of research activity.

4.4.7 "Exogenous" factors

Public hospitals operate in constrained environments. They cannot chose where they are located, or the population they serve, and – at least in the short term – they have limited discretion about their size and the mix of specialties they have. These constraints may impact on the cost of service provision, irrespective of how "efficient" the hospital is.

Some jurisdictions make allowances for the constraining factors because they are deemed "exogenous" or outside the hospital's control. In England, allowance is made for the higher costs of land, buildings and staff in some parts of the country, through the Market Forces Factor.

In Victoria, hospitals receive various grants to compensate for such cost influences, it being particularly important to maintain access to health care facilities in isolated parts of the state. When activity-based funding was first introduced (1993), such grants were made to hospitals in rural and isolated areas because they faced higher transportation (ambulance) costs and because they would not be able to achieve sufficient levels of activity to generate economies of scale (Victorian Government Department of Health and Community Services, 1993a, Victorian Government Department of Health and Community Services, 1993b). These compensating payments have been periodically reviewed, and their basis has changed over time. Currently in Victoria (2007), additional "top up" payments are made to the DRG prices (Victorian Government Department of Human

Services, 2006). In effect, the policy of a single price per DRG that applies across the whole of Victoria has been abandoned.

Elsewhere, it is likely that allowance for exogenous factors is made through the block grants that hospitals receive alongside their activity related revenue. These arrangements tend to be negotiated on a hospital specific basis and details are not made public (though Victoria has an admirable policy of publishing hospital specific details of funding arrangements (Victorian Government Department of Human Services, 2006)).

4.5 Quality

There is nothing inherent in activity-based funding that will ensure that quality is enhanced – but the same can be said of global budgeting as well. Activity-based funding has been criticised, though, because it encourages hospitals to reduce the costs of care delivered to individual patients. The hope is that they will do this by operating in a more efficient manner, but another strategy might be to "skimp" on quality.

Compromises to quality might take a number of forms, but two have received specific attention. First, in the US, concerns have been raised that hospitals will engage in "risk selection", by trying to identify in advance (prior to admission) those patients whose costs are expected to be lower than the DRG-price and to deter patients with higher expected costs. The hospitals makes a profit on the former group, and a loss on the latter group. There is evidence that such behaviour occurred in the US following implementation of activity-based funding (Rogers et al., 1990). Such behaviour is less likely to occur in public health systems, however, where hospitals have an obligation to accept referrals and to treat patients requiring emergency care.

A second concern is that hospitals will try to discharge patients earlier than clinically appropriate, effectively shifting some of the costs onto carers in the community or primary care sectors. Again, there is evidence from the US that patients were discharged "quicker and sicker" following the introduction of activity-based funding (Kosecoff et al., 1990). But it has to be questioned whether this behaviour is undesirable – many countries have tried to reduce length of stay, irrespective of whether or not they have introduced activity-based funding. The challenge is to ensure that funding follows the patient as they are transferred to different settings. Unlike the US (and Australia), the NHS is in better position to co-ordinate care across settings, because ultimate (clinical and, possibly, financial) responsibility resides with the patient's GP. In countries, such as the US and Australia, GPs do not have formal responsibility for such co-ordination. Building on the NHS GP's role, in England practice based commissioning has been introduced so that GPs hold a budget for their patients' care. In addition, the English Department of Health has tried to "unbundle" the care pathway, by separating out various components of the care process (eg diagnostics, inpatient admission, and rehabilitation) and setting sub-HRG prices for each of these. However, while allowing GPs the opportunity to unbundle is laudable, trying to establish at national level precisely how this should be done and what price should be attached to each component seems unnecessary. It may be better to allow local flexibility and negotiation in the unbundling process, which may better reflect particular circumstances and encourage local innovation.

To ensure that quality is not compromised, effort must be put into measuring and monitoring quality, such as the inspection regime overseen by the Healthcare Commission. At present in Wales there is a paucity of information on the quality of health care provision. For instance, no routine information is collected on the health outcomes associated with treatment and even in-hospital mortality rates by hospital are not monitored – in contrast to Scotland and England where they have been published since the early 1990s (Street, 2002).

Rather than a threat to quality, the introduction of activity-based funding in Wales might be an opportunity to consider how best to develop formal mechanisms to measure quality and to build on best practice.

