chapter ten

Moving towards transparency, efficiency and quality in hospitals: Conclusions and recommendations

Reinhard Busse and Wilm Quentin

10.1 Introduction

Part One of this book has provided comparative information from 12 European countries about the specific characteristics of their diagnosis-related group (DRG) systems, about how these systems are used for hospital payment and about the progress that has been made in moving towards transparency, efficiency and quality in hospitals. Part Two provides more detailed information from the 12 European countries and facilitates insights into the strengths and problems of DRG systems and DRG-based hospital payment systems in each of these countries. Together, the two parts of the book demonstrate a great degree of diversity in the specific design features of DRG systems and DRG-based hospital payment systems across countries, but at the same time they reveal that most countries are struggling with similar issues in their pursuit of common goals.

This chapter draws together the findings from Part One and Part Two in order to address the question raised in the title of this book; namely, whether we are moving towards transparency, efficiency and quality in European hospitals. In addition, the chapter makes specific recommendations for policy-makers regarding how best to design DRG-based hospital payment systems given country-specific aims and objectives, and it explores the potential for cooperation across European countries in designing and developing DRG systems and DRG-based hospital payment systems – a process, which could ultimately lead to the emergence of European DRGs as the answer to common problems in this field in European countries.

The next section (10.2) summarizes the country experiences and draws on findings of the available literature presented, especially in Chapters 7 and 8, in order to provide an overview of the status quo. That is: where are we now, in terms of transparency, efficiency, and quality in hospitals? Subsequently, section 10.3 makes recommendations for both types of countries – those preparing the introduction of DRG systems, and those optimizing existing systems. This section is structured according to the three building blocks introduced in Chapter 3; namely, the DRG system itself, hospital cost information, and actual DRG-based hospital payment. Finally, section 10.4 draws conclusions from the vast experience summarized in this book and aims to look into the future of DRGs in Europe, including the potential for coordinating, and eventually harmonizing DRG systems and DRG-based hospital payment in Europe.

10.2 Where are we now?

In almost all European countries in which DRGs have been introduced since the mid-1980s, the most important aims related to their introduction included increasing transparency, improving efficiency and assuring quality of hospital care (see Chapter 2). Today, after more than a decade of experience with using DRGs in most European countries, it is time to consider whether the extensive use of DRGs in the 12 countries included in this book has contributed towards achieving these aims. The country chapters in Part Two and the extensive literature searches carried out for chapters 7 and 8 on the effects of DRG-based hospital payment systems on efficiency and quality of care provide a solid foundation for approaching this question. The following subsections discuss how far European countries have moved towards achieving each of these aims.

10.2.1 Moving towards transparency?

Following the introduction of DRGs and DRG-based hospital payment systems, transparency of hospital services and costs has substantially improved in all countries, essentially for four interrelated reasons: (1) DRGs provide a concise measure for reporting hospital activity; (2) DRGs facilitate performance comparisons of costs, efficiency and quality; (3) hospitals are incentivized to increase their efforts in coding diagnoses and procedures; and (4) hospitals are encouraged to improve their cost-accounting systems (see Chapter 5).

First, because DRGs aggregate the confusingly large number of patients treated by hospitals into a small number of groups of patients with similar clinical characteristics and similar resource-consumption patterns, they provide a concise and meaningful measure of hospital outputs (Fetter et al., 1976; Goldfield, 2010). Prior to the introduction of DRGs, hospital activity was reported either on the basis of highly aggregated measures, such as the number of provided bed days and the number of discharged patients, or on the basis of very detailed measures, such as the main diagnoses or procedures of all patients. However, because none of these measures summarized patients with similar clinical characteristics and similar resource-need patterns, they could not meaningfully reflect hospital activity. Today, the vast majority of hospitals in all

countries – often including hospitals with different ownership (profit-making versus non-profit-making) and different levels of specialization (for example, teaching hospitals versus general hospitals) – are required to prepare detailed activity reports that specify the number and type of DRGs provided. These are usually made available to the public and help to overcome agency problems that existed prior to the introduction of DRGs, because purchasers did not have a meaningful measure for hospital activity.

Second, regulators, payers and hospital managers in most countries (for example, Finland, France, Ireland and Spain) are starting to use DRGs for hospital performance comparisons. They compare resource use of hospitals by assessing whether patients in one DRG are staying significantly longer in one hospital than in another, for example, or whether one hospital is significantly more costly than another when treating patients within the same DRG. Similarly, quality is compared by determining whether patients assigned to a particular DRG have a higher rate of complications in one hospital than in another, and efficiency is assessed by using DRGs as a measure of hospital output.

Third, because hospitals receive higher DRG-based payments if they 'code' (input) all relevant diagnoses and procedures, they have strong incentives to improve their coding practices. In many countries, clinicians, nurses or documentation assistants are specifically trained in order to improve their coding skills. Consequently, almost all countries find that information about diagnoses and procedures in hospitals has improved considerably since the introduction of DRGs. In addition, payers have introduced auditing systems to assure that the provided information is correct, which further increases the reliability of the available information. However, at the same time, the coding-related administrative workload has been of concern for clinicians in many countries.

Fourth, as discussed in Chapter 5, the introduction of DRG-based hospital payment has influenced cost-accounting practices in hospitals. On the one hand, regulators have mandated improved and standardized cost-accounting systems in hospitals, while on the other hand, hospitals have been incentivized to improve their cost-accounting systems for management purposes. Consequently, the quality of cost information has improved in most countries.

However, if patients within a DRG do not adequately account for differences between patients – that is, if DRGs are not sufficiently homogeneous – they are an inadequate measure of hospital activity and, consequently, hospital performance comparisons on the basis of DRGs will be unfair. Therefore, the methods used for ensuring that DRG systems are an adequate measure of hospital activity are highly important, particularly because innovations are continuously changing the way hospital services are provided. In addition, performance comparisons on the basis of DRGs need to take into account that certain factors may be beyond the control of hospitals (for example, treating a larger share of socially disadvantaged patients or having higher labour costs), which are not accounted for in the DRG system. Furthermore, while DRGs have contributed to increased transparency of hospital services within countries, transparency of hospital services across countries remains limited because different DRG systems are used in different countries, thus preventing – or at least severely complicating – comparisons of hospital activity and performance across borders except where the same systems are in use.

10.2.2 Moving towards efficiency?

As discussed in Chapter 7, although improving hospital efficiency is generally a key motivation for introducing DRG-based hospital payment systems, there are relatively few studies that have explicitly identified and quantified the impact of these systems on efficiency using established data-driven methods such as data envelopment analysis (DEA) or stochastic frontier analyses. Rather, most research has concentrated on indicators of efficiency – such as activity and length of stay – which are more easily measured, but by definition provide only a partial picture of efficiency.

Existing studies using DEA or stochastic frontier analyses – both with their own particular limitations (Street et al., 2010) – have produced mixed evidence on the extent to which DRG-based hospital payment has contributed to higher efficiency levels in hospitals. The studies reviewed in Chapter 7 reported that the introduction of DRG-based hospital payment was associated with improved technical efficiency in Portugal, Sweden and Norway, but that no positive impact was observed in the United States and in an Austrian study. On the one hand, this mixed evidence could be related to the considerable differences in the design and operation of DRG-based hospital payment systems in different countries and to heterogeneity in the hospital payment systems that existed prior to the introduction of DRG-based hospital payment. On the other hand, studies may have underestimated (or overestimated) the effect of DRG-based hospital payment on efficiency because attribution of efficiency changes to a hospital payment reform in longitudinal studies is complicated by the existence of confounding factors, such as changes being part of wider reform packages, and because detected changes could merely represent changes in documentation practice. In addition, because of an almost complete absence of data, it remains unknown whether the effect of the potential unintended consequences of DRG-based hospital payment systems (such as overtreatment of admitted patients ('gaming') or increased admissions of patients for unnecessary services (see Chapter 6)) could have led to reduced allocative (output) efficiency.