5. The evidence of activity-based funding

5.1 Introduction

In this section we summarise studies that have looked at the impact of activity-based funding in the four jurisdictions on which this review has focussed. While there is a limited literature on the effects in Denmark and Sweden, a number of studies have explored the Norwegian experience and these are considered in some detail.

The Victorian policy with respect to waiting lists is then described, followed by a summary of the effect of the policy. This is an updated and formalised version of a previously published paper (Street and Duckett, 1996). The policy is of particular interest to Wales, because activity-based funding in Victoria was formulated specifically to ensure that patients waiting for treatment were afforded priority when activity increased. The Victorian policy, therefore, offers an alternative – or supplement – to setting waiting list targets.

5.2 Impact in Denmark

Activity-based funding was first introduced in 2002 with a 1.5 billion DKK activity-based fund (although activity-based payments had been used earlier to mediate between counties for patients choosing treatment at another hospital outside the residential county). Because of the limited timeframe since ABF was introduced no independent evaluative studies have yet emerged that assess the impact of ABF. Nor is it straightforward to isolate the potential impact of ABF from other initiatives implemented in the same period – particularly a waiting guarantee introduced in 2002 for a number of elective surgical procedures. Therefore it has not been possible to establish any clear relation between e.g. the development in expenditures or activity and the use of ABF-models in 2002.

Activity has however increased rapidly after the introduction of the national initiative with a 1.5 billion DKK activity-based fund (Ministry of the Interior and Health, 2005a). The activity increased in terms of DRG-value, number of operations, and the number of contacts. From 2004 where the initiative with minimum 20% of the funds being activity-based, the increase in activity rose even faster.

5.3 Impact in Stockholm, Sweden

Productivity in the Stockholm hospitals was estimated to increase by about 20% in the first two years of the reform (Mikkola et al., 2002, Charpentier and Samuelson, 1999). Costs also fell, because the DRG prices were reduced year-on-year (Mikkola et al., 2002). The productivity progress was a consequence of decreased average length of stay, an increase in number of operations and faster turnover of patients (Jonsson, 1996, Charpentier and Samuelson, 1999). For instance, the lengths of orthopaedic stays almost halved between 1990 and 1992 in Stockholm county because patients were transferred earlier to ‘cheaper’ beds in geriatric wards or old-age homes (Strömberg et al., 1997). Long waiting lists were also reduced during the first 2 years of the reform and the quality of care was claimed to be improved due to shorter queues, while there was no evidence of “DRG-creep” or patient selection (Mikkola et al., 2002).

However, productivity improvements proved temporary. By 1997, the productivity of hospitals in Stockholm was similar to level observed 1991 (Mikkola et al., 2002). Queues also reappeared and examples of DRG-creep were noted, although still at a rather low level. Productivity declines may be due to various reasons, including a failure to reduce hospital capacity and a movement from 100% activity-based funding. Furthermore activity growth had to be reined in because it had begun to exceed the available budget (Charpentier and Samuelson, 1999).

5.4 Studies in Norway

5.4.1 Activity rates

The main reason for implementation of the Norwegian ABF-reform was mainly to increase hospital efficiency in order to reduce waiting times. However, it was up to the county councils to implement the new financing system in their hospitals. By the year 1997, 15 out of 19 counties had adopted the reform, and in 1998, two more counties implemented ABF, the remaining two counties implemented the system in year 2000. Kjerstad analyses the effect of the Norwegian ABF reform on the number of patients treated and the number of DRG points produced for the period 1996 to 1998 (Kjerstad, 2003). The results show that there are significant differences between the hospitals that had adapted the ABF system and those which still had the same financial system as before the reform. They find that the ABF-reform had a positive effect on the number of patients treated and DRG points produced. In fact, hospitals with ABF had around 3% higher DRG points compared to non-ABF hospitals.

Biørn *et al* study the effect of ABF reform on efficiency in Norway for the period 1992 to 2000 (Biørn et al., 2003). They find an average yearly increase in hospital activity by 3.2% from 1997 to 2000, compared with 2% in the period from 1992-1997. Further, they find that the ABF reform has improved efficiency when measured as technical efficiency, while the effect on cost efficiency has been constant or declining. However, they argue that the latter effect might be due to a shortage of health care personnel, which in turn might have worked in the direction of increased cost of labour related to the increased production.

The Norwegian Research Council has recently released an evaluation report concerning the impact of the Norwegian hospital reform introduced in January 2002 (Norwegian Research Council, 2007). The report contains several aspects of this reform such as the impact on activity, prioritisation, long-term care and hospital length of stay for the elderly, etc. However, it's not quite clear that change in activity rates or length of stay is due to the hospital reform alone but that the system of activity-based financing might have contributed to these changes. One of the studies in the evaluation report examines the impact of the Norwegian hospital reform with respect to the growth of hospital activity in the period from 1999 to 2005. The impact of the reform was analysed by comparing the growth in activity in period before and after the reform, and imposed control of other relevant factors influencing the development in hospital activity.

The study analyses changes in total hospital activity (daycare and in-patient admissions), six different types of admissions (acute care, elective care, surgical DRGs and non-surgical DRGs, daycare and in-patient care), six different DRGs and total hospital activity among five different age-groups. Hospital activity was measured as DRG-points or according to the number of hospital stays.

In general, the results indicate a growth in hospital activity (measured as DRG-points) after the hospital reform both across all types of admissions (6 categories) and age groups (5 categories). The growth in hospital activity was 18.3% after the reform (from 2001 to 2005) compared with 9.4% before the reform (from 1999 to 2001). But activity differed across DRGs – the study found positive growth for four DRGs but reduced activity for two of the DRG groups after the reform. The study results were robust when controlling for a general time-trend, changes in the ABF reimbursement rates, changes in LoS, demographic changes (population growth) and changes in the size and specialization level of the health enterprises.

5.4.2 Other measures of "efficiency"

The implementation of activity-based funding has shown positive effect on efficiency both in terms of reduced waiting times and improved activity (Kjerstad, 2003, Biørn et al., 2003). In a recent study, Hagen et al (2006) analyse the effect of introduction of ABF on hospital efficiency (Hagen et al., 2006). They find that introduction of ABF affected technical efficiency positively and significantly while the effect of cost efficiency was insignificant. The effect of ABF on technical efficiency was between 4 to 5%. (Technical efficiency is measured as hospitals ability to produce to more output with the same amount of input)

Another study in the evaluation report is an analysis of hospital efficiency in Norway compared with other Nordic countries (Kittelsen et al., 2007). The study is based on data from 729 hospitals in Finland (1999-2004), Norway (1999-2004), Sweden (2002-2004) and Denmark (2002). Productivity

measures are obtained by using data envelopment analysis (DEA). The results indicate that productivity in Norwegian hospitals is lower than Finland and Denmark. However, they find that the reform has had a positive effect on hospital efficiency, i.e. between 3 and 4 percentage points.

5.4.3 Quality

Sandvik *et al* study the impact of ABF on quality based on patient satisfaction (Sandvik et al., 2000). Their study is based on 2221 records from emergency room admissions of patients at 15 somatic hospitals in Norway. Half of the records were from patients admitted in the fall of 1996 (one year before the ABF reform), and the other half were from patients admitted the fall of 1998. Four categories of patients were considered in the study; patients with stroke, fracture of the neck of the femur, acute abdominal pain, and randomly chosen admitted patients. The results indicate that some of the patients were discharged from the hospital without sufficiently medical clearance. After the ABF reform, patients were more satisfied with nursing care and information flow compared with patients before the reform. On the other hand, patients reported less satisfaction with the organisation of doctors' care, unexpected waiting times and medically incorrect treatment after the reform.

Hagen *et al* consider the effect of ABF system on quality measured as patient experiences with hospital care (Hagen et al., 2006). They find an increase in patient satisfaction after the reform as a result of lower waiting times, which in turn is an effect of the introduction of ABF reform.

5.4.4 Overall expenditure

The funding of hospitals in Norway is based on a combination of block grants and ABF based on DRG prices. Comparison of hospitals' revenue and expenditures show that the actual ABF coverage of hospitals' expenditure is less than what hospitals receive. For example, in 2004 the funding was based on 40% ABF and 60% block grants. In 2005 the share of ABF increased to 60%. According to SAMDATA (2006) only 26,8% of hospitals' actual expenditure was covered through ABF in 2004 (Jørgenvåg, 2006). In 2005, 41% of hospitals' expenditure was covered through ABF. However this increase could be because of an increase in the percentage of DRG reimbursement in 2005.