There is generally agreement in the literature that the introduction of DRG-based hospital payment systems has led to increased activity and reduced length of stay, and it is consequently often assumed that hospital efficiency has improved. For example, studies have found that hospital admissions increased following the introduction of DRG-based hospital payment in Australia, Denmark, England, France, Germany, Norway and, at least initially, in Sweden, while results for Italy are mixed (see Table 7.4 in Chapter 7). Hospital activity did not increase in the United States, but this is in line with the expected effects of DRG-based hospital payment when replacing a fee-for-service system. Yet, of course, the aforementioned points regarding country-specific contexts and the difficulties in attributing causality also apply here.

Mostly based on the evidence of these studies, the authors of the country-specific chapters in Part Two come to similar conclusions. In Austria and England, for example, DRG-based hospital payment is thought to have contributed to increased efficiency. In the chapters on Estonia, Germany, Ireland, Poland, Portugal, Sweden and the Netherlands, the authors do not directly comment on the effect of DRG-based hospital payment on efficiency but

they highlight rather positive trends in costs, length of stay or productivity. For Finland and Spain (see chapters 18 and 22), DRG-based hospital payment is thought to have had only minimal effects on efficiency because country-specific design features imply that hospitals are not exposed to strong incentives for efficiency improvement (see Chapter 6). By contrast, in Chapter 13, Or and Bellanger come to a rather negative conclusion about the effect of the French GHM system on efficiency, which seems to be strongly influenced by the results of an evaluation by the Auditor's Office (Cour des Comptes, 2009).

In summary, while the evidence remains limited because of the above-mentioned difficulties in measuring and detecting efficiency changes (and in attributing them to the introduction of a specific payment system), the bulk of the literature and most of the authors in this book assume that DRG-based hospital payment systems have had a somewhat positive effect on efficiency. However, it is also clear that DRG-based hospital payment systems can have unintended consequences, such as 'cream-skimming', 'up-coding', overtreatment/'gaming', supplier-induced demand, and so on (see Chapter 6). If these unintended consequences are not accounted for by the specific design features of the payment system or by the regulatory and institutional context, they might threaten to outweigh any efficiency improvements that could be expected as a result of the introduction of DRG-based hospital payment systems.

10.2.3 Moving towards quality?

The effect of DRGs on quality of care has always been highly controversial: there have been major concerns on the part of health professionals in many countries that DRG-based hospital payment systems might compromise quality of care because hospitals are incentivized to reduce costs. However, at the same time, proponents of the use of DRGs have argued that quality of care could in fact be improved, because DRGs contribute to increased transparency in the quality of care and because hospitals are incentivized to invest in quality improvements that lead to reduced costs (for example, infection control measures or improved surgical techniques).

As discussed in Chapter 8, the effect of DRGs on quality of care has been assessed in numerous studies from the United States and – more recently – also in studies from Europe. The reviewed evidence from the United States has produced a multifaceted picture: some studies found that processes of care (for example, as measured by physician and nurse cognitive performance) improved following the introduction of DRG-based hospital payment (Kahn et al., 1990b), even though these changes could not be directly attributed to the hospital payment reform (Rogers et al., 1990). At the same time, a larger proportion of patients were found to have been discharged in unstable conditions after the implementation of DRG-based payment (Kosecoff et al., 1990), but mortality at 30 and 180 days following hospitalization was unaffected (Kahn et al., 1990a). It appeared that quality of care improved in certain hospitals and certain areas of care, such as colorectal cancer surgery (Schwartz & Tartter, 1998), but was worse in other areas of care (Gilman, 2000), in particular in hospitals for which

the introduction of DRG-based payment implied high levels of financial pressure (Cutler, 1995). In summary, studies from the United States suggest that quality of care was, in general, not significantly affected by the introduction of DRG-based hospital payment, as it did not compromise the long-term trend towards improved quality of care in hospitals (Rogers et al., 1990). However, the effect on quality needs to be closely monitored because there could be adverse effects for certain patient groups in certain hospitals and because a trend towards more unstable discharges emerged after the implementation of DRGs.

In Europe, the available research evaluating the impact on care quality and patient outcomes is too limited to draw any firm conclusions, in particular because evidence is available only from a limited number of countries. In England, little measurable change was found in the quality of care following the introduction of DRG-based payment, in terms of in-hospital mortality, 30-day post-surgical mortality, and emergency readmissions after treatment for hip fracture (Farrar et al., 2009). In Germany, 30-day post-discharge mortality significantly decreased during the introduction period of DRG-based hospital payment, and a large number of quality indicators were found to have improved over the same period of time (Fürstenberg et al., 2011). In Norway and Italy, studies did not find that quality decreased following the introduction of DRG-based payment (see Chapter 8), while one study from Sweden showed that patient-perceived quality of care decreased after the introduction of DRG-based hospital payment (Ljunggren & Sjödén, 2003).

In general, it seems that quality was not adversely affected by the introduction of DRG-based hospital payment in most European countries. However, of course, the impact of DRG-based hospital payment on quality of care always depends on the country-specific design features of the systems and the regulatory and health care context(s) in question. The effect of DRG-based hospital payments on quality of care might be different in Europe from that in the United States because (1) DRG-based hospital payment systems in most countries did not replace fee-for-service systems (as was the case in the United States) but rather global budgets, which were already partly adjusted for activity measured in cases or bed days (see Chapters 2 and 7); and because (2) there is a much stronger public sector presence in the provision of health care in Europe than in the United States.

Surprisingly, only very few countries explicitly adjust DRG-based hospital payments on the basis of information regarding quality in hospitals. One notable exception is England, where the Commissioning for Quality and Innovation (CQUIN) framework allows purchasers to link a moderate proportion of hospitals' income (that is, 1.5 per cent in 2010/2011) to the achievement of locally negotiated quality goals. In the Netherlands, insurers can negotiate with hospitals regarding price, volume and quality of care for about 30 per cent of Dutch DRGs (Diagnose Behandeling Combinaties, DBCs – see Chapter 23). However, apparently insurers and hospitals negotiate predominantly on price and volume, while quality plays only a minor role in the negotiation process. Instead of adjusting DRG-based hospital payment for quality, most countries reward quality improvements through specific budgets that are independent from DRG-based hospital payment (see Chapter 8).

One problem relating to quality adjustments of DRG-based hospital payments is that in many European countries, information on quality in hospitals is still insufficient. However, data quality (at least in terms of diagnoses and procedures) has been found to have improved considerably following the introduction of DRGs in many countries. In addition, the authors of the country-specific chapters in Part Two of this book (see, for example, Chapter 13 on France or Chapter 14 on Germany) highlight that national quality measurement programmes have been introduced in recent years. If these data are found to provide valid and reliable indicators for the quality of care, it is likely that there will be increased efforts to use such data also for payment purposes, called pay-for-performance (P4P).