5.4.5 Reporting behaviour (eg DRG creep/upcoding)

Hospitals might have incentives to upcode DRGs, i.e. report more severe diseases/DRGs, in order to increase their income. Based on data on two million patients, Aakvik and Kjerstad study hospitals' upcoding incentives (Aakvik and Kjerstad, 2005). They distinguish between hospitals with activity-based financing (ABF) at the department level and hospitals with ABF implemented at the hospital level only. They find that the percentage of cases with complicated conditions has increased from 17.4 percent in 1997, when ABF was introduced, to 30.4 percent in 2000, a process yielding substantially higher income to hospitals. However, they find only a small (but significant) difference between hospitals that have implemented the ABF at the department level compared with those who have not. In 2000, hospitals who had implemented ABF at the department level had a two percentage point higher use of complicated cases compared with the other types of hospitals. They also seek to find out if upcoding could result in shorter Length of stay (LOS) for complicated cases, but they find no evidence of upcoding; length of stay for complicated cases in ABF hospitals are not significantly different from LOS at ABF that have not implemented ABF at the department level. Aakvik and Kjerstad argue that the large increase in the use of complicated cases (at both types of hospitals) may still be explained by the reimbursement system, although the difference between hospitals having direct DRG reimbursement at the department level is only marginally different to those with ABF at the hospital level.

5.5 Waiting Lists in Victoria, Australia

5.5.1 Revising the incentives associated with waiting lists

Prior to the 1990s waiting list management in Victoria was the responsibility of each hospital. Surgeons, working in either hospital outpatient departments or their own private rooms, decided when patients needed treatment and then notified hospitals of the patient's name, operation to be performed and urgency status. Hospital administrative staff maintained computerised lists of patients waiting and provided monthly returns to the Department of Health that were the basis of published waiting list statistics. Hospitals conducted 'audits' of their own waiting lists by telephoning or writing to patients on a regular basis, usually six-monthly. There was no formal independent verification of the waiting list.

In Victoria, and Australia generally, waiting lists had long been used as a political tool by hospital administrators and clinicians to bargain for additional resources. Revenue increases and targeted spending similar to strategies in other public systems did little to resolve the problem beyond the short term. By the same token, budget reductions designed to force managers to reassess internal efficiency often met with threats (or the reality) of ward closures and consequential waiting list increases. Doctors had strong incentives to maintain lists in the expectation that their presence would encourage patients to seek private treatment, usually with the doctor who would have seen them in the public system had they waited long enough.

Two strategies traditionally proposed to reduce public hospital waiting lists - increased funding and incentives to encourage patients to use the private sector - failed to provide a long-term solution to the existence of waiting lists. The government often provided additional resources to hospitals to reduce waiting lists (especially in the run up to elections), but this created perverse incentives by rewarding hospitals with longer waiting lists. Consequently the number of people on waiting lists was relatively unchanged through the 1980s.

The approach taken to tackling Victorian waiting lists involved three distinct steps.

1. Hospital funding was linked to activity to ensure hospitals had the resources to reduce waiting lists.
2. A method for better defining the problem and categorising waiting list patients was developed.
3. Financial incentives were related specifically to the treatment of patients on the waiting list.

We describe these steps in more detail, before assessing the effectiveness of the policy.

Prior to the introduction of activity-based funding, hospital received global budgets which (in simplified form) can be expressed as:

$$R^G = p_{1j}\bar{Q}_j + p_2 W + \mathbf{Z}^G$$

where $\bar{Q}$ represents the target volume of activity, with patients described using DRGs (*j*), W represents the number of people on the hospital's waiting list, and $\mathbf{Z}^G$ represents other payments to hospitals, often taking the form of specific grants. p_{1j} and p_2 are, respectively, the hospital-specific prices paid for treating a patient in a particular DRG and for "maintaining" a patient on the waiting list. Of course, policy-makers did not express p_2 in these terms, but this specification of the revenue function merely reflects the policy of awarding additional money to hospitals in proportion to the size of their waiting list. Clearly, if hospitals receive more money the more patients on the waiting list (ie when $p_2 > 0$), it is in the interest of hospitals to keep people waiting.

In 1993, the Department introduced activity-based funding, which changed the hospital revenue function in a number of ways.

First, local prices per unit of activity (p_{1j}) were replaced with fixed prices $\hat{p}_{1j}$.

Second, the Department wanted to create incentives for hospitals to exceed their target activity rates. This involved linking revenue not to the number on the waiting list, W , but to additional activity, $Q - \bar{Q}$, where Q represents actual activity.