10.3 Improving transparency, efficiency and quality in hospitals: Recommendations for DRG systems and DRG-based hospital payment systems

As highlighted in the previous section (10.2), the specific design features of DRG systems and of DRG-based hospital payment systems are of utmost importance because they determine whether countries will be able to reap the potential benefits of these systems in terms of transparency, efficiency and quality in hospitals. This section takes up again the three main building blocks of DRG-based hospital payment systems introduced in Chapter 3; namely, the DRG system for patient classification purposes, hospital cost information, and the actual DRG-based hospital payment (see section 3.2 and Figure 3.1 in Chapter 3), and makes recommendations concerning the most important issues that need to be considered when introducing, revising, extending or harmonizing DRG systems and DRG-based hospital payment systems. The section does not provide detailed instructions in the sense of a 'how to' manual, as readers interested in this kind of information can find it in existing publications (see Langenbrunner et al., 2009; Cashin et al., 2005).

However, before turning to the building blocks of DRG-based hospital payment systems, three questions should be explored, which must represent the starting point for introducing DRGs.

First, is the political situation favourable to the introduction of a DRG system or of a DRG-based hospital payment system?

While this may seem to be an obvious point, the politics of health policy-making are too often overlooked (Eggleston et al., 2008). The introduction of DRG systems has been influenced by political agendas, along with the structure of political and health care systems, by the presence or absence of supporters and by the general economic and political context (D'Aunno et al., 2008). If these factors are not conducive to the introduction of a DRG system, the adoption of DRGs could be delayed or the application of DRGs could be limited to only certain regions or to a subset of hospitals. Furthermore, as noted in the chapter on Poland (Chapter 20), in a generally positive economic environment, the availability of additional financial resources may be able to assure support from various actors that would otherwise be opposed to the reform.

Second, is the institutional and legal context adequate for the introduction of DRGs and DRG-based hospital payment?

One prerequisite for DRG-based hospital payment to work is that purchasers and providers are separate entities. Public hospitals need to have a certain degree of autonomy for managing health care resources, for example, as autonomized organizations with decision rights regarding how to manage hospital resources (Busse et al., 2002; Langenbrunner et al., 2009). Purchasers need to have the capacity for managing the DRG system, for monitoring potential unintended consequences, and for negotiating contracts with private (profit-making or non-profit-making) hospitals. Furthermore, the legal and institutional context should not prevent the (intended) reorganization of care; for example, moving the provision of certain services from acute inpatient hospital care to outpatient care or long-term care settings.

Third, what is the intended purpose of using DRGs?

As illustrated in the country-specific chapters in Part Two and as summarized in Chapter 2, the purpose of using DRGs can change over time. Often countries begin using DRGs with the aim of improving transparency of hospital activity. While this can already be ambitious – in terms of DRG system development/adjustment, management capacities and hospital data requirements – the (intended and unintended) effects of using DRGs merely as a measure of hospital activity are likely to be rather limited. Once countries have gathered experience with a DRG system and have gained confidence in the ability of the system to reflect adequately hospital activity, countries have always started moving towards using DRGs for determining a progressively increasing proportion of hospital revenues. Other countries have introduced DRGs directly with the purpose of using them for hospital payment. The purpose – namely, hospital activity measurement or hospital payment (in DRG-based case payment or DRG-based budget allocation systems) – implies different requirements for the capacity of purchasers and providers, and for the building blocks of the systems.

10.3.1 DRG systems

Countries planning to introduce DRG systems have two options: (1) they can develop a new DRG system from scratch (as described by Cashin and colleagues (2005)), or (2) they can import one of the already-existing DRG systems from abroad. Chapter 4 shows that most countries included in this book have adopted DRG systems that were originally developed abroad. Those first experimenting with DRGs in England, Portugal, France and Ireland used different versions of DRG systems developed in the United States as the starting point. Subsequently, several countries adopted DRG systems from the United States, either Health Care Financing Administration (HCFA-)DRGs or All Patient (AP-)DRGs (as in Ireland, Spain and Portugal). More recently, Australian Refined (AR-)DRGs have been adopted by a large number of countries in Europe, also going beyond those included in this book (for example, Ireland as well as Slovenia (Don, 2003), Croatia (Voncina et al., 2007) and Romania (Radu et al., 2010)). AR-DRGs served as the origin for developing the German DRG (G-DRG)

system, which have in turn become the starting point for the development of DRGs in Switzerland. Finally, Poland has developed its own DRG system on the basis of the English system. Given that developing a new DRG system is a highly complex process, requiring several years of work (and which will not necessarily lead to a superior system compared to the existing ones), adopting a DRG system from abroad – at least as a starting point for country-specific modifications – appears to be the preferable solution.

When deciding which DRG system to adopt, countries need to consider a wide range of issues, such as the adequacy of the system for the national hospital context (in terms of clinical acceptability, cost homogeneity, and existing coding systems for diagnoses and procedures), the availability of training material and technical support systems (for example, software applications), and the costs related to obtaining copyright for using the system, in particular if the DRG system is produced by private enterprises (Don, 2003). Ideally, alternative DRG systems are evaluated using available data from hospital discharge summaries in order to reveal differences in the adequacy of alternative systems for the country-specific context (Aisbett et al., 2007). The additional administrative costs of coding diagnoses and procedures, installing necessary information technology (IT) systems, and enabling data transfer between providers and purchasers should also be considered when introducing DRGs. In particular, start-up costs may be higher if a DRG system is chosen that is based on coding systems for diagnoses and procedures that are not yet used in the country – but this does not need to be prohibitive, as shown by the case of Ireland, which adopted the Australian coding system when changing from HCFA-DRGs to AR-DRGs in 2003 (see Chapter 15).

Historically, most countries that introduced DRG systems initially did so for the classification of acute hospital inpatients. The reason for excluding outpatients, day cases, rehabilitation and psychiatric care from DRGs was that diagnoses were found to be a bad predictor of resource consumption and that dominant procedures were absent in psychiatric and rehabilitation facilities (Lave, 2003; Cotterill & Thomas, 2004). However, in recent years many countries have extended their DRG systems to account for day cases and sometimes have even included outpatient activity (see Figure 10.1 and Chapter 4). Furthermore, similar to the situation in the United States, where DRG-like systems were introduced for rehabilitation facilities in 2002 and for psychiatric facilities in 2005 (MedPAC, 2008, 2010), a number of European countries (such as England, France and Germany) are extending the concept of DRGs to other types of hospital care (namely, rehabilitation or psychiatric facilities) or have plans to do so in the near future (see Chapter 4 and the relevant country-specific chapters in Part Two).

Because hospital activity in most European countries is progressively expanding into day-case and/or outpatient settings, it is important for countries to explicitly consider these areas of care when designing or updating their DRG systems. Some DRG systems – such as NordDRGs, AR-DRGs, and the French system of patient classification (GHMs) – have been explicitly designed to take into account day-case and/or outpatient activity, which is important because otherwise an increasingly important share of hospital activity would be left out of the systems.