Third, the Department wanted hospitals to give priority to patients waiting for treatment when increasing activity. Moreover, the Department was concerned both about the number waiting and the deterioration in their condition that patients might experience while waiting to receive treatment. Deterioration is a function both of the time spent waiting and of the clinical urgency of the condition. In order to incorporate these concerns into the payment system, the Department developed a classification system to categorise patients waiting for elective surgery according to objective standards agreed by clinicians about the urgency of treatment. Three categories were devised such

that $W = w_1 + w_2 + w_3$, comprising patients in urgent need of treatment (w_1), those classified as semi-urgent (w_2), and non-urgent patients (w_3). Table 5.1 shows the number of patients in each category at the time the policy was introduced.

Table 5.1: Patients waiting for elective surgery in Victoria

		July 1993		*July 1994*	
Category 1: Total		1298		195	
	Waiting for less than 30 days		*449*		*190*
	Waiting for more than 30 days		*849*		*5*
Category 2: Total		12115		8506	
	Waiting for less than 90 days		*6680*		*5480*
	Waiting for more than 90 days		*5435*		*3026*
Category 3: Total		15332		15340	
Total waiting		**28745**		**24041**	

Fourth, despite wishing to encourage increased activity, the Department wanted to maintain control of global expenditure. A capping mechanism was provided through an 'additional throughput pool', *P*, which in 1993/94 had sufficient funds to pay for a 7% increase in activity. Funds from the pool were allocated quarterly according to each hospital's proportional contribution to additional activity (i.e. the price paid per case fluctuated so that price per case multiplied by the number of cases treated was equal to the available revenue). Hence, the unit price of treating an additional patient was calculated by dividing the amount of money in the throughput pool by the amount of additional activity provided across the hospital sector as a whole. Formally, this is expressed as:

$$p_3 = \frac{P}{\sum_{k=1}^{K}\left(Q_{jk} - \bar{Q}_{jk}\right)}$$

where *k* represents a hospital.

Finally, the Department wanted to ensure that patients on waiting lists were given priority when hospitals increased their activity. This was achieved by making access to the additional throughput pool *P* dependent on whether patients on the hospital's waiting list were treated.

Under funding arrangements for the first year of its introduction, hospitals were unable to claim revenue for additional output unless they had cleared their category w_1 patients by the end of December 1993. Hospitals with category 1 patients waiting more than the clinically desirable 30 days on 1 January 1994 were denied access to additional funds in subsequent quarters. In later years, the policy was revised to encourage hospital to clear category 2 patients by 1 April 1994, hence the funding condition was made dependent upon eliminating w_2.

As a consequence, the resulting hospital revenue function is more sophisticated than that under the earlier funding arrangements. Formally, the revenue function can be expressed as:

$$R^A = \hat{p}_{1j}\bar{Q}_j + \rho\left[p_3\left(Q_j - \bar{Q}_j\right)\right] + \mathbf{Z}^A$$

where ρ is a binary indicator variable taking a value of 1 if there are no category 1 patients (ie $w_1 = 0$) and zero otherwise.

5.5.2 The effect of the policy

The new incentive structure for waiting list management had an immediate effect. Table 5.1 shows that, within a year of the funding reform, the number on the waiting list had fallen by more than 4,700 patients, some 16% of the pre-reform total.

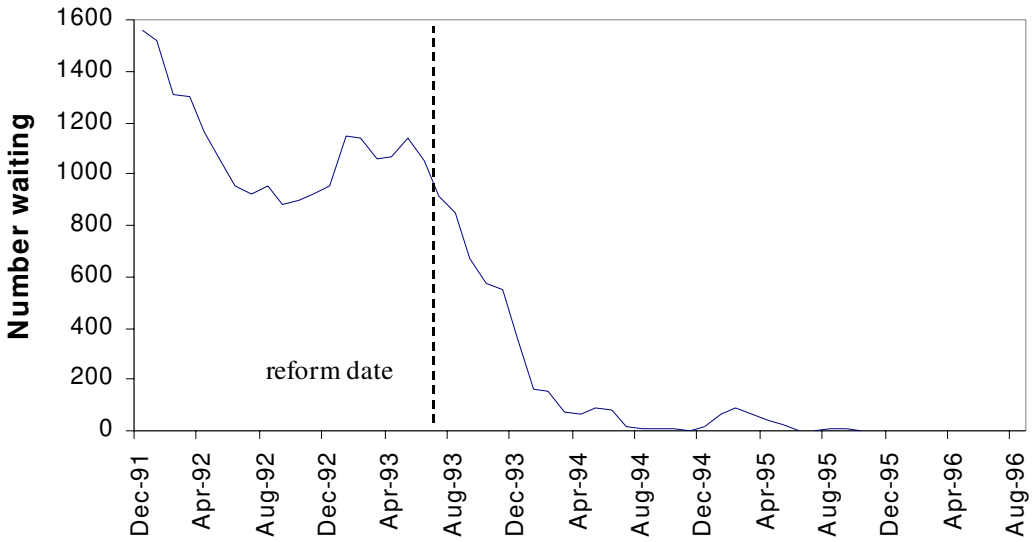


Figure 5.1: Category 1 patients waiting longer than 30 days

The most dramatic fall was in the principal target population of category 1 patients waiting more than 30 days. This was not a short-lived effect. As Figure 5.1 shows, by February 1996, nobody fell into this category, a situation that persisted until (at least) August 1996, more than three years after the reform was introduced.

Figure 5.1 also shows a decline in the number of category 1 patients prior to the introduction of activity-based funding. This was partly the result of a pre-election promise of additional funding to hospitals to clear lists. This was a targeted one-off initiative and enshrined the worst perverse incentives of providing additional funding to reduce lists – and was not sustained following withdrawal of funding.

There was also a decline in the number of category 2 patients waiting longer than clinically acceptable. The number waiting more than 90 days fell substantially in the immediate aftermath of the reform, with almost 2,500 fewer patients in this category in July 1994 compared to the previous year. The size of this reduction was not maintained, although the number of patients in this category never returned to pre-reform levels, as Figure 5.2 demonstrates.

In the absence of external audit it is possible that the hospitals' response to the financial incentives would have been to encourage surgeons to manipulate categorisation and/or additions to the waiting list. However, the relative stability of the number of category 3 patients indicates that reduction in categories 1 and 2 was not achieved by simply re-categorising patients from target categories to the residual, untargeted, category 3.

It appears that hospitals achieved waiting list reductions alongside increases in the number of elective surgery patients. The number of additions to the list increased, as shown in 5.3, with monthly additions in 1993/94 some 10% higher than in 1992/93. However, these additions were offset by increases in the number of patients treated (or deleted from the list for other reasons).