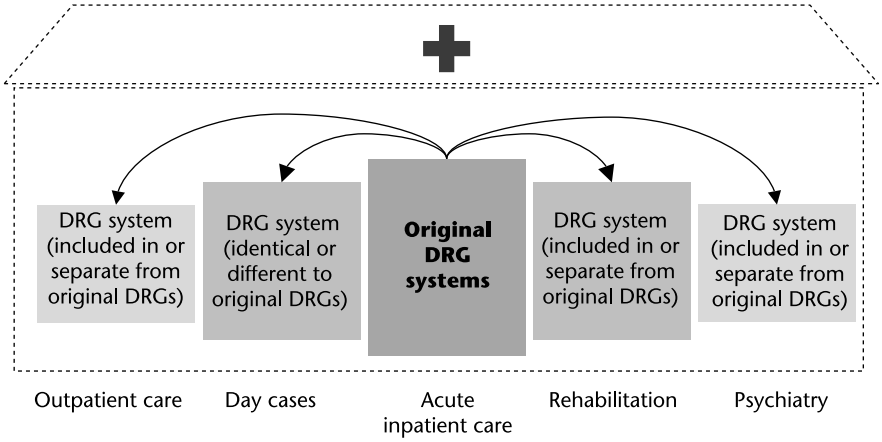

Figure 10.1 Extension of DRG systems from acute inpatient care to other sectors

The purposes of using DRG systems – that is, contributing to transparency in the hospital sector and paying hospitals fairly for provided services – can only be achieved if the defined groups of patients are sufficiently homogeneous in terms of treatment costs. Otherwise, performance comparisons on the basis of DRGs do not adequately control for differences in patients within the same groups; and hospital payment for a large number of patients is not appropriate – it can be either too high or too low. In order to ensure homogeneous groups of patients, DRG systems need to consider the most important determinants of resource consumption as classification variables. This can be achieved only if detailed information relating to treatment costs in hospitals (see subsection 10.3.2 and Chapter 5) is available for designing and updating the system. In addition, consultation mechanisms must be established, which can ensure that input from medical professionals is considered by the responsible DRG institutions during the process of updating and designing the system. This is also important because the selection of classification variables must carefully consider the incentives of using certain variables (such as specific procedures) for defining DRGs. If the DRG system is used for hospital payment, that system should ideally produce neutral incentives for alternative treatment options, in order to ensure that patients are treated according to their medical needs – and not according to profit considerations. Under such circumstances, decisions regarding which treatment options to choose can be left to clinicians.

As part of the attempt to increase resource homogeneity of DRGs, almost all systems have seen an expansion in the number of groups over the past few years (see Chapter 4). Today, the German G-DRG system defines 1200 DRGs, the English HRG system consists of about 1400 HRGs, and the French GHM system comprises almost 2300 groups. However, an increasingly large number of groups also brings about problems. First, with an increasingly large number of groups, it becomes more difficult to reliably calculate relevant and significant differences in the average treatment costs of patients within different DRGs. Therefore, it does not seem to be a coincidence that larger European countries

are operating systems with a larger number of groups because larger countries should be better able to reliably calculate average costs of patients within relatively poorly populated DRGs.[1] Second, a more complex system is likely to define groups which are less clearly distinguishable from each other. The problem is not so much that hospitals would have difficulties grouping patients into the appropriate DRGs, because all countries use software tools for the classification of patients, but rather that, if the criteria used for grouping of patients into different DRGs are less distinguishable, it becomes increasingly difficult for purchasers or regulators to audit hospital activity and to detect whether hospitals are engaging in up-coding or gaming (see Chapter 6).

In addition, regular updates of DRG systems are important in order to account for changes in medical practice and hospital resource consumption, as well as to incorporate technological innovation. Chapter 9 has shown that most countries regularly update their DRG systems, albeit at different frequencies and with a different time-lag between data collection and using those data for updating the DRG system. Obviously, countries with frequent updates of their DRG system and with a short time-lag between data collection and use of the information for DRG-based hospital payment are in a better position to (1) correct the DRG system if unintended consequences of using a particular classification variable are detected (for example, unexplained increases in certain procedures); and (2) incorporate technological innovations into their systems. In fact, while it is important to have a good DRG system, it is at least as important to have a well-designed system for monitoring the effects of DRGs and to update and optimize the system over time.

Finally, DRG systems can be designed to facilitate attempts to incorporate quality into DRG-based hospital payment systems (for details see subsection 10.3.3). For example, Medicare in the Unites States demands that hospitals code into the system whether primary and secondary diagnoses were present on admission (Department of Health and Human Services, 2008). If certain diagnoses were not present on admission, they are excluded from consideration during the grouping process. Additionally, for certain high-volume DRGs in disease areas in which clear consensus exists regarding what constitutes best practice (for example, cholecystectomy, hip fracture, and stroke), it would be worth expanding on the concept introduced in the United Kingdom (Department of Health, 2011), to explicitly use such best practice care processes instead of the average across all hospitals. This would ideally lead to more clearly specified groups of patients with more homogeneous care processes, aligned with best practice guidelines. Obviously, if used for payment, such a process needs to be accompanied by appropriate measures to ensure that hospitals do not cut costs by under-providing services.

10.3.2 Hospital cost information

Chapters 2 and 5 have highlighted the importance of accurate cost-accounting information for the development of DRG systems and for the calculation of DRG payment rates. However, the availability of high-quality cost-accounting information is not a prerequisite for the introduction of DRG systems. Many

countries originally introduced DRG systems and cost weights from abroad also because they did not have the necessary information for developing their own systems (as was the case in Ireland, Poland, Portugal and Spain). These countries adjusted imported DRG weights to the local cost context, using highly aggregated cost-accounting data and a set of internal DRG cost weights (see for example Chapter 22) or used data from a previously existing fee-for-service system for the calculation of weights (see for example Chapter 20). Nevertheless, even though it is possible to start using DRGs without having high-quality cost-accounting information, countries usually realize with the passing of time that better data are required in order to verify that the system and payment rates are adequate for the local cost context.

Therefore, standardized (sometimes mandatory) cost-accounting systems have been introduced in at least a sample of hospitals in most of the countries included in this book. Most frequently, data for the refinement of DRG systems and for the calculation of DRG weights are collected from a selected number of hospitals that use comparable cost-accounting systems meeting predefined quality standards (for example, in Finland, France, Germany and Sweden). However, the size of the hospital sample varies considerably, between 6 per cent in Germany and 62 per cent in Sweden. Other countries require all hospitals to report their activity and unit costs annually to their regulatory authority, but have fewer demands in terms of the quality and level of detail of this information (for example, England). In addition, the time-lag varies between data collection and the use of these data to readjust the DRG system and the DRG payment rates (see Chapter 9).

In countries in which cost-accounting data are collected from hospitals, this information is generally used to set DRG weights (the basis of DRG payment rates) at the average costs of cases within a DRG. However, average costs are usually calculated only after having excluded outliers through trimming (Schreyögg et al., 2006). This is because a relatively small number of high-cost outliers usually accounts for a relatively large proportion of total costs of all cases within a DRG. Consequently, calculating DRG weights on the basis of average costs of all cases (including outliers) would lead to an overvaluation of DRG weights for most cases. Recently, England has moved away from the concept of using average costs for determining DRG weights for a small number of high-volume DRGs (for example, hip fracture, cholecystectomy, stroke). For these DRGs, weights are set to reflect costs of efficient high-quality providers instead of average costs. However, this does not mean that cost-accounting data become less important. Quite the contrary; very reliable and comparable cost-accounting data are needed to be able to identify efficient providers, and to be sure that lower costs in certain hospitals are not the result of inaccuracies in the cost-accounting methodology.

When cost-accounting information is used to determine DRG weights, it is important that only those cost categories are included in the calculation of average costs that are paid for through the DRG-based hospital payment system. This is important because many countries use specific budgets or other payment systems for certain cost categories or certain activities (see subsection 10.3.3). For example, capital costs are not included in DRG weights in some countries (such as Germany, Ireland and Spain), whereas other countries include capital

costs in the calculation. Whether to include capital costs when setting DRG weights depends on the objectives that countries want to achieve. Including capital costs in DRG weights will imply stronger incentives of the DRG-based hospital payment system for the reorganization of care, possibly leading to the concentration of large-scale equipment or certain specialties in fewer hospitals. While the reorganization of care can be an intended objective, it must be borne in mind that this could also compromise accessibility of services in poorly populated rural areas.