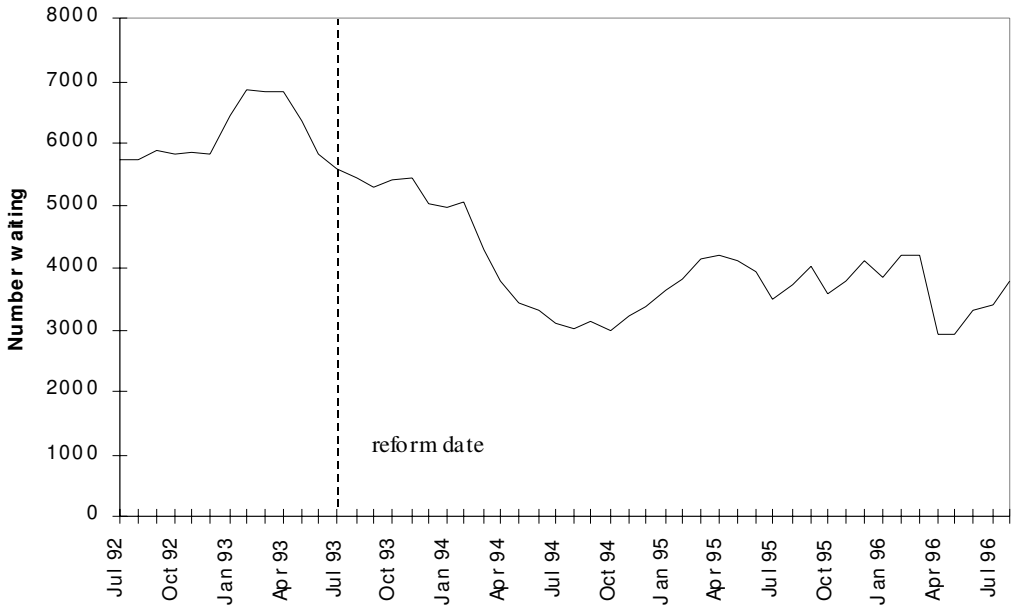


Figure 5.2: Category 2 patients waiting more than 90 days

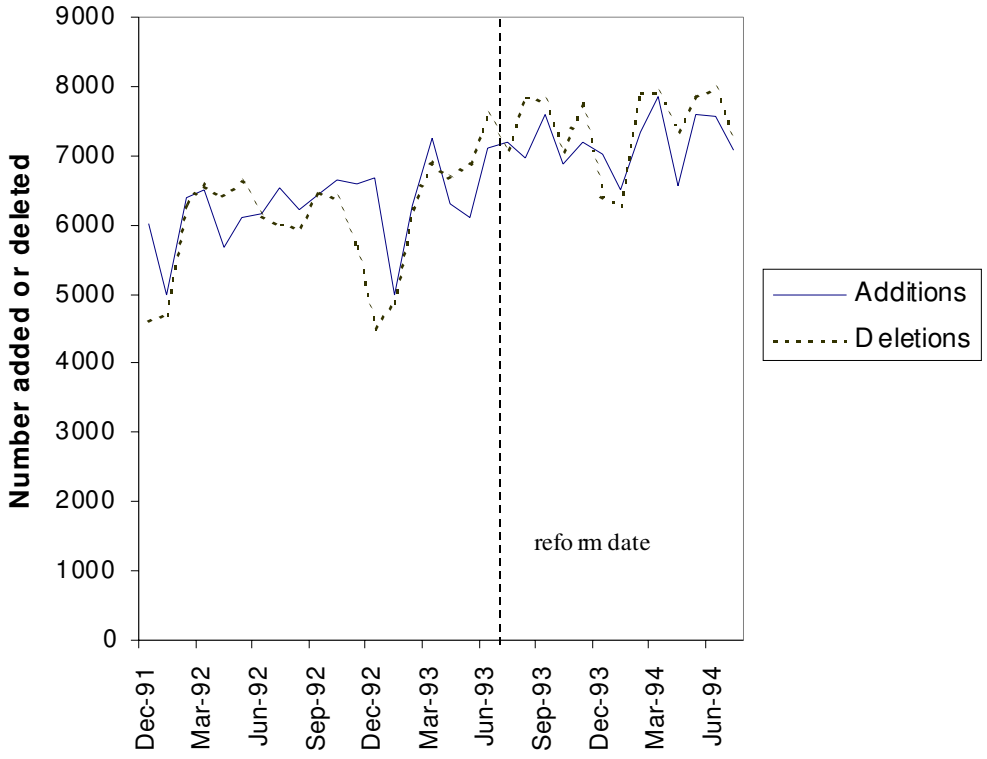


Figure 5.3: Additions to and deletions from waiting lists

6. Conclusions

Since its introduction in the US in the 1980s, activity-based funding has been adopted by progressively more countries, including (private or social) insurance-based systems or public health systems, and replacing cost-reimbursement or global budgeting arrangements.

There are many attractions to activity-based funding, but perhaps the most important are fairness and transparency. Fairness because equal payment is made for equal work. Transparency because activity-based funding formulae – though often complex – need to be specified in detail, so it is clear what payments are being made for.

Many other policy claims are made about what activity-based funding might achieve, but these require qualification. The table provides some examples.

Aims	Qualification
Increase efficiency in the provision of existing levels of activity	Prices based on average costs may dampen incentives for low cost providers to improve. High cost providers may skimp on quality to mitigate revenue losses Possible adverse consequences include selection of patients with low expected costs and up-coding – so ongoing review of the casemix classification system and audits of coding are necessary.
Where needed, encourage expansion of activity	Cost-based prices provide neutral signals about what is needed. Additional incentives are required to indicate what is most desirable.
Enhance patient choice	Yes, compared to global budgets, as no need for price negotiation.
Increase patient satisfaction	No obvious reason why satisfaction should be higher under ABF than alternative funding mechanisms
Reduce waiting lists	Yes, if incentives are structured so that activity increases are focused on waiting list conditions as in Victoria. In England, the target-setting regime has probably been more important than ABF in successfully reducing conditions with long waiting times.
Improve quality	Quality in danger of being compromised, especially if hospitals engage in risk selection, quality skimping or cost-shifting. Better measurement and monitoring of quality - in particular of patient outcomes - is required, together with enhanced regulatory safeguards and incentives.
Keep costs under control	Not compared to global budgeting. Additional mechanisms have been introduced in England to control overall expenditure such as activity ceilings, two-part tariffs and demand management mechanisms.
Channel funding where it is needed	Within the acute sector, cost-based prices provide neutral signals. Ability to channel funding away from acute sector depends on relative bargaining power of hospitals and commissioners, and mechanisms such as practice based budgeting to influence GP referral behaviour.
Shift patterns of service provision away from historical patterns	Ability of commissioners to redirect funding away from hospitals may be counteracted by hospitals trying to attract activity into the acute sector which is better undertaken in other settings. Risk that treatment centres and independent sector providers will “cream skim” less complex activity, thereby undermining economies of scale in NHS hospitals, with consequent inflation in unit costs.
Encourage the development of new, cost-effective treatment pathways	Yes, in the acute sector - exemplified by the structure of the elective tariff to encourage day case provision and by the development of treatment centres. For pathways spanning different providers, ABF might frustrate co-operative working practices unless the pathway can be “unbundled” to ensure fair reimbursement between providers.
Introduce fairness and transparency in	Yes, essentially ABF is perceived to be fair (equal pay for equal work) and transparent.