There has been some debate about which cost-accounting methodology is preferable (Tan, 2009). At a theoretical level, there is consensus that bottom-up micro-costing generates the highest quality of data for developing DRG systems and for calculating DRG weights (but also for hospital managers in terms of planning and controlling) because it allows differences in resource consumption and costs for individual patients to be identified. However, bottom-up micro-costing is also very demanding in terms of its impact on hospital information systems, data requirements and analytical complexity. Top-down micro-costing is more feasible because consumed resources are not valued for individual patients but for the average patient (see Chapter 5). In addition, top-down micro-costing has been found to be a fairly accurate alternative to bottom-up micro-costing, and it is possible to combine both methods and to restrict bottom-up micro-costing only to the most important cost components (Tan et al., 2009). By contrast, gross-costing produces relatively inaccurate estimates because it is unable to trace consumed resources to individual patients.

When deciding on the size of the data sample of cost-collecting hospitals, there seems to be a trade-off between collecting high-quality cost-accounting information and the goal of ensuring that a large and representative sample of hospitals contributes to a national cost database. More complex cost-accounting systems – collecting more detailed patient-level information using a bottom-up micro-costing approach – are also more costly to operate, which may make the data-collection exercise prohibitively costly if it is extended to a large number of hospitals. Concerning this trade-off, the Netherlands seem to have struck an interesting balance between representativeness and data quality, by collecting resource-use data from all hospitals (assuring representativeness of the data) and unit costs using bottom-up micro-costing from a small sample of hospitals.

Because collecting detailed cost-accounting information requires additional work from hospitals, regulatory authorities in some countries have started to provide monetary incentives to hospitals if they comply with predefined cost-accounting standards. For example, in France, the Regional Health Agencies (ARSs) pay the equivalent of the yearly salary for a financial controller for hospitals contributing to the national cost database (ENCC). In Germany, the national DRG institute (the InEK) pays hospitals a lump sum for participating in the data-collection exercise, and a variable amount of money related to the number of delivered cases and their data quality. In addition, because cost-accounting information is of such high importance, almost all countries that collect cost-accounting data have also implemented monitoring systems to verify the accuracy of the delivered data. However, if better cost-accounting information is collected in hospitals, this does not only contribute to more accurate data for regulators; in addition, hospital managers find this information

useful because it enables the identification of the most important cost components and facilitates comparisons of resource consumption for similar patients across different hospitals.

10.3.3 DRG-based hospital payment

The countries included in this book have, in general, implemented one of two main models of DRG-based hospital payment systems: (1) DRG-based case payment systems (in Estonia, England, Finland, France, Germany, Poland, the Netherlands and Sweden) and (2) DRG-based budget allocation systems (in Austria, Ireland, Portugal and Spain; see Chapter 6). In DRG-based case payment systems, each discharged patient is grouped into the applicable DRG, and hospitals receive a payment per case that is determined by the weight of that DRG (after monetary conversion and relevant adjustments). In DRG-based budget allocation systems, the available regional or national hospital budget is distributed to individual hospitals on the basis of the number and type of DRGs that those hospitals produced (namely, the casemix of the hospitals) during one of the previous years, or that they are expected to produce in the current year. The existence of these alternative models facilitates the adjustment of the DRG-based hospital payment system to the country-specific context and to the pre-existing hospital payment system.

Adjusting DRG-based hospital payment to the country-specific context and to take account of the pre-existing payment system is important because new hospital payment systems should be introduced carefully over extended periods of time, in order to allow purchasers to monitor the potential unintended consequences and to give hospitals the necessary time to adjust to the changing context. Almost all countries included in this book have introduced DRG-based hospital payment systems over many years, usually operating the new DRG-based hospital payment system simultaneously with the pre-existing system and slowly increasing the share of total hospital revenues related to DRGs. For example, in Ireland, the share of hospital budgets that is determined on the basis of DRG-based budget allocation has increased progressively from 15 per cent in 2001 to 80 per cent in 2010. In Estonia, DRG-based case payment initially accounted for only 10 per cent of hospital payment in 2004, with the rest being determined on the basis of fee-for-service charges. Later, the proportion of DRG-based case payments as a percentage of total hospital payments per discharge was progressively increased to 70 per cent in 2007.

As explained in Chapter 6, there are three main incentives for hospitals resulting from DRG-based hospital payment systems:

(1) to reduce costs per treated patient,
(2) to increase revenues per patient, and
(3) to increase the number of patients.

These incentives can have both intended and unintended consequences. Therefore, it is important for countries to take into account the unintended consequences when designing their DRG-based hospital payment systems as part of the overall hospital payment system.

Concerning the first incentive, it is important that hospitals are adequately paid for the costs of provided services because, otherwise, they may reduce costs beyond acceptable levels and, in particular, may try to avoid high-cost patients. Therefore, a whole set of different mechanisms is used by European countries in order to avoid these unintended consequences: first, in order to adequately account for high-cost cases, all countries except for the Netherlands and Spain provide per diem-based additional payments to hospitals for outlier cases that stay in hospitals for longer than a specified length-of-stay threshold (for example, Austria, Germany, France, England, Ireland and Portugal) or additional fee-for-service payments for cases that exceed a specified cost threshold (for example, Estonia, Finland and Sweden). Second, additional payments are provided for certain high-cost services that are not adequately financed through the normal DRG-based payment system (for example, for certain high-cost drugs or devices), and some countries have defined specific DRGs for intensive care treatment according to the length of stay in these departments (such as in Germany), or finance treatment in intensive care units (ICUs) on the basis of per diem-based surcharges (such as Austria). Third, procedures have come to play a much more important role in most European DRG systems (see Chapter 4) compared to the DRG systems originally developed in the United States. Fourth, several countries have introduced adjustment factors to take into account structural differences between hospitals and to provide adequate payments to different kinds of hospitals (see Chapter 6).

In order to avoid hospitals being able to increase revenues per treated patient through up-coding or gaming, several countries have installed systems for regular auditing. For example, in Germany, the regional medical review boards of the sickness funds send teams to randomly selected hospitals to audit patients' medical records in order to evaluate whether they are correctly coding and treating patients (MDS, 2011). In 2009, 12 per cent of all hospital cases were audited by the sickness funds, resulting in average claw-back sums of around €800 per audited case. In France, a total of 1 per cent of hospital discharges were audited by the Regional Hospitalization Agencies (ARHs) in 2006, which found that 60 per cent of evaluated records had some kind of coding error. It is important for regulators to monitor both the adequacy of hospital treatment and whether it was really necessary for patients to be treated as inpatients.

Countering the third incentive of DRG-based hospital payment systems – that is, to increase the number of patients – several countries have introduced global expenditure control measures. For example, some countries are operating their DRG-based case payment systems within predefined volume limits. In Germany, DRGs are used to negotiate 'revenue budgets', which limit (to a certain degree) the total amount of money that hospitals can earn from DRG-based case payments. If hospitals provide more DRGs than agreed, they have to pay back at the beginning of the next year a certain percentage of the DRG-based case payments that they earned in excess of the negotiated revenue budgets (and they are rewarded with increased payments per case if they remained below the budget). By contrast, in the Netherlands, hospitals do not receive any payments for those cases treated in excess of the budget set prospectively which cannot be negotiated between insurers and hospitals.

Similarly, aiming to achieve expenditure control, France and Poland adjust national DRG-based case-payment rates in order to stay within global expenditure targets. However, in France, this approach is criticized for not being transparent enough, because payment rates are progressively set independently of average costs. Instead, Or and Bellanger (see Chapter 13 of this volume) argue in favour of clear volume targets for hospitals.

As chapters 6 and 8 have shown, all three DRG-inherent incentives may both improve or compromise quality of care. Although quality has been of continuous concern for policy-makers across Europe, it is still relatively rarely explicitly taken into account in existing DRG-based hospital payment systems. However, as evidenced by the examples presented in Chapter 8, it is possible to refine these systems to integrate direct incentives for improving quality. For example, DRG-based payments can be adjusted at the hospital level by increasing payments for all patients treated by one hospital, if one hospital provides above-average quality as measured through hospital-level quality indicators. Similarly, it is possible to increase payments to a hospital for all patients falling into one DRG if the hospital scores above average on DRG-specific quality indicators, or to adjust payments for individual patients if quality can be more robust monitored at the individual patient level (see Table 10.1). Yet, an essential prerequisite is that reliable quality indicators are developed and that more robust data about quality of care are collected in hospitals. Consequently, most countries have started collecting more detailed information regarding quality in hospitals in order to ensure that care quality is not compromised by the cost-reduction incentives of DRG-based hospital payment systems.

In addition, as discussed in Chapter 9, it is important that countries take into account the effect that DRG-based hospital payment may have on the adoption and use of technological innovations. Chapter 9 showed that most (but not all) countries included in this book have complemented their DRG-based payment systems with specific short-term payment instruments targeted at encouraging the adoption and use of technological innovations. However, short-term payment instruments should be employed very carefully, and granted only after careful assessment of the likely effects of the technology in question on costs, as well as quality of care. They should be limited to technological innovations that offer either considerable quality improvements over existing technologies, or options for diagnosis and treatment of previously untreatable conditions. Otherwise, if countries should want to provide short-term payment incentives for technological innovations with expected significant quality improvements but for which the evidence remains uncertain, one possible approach is that of so-called Coverage with Evidence Development (CED) (see Chapter 9, and Hutton and colleagues (2007)).

The payment of hospitals in all countries therefore consists of a highly sophisticated mix of different payment mechanisms that aim to modify the type and strength of the incentives of DRG-based hospital payment. The resulting intricately blended payment systems – incorporating elements of fee-for-service payment, per diem payment and global budgets – are more likely to contribute to achieving the societal objectives of securing high-quality hospital care at affordable costs than any other hospital payment mechanism alone (Ellis & McGuire, 1986).

Table 10.1 Options for integrating quality into DRG-based hospital payment systems and examples from selected countries in Europe and the United States

Type of payment adjustment/ calculation	*Mechanism*	*Examples*
Hospital based	• Payment for entire hospital activity is adjusted upwards or downwards by a certain percentage • Hospital receives specific budgetary allocation unrelated to activity	• Predefined quality results are met/not met (for example, in England) • Overall readmission rate is below/above average or below/above agreed target (for example, in the United States) • Hospitals install new quality improvement measures (for example, in France)
DRG/disease based	• Payment for all patients with a certain DRG (or a disease entity) is adjusted upwards or downwards by a certain percentage • DRG payment is not based on average costs but only on costs of those hospitals delivering 'good quality'	• Insurers negotiate with hospitals that DRG payment is higher/lower if certain quality standards are met/not met (for example, in Germany and the Netherlands) • DRG payment for all hospitals is based on 'best practice'; that is, costs incurred by efficient, high-quality hospitals (for example, in England)
Patient based	• No payment is made for a case • Payment for an individual patient is adjusted upwards or downwards by a certain amount	• Readmissions within 30 days are not paid separately but as part of the original admission (for example, in England and Germany) • Complications (that is, certain conditions that were not present upon admission) cannot be used to classify patients into DRGs that are weighted more heavily (for example, in the United States)

Figure 10.2 illustrates that DRG-based hospital payments generally account for only part of total hospital revenues. In the figure, the DRG-based payments – which are often operated partially and/or during the implementation phase simultaneously with a pre-existing hospital payment system (such as global budgets or fee-for-service payments) – constitute the basis of hospital revenues. These DRG-based hospital payments are often already adjusted for high-cost cases through outlier payments, as well as for quality and/or for structural differences between hospitals through structural adjustment factors.

On top of this, hospitals may receive additional payments for specific activities for DRG-classified patients, for example for certain expensive drugs, for certain services that are not adequately accounted for in the DRG system, and for certain cost-increasing technological innovations. Such payments may be integrated to different degrees into the DRG-based hospital payment systems, for example in the form of 'unbundled HRGs' in England or supplementary payments in Germany.

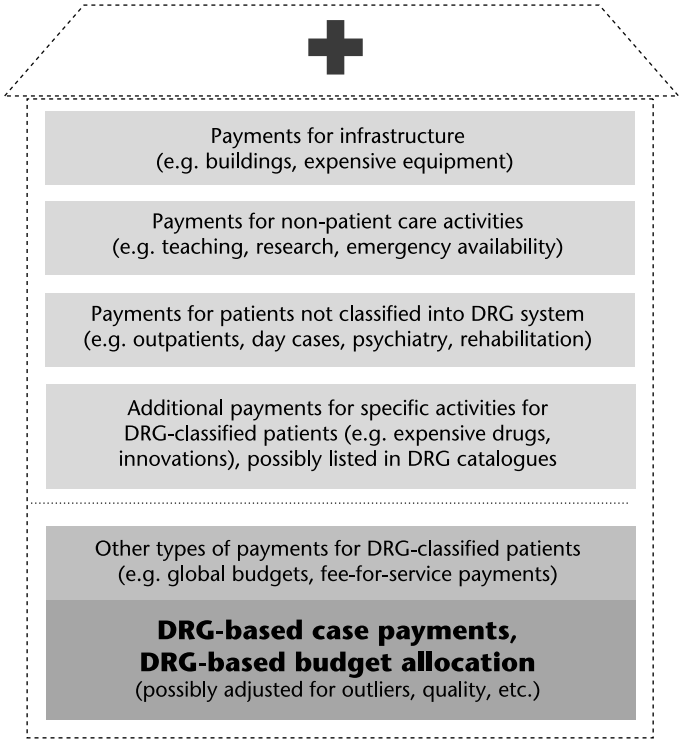

Figure 10.2 DRG-based hospital payment within the mix of total hospital revenues

A further element of hospital revenue originates from payments for patients not classified into the DRG system. The extent of these payments depends on both the types of activities hospitals are undertaking (for example, whether outpatients constitute a large part of their activity) and whether these have been incorporated into the DRG system (see Figure 10.1).

Furthermore, certain hospitals usually receive additional payments or budgets for non-patient care activities, such as teaching and research (although some countries may account for the extra costs of teaching and research within their DRG-based budget allocation model by operating separate systems for teaching hospitals and non-teaching hospitals – see, for example, Chapter 15) or emergency availability. Finally, several countries pay separately for capital investments (buildings and expensive equipment) or for certain structural quality measures, such as infection control programmes.

10.4 Conclusions: Future of DRG systems in Europe

Based on the experiences of the 12 countries included in Part Two of this book, the previous section has made recommendations regarding how best to design DRG systems, how to improve hospital cost information and how to maximize the intended consequences of DRG-based hospital payment systems, while

avoiding the unintended ones. These recommendations may contribute towards improved national DRG systems and better DRG-based hospital payment systems in different countries. However, because the goals of European countries and the problems they face are highly similar, it is at least worth considering the benefits of increased cooperation, coordination and harmonization of DRG systems in Europe.