funding providers	Need to take account of influences on costs that providers cannot control, such as differential input prices (corrected for in England using the Market Forces Factor). May be a case for accounting for (dis)economies of scale and scope. Need to ensure sufficiently refined casemix classification system so that hospitals are not penalised for systematically attracting high cost patients within a HRG.
Encourage providers to be responsive to patients and purchasers	Yes, to patients, if hospitals are more active in seeking "business" now that they are paid on the basis of activity. But commissioners may clash with hospitals if they want to redirect activity to non-hospital settings.

The extent to which policy aims are realised depends on the specific form that activity-based funding takes, and how prices are set. Prices could simply reflect the (average) costs of existing practice. In this case, activity-based funding would encourage hospitals to ensure that their costs were (at least) below average, but might not stimulate much greater effort to reduce costs. This pricing rule would also take the existing mix of services as appropriate.

But prices could play a more extensive role, so that they are analogous to prices in most markets. Usually (market) prices provide important signals to producers about the demand for particular services – if there is under-provision, prices rise, thereby encouraging providers to expand provision. Prices in the health system could be regulated in a similar way if there is evidence that some treatments are being under-supplied. Prices, therefore, can be used as a policy instrument to signal what the health system should be doing and to sharpen incentives so that good practice is rewarded and emulated.

The perceived advantages of activity-based funding also depend on the funding system that it replaces. For instance, a key attraction of activity-based funding in the US was the promise of cost control compared to cost-based reimbursement. But in countries where global budgets had been in place, activity-based funding may make expenditure control more difficult.

Activity-based funding can also lead to unintended consequences. For instance, critics of activity-based funding have argued that it may compromise quality by encouraging hospitals to be overly cost conscious, leading them to cut corners or shift costs onto other contributors to the care process, such as GPs. To guard against such behaviour, activity-based funding has to be supplemented by additional regulatory mechanisms, such as activity ceilings, marginal pricing, data audit, monitoring of care process and measurement of patient satisfaction and health outcomes.

The experience of countries that are the subject of this review suggests that activity-based funding can be used to stimulate activity, reduce waiting times, and need not compromise quality. Nevertheless there are some challenges and risks associated with these funding arrangements.

First, control of global expenditure is more difficult than under global budgets. The English have recognised this – somewhat belatedly – and are introducing Practice Based Commissioning (PBC) to encourage GPs to control expenditure by limiting their referrals. But experience from fundholding suggests that PBC will not be a powerful enough mechanism to restrain overall expenditure (Street, 2007). The Victorian model, where activity increases are subject to an expenditure cap, appears to be a better approach.

Second, activity-based funding is most suitable for acute services. Attempts have been made to classify patients requiring non-acute services, and to fund these in a similar manner, with Victoria again leading the way. However, this remains a challenge and, in the meantime, alternative arrangements need to be considered to ensure that funding of such services is not compromised.

Third, there is a danger that activity-based funding might compromise quality. However, its introduction would provide an opportunity to improve the monitoring of the quality of care and to build on existing regulatory mechanisms to encourage quality improvements.

Fourth, there are many technical choices to be made about the specific form that activity-based funding might take and there are no “hard and fast” rules about what is the most appropriate formulation – our review reveals widespread international diversity in these choices. Often the choices are context-specific and dependent on what objectives are most desired. Activity-based funding is first and foremost an incentive mechanism, the power of which lies firstly in its ability to be designed so that clear financial incentives are attached to desired objectives and secondly in its flexibility, so that incentives can be altered or “tweaked” in line with behavioural changes and as circumstances change.

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