Currently, six of the twelve countries included in this book develop, update and operate their own national DRG systems. The other six countries use either imported DRG systems from abroad (for example, from Australia and the United States) or a national version of the common Nordic system of patient classification (NordDRGs). Each country with a national DRG system analyses its own national database to improve resource homogeneity of DRGs; develops and updates its own cost-accounting guidelines; has developed its own national consultation mechanisms with medical professionals; develops national software applications; evaluates technological innovations; updates national procedure coding systems, and so on. This raises two important questions: (1) Do all countries have the finances and skills to do this? And (2) is it worth it?

In regard to the first question, the answer – at least for smaller countries – is a clear 'no'. For practical reasons, without pan-European cooperation, these countries will always need to import certain important elements of their DRG systems. Further, if they have to do so anyway, it is not evident why imported DRG systems from outside Europe – which are used in several European countries – should be better able to define homogeneous groups of patients in these countries than a common European DRG system. In regard to the second question, one might argue that these efforts were worthwhile if the resulting national DRG systems were really tailor-made to achieve national objectives and better adjusted to the country-specific context than a multi-country solution. Before the EuroDRG project (which inspired this book), we did not know whether this was the case, because the ability of different DRG systems to define homogeneous groups of patients (in terms of clinical meaningfulness and costs) had not been assessed across European countries.

If the factors to explain cost differences (in terms of the patient characteristics and diagnoses as well as procedures performed and services provided) were sufficiently similar across European hospitals (and the parallel work of the EuroDRG project – to be published in 2012 – shows that this is the case), there would be a case for cooperation in terms of the development of DRG systems in Europe. The benefits would include: (1) avoiding duplication of work, (2) improving knowledge exchange in the refinement of DRG systems, (3) increasing transparency of hospital services across countries, and (4) facilitating cross-border movements of patients and payments. However, similar to the historical emergence of DRG systems as a result of political decisions, a coordination of European DRG systems – and, ultimately, possibly a harmonized DRG system – is likely to emerge only if there is sufficiently strong political will to support the emergence of a common European hospital market, as well as an increasing level of mobility of European patients. While this may be an unrealistic scenario in the short term, the recent *Directive on the Application of Patients' Rights in Cross-Border Healthcare* (European Parliament and Council, 2011) demonstrates that now is the time to start such a discussion.

The NordDRG system (see Chapter 16) provides an example of the feasibility of developing a common DRG system for a group of countries. NordDRGs emerged from existing cooperation between Nordic countries in the development of a common procedure classification system, and the presence of a common problem across Nordic countries during the mid-1990s; namely, how to convert the national or imported DRG systems from using the International Classification of Diseases (ICD) 9th revision for the coding of diagnoses to the ICD-10 codes. Consequently, countries amalgamated their efforts to develop a common DRG system that would replace existing national systems and imported DRG systems from abroad. The example of NordDRGs shows that a common DRG system does not prevent the adaptation of the common system to meet country-specific needs. Since the very beginning of NordDRGs, several countries have developed national versions of the system, and DRG weights are always calculated separately for each country. In addition, country-specific modifications of the underlying classifications of diagnoses and procedures exist, adding further detail where necessary but conforming to the general logic of the systems. Every year, NordDRGs are jointly updated by the Nordic Casemix Centre and country-specific modifications are then added to the updated version of the common NordDRG system.

The example of NordDRGs suggests that a first requirement for a common European DRG system (which could be called the 'EuroDRG' system) would be to harmonize the coding of diagnoses and procedures, or – as a second-best option – to develop a mapping system that would allow translation of codes from different coding systems into a common European coding system. The Hospital Data Project as part of the European Union (EU)'s Health Monitoring Programme has suggested a common – albeit for patient classification purposes, too rudimentary – format for hospital activity data, to improve comparability (Kiwa Prismant, 2008). For the coding of diagnoses, an agreement on a coding system should be relatively unproblematic, since the ICD-10 is already used for cause-of-death statistics in all countries. For procedures, an agreement could be more difficult to reach. This is testified by four decades of work, but the as yet unfinished attempt to develop such an international classification system, initially termed the International Classification of Procedures in Medicine (ICPM), and later the International Classification of Health Interventions (ICHI). European countries may consider not waiting for this development to be finished but to coordinate their efforts based on their own coding and patient classification systems.

As a starting point, the EuroDRG project has not only compared the DRG systems and their effects on transparency, efficiency and quality (in this volume), but has also compared in depth the classification of patients into DRGs across the DRG systems for 10 episodes of care. A common EuroDRG system could draw on the best features of national DRG systems, such as the most relevant classification variables, concepts for the definition of severity groups (for example, the patient clinical complexity levels (PCCLs), as used in AR-DRGs and G-DRGs; see Chapter 4) or the definition of short-stay groups, as in NordDRGs. However, detailed cost information collected on the basis of a standardized cost-accounting system from a sufficiently large and representative sample of hospitals from all participating countries would be necessary in order

to test the ability of such a EuroDRG system to define homogeneous groups of patients across different countries.

A common EuroDRG system would not need to be employed in all countries and all hospitals from the beginning. It could initially be used only for the purpose of increasing transparency, possibly even coexisting simultaneously with national DRG systems, which could continue to be used for payment purposes for a limited time period – similar to the current situation in Spain (see Chapter 22). Furthermore, country examples included in this book show that it is possible to use DRG systems only for a subset of voluntarily participating hospitals (for example, as is the case in Ireland; see Chapter 15) or for certain regions (as in Spain; see Chapter 22). Similarly, EuroDRGs could initially be used only in certain countries, in certain hospitals interested in international performance comparisons, or for those patients treated in countries in which they are not permanent residents.

The starting point of this book (see Chapter 1) was the problem formulated by Dr. Eugene Codman in 1913: 'Really the whole hospital problem rests on one question: What happens to the cases? [...] We must formulate some method of hospital report showing as nearly as possible what are the results of the treatment obtained at different institutions.' While this book has demonstrated that DRGs have contributed to improved transparency *within* hospitals, the concept of DRGs has one important drawback: they are almost always restricted to one hospital stay, and providers are not encouraged to take into account the long-term effects of their treatment(s) in terms of continuity of care, patient outcomes and, ultimately, population health. While certain modifications of DRG-based hospital payment systems – such as not-paying for readmissions in England and Germany – aim to overcome (parts of) these problems, measuring the wider performance of hospitals in terms of the named outcomes remains a major obstacle. In this respect, only the Dutch DBCs have the advantage of defining groups on the basis of the treatment that is necessary for a specific condition, independent of the number of outpatient visits, diagnostic tests and inpatient admissions. Therefore, future developments of DRGs should be linked to efforts that aim to measure and ultimately increase the performance of health systems as a whole.

10.5 Note

1 The Netherlands may be considered an exception to this rule but they are currently in the process of reducing the complexity of their system; see Chapter 23.

10.6 References

Aisbett, C., Wiley, M.M., McCarthy, B., Mulligan, A. (2007). *Measuring Hospital Casemix: Evaluation of Alternative Approaches for the Irish Hospital System*. Dublin: Economic and Social Research Institute (ESRI Working Paper No. 192).

Busse, R., van der Grinten, T., Svensson, P. (2002). Regulating entrepreneurial behaviour in hospitals: theory and practice, in R.B. Saltman, R. Busse, E. Mossialos, eds. *Regulating Entrepreneurial Behaviour in European Health Care Systems*. Buckingham: Open University Press.

Cashin, C., O'Dougherty, S., Yevgeniy, S. et al. (2005). *Case-Based Hospital Payment Systems: A Step-By-Step Guide for Design and Implementation in Low- and Middle-Income Countries*. Bethesda, MD: United States Agency for International Development (USAID) ZdravPlus Project.

Cotterill, P.G., Thomas, F.G. (2004). Prospective payment for Medicare inpatient psychiatric care: assessing the alternatives. *Health Care Financing Review*, 26(1):85–101.

Cour des comptes (2009). *La Securité Sociale, chapitre 7, La mise en place de la T2A: Bilan à mi-parcours*. Paris, Cour des comptes (February).

Cutler, D. (1995). The incidence of adverse medical outcomes under prospective payment. *Econometrica*, 63(1):29–50.

D'Aunno, T., Kimberly, J.R., de Pouvourville, G. (2008). Conclusions: the global diffusion of casemix, in J.R. Kimberly, G. de Pouvourville, T. D'Aunno, eds. *The Globalization of Managerial Innovation in Health Care*. Cambridge: Cambridge University Press.

Department of Health (2011). *Best Practice Tariffs*. London: Department of Health (http://www.dh.gov.uk/en/Managingyourorganisation/NHSFinancialReforms/DH_105080, accessed 27 July 2011).

Department of Health and Human Services (2008). *Changes to the Hospital Inpatient Prospective Payment Systems and Fiscal Year 2009 Rates*. Washington, DC: United States Department of Health and Human Services.

Don, H. (2003). Implementing DRGs in Slovenia: why the Australian variant was selected. *Australian Health Review*, 26:50–60.

Eggleston, K., Shen, Y.C., Lau, J., Schmid, C.H., Chan, J. (2008). Hospital ownership and quality of care: what explains the different results in the literature? *Health Economics*, 17(12):1345–62.

Ellis, R.P., McGuire, T.G. (1986). Provider behavior under prospective reimbursement – cost-sharing and supply. *Journal of Health Economics*, 5(2):129–51.

European Parliament and Council (2011). *Directive 2011/24/EU of 9 March 2011 on the Application of Patients' Rights in Cross-Border Healthcare*. Brussels: Official Journal of the European Union (L88/45-L88/65).

Farrar, S., Yi, D., Sutton, M. et al. (2009). Has payment by results affected the way that English hospitals provide care? Difference-in-differences analysis. *British Medical Journal*, 339:b3047.

Fetter, R.B., Thompson, J.D., Mills, R.E. (1976). A system for cost and reimbursement control in hospitals. *Yale Journal of Biology and Medicine*, 49:123–36.

Fürstenberg, T., Laschat, M., Zich, K. et al. (2011). *G-DRG Begleitforschung gemäß §17b Abs. 8 KHG: Endbericht des zweiten Forschungszyklus*. Siegburg: Institut für das Entgeldsystem in Krankenhaus (InEK).

Gilman, B.H. (2000). Hospital response to DRG refinements: the impact of multiple reimbursement incentives on inpatient length of stay. *Health Economics*, 9(4):277–94.

Goldfield, N. (2010). The evolution of diagnosis-related groups (DRGs): from its beginnings in casemix and resource use theory, to its implementation for payment and now for its current utilization for quality within and outside the hospital. *Quality Management in Health Care*, 19(1):3–16.

Hutton, J., Trueman, P., Henshall, C. (2007). Coverage with evidence development: an examination of conceptual and policy issues. *International Journal of Technology Assessment in Health Care*, 23:425–32.

Kahn, K.L., Keeler, E.B., Sherwood, M.J. (1990a). Comparing outcomes of care before and after implementation of the DRG-based prospective payment system. *Journal of the American Medical Association*, 264(15):1984–8.

Kahn, K.L., Rogers, W.H., Rubenstein, L.V. et al. (1990b). Measuring quality of care with explicit process criteria before and after implementation of the DRG-based prospective payment system. *Journal of the American Medical Association*, 264(15):1969–73.

Kiwa Prismant (2008). *Hospital Data Project Phase 2: Final Report. The Need for Metadata and Data*. Utrecht: Kiwa Prismant.

Kiwa Prismant (2010). *Kengetallen Nederlandse Ziekenhuizen 2009 [Key Numbers Dutch Hospitals 2009]*. Utrecht: Dutch Hospital Data.

Kosecoff, J., Kahn, K.L., Rogers, W.H. et al. (1990). Prospective payment system and impairment at discharge. The 'quicker-and-sicker' story revisited. *Journal of the American Medical Association*, 264(15):1980–3.

Langenbrunner, J., Cashin, C., O'Dougherty, S. (2009). *Designing and Implementing Health Care Provider Payment Systems. How-To Manuals*. Washington, DC: World Bank (http://siteresources.worldbank.org/HEALTHNUTRITIONANDPOPULATION/Resources/Peer-Reviewed-Publications/ProviderPaymentHowTo.pdf , accessed 5 September 2011).

Lave, J.R. (2003). Developing a Medicare prospective payment system for inpatient psychiatric care. *Health Affairs*, 22(5):97–109.

Ljunggren, B., Sjödén, P. (2003). Patient-reported quality of life before, compared with after a DRG intervention. *International Journal for Quality in Health Care*, 15(5): 433–40.

MDS (2011). *Abrechnungsprüfungen der MDK in Krankenhäusern sind angemessen, wirtschaftlich und zielführend. Zahlen und Fakten der MDK-Gemeinschaft*. Essen: Medizinischer Dienst des Spitzenverbandes Bund der Krankenkassen e.V.

MedPAC (2008). *Rehabilitation Facilities (Inpatient) Payment System*. Washington, DC: Medicare Payment Advisory Commission.

MedPAC (2010). *Psychiatric Hospital Services Payment System*. Washington, DC: Medicare Payment Advisory Commission.

Radu, C., Chiriac, D.N., Vladescu, C. (2010). Changing patient classification system for hospital reimbursement in Romania. *Croatian Medical Journal*, 51(3):250–8.

Rogers, W.H., Draper, D., Kahn, K.L. et al. (1990). Quality of care before and after implementation of the DRG-based prospective payment system. A summary of effects. *Journal of the American Medical Association*, 264(15):1989–94.

Schreyögg, J., Stargardt, T., Tiemann, O., Busse, R. (2006). Methods to determine reimbursement rates for diagnosis related groups (DRG): a comparison of nine European countries. *Health Care Management Science*, 9(3):215–23.

Schwartz, M.H., Tartter, P.I. (1998). Decreased length of stay for patients with colorectal cancer: implications of DRG use. *Journal for Healthcare Quality*, 20(4):22–5.

Street, A., Scheller-Kreinsen, D., Geissler, A., Busse, R. (2010). Determinants of hospital costs and performance variation: methods, models and variables for the EuroDRG project. *Working Papers in Health Policy and Management*, 3:1–44.

Tan, S.S. (2009). *Micro-costing in Economic Evaluations: Issues of Accuracy, Feasibility, Consistency and Generalizability*. Rotterdam: Erasmus Universiteit Rotterdam.

Tan, S.S., Rutten, F.F., van Ineveld, B.M., Redekop, W.K., Hakkaart-van Roijen, R.L. (2009). Comparing methodologies for the cost estimation of hospital services. *European Journal of Health Economics*, 10:39–45.

Voncina, L., Strizrep, T., Dzakula, A. (2007). The introduction of DRGs in Croatia. *Eurohealth*, 13(1):4–5.